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Juliette Kon Kam King

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THÈSE DE DOCTORAT

TRAC(K)ING FISHE(R)S IN THE SOUTH PACIFIC Surveillances in and of a More-than-Human Ocean

Présentée en vue de l'obtention du grade de docteur
en **géographie et aménagement de l'espace** de l'**Université Paul
Valéry Montpellier III**

en cotutelle avec l'Université de Brême

Ecole Doctorale n°60 – Territoires, Temps Sociétés et Développement

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ABSTRACT

Keywords: surveillance, offshore space, fisheries, territory, South Pacific, environmental management, state, EEZ, maritime security, fisheries science, Fiji, New Caledonia, Oceania

This research examines the politics and practices of tuna fisheries surveillance in the South Pacific region in relation to the territorialisation of the oceans. The thesis provides a socio-historical analysis of surveillance and territory-making modalities in offshore spaces, characterised as vast, distant, hardly accessible, labile and more-than-human environments. At the crossroads of environmental humanities, science and technology studies and surveillance studies, this work revisits notions of surveillance and territory from an oceanic stance. It draws on a qualitative and multi-sited investigation combining archive analysis, interviews and observations relating to Fiji and New Caledonia's tuna fishing industries and their surveillance and management at the territorial, national and regional levels.

This research understands surveillance as a set of data-collecting and calculative practices to manage uncertainties. This definition comprehends the surveillance of both the social and natural dimensions of fisheries and various forms of surveillance concerned with marine ecosystem study, natural resource management, biodiversity conservation, market development or maritime security. The thesis first retraces the establishment, from the 1950s, of some main tuna fisheries surveillance apparatuses: the collection of fishers' logsheets, onboard fisheries observer programmes, tuna tagging programmes and maritime patrols. It then examines the main infrastructures underlying surveillance, starting with those that condition physical and cognitive access to offshore worlds, i.e. the fishing, oceanographic and military vessels. It analyses the associated practices of collecting, processing and circulating surveillance information that permits and constrains offshore surveillance.

The thesis shows the pivotal influence of surveillance as an instrument of territorialisation at sea. It describes offshore environmental surveillance as opportunistic, distributed, and partly delegated to surveillance subjects. Offshore surveillance hinges on pre-existing infrastructures and assembles multipotent boundary apparatuses that support plural and sometimes antagonistic scientific, regulatory, protective, coercive and commercial purposes. These apparatuses are shared and dependent on the involvement of actors subjected to multiple binds and variously interested and invested in the oceans and their surveillance. This fluid approach consists of a pragmatic strategy to make the surveillance of elusive offshore worlds possible by rationalising limited surveillance capacities and circumventing infrastructures' rigidity. However, it simultaneously induces friction, which refracts territorialisation processes when these are projected over offshore spaces and produces specific lock-ins and forms of ignorance and inaction. This study contributes to contemporary research on surveillance and informational governance with a reflection on infrastructure governance.

RESUME

Mots-clés : surveillance, espaces hauturiers, pêche, territoire, Pacifique Sud, gestion de l'environnement, Etat, ZEE, sécurité maritime, science halieutique, Fidji, Nouvelle-Calédonie, Océanie

Cette recherche porte sur les politiques et pratiques de surveillance des pêcheries thonières dans la région du Pacifique Sud en lien avec la territorialisation des océans. La thèse déploie une analyse socio-historique des modalités de surveillance et de fabrique des territoires dans des espaces hauturiers, entendus comme des environnements vastes, distants, difficiles d'accès, labiles et plus qu'humains. Croisant les humanités environnementales, les études sociales des sciences et des techniques et les études de la surveillance, cette thèse travaille les notions de surveillance et de territoire depuis une perspective océanique. Elle repose sur une enquête qualitative et multi-située combinant l'analyse d'archives, d'entretiens et d'observations portant sur les industries thonières de Fidji et Nouvelle-Calédonie et sur leur surveillance et gestion aux niveaux territorial, national et régional.

Cette recherche considère la surveillance comme un ensemble de pratiques de collecte de données et de pratiques calculatoires visant à gérer des incertitudes. Cette définition permet d'aborder les dimensions sociales et naturelles des pêcheries ainsi que diverses formes de surveillance liées à l'étude des écosystèmes, la gestion des ressources, la conservation de la biodiversité, le développement de marchés ou la sécurité maritime. La thèse retrace la mise en place, depuis 1950, des principaux dispositifs de surveillance des pêcheries thonières : fiches de pêche, programmes d'observateurs embarqués, programmes de marquage de thonidés et patrouilles maritimes. Elle étudie les infrastructures qui conditionnent l'accès physique et cognitif aux mondes hauturiers et sous-tendent leur surveillance : les navires halieutiques, océanographiques et militaires. Elle analyse les pratiques de collecte, traitement et circulation des données qui rendent possible mais aussi contraignent la surveillance hauturière.

La thèse souligne le rôle de la surveillance en tant qu'instrument de territorialisation des océans. Elle décrit la surveillance environnementale hauturière comme opportuniste, distribuée et en partie déléguée à ses sujets. Elle s'appuie sur des infrastructures préexistantes et assemble des dispositifs frontières multipotents qui soutiennent plusieurs objectifs scientifiques, réglementaires, sécuritaires, coercitifs ou commerciaux, parfois antagonistes. Ces dispositifs sont partagés et dépendent d'acteurs porteurs de divers engagements et investissements vis-à-vis des océans et de leur surveillance. Cette approche fluide découle d'une stratégie pragmatique qui rend la surveillance hauturière possible en rationalisant des ressources limitées et en contournant la rigidité des infrastructures qui la contraignent. Dans le même temps, cette approche est source de frictions. Ces frictions aboutissent à un processus de territorialisation réfracté, lorsqu'il est projeté sur les espaces hauturiers, et produit des verrouillages et des formes d'ignorance et d'inaction spécifiques. Cette étude contribue aux recherches sur la surveillance et la gouvernance informationnelle avec une réflexion sur la gouvernance des infrastructures.

ZUSAMMENFASSUNG

Stichworte : Überwachung, Offshore-Gebiete, Fischerei, Territorium, Staat, Umweltmanagement, Südpazifik, ausschließliche Wirtschaftszone (AWZ), maritime Sicherheit, Fischereiwissenschaft, Fidschi, Neukaledonien, Ozeanien

Diese Forschungsarbeit untersucht die Politik und Praxis der Überwachung des Thunfischfangs im Südpazifik vor dem Hintergrund der Territorialisierung der Ozeane. Die Dissertation liefert eine sozio-historische Analyse der Überwachungs- und Territorialisierungsmodalitäten in Offshore-Gebieten, die als riesige, weit entfernte, schwer zugängliche, instabile und ‚mehr-als-menschliche‘ Umwelten charakterisiert werden. An der Schnittstelle von *Environmental Humanities*, *Science and Technology Studies* und *Surveillance Studies* entwickelt diese Arbeit die Begriffe Überwachung und Territorium aus einer ozeanischen Perspektive. Sie stützt sich dabei auf qualitative Untersuchungen, Archivanalysen, Interviews und Beobachtungen im Zusammenhang mit der Thunfischindustrie in Fidschi und Neukaledonien, sowie deren Überwachung und Management auf Territorialer, nationaler und regionaler Ebene.

Überwachung wird hier als eine Reihe von Datenerfassungs- und Berechnungspraktiken zur Bewältigung von Ungewissheiten verstanden. Diese Definition umfasst die Überwachung sowohl der sozialen als auch der natürlichen Dimensionen der Fischerei, ebenso wie verschiedene Formen der Überwachung, die sich mit der Untersuchung mariner Ökosysteme, der Bewirtschaftung natürlicher Ressourcen, der Erhaltung der biologischen Vielfalt, der Marktentwicklung oder der maritimen Sicherheit befassen. Zunächst zeichnet diese Dissertation die Entwicklung der wichtigsten Überwachungsdispositive für den Thunfischfang seit den 1950er Jahren nach: die Erfassung der Logbücher der Fischer, die Programme für Fischerei-Beobachter an Bord, die Programme zur Markierung von Thunfisch und die maritimen Patrouillen. Anschließend werden die wichtigsten Infrastrukturen untersucht, die der Überwachung zugrunde liegen, beginnend mit denjenigen, die den physischen und kognitiven Zugang zu den küstennahen Welten bestimmen, d. h. die Fischerei-, Ozeanographie- und Militärschiffe. Analysiert werden hierbei die damit verbundenen Praktiken der Erfassung, Verarbeitung und Weitergabe von Überwachungsinformationen, die die Offshore-Überwachung ermöglichen und einschränken.

Die Überwachung hat einen zentralen Einfluss als Instrument der Territorialisierung auf See. Die Offshore-Umweltüberwachung ist dabei opportunistisch, verteilt und teilweise an Überwachungssubjekte delegiert. Sie stützt sich auf bereits existierende Infrastrukturen und stellt multipotente Grenzdispositive zusammen, die vielfältige und manchmal antagonistische Zwecke verfolgen, die der Wissenschaft, der Regulierung, dem Schutz, der Durchsetzung von Normen oder dem Kommerz dienen. Diese Dispositive werden gemeinsam genutzt und sind von der Beteiligung von

Akteuren abhängig, die verschiedenen Bindungen unterliegen und auch unterschiedlich an den Ozeanen und ihrer Überwachung interessiert sind und in sie investieren. Ein solchermaßen ‚fluider‘ Ansatz ist eine pragmatische Strategie, um die Überwachung schwer fassbarer Offshore-Welten zu ermöglichen, indem die begrenzten Überwachungskapazitäten rationalisiert und die Starrheit der Infrastrukturen umgangen werden. Gleichzeitig erzeugt dieser Ansatz aber auch Reibungen (*friction*), die Prozesse der Territorialisierung brechen, wenn diese auf Offshore-Räume projiziert werden, und dabei spezifische Lock-ins und Formen von Unwissenheit und Untätigkeit produzieren. Diese Studie leistet somit einen kritischen Beitrag zur zeitgenössischen Forschung über Überwachung und Informationelle Governance auf See und reflektiert zugleich über die Governance der Infrastrukturen.

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LIST OF ACRONYMS

AIS:	Automatic Identification System
AEM:	Action de l'Etat en Mer (Action of the State at Sea)
BMBF:	Bundersministerium für Bildung und Forschung (Federal Ministry of Education and Research of Germany)
CCTV:	Closed-Circuit Television Camera
CLS:	Collecte Localisation Satellites
CMM:	Conservation and Management Measure
COSS:	Centre Opérationnel de Surveillance et de Sauvetage (Operationnal Surveillance and Rescue Centre)
CPUE:	Catch Per Unit Effort
CRGA:	Committee of Representatives of Governments and Administrations
DAM:	Direction des Affaires Maritimes (Directorate of Maritime Affairs)
DTSI:	Direction des Technologies et des Services de l'Information (Directorate of Technologies and Information Services)
DWFN:	Distant Water Fishing Nation
EAF:	Ecosystem Approach to Fisheries
EBM:	Ecosystem-Based Management
EU:	European Union
EEZ:	Exclusive Economic Zone
EMIA:	Etat-Major Inter-Armées (Joint chiefs of military staff)
eNGO:	Environmental Non-Governmental Organization
(d)FAD:	(drifting) Fish Aggregating Device
FAO:	Food and Agriculture Organization of the United Nations
FAME:	Fisheries, Aquaculture and Marine Ecosystem Division
FEMA:	Fisheries and Ecosystem Monitoring and Analysis
FFA:	(Pacific Islands) Forum Fisheries Agency
FFIA:	Fiji Fishing Industry Association
FMSRCC:	Fiji Maritime Surveillance Rescue Coordination Centre
GIZ:	German Agency for International Cooperation

GPS:	Global Positioning System
HACCP:	Hazard Analysis and Critical Control Point
IATTC:	Inter-American Tropical Tuna Commission
ICCAT:	International Commission for the Conservation of Atlantic Tuna
ICES:	International Council for the Exploration of the Sea
IFREMER:	Institut Français de Recherche pour l'Exploitation de la Mer (French Research Institute for the Exploitation of the Sea)
IMO:	International Maritime Organisation
IOC-UNESCO:	Intergovernmental Oceanographic Commission of UNESCO
IOFC:	Indian Ocean Fishery Commission
IPFC:	Indo-Pacific Fishery Council
IRD:	Institut de Recherche pour le Développement (French National Research Institute for Sustainable Development)
IUCN:	International Union for the Conservation of Nature
LOIS:	Large Oceanic Island State
LSMPA:	Large Scale Marine Protected Area
MARPOL:	International Convention for the Prevention of Pollution from Ships
MCS:	Monitoring, Control and Surveillance
MFCL:	Multifan-CL
MHLC:	Multilateral High-Level Conference
MMA:	Marine Managed Area
MNHN:	Museum National d'Histoire Naturelle (National Museum of Natural History)
MPA:	Marine Protected Area
MSC:	Marine Stewardship Council
MRCC:	Maritime Rescue Coordination Centre
MSP:	Marine Spatial Planning
MSY:	Maximum Sustainable Yield
NGO:	Non-Governmental Organisation
OECD:	Organisation for Economic Cooperation and Development
OFP:	Oceanic Fisheries Programme (of the Pacific Community)
ORSTOM:	Office de la Recherche Scientifique et Technique Outre-Mer (Overseas Scientific and Technical Research Office – now IRD)

PICTs:	Pacific Island Countries and Territories
PIRFO:	Pacific Islands Regional Fisheries Observer
PNA:	Parties to Nauru Agreement
PPB:	Pacific Patrol Boat (programme)
QUAD:	Quadrilateral Defence Coordination Group (US, France, Australia, New Zealand)
RFMO:	Regional Fisheries Management Organisation
RTMF:	Regional Technical Meeting on Fisheries
SAM:	Stock Assessment and Monitoring
SDG:	Sustainable Development Goal
SIDS:	Small Island Developing States
SOLAS:	Safety of Life at Sea
SPC:	Pacific Community (formerly: South Pacific Commission)
SPNMCP:	Service du Parc Naturel de la Mer de Corail et de la Pêche (Service of the Coral Sea Natural Park and Fisheries)
SPREP:	South Pacific Regional Environment Programme
SPRTRAMP:	South Pacific Regional Tuna Resource Assessment and Monitoring Project
SSAP:	Skipjack Survey and Assessment Programme
STS:	Science and Technology Studies
TAC:	Total Allowable Catch
TBAP:	Tuna and Billfish Assessment Programme
UNCLOS:	United Nations Convention on the Law of the Sea
UNESCO:	United Nations Educational, Scientific and Cultural Organization
UN:	United Nations
US:	United States of America
USMLT:	United States Multilateral Treaty
USP:	University of the South Pacific
VMS:	Vessel Monitoring System
VDS:	Vessel Day Scheme
WCPFC:	Western and Central Pacific Fisheries Commission
WCPO:	Western and Central Pacific Ocean
WWF:	Worldwide Fund for Nature

ZMT: Leibniz Zentrum für Marine Tropenforschung (Leibniz Centre for Tropical Marine Research)

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Foreword

Science becomes the myth not of what escapes human agency and responsibility in a realm above the fray, but rather of accountability and responsibility for translations and solidarities linking the cacophonous visions and visionary voices that characterise the knowledges of the subjugated. [...] The only way to find a larger vision is to be somewhere in particular. (Haraway, 1988, p. 581-582,588)

Before delving into the topic of this dissertation – the surveillance and territorialisation of industrial tuna fisheries in the offshore waters of the South Pacific Ocean – I provide in this foreword section some preliminary considerations on the ‘background’ of this research. Considering that my research largely deals with the production of (in)visibilities and concurring that knowledge is never a view “from nowhere” (Haraway, 1988, p. 581), it is only expected that I first situate my work and own gaze on oceanic matters and account for what influenced the framing of my research.

I. Research Context and Inception

I initiated this research in mid-2018 as part of a broader scientific project funded under the binational social sciences and humanities programme of the French and German National Research Agencies and led by the French National Research Institute for Sustainable Development (IRD) and the Leibniz Centre for Tropical Marine Research (ZMT). The aim of the project “A Sea of Connections: Contextualising Fisheries in the South Pacific Region” (SOCPacific) was to study oceanic governance, fisheries management and marine biodiversity conservation policies in Fiji, Vanuatu and New Caledonia using a multi/interdisciplinary perspective (Fache & Breckwoldt, 2019).

The existence of such a project reflects the more general ‘oceanisation’ of global scientific and political agendas whereby oceanic matters increasingly come to the fore of socio-economic, political and environmental concerns. Devised by two scientists already involved in Fijian social studies, SOCPacific resonated with these wider agendas. For instance, French President E. Macron greatly pushed forward new plans relating to the “Indo-Pacific axis”¹, reviving and reframing the focus on the South Pacific region, its overseas territories (New Caledonia, Wallis and Futuna, and French Polynesia), and their marine environments. IRD, historically created to conduct research in the French colonies and then with the ‘Global South’, has recently engaged in advancing a “sustainability science”².² Under this

¹ E.g. see one of his discourses on the topic: <https://www.vie-publique.fr/discours/290557-emmanuel-macron-27072023-indopacifique> (accessed: 22.08.24)

² <https://www.ird.fr/sciencedeladurabilite/C3%A9> (accessed: 26.08.24)

banner, the institute progresses oceanic research in the Pacific region. Hence, SOCPacific contributed to consolidating IRD's presence in the region by animating its social science research efforts and cooperation with the University of the South Pacific (USP).

The project's rationale was that fisheries, one of the most important fields of activity in the region, had been predominantly studied through the lens of economics and marine ecology, whereas other disciplinary perspectives would provide valuable and complementary lighting on the many connections in which fisheries and their management are embedded. Indeed, the predominance of natural sciences and other bioeconomic and resource-driven stances have permitted important yet only partial ways of thinking about the ocean (Cardwell & Thornton, 2015). The project initially pursued three main threads:

- 1) assessing the social values of places and resources in connection to offshore and inshore fisheries;
- 2) unpacking the connections and tensions between fishing and conservation interests and practices, in particular within Marine Managed Areas (MMAs) and Marine Protected Areas (MPAs);
- 3) enquiring how fisheries and existing management tools are integrated into the Marine Spatial Planning (MSP) schemes currently under development in the South Pacific Region.³

For several of the scientists involved in SOCPacific, myself included, this project represented our first incursion into the marine⁴ realm. Little did I know, when I started my research, about the ocean, fisheries, or the Pacific region. When I joined the project, I was concluding a Master's degree in Science and Technology Studies (STS) and Environmental Humanities and finishing a Master's thesis on soil-human relations and the evolution of soil mapping, monitoring, science and public policies in France (Kon Kam King, 2018). Combined with my previous educational training in mostly terrestrial ecology, suffice it to say that I had a 'terrestrial bias' when starting my Ph.D. degree.

As I started reviewing the literature to elaborate my research project, I was struck by the many similarities I could find in descriptions by social scientists about 'the' soil and 'the' ocean, although with a lag of a few decades. Both bodies of research, for instance, invoked the 'frontier' concept to allude to the soil and the ocean and depicted these planetary compartments as having been long neglected and reduced to mere inert and flat supports of human societies (e.g. Oreskes, 2014 on oceans; e.g. Puig de la Bellacasa, 2014 on soils). Both bodies of research also called for shifting these 'underworlds' from background to focus and acknowledging the multidimensional, lively yet also complex, hardly visible and particularly resistant to observation networks of biotic and abiotic entities that constitute and produce soils and oceans alike. These similarities permitted me to displace and put in perspective my previous investigations on 'nature-culture' and power-knowledge relations from the soil to the ocean

³ For more information on the project, see Fache & Breckwoldt (2023)

⁴ I use the term 'marine' to refer to the more-than-human ocean, leaving the term 'maritime' to refer to anthropic activities.

and its offshore waters, which epitomised the ‘black box’ metaphor. In particular, I retained my previous interest in the role of environmental monitoring and knowledge infrastructures in mediating human/non-human relations. My interest in the material ‘resistance’ of things moved from soils to oceans and, more precisely, offshore worlds.⁵ Far from the shore, three-dimensional, immense, dynamic yet apparently homogeneous if not empty, offshore waters and their mobile inhabitants seemed a case in point of resistance to knowledge production and governing endeavours of opaque worlds.

My focus on tuna fisheries derived from aligning personal and external expectations. Tuna was the (commercial) fish I knew the most about and was the most interested in, given its outstanding biological traits. Considering that many of my SOCPacific colleagues were addressing artisanal and small-scale commercial fishing activities primarily operating in coastal waters and given tunas’ regional and global importance, I thought it relevant to use the offshore industrial tuna fisheries as an entry point for my research. If my initial aim was to encompass both offshore and inshore fisheries and interrogate their connections, my first results showed that they had largely been constituted as two worlds apart, leading me to retain my focus on tuna fisheries. This allowed me to address two additional considerations. From a scientific perspective, I observed that social studies (besides economic studies) of industrial fisheries and offshore ecosystems were overall scarce. From a personal viewpoint, it permitted me to alleviate some ethical and political uneasiness regarding my position as a Western scientist conducting her research in a postcolonial context. Investigating commercial and highly globalised supply chains stretched between the continents and the oceans allowed me, in particular, to conduct fieldwork in labour places rather than in more personal spheres – even though these are only murky boundaries. The ‘ocean’ I would study, therefore, became one made of and by highly mobile pelagic fish and industrial fishing vessels, private companies, regional and national fisheries management organisations, scientific institutions, surveillance centres, etc.

Although I would not claim that this research embodies a longed-for trans/interdisciplinary science, I did draw inspiration from various disciplinary fields (narrowed down to the social sciences and humanities) that have helped me, here too, to align my educational training in sociology and history of sciences with my later enrolment in geography as part of this Ph.D. degree and with what I could observe empirically. Hence, I am particularly indebted to the STS that have helped me focus on knowledge and co-production processes and pay attention to the world’s materiality; to environmental anthropology for helping me think of and write about nature-culture entanglements; to critical and environmental geography for helping me consider issues of distance and proximity and of spatial and territorial features; and to surveillance studies for helping me reflect more frontally on state (and beyond) power and exercise and relations and structures of control. Crossing these various fields of enquiries enables

⁵ I speak of ‘worlds’, plural, in reference to contemporary debates in anthropology of nature to be attuned to other worldviews and take emic perspectives seriously (e.g. Cadena & Blaser, 2018). The plural helps me frame worlds as emergent, continuously produced through heterogenous knowledge and practices.

this research to advance on several fronts of each of these fields. For instance, these geographical influences contribute to STS’ ‘spatial turn’ (e.g. Kohler, 2002; Mahony, 2015). My historical approach to tuna fisheries also partakes in calls for a “new political sociology of science” more attuned to the influence of structural and longstanding power relations on knowledge production (see Frickel & Moore, 2006). Conversely, the mobilisation of STS and environmental humanities permits to give (literally speaking) depth and re-populate the fields of Surveillance Studies and International Relations with animals, waters, technologies, instruments, etc.

II. Thinking and Writing about the Ocean with the ‘Blue Humanities’

1. ‘Oceanising’ Social Sciences

Against those considerations, I loosely affiliate my research to the emerging ‘Blue Humanities’ scholarship. In this section, I explain how I approach the ‘ocean’ and why thinking about and with it matters. The ‘oceanisation’ of scientific agendas has not left social sciences untouched. Two main trends can be outlined in the social sciences and humanities: one using the ocean as a metaphor to think of social processes and structures, and a second interested in exploring the social dimensions of the ocean and largely nurtured by Oceanian studies. In this dissertation, I attempt to combine both approaches.

The first body of research has used the ocean (and aquatic worlds more generally) as a “theory machine”, i.e. “a substance or phenomenon to which people appeal as they model other phenomena in the world” (Helmreich, 2016, p. 95). Embraced from a symbolic perspective, the *concept* of water – salted or not – has supported novel metaphors hinging on images of liquidity, flows and currents to describe in a new fashion various social, political and economic transformations linked in particular to modernity and globalisation. This ‘turn to water’ helped account for contemporary societies’ heightened mobility or propose new philosophical theories on resistance and evasion to social order and (fix) state power (Adey, 2003). The conceptualisation of the “liquid society” by sociologist Z. Bauman – then declined by surveillance scholar D. Lyon with his “liquid surveillance” (Lyon, 2010) – illustrates such a trend. Philosophers such as G. Deleuze and F. Guattari also referred to the ocean to think about the tension between “smooth” and “striated” spaces – i.e. between open, nomadic and de-territorialised spaces *versus* territorialised, homogenised, and hierarchized spaces (Deleuze & Guattari, 1994).

Acknowledging the overrepresentation of the land in social studies and theories, many social scientists suggested looking at the ocean to rethink terrestrially-inspired notions of space, territory⁶ or boundary, arguing that the ocean can provide a “fertile environment” (Steinberg & Peters, 2015, p. 252), requesting but also affording “new understandings of mapping and representing, living and knowing,

⁶ The term “territory” itself attests to the terrestrial anchor of the concept.

governing and resisting” (Hannigan, 2017). In line with G. Deleuze and F. Guattari’s work, human geographers J. Anderson and K. Peters explained that scholarly interest in the ocean goes beyond the latter (Anderson & Peters, 2014). It also serves to open up new ways of thinking about terrestrial or aerial worlds, to reconsider our “earth writing”, and promote a “fluid ontology”:

Here, we suggest a shift towards a ‘fluid ontology’, promoting a knowledge of the world which is neither ‘land’ biased nor ‘locked’ to static and bounded interpretations of space, but rather one that conceives of our (water)world as one which is in flux, changeable, processual and in a constant state of becoming. [...] Maybe the world is fluid [...]. Perhaps by this ‘simple’ change in vocabulary, we can rethink our ‘earth writing’. (Anderson & Peters, 2014, p. 12)

I understand this invitation to reconsider “earth writing” in several ways. My research empirically looks into the ocean to shed new light – and therefore renew terrestrially-dominated perspectives – on social phenomena such as surveillance and territorialisation. From an epistemological perspective, I remain attentive to the processual, in-becoming emergence of entities and categories (see also Ingold, 2021). Finally, I approach this call away from “earth writing” quite literally to explore ‘fluid’ ways of writing, more capable of accounting for the complexity of the intertwinements at stake, in opposition to more structured, hierarchised and therefore ‘bounded’ writing styles.

However, as warned by anthropologist and STS scholar S. Helmreich, this ‘turn to water’, although valuable from a heuristic perspective, is often on the verge of conjuring new reifications – in the first place, the land-sea dichotomy (Helmreich, 2016). Seawater is not necessarily liquid but can also be iced; legal or oceanographic boundaries may mitigate or hamper the ‘free-flowing’ of oceanic entities. Water may not be so smooth after all, and liquid matter may not prevent turbulences and “frictions”⁷ (Tsing, 2011). To avoid the pitfall of “reduc[ing] the sea to a metaphor for flux and flow while ignoring the actual mobilities that are experienced by those who traverse or gaze upon its surface” (Anderson & Peters, 2014, p. xv), a second and more materialist body of oceanic research has progressed, arguing for empirical investigations of the ocean. The point is not to treat the ocean as a mere semiotic entity for theory-building and writing but to also enquire in its material aspects. “Thinking *from* the water”, as K. Peters and J. Anderson called for (Anderson & Peters, 2014, p. 4), requires scientists to look *into* this water without fetishising it. In what follows, I introduce further this second strand of research.

2. Enlivening and Socialising the Ocean

The burgeoning interest of social sciences for oceanic *matters* – understood figuratively and literally, and consequently including the ocean as a material entity – has given rise to the new-born and

⁷ Anthropologist A. Tsing (2011) described frictions as “the awkward, unequal, unstable and creative qualities of interconnection across differences” (p.4). The idea of frictions is used to outline the idea that flows do not occur “magically” but through frictions that are enhanced or inhibited by particular processes.

multidisciplinary blue humanities scholarship⁸ (Deloughrey et al., 2016) aiming to make marine social sciences more “lively” (Bear, 2013, p. 22) and “fluid” (Satizábal & Batterbury, 2018, p. 1).

The constitution of the blue humanities also stems from critical reviews in (Western) sociology, history or geography, condemning the long neglect of the ocean in these disciplines (e.g. Anderson & Peters, 2014; Oreskes, 2014; Steinberg & Peters, 2015; Hannigan, 2017). Admittedly, maritime topics such as piracy, immigration, shipping or fishing communities were not absent from the social sciences (especially in maritime anthropology and sociology) but lacked conceptual and theoretical coherence (Hannigan, 2017). More importantly, these publications outlined how Western social sciences failed to properly engage with the ocean and consider it a ‘lively matter that matters’ and not just a symbolic or, at best, inert material entity. This neglect tells of a specific representation of the ocean that has long dominated many Western social sciences. Virtually impenetrable to human bodies and free of any permanent human settlements, the ocean was chiefly approached as a lifeless background to human societies and the (equally human-bounded) world history, as a flat surface separating (terrestrial) loci of interest, or as a romanticised or dangerous ‘other’ (Corbin, 2010).

Exceptions to these approaches do exist, however, and continue to progress. Noticeably, many of these come from Oceanian studies, disclosing, thanks to the study of indigenous Pacific societies, new worldviews in which the ocean is central and tightly intertwined with land and humans. Engaging more frontally with these humans-oceans entanglements, these works greatly contributed to debunking the terrestrial prism predominant in much social science research (e.g. Johannes, 1981; Hau’Ofa, 1994; Hviding, 1996; D’Arcy, 2006). E. Hau’Ofa, for instance, was particularly influential in pointing out how the ‘isolated’ and ‘marginal’ depiction of Oceanian islands in the Pacific Ocean reflected a historical construct from continental and colonial discourses. Those dominant discourses dismissed internal interpretations of the Pacific Ocean as a plentiful “Sea of Islands” and a source of social, economic and cultural connections between Oceanian peoples (Hau’Ofa, 1994). This scientific gesture is, therefore, not only epistemological but also eminently political. It brings to light perspectives and worlds dismissed or kept invisible. It also permits us to think differently about a world and in a world whose current socio-environmental transformations and challenges require new ways of thinking and doing to live with.

My work affiliates with this scholarship that examines how the ocean, made of and by water, animals, humans, artefacts, discourses, knowledge, etc., comes to be in a processual manner. This scholarship retraces and resituates the cultural, political and technological factors that helped co-construct the ocean. Investigating various geographies, eras and social groups, these works started providing a fuller, more

⁸ Like any scientific field, such banner is to be understood malleably, to help provide a rough mapping of the scholarly field even though those boundaries are neither fixed nor undisputed. Not all authors I refer to here explicitly claim their affiliation to this label yet I group them based on my own appreciation of their ontological and epistemological similarities or because they cross-reference each other.

nanced and complex account of the variety, contingency and dynamism of humans-oceans relationships – and simultaneously portrayed alternative models to the dominant perception of the latter.

The blue humanities may be read as an emanation from the wider “environmental humanities” (Heise et al., 2017), drawing on STS, feminist studies, environmental history, anthropology of nature, political ecology, more-than-human geography, and posthumanist theories to think ‘nature’ and open social science perspectives ‘beyond the human’ (see, e.g. Rose et al., 2012).⁹ From the end of the 1970s, accompanying the proliferation of technological innovations, industrial hazards and associated environmental issues, related empirical and theoretical research proposed an onto-epistemological shift to rethink the place and role of non-human entities – and, therefore, of human entities. Previous social theories heavily focused on humans and immaterial things, such as discourses and systems of thought that were deemed specific to human societies. Anthropology of techniques, along with M. Foucault and his notion of “apparatus” developed in the 1970s or with G. Deleuze and F. Guattari’s concept of “assemblage” from the 1980s, initiated new considerations to think together interrelated yet composite “objects”, including both material and discursive entities (Dodier & Stavrianakis, 2018).¹⁰

In the wake of these works, empirical research developed to ‘repopulate’ social studies, firstly by outlining the role of artefacts in shaping societies (e.g. Latour, 1994; Winner, 2007). In STS, the Actor-Network Theory advanced, for instance, the idea that agency is distributed, i.e. not pre-given and limited to humans but rather emerging from the interactions of a composite network of “actants” (Latour, 1987). Such considerations rapidly spread beyond the technological realm to ‘natural’ entities such as animals, plants, mushrooms, and more recently abiotic entities, as part of a growing enquiry into the ‘Anthropocene era’ and in line with the ‘ontological turn’ in anthropology (Heywood, 2018). With a rekindled interest in the notion of ‘assemblage’, the role of ‘non-humans’, ‘more-than-humans’ or ‘other-than-humans’ in co-constructing worlds (Tsing, 2015) is acknowledged, along with the existence of other ways of living with these entities other than human. Another consequence of these shifts was a larger emphasis on materiality (Bennett, 2010).

This series of displacements bears important epistemological concerns to acknowledge the heterogeneity and materiality of worlds. They also bear ethical and political considerations to move beyond an overly anthropocentric gaze and resist narratives of humans’ exceptionalism in an attempt to reflect on and imagine appropriate ways to live *with* others. More attuned to Oceanian worldviews, these

⁹ Delving in the respective history and specificities of each of these fields goes beyond my goal here, which only aims to outline some of their critical inputs guiding my research.

¹⁰ “Dispositif” in French (original). Foucault understands an apparatus as “a thoroughly heterogeneous ensemble consisting of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions – in short, the said as much as the unsaid. Such are the elements of the apparatus. The apparatus itself is the system of relations that can be established between these elements.” (Foucault 1977 [1980]). The notion of “assemblage” (“agencement” in original French version) similarly articulates discursive and non-discursive aspects but with a more dynamic and rhizomatic, rather than networked, understanding of the links between the components.

relational approaches help put in perspective modernist and reifying dichotomies of object/subject, nature/culture, technoscientific/political, or technical/social that have ontologically, epistemologically and methodologically prevailed in modern science.

How can these reflections help us think about the ocean? In a similar interrogation on land and the making of natural resources, anthropologist T. Li outlined that uses and meanings are neither stable nor undisputed, that materiality ‘affords’ specific uses and values and that inscription devices are pivotal in assembling things like land or the ocean, in my case, as natural resources (Li, 2014). I find such an assemblage-inspired approach useful to contemplate the ocean and consider, in particular, its role in both affording and constraining certain forms of activities – such as fishing, surveillance and territory-making. Following this lead, also declined in the marine realm (e.g. Bear, 2013), I think of the ocean not just as seawater but as an assemblage of heterogeneous entities, i.e. as an entanglement of practices of knowing and being, of humans and non-humans, of discourses and matters. J. Lehman’s interest in “geontopolitics”¹¹ argues that the ocean is so imbricated with human, fishy and other forms of life that it is indistinct from it (Lehman, 2016a, p. 119). Therefore, I do not separate the ocean from its fish or fishers. The entities that assemble the ocean are not pre-identified but uncovered through an empirical investigation, enquiring into connections and the making of disconnections (Fache et al., 2022). The notion of assemblage points to the open-ended character, indeterminacy and contingency – without forbidding its stability – of such human/non-human, material/immaterial gathering, and helps for a fluid enquiry into these dis/re/connections rather than presuming them (Braverman & Johnson, 2020).

Consequently, I do not approach the ocean with preconceived ideas about its materiality and agency (or lack thereof). Instead, I focus on the unremitting tension and articulation underlying the ocean as both a ‘natural’ and ‘cultural’ object (Helmreich, 2009): an intertwining of humans and non-humans, a landscape (or rather, oceanscape), a space and a category all at one. I concur with S. Helmreich’s constructivist approach that the material existence of the ocean cannot be accessed and made meaningful without mediation and is therefore inseparable from the knowledge that makes it legible (Helmreich, 2016; see also Lehman, 2016b). Technologies, language, conceptions of nature, academic, regulatory and legal structures, etc., shape how human societies engage with the ocean and make it significant while translating and transforming it back in the process. The ocean consists of a situated and processual phenomenon, emerging from specific practices, through which particular social, political, cognitive and ‘natural’ orders are co-produced (Paxson & Helmreich, 2014).

¹¹ Here, J. Lehman draws on the concept of “geontological power” to discuss a shift away from the governance of life as explored by Foucault with his concept of “biopolitics” and toward the governance of a “contemporary indistinction between life, death, and nonlife” – across the geological, biological, technological.

PART I
General Introduction

II. Thinking and Writing about the Ocean with the 'Blue Humanities'

CHAPTER 1. Introduction

I. Fragments from the Field

1. Fishing for Tuna

Suva, Fiji, July 2019. I was in the capital city's harbour, on the deck of a second-hand tuna fishing vessel belonging to a locally-based company. I was discussing with R., a 40-year-old Indigenous Fijian captain coming from one of the 300+ islands that constitute, with about 1.3 million km² of marine space, the heterogeneous territory of the Republic of Fiji. In parallel to claiming its independence from Great Britain in 1970 and following the 1982 United Nations Convention on the Law of the Sea (UNCLOS) adoption, Fiji significantly expanded its territory from the land to the ocean, claiming jurisdiction over its adjacent territorial seas, archipelagic waters and Exclusive Economic Zone (EEZ).¹² If Fiji retains full sovereignty in its archipelagic waters and territorial seas, its sovereign rights over its EEZ are, like any other UNCLOS member state, limited to exploring, using and managing marine resources.

Captain R. worked in the domestic offshore fishing industry, which consists of longline tuna fishing. Most of Fiji's offshore economy relates to tuna fishing, with 86 Fijian-flagged vessels operating in Fiji's waters, neighbouring countries' waters and international waters (Fiji Ministry of Fisheries, 2021). 'Offshore' covers various definitions and distances from the shore. In Fiji, the term colloquially refers to this vast volume of waters situated 'beyond the reefs' and where tunas and other pelagic animals can be found. The reefs also constitute a legal and governance boundary, distinguishing the offshore from the inshore *iqoliqoli*, those marine tenure areas over which Indigenous Fijian communities have customary fishing rights (see Sloan & Chand, 2016). From a regulatory perspective, however, Fiji distinguishes an 'offshore' fishing license, authorising vessels to fish in the archipelagic waters and territorial sea, from an 'EEZ' license, permitting fishing vessels to operate in EEZ waters.

R. had just returned from a two-week-long fishing campaign and was about to leave the day after on another fishing trip. Amid his preparations, I caught an hour of his not-so-spare time to ask him about his life at sea.¹³ Initially working in the shipping industry, R. transferred to fishing in 1998. Instead of navigating along predetermined lanes, his life now consists of tracking and extracting tunas from the ocean, working to capture a 'wild', elusive and yet highly valued and coveted resource underpinning one of the largest industries on the planet. The campaign he had just achieved was relatively

¹² Territorial waters refer to the marine area which extends up to 12 nautical miles (nm) from the baseline. For archipelagic states like Fiji, the combined land masses are considered as forming a single unit from which to establish those territorial waters, which therefore encompass the waters around, between and connecting the state's islands. The EEZ spans from the limit of the territorial sea up to 200 nm.

¹³ I choose in this dissertation not to make any distinction between the terms of "sea" and "ocean". My research did not evidence any specific difference between the two terms, which I use interchangeably.

disappointing. He spent much time and money “steaming”, i.e. burning fuel to reach remote fishing grounds in the “open ocean”, only to bring back a half-full vessel with few bigeye and yellowfin tunas – the two most valuable fish he was after. This extensive, costly and unpredictable mobility is part of the tuna fishing game. Still, “fishing pays more”, R. said in contrast to his previous shipping experience, “but it’s a real headache. I found out that *fishing is all about what you can’t see*. You really have to be patient and smart to *predict* the fishing grounds” (Field notes, Suva, 05.07.19, my emphasis).

To address this uncertainty, experience is critical. Captains self-record their practices to build such experience. They also talk to or spy on each other to identify labile fishing grounds, thanks to technological devices that have greatly improved communication and, simultaneously, vessels’ visibility at sea. Those devices also make a hazardous profession safer by improving their connection to maritime surveillance and rescue centres. Other technological developments have transformed the sector. Many private companies now propose ‘fish finders’, as the fishing industry calls them, including echosounders to probe the ocean or decision support tools that guesstimate where tunas may be, based on the crossing of satellite-derived oceanographic information and knowledge of fish ecology.

Fortunately, no particular incident happened during R.’s latest trip, and he safely returned to port to offload his catch to a processing room a few meters away from the deck. The vessel’s arrival initiated a long, shore-based, operational chain destined to bring fish food onto (predominantly distant) consumers’ plates. Under the lens of surveillance cameras – some recently placed onboard the fishing vessel – other people came at 4 am to scrutinise the vessel’s return. Ministry of Fisheries representatives verified that fishers correctly reported their catch in their logsheets, which they must return as part of their fishing license requirements, and inspected potential compliance issues. Several company managers and the owner closely watched the crew as they transferred the catch to verify that they would neither steal nor damage the fish.

Finally, the “onshore staff” took over, sorting the fish depending on their species and quality in the processing room. “Export fish” and ‘sustainable’ Marine Stewardship Council (MSC)-certified¹⁴ fish bring the company the most money. Therefore, certain Fijian companies have become particularly interested in developing their MSC certifications to compensate for their decreasing catch. Several people meticulously recorded the catch throughout processing for various reasons. Onshore employees tracked the fishing campaign’s outcome to see how customers’ demands could be met. Fishing captain R. attended the process to ensure that the company’s records matched his and that he would be paid accordingly. The day was special, too, as a private company came to trial a food-chain traceability “from bait to plate” solution, aiming to digitally record various data about the ‘afterlife’ of the fish regarding where it was caught, transformed, and sold. This company offers to track fish and their by-products

¹⁴ MSC is one of the leading certification schemes to label fish food as ‘sustainable’ (see Chapter 7).

throughout the highly globalised tuna supply chain to guarantee the traceability, transparency, and accountability of fishery products to the consumers.

2. Researching Tunas

Noumea, New Caledonia, November 2019. I was over a thousand kilometres away from Suva's harbour. Next to the Pacific Community (SPC) headquarters, a regional organisation providing technical and scientific advice to its (mainly South Pacific) member states,¹⁵ I met with J., a British tuna scientist who had freshly returned from the prominent tuna tagging campaigns coordinated by SPC and its Oceanic Fisheries Programme (OFP). OFP is the leading programme in the region devoted to "tuna fisheries research, fishery monitoring, stock assessment and data management".¹⁶ J. and his colleagues work as scientists and scientific advisers to assist national fisheries authorities and the Western Central Pacific Fisheries Commission (WCPFC), the regional and intergovernmental organisation in charge of managing tunas in the Western and Central Pacific Ocean (WCPO), in deciding tuna management policies. J.'s job serves "to understand where the fishes are, where they are caught, and how many might be left".¹⁷ Again, the fugitive character of tunas makes this question thorny, both for scientists and managers, as tunas repeatedly swim across various jurisdictions and international waters.

Like Captain R., J. described tuna fishing as a "cat and mouse game in three dimensions" (Fishery scientist, Noumea, 11.11.19). His first tuna fishing experience left him with such a vivid impression that he decided to complete a Ph.D. degree in tuna behaviour and join SPC and its tagging program. I had to wait several weeks to meet J., as he was at sea cruising through the largest ocean on the planet and tracking tunas just like Captain R. In his case, fishing for tunas aims to take biological samples and equip fish with various tags before releasing them alive into the water for scientists to track their lives and behaviour. The tagging programme has a long history in the region and articulates with other data collection programmes (consisting of fishers' logsheets, onboard and in-port fisheries observer programmes, etc.) to fuel SPC's stock assessment models.

Although the tagging programme is the most extensive one in the world, J. told me his doubts about the validity of the stock assessment models and how this uncertainty is exploited in multilateral management negotiations. Many unknowns remain regarding the hidden lives of tunas and oceanic ecosystems. Adding to this are novel threats that make relevant assessments even more critical. First, the growing recognition of the intertwining (and therefore dependency) of tunas with other species has led to recognising the need for a more integrated and so-called 'ecosystem approach to fisheries' instead

¹⁵ SPC members include Fiji and New Caledonia, along with: American Samoa, Australia, Cook Islands, Federated States of Micronesia, France, French Polynesia, Guam, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Northern Marian Islands, Palau, Papua New Guinea, Pitcairn Islands, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, United Kingdom, US, Vanuatu, Wallis and Futuna.

¹⁶ OFP website: <https://oceanfish.spc.int/> (accessed : 30.05.24)

¹⁷ Quotation from an unpublished journal written and provided to me by the interviewee.

of the monospecific approach that dominates fishery science and management. Concerns about climate change's impacts on tuna distribution (and availability to coastal states) also foster new research endeavours. However, the most urgent research agenda regards the dramatic intensification of purse seine fishing on drifting Fishing Aggregating Devices (dFADs). For unknown reasons, tunas tend to aggregate under these floating devices. The ever-upgraded equipment of dFADs with beacons, sonars and/or echo sounders has tremendously helped fishers locate fish and 'harvest' them instead of 'hunting' them (Reyes & Airaud, 2022). The dramatic efficiency of dFADs and the pollution they engender worry scientists like J. regarding their impact on tuna stocks and marine ecosystems. As dFADs transform fishing practices, they also challenge some of the main assumptions underlying fishery science and its stock assessment models. Conjointly, however, dFADs also offer new perspectives to scientists for studying oceanic ecosystems.

3. Controlling Tuna Fishers at Sea

Somewhere in the Pacific Ocean, between New Caledonia and Fiji, December 2019. I was on board *D'Entrecasteaux*, one of the four French military vessels based in Noumea. I joined the crew to observe 'maritime surveillance' in practice. The four week-long patrol mission involved several objectives. The first part of the mission consisted of patrolling parts and parcels of the 1,240,601 km² EEZ¹⁸ of New Caledonia to protect France's territory and secure its sovereign rights over its EEZ. It contributed to improving the knowledge of the EEZ by reporting on its 'patterns of life' and supporting hydrographic investigations to chart the poorly known marine territory of New Caledonia. The second part of the mission consisted of strengthening bilateral cooperation with Vanuatu and Fiji through diplomatic encounters, joint military capacity-building exercises, maritime information exchanges and maritime surveillance assistance.

The main threats weighing on New Caledonia's waters are not military ones. Sources of maritime insecurities instead include illegal fishing, narco-trafficking activities, and the illegal human frequentation of the New Caledonian Coral Sea Natural Park's recently created marine reserves. Hence, in this part of the world, the French Navy is more concerned with policing illicit flows than war. These new attributions derive from the New Caledonia Government's limited capacities to access, patrol and control the EEZ's environment it is responsible for and from growing inter-state competition for the Indo-Pacific region's spaces and resources.

Against that context, the French Navy has accentuated its maritime surveillance efforts. However, one *D'Entrecasteaux* crew member told me how difficult it is to patrol the Pacific Ocean, given its immensity and illegibility. It is unlikely to meet anyone or anything by chance: "It is like searching for

¹⁸ Source : French government - <https://maritimelimits.gouv.fr/resources/areas-frances-maritime-spaces-sovereignty-and-jurisdiction> (accessed: 20.12.21) This information is contentious however, considering that the maritime boundaries of New Caledonia are disputed by Vanuatu as both France and Vanuatu claim ownership of the Matthew and Hunter Islands.

a needle in a haystack – but without even possibly having the needle in there” (Field notes, patrolling mission, Dec. 2019). Complementary surveillance practices emerge to optimise costly patrolling operations by sourcing alternative information and cross-analysing multiple yet patchy maritime data in integrated databases. Increasingly, maritime security efforts build on ‘intelligence’ to characterise, anticipate and address maritime risks with limited operation means. If emerging technologies permit the production of new maritime data, they also offer evasion lanes to surveillance subjects, who can, in turn, observe and avoid their surveillants. During a night watch, the operations officer lamented that fishers are “far more [technologically] equipped than the Navy” (Field notes, patrolling mission, Dec. 2019).

4. Controlling Tuna Fishers from the Shore

Paris, France, May 2021. Back in my hometown, I was ‘working from home’ after my second trip to Fiji and New Caledonia was cancelled because of the Covid-19 pandemic. Fieldwork then consisted of staying in front of my computer, attending online meetings, scrolling through social media feeds and conducting online interviews. One day, I talked to officer A. from the Regional Fisheries Surveillance Centre of the Forum Fisheries Agency (FFA), based in Honiara, Solomon Islands. FFA helps its member countries – a group of 17 Pacific Islands¹⁹ – to “manage, control and develop their tuna fisheries” in their EEZs and foster “regional solidarity”.²⁰ To achieve these goals, FFA develops “Monitoring, Control, Surveillance” (MCS) mechanisms to control fishing activities and prevent, deter and eliminate Illegal, Unreported and Unregulated (IUU) fishing in the Pacific. Contrary to fishery scientist J. or fishing Captain R. and more like the French Navy, FFA does not track fish as much as their fishers. Throughout the interview, I learned that FFA estimated in 2016 that IUU fishing caused its members about US\$150 million loss and could have severe environmental impacts on oceanic ecosystems. Correctly understanding and addressing IUU fishing constituted a priority to ensuring tuna fisheries’ economic *and* environmental sustainability (FFA chief officer, Honiara, 21.05.21).

“We look after a very big area of water”, A. explained, “with very large EEZs, which makes it difficult to undertake effective MCS. Another characteristic is that we have highly valuable tuna resources that we try to manage [...] but tuna is highly migratory [...], and our region has limited MCS resources available to our members” (FFA chief officer, Honiara, 21.05.21). Facing the challenges of harnessing such vast territories and keeping a close watch on highly globalised activities occurring far from sight, the Pacific Islands opted for regional cooperation and the pooling of surveillance resources

¹⁹ There are many terms to refer to the states and territories of the South Pacific region, conveying various perspectives on the region. For long, external discourses on the region would speak of ‘small island developing states’ (SIDS) before the latter opposed this belittling perspective with the ‘large oceanic island state’ (LOIS) label. They are most commonly referred to as ‘Pacific Islands Countries and Territories’ (PICTs). However, I choose to refer more simply to the ‘Pacific Islands’ because this category permits to accommodate their fluctuating status before and after some of them proclaimed their independence from previously established colonial authorities. Under that category, the term ‘Island’ may encompass more than one islandic land mass, however. Many Pacific Islands are archipelagos, characterised by important internal heterogeneity.

²⁰ FFA website: <https://www.ffa.int/about> (accessed: 23.09.21)

and information as their main strategy. Hence, FFA oversees various surveillance apparatuses aiming to control tuna fisheries and enforce management and conservation measures from a distance – and despite this distance.²¹ These include onboard observer programmes, Vessel Monitoring Systems (VMS), shared and integrated information systems, and joint regional fisheries policing operations supported by France, Australia, New Zealand and the United States of America (US).

Paralleling (and intersecting) the evolution of maritime security agendas, the scope of fisheries management and MCS activities has widened. Starting with a focus on economic returns, FFA now pays greater attention to environmental and social agendas, with the aim of developing a more comprehensive understanding of ‘sustainable’ fisheries by considering protected species, pollution, labour and human rights or the intersection of fisheries with several types of maritime crimes. These topics bring new surveillance challenges and intertwine with other sectors and actors previously deemed outside the realm of fisheries management.

*

These extracts outlined several features that constitute the core of this dissertation. They sketched the complex and reticular organisation of tuna supply chains and underlying tuna fisheries (understood as an assemblage of people, technologies, spaces and fish involved in the capture of tuna fish) that operate in vast, remote, labile, hazardous and hardly accessible offshore spaces. These features account for the challenging knowability of tunas and their fishers. Each of these extracts points to actors deploying various surveillance practices to alleviate such ignorance for various reasons. Tracking tunas or tuna fishers across the ocean largely relies on tracing them, i.e. following indirect and patchy cues of their presence or absence in specific places. The idea of ‘trace’ also permits to hint at attempts of tracing new lines on oceanic charts (and, increasingly in digital databases)²² which remain patchy, filled with blank and largely devoid of fishe(r)s (Helmreich, 2011). Increasingly, tuna fisheries are traced on maps or inscribed in databases to make them visible and manageable from the shore. Technological developments support these endeavours, which variously aim to exploit, study or manage tuna fish and control fishers’ activities at sea. Finally, the last two extracts show that tuna fisheries are embedded into coastal states’ wider concerns about territory and security at sea. This dissertation precisely enquires into the complex intersections between the state, the fish and the territory and into the role of surveillance in mediating and shaping these relations.

²¹ Such distance was further accentuated at the time of our interview by the Covid-19 pandemic, which made physical access to the fishing vessels even more complicated.

²² E.g. see the work of M. Noucher for a reflection on the evolution of mapping practices in the digital era, resulting in the production of information systems rather than ‘traditional’ paper maps (Noucher, 2017).

II. Of Tunas and Men

1. The Fish

When I introduce my research as focusing on ‘tunas’ and ‘tuna fisheries’ to my – primarily French and urban – personal social circles, most people grin. Tunas, where I come from, tend to be poorly considered animals (Bataille-Benguigui, 2011). In the minds of many, the term first appeals to cheap and canned fast food or an insult to mock someone’s poor look. Besides that, many European consumers know little about tunas, whether as living organisms or fish products. This observation of relative indifference among many Western consumers is all the more striking as it dramatically contrasts with the overwhelming abundance of tuna products in European supermarkets or restaurants. The European Union (EU), along with other countries like the US and Japan, is one of the leading players in both ends (extractive and consuming) of the tuna food production chain. The US and the EU are the main markets for canned tuna, while Japan is the first importer of fresh and frozen tuna (FAO, 2020). All three have extensive tuna fishing fleets capturing tunas in the world’s oceans. Such ignorance of the supply chain applies to many seafood products: people at a restaurant may merely ask for ‘fish’, thereby encompassing thousands of different fish species in the same category.²³ Despite their omnipresence in human societies, fish remain relatively invisible to the eyes of many (Probyn, 2016). As evidenced in the previous section, such neglect is obviously perspectival and not absolute.

Before starting this research, I also had limited preoccupation with tunas. My first encounter with one, beside in my plate, occurred in the South Pacific Ocean when I attended a lecture in Ecological Physiology at the University of Auckland, New Zealand. The lab class consisted of dissecting a skipjack tuna to observe how its organism was adapted to its lifestyle, having to move continuously to keep breathing. Mobility is necessary for tuna’s life, searching for scarce and scattered food sources in an ever-transforming pelagic environment or for appropriate spawning locations. Their organism has evolved to sustain such requirements. Looking into ‘my’ tuna, I discovered that its “structural design” permits this fish to be one of the fastest-cruising and mobile predators at sea, thereby ensuring “maximal efficiency with regard to its habitat and lifestyle”.²⁴ The entirety of skipjack’s organism is said to serve mobility and rapidity: a large heart and gills to provide muscles with more oxygen, a pyramid-shaped and thick-walled heart to increase blood pressure, or a streamlined and stiff body shape to limit drag when swimming (Sfakiotakis et al., 1999). Tunas’ swimming capacities enable them to inhabit the “nutrient-poor blue waters of the open sea” and turn “all the sea” into “their native country” (Manarangi-Trott, 2008, p. 1).

²³ As an indication, FishBase, a global scientific fish information system, lists over 33, 000 *known* fish species – although many of them are not consumed by humans.

²⁴ Personal notes from the lecture, Auckland, 12.08.13

According to certain fisheries scientists I could interview, these traits confer tunas with great resilience to fishing exploitation – making them look like a hardly exhaustible natural resource. Skipjack tunas, in particular, with their hypermobility, rapid growth and high reproduction turnover, have been introduced to me on several occasions as the “cockroaches of the sea” (e.g. Fishery scientist, Australia, 23.02.21). They have also permitted tunas to become the foundation of some of the largest fisheries in the world (Garrido Gamarro et al., 2013), with over seven million metric tons harvested yearly for an annual value of almost US\$10 billion.²⁵ Steadily increasing over the years, tunas now rank among the most fished animals and significantly contribute to global food security and many national economies.

The WCPO is the largest tuna fishing ground in the world and provides over half the global tuna supply (WCPFC, 2022). More specifically, about 34% of the global tuna catch per year is extracted from waters under the jurisdictions of the Pacific Islands, which cover the vast majority of the WCPO space (see Figure 1).²⁶ This production chiefly derives from capturing four main tuna species, using four main fishing techniques – with purse seining and longlining being the predominant ones (see Figure 2 and 3). For countries like Kiribati or Tokelau, benefits deriving from tuna exploitation account for over 70% of government revenues (Bell et al., 2021) and mainly stem from the sale of fishing licenses that grant access (primarily to foreign fishers) to the extensive marine areas under their jurisdictions. However, much of tuna-derived economic benefits are captured by the distant water fishing fleets exploiting their waters (Barclay & Cartwright, 2008) or lost to IUU fishing (MRAG Asia Pacific, 2021). Complementary economic revenues for the Pacific Islands come from the many employments associated to the tuna fisheries, including fishers, processors, fisheries observers and managers, etc. Tunas also sustain the livelihoods of many of their coastal populations. In that sense, they constitute a “bioinfrastructure” for the Pacific Islands and human societies at large, i.e. an “understated, stabilised, indispensable ground upon which a collective lives and works” (Puig de la Bellacasa, 2014, p. 33; see also Bueger et al., 2023). There is more to tunas than meets the eye.

²⁵ <https://www.un.org/en/observances/tuna-day> (accessed: 22.08.24)

²⁶ <https://thedocs.worldbank.org/en/doc/102721466580391096-0070022016/original/PACIFICPOSSIBLETunaSummarypaper.pdf> (accessed: 22.08.24)

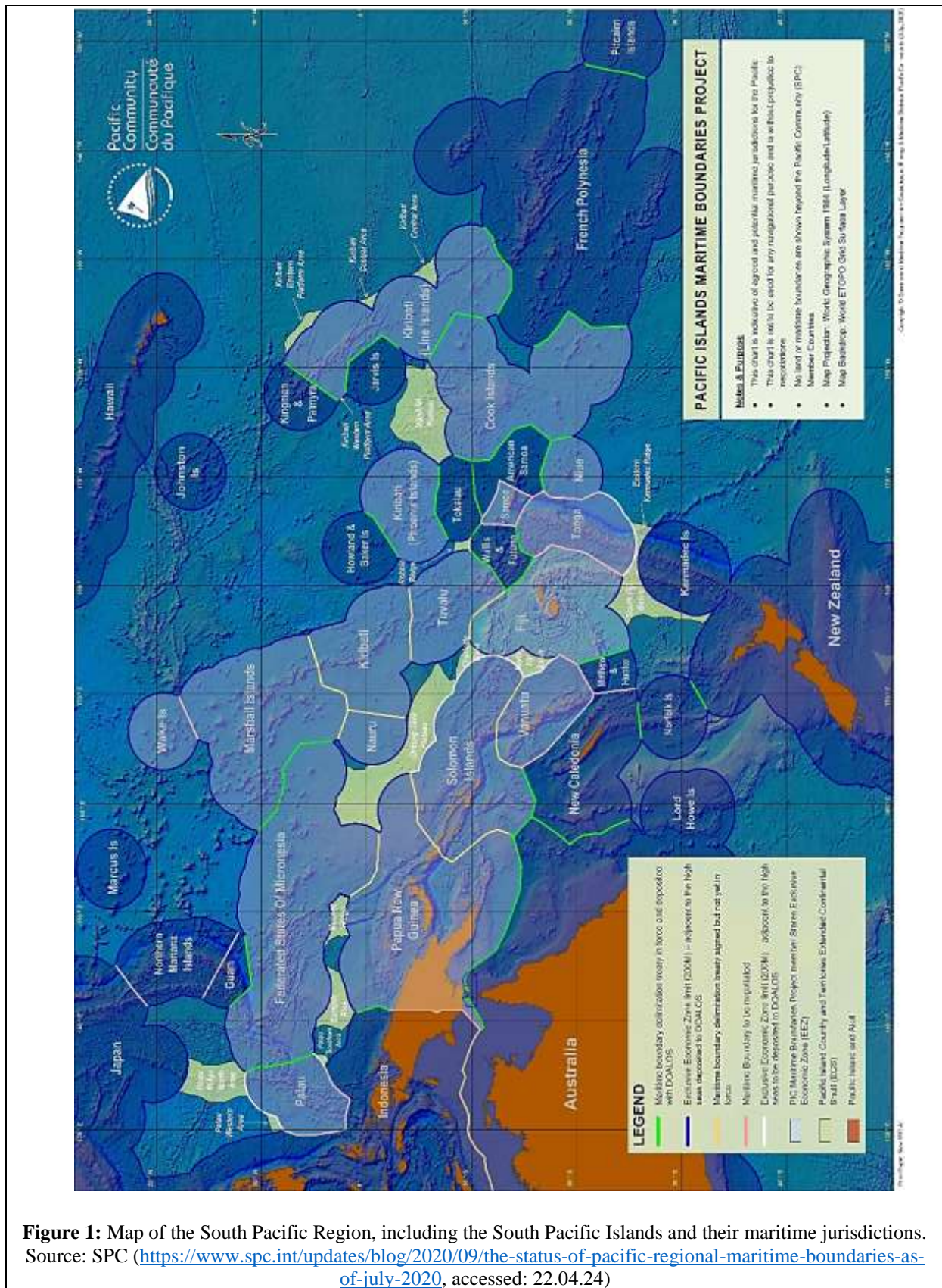


Figure 1: Map of the South Pacific Region, including the South Pacific Islands and their maritime jurisdictions. Source: SPC (<https://www.spc.int/updates/blog/2020/09/the-status-of-pacific-regional-maritime-boundaries-as-of-july-2020>, accessed: 22.04.24)

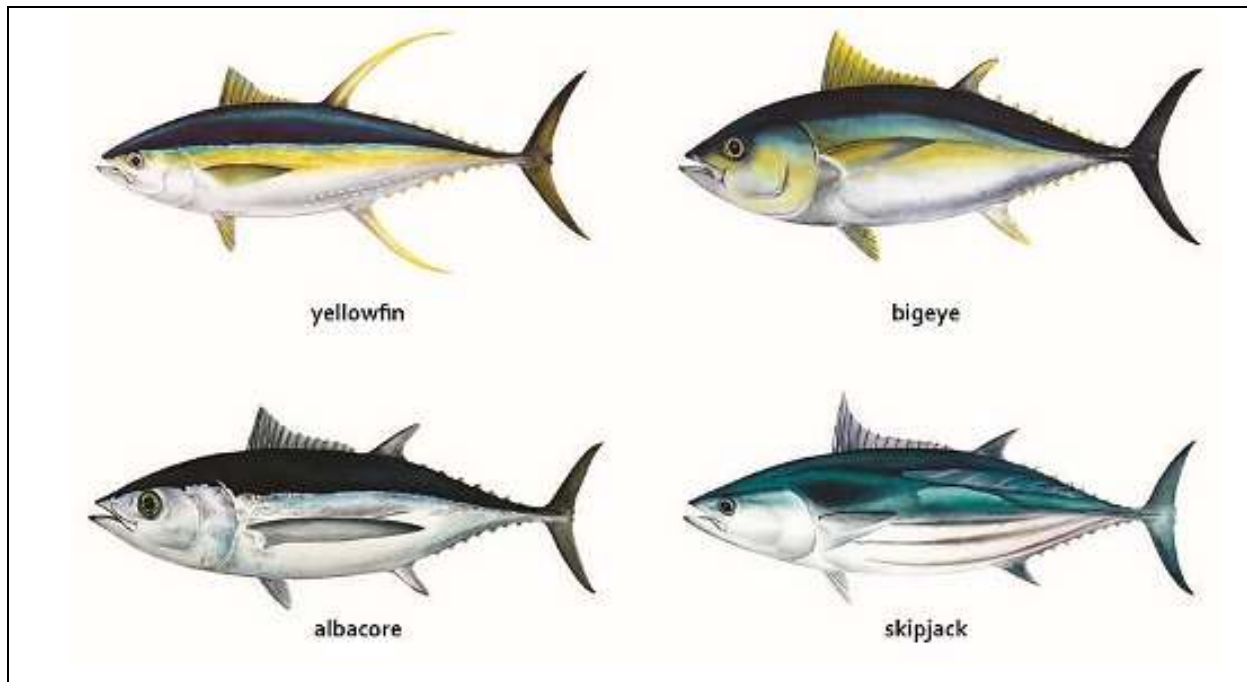


Figure 2: The four main commercial species of tropical and subtropical tunas of the Western and Central Pacific Ocean: yellowfin (*Thunnus albacares*), bigeye (*Thunnus obesus*), albacore (*Thunnus alalunga*), and skipjack (*Katsuwonus pelamis*) (Allain et al., 2016, p. 33). With bluefin tuna (*Thunnus thynnus*), these species represent the most economically important ones. They inhabit various ecological niches, ranging from temperate to tropical areas, from the surface to deeper and cooler waters and from coastal to offshore waters.²⁷

²⁷ <https://www.fao.org/fishery/topic/16082/en> (accessed: 22.08.24)

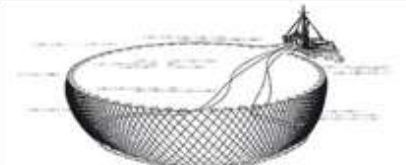

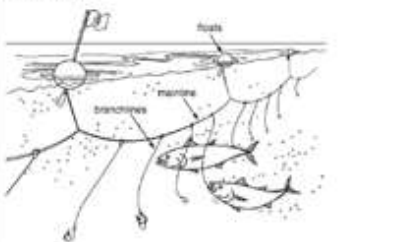


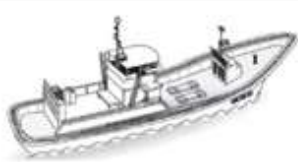
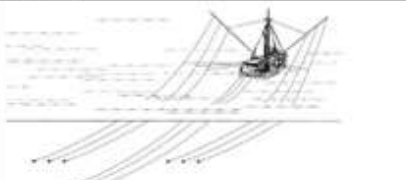

Gear Type	Typical Vessel
<p>Purse seine</p> 	
<p>Mainly skipjack and small yellowfin are caught by purse seine gear. Most catch is for canning.</p>	<p>About 72% of the tuna catch in the WCPO region is by purse seine gear (about 1.5 million tons in 2006). Most of the purse seine catch is taken within 5° of the equator.</p>
<p>Longline</p> 	
<p>Most tuna caught are large size yellowfin, bigeye, and albacore. The prime yellowfin and bigeye often are exported fresh to overseas markets. Most of the albacore is for canning.</p>	<p>About 10% of the tuna catch in the WCPO region is by longline gear (about 229,000 tons in 2006). There are two main types of longliners: (1) relatively large vessels with mechanical freezing equipment (often based outside the Pacific Islands), and (2) smaller vessels that mainly use ice to preserve fish and are typically based in the Pacific Islands.</p>
<p>Pole-and-line</p> 	
<p>Mainly skipjack and small yellowfin are caught by pole-and-line gear. Most catch is for canning or producing a dried product.</p>	<p>About 10% of the tuna catch in the WCPO region is by pole-and-line gear, about 212,000 tons in 2006. In the 1980s, several Pacific Island countries had fleets of these vessels, but most no longer operate because of competition with the more productive purse seine gear. Most of the catch by this gear is made in Asian waters.</p>
<p>Trolling</p> 	
<p>Large-scale trolling targets albacore for canning.</p>	<p>Gear types other than the three listed above are responsible for about 10% of tuna catch in the WCPO. Large-scale trolling is an important part of this. It is carried out in the cool water to the south and north of the Pacific Islands region. Trolling in the south results in about 5,000 tons of albacore annually.</p>

Figure 3: Dominant fishing techniques to catch tunas in the Western and Central Pacific Ocean (Barclay, 2014, p. 157)

Tunas are gaining increased public visibility, especially now that some of their ‘stocks’ are on the verge of collapsing – along with the social and (blue) economic worlds they sustain. This became particularly evident after vivid media coverage of bluefin tuna’s decline because of sushi consumption. Recent assessments suggested that certain yellowfin, bigeye and albacore stocks are near the overexploitation threshold (e.g. ISSF, 2024): it appears that tunas might be overfished after all. This realisation raises new sustainability concerns amongst coastal countries like the Pacific Islands, which rely heavily on this sector, conservationists and Non-Governmental Organisations (NGOs), consumers or members of the industry. Sustainability concerns are not only economic, but also ecological and social. As top predators, tunas play a key role in marine ecosystems. Although fish conservation long lagged behind other more charismatic and mostly terrestrial and mammal species (Telesca, 2020), tunas are increasingly portrayed by conservation organisations like the World Wide Fund for Nature (WWF) as “more than just seafood”, i.e. as more than ‘tuna’ (singular, for the commodity).²⁸ Tuna fisheries are criticised for affecting other fish species incidentally caught as ‘bycatch’ or aggravating maritime pollution. From a social perspective, tuna fisheries have also come under the public lens in connection to human right abuses (e.g. Human Rights at Sea, 2020). As tunas are framed through diversifying environmental and socio-economic considerations, whether and how they should be cared for and how their fisheries should be managed becomes a forefront and all the more complex issue.

With her above-mentioned concept of bioinfrastructure, feminist scholar M. Puig de la Bellacasa draws on the concept of infrastructure (Star & Ruhleder, 1996) to problematise ethical, political and epistemological issues of invisibility, background and focus characterising most infrastructures:

[...] invisibility does have ontological consequences. Being invisible can change the conditions of existence of the invisible, of those who would not see it, and the relations between them. And that is precisely the heart of the matter: the point is not to make ‘visible’ what has been rightfully or wrongly made ‘absent’ but to focus on what happens in and through this irruption into presence. (Puig de la Bellacasa, 2014, p. 38)

An increasing number of people attempt to make tunas and their associated fisheries visible – be it to catch those fish, assess their stocks’ health and economic value, evaluate the environmental impact of fishing activities, etc. However, making visible is not a neutral affair. Making tuna fisheries visible constitutes both my research’s goal *and* question: not only does it aim to uncover parts and parcels of a world little covered by social sciences but it also, through its focus on surveillance, peers into the reasons why and the ways tuna fisheries are made visible, by whom and with what effects.

²⁸ <https://www.worldwildlife.org/species/bigeye-tuna> (accessed: 30.05.24)

2. The Marine Territory

The historical development of the tuna fishing industry through the 20th century is tightly connected with inter-state territorial disputes over the ocean. Tunas are never just about tunas, as I said, and their history is intertwined with capitalist expansion, state formation and territory-making at sea.

Traditional tuna fishing has been carried on for a long time in many parts of the world, but its industrialisation is much more recent (Majkowski, 2007). It is entrenched in (post)colonial tensions between, roughly saying, industrialised fishing nations and coastal states, many of which did not have the material and financial capacities to set up their own industrial fleets. Such history departs from the 1940s onward, when increasing demand for canned tuna pushed Pacific tuna fisheries to industrialise with the Japanese longline and pole-and-line fisheries, followed by the US fishing fleet (Miyake et al., 2004). In that era, the vast majority of the ocean laid under the *Mare Liberum* ('freedom of the sea') doctrine leaving most marine spaces outside any state's jurisdiction virtually ungoverned (and allegedly ungovernable) and, therefore, free of access and use – at least from states' perspective.

This customary regime is rooted in extensive debates between European states and jurists on states' legitimacy and capacity to control and appropriate marine spaces. The *Mare Liberum* regime was instrumental in supporting imperialist, mercantilist and capitalist expansion throughout the globe and over centuries (Schmitt, 2017; Steinberg, 2001). In the 20th century, it facilitated the spread of Japan and US fishing fleets, followed by Korean, Taiwanese or Chinese ones, all chasing highly mobile and 'open access' tuna fish. The construction of offshore spaces and tunas as 'wild' and unclaimed was pivotal to engaging a frontier process and turning 'nature' into a new resource and commodity (Rasmussen & Lund, 2018). Unlike other frontier processes, offshore spaces were relatively unoccupied in practice. There was little to affront and overcome on the other side of the (polycentric and in-movement) frontier. At first, fishing nations were not so concerned with displacing and dispossessing things and human beings to appropriate these spaces rather than *physically* accessing them.²⁹ Technological innovations in navigation and fish storage enabled the reticular expansion of their fleets in waters more and more remote from their land and progressively closer to other coastal territories.

Hence, the 20th century saw the continuation of empire-building. Only this time, states were not only interested in exploiting marine surfaces to circulate vessels, people, goods and (especially military) power between lands. They were also very much after exploiting the ocean *itself* and the living entities within. The previously dominant conceptualisation of the oceans as connective surfaces was supplemented by that of the 'ocean-well', a new cornucopia of natural resources that would become in itself the source of exploitative activities and economic development (Steinberg, 2001; Locher, 2020).

²⁹ The process would, admittedly, still disrupt 'non-human assemblages' by extracting tuna fish from wider multispecies entanglements.

The ocean “became seen not just as a transit medium but as a space to be controlled in its own right” (Lambach, 2021, p. 6). For historian of science N. Oreskes:

this shift in understanding – from the ocean as deep, dark, vast and mostly inaccessible and not (except to mariners and fishermen) terribly important to the ocean as a vast abode of life, both familiar and strange, and a place on which all life, both marine and terrestrial, depends – is one of the most important cultural and scientific shifts of the 20th century. (Oreskes, 2014, p. 384)

In the wake of a widespread decolonisation process, coastal states (many of which were under colonial regimes) witnessing distant water fishing fleets extracting fish and economic revenues from the sea started to lay expanded claims over their surrounding marine waters. This reignited *and* reshaped territorial disputes over the oceans, roughly opposing Distant Water Fishing Nations (DWFNs) to coastal states like the Pacific Islands regarding fish resources. These fisheries-related territorial conflicts folded within broader strategic considerations pertaining to the Cold War context and the rise of global environmental concerns. Resulting in lengthy intergovernmental negotiations, they led to the adoption of the United Nations Convention on the Law of the Sea (UNCLOS) in 1982. The Convention marked the “Westphalian moment for the world maritime sphere” (Ryan, 2019, p. 1067) as it provided states with new legally formalised instruments to expand their jurisdictions over the ocean.³⁰ The EEZ creation permitted coastal states to expand their sovereign influence over marine resources as far as 200 nm from their shore, eventuating in the sudden territorialisation of most of the Earth’s planet – and marine fish.

The territorialisation of the ocean attests to and expresses new humans-oceans relations while transforming them in return (Lambach, 2021). EEZs can be read as an ‘ecologisation’ of these relations, and, overall, of the territorial question at sea, whereby offshore marine spaces were conceived and appropriated as voluminous and more-than-human environments³¹ providing states with natural resources to manage sustainably. Granting sovereign rights and duties over marine resources, the EEZs reflect an appropriation of marine spaces through an environmental lens – and an appropriation and conservation of marine resources through a territorial lens. As I will show in this dissertation (cf. Chapter 5), states debated during UNCLOS negotiations the need to, and how best to, manage the marine environment to strategically promote or resist the creation of the EEZs. If tuna fish were central in these disputes, the EEZ creation did not resolve the ‘tuna issue’ between DWFNs and coastal states, as tuna fish would largely disregard, overflow and escape the new maritime boundaries. The (im)possibility of governing offshore environments with area-based instruments remained unclear and territorial conflicts persisted, especially in the South Pacific region.

³⁰ These include the territorial sea, the contiguous zone, the continental shelf and the exclusive economic zone.

³¹ I use the term ‘environment’ to problematise socio-natural relations (see Chartier & Rodary, 2016).

Recent transformations of human-ocean relations show these territorial questions to remain very much alive – and reshaped by renewed conceptions and usages of the ocean. The past decades have seen the emergence of a novel “scramble” for marine spaces and resources, sparking new frontier dynamics in the Pacific Ocean (Fache et al., 2021). Against the stagnation of land-based economies and the rarefaction of terrestrial resources (OECD, 2016), the ocean now embodies a promising field for sustaining human needs and the rise of “blue-green capitalism” (Helmreich, 2007, p. 106). While this frontier migrates off the shore and into the ocean’s depths, human activities at sea expand through fishing, mining, shipping, ‘Blue tourism’ or bioprospecting (e.g. see Helmreich, 2009; Bailey et al., 2014; Flécher, 2015; Hannigan, 2017).

Against those economic prospects, increasingly gathered under the ‘Blue Economy’ label, more looming perspectives come to the fore of global ocean agendas. Growing worries for the socio-environmental sustainability of these developments exacerbate the exploitation-conservation tension. Recent global assessments such as the 2016 World Ocean Assessment I³² alerted to the declining health of the world’s oceans and their soon-to-be-reached limited carrying capacities, bolstering attention to their fragility and the temporal emergency of better caring for them. This realisation contrasts with previous and prominent conceptions of the ocean as an inexhaustible and immutable resource. Submersion due to sea level rise, food scarcity or sanitary issues caused by polluted fishery stocks are some of the threats looming over human societies, making the ocean a source of insecurity, too. The South Pacific region is a good example to think of the unequal vulnerability to these threats, considering that the Pacific Islands are particularly (but here too, unevenly) exposed to sea-level rise and dependent on dwindling fisheries resources (Barclay & Cartwright, 2007; Crook & Rudiak-Gould, 2018).

If the ocean is still very much about surface circulations and fisheries, it is also less and less about those dimensions *only*. It has become an unprecedented *volume* of opportunities and challenges for economic development, livelihood security, biodiversity conservation... and sovereign affirmations (Quirk & Hanich, 2016; see also Bambridge et al., 2021). The contemporary period witnesses both an ‘extensification’ and ‘intensification’ of oceanic territorialisation processes, inside and outside national boundaries (Ryan, 2019; see also Elden, 2009, 2013). State expansion continues in the 21st century with claims over the “extended continental shelf”. UNCLOS’ international regime is shaken by renewed territorial disputes, e.g. in South East Asia between Japan, China, Taiwan, Vietnam, Brunei, Malaysia and the Philippines around the Senkaku/Diao yu, Paracel and Spratly Islands and associated marine spaces and resources (e.g. see Emmers, 2009). Additionally, the ‘marine turn’ and offshore projection of the conservation sector has advanced a reinterpretation of the ocean as an ecosystem warranting protection, best achieved by the creation of (large-scale) Marine Protected Areas (MPAs) and other conservation territories (Zimmerer, 2006; Adams, 2017), including in offshore waters inside *and* outside

³² <https://www.un.org/regularprocess/woa2launch> (accessed: 22.08.24)

state jurisdiction (Alger & Dauvergne, 2017b; Legroux, 2024). In 2017, the UN claimed that the spatial extent of MPAs had more than doubled since 2010 – mostly in the Pacific Islands’ EEZs (Humphreys & Clark, 2020).³³ The intensification of possibly competing uses of limited marine spatial resources have also pushed forward the new concept of Marine Spatial Planning (MSP) to govern an ever-denser marine world with an ecosystem-based approach to ocean management, by organising maritime activities in space and time (e.g. see Ehler, 2021).

Current territorialisation endeavours take on new shapes and are made all the more complex due to the growing involvement of non-state actors in the matter which collide with states’ interests in reaffirming their authority over marine spaces and asserting environmental stewardship on the international stage (Leenhardt et al., 2013; Le Meur et al., 2018). Although they change shape, these phenomena prolong the projection of territorialisation attempts over offshore spaces, confronted to and (re)problematised in link to more-than-human marine environments.

3. The Offshore Environment and its Surveillance

These contemporary developments revive the long-debated status of offshore spaces and their appropriability. The establishment of offshore MPAs, for instance, raises once again the (im)possibility to effectively monitor, surveil and control these conservation territories and ‘materially’ enforce what would otherwise remain mere “paper parks” (e.g. see Leenhardt et al., 2013).

Offshore marine worlds have long been constructed, especially in Western cultures, as the epitome of otherness, making the ocean “alien” to human societies (Helmreich, 2009). The very term ‘offshore’ pushes these spaces beyond and to the margins, as attested by expressions such as ‘areas *beyond* national jurisdictions’ or ‘*beyond* the reefs’. Other expressions referring to the ‘open ocean’, ‘open waters’, or the ‘Big Blue’ tell of their relative indeterminacy but also of their potentiality. Against that diversity of labels and geographical oceanic divides, I retain the loosely defined term ‘offshore’, precisely to interrogate those notions of distance and otherness and the processual co-production of these spaces and the worlds wherein by human and other-than-human entities and practices.

Offshore spaces reside within blurred, moving and overlapping boundaries, attesting to the difficulty of precisely grabbing and making these spaces intelligible. Whereas they cover most of the planet’s surface, they are often portrayed as a “vast black box where fish simply disappear” (Mandel, 2006, online). Offshore fish like tunas, hard to spot, find and catch, personify elusiveness. Humans, too, may disappear, as attested by the increasing suspicion that offshore activities like shipping and fishing trigger. Offshore activities are frequently associated with security threats such as piracy, illegal trading, or

³³ Such quantification is subject to controversy, however, given the discrepancy there can be between an MPA proclamation and its effective implementation.

environmental degradation (Larsen, 2020). Relatedly, offshore spaces can strategically be constructed as such to establish, maintain or enhance distance from certain institutions or rules (Legroux, 2024).

Social scientists S. Bush and A. Mol highlighted the influence of knowledge (and, sometimes voluntary, ignorance) in shaping offshore management when they argued that authoritative scientific discourses on offshore spaces tend to describe them in abstract and “placeless” manners, using coordinates of longitude and latitude and ranges of depths: to them, such representations nurture a “highly stylised, homogenising and placeless geography of the marine environment”, shaping, in turn, equally homogenising sustainability governance arrangements (Bush & Mol, 2015, p. 28). A similar analysis could be applied to how UNCLOS demarcates the sea using absolute metrics and defines maritime boundaries with little consideration for spatial uses by humans, animals or sea level rise. Such observations outline the relations between knowledge (or lack thereof) and possibilities for control of the offshore world – and, conversely, about the influence of power on knowledge production.

Contemporary territorialisation prospects increasingly turn to recent techno-scientific innovations that have stirred renewed expectations of building panoptic views of the offshore world to make it more transparent and amenable to territorial control. Marine data, including spatial ones, have considerably developed over the past decades, mainly benefitting from the satellite and digital ‘revolutions’ that have reignited the “measure everything everywhere” ethos (Lehman, 2016a, p. 117). Switching from a dearth to a wealth of data, the ocean increasingly becomes a stream of information while ceasing to constitute a given and inert context to politics (Lehman, 2016a). These perspectives accommodate new socio-technical imaginaries of – at last – making the ocean visible, legible and tameable.

My ‘fragments from the field’ (cf. Section I), hinting at far more complex surveillance convolutions than meet the eye, debunk such an assumption and show the existence not of ‘one’ surveillance relating to territorial control but of multiple forms of surveillances. These fragments outline my informants’ difficulties in knowing what happens ‘out there’ in the offshore. They also reveal, regardless, the breadth of efforts to alleviate such ignorance and build a better ‘picture’ of the ocean to make it, at least partially, visible. Finally, they show that surveillance is a doing not only of the state but also of fishers, scientists, private companies, etc., pursuing multiple purposes with various practices and instruments. Surveilling tuna fishe(r)s touches upon territorial control and sovereignty at sea, as well as science, commercial profitability, labour organisation or safety. It is more-than-human in that it applies to ‘natural’ and ‘social’ constituents of offshore worlds and because its implementation is distributed across various human and other-than-human entities.

Making visible, as I said, is far from a neutral gesture. The surveillance of offshore environments, first centred on the surveillance of tuna fishe(r)s, is filled with politics and embedded views about what the ocean and tuna fisheries are and/or should be. As surveillance helps, in return, to orient or legitimate (in)decisions and (in)actions, it plays a role in its own right in the ‘production’ and the reorganisation of

the ocean and its future. Understanding what kind of ocean and tuna fisheries surveillance produces and unveiling these embedded politics are some of the main objectives underlying this dissertation. The latter scrutinises the multifarious, convoluted and sometimes more concealed facets of surveillance.

III. Research Questions and Outline of the Thesis

These transformations in human-ocean relations interrogate anew the potential specificities of offshore worlds. They raise the question of whether they constitute worlds of their own which should be treated as such (e.g. Peters, 2014a) or if contemporary surveillance practices contribute to making offshore spaces more “banal” and amenable to territorialisation (Trouillet, 2006, p. 13). This dissertation contributes to this general enquiry by examining the intersections of surveillance, territory-making and the offshore environment. More specifically, it examines the role of surveillance in projecting territorialisation from the land to the ocean, (re-)conceptualised as a voluminous, lively and more-than-human environment, and in framing relations between the state, the fishe(r)s and the territory at sea.

Addressing such a question calls for a grounded and empirical dive to engage seriously with offshore worlds’ material characteristics and examine how territorial attempts are effectively produced, negotiated and challenged in the ‘field’ and by this very field. To that end, this research provides a socio-historical analysis of the politics and practices of surveillance of the South Pacific’s offshore environment in link with its territorialisation by the Pacific Islands – for which both surveillance and territorialisation were and remain primarily concerned with offshore tuna fisheries. Hence, I scrutinise surveillance modalities in the territorialisation of a world characterised by vast, distant and hardly accessible spaces frequented by highly mobile and elusive fishe(r)s.

In the remainder of this **Part I**, I further specify my scientific stance on these questions. **Chapter 2** provides a literature review to clarify the main concepts of surveillance, territory and state sovereignty that I have briefly started to introduce. At the crossroads of environmental humanities, science and technology studies (STS), critical and environmental geography and surveillance studies, it details how I understand, study and relate notions of ‘territory’ and ‘surveillance’ in a postmodern, materialist, processual and pragmatic fashion.

Chapter 3 describes the methodology and data underpinning this research. It justifies the relevance of my case study, suggesting that thinking of surveillance and territory from the South Pacific Ocean permits interesting displacements and complementary insights compared to existing research. It provides general information on tuna fisheries in the region, with a focus on Fiji and New Caledonia where I conducted my investigations, as well as on the main actors and institutions involved in their governance and management. I also reflect on the methodological challenges of conducting fieldwork (or ‘sea-work’) and accessing offshore worlds and how their characteristics carved my research.

Following this general introduction, **Part II** retraces the historical development and problematisation of tuna fisheries, offshore territory, and surveillance in the South Pacific region since the mid-20th century. It describes offshore surveillance as largely opportunistic, delegated, distributed and relying on shared and multipotent ‘boundary surveillance apparatuses’. It suggests that the projection of territorialisation over offshore spaces is ‘refracted’ by its very encounter with the oceanic milieu.

Chapter 4 describes the development of the global tuna fishing supply chain and the tuna fishing industry through the Pacific Ocean by confronting the perspectives of the leading fishing nations (Japan and the US) and the Pacific Islands and their colonial authorities. It outlines the emergence of a frontier narrative on the offshore environment and the challenges of exploiting the latter. It delineates a first era from the 1950s to the 1970s, characterised by the virtual lack of knowledge of offshore environments, the unequal deployment of surveillance and industrial capacities, and economic opportunities primarily captured by powers external to the Pacific Islands. It evidences the tight connections between the political economy of the tuna industry and the political economy of offshore knowledge.

Chapter 5 recounts how the Pacific Islands endeavoured to reverse this equilibrium from the 1970s, in the wake of a regional independence wave and the broader Cold War context, by territorialising their adjacent offshore waters to capture tunas and associated economic benefits. To that end, they developed their surveillance capacities to build their own knowledge of this newly coveted resource. The chapter retraces the creation of some main surveillance apparatuses used to build knowledge on tuna stocks and fishing activities, including tuna tagging programmes, fisheries observer programmes and the collection of fishers’ logsheets. It unveils the tensions caused by the intertwining of scientific efforts to survey tuna resources with regulatory and coercive endeavours to control foreign fishers exploiting those resources, and the boundary-work strategies devised to overcome them. These tensions and demarcations permit to problematise the frictional coexistence yet necessary articulation of various forms of surveillance within partly opportunistic, shared and multipotent surveillance apparatuses.

Chapter 6 investigates the Pacific Islands’ efforts to effectively materialise their EEZs and enforce and secure their sovereign rights over vast, remote and porous marine volumes by drawing on institutional, legal and surveillance instruments. Against their limited human, financial and technological capacities to surveil and enforce their maritime boundaries and tuna fisheries regulations, the Pacific Islands strategically and pragmatically adopted a regionalist approach to territorialisation at sea, resulting in the regional harmonisation of tuna fisheries regulations and the pooling, delegation and sharing of surveillance apparatuses (including patrolling resources and information systems). The production of such a regional space, aiming to strengthen without overriding the Pacific Island states’ sovereignties at sea, resulted in original articulations between the EEZ territories, the states and (non-sovereign) apparatuses of surveillance and control.

In the following and final **Part III**, I focus on the functioning of surveillance in and through practice to disclose the challenges that surveillance practitioners encounter in the field and the factors that make surveillance deployment in a water world more turbulent than smooth. This section pays particular attention to the main infrastructures underlying surveillance apparatuses, particularly the vessels that condition physical access to offshore worlds. It unpacks the role of these infrastructures in constraining offshore surveillance existence and unfolding by colliding various forms of surveillances.

Chapter 7 looks into the role of tuna fishing vessels and fishers as the fundamental infrastructure underpinning most tuna fisheries surveillance apparatuses (logsheets, fisheries observer programmes, and vessel monitoring systems). It outlines states' dependence on the surveillance capacities of the fishers they place under surveillance and the necessary yet inherently fragile enrolment of these surveillance subjects as surveillance agents. It evidences blurred boundaries between surveillants and their subjects and the negotiated co-production of surveillance with the latter. It explains the necessity of establishing 'boundary surveillance apparatuses' shared between various actors for multiple scientific, regulatory, commercial, protective and coercive purposes. Finally, it outlines the inherent difficulty and continuous work required to make such a surveillance assemblage hold, while only imperfectly meeting each of the multiple objectives it is supposed to serve.

Chapter 8 peers into the work of fishery scientists to surveil the offshore environment by completing fisheries surveillance apparatuses with at-sea scientific campaigns on oceanographic vessels. It describes how offshore environments and tuna fish shape scientific practices, blurring the divide between science and fishing and leading to fluid and opportunistic surveillance practices. It investigates the role of scientists as surveillance agents, developing both scientific and regulatory forms of surveillance and the use of the latter by fisheries managers to decide on fisheries management measures. This chapter explains the specific forms of invisibilities regulatory surveillance produces, preventing certain forms of knowledge and enclosing tuna fisheries within a narrow and exclusionary (regulatory) science-management complex.

Chapter 9 finally examines the role of the navies and their military vessels as the crux of patrolling and policing capacities for states to surveil and order offshore spaces. Like fishing and scientific vessels, military vessels constitute boundary infrastructures that increasingly serve environmental and fisheries policing missions in addition to their traditional military and diplomatic preoccupations. It describes this organisation as a rationalising logic to optimise limited resources. It shows that this blurs the boundary between the military and the police and expands maritime security to fisheries and more general environmental matters. It argues that contemporary integrated, transnational, and trans-sectoral forms of maritime surveillance and security are not so much an adaptation to new socio-political contexts as they are a pragmatic answer to the organisational challenges of surveilling offshore spaces. Finally, the

chapter examines how environmental missions contribute to ecologising armies and how the latter input new problematisation of tuna fisheries and biodiversity conservation through their military lens.

The **General Conclusion** provides overall considerations on the reasons for the projection of surveillance at sea, the characteristics of surveillance as it encounters offshore worlds, and its influence in shaping territorialisation processes, marine environments and human-ocean relations. It proposes to see marine territorialisation as a refractive process, deviated by its encounter with the marine milieu. It suggests that the existence of offshore surveillance depends on its capacity to become fluid and accommodate different, partly antagonistic objectives – thereby necessitating the study of surveillance in a decompartmentalised fashion. The coexistence of various and polycentric forms of surveillance within shared and multipotent boundary apparatuses results in frictions that constrain, in return, the capacity of offshore surveillance to support any of these objectives. The thesis suggests that the deployment of surveillance permits the production of knowledge to support action while simultaneously producing specific forms of lock-ins, ignorances and inactions – consequently hindering how offshore environments can be framed, known and managed and calling for more sustained consideration to the governance of underlying surveillance infrastructures.

CHAPTER 2. Conceptualising Territory and Surveillances in a More-than-Human Ocean

In the previous introductory chapter, I extensively referred to notions of state sovereignty, territory and surveillance. Given their predominance and polysemy in social sciences and humanities, in this chapter, I clarify how I use these concepts by reviewing the scientific literature.

I. Ocean, Terrain, Territory³⁴

Social scientists, especially geographers, have extensively worked on the joint notions of territory and territorialisation as one way of problematising the spatial facets of human and non-human beings. Historically, the concept of territory was entrenched in state formation before it progressively pluralised to think more generally of the appropriation and control of spaces by non-state actors. This expansion has led to various criticisms. Given that all spaces could be considered under various forms of appropriation, the concept appeared to lose its analytical strength and converge indistinctively toward the notion of space (Rodary, 2019).

The notion of space, too, has complexified over time to think beyond physical(ly) flat spaces only, to dismantle a positivist understanding of space as something ‘given’ and simply ‘already there’ at the surface of the Earth, and to think also of how spaces are used, lived, conceived, imagined – and socially produced (e.g. Di Méo, 1998). With many disciplines besides geography interested in ‘the spatial’, i.e. in acknowledging that where things happen matters, there emerges a profusion of additional and sometimes overlapping terms used to describe the spatial dimensions of social processes. Hence, the oceanic literature is increasingly concerned not only with ‘territory’ but also with, e.g., “area-based management” (e.g. Melvin et al., 2023), “zonation” (Ryan, 2019), “enclosure” (McCormack, 2017) “functional territorialisation” (Lambach, 2021) or the creation of “pragmatic spaces” (Bueger, 2020b) stemming from distinct disciplinary and theoretical anchors.

Territory, in this dissertation, remains related to the state but is hardly a matter of the state only. It permits, precisely, to question the extent and type of state sovereignty at sea and its dependence on or contestation by other entities that mitigate its power and capacity of control and eventually create other forms of territorialisation. Hence, my initial understanding of the territory as a state-controlled space is chiefly a heuristic archetype I use as a departure point, informed by the predominance of state and military actors in my research,³⁵ before I progressively refine the concept against my empirical findings.

³⁴ This title is a direct reference and adaptation of S. Elden’s article “Land, Terrain, Territory” (Elden, 2010).

³⁵ It is likely that my departure point would have been different if my investigations had focused more on non-state actors and Indigenous communities in particular.

This permits an inductive, processual, and open-ended epistemological and theoretical stance attuned to how things unfold in the field, which then can be analysed and discussed with the help of social theories.

These considerations require additional precisions on the notions of ‘state’ and ‘sovereignty’. Discombobulating traditional understandings of territory equally calls for avoiding the pitfall of reifying and essentialising these related concepts. Scholars like M. Foucault have worked around the notion of sovereignty in distinction to governmentality, a rationalised and technicalised mode of government extensively hinging on knowledge systems (Foucault, 2004). Anthropologists (especially those interested in Oceania) have applied the term beyond the Westphalian state (see Le Meur & Mawyer, 2022). These fruitful reflections have, too, resulted in a (potentially) confusing conceptual pluralism. Again, I chose the strategy of retaining conventional definitions and making these categories heuristic ones only. Hence, I first use the notion of sovereignty following its dominant legal understanding, i.e. in relation to a state’s self-governing authority on its territory (Dardot & Laval, 2020), mainly to help me distinguish the state from other actors. I use the notion of sovereignty to interrogate boundary-making processes, the state’s ability to decide on the scope of its authority and define its relations with its subjects (internally) and against other states (externally). However, I simultaneously understand sovereignty as a labile concept that is continuously in the making, contested, and negotiated – i.e. not as something given but as something that is produced and may result in a form of sovereignty far distinct from this initial ideal type (Le Meur & Mawyer, 2022). Additionally, following P. Dardot and C. Laval, I do not choose between ‘state as a thing’ or ‘state as a practice’. The state may not be one static, given and bounded object. However, I still consider it a historical and dynamic institution that operates and can be approached through practices and instruments (see also Lascoumes & Laborier, 2011). The state can interact with other state and non-state entities, which can also have and exert power. This is a useful approach given that tuna fisheries and offshore surveillance are embedded in international and intergovernmental relations in which state entities are very much present – which simultaneously facilitates dialogue with the International Relations scholarship.

Against those preliminary general considerations, I shall detail how I conceptualise and investigate the territory more deeply. What resonated the most with my research questions and my empirical observations was the work of critical geographer S. Elden and scholars sympathetic to his (in-development) integrated theorisation of territory to study the workings of power. In particular, I retained two influential proposals from S. Elden: studying territory around the notion of “terrain” and considering territory as a political technology (Elden, 2010, 2021).

S. Elden’s work affiliates to a broader body of literature, reclaiming the multidimensionality of space and territory and inviting us to think ‘beyond areas’ and ‘beyond land’. There have been calls to unflatten spatial analysis and advance a ‘geography of volumes’ addressing long-neglected “politics of verticality” and more attentive to the “heights and depths of geographical practice and power” (Squire,

2017, p. 1). In his seminal article “Secure the Volume: Vertical Geopolitics and the Depth of Power”, S. Elden formalised the need to think with volumes and depth (Elden, 2013). Outlining the need to look upward and downward, research on territory has therefore moved to the atmosphere, the subterranean – and the ocean (e.g. see Steinberg & Peters, 2015).

Looking beyond the land and thinking of a three-dimensional physical world permitted S. Elden to further reflect on the multidimensionality of territory. He argued that territory was too often reduced to two main dimensions: a “political-strategic” reading of territory as applying to a “terrain” and a “political-economic” territory concerned with “land” (Elden, 2010). The first one chiefly refers to the military understanding of the territory as a bounded area created to control a terrain – a term deriving from physical geography and military jargon. The “political-economic” dimension of territory is interested in controlling “land” understood as a resource to be distributed, allocated, and embedded into property relations. Without dismissing these two registers, S. Elden offered to complete them with (at least) three additional ones to improve our understanding of the complexity of territory: the “political-material”, the “political-legal”, and the “political-technical” registers.

The political-material register is an invitation to consider territory’s physicality seriously. If S. Elden initially offered to consider the territory as “volumetric”, P. Steinberg and K. Peters, informed by an oceanic and watery rather than a geological perspective, pleaded for a “voluminous” approach more attuned to flows and mobilities (Steinberg & Peters, 2015). This debate helps me think about the tension between territory as related to *metrics* and its confrontation with a voluminous offshore world traversed by mobile fishe(r)s., i.e. between rigidity and fluidity.

To bypass the ‘volumetric-voluminous’ debate and land-sea divisions, S. Elden recently suggested working around the notion of “terrain” with a ‘thick’ understanding (Elden, 2021). Terrain avoids the pitfall of considering territory through the lens of land – as terrestrial and as a commodity only. As mentioned, the word ‘terrain’ already captures the military dimension. I find this dimension important to keep at bay to avoid an exclusively internalist reading of territory and discuss the latter against its ‘outside’ and in relation to other territories. The military dimension also permits the examination of relations between the military and geography and investigates how the military sector shapes landscapes and geographies (Elden, 2021). Such considerations are at the heart of Chapter 9 of this dissertation. Terrain, when emanating from physical geography, also permits capturing the physicality of landscapes and hinting at the political-material side of the territory to think more than human agencies – a central dimension of my dissertation. The terrain affords, resists, disrupts and eventually shapes the territory. J. Scott already explored this idea when he described how seasonal monsoons could create friction in state movement and how the state attempted to decrease these frictions while state opponents attempted, in contrast, to increase them (Scott, 2013). Likely, in a research work that inspired this dissertation, K. Peters examined the challenges for national governments to exercise regulatory power at sea and

effectively control vessels and enforce maritime security because of the very nature of the sea: “its mobile legal boundaries, its liquidity compared to ‘landed’ fixity, and its scale and depth” (Peters, 2014b, p. 414). For J. Scott, landscapes predispose, facilitate or frustrate state surveillance, control and extraction (Scott, 2013). These frictions are at the heart of my enquiry. Such a reading of the ‘terrain’ permits an “appreciation for – and methodological concern with – the dynamic multiplicity of the non-human world, and the capacity this holds to actively disrupt, withdraw from or deterritorialise established relations of power” and “opens up important questions for geographies of surveillance, policing and military practice” (Boyce, 2016, p. 254). Reciprocally, terrains are malleable and are continually remade by bordering and erecting fortifications, surveying, mapping, engineering, logistics, and other political technologies (Elden, 2021) – amongst which I add surveillance. This understanding of the terrain is akin to what I have been calling ‘offshore worlds’ in my introductory chapter and which enables me to emphasise that ‘volumes’ are not empty but filled with bodies that may not be as malleable or calculable (Adey, 2013; Squire, 2017).

These references to mapping, surveyance, surveillance and calculations lead to the last two dimensions identified by S. Elden to reflect on the territory: the “political-legal” and the “political-technical”. The territory is *produced* by a set of practices, including legal and calculative techniques to order spaces, entities and processes. Understanding the territory as dependent on techniques and laws and, therefore, as a produced, mutable and fluid process calls for a genealogical and historical study of territory – which I conduct in Part II of this manuscript. S. Elden called to refine our investigations of the role of innovations, e.g., in geometry with the use of coordinates, cartography and surveying, measurements and navigation techniques, etc., in the production of territory by permitting the quantification of space, the commanding of territory, the establishment of borders, etc. (Elden, 2010). In that sense, S. Elden also reads the territory as a political technology (or a bundle of) through which power can be enacted and which “comprises techniques for measuring land³⁶ and controlling terrain” (Elden, 2010, p. 811).

Against that framing, S. Elden drew on M. Foucault’s work to raise territory to the same analytical level as the population (Foucault, 2004). Although M. Foucault was concerned with the shift from a government of people to a government of population, S. Elden found parallels to examine the shift from terrain to territory through his attention to similar calculative techniques, which permit to measure, demarcate, order and regulate a “vibrant” terrain “with its specific qualities” (Elden, 2010, p. 810). This resonates with J. Scott’s work on the practices of the state to ‘see’ and make the nation’s human *and* more-than-human resources legible and tameable (Scott, 1998). For both the population and the territory, calculative techniques like those associated with surveillance are central to establishing such instruments of government. This perspective permits me to think about the role of surveillance in supporting

³⁶ This was published before his subsequent thicker definition of the concept of terrain.

territorialisation by measuring, ordering and regulating not only offshore spaces but also their ‘qualities’, including fish and fishers, amongst others. I now turn to other scholarships to enrich this understanding of surveillance beyond a state-centred and Foucauldian-oriented approach.

II. Taking the Study of Surveillance to Sea

1. From the Social Study of Surveillance to Surveillance Studies

The work of philosopher M. Foucault has been particularly influential in thinking of surveillance and reflecting on the working of power over people. Although he did not specifically define surveillance *per se*, he theorised the rise of a modern, rational and disciplinary power capable of addressing the problem of the “multitude” by relying on disciplinary apparatuses dispersed across several institutions and targeting people’s bodies to normalise them (Foucault, 1975). The disciplinary approach alleviates the burden of surveillance and enforcement by having people internalise norms and self-rectify their conduct accordingly. His analysis of J. Bentham’s prison architectural design of the *Panopticon* provided a telling illustration of that process. With its circular architecture, the *Panopticon* would make the multitude visible to the (invisible) few. Not knowing whether or not their surveillant is watching them, the subjects of surveillance – in this example, inmates – would auto-regulate and auto-discipline their behaviour. Thanks to the consciousness of the subject’s visibility, this coercive technology would optimise and automate the exercise of power. Foucault outlined a new economy of visibility whereby power imposes total visibility to all while becoming invisible.

Right before M. Foucault published these reflections, sociologist J. Rule had brought the concept of surveillance to the fore with his pioneering book *Private Lives and Public Surveillance* (Rule, 1974), in which he proposed a “detailed study of the collection and use, by government and other bureaucracies, of personal data on private individuals in order to control their behaviour”. For J. Rule, surveillance systems were a necessary instrument of social control and exerting control through sanction and dissuasion (Rule, 1974). Along with the panopticon image, these considerations have profoundly influenced the social study of surveillance, embedding the latter in matters of control, social sorting, private life, and the role of new technologies in public (mostly urban) spaces (Aïm, 2020).

In that vein, M. Foucault further attuned his enquiry into the connections between surveillance and discipline by articulating them with the notions of security, territory and population in a context of growing flows of people and objects challenging traditional territorialities (Foucault, 2004). M. Foucault conceptualised a “society of security” in which power governs not only through the incarceration and disciplining of people’s conduct but also by managing flows of a given territory and reframing people

as a biological population.³⁷ In the society of security, surveillance expands to the open world and outside the prison ‘lab’. Security, here, aims to control while permitting flows, i.e. to maximise desired ones and minimise undesired mobilities. This regulation draws on security apparatuses involving traceability techniques and risk calculations. This understanding of security is useful for discussing maritime security practices but is only internalist, concerned with flows occurring *within* the territory. The more porous marine territory (cf. Chapter 6) leads to thinking flows within, outside and across the territory and thinking of security not only as a ‘domestic’ matter and expanding maritime security practices beyond national boundaries (cf. Chapter 9).

Philosopher G. Deleuze provided an influential reinterpretation of M. Foucault’s work on discipline to think about the connections between surveillance, security and control with his conceptualisation of the “societies of control” (Deleuze, 1990). He conceptualised the society of control in conjunction with computer developments and the progress of information technologies, whereby individuals are tracked, calculated, decomposed and recomposed in flows of information or “dividuals”. For G. Deleuze, the society of control implies a governmental interest not limited to the subjectivisation of individuals and the control of flows of people or goods – i.e. of actual entities – but also *data*³⁸ (Deleuze, 1990). Contrary to M. Foucault’s approach, the society of control does not target human subjects directly but through representations and relies on more *ad hoc* and informal networks than ‘solid’ institutions. His work reflects on modalities of control *at a distance* and in the “open air”, with a more distributed understanding of surveillance, and considers the centrality of information technologies and data that I also evidence in my case study.

The role of surveillance for social control was also at the core of sociologist A. Giddens’s work. For A. Giddens, nation-states replaced violence with administrative surveillance, i.e., storing and controlling information to control people’s activities (Giddens, 2007). Surveillance constituted a marker for modernity. Interestingly, both G. Deleuze and A. Giddens connected surveillance and market entities instead of limiting their analyses to state power – opening the door to distinct purposes of surveillance. A. Giddens traced the origins of surveillance with capitalist industries and the surveillance of workplaces. At the same time, G. Deleuze associated the emergence of societies of control with transformations in capitalism and the replacement of factories by corporate enterprises. The analysis of surveillance progressively overflowed state security to consider other domains, such as banking, insurance or marketing companies and the more recently flourishing digital economy (e.g. Quessada & Sadin, 2010; Zuboff, 2015).

³⁷ Although M. Foucault will then focus more on the concept of population, one can see here the connections with the territory influencing S. Elden’s reflections on the topic.

³⁸ In this dissertation, I do not distinguish between ‘data’ and ‘information’. Only certain informants distinguished the two concepts so I decided to use them alike and clarify when needed. I use ‘knowledge’ to refer to information in context, i.e. interpreted.

These seminal works were only indirectly concerned with surveillance, as part of a wider enquiry into social control and domination. This helps outline the *relational* nature of surveillance, but they do not investigate surveillance as a fully-fledged social phenomenon. In the wake of these seminal publications and against the inflation of information systems and surveillance technologies from the 1990s, political and sociological research focusing explicitly on surveillance flourished and eventually gathered under the banner of Surveillance Studies in the early 2000s (Aim, 2020).

Surveillance Studies are not a homogeneous field of research, but for clarity, I will outline two main phases in the field's evolution. The first wave was predominantly influenced by its historical context, involving the development of information and communication technologies and the exposure of abusive surveillance practices by the police and intelligence services of recently fallen totalitarian regimes (Leman-Langlois, 2011; Ball et al., 2012). The 9/11 attacks on the US and the subsequent reorientation of this country toward surveillance and global security, followed by various whistleblowing events such as Edward Snowden's revelations on the US surveillance programme, further strengthened the scientific, but also ethical, interest of Surveillance Studies in digital surveillance technologies, security and state power (Ball et al., 2012). This first wave, therefore, retained a concern for social control, domination and security and mostly read its contemporary epoch as evolving toward a "society of maximum security" (Marx, 1988) thanks to information technologies supporting the automated collection and exploitation of personal data (Clarke, 1988), and endeavoured to unpack the categorising, sorting and resulting discriminatory and performative practices linked to surveillance and security apparatuses to raise ethical considerations on surveillance.

This technological orientation supported a fairly linear interpretation of the evolution of surveillance, shifting from pre-modern (operating directly, face-to-face) to modern (rationalised through recording and accounting techniques to document past and present activities and favour uniformity and homogeneity in societies) and even "postmodern" (drawing on digital technologies to monitor behavioural and biometric traits and traces in a future-oriented perspective and spanning every field of societies) (Lyon, 2007). Such surveillance society would be characterised by increased bureaucratic investments in the routine, systematic and long term collection, storage and use of information for governance and control purposes (Boersma et al., 2014). Sociologist D. Lyon, one of the leading figures of the field, would thus define surveillance as the "collection and processing of personal data, whether identifiable or not, for the purposes of influencing or managing those whose data have been garnered" (Lyon, 2001, p. 2). The simultaneous increased visibility and invisibility of surveillance, its banalisation and democratisation (expanding both downwards and upwards, towards elite groups for 'transparency' sake) or the blurring divide between surveillance agents and subjects were advanced as defining criteria of the new surveillance paradigm (Ball et al., 2012). Arbitrating the systematisation of postmodern surveillance forms in contemporary societies, the first wave of Surveillance Studies was largely dominated by top-down, structural and organisational approaches. It raised critical concerns for

protecting privacy against the extensive use of surveillance as a technology of power by nation-states, administrative bodies and private companies (Giddens, 2007; Ball et al., 2012; Bauman & Lyon, 2013). These works generally asserted that surveillance would lead to more pervasive forms of control instead of solving some of the issues of modernity.

Critical reviews of this first wave eventually pointed out a tendency to overgeneralise ideal-typical perceptions of surveillance, neglect surveillance's empirical variety and complexity, and adopt an overly militant stance (Quessada & Sadin, 2010). Surveillance Studies would back against issues of control and domination too systematically (Marx, 2006) and be overly technocentric, technologically deterministic or even technophobic (Wood, 2009; Marx, 2015; Castagnino, 2018). My case study exemplifies more diverse forms of surveillance than that deployed by the state and its military and administrative institutions to control society – although those remain very much present. To address these hurdles, certain surveillance scholars advocated for finer and more diversified investigations of surveillance and human-technology interactions (Ball et al., 2012).

Another wave of Surveillance Studies ensued to 'provincialise' the study of surveillance, examine its variety and resist a reifying and normative understanding of surveillance by adopting a more agnostic stance (Monahan et al., 2010; Castagnino, 2018). This involved several turns, which this dissertation intends to contribute to. A first turn implied complexifying the concept of surveillance as a mere (and badly perceived) instrument of social domination. Conventional research fields linked to the police, warfare, international security or commercial organisations were complemented by enquiries into other professional or familial terrains in more diverse geographical and historical settings and distinguishing, for instance, (non-)organisational or (non-)strategic forms of surveillance. These applied, for instance, to the study of self-surveillance, surveillance operated by non-state actors (e.g. citizens on other citizens, private firms), participatory or voluntary surveillance³⁹ and permitted to relate surveillance not to security only but also to care or protection (Marx, 2015). Cultural approaches started examining how surveillance is lived, perceived and imagined (Lyon in Boersma et al., 2014), investigating surveillance not only from the top but also from the bottom. Enquiries into practices of counter-surveillance or obfuscation also complement these new lines of research (Monahan, 2006, 2011). With these works, the study of surveillance as an issue of *seeing* is completed with questions on what it is to *be seen* and how people negotiate their privacy and manage their (in)visibility. These considerations are particularly interesting to discuss how fishers negotiate their (in)visibility at sea and accommodate contrary purposes of cooperation and competition in fishing, improving their safety at sea and escaping coercive control from shore-based (private and public) authorities (cf. Chapter 7).

A second turn relates to epistemological and methodological considerations on how to study surveillance. The diversification of Surveillance Studies' interests has permitted acknowledging the

³⁹ E.g. see (Albrechtslund, 2008)

multiplicity of surveillances (at the core of my own work) instead of approaching it as a unified ‘blackbox’ relying on multiplying surveillance apparatuses (Smith in Ball et al., 2012). One pitfall, however, was that it contributed to making the notion of surveillance more difficult to narrow and specify, calling into question the relevance of surveillance as an analytical concept (and echoing the debate between space/territory evoked in Section I):

Regardless of the limitative criterion (e.g. the control-oriented objective of surveillance or the technological nature of the means of surveillance), all definitional attempts stumble over the fact that they aim to characterise a banal and universal phenomenon (surveilling, i.e. producing information about, something or someone to act) as a specific political and social phenomenon that would be constitutive of modern societies. (Castagnino, 2018, p. 31, my translation)⁴⁰

Against that drawback, critical reviewers of Surveillance Studies, often inspired by the field of STS, called for empirically-driven and situated approaches to surveillance, favouring not only historical and geographical but also ethnographic and praxiographic examinations of surveillance to understand its making in context and through practices (e.g. see Gad & Lauritsen, 2009; Galič et al., 2017; Castagnino, 2017; Benbouzid, 2018). The goal is to complement formerly dominant structural approaches interested in the political effects of surveillance by uncovering what it is to ‘surveil’ (Castagnino, 2017). Hence, Part II of this dissertation provides a historical and geographical examination of surveillance while Part III investigates surveillance practices to build such a situated comprehension of surveillance ‘in the field’.

2. Surveillance in Risk Studies

These evolutions echo and converge with other fields of social science that are also concerned with surveillance but have been led relatively separately. F. Castagnino, for instance, highlighted parallels between Surveillance Studies and Risk Studies, which have equally been concerned with surveillance activities through the lens of risk management – and therefore safety rather than security (Castagnino, 2017). F. Castagnino suggested that the difference between the two was chiefly a matter of intentionality. In the case of maritime surveillance, geographer M. Fournier similarly defined security as the management of criminal risks and maritime safety as the prevention of anthropic or natural risks that could imperil lives or goods (Fournier, 2013). This evidences close connections between the two concepts, which incidentally tend to merge under contemporary understandings of maritime security (Bueger, 2015a).

⁴⁰ In original : « Quel que soit le critère limitatif retenu (le but de la surveillance tournée vers le contrôle par exemple, ou le caractère technique des moyens de surveillance), les tentatives de définition semblent toutes buter sur le fait qu’elles veulent caractériser un phénomène banal et universel (surveiller – soit produire de l’information – quelque chose ou quelqu’un pour agir) comme un phénomène politique et social spécifique, constitutif des sociétés contemporaines ».

Risk Studies were popularised after Ulrich Beck's work on the "Risk Society" (Beck, 1992). They have retraced the emergence of risk as a technology of government in a context where industrial hazards proliferated and where states found themselves unable and unwilling to prevent accidents and fully protect individuals. The risk-based approach replaced a logic aiming to stop accidents with a logic intending to manage hazards in order to reconcile industrial activity and safety. Risk policies initially permitted a social compromise drawing on expert knowledge (rather than policing or military intelligence), whereby workers would benefit from better protection without impeding industrial progress (Ewald, 1986; Fressoz, 2012). The development of risk-based management can be read as the propagation of the security logic beyond the maintenance of public order and into other fields, such as the industrial or health sectors, and the transformation of the "Security State" into the "Providence State". Risk management implies calculations, anticipation and insurance practices to translate an uncertain threat into a manageable risk. A risk-based governing approach aims to collect data and produce knowledge to reduce uncertainty about an activity and make it controllable.

Risk Studies, too, resonate with M. Foucault's work on surveillance and security, with more emphasis on his reflections on surveillance's role in supporting capitalist industrialisation and the maintenance of productive forces (Foucault, 2004). The concept of risk allows for introducing another dimension of surveillance, visible from the outset in most dictionaries, as relating to production processes, environmental degradations, health and safety, and therefore completing the dimension of surveillance relating to policing and security (Castagnino, 2017). As I will show, all these dimensions cohabit in my case study – and must cohabit to make offshore surveillance possible. Interestingly, when surveillance is related to production, environment, health and safety, it tends to be perceived much differently from its policing-security dimension. In this case, the rationale of surveillance is more rarely called into question, and when criticisms arise, it is generally to denounce the fallibility of surveillance systems and their inaptitude to prevent risk and ensure protection effectively. Contrary to dominant discourses in Surveillance Studies, much research on risk calls for more and better surveillance (Castagnino, 2017) – e.g. to prevent the collapse of fish stocks or to improve maritime safety.

Several scholars have explored the convergences of Risk Studies and Surveillance Studies along different lines. Surveillance scientists R. Ericson and K. Haggerty looked into the transformation of policing institutions under the influence of risk-based approaches (Ericson & Haggerty, 1997) – also visible in Chapter 9 of this thesis. F. Castagnino investigated the railway industry's surveillance practices to prevent accidents (safety) and malicious and criminal acts (security), showing their similarities despite their different objectives (Castagnino, 2017). Significant for my research, the consideration of safety aspects places more emphasis on the surveillance of non-human entities and the acknowledgement of their agency, a dimension more often neglected in Surveillance Studies than in Risk Studies. Surveillance does not only target human subjects but also objects, as shown by P. Adey's work on airport surveillance (Adey, 2003). His study outlined how making airports both safe and secure

entails the surveillance of human *and* non-human mobilities and tracing various things such as luggage, passports, or planes. However, Castagnino and Adey's works only consider artefacts in their analyses. They do not incorporate the surveillance of 'natural' entities such as animals or oceans, which may arouse distinct practical, political and ethical modalities for Surveillance Studies. Tunas exhibit distinct traits compared to luggage or railways. Conveniently, Risk Studies have largely been concerned with environmental issues, as I will discuss more thoroughly in the next section. Together with Environmental Humanities, Risk Studies help bridge this divide between human and non-human surveillance to think of a 'more-than-human surveillance'.

3. Giving 'Life' to Surveillance – Inputs from Environmental Studies

There has been an increased recognition that, similarly to human societies, 'natural' worlds are permeated by more sustained and various surveillance efforts. Against this background, surveillance scholars K. Haggerty and D. Trottier recently called for further investigation of the nexus between humans, nature and surveillance (Haggerty & Trottier, 2015). To that end, they offered to reconceptualise surveillance as "collecting and analysing information about populations and places for purposes of governance" to incorporate monitoring practices and animal populations. Research on the topic intensifies but was already worked by a wider scholarship that I loosely gather under the Environmental Humanities scholarship, interested in investigating relations between human societies and 'natures' through the lens of surveillance and its multiple forms and roles (e.g. control, security, care and protection).

i. The Scientific Surveillance of the Environment

The social study of environmental surveillance has predominantly looked into scientific monitoring activities. Science can resemble, in many respects, a form of surveillance as scientists also "systematically collect, organise, analyse, interpret and disseminate data with the aim of influencing others" (Monahan, 2011). Intersecting science and society, such research evidenced connections between 'scientific surveillance' and public administrations but also the police and the military. For instance, the term "monitoring", understood in environmental sciences as the regular and systematic collection of data about natural systems through time, comes from the military realm (Aronova, 2015). The utilisation of surveillance technologies developed by the military to observe, track, and measure natural entities and processes further entangles the science and the military.

Given its particularly authoritative influence in speaking about 'nature' (Helmreich, 2009; Lascoumes, 2012a), the making and role of natural sciences were largely addressed by STS (whose inputs remain underexploited in Surveillance studies, as I have mentioned). STS decrypted the various operations through which scientists translate, reduce and standardise the 'natural world' to make it legible and governable by producing data, classifications and inscriptions. Their circulations to centres

of accumulation and calculation and between various social groups permit the stabilisation of specific understandings of ‘nature’ (Star & Griesemer, 1989; Latour, 1999). Reminiscing observations made by Surveillance studies about classification schemes and other knowledge infrastructures, these works unpacked the values and politics entrenched in these understandings of ‘nature’ and described their performative capacity (Bowker, 2000; Bowker & Star, 2000).

Research into the history of science more specifically retraced the role of techno-geosciences - including oceanography (e.g. see Benson, 2012; Lehman, 2016) – in supporting the development of ‘environmental surveillance’ and then ‘environmental monitoring’ at a global scale during the Cold War. The Cold War context marked the expansion and intensification of inventories and monitoring infrastructures, initially for military and national security reasons. This era was also an era of increasing environmental awareness, with spreading considerations about the limits of the Earth system and the necessity to preserve nature and/or conserve natural resources. This era drew new connections between natural resource conservation and security, expanding this latter concept moving beyond its ‘traditional’ understanding. This resourcist approach to the environment became dominant in international fora concerned with addressing human demographic growth and associated food *security* concerns. In that context, the inventoring and monitoring of natural resources such as fisheries became pivotal to their rational management (Mahrane & Bonneuil, 2014). These scientific practices permit to take ‘nature’ into account and make it amenable to ecological, spatial and political planning (Höhler & Ziegler, 2010; Aronova, 2015; Westermann & Rohr, 2015). These transformations have led some scholars to mobilise Foucauldian interpretations of environmental surveillance (e.g. see Collier et al., 2004; Granjou & Mauz, 2009) to consider this phenomenon as a technology of government oriented this time to the government of ‘nature’ and of human-nature relations (Lascoumes, 2012b; Arpin et al., 2015).

The expansion and diversification of environmental surveillance and/or monitoring blurs the line between the two terms. In Surveillance Studies, the difference between the two is rarely addressed and, in Environmental Studies, the semantic shift mostly appears historical – and only results in camouflaging the military origins of monitoring, presented as a scientific, ‘neutral’ activity. Instead of pre-defining the two terms and their differences, I privilege the use of ‘surveillance’ only to outline the common and overlapping intent and practice of collecting information. However, I discuss its various shapes and emic labelling throughout the dissertation.

ii. Surveillance of the Bios: From Sanitary Risks to Biosecurity

Although Castagnino’s research on surveillance in the railway sector does not deal with living non-humans, his proposal to cross Surveillance and Risk Studies helps open such breach (Castagnino, 2017). Risk studies have initially been interested in the ‘natural’ environment because of the detrimental effects of industrial activities on rivers or soils and, for that reason, on people’s health. From the 1990s, the

multiplication of sanitary crises in the food industry (e.g. mad cow disease, avian influenza) led to the expansion of surveillance practices to microorganisms, animals and plants to ensure sanitary security.

This phenomenon attracted a wealth of social research, variously concerned with associated public policy transformations, risk perceptions, or scientific experts' (contested) role in producing science-based and risk-oriented knowledge to assess and inform risk management (Charrier et al., 2020). More relevant for my purpose on surveillance, some studies analysed the specific assemblages of techniques, devices and labour deployed to 'put in risk' these emergent public problems. They accounted for the development of new traceability systems operating through the food chain or of epidemiological surveillance apparatuses aiming to trace and translate biological threats into calculable and manageable dimensions (e.g. Torny, 1997, 1998; Granjou & Valceschini, 2005; Barbier, 2006; Prete, 2008)⁴¹, and which I explore in Chapter 7 of this thesis.

These sanitary crises, linked to the intensification of global biological flows, were partly reframed after the 9/11 attacks and the subsequent heightening of security concerns (cf. Section II.1) under a new "biosecurity" framework to manage disease risks (Barker et al., 2013).⁴² Another overlapping set of literature devoted to biosecurity emerged to address the connections between risk, safety, security, and surveillance regarding non-human biological entities more frontally (Cardon & Barbier, 2017). This body of work outlined the plurality of "biosecurities" (Hinchliffe & Bingham, 2008), which now expand beyond the agrifood realm (e.g. Keck, 2008) to address also bioterrorism (e.g. Collier et al., 2004), the protection of 'Indigenous' ecosystems against the 'invasion' of 'alien' species (e.g. Buller, 2008) and holistic considerations brought up by the "One Health" agenda (e.g. Woods, 2022).

Biosecurity connects to considerations of territory, population, security and surveillance. It consists of attempts to govern the biological in order to contain emergent risks (Braun, 2007) thanks to the surveillance, regulation, and promotion or halting of (un)desired circulations of biological organisms (Bingham et al., 2008) and to the demarcation of new territorial units (Hinchliffe & Bingham, 2008). Hinging on the premise that forms of life can be threatening and that threatening forms of life can be contained and managed, biosecurity aims to make (generally human but not just human) life safe and secure (Hinchliffe, 2018). Such securitisation of the bios is frequently understood as a Foucauldian "return to power" (Hinchliffe & Lavau, 2013), entailing new forms of territorialisation and borders control, security apparatuses and regimes of (bio)surveillance and monitoring at the crossroads of

⁴¹ Interestingly, Prete (2008) draws connections between sanitary/environmental surveillance research and risk governance to the research in Surveillance studies and its interest in the new politics of surveillance and visibility (Haggerty & Ericson, 2006).

⁴² It is useful to outline here that Foucault's reflections on power, knowledge and surveillance incidentally hinged on the analysis of various case studies linked to the management of diseases and epidemics such as the plague or leprosy, putting at play animals or microorganisms, although he did not conceptualise much their influence on human health and social organisation. More generally, public health is one of the richest areas in which the concept of 'surveillance' is mobilised (Ball et al., 2012).

sanitary and military logic (Barker et al., 2013; Fortané & Keck, 2015) – and reaching unprecedented and novel configurations in the Covid-19 pandemic. Research on biosecurity therefore bears strong similarities with Surveillance Studies, in particular given its re-examination and expansion of M. Foucault’s work beyond the human (e.g. see Barbier, 2006; Hinchliffe & Bingham, 2008; Collard, 2012).

More distinctively, perhaps, the literature on biosecurity draws on Environmental Humanities to account more finely for non-humans and their agency (Barker et al., 2013) – a consideration particularly important for my research on tunas and offshore ecosystems. It contributed to examining the underexplored specificities of stakes, knowledge, techniques and actors involved in surveilling and controlling these living non-humans (Fortané & Keck, 2015), compared to artefacts such as railways or suitcases addressed by F. Castagnino or P. Adey’s works (Adey, 2003; Castagnino, 2017). These research works highlighted the complex mutability of life and the impossibility of translating it into accurately calculated risks. Given the inapplicability of risk-based calculations and rigid regulatory frameworks, they reconceptualised bio-insecurity as an *emergent* phenomenon constantly adjusting to irreducible uncertainties – a point that I explore in particular in Chapter 8.

These studies also investigated the role of biosurveillance and biosecurity in shaping categories of life distinguishing for instance between ‘wild’ and ‘domestic’, ‘alien’ and ‘native’, thereby granting different values and tolerances to biological human and non-human organisms, and in transforming their relations (e.g. Collard, 2012; Hinchliffe & Lavau, 2013). This incursion beyond the ‘domestic’ leads me to introduce another set of research concerned with biosurveillance, this time not so much to secure human life but rather ‘wildlife’ and biodiversity.

iii. Tracking and Monitoring Wildlife: Politics of Nature Conservation

Another strand of literature concerned with the surveillance of biological organisms relates to nature conservation. Its enquiries are not so much interested in public health or farming (the ‘domestic’ sphere) but more explicitly in the surveillance and conservation of ‘nature’. These are not entirely unrelated: for instance, some of the techniques now used for nature conservation originated from pest control and biosecurity apparatuses (W. M. Adams, 2017), while biosecurity apparatuses sometimes merge with pre-existing scientific or conservation apparatuses (Fortané & Keck, 2015).

Compared to human-oriented surveillance, the ‘wilder’ surveillance becomes, the less it tends to be conferred with malevolence (Turchetti & Roberts, 2014). However, an expanding body of research has endeavoured to reflect critically on the political and ethical aspects of wildlife surveillance and its consequences for both non-humans and humans. This scholarly literature, anchored in ‘Humanimal’ Geography (Bortolamiol et al., 2017), History of Science (e.g. Benson, 2010), Anthropology of Nature (e.g. Mitchell, 2018), or Media Studies (e.g. Gabrys, 2021) examine the expansion and transformations of surveillance and monitoring practices to track nature and the reconfiguration of human-wildlife

relations and biodiversity conservation politics. It paid particular attention to the development of “digital ecologies” and “digital conservation” and the influence of tracking and sensing technologies in providing new ways of visualising, knowing, representing and relating to nature (Arts et al., 2015). Various studies showed the instrumental role of information technologies and “datafication” processes in supporting the regulation of nature and the living or dying of certain species (Bowker, 2000; Braverman, 2014; Devictor & Bensaude-Vincent, 2016) or in producing conservation or exploitation territories (W. Adams, 2017). If security aspects are less overtly mentioned in this corpus of research, references to M. Foucault’s work spread alike.

Like in Surveillance Studies, more recent discussions mitigated this Foucauldian approach to investigate other forms of relations permitted by the “Janus-faced character of surveillance” (Haggerty & Trottier, 2015, p. 17), such as spectacularisation, domestication, democratisation, stewardship or care (Manceron, 2013; Whitney, 2014; W. Adams, 2017). Other research also reflected on the capacity of animals (and people) to resist and escape wildlife surveillance apparatuses (Arpin et al., 2014; Granjou & Mauz, 2009). In their call to expand Surveillance studies beyond the humans, K. Haggerty and D. Trottier identified three general ways in which surveillance reconfigured ‘nature’. First, as I just mentioned and will show in the case of tunas and offshore ecosystems, nature is increasingly becoming a target of surveillance practices. This increased surveillance of nature calls into question the modernist nature-culture divide and deserves further investigation. Second, nature also provides an inspirational model to surveillance, exemplified with military camouflage and more contemporary biomimetic developments. Third, nature is also increasingly enrolled to conduct surveillance, e.g. by using animals as environment probes to access remote locations such as the ocean (e.g. Mandel, 2006; Benson, 2010). I show evidence of such practices in Chapter 7 and 8, with fishers and scientists relying on animals to find tuna fish or study offshore ecosystems.

The surveillance of wildlife, at the boundary between humans and non-humans, bears social and ethical implications regarding human relations to ‘nature’ but also regarding power relations over humans, as it can serve to regulate and control people’s behaviours as well (e.g. Mouton & Rock, 2021). The surveillance of tuna fish, for instance, can reveal the existence of illegal fishing practices or lead to privileging the protection of tuna fish over foreign fishers (cf. Chapter 9). These multispecies investigations predominantly focus on terrestrial and endangered animals (mammals and birds in particular) and conservation sciences. Less attention has been given to oceanic ecosystems and to fish in particular (see e.g. Bear & Eden, 2011; Gibbs, 2020 for exceptions). This dissertation, and especially its eighth chapter, focuses on the surveillance of tuna and fisheries science, contributes to filling this lacuna.

4. Cross-Considerations with STS to Conceptualise and Study Emergent, Multiple and More-than-Human Surveillances

The previous sections of this chapter introduced different and fairly distinct bodies of research with distinct themes, but all are interested in surveillance. Their differences derive from somewhat specific historical trajectories and research subjects. However, because they increasingly acknowledge the many facets of surveillance, they present theoretical and epistemological convergences about surveillance that remain underexplored, especially from an empirical perspective.

i. Redefining Surveillance to Think Its Plurality

At the theoretical level, my research argues for the relevance, if not the necessity, of studying these various forms of surveillance altogether – applying to humans *and* non-humans, for coercive, scientific, protective and/or commercial purposes – to better understand their (dis)connections and the complexity of surveillance as a multidimensional and relational phenomenon. Leading an agnostic and open-ended investigation on surveillance avoids the pitfall of compartmentalising surveillance by delimitating it *a priori* and, therefore, overlooking certain of its dimensions. Hence, my research does not aim to compare the surveillance of fishers with the surveillance of fish or think protective surveillance related to maritime safety against coercive surveillance addressing illicit fishing activities. Rather, it evidences their entanglement and explores the frictions resulting from such entanglement. Focusing only on humans or non-humans would leave the description and understanding of surveillance, its functioning, and its effects incomplete. Similarly, focusing on a restricted, military-oriented understanding of maritime surveillance or scientific monitoring would also leave this analysis incomplete.

Such an inclusive interest in surveillance requires an equally comprehensive definition. In his objective to encompass the surveillance of humans and non-humans for security and safety purposes in the railway sector, F. Castagnino relied on their commonalities to define surveillance as “a set of practices consisting in collecting data, on people or processes, in order to manage an uncertainty about them” (Castagnino, 2017, p. 24).⁴³ He proposed to understand surveillance as a social practice of Weberian rationalisation, oriented toward action and achieving a specific end – rather than as a global policy emanating from a central power. In that sense, surveillance is conceived relationally: it derives from the search for organisational efficiency and consists of a solution to such organisational challenges. The advantage of his definition centred on the accumulation of data and the management of uncertainty is that it allows me to think together various objectives of surveillance, e.g. ‘scientific’, ‘commercial’, ‘regulatory’, ‘protective’, or ‘coercive’, i.e. in relation to other objects such as scientific knowledge, commercialisation, rule-making, safety and care, or rule-enforcement, sanctioning, security and

⁴³ “pratiques consistant à recueillir des données, sur des personnes ou des processus, afin de gérer une incertitude les concernant” in original, my translation.

policing. These labile and heuristic labels help me interrogate various forms of surveillances and their relations with one another. Such a definition works well to comprehend maritime security and its contemporary widening to ‘unconventional’ threats linked to environmental concerns (Bueger, 2015b). This approach also works with fishing companies’ interest in managing uncertainty about their commercial operations or ensuring their products’ sanitary viability. It permits looking beyond while retaining the policing or military sphere to consider the role of other actors in surveillance. F. Castagnino’s proposed definition of surveillance mentions the surveillance of “processes”, which is helpful for the surveillance of ‘natural’ processes such as seismic activity or, more relevant to my case, oceanographic currents or ecosystem dynamics. However, his mention of “people” is too restrictive for my interest in pelagic fish such as tunas or fishing vessels. Therefore, I adapt his definition by considering surveillance as the collection of data not only on people or processes but more generally on ‘entities’, human or not. Additionally, I extend my enquiry beyond the stage of data collection: surveillance also requires calculative work to separate and assemble data to produce knowledge and support action. These practices inform, in return, data collection and, therefore, cannot be overlooked.

ii. **Studying Surveillance in Practice and through its Apparatuses and Infrastructures**

Thinking in terms of moving lines was the process put forward by Herman Melville, and this involved fishing lines and lines of descent which could be dangerous, even fatal. [...] Untangling these lines within a social apparatus is, in each case, like drawing up a map, doing cartography, surveying unknown landscapes, and this is what he [Foucault] calls ‘working on the ground’. One has to position oneself on these lines themselves, these lines which do not just make up the social apparatus but run through it and pull at it, from North to South, from East to West, or diagonally. (Deleuze, 1992, p. 159)

Most of the criticisms against surveillance studies pertain to their overreliance on grand narratives about the ineluctable expansion of surveillance across all social spheres and dimensions, in particular through the often *a priori* and partial mobilisation of Foucauldian-inspired theories (mainly linked to the *Panopticon* figure). To avoid such pitfalls, I abide by recurring calls to favour an empirically-driven research design (e.g. Gad & Lauritsen, 2009; Castagnino, 2017; Bueger, 2021). This empirical stance, rather than an *a priori* conceptualisation, led me to decompartmentalise surveillance.

I understand surveillance as a situated and emergent phenomenon. Such stance concurs with the now more widely accepted idea that not all surveillances necessarily pursue the same objectives and that their respective specificities need to be investigated and described without presuming their effects – while conceding that these surveillances may also produce unforeseen effects unrelated to their original intent (Barbier, 2006). However, this agnostic perspective on surveillance does not mean that I approach it as a neutral activity. I approach surveillance as a (distributed) activity, necessitating the labour of several

entities involved in surveilling, i.e. collecting, managing, and using information. Surveillance is not merely a concept but also a range of discourses, practices, instruments, knowledge... that constitute it.

It is therefore helpful to approach surveillance through its “apparatuses” (Foucault, 1975). This strategy permits us to consider, interpret and describe, simultaneously, the intertwining of knowledge and power and networked material and discursive entities that shape surveillance. The notion of apparatus serves both a descriptive and methodological objective. As outlined by Deleuze’s quotation in the opening of this section and referring to fisheries, thinking the surveillance apparatus requires mapping the many lines that connect various entities in the making of surveillance. G. Deleuze and F. Guattari’s reading of composite material and immaterial ensembles led them to conceptualise the “assemblage”, permitting more fluid and indeterminate relations between its constituents than the notion of apparatus suggests (Deleuze & Guattari, 1994). K. Haggerty and R. Ericson departed from M. Foucault’s apparatus to revisit the description of surveillance systems with this concept of assemblage (Ericson & Haggerty, 1997). Seeking to account for contemporary technological transformations and to describe the convergence of previously distinct surveillance systems – a phenomenon particularly visible in my case study – they conceptualised a “surveillant assemblage”. This is useful to develop a more indeterminate understanding of surveillance systems. The surveillant assemblage exists as a “potentiality”; it is “multiple, unstable and lacks discernible boundaries or responsible governmental departments” (Ericson & Haggerty, 1997, p. 609). The more ‘malleable’ assemblage helps outline that surveillance systems, if originally devised for a specific purpose, can serve other uses. Second, they advanced that the surveillant assemblage does not approach the subject as a mere body, as was the case in Foucault’s disciplinary *Panopticon*, but rather aims to turn it into an object of knowledge by breaking the body down into ‘pure’ information. Hence, joining G. Deleuze’s society of control, they argued that the surveillant assemblage entails multiplying the individuals by creating “data doubles”. The surveillant assemblage initially targets and monitors a cyborgised “flesh-technology-information” body but is also productive of a new and entirely informational individual. This argument is important to orient my investigation toward the surveillance subjects and their associated ‘bodiless’ data double – and toward what happens to these data.

Although I wish to retain those considerations for my research, I also depart from K. Haggerty and R. Ericson’s surveillant assemblage to privilege the term ‘surveillance assemblage’. First, this helps me take some distance from their argument that surveillance rhizomatically spreads throughout society. Interestingly, these scholars asserted that even the ocean, supposedly the ultimate place for disappearance, no longer escapes the surveillant assemblage. I argue that these affirmations need to be verified empirically – and my research incidentally shows that surveillance does not automatically spread (cf. Part III). Additionally, speaking of surveillance assemblage helps me bypass the divide between surveillance agents (surveillants) and surveillance subjects, which is dramatically blurred in my case study on tuna fisheries surveillance.

However, I do not reject the notion of apparatus for the sake of assemblage. In this dissertation, I articulate the two notions to think together about the many practices and instruments of surveillance I could observe in the field and their crossing. Hence, I distinguish formalised (and often institutionalised) surveillance apparatuses such as fisheries observer programmes from less structured and stable forms of surveillance, such as those fishers can sometimes deploy at sea to search for birds and spot fishing grounds or the ‘spontaneous’ reporting by fishers at sea of illegal activities to the police services. Hence, I envision a rhizomatic and fluid surveillance assemblage comprising various surveillance apparatuses – strategic, oriented to a particular direction, inscribed into power relations, and often articulated with one another and used conjointly – as well as more *ad hoc* forms and practices of surveillance.

Both apparatus and assemblage notions help us think of surveillance as distributed and outline the involvement of various entities in the making of surveillance. One pivotal notion I use through this dissertation is the notion of “boundary apparatus” devised by sociologist N. Fortané in a study of animal and zoonotic disease surveillance (Fortané, 2015). He suggested that surveillance rarely emerges *ex nihilo* and tends to rearrange pre-existing apparatuses. With this concept, N. Fortané articulates the notion of sociotechnical apparatus with that of “boundary object”⁴⁴ developed by L. Star and J. Griesemer (Star & Griesemer, 1989). Boundary apparatuses refer to surveillance apparatuses whose functioning depends on articulating various actors’ different involvements (motives, purposes, know-how, etc.). The concept of boundary apparatus allows for capturing the (frictional) coexistence of these various involvements whose imbrication produces forms of ignorance precisely because they cohabit within common apparatuses despite following distinct and possibly antagonistic purposes (see also Benson, 2012). As I will show in the rest of this dissertation, such tensions are at the core of offshore surveillance. This approach helps consider the diversity of surveillances through these apparatuses rather than considering the diversity of apparatuses as a sign of uniform, ramping surveillance and governing power (Potte-Bonneville, 2010).

Finally, these considerations, along with my empirical findings, lead me to complement this focus on surveillance assemblage and apparatuses with a focus on the infrastructures of surveillance that underlay them. My interest in infrastructures hints at longstanding attention in social sciences to the struggles over their design and control and their role in shaping social orders. STS, in particular, have devoted much effort to the topic in the wake of the work of B. Latour and S. Woolgar (Latour & Woolgar, 2013) and as part of a materialist turn interested in information technologies and knowledge infrastructures. These works have valuably outlined the politics embedded in these material devices and their capacity for agency. The seminal research of S. Star and G. Bowker pinpointed some important

⁴⁴ L. Star and J. Griesemer developed the concept of boundary object to analysis the role of ‘objects’ (material or not) in enabling cooperation amongst heterogeneous social groups. Boundary objects provide space for interpretative flexibility and therefore permit different groups to work together without consensus. Boundary objects permit different groups to meet at the ‘boundary’, understood as a shared space of encounter, while permitting this very boundary to subsist.

characteristics of infrastructure (e.g. Star & Ruhleder, 1996; Bowker & Star, 2000). Among those that will come to matter in the following chapters are the ideas that infrastructures embody and carry within them situated political yet also often invisible standards. Infrastructures tend to be built incrementally, from an “installed base”, and to have extensive spatial and/or temporal scope (Star, 2010). This contributes to another feature, that of often being embedded (often irreversibly) into other (infra)structures (Bowker, 2000).

Security studies have also grown interest in infrastructures, especially in ‘critical’ infrastructures, following the 9/11 terrorist attacks and a renewed concern for “the role of things in society” (Aradau, 2010, p. 1). More recently, some scholars ventured into a fruitful crossing with STS on the matter to unpack “emergent modes of securitisation” (Klimburg-Witjes & Bowker, 2021, p. 23-24), including the securitisation of critical maritime infrastructures (Bueger et al., 2023).

In their review of the various analytical stances used to study infrastructures in international relations, C. Bueger *et al.* distinguished a “realist and liberal scholarship”, viewing infrastructures as mere ‘objects’ for politics and describing how actors govern them, from an STS-related scholarship conceptualising infrastructures as part of a socio-material ensemble. With this perspective, STS look into “infrastructuring”, i.e. not only into the politics surrounding infrastructures but also into the role and capacity of agency of the latter in influencing politics and shaping social order in return. Eventually, C. Bueger *et al.* suggested an “infrastructuralist” approach (uncoincidentally inspired by empirical research on marine issues). This approach views infrastructures as what lies underneath social institutions and interrogates more centrally (and perhaps causally) the foundational role of infrastructures in holding social order and organising social life. This argument strongly echoes what I could observe in the field and the infrastructural role of particular material and informational structures (e.g., vessels and fishers’ data) in offshore worlds’ access, knowledge, and making.

My approach draws on the inputs from these several schools of thought in combination with surveillance studies. As I describe the functioning of surveillance, I mobilise several analytical tools provided by infrastructure studies. For instance, I operate an “infrastructural inversion” (Bowker, 1994, p. 10) to resituate the creation of those standards that still largely condition, to date, how the offshore environment is predominantly described and thought of (cf. Part II). In describing the functioning of these surveillance infrastructures and the work they require, I also pay attention to the work of maintenance, another important – yet long neglected – dimension underlying infrastructures and evidenced by infrastructure studies (Denis & Pontille, 2022) and which requires a form of watchfulness similar to that required by surveillant agents to surveil the ocean (cf. Part III). Reciprocally, the mobilisation of surveillance studies to discuss those infrastructures helps me circumvent a criticism sometimes addressed against STS studies for providing ‘internalist’, micro-driven analyses of infrastructures – at the expense of an analytical framework also accounting for the broader socio-eco-

political context and power relations, not necessarily directly concerned with the infrastructure at stake yet still weighing on it (see Frickel & Moore, 2006).

The role of infrastructures became visible as I was interviewing actors involved in the tuna fishing industry and its surveillance. I was struck by their constant allusions to the difficulty of *accessing* offshore waters. Access issues were central to those wishing either to exploit or surveil it. Still today, despite recurring discourses on technological improvements, mobility far out at sea and on offshore vessels seems far from being straightforward. During my investigations, I heard repeated mentions of the material constraints raised by offshore spaces and the need for appropriate technologies to reach its waters, probe its insides and accommodate challenging distances. These observations evidence the influence of the ocean's materiality on the functioning of surveillance. Even in the case of those effectively managing to venture into offshore waters with adapted vessels, I was surprised to see how many resources and how much labour were necessary only to ensure the mere functioning of the vessel, which would, in turn, support and permit the commercial, scientific or policing (i.e. law-enforcing) activities these vessels were supposed to serve for. Vessels appeared to be one type of infrastructure underlying, and therefore foundational to, the surveillance apparatuses I was investigating. They were a matter "that enable[d] the movement of other matter" (Larkin, 2013): of surveillance subjects/agents, of informational supports. Even in the case of supposedly 'remote' forms of surveillance, such as Vessel Monitoring Systems (VMS), vessels have to be equipped with sensors and, therefore, conserve an integral role in the functioning of the apparatus.

These observations led me to structure Part III of this dissertation around the three main infrastructures that permit physical, and therefore informational, access to the offshore ocean and its fisheries. First is the fishing vessel, constituting the main purveyor of surveillance information (cf. Chapter 7). Second is the oceanographic vessel, which aims to provide 'fishery-independent' information – an independence which I will show remains relative after all (cf. Chapter 8). Last is the military vessel, patrolling and policing the sea to enforce law (cf. Chapter 9). I use this distinction as a loose structure, approaching these three principal 'surveillance probes' as starting points, providing that surveillance is not an exclusively marine practice and that these vessels also interact. However, with this structure, I show the foundational role of these three vessels in permitting and shaping surveillance. Infrastructures, as I said, tend to be layered (Bowker & Star, 2000). Vessels only constitute the first underlying layer of offshore surveillance. They support a range of surveillance apparatuses (e.g. logsheet, observer programmes) that produce data on fisheries and the ocean, and therefore also constitute influential knowledge infrastructures. Data produced by fishers or onboard fishery observers, for instance, are, in turn, (more or less visibly) embedded in many other knowledge production processes, e.g. to assess the status of fish stocks, the extent of illegal fishing activities or the ecological state of the global ocean.

Surveilling the vast South Pacific Ocean perennially requires extensive (and expensive) surveillance infrastructures that underlie surveillance apparatuses and the more general surveillance assemblage. As pinpointed by scholars C. Bueger *et al.*, the rapprochement of the two notions of “infrastructure” and “assemblage” outlines an interesting tension between the rigidity and stability of the former and the flexibility (and arguably fragility) of the latter, including in terms of temporality (Bueger *et al.*, 2023). Infrastructures constrain while simultaneously providing some degree of stability to the wider surveillance assemblage. Conversely, these infrastructures may precisely uphold some degree of malleability because of their inscription in this assemblage. My research offers some empirical elements to this question. This dialectic between stability and flexibility and ‘tailorability’ is helpful in thinking about and describing some of the tensions that underly surveillance apparatuses.

My perspective on surveillance calls for an ethnographic approach attentive to practices to identify and understand the relations between the various elements involved in the surveillance assemblage. This method of observation aims to understand what it is exactly to surveil tuna fisheries. To that end, I follow N. Green and N. Zurawski and look at the many dimensions of surveillance: materiality, knowledge, communication and discourses, daily activities and practices, and the politics of surveillance and data management (Green & Zurawski, 2015). The next chapter explains more thoroughly the challenges and methods of conducting such ethnography in the field.

CHAPTER 3. Investigating Oceanic Surveillances: Methods and Material

This third chapter first briefly describes my field of study to explain its relevance in relation to my research questions. I then account for the methodological challenges I encountered in accessing and conducting my fieldwork and the various strategies I deployed to bypass them while backtracking their influence on my research process and results. Finally, I expose in more detail the exact corpus of data on which this dissertation relies.

I. Introducing the Field: Rationales for its Selection and Delimitation

1. Industrial Tuna Fisheries of the South Pacific Region: High Stakes of Surveillance

i. Tuna Fisheries in the South Pacific Region

Studying the surveillance of tuna fisheries in the South Pacific region permits the displacement of surveillance studies into the legally and physically complex offshore world. Because they encompass heterogeneous entities such as fish and fishers, tuna fisheries are indisputably ‘more-than-human’ and provide an excellent subject to investigate an equally ‘more-than-human’ surveillance. They represent a unique case study to empirically test discourses on the rampant expansion of surveillance and the territorialisation of the offshore marine environment.

The South Pacific region is relevant in several regards. As I will show in Chapter 5, tuna fisheries were tightly associated with building many Pacific Island nations after they proclaimed their independence from the 1960s onwards.⁴⁵ Against the limited land resources but extensive Exclusive Economic Zones (EEZs) of many of them (cf. Figure 1), they identified tuna resources as the main resource capable of supporting their economic development and political affirmation. This historical context allows for investigating state formation and territory-making in regard to the offshore environment.

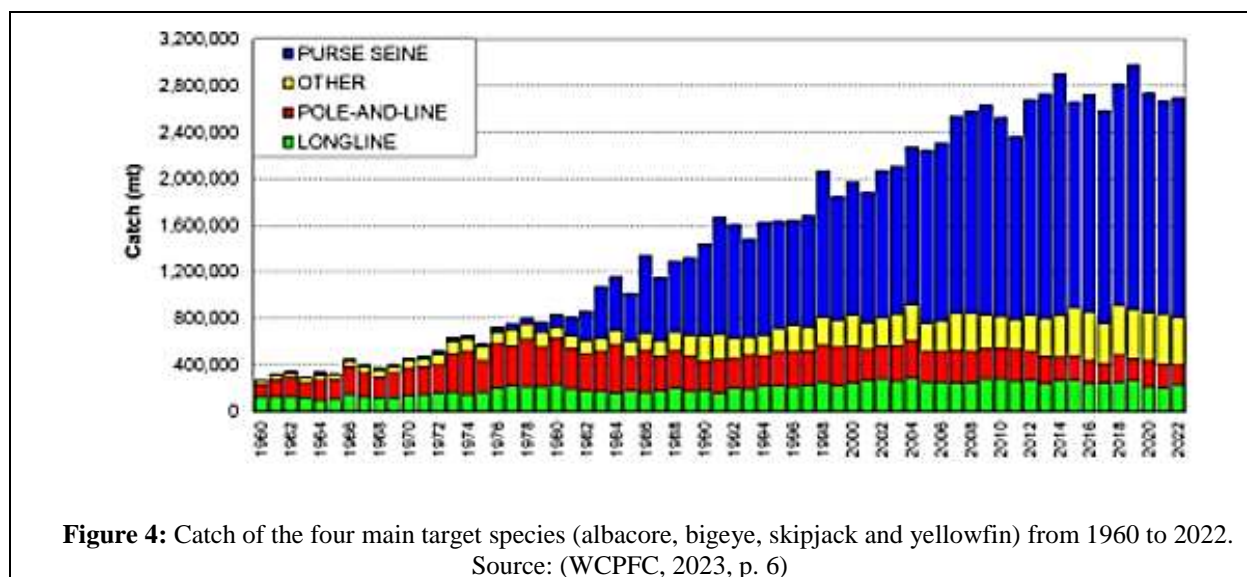
The region’s geography makes interrogating territorialisation processes particularly interesting considering that it is embedded in the largest world ocean⁴⁶ and most of its waters are under state

⁴⁵ The decolonisation of Oceania started in 1962 when Samoa proclaimed its independence.

⁴⁶ The Pacific Ocean covers over 30% of the Earth’s surface (<https://oceanexplorer.noaa.gov/facts/pacific-size.html>, accessed: 30.08.24).

jurisdictions, with very few international waters left. Following the entry into force of UNCLOS and the creation of the EEZs, setting sovereign rights and duties on sustainably managing marine resources, the Pacific Islands were vested with considerable opportunities and challenges to control these spaces and associated resources, considering their limited human, material, and financial resources. The marine territories of the Pacific Islands cover over 38.5 million km² for a combined land area of about only 550,000 km² (Jollands & Fisher, 2017). A country like Tuvalu has a land area of 30km² and a population of 10,876 inhabitants for about 749,790km² of waters under its jurisdiction.⁴⁷

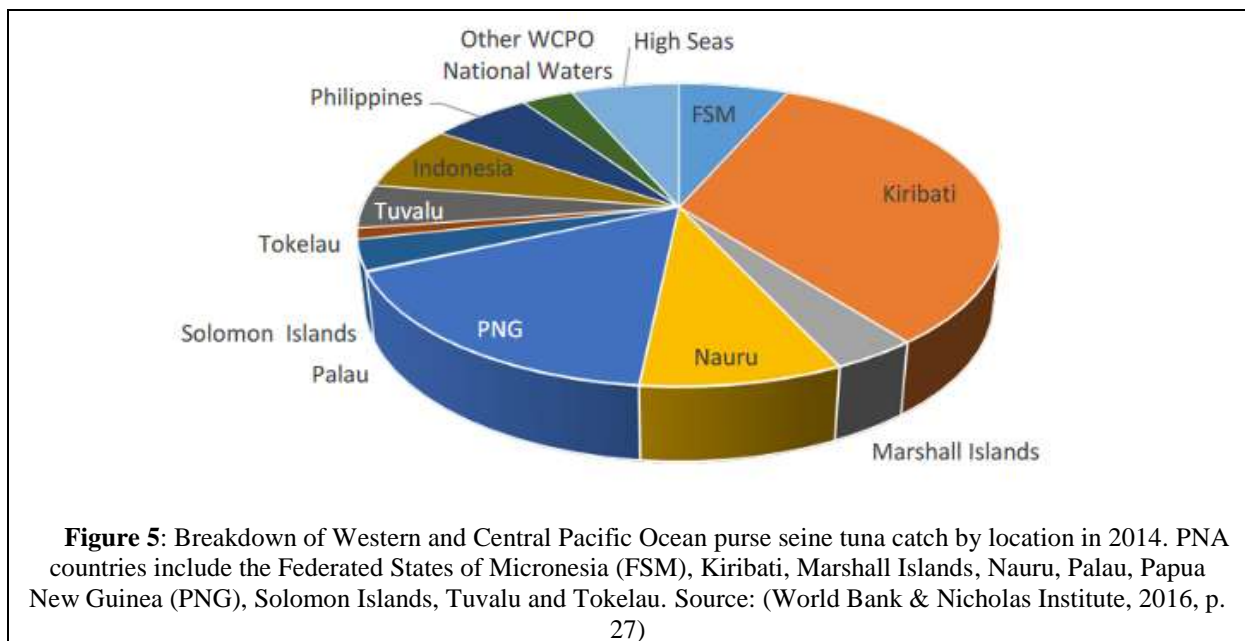
The region harbours the largest tuna fisheries in the world, harvesting what are considered some of the last biologically healthy tuna stocks (World Bank & Nicholas Institute, 2016). Fishing is the region's primary maritime activity at sea, with fishing vessels accounting for most of the recorded shipping movements (Kraft, 2019). Tuna fisheries have considerably developed in the region from the 1950s onward, firstly under the lead of Japanese pole-and-line and longline fishing fleets and US purse seine fleets. Tuna catches in the Western and Central Pacific Ocean (WCPO) have continuously risen yearly (see Figure 4) and account for 54% of the global tuna catch for an economic value of about US\$5.95 billion (WCPFC, 2023). Over 30% of the world's tuna catch derives from waters under the Pacific Islands' jurisdiction (World Bank & Nicholas Institute, 2016), representing over 55% of the total WCPO tuna catch (FFA, 2023).



Today, tuna catch mainly derives from the purse seine and longline fisheries. The purse seine fishery has grown significantly since the 1980s against many fishing vessels and improved fishing effort on drifting Fishing Aggregating Devices (dFADs). Most of the purse seine activity was historically conducted by distant water fishing fleets from Japan, Korea, Taiwan and the US. Pacific Island-flagged

⁴⁷ Data provided for 2023. Source: <https://www.spc.int/our-members> (accessed : 30.08.24).

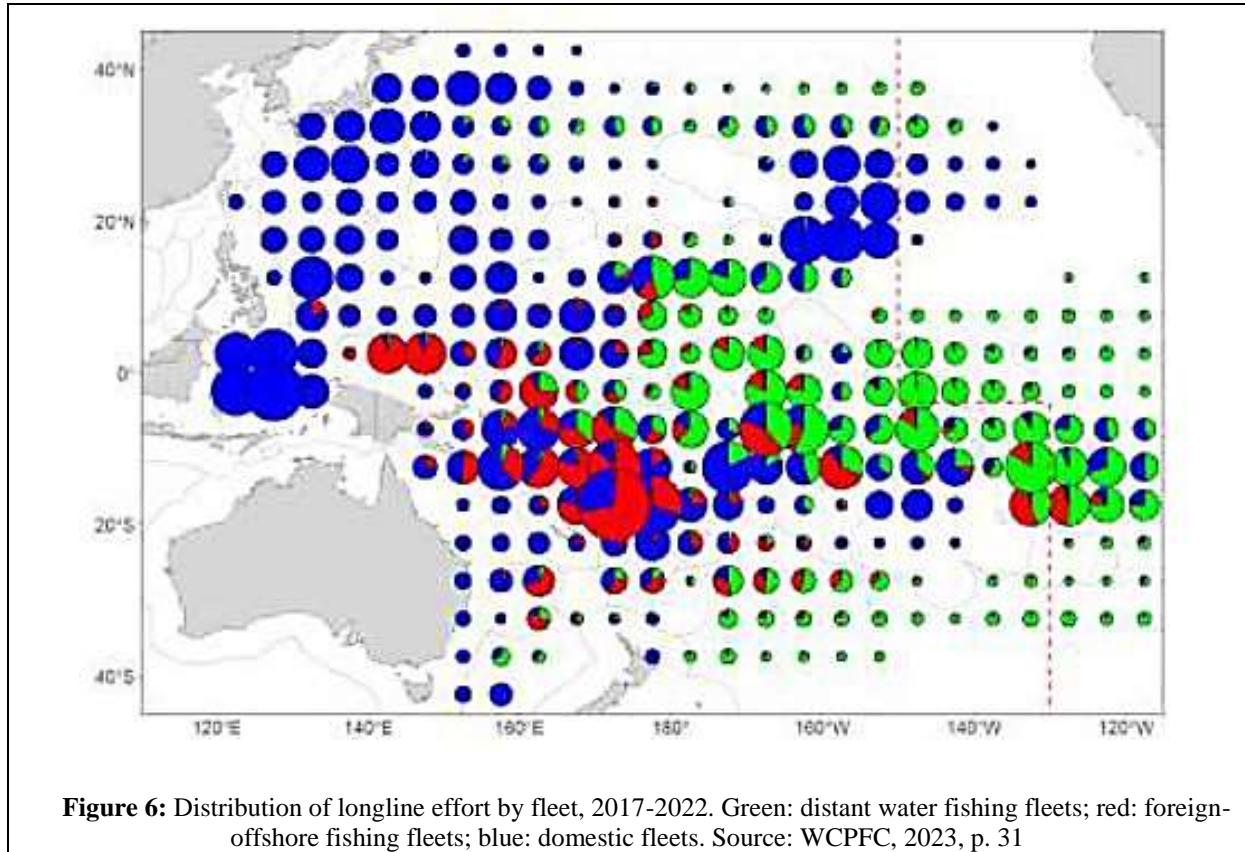
fleets have grown over the past two decades, comprising vessels fishing under multilateral or bilateral agreements, domestically-based and chartered vessels (Allain et al., 2016). Comprising 250-300 vessels, it accounts for about 70% of the total tuna catch volume, mostly including skipjack tuna (representing about 70% of the total catch) and an estimated economic value of US\$3 billion (WCPFC, 2023). The vast majority of purse seine catch is extracted in the equatorial waters of nine Pacific Islands (see Figure 5) that gathered together as Parties to the Nauru Agreement (PNA). The PNA group mostly extract benefits from the tuna resource by charging purse seiners access fees. General license and access fee revenues (for all fisheries compounded) bring about US\$500 million annually to the Pacific Islands (FFA, 2023).⁴⁸



The longline fishery is far more diverse and widespread than the purse seine fishery (see Figure 6), comprising far more numerous vessels (1,700 vessels in 2019) generally divided into two main categories: large distant water longliners undertaking several months-long fishing campaigns and targeting yellowfin, bigeye and albacore tunas; and smaller, usually domestically-based, longliners undertaking shorter trips (< one month) and supplying the fresh sashimi market and albacore canneries (WCPFC, 2023). Contrary to the purse seine fishery, longline fishing occurs across the WCPO, with much of the harvest occurring in international waters. The waters of the Cook Islands, Kiribati, Solomon Islands and Fiji still provide about 20% of the total catch (World Bank & Nicholas Institute, 2016). Most of the harvest is conducted by vessels flagged to Japan, China, Korea, Indonesia, Taiwan and Vietnam. However, Fiji and Vanuatu are the only Pacific Islands contributing for a significant part of the Southern albacore longline fisheries (World Bank & Nicholas Institute, 2016). The longline fishery does not only

⁴⁸ These revenues contribute over 25% of government revenues in at least six Pacific Island countries.

catch tunas but also other bycatch (including commercial) fish species like swordfish, striped, blue and black marlin, sharks, wahoo, etc. Although it only harvests 8-10% of the total WCPO catch, it produces higher-value fish commodities; therefore, it has an economic value nearing that of the purse seine industry, estimated to be US\$1.5 billion, i.e. 25% of the total WCPO tuna catch value (WCPFC, 2023).



The value of the tuna fisheries for the Pacific Islands exceeds that deriving from the harvesting of tuna and includes associated activities such as processing. Processing activities employed over 18,000 workers in 2022 out of over 27,800 (both public and private) employees more generally involved in the tuna fisheries sector in the Pacific Islands (FFA, 2023). Processing activities are particularly important in countries like Papua New Guinea, Solomon Islands and Fiji. Figure 7 provides synthetic indicators of the importance of tuna fisheries for a group of Pacific Islands.

FFA member	Catch EEZ	Value EEZ	Own fleet catch	Own fleet catch value	Volumes handled or processed onshore*	Purse seine unloading volumes	Employment	Tuna Exports ^a	Access & License fees	
	'000 mt	US\$ m	'000 mt	US\$ m	mt	mt	No.	US\$ m	US\$ m	% of Gov revenue
Cook Is.	13	44	4	11	130	-	80	1	6	5%
Fiji	8	38	11	54	41,744	2,638	3,315	95	2	0.2%
FSM	190	327	168	285	39,656	178,889	941	154	70	52%
Kiribati	317	505	199	328	1,213	314,578	1,006	78	113	66%
Marshall Islands	54	111	89	147	13,450	183,076	1,120	61	32	43%
Nauru	123	184	106	163	-	325	376	110	44	25%
Niue	0.1	0	0.002	0	-	-	4	0	1	6%
Palau	1	7	0.002	0	-	-	34	0	8	14%
PNG	556	928	185	301	111,942	412,580	14,282	243	119	3%
Samoa	1	6	2	10	4,381	-	332	0.01	1	1%
Solomon Islands	131	250	46	105	28,052	58,434	3,600	68	38	10%
Tokelau	10	22	0.04	0	-	-	8	0	11	72%
Tonga	1	8	0.3	2	2,525	-	293	0.43	1	1%
Tuvalu	76	120	27	43	-	71,101	123	27	31	77%
Vanuatu	5	23	62	131	1,603	-	1,132	124	2	1%
Total	1,487	2,574	900	1,581	244,696	1,221,621	26,646	963	481	na

*Annual average over 2019-21. ^aIncludes only exports to EU, Japan, Thailand and US

Figure 7: Indicators on tuna fisheries for Pacific Islands members of the Forum Fisheries Agency. Source: FFA, 2023, p.2

Against the national, regional and global importance of tuna fisheries, accurately surveilling the state of the resource and fishing fleets' compliance with conservation and management measures is paramount for ecological, political, economic and social reasons. Despite the challenges for the Pacific Islands of controlling large fisheries over vast offshore spaces and considering their reliance on tuna fisheries, the Pacific Islands have developed extensive, original, multilevel and longstanding efforts devoted to the proper monitoring, surveillance and control of tuna fisheries. These include the largest tuna tagging programme, first launched in the 1970s, the conduct of regional tuna fisheries police operations under the regional surveillance centre of the Forum for Fisheries Agency (FFA), and the largest fisheries observer programmes in the world (WCPFC, 2010).

Hence, the South Pacific region is an epicentre of tuna fisheries surveillance. Taking this region as a case study also allows for several scientific displacements and for the 'provincialisation'⁴⁹ of the study of surveillance, science and technology. Those remain largely directed towards European and American contexts and land-based and urban case studies because of their dominance in scientific production and technological innovations (e.g. Dumoulin Kervran et al., 2017 on STS; Gautreau, 2018 on biodiversity research; Peters, 2014b on surveillance studies). Much fewer works in these fields of research cover the

⁴⁹ I use the notion of 'provincialisation' in reference to contemporary historiographic reflections in STS criticising the dominance of Western-oriented and elite-centred research and calling for a geographical widening of historical research. This turn aims in particular to critically question longstanding centre-peripheries models underlying Western history.

South Pacific Ocean. Studying surveillance in a postcolonial and not Western-centred context provides novel insights into the roles and perceptions of science, technology and surveillance regarding sovereignty, security, biodiversity conservation, and marine sustainability.

ii. Fiji and New Caledonia

Considering the wide scale and diversity of tuna fisheries in this region, I started my enquiry from ‘the bottom’, i.e. from the anchorage of the tuna fisheries in Fiji and New Caledonia. I first chose Fiji because it hosts the largest domestic tuna fishery of the three countries and territory covered by the SOCPacific project (cf. Foreword). It is also one of the region’s main processing centres (Campbell & Godfrey, 2010). After my stay in Fiji, I travelled to New Caledonia and the headquarters of the Pacific Community (SPC), the regional scientific and technical institution in charge of monitoring tuna stocks and their wider oceanic ecosystems. My stay in New Caledonia also led me to consider its local tuna industry.

These two Pacific Islands offer another decentring concerning the study of tuna fisheries, providing that they only comprise longline fishing fleets. Since the 2000s, several Pacific Islands including Fiji and New Caledonia have developed domestic albacore longline fleets that account for about half of the catch (Allain et al., 2016) and are significant to their economies. Investigating the longline fishery rather than the equatorial skipjack purse seine fishery allows for investigating tuna fisheries from its less scrutinised ‘margins’. This point is all the more important considering that the longline fishery’s catch is affected by the purse seine industry, which catches juvenile bigeye and yellowfin tunas before longliners can capture them as adults. The longline fishery also bears specific management concerns, considering that it accounts for a large proportion of bycatch species and for about 40% of the economic loss attributed to Illegal, Underreporting and Unregulated (IUU) fishing activities (MRAG Asia Pacific, 2021). Longline fisheries display several features (e.g. diversity, number of vessels, lengthy fishing trips, incapacity to host fisheries observers on board many vessels because of their size, etc.) that make their surveillance particularly challenging.

Fiji and New Caledonia may be on the margins of the tuna fishing sector but they contrastingly have more offshore surveillance capacities than many other Pacific Islands. Fiji became independent from Great Britain in 1970 and was particularly involved in UNCLOS negotiations and lobbying for the creation of the EEZs (cf. Chapter 5). It is one of the largest Pacific Islands, comprising 904,590 inhabitants and 18,270km² of land spread across 330 islands, against an EEZ area of 1,282,980 km².⁵⁰ It has grown a domestic longline fishing fleet which harvests the second largest amount of tuna catch amongst the Pacific Islands after Vanuatu – both supplying around 5% of the total WCPO longline catch, although well behind China (16%) and Japan (18%) (World Bank & Nicholas Institute, 2016). The tuna

⁵⁰ Data provided for 2023. Source: SPC website, <https://www.spc.int/our-members> (accessed : 30.08.24).

sector constitutes an important source of employment to the local population (20.8% in 2015 – Fiji Bureau of Statistics, 2015).⁵¹ Fiji's fishing fleet mostly operates in Fiji's EEZ (76%) while some Fiji-flagged vessels also fish in neighbouring countries where they have fishing licenses (18%) and in the high seas (6%) (Ministry of Fisheries, 2022). In 2022, the fleet comprised 73 vessels, with only 60 vessels maximum authorised to fish in Fiji's EEZ – with the remaining vessels fishing outside (Ministry of Fisheries, 2022). Most of Fiji's fishing industry is export-oriented and targets albacore tuna for the canning industry and bigeye and yellowfin for the fresh sashimi market of Japan and the US.⁵² However, there have been growing concerns for the economic sustainability of the albacore longline fleet against declining profitability even though the government's regulatory Total Allowable Catch has not been reached. Fiji also established various regulatory measures for its EEZ, calling for additional surveillance prerogatives and attesting to its sustained interest in its offshore territory. These include the closure of its EEZ to non-domestically based fishing vessels or conservation measures applying to shark bycatch. Fiji also committed to sustainably managing its entire EEZ by 2030 and creating a network of no-take MPAs covering 30% of its marine waters. More generally, Fiji has been particularly engaged in international fora regarding oceanic and climate change agendas (e.g. the country co-hosted the United Nations Ocean Conference in 2017).

New Caledonia has a similar land area (18,280 km²) to Fiji, a population of 275,314 and an EEZ of 1,422,540 km².⁵³ New Caledonia is a French overseas territory. Following particularly vivid tensions with the French State resulting in the Noumea Accord in 1998, governance rearrangements attributed to the Territory increased political powers over, amongst other things, the management of its EEZ's resources and environment while the French State retained regal powers. In that context, the Territory progressively increased the regulation of its EEZ. For instance, it only authorises domestic fishing vessels to fish in its EEZ and has set conservation regulations prohibiting catching and retaining sharks and rays. In contrast to Fiji, its longline fishing fleet is much smaller, with only 16 vessels exclusively operating in its EEZ in 2023 and catching 2,611 mt of albacore (70%), yellowfin (16%) and other bycatch species (Government of New Caledonia, 2024). The sector only contributes to a fraction of the domestic economy, chiefly structured around the (troubled)⁵⁴ nickel mining industry. Another distinction is that most of the fishing industry's production mainly targets the domestic market, with only 20% of its catch exported to Japan and, to a lesser extent, to the EU and the US (Government of New Caledonia, 2024). In 2014, New Caledonia proclaimed its Natural Park of the Coral Sea spanning its entire EEZ and aiming to establish a sustainable management area over its offshore marine ecosystems. Within the Park, New Caledonia established no-take MPAs as part of its commitment to

⁵¹ Fiji government website: <http://www.statsfiji.gov.fj/latest-releases/keystats> (accessed: 30.08.24)

⁵² In 2019, 11,025 t out of 12,797 were exported (Ministry of Fiji, 2020).

⁵³ Data provided for 2023. Source: SPC website, <https://www.spc.int/our-members> (accessed : 30.08.24).

⁵⁴ See for instance Thydjepache et al. (2023)

protecting at least 10% of its marine waters⁵⁵ and has recently started to work on developing its surveillance capacities to support the proper management of this Park.

Instead of drawing a formal point-to-point comparison between Fiji and New Caledonia, I approached their ports, fishing companies and fisheries institutions as situated locations where surveillance emerges through interactions with national and regional contexts. Fiji and New Caledonia also interact, e.g. through bilateral cooperation in maritime surveillance (cf. Chapter 9). Still, this double-based investigation allows us to contrast these two case studies and their surveillance and management policies and strategies and to illuminate (sub)regional processes. Despite some commonalities (e.g. a locally-based tuna longline industry targeting albacore tuna, a commitment to create offshore (large scale) MPAs, and similar-sized EEZ areas), Fiji and New Caledonia show distinctive social, economic and political configurations that weigh on the surveillance and control of their offshore territories and tuna fisheries. New Caledonia's fishing industry is much more locally integrated than Fiji's, and this territory benefits from the French States' financial, technological and human help for maritime surveillance. In contrast, Fiji is much more integrated into the broader group of Pacific Islands and its many regional intergovernmental organisations (Karcher et al., 2020).

2. Tuna Fisheries Surveillance Apparatuses

As mentioned in the previous chapter, I decided to ground my examination in specific surveillance apparatuses to unpack their creation, functioning and articulation with one another and within a wider surveillance assemblage. Given my interest in territorialisation processes, I selected the main surveillance apparatuses established by governmental authorities to surveil tuna resources and tuna fishers. These include fishers' logsheets, fisheries observer programmes, Vessel Monitoring Systems (VMS), tuna tagging programmes, and patrolling operations. Additionally, in order to investigate the role of the offshore world's materiality in shaping surveillance and because surveillance at sea often remains the main objective for the actors I studied, I decided to focus more specifically on surveillance apparatuses that comprise at-sea components.

These apparatuses constitute the main pillars to inform fisheries management and enforce fisheries regulations. They provide the largest wealth of data used by fisheries authorities, be it for scientific, regulatory or coercive purposes. However, I do not examine these apparatuses in isolation – they only constitute guiding threads from which I unfold my investigations. Not only do they interact with one another – e.g. stock assessments mobilise data provided by fishers' logsheets, fisheries observers' workbooks and tagging programmes – but they also coexist with colliding or, on the contrary, parallel surveillance practices, sometimes more informal. These are equally important to understand what

⁵⁵ <https://mer-de-corail.gouv.nc/fr/actualites/13-12-2023/extension-des-reserves-le-parc-sous-haute-protection> (accessed: 30.08.24)

escapes the institutional surveillance apparatuses. Looking into the creation of these apparatuses is essential to account for their situatedness and to unveil the influence of specific surveillance views and objectives on their establishment. In that respect, I retrace the historical development of these apparatuses in Part II. Because these programmes form the backbone of the second part of this dissertation, I introduce them here only succinctly:

- **Fishers' logsheets:** as part of their fishing license requirements, fishing captains must report on standardised logsheets details of their fishing operations or “catch and effort data”, e.g. including information on the data and location of their fishing sets, the species and quantities of fish they caught, etc. These logsheets permit the collection of fisheries statistics by fisheries authorities.
- **Vessel Monitoring Systems (VMS):** fishing vessels must possess on board devices that regularly record and transmit information to fisheries authorities on the exact location of the vessel at sea and its speed.
- **Fisheries observer programmes:** human fisheries observers⁵⁶ are placed on board fishing vessels to collect catch and effort data (permitting the verification of logsheet data) and additional data on bycatch species, fishing practices, compliance to conservation and management measures, vessels encountered at sea, etc. as well as biological samples on fish.
- **The tuna tagging and biological sampling programme:** this programme consists of a series of fisheries science campaigns at sea led by SPC. The main objective of the campaigns is to capture-mark-recapture tuna fish and other pelagic fish and to collect biological samples to gather information on their biology and ecology.
- **Patrolling operations:** these relate to maritime and aerial patrols conducted as part of maritime surveillance, maritime security, and fisheries police missions.

3. A Multilevel and Multi-Actor Analysis

For reasons I detail in Part II of the dissertation, the surveillance of the tuna fisheries and its apparatuses are not just a matter of the state and involve many different actors partaking in the complex multiscalar and multilevel governance and management of the South Pacific tuna fisheries. I will now briefly introduce the main institutions, besides the fishing industry, involved in the surveillance and management of tuna fisheries at the national, sub-regional and regional levels.

i. National Authorities

In Fiji, the Ministry of Fisheries and its Offshore Fisheries Division are responsible for the management of the tuna fishing industry. The division grants fishing licenses, manages logsheet data, VMS data and observer data, and verifies compliance of the industry to conservation and management

⁵⁶ There are current tests to use cameras instead of or in complement to those human observers – a topic discussed in Chapter 7.

measures by conducting boarding, inspection and investigation of potential offences. Other administrations including the Ministry of Labour or the Ministry of Health also play a role in managing certain aspects of the tuna fishing industry (labour rights, sanitary requirements). The Republic of Fiji Navy and the Fijian Maritime Search and Rescue Coordination Centre also contribute to tuna fisheries surveillance by patrolling Fiji's EEZ and monitoring fishing vessels' VMS.

In New Caledonia, the management of the tuna industry is under the Government's authority while the French State, through its Action of the State at Sea (Action de l'Etat en Mer) remains responsible for fisheries police attributions. The Directorate of Maritime Affairs (Direction des Affaires Maritimes - DAM), under the co-tutelle of the Government of New Caledonia and the French State, was in charge of managing the tuna fishing industry until 2021, when the Government of New Caledonia decided to establish a fully autonomous division called the Coral Sea Natural Park and Fisheries Service (Service du Parc Naturel de la Mer de Corail et de la Pêche – SPNMCP). At the operational level, the Maritime Rescue Coordination Centre (MRCC), transformed in 2023 into the Surveillance and Safety Operational Centre (Centre Opérationnel de Surveillance et de Sauvetage – COSS) also oversees the fishing industry through its VMS data for purposes of maritime safety. The French Navy conducts the patrolling operations involving fisheries police missions.

ii. The Western and Central Pacific Fisheries Commission

After the creation of the EEZs, nation states rapidly faced the fact that many offshore fish species, including tunas, marlins and swordfish, are highly mobile and routinely straddle multiple jurisdictions or venture into international waters regardless of political boundaries. This behaviour entailed many debates between countries regarding their management and the need for this management to be international (cf. chapters 5 and 6). In 1995, the United Nations Fish Stock Agreement⁵⁷ (UNFSA) came to complete UNCLOS's lacunae regarding the management of 'highly migratory and straddling' fish stocks. The Agreement devised the creation of Regional Fisheries Management Organisations (RFMOs), bringing together fishing and coastal nations, and vested them with competence over the high seas and the power to adopt legally binding and science-based conservation and management measures across the biological range of the fish stocks.

The relevant RFMO to tuna fisheries in the South Pacific region and for Fiji and New Caledonia is the Western and Central Pacific Fisheries Commission (WCPFC) which entered into force in 2004 after lengthy negotiations between the Pacific Islands and DWFNs (cf. Chapter 6). Its convention area encompasses much of the WCPO and overlaps that of the International Atlantic Tuna Commission, the RFMO concerned with Eastern Pacific tuna stocks. The WCPFC comprises 26 state members and seven

⁵⁷ Officially the "Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks"

participating territories, including Fiji and New Caledonia. The Commission sets out, amongst other things, minimum standard requirements for the surveillance of tuna fisheries to be followed and implemented by member states – e.g. regarding logsheet information, VMS device standards or fisheries observer coverage. The WCPFC comprises two subsidiary bodies: the Technical and Compliance Committee deals with compliance issues against the conservation and management measures of the Commission, while the Scientific Committee ensures that “the Commission has the best available scientific information on which to consider appropriate conservation and management measures”.⁵⁸ In particular, the Scientific Committee oversees the scientific surveillance and assessment of fish stocks.

iii. The Forum Fisheries Agency FFA and Sub-Regional Organisations

Considering common challenges in managing vast EEZs despite limited resources, 17 Pacific Islands including Fiji joined – after proclaiming their independence and their EEZs – under the Pacific Island Forum (PIF - then called the South Pacific Forum) and created in 1979 the sub-regional intergovernmental Forum Fisheries Agency (FFA) to assist them in developing, managing and controlling their tuna fisheries and pool their assets and capacities, in particular in terms of surveillance.⁵⁹ New Caledonia, not a member of the PIF, only retains an observer status in FFA.

FFA provides scientific, legal and technical support in fisheries management and enforcement to its members but has no power of enforcement or regulation. It assists its member countries with the management of fisheries observers and VMS data. It also hosts a Regional Fisheries Surveillance Centre fusing maritime information and developing fisheries intelligence to support the Pacific Islands in addressing IUU fishing issues. This centre also coordinates regional fisheries police operations in the EEZs of FFA member countries in cooperation with the Quadrilateral Defence Coordination Group (QUADS) involving military forces and maritime surveillance assets of Australia, New Zealand, France and the US.

Other multilateral arrangements exist between smaller sets of Pacific Islands and under the overarching FFA and WCPFC organisations. Although neither Fiji nor New Caledonia are members to this organisation, PNA is the most influential one and weighs heavily in framing fisheries management in the WCPO. As I briefly mentioned already, the PNA group gathers neighbouring Pacific Islands whose EEZs host most of the purse seine tuna fishing grounds. These countries joined in 1982, when purse seine fishing was mostly conducted by foreign fleets, to cooperate in establishing management measures and increase their socio-economic benefits deriving from this tuna fishery (cf. Chapter 6).

⁵⁸ <https://www.wcpfc.int/frequently-asked-questions-and-brochures> (accessed: 08/04/2022)

⁵⁹ <https://www.ffa.int/about> (accessed: 05/04/2022). FFA members are: Australia, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu.

Given the success and influence of PNA, other sub-regional agreements have been discussed such as the Tokelau Arrangement targeting the South Pacific albacore tuna fishery (e.g. see Campling et al., 2017). Contrary to PNA however, none of them has led to any legally binding decisions so far and they have been far less influential with regard to tuna fisheries (Aqorau in Fry & Tarte, 2015).

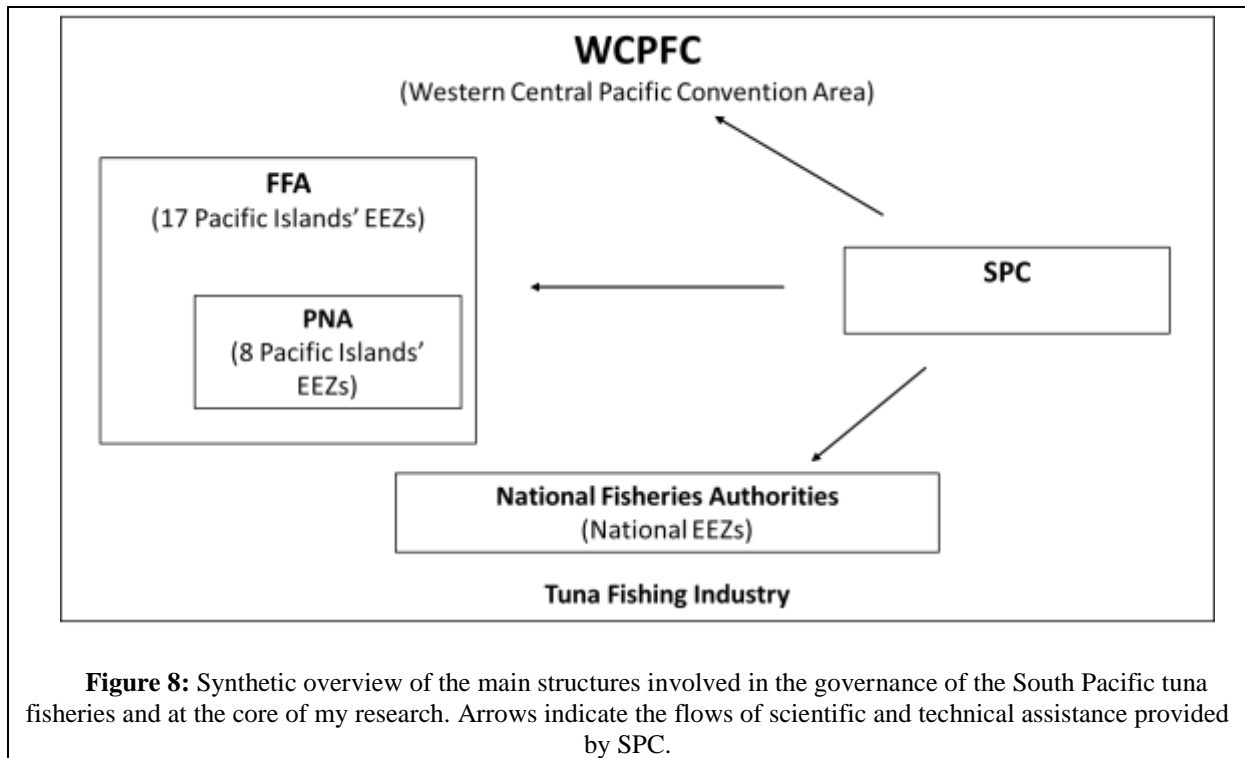
iv. The Pacific Community

The Pacific Community (SPC – formerly the South Pacific Community) is another institutional originality of the region. SPC was established in 1947 by the governments⁶⁰ that then administered the South Pacific Region. It was conceived as a scientific and technical organisation supporting the development, including fisheries development, of the Pacific Islands in the aftermath of World War II (cf. Chapter 4). Comprising 27 countries and territories (including the Pacific Islands but also Australia, New Zealand, France, the United Kingdom and the US), SPC comprises the Division of Fisheries, Aquaculture and Marine Ecosystems (FAME), more specifically devoted to assisting the Pacific Islands with relevant information and tools for the management and development of their aquatic resources. Within this division, the Oceanic Fisheries Programme more specifically deals with tuna fisheries and offshore ecosystems. In that respect, SPC plays two main roles. As the main scientific provider to the WCPFC, it conducts periodic stock assessments for the main fish species managed by the commission and operates the tuna tagging programme. SPC also assists its member countries and territories by conducting research at the national/territorial level, building capacities in data collection and analysis, etc. The organisation manages regional databases for WCPFC and its member countries comprising logsheet data, observer data and tagging data.

*

Against that complex institutional framework (see Figure 8), I adopted a multilevel perspective. I interrogated the making and intertwining of surveillance apparatuses and practices, considering that they are framed and operated under the combined influence of local, national/territorial, sub-regional, and regional and global visions and strategies. To circumscribe my field of study, I ‘followed the data’ and, therefore, selected sites where surveillance is practically operated and data are collected (e.g. FFA surveillance centre; SPC’s headquarters; national administrations; Fijian fishing companies and fishing vessels; etc.) and understood these sites as local(ised) places where several scales and levels can intertwine (Cash et al., 2006).

⁶⁰ Australia, France, New Zealand, Netherlands, the United Kingdom and the US



II. Methods: from Fieldwork to ‘Sea-Work’ – Accessing Offshore Tuna Fisheries

1. A Distant Field: The Challenges of Doing Research Offshore

Offshore worlds are progressively attracting more interest from the social sciences. Geographer C. Parrain postulated from her work on offshore sailing, that these worlds constitute a territory of their own – or “maritory”⁶¹ – characterised by hypermobility and transience (Parrain, 2010). Resisting any deterministic approach, I did experience during my research that offshore spaces were peculiar because of their remoteness from the coast and difficult accessibility – and/or because of the evasion and ‘offshoring’ strategies of actors deliberately producing such distance. The offshore ocean is largely invisible to the human eye (especially when considering its vertical dimension), and going there requires time and specific transportation, capable of supporting fluctuating and regularly gruelling weather conditions. Such challenges impede scientific fieldwork – both for social and natural scientists, as attested by the difficulties in conducting oceanographic campaigns (see Oreskes, 2000). Emerging social science literature shares this observation that the offshore ocean is a “tough field of research” (Parrain, 2012, p. 3). Beyond these physical impediments, sociologist C. Flécher outlined the economic, political and diplomatic restrictions that conditioned her access on board commercial shipping vessels or the

⁶¹ “Merritoire” in original – my translation. This neologism serves to outline and contest the terrestrial bias of geographical thinking (see also Barrena et al., 2021).

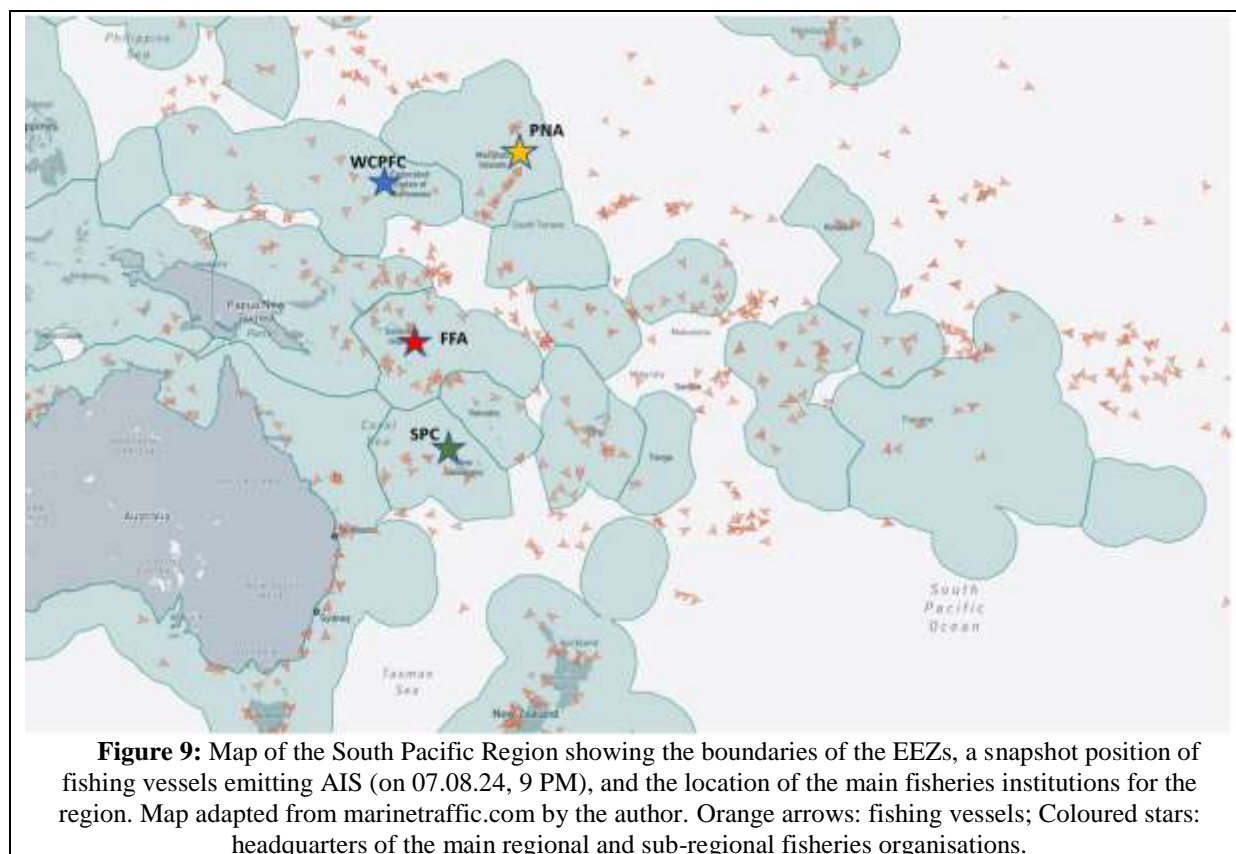
ephemeral existence of the social collectives she was able to observe but was unable to revisit afterwards (Flécher, 2015). Even on shore, C. Bueger exposed the impossibility for him to identify a temporally and spatially defined field to investigate the global governance of counter-piracy because of the scattered and highly globalised structure of its (mostly digital) socialities (Bueger, 2021). Tuna fisheries display similar hindrances, further accentuated or transformed by the Covid-19 pandemic and the associated mobility restrictions. This section introduces these obstacles in more details before explaining how I coped with such difficulties.⁶²

i. Physical and Spatio-Temporal Distances

Physical offshore spaces are characterised by their distance to the shore and vastness. In Fiji, tuna longliners must stay at least three nautical miles from the reefs. In New Caledonia, industrial tuna fisheries are only authorised in the EEZ, i.e. beyond 12 nautical miles. The EEZ of these two Pacific Islands, respectively, spans about 1.3 and 1.4 million km². Fishing vessels generally navigate about a whole day or more before reaching their first fishing grounds, and their campaigns last from one or two weeks up to several months at a time. Sleeping capacities on board are tight, even more so in the case of longliners, and make it difficult to welcome additional members. Being at sea does not suffice to observe or interact with other marine entities as other vessels, fish or fishing gear occupy variable and temporary positions unknown to many.

Tuna supply chains are profoundly globalised and connect the South Pacific tuna fisheries to actors from more than fifty countries. A tuna can be caught in the high seas or a given EEZ. Then, it can be transshipped to another vessel that will carry it to the processing facilities of another country before it is shipped or flown to the end consumers of yet another country, such as Japan or the US. On board, crew members are often multinational and fish in jurisdictions different from their flag. Various geographies collide in the spatial unity of the ship, which embodies both the vehicle and the result of globalisation. This transnational organisation results in a multilevel governance with many regional institutions physically scattered across the WCPO: SPC's Oceanic Fisheries Programme is based in New Caledonia, FFA is in the Solomon Islands, and WCPFC is in the Federated States of Micronesia (see Figure 9).

⁶² This section largely takes up and translates reflections exposed in an article co-written with N. Legroux (Kon Kam King & Legroux, 2022).



Adding to (and caused by) these specificities, my study subjects are hypermobile. Tunas and associated fish move across the Pacific Ocean, more or less followed by fishing fleets, then across different supply chains. For fishers I met in Fiji and New Caledonia, stopovers on land would only last 24 to 48 hours. Encounters with them were thus fragmented and hardly plannable. Most often, I would manage to finally meet a captain or a crew member, only to learn that they were to leave an hour later for another fishing campaign lasting a couple of weeks. Tuna scientists, managers or NGOs are also continuously on the move, travelling between the many tuna fisheries institutions for punctual and face-to-face meetings. For instance, when I arrived in New Caledonia in August 2019 to interview SPC's fisheries scientists, most were at sea tagging tunas or in Pohnpei for the Scientific Committee of WCPFC. Arrhythmia issues contributed to my physical distance to the field.

My affiliation to a 'Global North-Global South' research project only enhanced this spatio-temporal distance to the field, with my France-based living and workplaces located thousands of kilometres away from Fiji and New Caledonia – and 10-12 hours away from their time zone. Such configuration became more problematic after the outset of the Covid-19 pandemic. One significant effect of the pandemic and the resultant mobility restrictions was the complete and unforeseen cancellation of the second half of my fieldwork.⁶³ The indefinite lock-down situation kept me in Paris (France) for the rest of my research.

⁶³ After a preliminary and largely exploratory fieldwork in both places, I was supposed to return there for about six more months. This second phase aimed to consolidate the observation of specific sites of study but also to target new ones that I did

These physical distances were not exclusively due to my position as a Ph.D. student outsider to the world I intended to investigate. Rather, they appeared as constitutive of this world. Most, if not all, of the actors I observed were also confronted with this problem of being or feeling distant from one another in space and time – admittedly to different extents. Fishers leave their families and employers to fish at sea. Managers of fishing companies attempt to oversee their employees working far away from their offices. Fisheries managers travel back and forth between various organisations without ever going to sea. Navy sailors leave for months searching for traces of fishers that they hardly know and may never encounter. Because of its geographical specificities, the offshore world is productive of particular socialities and constrains the relations between the interviewer and the interviewees, as well as between the interviewees themselves.

ii. Social Distances

Other forms of distances, deriving from various social processes, were also at play in my capacity to access my field of research. Contrary to one of its many names, the 'open ocean' paradoxically appeared to me as a highly closed social world – an argument that largely structures Part III of this dissertation. Tuna fisheries are entangled in security, economic or geopolitical imperatives that further hinder their access. This social world is not merely at a distance; it can also actively cultivate or even exacerbate the latter with 'offshoring' practices. Access to the port is highly regulated, with various devices supervising and constraining its access (barriers, surveillance cameras, gate lodges with guards). Industrial secret weighs on fishing and processing companies' openness and access to fisheries data in particular.

Compliance issues or fishing licensing are discussed in national or intergovernmental arenas with restricted access. I had to sign a confidentiality agreement to attend the Scientific Committee of WCPFC with the New Caledonia delegation or board with the French Navy and consult some of their restricted documents. I was refused attendance to the Technical and Compliance Committee of WCPFC by New Caledonia because the event was deemed "too sensitive": the meeting, examining compliance, "takes place during a closed session. Debates can be heated." a fisheries manager argued (e-mails from a New Caledonian fisheries manager, Sept. 2020). An EU representative told me that he was not allowed to divulge anything about his negotiations with a Pacific Island country licensing and IUU fishing (EU fisheries delegate, Suva, 14.06.19). I had to submit a formal application to Fiji's Ministry of Fisheries introducing my research project and the exact questions I wanted to ask its Offshore Division to be authorised to contact any of its members. Although I obtained the initial approval, I could not proceed further: I was then told that interviews were impossible and that only written questionnaires would be authorised. I eventually lost contact with the division's representatives, who stopped replying to my

not have the time or opportunity to investigate the first time. In particular, I intended to contact the fisheries authorities of Fiji and New Caledonia, the maritime surveillance centre of Fiji, other fishing companies in New Caledonia, and the FFA regional fisheries surveillance centre in Solomon Islands.

emails.⁶⁴ Trying to circumvent my difficulties in accessing specific actors like the fisheries authorities of Fiji and New Caledonia, I met with private companies they contracted for specific projects, only to find out that they were also constrained by confidentiality agreements with their clients. Another source of distance stemmed from the highly gendered structure of the tuna fishing world, which also influenced my interactions with the interviewees (mostly males). Several times, I was advised not to embark on board a Fijian fishing vessel, i.e. in a confined, isolated, shared space for weeks where I would have been the only woman.⁶⁵

All these different socio-political aspects help think of distance to the offshore world in a relational way and largely defined my access to and observational capacity of this socio-natural world.

iii. Problematising the distance to the field

These spatio-temporal and social distances constituted a methodological challenge as much as a datum for my investigation. In particular, they influenced my research question and its narrowing around issues of surveillance and distance, remoteness and ‘offshoring’.

Although I did not manage to join a fishing campaign to observe fishing ‘in the doing’ as I had hoped, I was able to take part in a three-week-long patrolling mission partly related to the surveillance and policing of tuna fisheries. Even at sea, I could witness the persistent distance separating me (and the Navy sailors alike) from tuna fishe(r)s: fishing vessels were often far from immediate sight, and fishers’ doings were hard to discern. This immersion, complementary to various interviews with and observations of fishing companies, scientists, NGOs or fisheries managers, led me to realise that, similarly to me, these actors too were faced with the impediment of knowing more about tuna fisheries. Yet we all had some interest (although for different, sometimes overlapping, purposes) in making them visible and legible. To a certain extent, we all were engaged in some form of surveillance.⁶⁶ These (dis)connections and issues of distance and invisibility led me to reorient my research around the notion of surveillance and to pay attention to how these actors would attempt to overcome the ‘invisibility’ of tuna fisheries through specific surveillance apparatuses.

⁶⁴ I cannot be certain of the reasons for my failure to approach the Ministry of Fisheries. My French nationality or my remote investigation during the Covid-19 pandemic may have complicated the relation. Other interviewees in Fiji told me on several occasions that the Fisheries authorities were highly secretive and would never agree to interviews.

⁶⁵ In 2020, Fiji Fishing Industry Association reported 126 women for 1 429 men amongst its members including 18 fishing companies and 63 fishing vessels. At sea, the imbalance was even stronger, with 5 women for 1 032 men. Source: WWF Pacific post on its Facebook page, published on 30/09/2021. Available at: <https://www.facebook.com/wwfpacific/photos/a.139266129515527/4130740087034758/> (accessed: 30/09/2021)

⁶⁶ Here, I draw on reflections from anthropologists regarding the position of the scientist as part of the phenomenon that is being explored (e.g. see Mitchell, 2018)

2. Investigative Strategies to Overcome Distances to Offshore Tuna Fisheries

i. Redefining the 'Field'

Offshore tuna fisheries involve extreme and complex distances. This raises the more general question of the possibility and practical modalities for social scientists to conduct an ethnographic investigation at a distance (Mead, 2000; Postill, 2016) and to seize 'offshore' research subjects (whether they be vessels, fishers, fish, etc.). This question relates to a broader debate from the 1970s in social sciences to refute an essentialist understanding of the concept of 'field' and turn it into a new subject of study and reflexivity (Stocking, 1984; Ferguson, 1997). Against the diversification of the topics investigated by social sciences, the globalisation of social processes and the boom of remote modes of communication, this line of research called for epistemological and methodological transformations regarding to the Malinowskian-archetypical understanding of the field and the predominance, if not the "fetishisation", of participant observation (Gupta & Ferguson, 1997).

These research works proposed to reconceptualise the field as a relational rather than a bounded physical space (Martin, 1998; Beaulieu, 2010).⁶⁷ They suggested new methods of investigation, such as "multi-sited" ethnographies "tracing" artefacts, individuals, metaphors or, in my case, fisheries data, to account for the spatial transformations of social processes in contexts of intensified and globalised mobilities (Marcus, 1995, 2002). From the outset of my research, such an epistemological approach seemed particularly relevant to studying the highly mobile and globalised tuna fisheries. However, it also raises many methodological and logistical challenges to its implementation (Burrell, 2009): in my case, the multiplication of study sites only exacerbated the distances I had to overcome.

In that respect, digital communication technologies have opened new methodological perspectives to researchers remote from their field (Hoang et al., 2021). Not only do they permit new channels for data collection but they also transform regimes of socialities. Online social exchanges reshaped the conventional understanding of "presence" (Coleman & Collins, 2006) and the physicality of interaction spaces (see also Koya Vaka'uta, 2017). These transformations fuelled new enquiries into the modalities and practicalities of online ethnography (Hine, 2015). Various introduced as a promise or a peril for social sciences (see Boukala & Cercllet, 2020), digital platforms emerged as a research instrument, a method, a field and a topic all at once (Bourdoloie, 2014). Many scholars have agreed on the benefit of combining digital research methods with traditional ones (e.g. Cornillet & Datchary, 2020). Moving beyond their apparent dualism, they now consider their articulation to develop a "connective ethnography", in which the researcher circulates through various locations and modes of

⁶⁷ These considerations draw evident parallels with those of critical geographers and exposed in Chapter 2.

communication, both online and offline (Hine, 2015). Digital tools are understood as a mediation among “multiplex” socialities occurring offline, online or partially online (Chibois, 2021).

ii. A Multi-Sited and Multiplex Approach

As mentioned, I opted for a multi-sited approach to investigate the threads connecting the remote and mobile tunas and tuna fishers to the shore. I, too, became mobile (see Meyer et al., 2017) and circulated through various sites with the aim of retracing, at least partially, the trajectories of fish, fishers and their data. I delineated my field in a processual and inductive fashion (Coleman & Collins, 2006), as an assemblage of places, actants, practices and discourses. This approach helped me circumvent the hurdle of going offshore by approaching my field’s ‘terrestrial side’.

Starting my research in Montpellier in mid-2018, where I conducted several preliminary interviews with locally-based tuna fisheries scientists, I moved to Suva, the capital city of Fiji, for three months in 2019. I spent much of my time there at the Port of Suva where most fishing vessels, fishing companies, processing companies and support companies are located. I conducted about 30 semi-directed interviews with various types of actors: fishing captains and crew members; employees, managers and owners of fishing and processing companies; technicians and representatives of private companies providing surveillance services.⁶⁸ For one owner travelling back and forth between Fiji and New Zealand, I had to conduct the interview online.

I could also partake in several events, making my approach akin to participatory sociology rather than embedded ethnography (e.g. see Collins, 2010). At the port, I went on board several fishing vessels prior to their departure or upon their return from the sea; I attended an offloading operation and visited two processing plants; I observed several technical tests to mark fish and improve their traceability or install cameras on fishing vessels. I participated in a three-day workshop on tuna certification and traceability, reuniting most of the Fijian tuna industry sector (i.e. companies, national administrations, FFA, environmental NGOs, etc.). At the same port, I visited the crews and ships of the French Navy based in New Caledonia during their regional missions and their stopovers in Fiji. I completed these investigations by spending some time at the University of the South Pacific (USP) to talk to marine scientists involved in tuna fisheries and offshore ecosystems research. Finally, I interviewed other actors also invested in tuna fisheries or the management of Fiji’s EEZ, e.g. representatives of the EU Delegation, conservation and human rights NGOs like WWF and Pacific Dialogue, and the Fiji Fishing Industry Association (FFIA).

Following these three months in Fiji, I flew to Noumea (New Caledonia) for another 3.5-month stay and conducted about 35 interviews. I interviewed many of SPC’s oceanic fisheries team and attended

⁶⁸ I studied four different domestic fishing companies, three of them being the most ancient and some of the largest in Fiji. I could not approach every fishing company present in Fiji, especially the more recent, China-affiliated ones.

several of their meetings and workshops. I met offshore marine scientists from IRD, the University of New Caledonia and the French National Museum of Natural History (MNHN) involved in the study of New Caledonia's EEZ and its offshore biodiversity and/or in the Coral Sea Natural Park; I attended some of their conferences and workshops. I interviewed former and current representatives of the fisheries administration, the owner of one of the main tuna fishing companies in New Caledonia, and several game fishers. Much of my time in Noumea was also devoted to meeting actors involved in maritime surveillance: MRCC, French military forces, and representatives of the Action of the State at Sea. I could visit and spend a day in the MRCC's surveillance room. The last three weeks of my fieldwork in the region consisted of embarking on one of the military vessels for a polyvalent mission across the waters of New Caledonia, Vanuatu and Fiji. This experience was pivotal in helping me better comprehend what it is to be 'offshore' and to surveil the Pacific Ocean, its fish and fishers.

Despite these already substantial movements, I realised that socialities ramified in many more locations than Fiji and New Caledonia. Often, people pointed to other relevant actors in Australia, New Zealand, the Solomon Islands, the US or even Italy where the Food and Agriculture Organisation (FAO) lies. I therefore resorted to online communication tools such as Skype, Zoom, Facebook and WhatsApp to conduct interviews from afar with tuna fisheries scientists and experts, FAO and FFA representatives, and onboard fisheries observers. These tools and e-mails also helped me prolong certain interviews and gain complementary information or updates.

Digital devices became even more instrumental after the outbreak of the Covid-19 pandemic, which constrained me to conduct my investigations from Paris. This situation made the complementary study of online socialities another critical research strategy for me. If the pandemic closed the doors on many selected study sites, the amplification of teleworking, paradoxically, opened other doors. In particular, I could attend online the preparatory workshops and annual conferences of the Scientific Committee of WCPFC that would normally have taken place in Noumea and Pohnpei (Federated States of Micronesia), along with other public and professional conferences organised by SPC or FFA. However, this strategy did not help me overcome the temporal distance as I had to attend most of these meetings during night-time. I also joined various "Facebook groups" that gathered fisheries observers. Online communication tools are important for these actors who are often physically distant from one another. These online social platforms helped me track topics of discussion and comments and, on rarer occasions, to 'recruit' some interviewees. I also collected the many 'digital traces' left by the actors: announcements, reports, pictures, and videos posted on the websites, Twitter and Facebook accounts of institutions like SPC, Fiji's Ministry of Fisheries, the French military forces in New Caledonia, fishing companies, and NGOs.

Finally, I extensively exploited archives of regional political, scientific, and technical reports of SPC, FFA, and related institutions, which were digitalised and publicly available on SPC's website. Access to these archives was pivotal to building the historical dimension of this dissertation, exposed in Part II.

iii. A Collaborative Investigation

Owing to the perpetuation of the pandemic and the eventual definite cancellation of my second trip to Fiji and New Caledonia, I recruited two USP graduates in Marine Studies in Suva and a professional social science consultant in Noumea to conduct additional semi-directed interviews and help me complete my data. I provided them with a list of pre-identified actors to contact and detailed interview grids. This setting was rather complex and lengthy, with many adjustments depending on the people they would manage to plan appointments with. Some interviews were probably harder to negotiate because of this convoluted configuration. None of the contracts was completed, and only a fraction of the planned interviews was conducted effectively. Resembling in some regards a largely criticised 'cabinet science' (Bourrier & Kimber, 2022), this research design permitted certain forms of collaboration and exchanges, especially in Fiji, where local contractors were more knowledgeable in tuna fisheries than in qualitative interviews. They provided me with some updates about what was happening in Fiji after I had left, or suggested me certain contacts relevant to my study. Conversely, I gave them advice on interviewing methods and social science approaches in general. The fact that their social profile was different from mine – they both were Indigenous Fijian and Fijian-speakers, already had personal connections with some of the interviewees, and one was a man – certainly helped establish other relations with the interviewees than I would have been able to.

On a less formal level, I also resorted on several occasions to local friends or closer relations with specific interviewees, having the opportunity to go out to sea to provide me with pictures, personal accounts of at-sea campaigns, or updates on the Fijian and New Caledonian contexts. In particular, against my limited access to offshore spaces besides my participation in a military patrol, I relied on the testimonies of those who experience the sea and their "small stories" using personal diaries, logs, video documentaries, etc., often shared with me by interviewees, to indirectly capture the bodily and embodied experiences of offshore spaces (Lorimer, 2003; Squire, 2017). I used these documents to find clues about how things happen (and sometimes go wrong) at sea.

3. Reflective Feedback on the Research Methods

Confronted with many forms of distances to my field, I 'pulled out all of the stops' (Olivier de Sardan, 1995) and resorted to bricolage to conduct my fieldwork by assembling heterogeneous materials with digital modes of data collection ended up being more important than initially planned. My uneven presence in multiple study sites and alongside various types of actors turned my research design into a "patchwork ethnography" (Tsing, 2011; Günel et al., 2020), in which I moved back and

forth between various places (online and offline), producing patches of knowledge about various fragments of tuna fisheries and their surveillance. Therefore, I do not claim to expose an exhaustive depiction of the latter permitted by second-order objectivity or complete triangulation but rather intend to trace certain lines of exploratory (dis)connections between these fragments along “an empirical itinerary of associations and relations” (see Helmreich, 2009, p. 21-25). Patchwork ethnography requires “working with rather than against the gaps, constraints, partial knowledge and diverse commitments that characterise knowledge production” (Günel et al., 2020, online). Working with these gaps requires to acknowledge them. In this section, I discuss some of the effects of my multi-sited and multiplex research setting, of the extensive use of online observation tools and of some experiences more specific to my research on offshore tuna fisheries.

i. Persisting Time Distances

Online interviews compelled me to frame interactions in a formal manner, especially regarding the time of appointment. This need was further accentuated by the time difference between Europe and the South Pacific region (10-12 hours). Such practice conflicted with certain socialising habits, which entailed biases in the people I could interview remotely toward ‘expert’ figures. Online methods limited my access to a specific “clique” (Olivier de Sardan, 1995), having access to digital communication devices and proper Internet connection and used to the types of interactions these instruments afford. Once again, ‘sea people’ often escaped such research apparatus. While in Paris, I contacted fishers and fisheries observers in Fiji, Kiribati and Vanuatu. Although they agreed to discuss with me online and indicated a relatively free schedule, it was not easy to plan a specific date and time for the call. Even when such an appointment was made, many missed it and called me back at random times of their days – i.e. at random times of my nights – because of their irregular working schedule and/or because such formal meetings do not match their socialities. In Fiji, locals often use the expression “*Fiji time!*” to explain their ‘lateness’ to (generally Western) interlocutors, thereby hinting to cultural differences in temporalities. More generally, online interviews tend to be more constrained in time and in the type of relations they permit. My attendance to online meetings was particularly challenging, again because of the time difference between Paris and the South Pacific region. Working online from 12-6 am while in my bedroom was clear burden on my attention and capacity for observation. Even if I could witness the online exchanges, it was difficult for me to access their ‘context’ and establish new connections with other attendees to discuss and confront my observations of these events.

ii. A Blurred Divide between the Interviewer and the Interviewees

My distance to tuna fisheries, shared by some interviewees, positioned me alongside them rather than at an ‘inquiring distance’. I experienced a “lateral mode of engagement”, as described by Helmreich, connected to my interviewees by a “shared puzzlement” about tuna fisheries and the wider ocean (Helmreich, 2009, p. 22). Some interviewees seemed to assimilate me as another contributor to their

surveillance efforts. Restrained by their distance to fishers in particular, but also to scientists or specific institutions, some were curious about the information I could have gathered during my investigations. As an illustration, Navy sailors asked me to help them better understand the tuna fisheries sector and fishers' practices. While interviewing them, they also saw me as an informant capable of collecting and supplying them with information about their field of investigation. I decided to bypass these interrogations because I was sometimes unsure of the answer and felt uncomfortable divulging information from one informant to another without their agreement. As I circulated through various places and possibly "competing" study sites (Meyer et al., 2017), I sometimes felt bound to conflicting assimilations. The divide between the interviewer and the interviewee was further blurred by the use of online communication devices. During some interviews, I found out that certain interviewees had consulted my online profile⁶⁹ and formed specific conceptions of my research topic, limiting my ability to reframe or update the latter.

These experiences call for additional precisions regarding the ethical dimensions of my research. For my first interviews, I used formal contracts permitting the interviewees to establish the conditions under which I could use the interviews, their recordings and transcripts. However, such a system rapidly turned out impractical with certain interviewees (because of social or cultural aspects) or in certain interview configurations (e.g. at sea or in processing plants), especially in Fiji. I abandoned this formal strategy and decided more simply to explicit the context and purpose of my research, ask them to specify any restriction they could have, anonymise all interviews with pseudonyms, and not share any information from one interview to the other.

iii. **Personal Distance and Detachment from the Field**

Importantly and perhaps less often discussed, such a multi-sited and multiplex approach shaped my relation to the field, my research practice and my subject of study. The embodied dimension of the research and of scientific research is often overlooked in methodological discussions (Bengtsson, 2014) despite their effects on the research process (Haraway, 1988). Investigating at a distance and in multiple study sites for short periods hindered in-depth access to the latter and comprehensive participant observation. My online and from-home practices of investigations further enhanced this feeling of exteriority. If I sometimes felt a lateral mode of engagement with my interviewees, I also sometimes felt as if I were uncomfortably "lurking" (Garcia et al., 2009), e.g. when I was attending online meetings or invisibly tracking and recording written exchanges on Facebook groups. Although these provided useful means of observation, they kept me at a distance. 'Ethnography' from home also affected how I could organise my relation to my research work (Bernard, 2019) and sustained the feeling of being neither 'here' nor 'there'. However, as outlined by S. Bengtsson regarding her own experience of online ethnography, the concept of 'field' requires a delicate articulation between being 'in' the field *and* 'out'

⁶⁹ My online traces were rather limited but unpolished: I did not develop any specific strategy regarding my online presence.

of the researcher's personal environment (Bengtsson, 2014). These personal aspects were not without consequences on my capacity of attachment, engagement, and exchanges with my correspondents, but more importantly, perhaps, on the perceived legitimacy of my research. In a context of complex 'North-South' and 'scientific/non-scientific' cooperation and in a field where those who go to sea have more legitimacy than those who stay ashore, conducting fieldwork at a distance and in a relatively short period was a consequent limitation. This experience leads me to conclude that distances to the field should not serve as an argument to prevent investigating specific topics but they should not be an excuse to settle with remote investigative strategies either. Rather, I found remote investigation useful in initiating or prolonging *in situ* observation and physical co-presence.

III. Material

I conclude this chapter with a brief description of the main materials used in this research and their limits.

Part II of the dissertation is primarily historical. It draws on the systematic consultation and in-depth analysis of a series of scientific, technical, administrative and legal reports published by national governments, research institutes and regional institutions involved in tuna fisheries management available at SPC's digital library,⁷⁰ spanning 1952 to the creation of the WCPFC in 2004 and concerning tuna fisheries study, management, and tuna fisheries and maritime surveillance. Reports relating to SPC's annual technical meetings and Heads of Fisheries meetings were particularly useful as they contain intergovernmental discussions amongst the Pacific Islands about fisheries, national exposés and opinions, and expert reports produced for the sake of the Pacific Island fisheries administrations and governments. However, SPC's digital archives are only partial. I could not access the national archives of Fiji and New Caledonia, mostly paper-based. I could only access FFA's archives through SPC, which entailed limited coverage of the reports, which were often truncated for confidentiality reasons. Hence, access to reports about 'coercive' forms of surveillance and fisheries policing matters was much more limited than those concerning the 'scientific' surveillance of the tuna fisheries. These reports also provide only indirect accounts of non-institutional actors like fishers and local populations. I completed these historical insights by interviewing several persons formerly involved in the region's tuna fisheries development, surveillance and management and witnesses of the region's transformations.

Part III mostly draws on data collected during my interviews and personal observations in the (offline and online) field (see Appendix 1), completed by various reports provided to me by interviewees or accessed online on WCPFC, FFA, SPC, WWF, Ministry of Fisheries, Coral Sea Natural Park, French Ministry of Defence, etc. websites. Interviews were semi-directed. Most were recorded and transcribed and all were coded using the software Sonal. During the interviews, I would generally focus on labour

⁷⁰ SPC digital library: <https://www.spc.int/DigitalLibrary/FAME> (accessed: 27.09.24)

dimensions, question my informants about their professional trajectory and work content, and demand that they describe their practices in as much detail as possible. I also asked questions regarding data collection, the use of information and communication technologies, and the evolutions they could see in their field. As my research progressed, I could eventually ask more narrow questions on specific dimensions of the surveillance apparatuses I studied or specific events I had identified as influential. Interviews were conducted either in French or in English. Frequently, neither the informant nor I would use our native language, which may have hampered our mutual understanding. I treated these interviews more cautiously when I felt this may have been the case.

The main limitations of my corpus concern my limited access to national fisheries authorities, FFA and the Fiji Navy, partial coverage of fishing companies chiefly comprising historical companies, and the non-inclusion of stakeholders who do not ‘use’ tuna resources and/or offshore spaces directly but may still have views on them, such as coastal communities or offshore sea people of other sectors. Finally, it should be noted that my analysis draws on data obtained up until 2021. Therefore, it does not account for more recent events, e.g. New Caledonia’s last referendum and current riots, the 2022 Fijian national elections, or the 2021 announcement by several Pacific Islands of their intent to leave the PIF.

PART II
The State, the Fish and the Marine
Territory

The Historical Development of South Pacific Tuna Fisheries Surveillances

This second part unravels the history of the tuna fishing industry and the development and institutionalisation of its associated surveillance apparatuses, mainly from a political and organisational perspective and through the 20th century up to the contemporary period. Such a historical approach is important to understand how tuna fisheries and their surveillance were problematised and by whom and to examine the politics underlying the design of tuna fisheries surveillance apparatuses. It allows for disclosing the strategies and compromises that permit various surveillance interests and framings to hold together while simultaneously making each of their very existence possible.

In this part, I retrace the exploration and reconceptualisation of the South Pacific offshore environment as a resource well and the competitive rush to know, exploit and appropriate tuna resources. I describe the political, institutional, legal and practical arrangements made by the Pacific Islands to ‘materialise’ their territorial claims over offshore spaces. I show that surveillance was pivotal to that territorialisation process. However, its deployment necessitated the Pacific Islands to establish specific strategies and compromises against the challenges of surveilling a mobile and widespread resource and the material, political and legal specificities of the offshore marine spaces at stake. I describe the resulting surveillance as opportunistic, delegated (in particular to the surveillance subjects, therefore blurring the divide between the roles of surveillance agent and subject), shared and multipotent. Such offshore surveillance relies on boundary surveillance apparatuses and necessitates sometimes undesired yet unavoidable ‘awkward’ alliances between actors with distinct motives, interests and involvements. Building their marine territory required the Pacific Islands to lean against ‘more-than-sovereign’ and more-than-national surveillance practices and to produce overarching regional spaces of regulations and surveillance practices supporting but also mitigating their sovereign affirmation over offshore spaces.

Part II contains three chapters that articulate three loosely defined and partially overlapping periods with three types of surveillance. From the 1950s to the 1970s, there was little knowledge of tuna and offshore ecosystems, and surveillance efforts were emergent and relatively scattered. From the 1970s to the 1990s, surveillance was progressively structured to develop a scientific understanding of tuna fish and fishing activities’ impacts and support the Pacific Islands in defining management policies and regulations. From the 1990s, such surveillance was consolidated but was also complemented by efforts to effectively control the conduct of fishers, enforce regulations, prevent illegal fishing activities, and secure the EEZs. These periods do not replace each other. Rather, they bespeak the incremental ‘thickening’ of surveillance along that of territorialisation efforts.

CHAPTER 4. Offshore Frontier Promises: Exploring Pelagic Fish Resources

This chapter retraces the emergence of offshore fishing in the South Pacific region and how tunas were framed as a new resource supportive of national economic development. I propose to demarcate the first era of offshore fisheries development as characterised by an initial lack of surveillance and control of fishing activities from the 1950s to the 1970s. Over these decades, there was a rapid growth in the production and consumption of tuna products globally. Enduring the aftereffects of World War II and still entrenched in a colonial system, the South Pacific region was becoming a pivotal stage of the Cold War conflict. In that context, the South Pacific tuna fish raised vivid and conflicting interests amongst Japanese and American fishing fleets and, as importantly, within the Pacific Islands and their colonial administrations. Through that era, these actors strategically depicted the South Pacific Ocean as a new, far out, and until then neglected “frontier” (Fache et al., 2021). The ‘wild’ open ocean appeared uncontrolled, i.e. unknown but also unowned and unregulated, making it amenable to capitalistic colonial projects and states’ national security and welfare preoccupations.

The first two sections of this chapter provide a symmetrical examination of this process, looking both from ‘outside’ and ‘within’ the South Pacific region. They successively account for the rising and competing interests of Distant Water Fishing Nations (DWFNs) and then of the Pacific Islands and their colonial administrations in the *commercial* exploitation of offshore fish – and of certain tuna species in particular. However, making the offshore ocean ‘productive’, i.e. enrolling it into a market economy and turning live tunas or billfish into commodified ‘natural resources’, definitively was not a smooth and linear process. The commodification of tuna was framed as much by humans as by the fish themselves (Campling & Colás, 2018).

In describing the industrial development of tuna fisheries, I show that this process was largely ‘imported’ by international, foreign and colonial actors, initially in a disparate, competitive and uncoordinated fashion. In a context of widespread ignorance regarding offshore ecosystems, governments, fishery scientists, and fishers collaborated to deploy surveillance efforts framed around exploitation concerns and consisting of (and limited to) exploratory surveys to prospect for fish resources and experiment with fishing techniques. These rising socio-economic considerations constituted the preliminary steps to concretise the fishing and trading of pelagic fishes in a highly globalised, competitive and volatile market.

The last section examines the effective encounter of these many stakeholders lurking into the promises of offshore fish resources and attempting to concretise their exploitation, progressively remoulding the South Pacific region. As I said already, the industrialisation process was largely imported

but could not simply be transposed as such to the Pacific Islands. Requiring the conjunction of many factors, it had to adapt to the region's specificities. Therefore, the South Pacific offshore frontier provided a zone of "friction" (Tsing, 2011) where foreign, colonial and local interests collided. Encounter was not exactly symmetrical, however, and led to the constitution of situated assemblages heavily dominated by foreign and colonial stakeholders – which would structure much of the following era. These materialised with joint ventures based in the Pacific Island territories. The development of the tuna industry, in its inception, largely benefitted outward stakeholders, with most of the economic profits going to the colonies or DWFNs like Japan. To a certain extent, frictions were maintained to their lowest: the joint enterprises mostly functioned as territorial enclaves, operating in isolation and at a distance from the local societies. Hence, the initial development of industrial tuna fisheries mostly consisted of a remote extractive process, removing fish from the ocean and resources away from the Pacific Island populations and their local economies to benefit reticular empires.

I. The Expansion of Distant Offshore Fishing throughout the Pacific Ocean

1. The Early Exploitation of Offshore Fish in the South Pacific Region

The South Pacific Ocean was never just a flat surface to its local populations. Before the advent of an industrial offshore tuna industry in the South Pacific, there was already a centuries-long tradition of Pacific Islanders fishing on offshore pelagic fishes, especially in the Polynesian and Micronesian Islands. Local populations utilised traditional boats (e.g. pirogues, canoes) and fishing gear (e.g. pearl shells) to catch various pelagic fish, including some of today's main commercial ones such as skipjack, albacore or yellowfin tunas (Gillett & Tauati, 2018; Miyake et al., 2004).

However, exploiting such fish stocks was comparatively restrained, nowhere near as intensive and widespread as today. Pacific Island fishers predominantly operated near the shore, fishing by the outer side of the fringing and barrier reefs, constituting what fisheries administrations labelled a "nearshore oceanic fishery" (SPC, 1992a, p. 3). Exploiting more remote marine areas was more sporadic, chiefly opportunistic and associated with inter-island journeys. The substantial societal shifts induced by the European colonisation in the region also altered or erased certain forms of Indigenous knowledge associated with fisheries development and management (Fakahau & Shepard, 1986). This was particularly evident in territories like Fiji and New Caledonia with wealthier terrestrial resources. As observed by a marine biologist working with the French administration in New Caledonia in 1950, "Indigenous people [had] moved away from the sea after the colonisation" and favoured the consumption of meat over that of fish (Legand, 1950, p. 156). By the mid-20th century, offshore fishing in the Pacific Islands retained a limited and artisanal character.

Foreigners also partook in exploring the South Pacific offshore waters and oceanic fish. Their expeditions started around the 18th century and set the stage for the subsequent colonisation process.⁷¹ They supported and conveyed the progressive Western reinterpretation of the ocean as “a physical and intellectual space full of imperial and commercial significance” (Lambach, 2021, p. 6). Europeans, for example, provided exploratory and piecemeal accounts of marine biological resources as they ventured into the region. Whalers showed the marketable potential of oceanic resources in the 19th century and subsequently developed a commercial fishery around whale products (Fakahau & Shepard, 1986).⁷² However, endeavours to exploit offshore species other than whales and to a commercial level only gained momentum at the outset of the 20th century. This was facilitated, in part, by the development of motorised vessels that enable the chase of mobile fish through the ocean (Finley, 2017). The first records of such ambition in the region point to the investigations led by a US vessel in 1899, which surveyed parts of the South Pacific oceanic waters in search of tuna resources. This interest in tuna was attributable to the parallel emergence of the US canned tuna industry and the growth of the US domestic demand for such fish products (Havice, 2018). Nonetheless, these initial campaigns yielded inconclusive results (Barclay, 2014).

The turning point came with Japan, which pioneered the expansion of industrial tuna fishing fleets through the Pacific Ocean. In the aftermath of World War I, the League of Nations endowed Japan with administering Pacific Islands formerly colonised by Germany, including the now Federated States of Micronesia, Marshall Islands, Palau and Northern Mariana Islands. In the double interest of producing more food for the Japanese population and of coincidentally abiding by its mandate to contribute to the economic development of these Pacific Islands, the Japanese government undertook to develop tuna fisheries by surveying the marine resources of the region, subsidising domestic fishing companies, and setting up onshore fishing and processing facilities (Gillett, 2006). Under these efforts, two main fisheries expanded: a pole-and-line industry, supported by fishing bases in Palau, Federated States of Micronesia and Northern Mariana Islands, and a longline industry based in Japan.⁷³ Those primarily targeted albacore tuna for the Japanese domestic market (Gillett & Tauati, 2018). Japanese people largely spearheaded those fishing operations, independently from Pacific Islanders, making the most of

⁷¹ Marine traders, along with missionaries, from Australia, New Zealand and Europe were greatly influential in initiating preliminary ties with Pacific Island communities and in laying out navigating routes permitting these connections. These contacts contributed to the following establishment of colonial regimes by the British Empire, France, the Netherlands, the US, etc.

⁷² British whalers were the first to exploit the Pacific waters at a small scale, before the American fleet became dominant in the region during the 19th century. They hunted on sperm, Southern right and humpback whales. The well-renowned *Moby Dick* novel by H. Melville (1951) draws on actual whaling events taking place in the South Pacific area. Surrounding waters of both Fiji and New Caledonia were important sites for whaling activity. Whaling started to decline by the end of the 19th century (Lever, 1964).

⁷³ The longline fishing technique had been developed by Japanese fishers for about two centuries and was used to fish away from the coasts. Because of its strenuousness and offshore location, the longline was nicknamed the “widow-making line”. Technological innovations appeared in the 1910s, with English fishers developing a mechanised longline hauler in particular. Longlining was then taken up by Hawaiian fishers, which further adapted the technique to their liking (Angot & Criou, 1961).

the absence of restrictions granted by the ‘freedom of the seas’ customary regime that applied to most of the Pacific waters at that time. By the 1930s, Japan had become the lead fishing power in the world, founding a “pelagic empire” on technological superiority in catching, processing and logistics but also on the monopolising of certain environmental and technical knowledge and bodily skills for handling fish (Heé, 2020, p. 417).

2. Post-World War II Industrial Tuna Fisheries and the Expansion of the Japanese Fleets

World War II temporarily halted the development of the Japanese tuna fisheries, firstly because the war had destroyed many fishing vessels and onshore infrastructures. After the conflict, fisheries became pivotal during the US-Japanese negotiations for a peace treaty and almost caused the negotiations to fail (Finley, 2011). The US took control of most of Japan’s colonies in the Pacific and placed restrictions on the mobility of Japanese fishing vessels. Those could only fish near the shore areas of Japan, below the ‘MacArthur Lines’, which severely reduced their privileged access to the Pacific fishing grounds (Gillett & Tauati, 2018). At the same time, however, to strengthen his authority on Japan, D. MacArthur supported the Japanese fishing industry by providing fuel and material so that the vessels could resume their activities, provide proteins to the Japanese people and make Japan self-sufficient again. This policy helped the Japanese fleet recover its pre-war capacities by 1947 and aspire to return to the world market, but it also aggravated fishing pressure on nearshore fish stocks (Finley, 2011). It followed that, by the 1950s, Japan was impatiently seeking to expand its fishing grounds. This became possible after the US eventually relaxed and suspended the MacArthur lines. The US thought that releasing the Japanese fishing fleets would help obstruct the attempts of the Soviet Union to extend its marine jurisdiction (Finley, 2011). In 1952, the Japanese tuna fishing fleets could resume their expansion through the Pacific Ocean.

During this new wave of expansion, Japanese fishers targeted tunas, and albacore in particular, to supply American canneries in Hawaii, American Samoa or the US mainland. American demand for the white-fleshed albacore tuna was soaring after it was successfully marketed by the American Van Camp company as the “chicken of the sea”, which helped convince American consumers to replace canned salmon with canned tuna (see Mongruel et al., 2010). Billfish and sharks were also caught in significant quantities during these fishing operations but had lower commercial value. Hence, they were frequently discarded at sea if the vessel was fully loaded and additional tunas were biting (UNDP et al., 1970). Japanese fishers worked to extract from offshore multispecies assemblages the species that the capital could see and value, abandoning others on the way (Tsing, 2015).

However, having lost responsibility over Pacific territories, Japan and its fishers no longer had access to the onshore facilities of the Micronesian islands, which constrained their operations. Pole-and-line vessels, necessitating live bait fish to lure tunas, could not fish too far away from the coasts: the vessels

needed access to sufficient baitfish resources and the capacity to keep them alive onboard the fishing vessels. This reliance on live baitfish also implied that the pole-and-line tuna fishery was tightly intertwined with inshore fisheries, being dependent on the availability of these resources while also causing additional pressure on their exploitation.⁷⁴ Considering that its fishing industry was serving to demonstrate Japan's modernity and leadership, the Japanese Government supported the fishery in alleviating these constraints by investing in 'applied' fishery science to improve fish-finding operations and fishing gear – while simultaneously pioneering tuna fisheries science (Heé, 2020).

Improvements in the handling and holding of baitfish and permission to fish them in other coastal waters permitted Japanese pole-and-line vessels to progressively increase the range of their fishing grounds around Micronesia and then down to the South of the Equator by the 1960s-1970s (Gillett, 2006). The invention of a "water spray system"⁷⁵ on pole-and-line vessels also made the technique more efficient at catching skipjack, which was increasingly targeted from the mid-1960s (Southwick, 2011). This permitted the number of Japanese pole-and-line vessels to grow from 34 in 1966 to 279 in 1975 (Virly, 1996). Similarly, Japanese longliners broadened their fishing areas so that "by 1962, most parts of the Pacific between 40° north and south latitude had been explored by Japanese longline fishermen" (Gillett, 2006, p. 12). Longliners notably benefitted from technological improvements in cold-storing systems. The cooling and then freezing of fish down to -55°C enabled longer fishing campaigns (>12 months) and permitted the targeting of new markets (e.g. for sashimi) from the late 1960s onward (FAO, 2005; Ward & Hindmarsh, 2007).

These innovations permitted Japanese fishers to operate throughout the Pacific Ocean in an isolated fashion, at a distance from and without any connection to the Pacific Islands and their populations. Japanese fishing vessels mostly travelled back and forth from their fishing grounds to the motherland or used 'motherships' to transship their catch, meaning that the latter were never landed in the Pacific Islands. Historian of science C. Finley described this organisation as a specific model of imperialism, distinct from the one used by the US or Europe. Instead of relying on (the cheaper) local workforce to exploit natural resources in the colonies to benefit the metropolitan territories, Japan sent its own people to the 'periphery' to extract the resources and bring them back to its 'core' (Finley, 2011).

⁷⁴ This entanglement caused important tensions in the Pacific Islands between industrial fishing fleets and artisanal fishers (cf. Chapter 5).

⁷⁵ Such system consists in a pipeline set around the ship to spray water on the surface of the ocean. The foam created by this water jet permits to 'hide' the ship and the fishers from the sight of the fishes and to create an "impression of excitement and feeding frenzy" to attract tunas (Southwick, 2011).

3. The Race for Tunas: The Diversification and Intensification of Tuna Fisheries

By the mid-1960s, other ‘distant’ nations entered the South Pacific tuna longline fishing industry. The Japanese fishing fleets had difficulties finding a sufficient workforce willing to endure the demanding working conditions on fishing vessels, and national labour was becoming too expensive, given the growth of the national economy. Consequently, many companies turned to cheaper Korean or Taiwanese workforce and settled in those countries. Korea and Taiwan-flagged longliners progressively entered the tuna industry in 1958 and 1963, respectively (Virly, 1996), often using Japanese captains and second-hand vessels (FFA, 1991b). Thanks to their lower production costs, these new fleets progressively outcompeted Japan for the supply of albacore tuna to canneries by the 1970s (Wilkinson, 1978a). In addition to this competition, the US passed tighter regulations regarding food safety and mercury levels in fish products,⁷⁶ which complicated access to the privileged US canning market (Barclay, 2014; Miyake et al., 2004). These transformations led Japanese fishers to seek new outlets and diversify their activities. In particular, they developed innovative techniques in longlining, permitting to set the line deeper and to target bigeye and yellowfin tunas, along with billfish, to supply the growing Japanese sashimi market (Wilkinson, 1978a; Bour & Galenon, 1979).⁷⁷ This strategy induced the partial relocation of Japanese longliners to other fishing grounds, moving further South and down to Australia and New Zealand (Kearney, 1977b).

Japanese fishers were not the only ones paying greater attention to the South Pacific waters after World War II. The US rapidly framed the region as another landmark of the American frontier. Certain Americans had ‘discovered’ the region during their mobilisation in the war. Amongst those was the ichthyologist⁷⁸ W. Chapman, who would shortly become a leading figure in US fisheries policy-making (see Finley, 2011). After several months at sea during the war and suspecting South Pacific tuna resources to be plentiful, he actively lobbied the US Government to ‘modernise’ the tuna fishing industry and expand it “deep into the Pacific” (Finley, 2011, p. 104). Tunas were akin to the “buffalo on the Great Plains”, and fishing was instrumental in expanding “America’s Manifest Destiny into the high seas” and forestalling the progression of Japan, the Soviet Union and their respective fleets (Finley, 2011, p. 15). After a conflict between Japan and the US on the Bristol Bay salmon fishery in the 1930s, tense competition between the two countries relocated to the Pacific waters and their tunas. W. Chapman felt that the race for tuna had started and that it was important that the US would be the first to lay claims on these resources ‘free’ from economic or political control of adjacent countries (Finley, 2017). His

⁷⁶ These regulations on mercury pollution were linked to the Minamata Bay disaster and disease – see Chapter 5.

⁷⁷ The hooks would therefore reach 250-300m-depth, when traditional longlines used by Korean and Taiwanese fishers would fish between 50 and 120/170-m-deep only.

⁷⁸ Ichthyology is a subfield of natural science concerned with the study of fish.

rationale was that if US fishers could be the first to locate South Pacific tunas, they would be able to appropriate the resource and exclude other fishing nations, particularly Japan. W. Chapman further argued that exploiting tuna resources would help salvage the economic situation of the US domestic tuna industry and offset parts of the costs linked to administering the Pacific Island territories (Finley, 2017).

This strategy led the US to develop large oceanographic programmes and exploratory fishing campaigns near Kiribati, French Polynesia, Marshall Islands or Palau, using pole-and-line, longline and purse seine vessels (Gillett, 2006). From the 1950s, disadvantaged by the growing competition of Japanese fishers, the California-based American pole-and-line industry converted many fishing vessels to purse seine to improve their tuna catches. Japanese fishers rapidly appropriated the method to develop a – relatively limited – commercial purse seine fishery (about 60-70 small-scale vessels) fishing seasonally around the coasts of Japan (Gillett & Lewis, 2003). However, the environmental specificities of the Pacific Ocean's tropical waters necessitated adaptations for the purse seine technology to cope with the faster-moving and deeper-swimming tuna schools. Japanese fisheries administrations, scientists and fishers sought ways to make the technique viable. In particular, they exploited the tendency of tunas to aggregate around logs to capture sufficient quantities of fish (Bour & Galenon, 1979), thereby initiating the subsequent development of Fish Aggregating Devices (FADs)-associated fishing practices.

American purse seiners, initially operating in the Eastern Pacific, progressively shifted their fishing grounds to the West in the mid-1970s for various reasons. Amongst those were oceanographic fluctuations that lowered their catches,⁷⁹ contentious relations to access the marine waters nearby countries of Central and Latin Americas,⁸⁰ and the arrival of new wildlife protection regulations in the US forbidding them to fish on dolphin-associated tuna schools⁸¹ – a 'multispecies assemblage' that did not occur in the Western part of the Pacific Ocean. The Japanese and US purse seine fisheries developed to an industrial level through the 1970s. In the case of the American fleet, the first fully commercial operation began in 1979 after relatively limited trials and developments since the 1940s. It rapidly became the largest fleet in the region with about 50 purse seiners in the mid-1980s (Gillett, 1986). The dramatic expansion and efficiency of the purse seine industry eventually outcompeted the pole-and-line fishing fleets. As for the expansion of the Japanese purse seine fleet, it was facilitated by incentives from the Japanese Government to replace pole-and-line licences by purse seine ones and improve the efficiency of its fishing industry (FFA, 1990c).

⁷⁹ These fluctuations were linked to the El Nino-Southern Oscillation, a warm ocean current that affects sea temperatures and therefore fish distributions.

⁸⁰ See Chapter 5.

⁸¹ See the Marine Mammal Protection Act passed in 1972.

By the 1970s, the tuna fishing industry had considerably developed and diversified, using three main techniques (pole-and-line, longline, purse seine) to target albacore, skipjack, yellowfin and bigeye tunas, exploiting and prospecting increasingly distant and deeper fishing grounds, and involving a growing number of fishing vessels from numerous countries. Offshore waters of the Pacific Ocean were increasingly populated and exploited by tuna fishing vessels, with over 3,700 longliners, 730 pole-and-liners and about 30 purse seiners by the late 1970s (WCPFC, 2021).⁸² Up until this date, those fishing vessels could operate in an unregulated fashion and free of charge as most of the Pacific Ocean was outside any country's jurisdiction.

This section highlighted the economic and political interests of fishing nations involved in developing tuna fisheries in the South Pacific region and subjecting the South Pacific offshore spaces and fish to new frontier dynamics. This historical account highlights the existence of a tight State-science-industrial complex supporting the expansion of tuna fisheries, especially in the US and Japan, instead of being led by private interests only. It also outlines the practical and marketing challenges of turning the 'wild' tuna fish (and other fish like billfish) into a natural resource exploitable at an industrial level. The 'successful' development of the tuna fishery (understood as its commercial viability) required the alignment of many factors at the global scale, ranging from technological capacities, workforce availability, consumers' preferences, regulations (or lack thereof) and inter-state relations (including frictions). These dimensions place the existence of tuna fisheries in a wider and more dynamic socio-ecosystem than the offshore ecosystem of tunas only and account for some of the specific features of this industry (e.g. its dynamism as well as its global and reticular organisation). These aspects contribute to shaping both the need for surveillance and the way such surveillance can emerge, as they constitute as many sources of uncertainty to address.

II. Offshore Fish: Speculative Natural Resources to 'Develop' the South Pacific Region

1. The Oceanic Frontier: A Turn to Unknown Fisheries for the Pacific Islands

Japan and the US initiated and shaped the preliminary developments of the tuna fishing industry in the South Pacific Ocean to displace their frontier and serve their domestic interests. They were, therefore, largely 'detached' from the Pacific Islands, neighbouring these newly exploited fishing grounds and their coastal communities. Nevertheless, the Pacific Islands grew a parallel interest in engaging in and benefitting from offshore fisheries, especially in the post-World War II era. Efforts

⁸² These data are only provided to situate the magnitude of the fisheries. There are several limitations to these figures, as they consider the vessels fishing in the (wider-encompassing) WCPFC area rather than the South Pacific waters only and also because they rely on historical and possibly incomplete data.

from historians to retrace the evolution of tuna fisheries in the world and the Pacific have recently intensified, but generally from the perspective of the leading (non-Pacific) fishing nations. This section attempts to complement this historiography from the standpoint of the Pacific Islands and provide a wider-encompassing understanding of the “frontier dynamic” at play (Fache et al., 2021, p. 60).

Right after World War II, the South Pacific region was still administered by the colonial powers in place: Australia, France, New Zealand, the Netherlands, the United Kingdom and the US. In regional fora, those were referred to as the “metropolitan governments” (e.g. see SPC, 1962, p. 6), a telling expression of the core-periphery organisation and power relations at stake. These governments and local administrations were increasingly concerned with stabilising and securing the region (Fry, 1981). As mentioned previously, the latter was becoming central to the Cold War conflict for reasons mingling not only social and commercial considerations but also (although more covert) strategic diplomatic and military ones. On one side, the US had established several military and communication bases in certain Micronesian islands and reframed the Pacific as pivotal to its national security. Alongside France and the UK, the US identified the region as the most adapted place to conduct nuclear tests, arguing for its isolated and peripheral geographic location and limited human occupation. On another side, undersea resources were also whetting metropolitan appetites. Finally, the colonial powers were increasingly concerned with ongoing socio-political transformations in local societies. Emerging nationalist aspirations, combined with a demographic boom and hunger and poverty struggles, made the region more susceptible to the communist influence of the Soviet Union and threatened the position and interests of the Western block. Those strategic aspects, however, were overlaid with discourses promoting the social and economic well-being of the island populations (Finley, 2017).

The six governments administering most of the Pacific Islands sought, therefore, to consolidate their rickety position and improve their influence, especially against that of the Soviet Union. Advancing their motive to ensure the well-being of the Pacific Island populations, the six governments convened in 1947 the “South Seas Conference” in Canberra (Australia). There, they ratified an agreement “to encourage and strengthen international cooperation in promoting the economic and social welfare and advancement of the peoples of the non-self-governing territories in the South Pacific region” (Agreement Establishing the South Pacific Commission, 1947, p. 3). The conference helped identify the newly and more formally delineated ‘South Pacific region’ (Fry, 1997) and led to establishing the South Pacific Commission (SPC)⁸³ with headquarters in Noumea (New Caledonia). SPC was to serve as a “consultative and advisory body [...] in matters affecting the economic and social development” of the Pacific Islands territories, providing and coordinating scientific and technical activities, advice and assistance to the metropolitan governments in fields of common interest (Agreement Establishing the

⁸³ The South Pacific Commission was later renamed the Pacific Community in 1997, to reflect the political transformations of the region and the associated organisational changes of SPC.

South Pacific Commission, 1947, p. 3). The organisation comprised three main bodies: a Commission, a Secretariat and a Conference. The former would include commissioners representing the participating governments and meet every year to decide on the programme and budget of the organisation. The Conference would constitute an advisory body involving delegates from *each* South Pacific territory to represent the local populations and make recommendations to the Commission (while being overseen by the latter). The governance of SPC granted a consultative role to the local populations while leaving decision-making capacity to the metropolitan governments.

Amongst the resolutions of the South Seas Conference, fisheries were readily identified by the colonial authorities as requiring “immediate projects” and research from SPC “with the special aim of improving the nutrition of the local inhabitants” (Agreement Establishing the South Pacific Commission, 1947, p. 12). This preoccupation was put on the agenda of the first Fisheries Conference held in New Caledonia in 1952, which aimed to define more precisely the work of SPC regarding fisheries and prefigure a “large fisheries development programme” for the region (SPC, 1952, p. 6). At that time, no territorial service was devoted to fisheries in the Pacific Islands that could inform and undertake fisheries development programmes (Adams et al., 1995), so SPC was heralded as the spearhead entity to address this lacuna. Fisheries matters were, therefore, mainly addressed at the regional level.

The 1952 Fisheries Conference gathered fisheries ‘experts’ tasked to make recommendations for the Commission to approve. These experts included members of the locally-based colonial administrations, and representatives, appointed observers, of international organisations like the Food and Agriculture Organisation (FAO) and the Indo-Pacific Fisheries Council.⁸⁴ Those experts were chiefly colonial expatriates, following the argument that native Pacific Islanders lacked experience and skills in fisheries science and management. They largely imported and transposed to the South Pacific region Western views and knowledge on fisheries gained in other marine environments. For instance, H. van Pel, the first recruited SPC fisheries officer charged to “assist and stimulate fisheries investigation and development” (Kroon, 1955, p. 17), had formerly worked as a skipper on a fishing vessel in the Atlantic and North Sea and then as a fisheries officer in the Indo-Pacific Dutch territories and for the FAO.

The 1952 Fisheries Conference marked a ‘fisheries turn’ in regional public policies, decided under the premise that fish resources were underexploited and yet bore the best perspectives for the general socio-economic development of Pacific Island territories. ‘Development’ encompassed a wide range of

⁸⁴ FAO was mandated by the United Nations to work on fisheries since 1946 to increase food production and distribution in the world, in particular in ‘developing’ areas. FAO was involved in fishery data collection, research training, development management and regional cooperation (S. M. Garcia, 1992). The Indo-Pacific Fisheries Council was established in 1948 by FAO to advise on the development of fisheries in the Asia-Pacific region. Thus, the Council covered parts of the oceanic waters also comprised under SPC (FAO, 1998). These organisations sent Western experts in oceanography and fisheries biology to ‘developing’ countries, to import Western technologies and ideologies and support the development of larger and mechanised fisheries (Finley, 2017).

considerations, although the development of a capitalist economy was particularly potent. Underlying this rhetoric was also the interest of the colonial powers to facilitate the integration of their South Pacific territories into the global and capitalist economy and away from the communist influence (Finley, 2017). Many of these territories (although not in the case of Fiji and New Caledonia) had limited land and agricultural resources. Fish food offered an important perspective to ensure food security. Initial considerations regarding the development of fisheries were “quite vast”, looking at “sea fisheries in all their aspects, as well as inland fisheries and fish culture, matters more or less closely related to fisheries [...]” (van Pel, 1961, p. 84). The ‘modernisation’ of fisheries, implying the scaling-up of fishing activities and the structuration and professionalisation of complete value chains to commercialise fish products, was deemed the most relevant strategy to provide not only food but also employment⁸⁵ and additional currency inflows to the South Pacific territories and their populations.

To these ends, SPC explored three main prospects to pursue fisheries development: encouraging small-scale artisanal fishing to provide more food to local populations, fostering small-scale commercial fisheries to supply local markets, and looking into industrialisation perspectives. In that process, offshore pelagic fish rapidly stood out as “the best possibilities” given that “in comparison with reef resources, those in the ocean are wider without a doubt” (SPC, 1952, p. 3, 6). Offshore fish promised to supply “much more important quantities” for local markets and, because of the limited size of the latter, even more so for foreign ones. In that sense, SPC fisheries experts introduced offshore resources as the main viable option for both local food security and economic development drawing on export. This was because of their presumed abundance and commercial value, especially in the case of tuna, for which a global market already existed and which was made evident by the expansion of the Japanese offshore fishery industry. The biological and ecological characteristics of offshore fish seemed another asset, as the latter appeared to be more resilient to large-scale exploitation than the more easily accessible coastal fish stocks – many of which were deemed already overexploited by local fishers. In that context, offshore fish also constituted a good opportunity to alleviate the fishing pressure on the inshore fish populations:

Care must, therefore, be taken to limit the fishing pressure in sensitive areas, and one of the most effective ways of achieving such protection is to turn the fishing activities onto pelagic species. Contrary to reef and lagoon species, pelagic fish are migratory, at least to a certain extent, and their habitat, in comparison, is unlimited. (van Pel, 1961, p. 148)

Such strategy epitomises the displacement of the extractive frontier from the shore to the offshore waters and the incorporation of these ‘unlimited’ spaces and associated resources into (although not exclusively) capitalist perspectives. Hence, the 1952 Fisheries Conference participants largely abided

⁸⁵ Hence, colonial authorities considered that the fisheries sector could provide alternative professional outlets – especially in certain Pacific Islands such as American Samoa with a forlorn maritime workforce previously involved in war effort (Devambe, 1964).

by the “food from the sea myth” envisioning the open ocean as a promise of natural resource diversity, abundance, and associated economic growth (Locher, 2020, p. 192). Such a stance properly evidences the more global and dominant “utopian, productivist and technicist” perception of that 1950s-1970s era, when the ocean was largely perceived as an inexhaustible source of food and a “new Eldorado” that accompanied the dramatic exploration and colonisation of the ocean and the expansion of industrial fishing (Locher, 2020, p. 193).

At this stage, however, the conclusions of the 1952 Fisheries Conference were largely speculative, as the participants had next to no information about the offshore fish of the South Pacific region. The offshore waters of the South Pacific Ocean were not only a frontier for exploitation but also for knowledge. There was “insufficient information” on the fish species’ taxonomy, biology and ecology and a lack of “quantitative statistics” to help assess the size of their populations (SPC, 1952, p. 3-4). Colonial administrations could only rely on partial and scattered information related to foreign-led commercial fishing activities or on scarce and emerging scientific endeavours and chiefly limited to the commercialised tuna species:

The distribution plan of the main species in those waters is still unknown, but some research and commercial operations have shown that certain regions were very well endowed. We have been signalled the presence of stocks in the equatorial waters north of New Guinea and south of Caroline Islands and in the equatorial waters south of Hawaii in sufficient abundance to justify their commercial exploitation, and we know there are variable quantities in the rest of the region. In those stocks, tuna plays an important role but many other species could have commercial value [...] (SPC, 1952, p. 3-4)

According to a French oceanographer in New Caledonia, the size and remoteness of the South Pacific had challenged leading oceanographic nations like Russia, the US or, to a lesser extent, Japan, and left this region one of the “least known oceanic regions in the world” (Dandonneau, 1979, p. 1). The region also displayed specific features (e.g. a deep thermocline, many islands affecting currents...) that made it differ significantly from other oceanic regions and hindered the mere transposition of oceanographic knowledge gained elsewhere.

2. The Concurrent Start of Offshore Fisheries Investigations and their Limits

As attested by the previous quote, the Pacific Islands’ administration found that formalised information on offshore fish as a commercial resource was limited and chiefly held by foreign governmental, scientific or private actors.⁸⁶ Offshore bioeconomic knowledge was embedded in the political economy of tuna fisheries and its imperial and capitalist roots (Heé, 2020). Imperialism, in the

⁸⁶ If tuna fishing was widespread among certain Pacific Islands Indigenous populations, such as in the Solomon Islands, it was not the case for the entire region and had partly been discombobulated by the colonisation process (e.g. Meltzoff & LiPuma, 1986)

history of the tuna fishing industry, was also informational – or rather, knowledge constituted a strong vehicle for imperialism. In the case of the tuna fishing industry, the *experiential* knowledge developed by Japanese fishers granted them enormous power, particularly influential in tuna diplomacy (Heé, 2020). The Japanese government and fishing companies had the largest scientific and commercial information pool on the region's tuna resources. However, those data were inaccessible to the Pacific Islands, which depended on the Japanese government's and industry's willingness to disclose them. Hence, the Pacific Island territories and their populations were largely peripheral to this 'geography of data ownership' and 'modern' fisheries science.

The existence of tuna stocks around the Pacific Islands was predominantly putative, supported by local and fortuitous testimonies of Pacific Islanders who believed they had spotted tuna schools near their islands or because they could sight Japanese longliners from the shore (Hinds, 1969). According to a French geographer consulted by SPC on tuna fisheries, the remote presence of Japanese fishing vessels exposed the Pacific Island territories to “a new form of activity which sometimes took place in full view of their shore” and helped demonstrate the existence of “vast possibilities as fishing grounds for fish of the tuna family” (Doumenge, 1966, p. 58). A report by R. Kearney, then fisheries officer in Papua New Guinea, illustrates how Japanese fishers contributed to showing new industrial prospects: “Evidence accumulated by Japanese-longliners and several cruises by Japanese research vessels suggested that the waters adjacent to Papua New Guinea were likely to harbour stocks of skipjack and yellowfin tuna [...] sufficient to support a sizeable industry” (SPC, 1972, p. 9). As the rest of the chapter will show, Japanese fishers not only hinted at the existence of these offshore resources but also provided a model and most of the skills for their exploitation.

Given their interests in the region's tuna resources, the colonial governments undertook to develop their own scientific and practical investigations at the national level. This largely contributed to the progressive development of a scientific form of surveillance to build tuna science, which was then “very much in its infancy” (SPC tuna fisheries scientist, Noumea, 19.11.19). More generally, tropical fisheries had remained a blinker in fisheries science. They required new scientific methodologies and knowledge to develop, initially sparking “wide-ranging differences of opinion regarding the most appropriate approaches” among scientific experts (Fakahau & Shepard, 1986, p. 81). In hindsight, a retired French marine biologist with an extensive career in the South Pacific region explained the historical geography of fisheries science and its influence regarding the knowledge of marine worlds:

These [concepts of fisheries science] were invented in Northern Atlantic by Europeans and Canadians. They developed the theories and methodologies for that discipline. Then, it was exported to other regions, in tropical areas, much later. Incidentally, we then observed that what had been defined in Northern Atlantic was not working so well in tropical areas. Fishes are not present in the same concentrations; they have different growth rates; there are different species... (Former marine taxonomist, Noumea, 17.09.19)

Tuna research was put to the service of economic development and natural resource exploitation rather than conservation (Finley, 2017; Hubbard, 2017).⁸⁷ The subordination of tuna science to national interests contributed to an isolated and competitive organisation of scientific research that was at odds with the more globalised functioning of contemporary science: tuna research was little collaborative, and exploratory programmes were pursued in a relatively uncoordinated and secluded fashion. Hence, there was much duplication of research activities from one country to the other (especially between competitors like Japan and the US), and many tuna scientists were unaware of the work conducted by other research fellows (Finley, 2011).

With the main objective of assessing the potential of these resources and identifying the best fishing areas and techniques to catch tunas, these administrations set up development programmes combining oceanographic research with fishing experimentations, often in collaboration with or in support of fishers (including professional and game fishers) and businesspeople. However, studying lively offshore ecosystems rapidly became arduous. Besides the 'peripheral' location of the region in the global geography of marine science, the study of horizontally and vertically mobile offshore water masses was challenging compared to more "topographically well-defined or easy to define" environments (Legand, 1962, p. 11). For French scientist M. Legand, then working in New Caledonia:

The pelagic world often is, for he who tries to interpret its biological laws, a world of fake correlations [...]. We explore it with sampling methods that are not very efficient, through punctual sampling; the rhythm of oceanic life is often faster than our investigation tools: the chemical-biological characteristics of the stations at the end of the oceanographic cruise tend to be chronologically incomparable to the ones at the beginning of the cruise. To space variations, one must add temporal variations, and this is only the first ones that we have attempted to study so far. (Legand, 1962, p. 3)

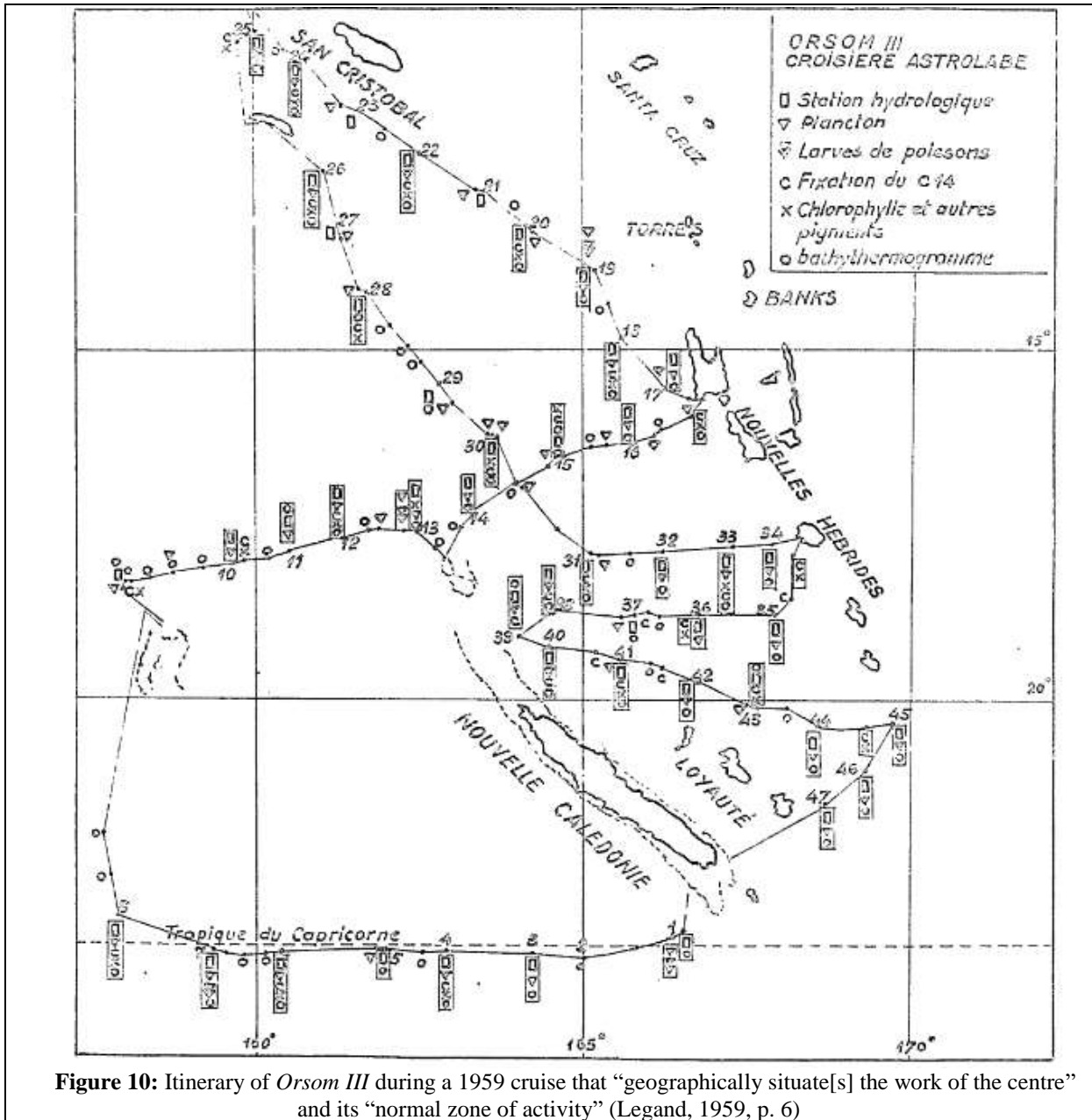
One of those programmes was the Hawaii-based Pacific Oceanic Fishery Investigations under the US Fish and Wildlife Service. It had been devised under W. Chapman's influence with the support of the US Navy and the West Coast fishing industry to focus on developing commercial fisheries and accompanying the expansion of American tuna fisheries in the South Pacific. By the mid-1950s, the US had already invested extensive efforts in descriptive oceanography, according to the programme's director O. Sette (Sette, 1954). However, this time, the US administration was more interested in the 'productive' dimensions of the ocean. The programme aimed to serve "the exploration, investigation, development and maintenance of the fishing resources and development of the high seas fishing industry of the territories and island possessions of the United States in the tropical and subtropical Pacific Ocean and intervening seas" (Sette, 1954). Operational work started in 1950 to undertake long-term and comprehensive research on offshore fisheries by conducting sea-going investigations. Those started

⁸⁷ More generally, many publications in history of science retrace the influential role of science in making 'nature' not only legible but also manageable and controllable, and in turning 'nature' and 'wildlife' into 'natural resources' open to exploitative activities (e.g. see Braun, 2000; Schiebinger, 2007).

around Hawaii and progressively extended their range of explorations to “elucidat[e] the facts regarding the distribution, ecology and behaviour” of “the tunas constitut[ing] the group of pelagic fishes in this region” (Sette & Schaefer, s. d., p. 85), and to identify ways to catch them in satisfying quantities. The programme rapidly focused on tunas that appeared to dominate pelagic populations and bore the most interesting commercial perspectives. Progress, however, was slower than hoped as the programme stumbled against many impediments, such as the lengthy renovation of a World War I vessel conditioning access to the sea.

Another example of offshore fish-oriented investigations regards the work of the Oceanographic Division of the French Institute for Oceania, located in New Caledonia. Created in 1948, it “virtually controlled” the French programme for developing maritime industries (SPC, 1952, p. 17). First focused on applied research on the lagoon fish of New Caledonia, the Institute rapidly concluded that there was no industrial perspective regarding these resources and turned to offshore ecosystems and their purportedly unknown tuna populations. At the 1952 SPC Fisheries Conference, the division reported that “almost everything of what happens beyond the reef in this country [New Caledonia] is ignored and there are very few elements on the economic possibilities in *Scombridae*⁸⁸ for instance”, and concluded that it would have to start its research “from scratch” (SPC, 1952, p. 40). Such reorientation was made possible in 1954 after the division acquired *Orsom III*, a small second-hand survey vessel capable of navigating outside the lagoon (Legand, 1959; Angot & Criou, 1961). A team of two marine biologists and one physical oceanographer – M. Legand, M. Angot and M. Rotsch – conducted discrete offshore expeditions from 1956 as part of a preliminary prospection programme around New Caledonia and in the adjacent Coral Sea before progressively broadening their enquiries toward the New Hebrides Condominium (now Vanuatu) and French Polynesia (see Figure 10).

⁸⁸ *Scombridae* are a family of fish including tuna, mackerel and bonito fish.



In a similar fashion to the US programme, the French Institute for Oceania sought to examine “the practical commercial possibilities of tuna fishing in the area, through trials carried out with fishing gear as similar as possible to that which would be used eventually by a fishing fleet” (Angot, 1959, p. 49). Research on the Pacific Ocean tunas also intended to serve France’s wider interests in tuna fisheries in the Atlantic and Indian Oceans (Grandperrin & Pianet, 1990). Like the US, French research endeavours were largely tainted with a geopolitical rush and competition to exert influence in the region and obtain privileged access to offshore fish resources. At stake was the ownership of information that could support new economic developments, as illustrated by this quote from M. Legand when he defended the relevance of the research work led by his division:

This [Australian] influence often rivals the French influence in the Pacific [...] at a time when Australian cruises can cover the entire Coral Sea, including sections of New Caledonia-New Hebrides. One will understand that French participation in this [research] activity is the only way to prevent our neighbours from being the only ones benefitting from moral... and maybe material profits. (Legand, 1959, p. 33)

Legand hoped that those profits could translate, from a practical perspective, into the identification and claim of productive fishing zones in the Coral Sea that could also be of interest to Australia and therefore required urgent action from the French government.

By the early 1960s, however, the scientists could not describe tuna distributions and their fluctuations quantitatively – a knowledge they esteemed necessary to assess the possible development of an actual tuna fishing industry. At the most, they could conclude on their “global certainty on the wealth of the region” and on the likely viability of a small-scale commercial yellowfin and albacore fishery for New Caledonia (Angot & Criou, 1961, p. 17). According to M. Legand, these limited findings resulted from insufficient human and material means and inadequate scientific methods. The research was too applied and development-oriented, preventing the more fundamental yet equally necessary understanding of the ocean and its fish. The lack of appropriate scientific resources did not permit establishing a proper “routine programme” involving more systematic, regular and denser at-sea observation and over a wider geographical area (Legand, 1962, p. 3). To support these efforts, the French Institute for Oceania imported *Coriolis* from continental France in 1961, an oceanographic vessel twice the size of *Orsom III*, capable of hosting up to 12 scientists and conducting more extensive campaigns in time and space. In the later 1970s, France further developed its research programmes to survey tuna resources, including aerial surveys and the development of remote sensing technologies to spot tuna schools and improve their catchability.

These undertakings remained limited in scope, considering their high costs and the limited funding made available by France to New Caledonia. Against that finding and despite the competitive interstate rush for tuna resources, M. Legand outlined the need to engage more collaborations with other forces such as the US or Australian research institutes, to upscale scientific efforts to the scale of the Pacific Ocean. The 1952 SPC Fisheries Conference readily recognised the need to improve the coordination of these various research programmes at the regional level. Ten years later, at the 1962 Technical Fisheries Conference, regional and territorial fisheries officers and scientists reasserted this opinion and recommended gathering “more information on two groups of tunas: those that live in superficial waters and those that live in subsuperficial waters, which the longline fishing industry relies on”, and on the bait fisheries associated to the former (SPC, 1962, p. 8). At that conference, inshore and offshore fisheries developments were considered distinct issues to address separately (SPC, 1962). This

epistemic, political and institutional demarcation remains influential to date.⁸⁹ Participants at the conference also acknowledged that SPC could be a relevant organisation to regionalise tuna research efforts, suggesting that it could undertake or coordinate offshore fisheries investigations in collaboration with appropriate actors. As shown in Chapter 5, this prefigured the progressive shift of SPC's tuna fisheries-associated efforts from development toward research (SPC, 1987b) and the structuration of offshore fisheries monitoring and assessment programmes. In the 1960s, however, this shift was only in its infancy as the organisation had little human and financial means to implement this plan. Facing that limitation, the Conference recommended that SPC first work as a library, gathering and diffusing existing information on those fishes and their associated fisheries.

The aim to build knowledge on the abundance, availability and catchability of offshore fish was not enough for the Pacific Islands to exploit these natural resources at a commercial, let alone industrial, level. Participants of the South Pacific Conferences recognised that industrial development had become “a proper science” over the years that also required socio-economic analyses at the territorial level to complete the ecological information on tuna resources and contribute to the establishment of comprehensive development programmes (SPC, 1952, 1962). These considerations outline the prevalence of surveillance practices to support industrial organisation development (Castagnino, 2017). Surveillance could not merely target the fish; it also had to apply to the human side of fisheries. In that initial stage, the collection of socio-economic information first aimed to survey and optimise the mobilisation of the productive forces to support industrial development. The Conference outlined the need for the type of statistics “usually used by fisheries services” and yet virtually inexistent in the region, ranging from information on vessels, fishing gear, workforce, onshore facilities, catch and effort, quantities of fish landed, processed and sold, to more general information on the structure, organisation and functioning of industrial sectors (SPC, 1962, p. 4). The “periodical and regular compilation and assessment of quantitative and qualitative information on fishing industries” was recognised by SPC experts as an “essential prerequisite to rational development” (van Pel, 1961, p. 52). These lacunae hindered the capacities of the territorial administrations to “formulate a fisheries policy and establish and implement development programmes” (SPC, 1962, p. 4). Again, the Conference recommended that the Pacific Island administrations start collecting data, not only on “fish, vessels and fishers” but also on the many “related amenities and activities” linked to the tuna industry in order to permit the rational planning of proper supply-chains (Devambeze, 1964, p. 5).

In this early phase of tuna fisheries developments, colonial governments and their scientific institutes worked hand in hand with individual (foreign/colonial) fishers to gather initial information on the availability and catchability of offshore resources, with a strong focus on the tuna species already

⁸⁹ It is, however, partially challenged, such as in the Regional Roadmap for Sustainable Pacific Fisheries which approaches both coastal and tuna fisheries.

exploited and commercialised. These individual endeavours were at first relatively rambling and largely imbued with inter-state competition to access and exploit the resource. They rapidly and repeatedly stumbled against the breadth of efforts required to appropriately study tuna populations, the wider offshore ocean and their associated fisheries.

III. A ‘Risky’ Business: Asymmetrical Encounters between the Pacific Islands and Distant Water Fishing Nations in Industrialising Offshore Fisheries

1. The Difficult Establishment of a Domestic Tuna Fishing Industry

The decision by colonial governments to foster fisheries development in the South Pacific region from the 1950s entailed various efforts to institutionalise fisheries and structure the sector, with the support of SPC, international development institutions like FAO, colonial administrations, or the short-lived South Pacific Islands Fisheries Development Agency.⁹⁰

Administrative fisheries services started to emerge in the Pacific Island territories in the 1960s, thanks to the support of SPC fisheries officers. H. van Pel, in particular, has been depicted by ulterior fisheries officers as “the father of modern institutional fisheries in the Pacific” (T. Adams et al., 1995, p. 9). This new institutional level appeared necessary to develop appropriate development policies and play an intermediary role between fishers and scientists. This permitted the progressing implication of Pacific island administrations and governments in fisheries and the consolidation of the national level in fisheries management. In Fiji, a Fisheries Division was created in 1966 under the Ministry of Agriculture, Fisheries and Forests to work on fisheries regulations, organisation and development. In New Caledonia, the regulation of marine fisheries and the organisation of the fishing profession were attributed in 1968 to the Territorial Department of Merchant Navy and Sea Fisheries (Service territorial de la marine marchande des pêches maritimes) under the State Service of Maritime Affairs (Eude, 1970). Once again, most Pacific Island fisheries services comprised expatriate fisheries officers.

Various development projects were undertaken to ‘modernise’ the fishing practices of local populations and structure the fisheries sector. These included providing new fishing vessels and fishing gear, training fishers in fish food preservation, or supporting the constitution of fisher cooperatives. In New Caledonia, for instance, a Fisheries Development Plan aimed in the early 1970s to “incite the small fishermen to go beyond the lagoon and improve their technique” (Eude, 1970, p. 3) by importing outside

⁹⁰ The South Pacific Islands Fisheries Development Agency was funded by UNDP in the early 1970s to focus more specifically on the development of reef and lagoon fisheries *and* of skipjack fisheries. However, due to various conflicts regarding the funding and the mandate of the agency, the project only lasted three years, with one employee. Regarding the development of skipjack fisheries, it was decided that the Agency would focus on projects conducted at the national level. Two projects were launched, in Fiji and in Western Samoa (UNDP et al., 1972).

know-how and expertise on offshore fishing. As part of this objective, skipjack fishing was “introduced” in 1970 by “two Tahitian crews” using traditional shell lure methods (Eude, 1970, p. 197). By the mid-1970s, about five fishing vessels were conducting seasonal and day-long campaigns on motorised vessels outside the lagoon (Loubens, 1976). The fishing activity of these vessels sufficed to supply the local market. However, despite substantial efforts throughout the South Pacific region and for over two decades to encourage small-scale commercial fisheries and organise and stabilise the value chain, overall results were considered “mediocre” (UNDP et al., 1970, p. 53). Amongst the explanatory factors identified by SPC and international development organisations were the considerable distances to the main markets, the lack of qualified workforce, appropriate fishing engines and capital, and the possibility for local consumers to fish by themselves instead of buying fish products at the market. Fiji Fisheries Officer A. Adams reported in 1968 that “fishing in Fiji and other Island territories is in the main unorganised, sporadic and a little more than subsistence in character” (Adams, 1968, p. 2).

Exploiting offshore fish resources and upscaling from subsistence to commercial fishing required many practical, technical and organisational adaptations to provide “adequate supplies for local markets” (Angot & Criou, 1961, p. 2), let alone foreign ones. Production had to be not only “abundant” but also “steady” (van Pel, 1961, p. 62), a predicament particularly challenging in the case of the wild and highly mobile pelagic fishes. The vessels used by small-scale fishers to go beyond the reefs were too small to conduct extensive fishing campaigns, which induced large seasonal fluctuations in tuna catches, as fishers could not track fish through the entire range of their displacements. Upscaling was far from being straightforward, as SPC fisheries officer R. Powell explained:

Subsistence fishing is no longer sufficient. Transitioning from subsistence to commercial fishing represents a very complicated social change. It requires local capital investments, the creation of many specialisations, and often the recruitment of experts selected for their rare technical knowledge. A subsistence fishing method can rarely be adapted to commercial fishing. For the island fisher who has always relied on traditional methods, the need to completely change his habits may be the most important issue.⁹¹ (Powell, 1963, p. 2)

This statement was even truer in the case of industrial tuna fisheries, which had a very different functioning and, therefore, distinct constraints. The “more evolved” and appropriate longline, purse seine and, although to a lesser extent, pole-and-line fishing vessels were “costly and complicated” to operate (van Pel, 1958, p. 13) and required “considerable investments, bigger boats and well-trained crews” (van Pel, 1961, p. 43). To give an appreciation of these costs, a SPC officer assessed that a medium-sized longline or pole-and-line fishing vessel was worth over AUS\$ 1 million, with annual

⁹¹ “La transition de la pêche vivrière à la pêche commerciale représente un changement social extrêmement compliqué. Elle exige l'investissement de capitaux locaux, la création de nombreuses spécialisations, et souvent le recrutement d'experts choisis pour leur connaissance de techniques peu répandues. Il est rare que l'on puisse adapter une méthode de pêche vivrière à la pêche commerciale. Pour le pêcheur des îles qui a toujours utilisé des méthodes traditionnelles, la nécessité de changer complètement ses habitudes constitue peut-être le problème le plus important.” in original

operations costs reaching roughly the same amount in 1976. Purse seiners were even more expensive, amounting to about AUS\$ 7 million and over AUS\$ 2 million in annual operation costs in 1980 (Kearney, 1981).⁹² Setting up such an industry did not only concern at-sea operations but also onshore infrastructures capable of supporting the latter and taking care of the processing and commercialisation of the fish. Industrial tuna fishing requires access to ports and storage facilities to land the fish, fuel, ice, electronics, maintenance or repair facilities and competent mechanics, meteorological services, transport services, contingent processing plants, and stable markets capable of absorbing the production (van Pel, 1961; SPC, 1962; Powell, 1963).

Those industrialisation prerequisites were deemed “impossible to solve immediately” by the participants of the 1952 SPC Fisheries Conference (SPC, 1952, p. 26). There was no actor in the Pacific Islands detaining enough capital; access to certain resources such as fuel or electronics was expensive because of the distance separating the Pacific Islands from the production centres; their domestic markets were limited as local populations were small and not participating in the market economy. The case of fuel offers an eloquent illustration of the infrastructural difficulties faced by the Pacific Islands to set up a tuna industry. In 1976, a 350-ton pole-and-line vessel would consume about AUS\$ 140,000 per year; a 276-ton longliner about AUS\$ 100,000 and a 1,100-ton purse seiner about AUS\$ 240,000, which exceeded the total annual fuel importations of Pacific Islands like Tuvalu and Niue (Kearney, 1981). These requirements became even more stringent in the 1970s with the oil crisis, which further complicated the capacity of the region to access fuel in sufficient and economical quantities.

More importantly, perhaps, administrators and SPC officers deplored that local populations had little interest and skill in *industrial* offshore fishing, which was effectively at odds with the ontologies, technologies and socio-economic structures of the South Pacific indigenous peoples. They claimed that Pacific Islanders lacked the technical know-how to operate imported vessels and capture tuna fish with these foreign techniques or had little business management expertise. Transposing to Oceanian societies an industrial way of fishing and organising labour was not easy, even though the colonisation had considerably transformed the latter and already trained professional mariners who could have provided accessible recruits for offshore fisheries. Fiji fisheries officer A. Adams observed that externally-led development programmes had failed to take into consideration the specificities of the Pacific Island populations (A. E. Adams, 1968). In New Caledonia, several reports from local fisheries scientists and officers mentioned the lack of “attraction for labour” (in comparison to leisure and subsistence fishing) and of qualification in industrial fishing, concluding that the fishing industry could only develop with professional supervision (Eude, 1970, p. 3; Legand, 1950). According to a Tongan fisheries officer, tuna fishing was also at odds with other forms of labour organisation, necessitating the “full recycling” of the

⁹² I could not find these estimates in US currency. Although the exact dates for these values is not specified, R. Schurmann reported that in that era a purse seiner cost an average US\$12-15 million when new and US\$6-9 million second-hand, with basic daily running costs amounting to US\$8,000-10,000 (Schurman, 1998).

working habits of the existing professional mariners (McGregor, 1987, p. 39). To work on a fishing vessel, mariners would have to adjust their habits away from “regular hours”, “regular and quiet quarter rotations” and other labour frameworks that were incompatible with large-scale and offshore fishing (McGregor, 1987, p. 39).

The exploitation of ‘wild’ tuna resources clashed, to a certain extent, with the Fordism model of industrial organisation that predominated in the 1950s-1960s, characterised by a highly standardised and codified approach to labour to permit mass production while securing a certain form of social stability with the workers (Storper & Scott, 1990).⁹³ Exploiting wildlife went together with adapting labour regulations to permit equally ‘savage’ and flexible working conditions. SPC fisheries officer R. Powell observed that Fijians were seemingly not attracted to the industrial livelihood and the backbreaking, lengthy and dangerous work Japanese fishers did on industrial longliners (Powell, 1967). Given the already well-developed foreign fleets, many regional fisheries experts initially concluded the difficulty of establishing competitive local fishing companies (e.g. see Adams, 1968; Brock, 1968; Kearney, 1979).

2. Foreign-Led and Dominated Industrial Developments in the Pacific Islands

Despite the early interest of Pacific Island colonial administrations in the industrial exploitation and exportation of commercial tuna species, they lacked the financial, material and human means to support these ambitions. Therefore, industrial developments were at first driven by external investments and actors. The emergence of industrial tuna fisheries-related facilities in Pacific Island territories started in the late 1940s with joint ventures between colonial or foreign companies and local actors (private or public ones) and the construction of fishing bases and processing facilities. The creation of these joint ventures permitted the Pacific Islands to enter into direct connection with the distant tuna fishing actors, providing places for “cultural friction” (Tsing, 2011, p. xi) between different customary, colonial and foreign systems and forming situated assemblages geared toward the exploitation and commercialisation of tuna fish.

i. The Creation of the Pago Pago Tuna Cannery in American Samoa

The first milestone in the incremental multiplication of such joint ventures was the establishment of the Pago Pago cannery in American Samoa in 1949. H. Gatty, an American aviator, navigator and writer, had prospected and experimented with fishing in the region. Fiji, at first, appeared as “one of the most favoured territories in the South Pacific” (van Pel, 1954, p. 12), seemingly endowed with tuna fish and

⁹³ Many of my interviewees held similar discourses on the specificities of tuna fishing labour. These perceptions and the practical specificities of the job have had a profound influence on the professional organisation of the sector and on the (de)regulation and management of the offshore fishing workforce in the region (cf. Chapter 7).

the baitfish resources required for pole-and-lining. Acting as a pioneering “frontier entrepreneur” (Fache et al., 2021, p. 62), with the support of the American Rockefeller Foundation, H. Gatty set up the South Seas Marine Products Limited Corporation to operate a pole-and-line fishing fleet based near Suva. He obtained a fishing license from the British Government, which was then administering Fiji and eager to address demographic, employment and food issues in the territory. Contrary to the inshore waters where customary fishing rights applied, offshore spaces and resources had been maintained under the jurisdiction of the British administration. This permitted to bypass any consultation with the indigenous Fijian communities (van Pel, 1954).⁹⁴ H. Gatty planned to exploit Fiji’s tuna resources but chose American Samoa to establish his processing Island Packers Company. Indeed, American Samoa had favourable customs conditions facilitating access to the flourishing and lucrative American market (Gillett, 2006). H. Gatty invested in three tuna fishing vessels from the US and two bait boats, as well as in an additional US-flagged transshipping vessel to move the fish from Fiji to the Pago Pago cannery. However, the fishing operations were not quite up and running. The fishing company rapidly ended up unable to provide steady and abundant supplies of tunas to the canning plant. Experts attributed this failure to the “lack of bait and the scarcity and erratic behaviour of large schools of tuna or skipjacks” (Doumenge, 1966, p. 4). This sentence points to the reliance of this undertaking on non-human entities whose enrolment in such capitalist endeavour turned out highly uncertain and uncontrolled. The fishing company and the cannery ended up being uneconomical because of these catch fluctuations, making the whole segment collapse (van Pel, 1954; Gillett, 2006).

The American Samoan administration, still willing to develop a tuna industry but lacking the credits to do so by itself, agreed with another American company, Van Camp, to lease the Pago Pago facility in 1953. This configuration resulted in a sort of ‘public-private partnership’ permitting to serve the respective interests of both sides. For the US Government, preserving ownership of the facility permitted to prevent the entry of foreign competitors into American Samoa and safeguard its domestic interests. Leasing was also the easiest option to circumvent the local customary land tenure regime, which complicated access to land property for non-locals (Doumenge, 1966). Finally, leasing permitted the administration to condition the exploitation of the cannery by Van Camp to the latter's contribution to local development. This included training Samoans and developing local fishing and processing skills to ‘modernise’ the territory and incorporate the local population into a capitalist economy. In exchange, the Van Camp Company obtained tariff advantages and adaptations in labour regulations from the US administration to access tuna catch provided by foreign fishers (e.g. from Japan, then Korea) and to supply the expanding US domestic market with cheap tuna cans (Doumenge, 1966).⁹⁵ These adaptations

⁹⁴ In Fiji, baitfishing had to occur inshore, where customary fishing rights applied and therefore hindered access to foreign industrial entities.

⁹⁵ These measures permitted to Van Camp Company to operate the cannery successfully but had dramatically negative impacts on the Californian tuna industry that could not produce tuna cans at such a low cost (Finley, 2017). The Pago Pago

offset higher energy or water costs due to the island's remoteness from other supply chains. The successful business of the Van Camp cannery influenced a second American company, Star Kist, to set foot in Pago Pago in 1963, while the Van Camp Company expanded its presence in the region by setting up a pole-and-line fishing base and a freezing plant in Palau the year after.

By the 1960s, although the tunas were caught by foreign fishers and sold to foreign consumers, the tuna industry in American Samoa still employed over six hundred people from the Pacific Islands. Mandated by SPC to provide a comprehensive review of the socio-economic repercussions of the (foreign-led) tuna industry developments in the Pacific Island territories, F. Doumenge estimated that salary benefits from the cannery employments trickled down to about a third of the American Samoan population and permitted the further development of support activities linked to the canning operations (Doumenge, 1966).⁹⁶ However, his estimates also showed how unbalanced the benefits of the operation were, largely privileging foreign and colonial stakeholders. He gauged that in 1962, fishing countries like Japan and Korea had gained about \$2 million each by selling their catch to the Pago Pago canneries. The US had gained over \$9 million from transporting and selling tuna products on the domestic market, selling fuel to fishing vessels, etc. In comparison, the local economy of Samoa only extracted about \$1 million of the revenues deriving from the tuna exploitation. On a sociological level, F. Doumenge reported on the local lack of integration of foreign fishers. Those had very limited contact with Samoan people and saved most of their money for their return home. Fisheries officer W. Wilkinson similarly reported that Korean fishers associated with the Pago Pago fishing base spent very little time on land and returned to their home country as soon as their contract was terminated and that shore-based technicians lived within the industrial facilities rather than in the adjacent urban areas (Wilkinson, 1978b). Additional linguistic, customary, social or work-habit-related differences further hindered their contacts with local societies (Doumenge, 1966). Nevertheless, the industry brought up important mutations for the latter, inducing inner migration flows to the urban centres and transforming familial structures.

ii. The Development of the Fiji Tuna Industry

In Fiji, after the failed attempt of H. Gatty to set-up a pole-and-line fishing fleet, the Fijian administration (still under British control) and the Japanese Ministry of Trade and Commerce resumed the idea of developing the tuna industry in the territory from the late 1950s. Similarly to American Samoa, the local authorities saw the project as an interesting prospect to increase foreign exchange earnings and to address the territorial socio-economic difficulties induced by the deterioration of the

canneries permitted to address the growing domestic demand by benefitting from the exploitation of cheaper tuna and workforce.

⁹⁶ Such calculation, as outlined by F. Doumenge, was difficult to do in an accurate fashion. My point here is not to use these take these data for granted but rather to outline the fact that the economic repercussions of the tuna industry outreach the cannery and branch out through the territory and the population.

copra industry in Levuka, Fiji's former capital (Novaczek et al., 2005; Havice & Campling, 2013). Revitalising Levuka was also important in decongesting Suva, Fiji's present capital city. Again, marine exploitation constituted an appealing outlet against the decline of land-based economies. For the Japanese fishing industry, establishing fishing bases in the region alleviated its reliance on motherships and facilitated the transport of their catch from the South Pacific to Japan. These discussions led to the constitution in 1963 of the (still existing) Pacific Fishing Company Limited (PAFCO), a joint venture associating three dominant Japanese fishing companies and locally-based Australian and British shareholders. However, according to F. Doumenge's findings, the latter's involvement in the company served as a 'dummy company' to facilitate the Japanese introduction to the British administration.

PAFCO served as a transshipment and freezing depot before being complemented with a canning facility in 1970 (Novaczek et al., 2005) to process the catch of Asian longliners on behalf of the US Bumble Bee Seafoods Company. The company contributed to the creation of local employment, although to a much more limited extent than in American Samoa, where the local administration had imposed tighter conditions for involving foreign partners in the territory. Much of the qualified positions (e.g., managing roles) went to expatriates from Japan or Europe, leaving only low-level jobs for the local population. The creation of PAFCO had limited impacts on the Fijian economy in the 1960s, mostly consisting of tariff benefits and thereby constituting an extraterritorial enclave for foreign empires. SPC fisheries officer R. Powell esteemed that "the number of Fijian employees was very limited" and that "so much of the gear, food and materials [were] imported that the small return in revenue [was] at present of some concern to the Government of Fiji" (Powell, 1967, p. 2). In the late 1980s, the Japanese partners decided to leave PAFCO which they deemed unprofitable, showing well that Fiji merely served as a relay to their fishing operation. One founding member of the Fijian tuna industry, still involved in the Fiji fishing industry to date, recalled how detached the Japanese associates were from the territory, contrary to the local stakeholders:

Eventually, the Japanese got tired of PAFCO and gave it to Fiji Government⁹⁷ as it was collapsing. As there were too many jobs on the line, Fiji kept supporting it and regrets this ever since, as PAFCO continues to lose money as most canneries in the world. (Owner of fishing company F., Suva, 17.07.19)

After the departure of the Japanese partners, Fiji Government acquired quasi-full (98%) ownership of the company to save local employment (Barclay & Cartwright, 2008).

iii. Initial Tuna Industry Developments in New Caledonia

In New Caledonia, the introductory developments of the tuna industry were quite similar to those of Fiji, although slower. Initial discussions with various Japanese fishing groups started in 1954 before the

⁹⁷ Fiji by then was an independent country – see Chapter 5.

latter preferred to defer their interests to the adjacent New Hebrides (now Vanuatu) because of its cheaper tariff regulations and greater political stability (Doumenge, 1966). From 1958, however, the intensification of nickel exports toward Japan rekindled the perspective of developing economic exchanges with this country. Once again, the project required the alignment of multiple interests to take shape. The Japanese Tayio-Gyogyo Company had received additional quotas for frozen fish from the Japanese Fisheries Agency and was looking for a fishing base to expand its operations. New Caledonian authorities were interested in welcoming the Japanese company to diversify the territory's economy, which was highly reliant on a then-receding mining sector. Discussions between the parties eventually led to the creation of a local company called "Société l'Océan", based in Noumea, to serve as an intermediary and relay for the Japanese company (Virly, 1996). The project planned for the creation of a cold-storage facility close to Noumea, providing that fishing operations would occur outside the territorial waters of New Caledonia, serve only for exportation (to the US), and prioritise local resources for fuel, food and low-level workforce supplies. Acknowledging the foreign origin of the venture, the New Caledonian administration set out a framework aiming to safeguard its interest in developing the territorial economy. The results remained limited, with only 48 local people recruited and limited tax income. "Financial disagreements" (Virly, 1996) led the operation to cease only a few years after its beginning in 1963. Another attempt to set up a cold storage base with another Japanese company failed again in the late 1970s because local costs were too high.

3. The Failed Capture of Tuna Exploitation Benefits by the Pacific Islands

Similar projects to establish fishing bases, canneries, and other processing facilities emerged in Palau, Vanuatu, French Polynesia, Solomon Islands and Papua New Guinea through the 1950s and 1960s, mostly under the lead of Japanese and American companies (Gillett, 2006). Retracing the specific emergence of the tuna industry for every Pacific Island territory would exceed the scope of this thesis.⁹⁸ Indeed, the inception of each of these ventures was subject to contentious diplomatic negotiations in order to coordinate the many participants at play and accommodate their various interests: governments, fishing companies, transporters, etc. These developments were not, therefore, homogeneous across the South Pacific region.

Despite the situated and non-linear nature of these developments, already visible in the three examples I examined, there were commonalities in this process. In particular, most of these developments were driven by external actors and supported their interests. Although most of the tuna industry-related projects consisted of joint ventures associating foreign and local stakeholders and attempting to articulate various interests, benefits mostly went to foreign or colonial actors. These joint

⁹⁸ Hence, I only focused on the first territory to host such development, i.e. American Samoa, and on Fiji and New Caledonia where I conducted the rest of my fieldwork.

ventures enabled foreign partners to extend their operations to new fishing grounds or profit from cheaper fish and labour compared to industrial nations like the US or Japan. For the colonial administrations of the Pacific Islands, the joint ventures offered an opportunity to ‘tie’ industrial tuna fisheries to their territories and incorporate them in their land planning and economic development strategies in the hope of involving more Pacific Islanders in the sector and “promote new forms of businesses, sources of revenues and employment” (Doumenge, 1966, p. v). Disillusion came rapidly, however, as the joint ventures resulted in isolated and volatile enclaves, operating at bay from local populations and swiftly switching from one territory to another to seek the most appropriate and profitable environmental, economic, political, regulatory and infrastructural conditions. Whether on land or at sea, the tuna fishing industry was distant and elusive, a strategy that permitted to mitigate (but not prevent entirely) frictional encounters with local populations.

This history strongly resonates with other stories of ‘nature’ exploitation by capitalist empires on behalf of ‘development’ considerations. The remote offshore ocean was akin to the ‘empty’ forest or desert in the colonial imagination. Environmental anthropologist A. Tsing, in particular, provided comparable accounts of frontier capitalism and the making of global supply chains in the case of Indonesian timber exploitation or matsutake mushroom commercialisation (Tsing, 2015). The latter bears many resemblances with that of offshore fishes. A. Tsing coincidentally compared it to whale trading as both rely on a ‘wild’, i.e. uncultivated resource resisting the conditions of the mono-specific plantation and contrasting with “stereotypes of factory discipline” (and therefore the possibility for a Fordist-type organisation). Contrary to plantation, offshore fishing draws on the association of multiple species, as evidenced through this chapter by the baitfish or the tuna-dolphin association issues. This results in subjecting the harvesting of tunas to the variabilities of tuna aggregations and presence, entailing much indeterminacy and instability in the exploitation of the offshore world, whose perpetual movement hampers the possibility for control.

These uncertainties did not preclude the possibility for capitalist exploitation to thrive and the tuna supply chain to form. A. Tsing suggests the notion of “patchy capitalism” to describe how capitalism still manages to draw on “unplanned patches” appropriate for and appropriated by the capital (Tsing, 2015, p. 5). The fortuitous conjunction of various entities permitted, through a work of translations, the disassembling and alienation of living fish from the offshore world to convert them into a mobile commodity. This idea helps us understand the spatially and temporally irregular development of industrial tuna fisheries in the South Pacific region. For it to be possible, it required the contingent collaboration of different entities with varied agendas but also technical, financial, human and environmental capitals and the creation of a “machinic assemblage” (Tsing, 2015, p. 5) oriented toward the exploitation, processing and transportation of tuna products. Such assemblage contributed to remoulding the South Pacific oceanic (and terrestrial) spaces, turning offshore waters into ‘pastures’ and

creating ‘micro-territories’ within the Pacific Islands, connected to the leading fishing nations like Japan and the US.

This idea of machinic assemblage hints at its dynamic and possibly ephemeral nature and the power relations that traverse it and make it hold. Hence, in that era, such assemblage was dominated by external actors and capitals, hastily disengaging when the business ceased to be profitable. Their withdrawal would dismantle the productive assemblage only to leave “ruins” (mostly economic at this stage, but possibly ecological too) (Tsing, 2015): the departure of the Japanese fishing companies from the PAFCO joint venture in Fiji, imperilling many local employments and leaving national authorities to salvage those ruins (cf. Chapter 5), is a good illustration of such process.

Conclusion

This chapter retraced the progressive discovery of the distant and ‘neglected’ offshore South Pacific Ocean and its pelagic fish. This process consisted of competing attempts to incorporate offshore environments into a global supply chain extracting and circulating tuna fish from their waters to distant markets. This exploratory stage can be characterised as one of initial ignorance about the exploitative perspectives of these remote marine areas – a stage by which tuna fisheries had not yet been “commercially proven” (Doulman, 1991b, p. 1). Tuna constituted a “speculative” promising commodity (Tsing, 2000) for the Pacific Islands and their colonial governments, envisioned before it could be performed. Although tuna industries had already developed in other oceanic regions, which provided a supportive model, the conquest of the unknown South Pacific offshore ocean was volatile, navigating many ebbs and flows and stumbling over many failures. The historical development of its tuna fisheries shows the difficulties associated with the offshore world’s sustained exploitation and economic profitability. The commercial exploitation of tuna was a risky venture. “Capturing the wealth from tuna” (Barclay & Cartwright, 2008) was an uncertain process, whose organisation was complicated by the lack of available knowledge – on the resource, the market, the labour force, etc. Initial explorations and commercial attempts by the Pacific Islands’ colonial governments combined fishing research and experiments, prefiguring initial ‘scientific’ surveillance efforts oriented toward exploitation concerns. These efforts were relatively scattered, unsystematic and competitive, and primarily driven by external, colonial and foreign, agendas.

The historical debuts of the tuna industry point to a dual understanding of offshore waters’ remoteness. Distant actors like the Japanese fishing fleets took advantage of this distance and fishe(r)s’ mobility to operate freely and unobserved in a virtually unregulated and uncontrolled space. Hinging on capital and oceanic (human and non-human) mobilities and transnational interconnections, these ‘offshoring’ strategies and practices permitted distant states to extend their influence beyond their territorial bounds in an imperial configuration (Havice, 2018). Conversely, the Pacific Island colonial administrations strove yet struggled to reduce this ‘offshoredness’ and connect far-out spaces and tuna

fishing operations to their shores and metropolises. This tension led to complex and ambivalent relations between DWFNs, colonial administrations, business operators, international development organisations, scientists, fishers and South Pacific populations.

In a consultancy report prepared in 1986 for regional fisheries institutions in the South Pacific, two fisheries experts – a fisheries officer from Tonga and a fishery consultant from Canada – stated that “it [was] evident that by the end of the 1970s [...] the exploratory phase of the South Pacific tuna fisheries was drawing to a close” (Fakahau & Shepard, 1986, p. 53). Tuna fisheries were roaring, but the benefits of these ‘developments’ largely escaped the Pacific Island populations and domestic economies. Despite their growing focus on fisheries, tuna fisheries remained outside their knowledge, influence and control. In addition, industrial developments were co-occurring throughout the region, generating mounting competition between the Pacific Islands, eager to attract foreign capital and vessels to serve their territorial economic interests. Concerns for the industry’s durability showed in the mid-1960s, with (foreign) fishers reporting on their declining catch and the necessity to fish increasingly remote fishing grounds (Doumenge, 1966). In his report on the socio-economic consequences of tuna industries in the Pacific Islands, F. Doumenge alerted to the end of this “era when only a few vessels had access to immense spaces and virtually unlimited and virgin fishing grounds” (Doumenge, 1966, p. 97). This prefigured the dawn of a new era, with arising reflections on the legitimacy of foreign nations and fishers to exploit offshore resources, sovereignty over fish resources and the necessity to manage the fisheries. Calls for Pacific Islands to “discipline the fisheries” (Doumenge, 1966, p. 37) and regulate resource use appeared, thereby springing mounting considerations on the need for surveilling, organising and controlling offshore fishing activities, and securing offshore fishing grounds – explored in the following chapter.

CHAPTER 5. Taking Stock of Tunas in a Divided Ocean: (Dis)entangling Surveillances, Science and Management

With this chapter, I now address lengthy yet structural, and perhaps some of the most pivotal, transformations that fundamentally reshaped South Pacific tuna fisheries from the 1970s into the 1990s. Amongst those changes described in Section I were the rise of global sustainability concerns related to the exploitation of marine fish stocks, radical revisions in the legal regime of the sea relating to the United Nations Convention on the Law of the Sea (UNCLOS), and the widespread decolonisation of the Pacific Islands. Ocean spaces were reframed as a resourceful environment necessitating management to guarantee the long-term conservation of tuna resources and their contribution to national development. Coastal states used ‘territory’ as a governing technology to answer this issue. The Pacific Islands attempted to reverse the asymmetrical relationships with the ‘overseas’ fishing nations by asserting sovereign prerogatives over Exclusive Economic Zones (EEZs) to seize ownership of the tuna resources and control their exploitation, thereby interlacing their future with that of tuna populations and their associated fisheries.

Such an attempt to enclose tuna resources by territorialising much of the Western and Central Pacific Ocean (WCPO) led the Pacific Islands to invest in surveillance activities to build their capacities in managing tuna resources and extracting economic benefits from them. Initial surveillance efforts sought to establish tuna fisheries research to understand the resource from a ‘biological’ perspective, i.e. to assess the magnitude and distribution of tuna stocks and evaluate the influence of fishing activities on their populations. Section II explores these endeavours to build ‘scientific’ surveillance and reorganise the pre-existent ‘geography of knowledge’, which had largely positioned the South Pacific region to the margins of tuna fisheries science. The section reassembles the genesis of the first surveillance apparatuses devised to survey and monitor tuna resources that still exist and constitute some of the main surveillance infrastructures of the region’s tuna fisheries (see also Table 1 for a synthetic timeline).

The scale of tuna distributions and the political economy of tunas led actors with conflicting interests to collaborate around shared regional surveillance apparatuses in a context of exacerbated tensions between the Pacific Islands and the Distant Water Fishing Nations (DWFNs). Surveillance data associated with fisheries science rapidly appeared multipotent and usable for competing and even antagonistic purposes. ‘Scientific’ data were inherently political as they could be used to understand tunas’ biology and population dynamics and assess their economic value, price fishing access fees, and control compliance with fishing license requirements that the Pacific Islands were progressively

establishing. This realisation further fuelled tensions between the Pacific Islands and DWFNs and transposed these tensions to conflicts over the control and (non-)sharing of surveillance apparatuses and information resources. Sovereignty issues over tuna resources entailed additional sovereignty issues over data. Section III analyses these tensions and how they were (at least partly) resolved. This era operated an influential “boundary work” (Gieryn, 1983), reliant on discursive, institutional and technical strategies, to demarcate *and* articulate various forms of ‘scientific’, ‘regulatory’ and ‘coercive’ forms of surveillance (understood here heuristically) within and across surveillance apparatuses and their associated information infrastructures.

Table 1: Summary of some key dates and events for the development of the ‘scientific’ surveillance of tuna fisheries in the South Pacific region

DATE	NATIONAL	REGIONAL	GLOBAL
1970	Independence of Fiji		
1971	Start of Papua New Guinea’s national tuna research programme	Creation of the South Pacific Forum (then renamed Pacific Islands Forum - PIF)	
1973			UNCLOS III - Discussions on the Exclusive Economic Zones (EEZs)
1977	Fiji Marine Spaces Act on maritime boundaries and fishing regulations	First tuna tagging campaign under the South Pacific Community (SPC)	
1978	Declaration of New Caledonia’s EEZ and sale of fishing licenses	Creation of a standard logsheet form for the region	
1979		Creation of the Forum Fisheries Agency (FFA)	
1980		Creation of the South Pacific Regional Environment Programme (SPREP)	
1981	Declaration of Fiji's EEZ Fiji started selling fishing licenses and collecting fisheries statistics	Start of the Tuna and Billfish Assessment Programme (TBAP) - collection of fisheries statistics under SPC	
1982			Adoption of the United Nations Convention on the Law of the Sea (UNCLOS)
ca. 1985		Climax of the tensions between SPC and FFA	
1986		Creation of the scientific Standing Committee on Tuna and Billfish with DWFNs	
1987		- Signature of the US Multilateral Treaty - Progressive resuming of the relations between FFA and SPC	
1990	Start of New Caledonia’s port sampling programme	The TBAP becomes the Oceanic Fisheries Programme	
1991	Start of Fiji’s port sampling programme		
1992		Start of the South Pacific Regional Tuna Research Project (SPRTRAMP)	
1995		Creation of SPC-FFA Data Collection Committee to harmonise fisheries forms	
1998	Noumea Agreement: progressive transfer of competences from the French State to New Caledonia		

I. The Fishy Dimension of Offshore Territories and the Political Life of Tunas

This first section describes global and regional environmental and political changes that dramatically impacted the South Pacific region and the framing of tuna fisheries and their surveillance. Growing environmental concerns for fish stocks and mounting competition for fish resources sparked territorial disputes between coastal and fishing states, overlaid by postcolonial tensions. These tensions suffused international negotiations to redefine the international legal regime of the sea. They also reworked the Pacific Islands' relations with tuna fisheries, offshore fishing grounds, and foreign and former colonial powers. This section retraces how the Pacific Islands territorialised the South Pacific Ocean to claim sovereign authority over tunas and the political resistance of fishing countries like the US. Finally, the section explains how this novel context re-problematized the Pacific Islands' surveillance needs to manage tuna resources within their newly claimed marine territories – starting with the need of assessing the extent and distribution of the resource.

1. Booming Fisheries: Reaching the Limit?

i. The Ocean as a New Environmental Problem

By the 1970s, against the boom of commercial fisheries and the continuous increase of fishing efforts, new discourses consolidated to question the pervasive conceptualisation of the world oceans as a limitless and enduring food reservoir for humankind. A series of environmental disasters, mostly caused by industrial activities, ignited a new regime of reflexivity regarding the impact of human activities on the oceans in localised scientific, civil and political spheres (Locher, 2019). Oil spills, mercury contamination of the Minamata Bay in Japan⁹⁹, and mounting public mobilisations against whale fishing and for the protection of marine mammals sparked environmental considerations regarding the health and management of the world oceans (Locher, 2018), mainly in a sectoral fashion. Those reached global arenas, resulting in various intergovernmental conferences¹⁰⁰ to coordinate globally and regionally in ocean management. Oceanic environments were portrayed as a common, better managed collectively than at the individual state level – a stance that would be highly discussed in the South Pacific region (as well as beyond).

⁹⁹ The mercury pollution of the Minamata Bay by a local chemical factory is a famous milestone in environmental health, which eventually led to the adoption of the Minamata Convention to curb human-induced mercury pollution. The mercury pollution affected marine ecosystems and, because of that, fish-eating people. Mercury content in fish food is still a strong preoccupation in the South Pacific region today, especially regarding apex predators like tuna that bio accumulate mercury in their bodies.

¹⁰⁰ These considerations suffused UNCLOS negotiations but also led to the 1972 United Nations Conference on the Human Environment in Stockholm for instance or the creation of the Regional Seas Programme of the United Nations Environment Programme (UNEP).

These considerations perspired to lower-level arenas, as attested by the apparition of related reports and discussions on marine pollution, marine resource conservation and marine reserves in the South Pacific Community (SPC)'s archives, first concerning coastal ecosystems.¹⁰¹ This evolution eventually resulted in the institutionalisation of environmental matters with the South Pacific Regional Environment Programme (SPREP) (Venkatesh et al., 1983). SPREP assisted the Pacific Islands with developing environmental legislation to prevent and manage oil pollution before its mandate widened to nature conservation, partially overlapping with fisheries considerations (cf. section III.2 of this chapter). International environmental NGOs also became more active in the region, with the arrival of the International Union for the Conservation of Nature (IUCN) and the World Wildlife Fund¹⁰² (WWF) in Fiji in 1979 and 1980 respectively, to promote nature conservation and provide technical assistance to the region (Riera, 2022).

These environmental considerations took place within a wider shift in nature conservation policies. The understanding of nature conservation progressively moved away from a preservationist stance toward a utilitarian approach centred on the (re)conciliation of nature protection with exploitation and of conservation with economic development, resulting in the formalisation of the concept of 'sustainable development' in the 1980s (Aubertin et al., 2008).¹⁰³ This shift also aimed to support a more participatory approach to managing not 'nature' but 'natural resources'.

This environmental regime also affected the fisheries sector. The longstanding "food from the sea myth" (Locher, 2020, p. 191), i.e. the representation of the oceans as a well of inexhaustible fish resources, had only recently started to be debunked. Only in the 1930s did the fairly young field of fishery science provide scientific proof that large marine fish stocks could be overfished and that fisheries may require some form of regulatory management after all (Finley, 2009; Rozwadowski, 2005). Transformations in fisheries management were even slower to occur. However, the sudden collapse of ancient, productive and lucrative fisheries between the 1960s and 1980s, such as the North West Atlantic cod, the Norwegian herring or the anchovy off the Peruvian coast, further flared up those considerations (Hilborn & Sibert, 1985; Finley, 2011; Locher, 2020). Closer to the South Pacific region, the Gulf of Thailand and the Southeast Asian Sea were also showing worrying signs of overexploitation following the expansion of Thailand in the global fish food supply chain (Finley, 2017). Observing growing overcapacity in commercial and industrial fisheries, certain fisheries managers and scientists alerted against a looming global fisheries crisis. Neo-Malthusian thinkers, in the wake of G. Hardin's

¹⁰¹ Note however that Australia created what is often considered as the first large-scale MPA with its Great Barrier Reef Marine Park in 1975 (Bambridge & D'Arcy, 2014), which now spans over 340,000 km² of marine waters.

¹⁰² Now renamed the World Wide Fund for Nature

¹⁰³ This notion covers the management of human activities and of their impacts on the biosphere so that current generations can take up the *most* benefits of living resources in a sustainable fashion, without hampering the needs or "aspirations" of future generations. These orientations in environmental policies were largely codified in the 1980 World Conservation Strategy of IUCN, WWF and UNEP's Brundtland report (e.g. see Chartier, 2004).

theorisation of the “Tragedy of the Commons” in 1968, extrapolated from these localised events and global catch statistics that fishing was nearing its global limit and blamed the free and open access regime to fish resources as the leading cause for overfishing (Locher, 2020).

ii. Intergovernmental Governance and Science-Based Management of Fisheries

These concerns laid the groundwork for new forms of ‘modern’ management and governance, promoting the creation of international science-based management agencies to regulate high-seas fishing activities and prevent fish stock depletion collectively. These approaches propagated through various oceanic regions while arousing longstanding scientific and political controversies on their relevance. Nascent intergovernmental techno-scientific and management bodies devoted to the conservation and ‘rational’ exploitation of marine fisheries appeared. In 1902, the International Council for the Exploration of the Sea (ICES) met for the first time to coordinate fisheries scientific research and analyse *inter alia* fisheries statistics to understand catch fluctuations in the cod, plaice and herring fisheries of the North Sea and North Atlantic waters (Rozwadowski, 2003). Organisations more explicitly devoted to fisheries management emerged in 1923, with the International Pacific Halibut Commission allowing Canada and the US to collaborate in assessing and preserving the stocks of the Pacific Halibut fishery. This trend would only intensify after World War II. Reflecting a utilitarian understanding of conservation, fisheries science and management consolidated around the Maximum Sustainable Yield (MSY) concept (e.g. see Maunder, 2008), which promised to balance fisheries’ development and fish stocks’ conservation. This science-based target, inspired by the philosophy of forestry science and portraying the oceans as a harvestable crop, aims for the maximum possible extraction of fish by considering fish populations’ renewal (Finley, 2009; Drakopoulos, 2019).¹⁰⁴

The institutionalisation of inter-state cooperation also applied to the mobile tuna fish. In some regions like the Eastern Pacific and the Atlantic, the intensification of tuna fishing capacity from the 1950s nurtured novel considerations on the need to oversee fishing efforts. Initially, tuna fisheries organisations had limited authority; their role was narrowed down to ‘scientific’ purposes, with science portrayed as an apolitical field of activity that could facilitate inter-state cooperation despite fishing competition. The Inter-American Tropical Tuna Commission (IATTC) was the first to emerge in 1949 after the US and Costa Rica agreed to cooperate in “the gathering and interpretation of *factual information*” on the Eastern Pacific tuna fisheries.¹⁰⁵ The 1949 IATTC Convention recognised the “mutual interest” of the two countries in “maintaining the populations of yellowfin and skipjack tuna and of other kinds of fish taken by tuna fishing vessels”, and in “maintaining the populations of these fishes at a level which will permit maximum sustained catches year after year” (Convention for the

¹⁰⁴ The MSY also served the political interests of the US in a Cold War context to maintain access to the world-oceans – see below.

¹⁰⁵ <https://www.iattc.org/en-US/About/Role> (accessed: 16.12.22, my emphasis).

Establishment of an Inter-American Tropical Tuna Commission, 1949, p. 1). Similarly, the International Commission for the Conservation of Atlantic Tunas (ICCAT) came into force in 1969 to study the populations of tuna and tuna-like fish in the Atlantic Ocean. The Indo-Pacific Fishery Council (IPFC) and the Indian Ocean Fishery Commission (IOFC) were set up within the Food and Agriculture Organisation (FAO) in 1948 and 1967 to oversee studies and information exchanges in the Indian Ocean.¹⁰⁶

These organisations bore distinct governance schemes derived from their specific trajectories. IATTC comprised a permanent research team devoted to collecting and managing fisheries data. In the case of ICCAT, such activity remained the prerogative of each Member State. IOFC and IPFC were more informal, relying on *ad hoc* groups of experts and drawing on general reviews to conduct stock assessments (Joseph, 1977). Despite these variations (which I will study in more depth for the South Pacific region), I am especially interested in their common responsibility to organise the production, dissemination and utilisation of tuna fisheries information and their involvement in the ‘scientific’ surveillance of tuna stocks. These organisations initially served and were limited to scientific collaboration before evolving into management organisations *per se* (cf. Chapter 6).

This intergovernmental approach to information collection and exchange on tuna fisheries was not without turmoil. Establishing such commissions fuelled many governance disputes between countries, especially through the 1970s-1990s era and in the case of the South Pacific region. The high mobility of pelagic fish like tunas arguably made them stand out from other oceanic resources – an argument that would become instrumental in arguing for or against the necessity of international cooperation in fisheries management and for or against the possibility for states to claim sovereignty over these resources.

2. In Need of Tuna Stock Assessment Studies

i. The ‘Virgin’ Skipjack Tuna Stock - a New Champion of the Pacific Islands’ Economic Development

Tuna overexploitation concerns came after in the South Pacific than other oceanic regions, mostly because of the later development of its tuna fisheries. Nevertheless, the global context and arising regional trends fed analogous reflections. The notions of stock assessment and conservation became more prevalent in the 1970s and folded into fisheries development objectives.

In 1975, SPC published a report from the Japanese National Marine Fisheries Service analysing that tropical tuna and billfish catch were stalling despite growing fishing effort and innovations, leading the

¹⁰⁶ Several of these management bodies have then evolved and been reshaped over time. IATTC and ICCAT still exist to date, the Indian Ocean Tuna Commission and the Commission for the Conservation of Southern Bluefin Tuna appeared in 1993, and the Western and Central Pacific Fisheries Commission in 2004.

authors to presume that “either a downward trend had started or that a maximum level of harvest had been reached” (Otsu, 1975, p. 30). The Japanese Fisheries Service’s fisheries statistics showed that “it would appear that the production of larger tunas and billfishes ha[d] attained its limit”, inducing “an urgent need to manage the resources in order that they can be properly utilised” (Otsu, 1975, p. 32). Various reports similarly refer to a longline fishery economic and environmental crisis induced by the diminution of the resource, overcapitalisation, tuna mercury contamination and fuel crisis (e.g. R. H. Baird, 1974). Longlining at that time became so uneconomical that “approximately half of the world’s longline fleet was tied up in 1975” (Kearney, 1976b, p. 15). At SPC’s Ninth Regional Technical Meeting on Fisheries (RTMF) reuniting Pacific Islands fisheries officers, participants observed that the tuna longline fishery was overcapitalised and had overpassed the MSY (SPC, 1977). US fisheries expert R. Shomura declared to the participants that albacore, bigeye, yellowfin and bluefin tunas in the tropical Pacific were nearing the exhaustion threshold (SPC, 1974a).

In that context, another tuna species, skipjack tuna, triggered commercial interests and helped displace the ‘offshore frontier’ once again. The 1970 decade saw a dramatic inflation in skipjack catch, initiated by the Japanese pole-and-line fishing fleet and accentuated by the expansion of the purse seine fishery (cf. Chapter 4). Between 1970 and 1973, skipjack catch estimates escalated from about 250,000 tons to 400,000 tons (SPC, 1975b), signalling a new ‘boom cycle’ for the tuna fishing industry. The scramble for skipjack tuna invigorated the aspirations of the Pacific Islands to develop an ‘offshore economy’.

In 1970, SPC’s Fourth RTMF acknowledged that “the skipjack reserves of the Western and Central Pacific constitute the last, large and *unexploited* tuna resource and that they will not escape the greed of other tuna fishers in the region” (SPC, 1970a, p. 19, my emphasis). Skipjack tuna stocks seemed relatively ‘virgin’ as their exploitation had been more recent. This time, however, the sense of urgency amongst Pacific Islands was more palpable: foreign fishers were no longer an offshore presence signalling an uncertain, promising and unlimited source of wealth, as described in Chapter 4, but now embodied ‘greedy’ and more advanced competitors in the race for these offshore resources. The 1970 RTMF urged “governments and territories to ensure that the resources would not be overexploited” and advised them to more accurately take stock of the skipjack resource (SPC, 1970a, p. 19). The meeting also encouraged the Pacific Islands to “initiate skipjack fisheries or expand existing ones”, considering that “skipjack tuna is probably the most important fish species involved in the future developmental plans of many islands and communities of the Pacific Ocean” (SPC, 1973, p. 31). Even though they acknowledged that Japanese and US fishers would likely retain a leading role in the skipjack fishery, the Pacific Islands asserted a stronger sense of concern and responsibility for skipjack’s exploitation and sustainable management.

Certain Pacific Islands readily developed a domestic skipjack fishing industry, hoping to appropriate benefits more successfully than in the previous era. Against the pending independence of Papua New Guinea in 1970, the locally-based Australian administration turned to skipjack as the main path to Papua New Guinea's economic autonomy. Already existent joint ventures involving Japanese skipjack pole-and-liners fuelled the conviction that skipjack represented a new and even the "only known avenue for economic self-sufficiency" (Kearney, 1982, p. 3). This statement came from R. Kearney, an Australian fisheries biologist recruited under a fisheries development programme for the territory. The programme included an exploratory project on tuna fisheries and aimed to intensify skipjack research. Little was known about skipjack tunas then, especially regarding their distribution, the magnitude of their populations, and their ability to stand ever-increasing fishing efforts. Like other tuna species, skipjack constituted a "speculative commodity" (Tsing, 2009). It was the least familiar of the tuna species caught at a commercial level in the region:

There were at the time no estimates of the distribution of the skipjack resources throughout the region, or even of the magnitude of the total resource and its ability to support sustainable catches. Island states therefore had *inadequate technical information* on which to base development alternatives or from which to formulate management strategies [...]. (Kearney, 1982, p. 3, my emphasis)

This quotation illustrates two important things: an emerging interest in the formulation of proper management strategies and the premise that such management would require specific 'technical information', first permitting the assessment of skipjack stocks. The Expert Committee on Tropical Skipjack, a working party created at the demand of SPC's members, identified that barriers to skipjack fisheries development in the Pacific Islands partly derived from the lack of information regarding the extent of the resource and the catch made by foreign fishers at the territorial scale (SPC, 1974a). Ongoing concerns for the management of tuna fisheries and the uncertain potential of skipjack tuna stocks bolstered the will to develop and organise the collection of fisheries information.

ii. **The Problematisation of Tuna Fisheries and their Surveillance by the Pacific Islands**

Conserving skipjack tuna while developing associated fisheries could not only rely on skipjack stock assessment. Live baitfish stocks were central to the functioning of a pole-and-line industry, thereby making the management of such a multispecies fishery all the more complex (Former SPC fisheries development officer, Noumea, 07.05.21). This concern was particularly salient in Fiji, which devoted much effort to assessing its baitfish stocks and to improving associated fishing and handling techniques, in order to support its domestic pole-and-line industry.¹⁰⁷ Innovations in fishing techniques also elicited

¹⁰⁷ At first, the interest of fisheries managers and scientists for baitfish stocks aimed to ensure that pole-and-line fishing vessels would have enough baitfish to catch tunas. Later on, with the development of the pole-and-line fishery and the stronger pressure put on baitfish resources, the problem was partly reframed to consider the impact of the pole-and-line and baitfish

new questions regarding fisheries' impacts on tuna resources. SPC stated that deep longlining "was the most revolutionary change that longline fishing had known in the last twenty-five years" and that it was "urgent to assess its impact" (Expert Committee on Tropical Skipjack, 1980, p. 2) and exposed similar considerations for purse seining. In the late 1980s, the dramatic expansion of troll and gillnet fishing also sparked much concern throughout the South Pacific (Hampton et al., 1989). This led SPC to command a consultation on the matter, which again "noted the paucity of information available on the surface fishery for albacore, and in particular on the likely level of interaction among the troll, gillnet and longline fisheries", and to endorse a proposal for data collection (Hampton et al., 1989, p. 2).

These reflections hint at a final and sprouting concern illustrating the growing and diversifying competition for tuna fish: the possible interactions between the various fisheries in development (SPC, 1983c). The purse seine industry, interested in skipjack, also catches yellowfin and bigeye tunas – targeted by the longline fishery. Given that longliners catch higher-value yellowfin tunas, such interaction could be "harmful to the economy" of this fishery (Tuna and Billfish Assessment Programme, 1985, p. 2). In addition, the higher tuna catch of purse seiners tended to drive down tuna prices on the markets. Concerns were also present at the territorial level. The case of Fiji, which at that time had one of the most developed tuna fisheries in the region, is illustrative. It was unclear how its skipjack fishing vessels could interact with "those in the waters of Fiji's neighbours or beyond" (Kearney, 1984, p. 1). The development of offshore fishing activities also sparked tensions within the territory's waters. By the late 1980s, Fiji had various offshore fisheries, including longliners, pole-and-line vessels, occasional purse seiners, an artisanal troll fishery and a "small but growing" game boat fleet associated with the tourism industry (SPC, 1991, p. 7). T. Adams, then director of Fiji's Fisheries Division, reported:

All sectors of the pelagic fishery [were] becoming increasingly vocal over the possibilities of interaction effects. Game fishermen complain about billfish catches by domestic longliners, domestic longliners complain about the discards by Taiwanese longliners [...], and pole-and-line fishermen worry about the potential interaction from proposed increases in purse seining (SPC, 1991, p. 7)

The potential impact of industrial tuna fisheries on artisanal and local fisheries initiated great worry in the Pacific Island Governments from the 1980s. Finally, although at a much more moderate level, questions regarding the "impact on the environment of fisheries working on the high seas" and the "ecological effects of harvesting tunas" started to appear, in link with the creation of SPREP and the arrival of environmental NGOs (Gulland, 1981, p. 6). For instance, Greenpeace set up a regional office in Fiji in 1993 and advocated for high-seas conservation, mitigating the impact of tuna fisheries on oceanic biodiversity and banning driftnet fishing (Riera, 2022).

fishery on local coastal communities who would also rely on those fish. This issue progressively dwindled because of the development of the purse seine fishery and the subsequent decline of the pole-and-line one.

From the 1970s, the expansion and complexification of tuna fisheries in the South Pacific region under the arrival and uncertain interactions of new fishing techniques and target species largely permeated management and conservation considerations. These fostered the need for and framed a ‘regulatory’ form of surveillance, consisting of collecting information to support management decision-making.

3. Geopolitical Reordering in the South Pacific Ocean: Sovereign Claims over Offshore Spaces and Fish

An in-depth understanding of the transformations affecting South Pacific tuna fisheries and the need for their research and management could not be complete without looking into the wider, yet entirely intertwined, evolutions in international law and the rights and duties of nation-states at sea. Ascending and competitive territorial claims at sea propelled the redefinition of state marine jurisdictions and their codification in UNCLOS. Writing about the ‘political life’ of fish (and tunas in particular) and the associated reterritorialisation of South Pacific marine spaces from the 1970s necessitates that I first move back in time and to other waters. As historian of science C. Finley argued in her vast account of commercial fisheries expansion across the globe, fish were never just about fish. They also served as a medium for nation-states to expand their sovereignty at sea and claim marine spaces in novel ways (Finley, 2017). The search for and claim over distant and extra-territorial fishing grounds entangled with sovereign projections *beyond* the three nautical mile-wide territorial waters, opening several decades of contention between nations states regarding state jurisdictions at sea. Regional and global transformations shall not be understood separately: international legal negotiations greatly transformed the South Pacific region, whereas the South Pacific context reciprocally weighed in on the negotiations and compromises established with UNCLOS.

i. The Law of the Sea Revisited

The development of commercial fisheries throughout the 20th century went hand in hand with a series of unilateral claims by states to expand their sovereign territory over marine spaces, in large part to secure fish stocks against the increased competition of foreign fishers. In the customary regime of the law of the Sea, the oceans were divided in a binary fashion into ‘territorial’ and ‘high seas’. In their territorial waters, coastal states had full control of marine resources, implying that they could prohibit foreign fishing activity and monopolise fish resources (Oda, 1983). Resources in the high seas, on the contrary, were left open access. In 1935, Norway unilaterally established a decree to extend its jurisdiction over an additional nautical mile to counter the expansion of British fishers. This claim was the first to obtain formal legal recognition by the International Court of Justice, which acknowledged that spatial enclosure could serve as a tool to protect local fish (Finley, 2017).

In 1945, the US issued the ‘Truman Proclamations’, a decisive turning point in this reterritorialisation process (Scharf, 2013). The first proclamation permitted US President H. Truman to assert – once again unilaterally – US jurisdiction over the natural resources of its contiguous continental shelf under the argument that this geological feature only prolonged the US terrestrial territory into the sea. The second proclamation stated that the US Government could establish ‘fishery conservation zones’ in the high seas adjacent to its territorial waters, where it could regulate and control fishing activities for the alleged conservation and protection of fish resources (Alexander, 1982; Drakopoulos, 2019). Such a move strategically met the interests of US coastal fishers in repelling the Japanese and Russian fishing industries from the Bristol Bay (Alaska) salmon fishery (Finley, 2017). However, the proclamation simultaneously bore detrimental consequences on other US maritime sectors that were more reliant on the freedom of the high seas. The distant tuna fishing industry and the military worried that the proclamations would open the way to the ‘creeping jurisdiction’ of other countries and threatened their ability to access distant waters – which it effectively did (Caron & Scheiber, 2004).

Indeed, the Truman Proclamations prompted other unilateral claims of various breadths, starting with Mexico a few months later. In 1952, Chile, Ecuador and Peru came together under the ‘Santiago Declaration’. With this Declaration, they announced their sovereign rights over the continental shelf *and* their 200 nm-contiguous waters and their joint intent to strengthen fisheries management and control the passage of foreign fishing and whaling vessels to protect their baitfish stocks (Finley, 2017). In 1975, Ecuador seized, fined and confiscated the catch of seven US tuna boats fishing by its coasts (Caron & Scheiber, 2004). These territorial claims, especially those of the Latin American countries bordering the Pacific Ocean, threatened US fishers’ access to the Eastern Pacific tuna and baitfish fishing grounds.¹⁰⁸ Disputes grew between industrial fishing nations, generally attempting to uphold the freedom of the seas and preserve their reticular empire, and coastal states advancing their ‘special interest’ and higher legitimacy in managing adjacent fish resources.

These territorial conflicts led the United Nations to launch a series of meetings. At stake were not just the marine spaces but also the fish within. In 1958, the United Nations held the first multilateral conference on the Law of the Sea (UNCLOS I) to discuss territorial issues at sea *and* the harvesting and conservation of living resources in the high seas.¹⁰⁹ This conference led to the adoption of several treaties¹¹⁰ which enshrined the concept of MSY as the main fisheries management target. The conference also set forth the ‘special interest’ of coastal states in living resources in areas adjacent to their territorial

¹⁰⁸ As mentioned in Chapter 4, the complicated access to baitfish for US baitfishing vessels largely contributed to fostering the expansion of the US purse seine fleet that could fish for tunas without having to access the inshore waters of Latin American countries.

¹⁰⁹ Rising interests in the mineral resources of the seabed also pervaded the negotiations. However, other topics such as shipping or safety for instance were not addressed by the Conference (and had already been covered by other international discussions and conventions). Hence, the Conference mostly affected the fishing and oil industries (Jessup, 1959).

¹¹⁰ Namely the Convention on the Territorial Sea and Contiguous Zone, the Convention on the Continental Shelf, the Convention on the High Seas, and the Convention on Fishing and Conservation of Living Resources in the High Seas.

waters. These treaties gave coastal states more regulatory power in the high seas adjacent to their coasts to support fish stock conservation.¹¹¹ Spatial proximity rather than effective use of marine spaces and their resources legitimated state authority over the marine environment.

Historical research on the MSY concept by N. Oreskes and C. Finley mitigated the jurisdictional power UNCLOS I effectively granted to coastal states (Finley & Oreskes, 2013). The MSY concept, portrayed as a ‘technical’ (read: ‘apolitical’) fisheries management instrument and the complementary principle that “conservation measures should be applied when scientific evidence shows that fishing activity adversely affects the magnitude and composition of the resources” permitted the US to advance its political agenda and dispute the territorial claims laid by Latin American countries (Oreskes & Finley, 2007, p. 5). This requirement that scientific evidence of the adverse impacts of fishing must be advanced to justify conservation measures placed the burden of proof on coastal countries, most of which did not have the needed capacity for this task at that time – and were, therefore, unable to establish such fisheries management measures in their adjacent waters. MSY, lacking scientific soundness, only served as a “policy disguised in science”, ensuring that fisheries-related international rules would fit US interests, in particular with regard to the Pacific Ocean (Finley & Oreskes, 2013, p. 1).

UNCLOS I failed to end fisheries and territorial disputes (Bishop, 1962), which continued through the 1960s as the scramble for marine resources and spaces intensified and caused another succession of territorial claims. In 1973, another conference relaunched the negotiations to examine the high seas regime, states’ rights and duties concerning fisheries resources (Lodge, 1991), and the projected exploitation of seabed resources (Alexander, 1982). By then, the realisation that overfishing was occurring and that existing fisheries management systems were ineffective had spread. ‘Developing’ nations (amongst which the Pacific Islands) were expressing growing frustrations, struggling to set up domestic fisheries and yet witnessing the propagation of Japanese, US, Soviet and European fleets fishing closer to their coasts. Throughout the negotiations, tensions between fishing and coastal states particularly touched upon highly mobile fish like tunas that would not stay ‘within’ the human-mapped boundaries in the making. Although marine fish and spaces were tightly linked, they were not equivalent. Particularly contentious was the issue of determining whether extended spatial jurisdiction should also imply extended national jurisdiction and rule-making capacity over these mobile fish – i.e. whether a ‘classical’ territorial approach granting sovereign authority over a (fish) population contained in a bounded space would effectively enable the conservation of tuna stocks.

Coastal states claimed their sovereign jurisdictions and ‘special interest’ over offshore fish and, therefore, over the activity of fishing vessels. Fishing nations such as Japan and the US refuted such arguments under the premise that ‘highly migratory’ fish like tunas, because they were transboundary,

¹¹¹ The Treaty in particular entitled coastal states to partake with other fishing states in prescribing conservation measures for offshore fisheries regardless of whether or not these coastal states fish beyond their national jurisdictions (Oda, 1983, p. 198).

could not be managed unilaterally at the national level. Rather, they asserted that tuna fish should be managed internationally, requiring coastal states to cooperate with fishing ones and permitting the latter to retain their influence in tuna fisheries governance. Interested in maintaining the seas open to its fishing and military vessels, the US heavily leveraged tuna fish's 'highly migratory' behaviour to contest the sovereign enclosure of the oceans. However, the US was torn between its dual status as a coastal state and a DWFN and between the divided interests of its inshore and offshore fishers. This tension largely pervaded its policies and strategies in UNCLOS negotiations to reconcile its domestic territorial considerations with its reticular imperial interests. It led the US to pursue a 'conventional' territorialisation strategy by enlarging its jurisdiction over its adjacent waters while promoting "more-than-territorial" (Havice, 2018, p. 1282) and non-sovereign approaches regarding the specific case of tuna fish to resist their sovereign appropriation by other states. These approaches consisted in shifting the scale of tuna fisheries governance from the territorial state to a regional and multilateral governance (Havice, 2018). In 1976, the US Government passed the Magnuson Stevens Fishery Conservation and Management Act, which extended the US exclusive fisheries zone to 200 nm. At the same time, it refused to recognise coastal state jurisdiction over highly migratory fish species *unless* the coastal states cooperated with the fishing nations to manage these transboundary resources (Doulman, 1990d). With that strategy, the US could 'extract' tuna fish from marine spaces and their associated territorialising endeavours while ensuring the protection of its coastal fishers. In complement, the Fishermen's Protective Act permitted the US to authorise trade and aid sanctions against countries arresting US vessels fishing by their coastal waters – another tool to resist the territorialisation endeavours of other states (Finley, 2017). The US retained similar strategies during UNCLOS negotiations. The country progressively agreed on the concept of the 200-nm-wide EEZ. However, regarding fisheries, it suggested a species-based approach to remove 'highly migratory species' like tunas from these zone-based regulations and institute their international management even *within* EEZs (Caron & Scheiber, 2004). The proposal did not pass as such, but it attests to the US's attempt to discombobulate the relation between territory and sovereignty in the case of tuna fish.

UNCLOS negotiations lasted until 1982. The Convention established a compromise between the positions of coastal and fishing states and permitted the codification of what was already becoming customary law. However, the new legal regime was only slowly and partially accepted. It would take a decade for the treaty to come into force and be enforced, and influential countries like the US today still refuse to ratify it. The first signatories were mostly postcolonial countries, showing the agreement to be driven "by the spirit of decolonisation" (Ryan, 2022, p. 5). The new convention striated the oceans into various zones with declining degrees of state sovereignty as the distance from the shore increased. Hence, UNCLOS reworked the notion of territory at sea by creating new legal territorial units with limited state sovereignty, particularly in the case of the EEZ (see also Chapter 6).

UNCLOS additionally framed fundamental principles to the conservation and management of living resources, requesting that allowable catch and conservation measures relied on the best scientific evidence available to reach the maximum sustainable yield, while considering the impact of fishing activities on bycatch species. To that end, the convention enjoined States to contribute and exchange through competent international fisheries organisations “available scientific information, catch and fishing effort statistics, and other data relevant to the conservation of fish stocks” (art. 61-5), thereby linking conservation and management purposes with some form of (‘scientific’) surveillance activity and formalising the need for fisheries data.

Under UNCLOS, fish became state property when located within 12 nm from the shore. In the EEZ, coastal States obtained sovereign rights to explore, exploit, conserve and manage natural resources. Importantly, however, these sovereign rights were limited by the requirement that States shall “fully utilise” these resources and “produce the maximum sustainable yield as qualified by relevant environmental and economic factors” (art. 62). The Convention requested that, “where the coastal state does not have the capacity to harvest the entire allowable catch, it shall, through agreement or other arrangements [...], give other States access to the surplus of the allowable catch” (art. 62). The territorialisation of the sea was not to impede on its exploitation. This latter provision pushed coastal countries into concluding fishing access agreements and further cemented the utilitarian ties between fisheries conservation and the economic exploitation of the sea. Waters beyond the EEZs remained open waters. There, ‘freedom of fishing’ prevailed, although it could be restricted on behalf of the conservation and management of the living resources.

However, UNCLOS left room for interpretative conflicts between coastal and fishing states regarding the management of straddling and highly migratory fish. The capacity of coastal states to expand their rights beyond their EEZs remained unclear (Lodge, 1991a). The convention required international and regional cooperation in their conservation and management but did not specify how such cooperation should be made operational – and therefore how authority conflicts should be resolved – and if such cooperation should apply to the EEZ waters as well (Caron & Scheiber, 2004). Contentious interpretations of these provisions became particularly stringent in the South Pacific region, particularly between the Pacific Islands and the US.

ii. **Decolonisation and Sovereign Affirmation over the South Pacific Ocean and its Fishes**

Returning to the South Pacific region, the positioning of the Pacific Islands regarding the redefinition of the Law of the Sea reflected the divide between ‘developing’ coastal states and industrialised DWFNs. The decolonisation process that many of the Pacific Islands underwent concomitantly to the negotiations intensified their interests in augmenting their authority over oceanic fish like tunas. Samoa was first to proclaim its independence in 1962 and was then followed by many other Pacific Islands, including Fiji

in 1970. Those that did not become fully independent gained more autonomy nonetheless. In New Caledonia, growing protests regarding the independence of the territory led to various revisions in its status and its relations with the metropole, especially throughout the 1980s, leading to an increased autonomy of the territory and the progressive transfer of powers to its Government.¹¹²

This political change greatly transformed inter-state relations, at a time when the Cold War still structured much of the international order. From the 1970s, given the setback of metropolitan powers over the South Pacific region, other countries like the Soviet Union, Japan or China started approaching Pacific Islands (e.g. Tonga, Fiji or Western Samoa) to establish bilateral ties, through diplomatic visits and fisheries-related undertakings. Fishing and diplomacy were interlaced: for instance, Japan conditioned its bilateral aid and development assistance to fishing ground access (Doulman, 1990). Against the possible arrival of the Soviet Union, Australia, New Zealand, France, and the US adapted their strategies to build up their relations with the Pacific Islands countries (cf. Chapter 6).

With sovereignty came the ambition of these newly constituted states to build their political and economic independence (Havice, 2018). Marine resources profiled a means to “replicate the success of the Organisation of Petroleum Exporting Countries, who had reversed the colonial order of wealth extraction by extending sovereign rights over natural resources and garnering resource rents from wealthy resource-importing countries” (Barclay, 2014, p. 163). The ongoing, global, transformations in the Law of the Sea, combined with this decolonisation process, heightened the focus of Pacific Island governments on offshore waters and fish. The economic perspectives of offshore resources preceded this era, as shown in Chapter 4, but were now overlaid with wider political considerations. Tunas not only represented an avenue for economic development but also for sovereign affirmation.

As soon as UNCLOS III started, the newly independent Pacific Islands expressed their interest in creating their EEZs with the 1976 Nauru Declaration and required more information on the impacts of “such decision on fisheries management and fishing rights” (SPC, 1975a). Such information was largely provided by SPC fisheries experts, including R. Kearney who had left the Papua New Guinean fisheries administration to raise money for a regional scientific programme to assess skipjack stocks (see below). In the experts’ efforts to sell the project to the Pacific Islands leaders, he and his team were amongst the first to produce a series of maps and reports to help the political leaders better fathom and *visualise* their potential marine territories and understand UNCLOS requirements on living marine resources. The first recruit of this programme, R. Gillett, drew 200-mile circles around the islands and produced a map that

¹¹² An indigenous nationalist movement emerged in the 1970s to claim for Kanak independence and sovereignty. The opposition of the metropolitan government and local communities descending from French colonialists led to violent altercations called ‘Les Événements’ and the signature of the 1988 Matignon Agreements, with measures deemed beneficial to the Kanak people. In 1998, the Noumea Agreement prolonged a ‘negotiated’ decolonisation process. It organised a progressive transfer of competences from the French State to New Caledonia and planned for the organisation of a series of referendums in the territory to arbitrate the transfer of the remaining sovereign powers. These referendums happened between 2018 and 2021. Although these referendums did not lead to proclaiming the sovereign independence of New Caledonia, they opened new (and unsettled, to date) negotiations regarding the status of the territory (David & Tirard, 2022).

tellingly showed “what we were dealing with” (SPC fisheries officer Y. from that era, Australia, 23.02.21), i.e. how UNCLOS could suddenly enclose much of the Pacific Ocean to the benefit of the Pacific Islands (see Figure 11). Admittedly, the draft contained “a few arbitrary decisions” (SPC officer Y., Australia, 23.02.21) regarding the attribution of some landmasses to certain countries, sparking immediate reactions from other governments and sowing the seeds of future territorial conflicts between the Pacific Islands (cf. Chapter 6), but it also helped governments to seize this attractive connection between the EEZ and the tuna economy. M. McGregor, then working for the Tonga Fisheries Service, reported at the time:

During the period in which Pacific Nations were declaring their rights to their fisheries zones there was much publicity on the radio and in the press. This inevitably led to popular pressure on the governments of the region to explain what was the purpose of declaring ownership of the seas. Governments have responded by declaring high priorities for developing their fisheries and it would seem that there is now fairly firm interest by governments in direct participation in the tuna fishing industry. (McGregor, 1987, p. 41)



The first ever attempt to map out the future EEZs of SPC member countries and territories was done by hand, with a compass, by Bob Gillett in the late-1970s. This map is still in the OFF offices today.

Figure 11: Draft map of the potential Pacific Islands’ EEZ drawn by a SPC fisheries officer (Judd, 2016a, p. 43)

Although most tuna catches then came from waters *beyond* the 12 nm territorial sea, most also came from waters that would fall *within* the breadth of the future Pacific Islands’ EEZs (Kearney, 1977a). R.

Kearney did not doubt that the anticipated creation of EEZs would “giv[e] unprecedented credibility to the rights and responsibilities of coastal States to manage resources within 200 mile zones” (Kearney, 1982, p. 3). If the territorialisation of the South Pacific Ocean by the Pacific Islands was tied to skipjack tunas, these were also a pretence for wider sovereign considerations and geopolitical affirmation strategies: “Skipjack was used as an example. [...] If they [the Pacific Island countries] took into account that they had at least 20% of the Pacific Ocean, they could start to influence shipping, as well as fishing, etc.” (SPC officer Y., Australia, 15.02.21).

Claims over tunas and offshore spaces also bore a symbolic dimension against colonial powers’ long dismissal of Pacific Islanders’ land and sea tenure systems (Schurman, 1998). If Western culture dominantly saw the sea as non-territorial, the territorial expansion permitted by UNCLOS resonated to a certain extent with Indigenous cosmologies and territorial organisations, which could serve as a strategic political lever to weigh in in international arenas. A SPC report attests to such strategic projections:

In most ACP [African, Caribbean and Pacific] States, traditional systems of reef tenure are upheld. It is a point not often appreciated, but the assumption of sovereignty over 200-mile economic exclusive zones under the Law of the Sea in the late 1970s would be seen as a natural extension of the traditional marine tenure concept by Pacific Islanders. For the rest of the world, the decision to adopt a 200-mile zone was not so easy since, in the Western world, marine spaces are traditionally held in common.¹¹³ (SCTB, 1992b, p. 16)

The praise of Indigenous cosmologies and management systems is entrenched in a wider promotion of traditional collective natural resource management approaches in the South Pacific, based on spatially-defined access and control rights (e.g. see Johannes, 2002). For the authors, “the concept of marine tenure, with limited access” appeared to “most fisheries managers as being the most effective way of ensuring effective fisheries management and conservation (thus avoiding the oft-quoted ‘Tragedy of the commons’)” (SCTB, 1992b, p. 16). This view mirrors some of the arguments advanced in UNCLOS negotiations in favour of oceanic enclosures.

Legal expert T. Aqorau, then advising Pacific Islands on UNCLOS and fisheries management-related matters at the regional level, analysed that “the concepts of self-determination and extended maritime jurisdiction were intertwined virtually from the outset of nationhood” (Aqorau, 1991, p. 4). Even more so, the construction of marine territories *and* the appropriation of tuna resources were foundational to the constitution of many Pacific Islands as independent nation-states. As a result, several Pacific Island countries shared their intent at the regional level to declare their EEZ and extend their fisheries

¹¹³ In another paragraph, the authors further described the specificities of indigenous marine tenure: “Some islands, particularly those atolls where tuna fishing is a way of life, claim traditional exclusive tenure to as far as 150 miles from the reef-edge. On larger islands, where reef and lagoon fisheries are the norm, exclusive access by each community is usually claimed as far as the drop-off on the outer barrier reef. Although these marine spaces are owned, in the same way as land, access privileges are often granted to other communities in return for future favours.” (p.17)

jurisdictions to 200 miles as early as 1976, and Fiji was even the first country to ratify UNCLOS (see Figure 12).

<i>Country</i>	<i>Year Declared</i>	<i>Country</i>	<i>Year Declared</i>
Cook Islands	1977	Palau	1979
Federated States of Micronesia	1979	Papua New Guinea	1978
Fiji	1981	Samoa	1977
Kiribati	1983	Solomon Islands	1978
Marshall Islands	1979	Tonga	1979
Nauru	1978	Tuvalu	1984
Niue	1978	Vanuatu	1978

Source: Doulman 1987b, 34–35.

Figure 12: Timeline of the Pacific Islands' EEZ proclamation (Havice & Campling, 2010)

iii. The Difficult Nationalisation and Management of Tuna Fisheries

These 'geo-political', both spatial and political, transformations caused various changes in fisheries institutions and policies. National fisheries services consolidated along and in support of Pacific Island governments, with the support of regional institutions like SPC. Their growth shows the strengthening of national authorities in the fisheries sector, which was previously addressed at the regional level and by colonial administrations (cf. Chapter 4). For instance, by 1978, Fiji's Fisheries Division comprised over 80 employees (Fiji Government, 1979). In New Caledonia, "the Territorial Department of the Merchant Navy and Sea Fisheries gradually recruited the staff necessary for effective assistance to the development of sea fisheries in the Territory" (New Caledonia Government, 1986, p. 1). Fisheries services were also voluntarily 'indigenised'. Consultants S. Fakahau (Tongan Fisheries Officer) and M. Shepard (Canadian fisheries expert) observed that out of ten countries they visited in 1980, only two fisheries divisions were headed by local nationals (Fakahau & Shepard, 1986). In 1986, the ratio had reversed and most were headed by locals (Fakahau & Shepard, 1986). A SPC fisheries officer from that period confirmed: "In Fiji, the staff of the fisheries service became more domestic in the 1980s, and they promoted Fijians over Indo-Fijians." (Former SPC fisheries officer L., Noumea, 07.05.21).

National fisheries services purposefully engaged in two main tuna development strategies opened by UNCLOS, which both intensified the need for fisheries information: building domestic tuna industries and selling fishing licenses to foreign fishers. Regarding the first aspect, there was at the time a widespread belief (and limited alternative options in the general absence of local investors) that state-funding and ownership would be the best approach to tying tuna industries and their economic benefits to their territory (Havice & Campling, 2010; Barclay, 2014). With the support of international

organisations like FAO or the United Nations Development Programme (UNDP)¹¹⁴ or in partnership with foreign companies interested in maintaining their access to the South Pacific fishing grounds, many Pacific Island governments conducted large-scale investments to set up fishing fleets and additional processing plants through the 1970s (Barclay, 2014). In the wake of Papua New Guinea, Solomon Islands, Kiribati, Tuvalu and Palau undertook to build pole-and-line fisheries to target skipjack tunas. This fishing technique appeared then the most appropriate to their local context, being ‘low technology’ and labour-intensive. Some governments also tried to develop a purse seine industry, such as the Solomon Islands or Nauru. Domestic small and medium-scale longline fishing fleets emerged in the following decades. Governments also sought to secure more benefits from the joint ventures they would establish. For instance, an agreement established in 1979 between the Solomon Islands and a Japanese fishing company required foreign parties to train Pacific Islanders and support offshore surveys and research on tuna and baitfish resources (SPC, 1974b). The year after, the Solomon Islands Government increased its share in the locally-based joint ventures to “shift [...] the balance of advantage in the direction of the local partner” (Scharmann, 1991, p. 317).

Overall, however, the nationalisation of the tuna industry did not live up to the initial expectations of the Pacific Island governments. Despite considerable public spending, multiple domestic companies collapsed over the years (e.g., in Kiribati, Marshall Islands, Nauru, Federated States of Micronesia). The case of Fiji’s first government-owned fishing company aptly illustrates this trend. As the country became independent in 1970, UNDP and FAO funded a three-year project to support the new government in investigating the potential for a pole-and-line skipjack fishery, examining the project’s environmental, financial, professional and marketing feasibility (SPC, 1970b). In 1975, the Fijian Government set up the Ika Corporation, a state-owned company within its Fisheries Division and under the control of its director R. Stone, a marine scientist and former fisher who had learned about skipjack fishing in Hawaii (Southwick, 2011). General objectives were to increase fish production and exports, generate employment, and support the functioning of the PAFCO cannery to its full capacity (in which the government had also increased its shares). It acquired second-hand Japanese pole-and-line and small purse seine fishing vessels and trained and recruited various technicians and fishers while relying on experienced Japanese captains (Stone, 1978; Southwick, 2011). In 1978, Ika Corporation left the governmental Fisheries Division to become a semi-commercial body of its own. According to a fisheries officer, initial results were deemed “very encouraging”, with vessels bringing 5 - 30 tons of skipjack per day (Wilkinson, 1978b, p. 1). The company grew steadily over the years, peaking at six state-owned vessels and seven chartered-Japanese vessels and 260 employees, becoming the main pole-and-line operator in the country and a significant one in the region by the 1980s (Southwick, 2011). However, the company rapidly encountered mounting difficulties due to limited capital, narrow qualified and/or

¹¹⁴ UNDP conducted at that time a ‘South Pacific Regional Fisheries’ development programme to support the newly independent Pacific Island countries.

interested workforce, ageing vessels with a relatively short fishing range, unsteady baitfish and tuna catch and, ultimately, the escalating presence of the more competitive purse seine industry (Southwick, 2011). The Fiji Government continued to subsidise the company over the years to preserve employment in the Ika Corporation and PAFCO. Progressively, PAFCO stopped processing skipjack and shifted to loining¹¹⁵ albacore, which further induced the collapse of the Ika Corporation (Barclay & Cartwright, 2008).

Considering their limited capacity to harvest tunas, the other strategy of the Pacific Islands was to sell fishing licenses to foreign fishers and extract an economic rent derived from access fees. Fiji started selling fishing licenses to Taiwanese longliners: in 1981, 35 foreign fishing vessels were licensed to fish in Fijian waters (SPC, 1982a). New Caledonia concluded several fishing agreements with Japanese and US fishing companies after establishing its EEZ in 1978 (SPC, 1981a). However, setting up and maintaining those agreements was challenging because of persisting power imbalances between the Pacific Islands and the DWFNs (cf. Chapter 6). To execute such strategy and price their access fees, Pacific Island fisheries representatives outlined their need for information on the size of the foreign fishing fleets operating in the region, their catch and profitability of this extractive activity (e.g. cost of fishing, sale value of the fish) (SPC, 1978).

iv. Reclaiming Power at the Regional Level

Institutional changes also occurred at the regional level. There were mounting criticisms amongst the Pacific Islands against SPC, decried as outdated and overtly ‘colonial’. Fiji’s Prime Minister, also heavily involved in UNCLOS negotiations, was a leading figure in this dissenting movement, pointing out that “SPC was a ‘colonial anachronism” (Former SPC officer Y., Australia, 23.02.21). In 1987, a Tongan representative pinpointed that SPC’s actions mismatched the needs and aspirations of the Pacific Islands, again showcasing the more voluntary positioning of national governments regarding fisheries development and management:

The institutional structure of the South Pacific Commission has remained the same or very much similar to that which existed during the period 1947-1961 when the Commission became involved in fisheries activities (...). During this period, very little expression of interests on fisheries were made by SPC member governments. Fisheries activities in both countries and regional institutions have increased dramatically fast over the years and, accordingly, the trend of thinking of member governments’ administrations have changed, so as their needs for assistance have increased. Member governments are frustrated by the lacking acknowledgment of their needs and expectations by the programmes. (Delegation of the Kingdom of Tonga, 1987, p. 2)

Wary of the pervasive influence of metropolitan governments in the organisations and particularly opposed to the ongoing French nuclear testing in the region, certain Pacific Island leaders argued for

¹¹⁵ i.e. cutting fillets

institutional transformations, both within and outside SPC. Within SPC, they sought to gain a bigger governing role than the former colonial governments still members of the organisation.¹¹⁶ Hence, in 1962, at a conference in Pago Pago (American Samoa), an agreement was reached to ensure that the South Pacific Conference, the body representing the Pacific Islands, would gain more weight against the Commission, dominated by the former colonial powers. Despite these changes, SPC still aroused some suspicion among Pacific leaders, leading some of them to set up another regional institution over which they would have control.

In 1971, under the impulsion of Fiji, Western Samoa and the Cook Islands, and with the involvement of Nauru, Tonga, New Zealand and Australia, the South Pacific Forum was created, explicitly excluding the remote former colonial powers, i.e. France and the US (Fisher, 2013).¹¹⁷ This new regional arena addressed various topics interesting to the Pacific Islands, from nuclear testing to decolonisation or civil aviation and the control of fishing resources. It aimed to promote regional cooperation and build a “Pacific voice” to advance the region’s interests and position in global diplomacy (Fry & Tarte, 2015, p. 3). This regionalist strategy intended to affirm the Pacific Islands in international fora and their negotiations against DWFNs. The South Pacific Forum established the South Pacific Bureau for Economic Cooperation (SPEC) as a research provider to alleviate the dependency of the Pacific Islands on SPC (Fry, 1981).

Concomitant to the unwinding of the UNCLOS III negotiations, the Forum members adopted the Declaration on the Law of the Sea and a Regional Fisheries Agency in 1977. The Declaration planned to create a South Pacific Regional Fisheries Agency, which eventually saw the light of day in 1979 with the creation of the Pacific Islands Forum Fisheries Agency (FFA). This decision stemmed from considerations by Papua New Guinea on environmental conservation and by Fiji on the Law of the Sea, as the two countries were also actively involved in UNCLOS negotiations (Sutherland, 1987). The two countries emphasised the need for the Pacific Islands to cooperate and coordinate in fisheries and environment conservation in order for them to fully benefit from the new oceanic regime and facilitate the fulfilment of their UNCLOS obligations (Doulman, 1990d).

However, the creation of FFA sparked a series of debates relating to its mandate and even more so “to the question of membership of the proposed Regional Fisheries Organisation”, the Forum reported

¹¹⁶ Cf. Chapter 4: Initially, SPC was managed by the colonial governments within the South Pacific Commission and representatives from the Pacific Islands would be consulted during the “South Pacific Conference”, which would draw on recommendations from sub-bodies like the Regional Technical Meeting on Fisheries. With the independence of certain Pacific Islands, the question arose to decide whether these new countries should become full members of the Commission or remained in the Conference – and conserve very limited, if not entirely absent, decision-making power. In 1983, independent Pacific Islands became full members of the Commission. However, the US, Australia, New Zealand and France simultaneously obtained voting rights for each of the territories they administrated, thereby conserving a strong influence in the decision-making process. Eventually, the division between the two bodies was abandoned (Fry, 1981).

¹¹⁷ The South Pacific Forum has been renamed the “Pacific Islands Forum” in 1999.

(South Pacific Bureau for Economic Cooperation, 1978, p. 1). Members hesitated between two different types of organisation distinctively privileging ecological or national economic considerations:

One would aim primarily at ensuring conservation and promoting optimum utilisation of the living resources throughout the sea in which they occur, as envisaged in the revised single negotiating text under consideration by the United Nations Conference on the Law of the Sea. The other would aim primarily at ensuring maximum benefits for the peoples of the coastal countries in the region and for the region as a whole. (Kearney, 1983a)

Particularly controversial was the membership of DWFNs and metropolitan governments, especially of the US, which was resisting coastal States' claims over their EEZs and highly migratory fish. Certain countries like Australia, the Cook Islands, New Zealand, Niue or Western Samoa initially supported US membership (Doulman, 1990d). However, the Pacific Islands with the largest stakes in tuna fisheries, like Fiji, Kiribati, Nauru, Tonga and Papua New Guinea, strongly opposed DWFN membership in the upcoming Agency. They felt that the US and countries like France and the UK were not acting as *representatives* of the territory they administered but as DWFNs and industrial nations defending their own interests (Carr, 2004).¹¹⁸

Political arguments put into play the 'nature' of the offshore fish and marine territories in relation to their governance. Prime Minister of the Solomon Islands P. Kenilorea argued for the indistinctiveness of the land and the sea: "We do not interfere in the coal mines of America – why should America be able to interfere in the fisheries of the independent Pacific Forum countries?" (Kenilorea quoted in Van Dyke & Heftel, 1981, p. 15). The Foreign Minister of Papua New Guinea castigated the rhetoric of the US on the highly migratory behaviour of tunas, which only evidenced the country's national political and economic agenda. The US's definition of 'highly migratory' was at odds with its simultaneous "claims [for] management rights over marlins, another highly migratory species, in order to safeguard the interests of its sports fishermen" (Olewale quoted in Van Dyke & Heftel, 1981, p. 16). Defining the exact 'nature' of marine spaces and offshore fishes – and of the latter's movements at sea – was contentious as the argument could be used politically to frame associated governance schemes.

Two main considerations eventually led to the exclusion of DWFNs from FFA. First was the will of the Pacific Islands to have their sovereign rights at sea recognised. Hence, the Forum Declaration prefiguring the creation of FFA stipulated that membership to the Agency would be "open to all Forum countries and all countries in the South Pacific with coastal states interest in the region *who support the sovereign rights*", a condition incompatible with the position of the US (South Pacific Bureau for Economic Cooperation, 1978, p. 1, my emphasis). The other one was the Pacific Islands' fear of being outweighed in this Agency by more (in particular financially) powerful nations. D. Doulman, then FFA

¹¹⁸ See also Chapter 9, showing that countries like France and the US continue to a certain extent to frame their Pacific Territories from their metropolitan perspective and interests.

Senior economist, reported that US membership would likely have oriented the focus of the Agency toward “technical aspects of tuna management at the expense of the economic concerns of South Pacific Island Countries” and only heightened the “inherent conflict of interest in fisheries management between coastal states and DFWNs” (Doulman, 1990d, p. 4). This quotation hints at the realisation that ‘technical aspects’ of tuna stock management were not neutral and traversed by power relations benefitting the US while overlooking the Pacific Islands’ sovereign economic concerns.

These considerations and the resulting economic orientation of FFA demarcated the agency from other fisheries management bodies (cf. Section I.1.ii). FFA would answer to a governing body “dominated by fisheries practitioners and policy-makers and not by scientists” and “serve the needs of member countries” (Doulman, 1990d, p. 5). This aspect was fundamental to abide by the sovereign aspirations of the Pacific Islands and to address repeated criticisms of DFWNs that interpreted FFA as a regional scientific and management fisheries organisation from which they were excluded despite their interests in the associated tuna fisheries. FFA and its member countries repeatedly outlined that FFA was not a regional fishery *management* organisation as framed by UNCLOS (cf. Section I.3.i) but merely a support and advisory organisation working for national governments “without detriment to the sovereign rights of coastal countries” (South Pacific Bureau for Economic Cooperation, 1978, p. 5). Hence, the FFA only aimed to facilitate coordination between its member countries and had no decision-making and regulatory competency overriding the national level. The role of the Agency was mainly *informational*, stemming from the recognition:

that the coastal countries of the South Pacific have an immediate and continuing need for information and advice concerning the living resources in the region and the ways and means of securing maximum benefits from them as well as for an effective instrument to coordinate policies in this field, and that management of resources moving over vast areas, control of their exploitation, surveillance and policing and collection of adequate statistical and other information require coordination by a regional agency. (South Pacific Bureau for Economic Cooperation, 1978, p. 4).

Contrary to regional fisheries agencies, which are usually concerned mostly with biological aspects, FFA would also focus on economic and legal fisheries management and development issues. It sought legal and administrative support to establish the EEZs and apply fisheries management and conservation measures within these zones - and not in the high seas. This comprised providing economic assistance “if requested, in negotiations with distant water fishing nations” regarding fishing access fees and help on surveillance and enforcement methodologies and practices (Fakahau & Shepard, 1986; South Pacific Bureau for Economic Cooperation, 1978, p. 3). In that respect, FFA was an institutional instrument that developed surveillance activities to support the Pacific Islands in managing their EEZs following UNCLOS’ requirements.

FFA was formally created in 1979, with headquarters in the Solomon Islands.¹¹⁹ The location of both the South Pacific Island Forum in Fiji and FFA in the Solomon Islands attests to the political will of the Pacific Islands to distance themselves from the former colonial powers, affirm their authorities over these new regional institutions, and open the way to a “new Pacific diplomacy” (Fry & Tarte, 2015). Contrary to the ‘scientific’ and ‘apolitical’ mandate of SPC, the South Pacific Island Forum explicitly aimed to provide a political stage for the Pacific Island governments. FFA served as an armed wing regarding tuna fisheries’ development, management and enforcement issues. The debates and consequences of this attempt to institutionalise the demarcation between these dimensions and between the ‘scientific’, ‘regulatory’ and ‘coercive’ surveillances tunas and tuna fishers are discussed in more detail below.

The emancipation of the South Pacific Islands from their former colonial governments and the transformations of the Law of the Sea through the 1970s opened new prerogatives and duties for the governments concerning tuna fisheries: “On the one hand, the Island States have the opportunity to benefit substantially from the harvesting of fish in the zone under their jurisdiction and, on the other, they must accept the responsibility of ensuring that the resource is rationally managed and that yields are maintained at optimum levels” (Kearney, 1977c, p. 1). Generating optimal revenues from selling fishing licenses and developing domestic industrial fisheries *while* ensuring the conservation of the resource (understood as its maximum sustainable exploitation) required nation states to assess the magnitude and the value of the fish resources in their *national* waters (S. M. Garcia, 1992). Such knowledge could, in turn, help define management measures, e.g. Total Allowable Catch (TAC), fishing fleet capacity, economic measures to extract revenues from the fishing industry, etc. (Brock, 1968; Hilborn & Sibert, 1985). These national duties, however, rapidly appeared at odds with the geographical distribution of the tuna fishes and the capacities of the Pacific Islands, and led to finding alternative strategies to address them.

II. The Setting up of Surveillance Apparatuses to Research and Manage Tuna Fisheries

This section retraces the establishment of some main and still existing surveillance apparatuses set up by and for the Pacific Islands at the regional scale to study tuna resources, including a tagging programme, the collection of statistics with logsheets and fisheries observer programmes. These apparatuses were firstly established to support biological research, i.e. survey tuna resources and ‘monitor’ their stocks to support (some aspects only of) the Pacific Islands’ tuna fisheries management efforts. The emic term ‘monitoring’ here would, therefore, refer to the longstanding biological

¹¹⁹ Original members of the FFA Convention included Australia, Cook Islands, Fiji, Kiribati, Nauru, New Zealand, Solomon Islands, Tonga, Tuvalu and Western Samoa. Other Pacific Islands countries such as Papua New Guinea, Niue, Vanuatu, Palau, and Marshall Islands joined after. FFA currently comprises 17 members.

surveillance of tuna fish, mostly under the lead of fisheries scientists. Although it would also necessitate to surveil fishing activities to evaluate their impact on fish stocks, it would largely leave aside the socio-economic and political dimensions of the fisheries – even though such ‘scientific’ biological surveillance and its associated apparatuses would inevitably come across these interconnected considerations.

1. The Skipjack Survey and Assessment Programme: Developing Tuna Surveillance for the South Pacific Region

i. The Need for a New Geography of Tuna Fisheries Data and Research

The many global and regional legal, political and environmental transformations described in the previous section renewed the need to surveil tunas and associated fishing activities. The focus first turned toward developing tuna fisheries science to support fisheries development and management, starting with assessment studies to evaluate the size of the resource and the newly coveted yet unfamiliar skipjack tuna.

Several endeavours to assess tuna resources already existed or were emergent but did not yet meet the needs of the Pacific Islands. As mentioned in Chapter 4, DWFNs operating in the region already had a consequent – and the largest – part of the existing information regarding tropical tunas provided by their commercial fishing fleets and scientific campaigns. The industrial organisation of foreign fishers came together with a strong surveillance culture (Lyon, 2018) firstly oriented to commercial purposes. Tongan fisheries officer S. Fakahau and Canadian fisheries consultant M. Shepard reported: “Because the basic exploration of the South Pacific tuna resource was conducted by highly developed industrial fisheries, monitoring of catches and efforts ha[d] been extensive from the very beginning” (Fakahau & Shepard, 1986, p. 57). Thanks to the development of their fleets, foreign fishing countries had “meticulous records” of catch and fishing effort, which they would use for (partial) “biological assessments of the state of the stocks and the effects of fishing upon them” or “assessments of resource potentials as a guide to local tuna development” (Fakahau & Shepard, 1986, p. 57). However, most of this information was not available to the South Pacific Islands, and for the records that were shared, SPC fisheries officers found that their format generally did not permit them to estimate the potential yield of the fishery for their use (Hilborn & Sibert, 1985).

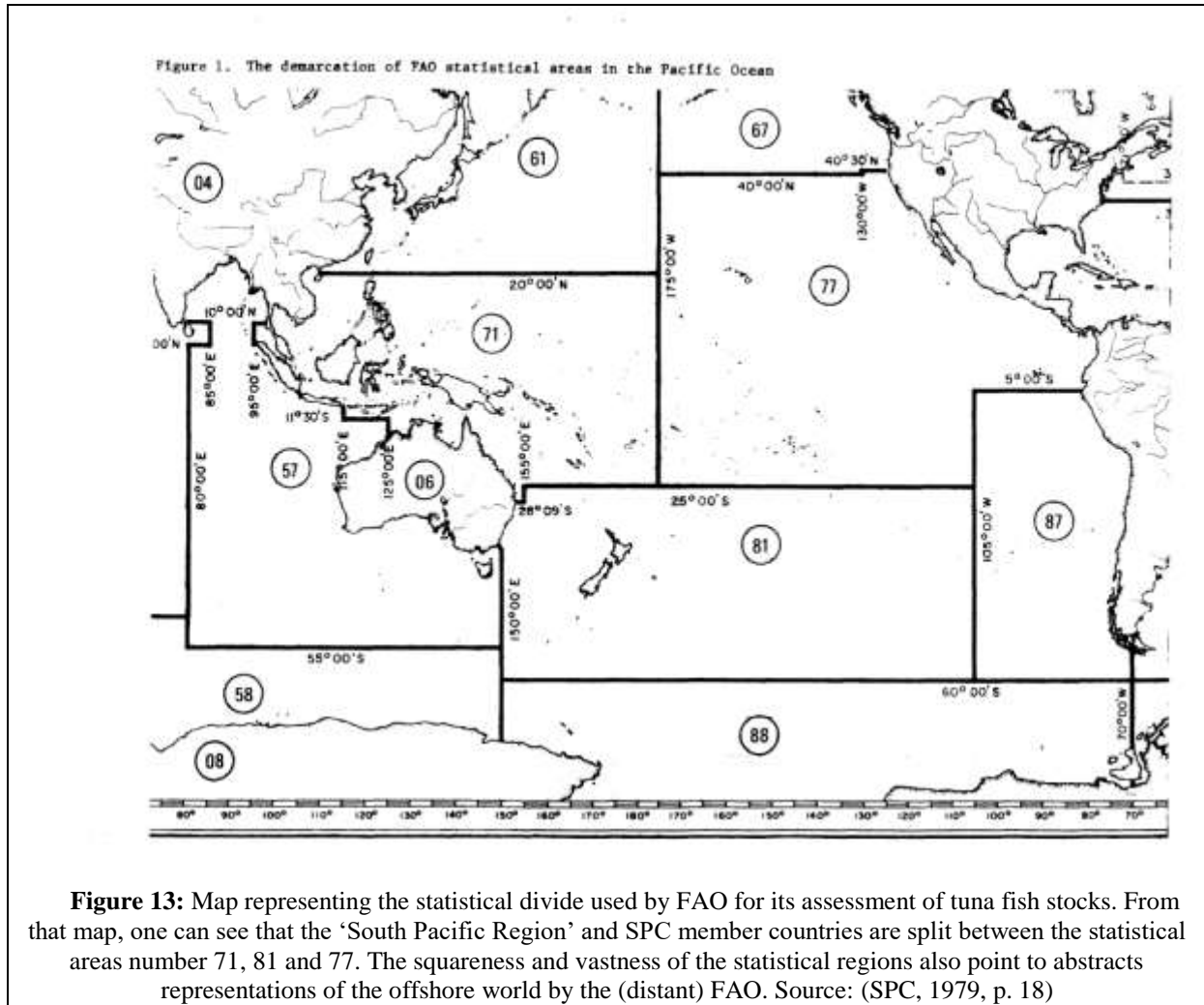
Another attempt to assess tuna stocks came from FAO’s global watch of fish stock statuses. In the early 1970s, the organisation evaluated the tropical tuna stocks (S. M. Garcia, 1992). Despite its interest in South Pacific tunas, FAO “had no source of information” and the region largely remained “a black box”, a former SPC scientist of that time explained (former SPC fisheries officer G., US, 15.02.21). Its annual *Yearbook of Fisheries Statistics* only provided a “crude summary” of limited use for the Pacific Islands (SPC, 1976, p. 3). In addition, the statistical distribution FAO chose to assess tuna stocks did not meet the requirements of the Pacific Islands to manage their administrative territory and the tuna

resources in it. Indeed, FAO had divided the Pacific Ocean into seven regions¹²⁰ which mismatched the territorial integrity of the Pacific Islands and the cohesiveness of the ‘South Pacific Region’ (see Figure 13). This issue is well explained in this address of SPC to FAO:

... the area designated as the Western Central Pacific Statistical Area is conveniently bounded to the west [...] and on the east by the International Date line. However, we are a little concerned with the problem of administrative jurisdiction in the various territories of the area; the lines drawn on your chart incorporate eleven of the SPC territories [...]. However, some of these territories have isolated atolls or islands which fall outside the boundaries [...]. (SPC, 1970a, p. 14)

There were also criticisms highlighting the lack of representativeness of this initiative, considering that none of the Pacific Islands was a member of the institutions involved (Kearney, 1976a). The sovereign affirmation of the Pacific Islands applied to tunas as much as to their study and knowledge. After the South Pacific region successfully undertook its tuna assessment programme for the SPC area (see below), FAO adapted its statistical breakdown to make it more coherent with that of SPC (SPC, 1989). This shows a reversal in the power relationship between these scientific initiatives and the institutions supporting them.

¹²⁰ Those statistical areas still exist to this date by FAO under the name of ‘FAO major fishing areas’. They are described by the organisation as ‘arbitrary areas’, determined against a complex set of various considerations, the boundary of ‘natural regions’, the boundaries of adjacent statistical fisheries bodies already established, existing national practices, national boundaries, longitude and latitude grid system, the distribution of the aquatic fauna and the distribution of the resources and the environmental conditions.



The more specific case of skipjack tuna raised additional difficulties, as outlined by R. Kearney in several reports he wrote to defend the setting up of a devoted research project. The fishery was recent and only covered “a small part of the total area of the known distribution of skipjack” (Kearney, 1983b, p. 92). There were not many available fisheries statistics about commercial fisheries’ catch and fishing effort, which were the most common tool for fishery scientists to assess offshore fish stocks (see also Chapter 9). Existing statistics were ill-adapted for the Pacific Islands because they were “not specifically compiled for this purpose” (Kearney, 1976a, p. 1). Addressing these lacunae required resorting to “less conventional techniques for evaluating the total resource” (Kearney, 1983b, p. 92).

ii. A Regional Research Design

These observations set in motion a series of discussions between Pacific Island representatives on the research work required to ensure the conservation and optimum use of offshore fish resources. In 1973, at SPC’s Sixth RTMF, a Working Party on the Development of Skipjack Tuna Fisheries in the South Pacific Ocean elaborated a list of proposals regarding skipjack research and associated data requirements. The group involved a mix of Pacific Island fisheries officers, French and US scientists,

SPC representatives and FAO experts. Building the region's scientific capacities still involved external expertise. The working party outlined that "the purpose of collecting data from a fishery varies from meeting the need to measure economic growth and success of the fishery for business to providing the basis for the management of the resources" (SPC, 1973, p. 32). If, from the onset, it acknowledged that fisheries information could be multipotent, serving 'commercial', 'scientific' and 'regulatory' objectives, it recommended privileging biological research to support the latter dimension. The working party advised that "it would be prudent to collect statistics which would meet the needs of stock assessment" to avoid what happened in many (Northern) fisheries, i.e. the apparition of management efforts *after* the resources had been (over)exploited (SPC, 1973, p. 33). Hence, collecting fisheries information aimed to identify the MSY in a risk-based approach to fisheries management.

The Working Group emitted some main recommendations regarding the design of tuna biological research. It recommended that the Pacific Islands initiate fishery statistics programmes centred on the collection of catch and effort data in "a standardised regional reporting form" to permit "inter and intra-regional comparisons" and "regional statistics" (SPC, 1973, p. 33). The group envisioned additional research programmes, including technical studies on fishing gear and baitfish, a tagging programme to define skipjack population parameters (migration, age, growth, mortality rates), a sampling programme to study the sub-population structure of skipjack tunas and the ecological study of the relations between oceanographic conditions and the spatial-temporal distribution and diet of skipjack tunas. These programmes set out major research axes for the following years – and the contemporary era (cf. Chapter 8). The working group also stated that "certain population parameters can only be studied over the entire range of stock" (SPC, 1973, p. 34), requiring research to be done at the regional scale to accommodate the suspected extensive distribution of these fish. The necessary "region-wide data collection with centralised analysis" made it "appropriate and urgent" to commence cooperative research efforts (SPC, 1973, p. 34). To that respect, the working group finally proposed the formation of a committee supervised by SPC and tasked with managing information flows between fishing nations and coastal states to assess skipjack resources (SPC, 1973, p. 31-38).

Upon these recommendations, SPC fisheries officer R. Baird constituted the Expert Committee on Tropical Skipjack, which mostly included metropolitan and international 'tuna specialists' selected for their expertise and convened for the first time in 1974. R. Baird invited R. Kearney, who had been attempting skipjack tuna research in Papua New Guinea since 1971 (cf. Section I.2.i). There, R. Kearney and his team had been conducting a national research programme, focused on tagging skipjack tunas – a method recommended by scientists from well-established Australian and regional tuna fisheries institutions, including IATTC. Tagging was a method already used by these organisations for other tuna species like bigeye and yellowfin tunas but it had not yet been applied to skipjack tunas. After adapting the technique to skipjack tunas, R. Kearney and his team spent three years tagging fish in Papua New Guinea's waters and recovering marks. They also spent considerable effort in collecting catch and effort

statistics from locally-based pole-and-line vessels. Rapidly, however, R. Kearney's team realised that their research programme was too small in scale:

As soon as I started to look at [the tagging data] I said: [...] We know where our fish are going to but we've got no idea where they're coming from. We've got no idea how many there are, and we're never going to find out, because they're clearly coming in and they're going out, but we've got no idea where they're coming from because no one else is tagging any. [...] We had to take a broader approach than just Papua New Guinea. Did it need to be pan-Western Pacific? Where was the boundary? To be frank, we had no idea, but we suspected that it was pretty big. [...]. Many of our fish started turning up in Samoan canneries and California. (Member of the Papua New Guinean skipjack research team, Noumea, 27.08.14)

Tags permitted the team to fathom the widespread mobility of certain skipjack tunas recaptured on the other side of the Pacific Ocean. The team worked out that with a larger tagging programme, it would become "mathematically possible" to find out how many skipjack tunas there were and that, as importantly, it could provide "the first estimate of the area" (Member of the Papua New Guinean skipjack research team, Noumea, 27.08.14). Such a programme would be too ambitious for the Papua New Guinean fisheries service alone but the idea rapidly met the interests of other Pacific Islands and regional tuna experts like SPC officer R. Baird.

The creation of the Expert Committee on Tropical Skipjack permitted the convergence and the cementing of these regional and national interests regarding skipjack tunas. SPC member countries recognised the usefulness of such a project not only to manage skipjack tunas but also to support the Pacific Islands in negotiating access agreements with foreign fishing companies (SPC, 1974b). The proposal of a regional tuna-tagging project was endorsed at SPC's Seventh RTMF in 1974 and became a priority of the upcoming Skipjack Survey and Assessment Programme (SSAP) under the lead of R. Kearney. The programme would pioneer tuna fisheries science not only for the region but also in the world, aiming to tag fish at an unprecedented scale, in an area lacking regional tuna fisheries organisations (Judd, 2016b).

The first tagging campaign set off in 1977, starting in Papua New Guinea and largely relying on protocols and techniques developed by the initial Papua New Guinean initiative. Although 'regional', the configuration of tuna science had highly localised roots, whose influence is still present to date (cf. Chapter 8). Other sea-going campaigns followed to incrementally cover the geographical range of the SPC area, tagging tunas, collecting biological data and surveying baitfish resources. The campaigns simultaneously permitted the regional study of skipjack tunas and the realisation of national surveys on skipjack tuna and baitfish stocks for the Pacific Islands. The resulting data were then computerised in a database devised to pursue three main objectives. The first one was to improve the understanding of skipjack tunas' migrations and stock structure and investigate potential detrimental interactions between distinct fisheries (cf. Section I.2.ii). The second objective was to provide information on the general

distribution and availability of skipjack and baitfish. The final objective was to identify biological parameters (e.g. growth and mortality rates) to permit skipjack stock assessment (Kearney, 1982).

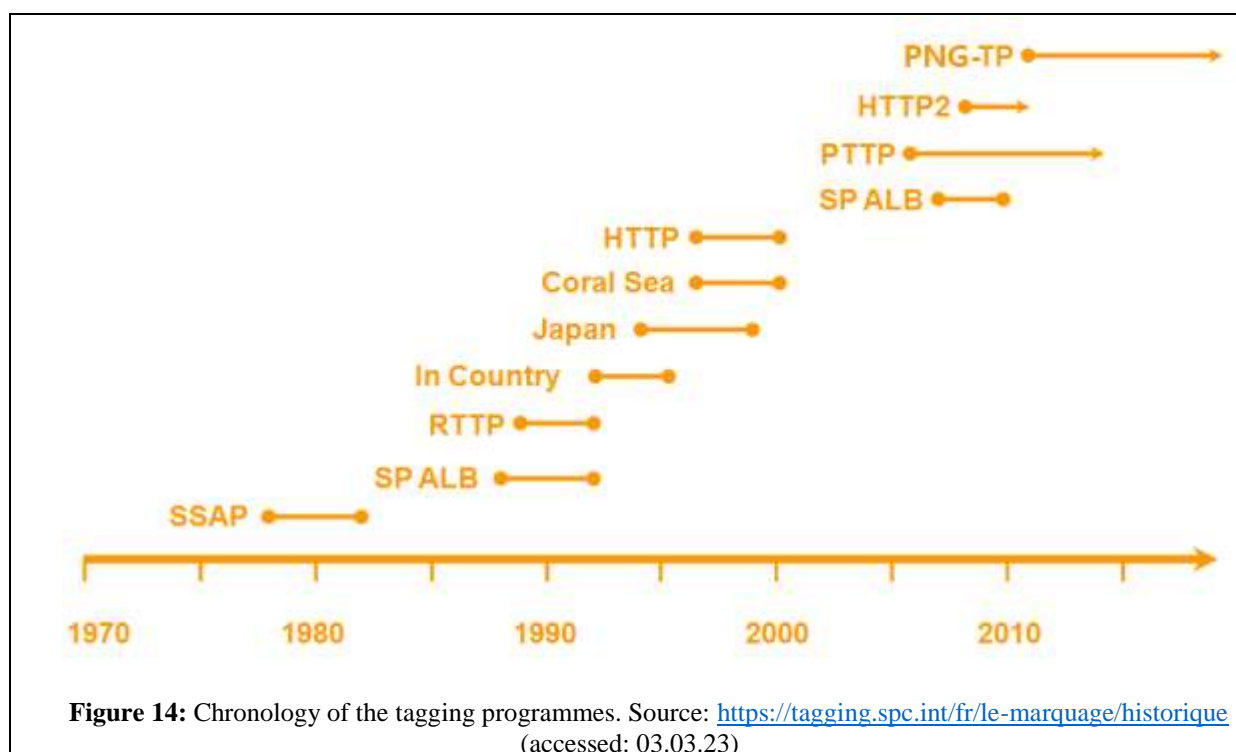
iii. **Outputs of the Programme: Fisheries Management as Development**

The programme ran from 1977 to 1981. Major findings led to the conclusion that there was a single skipjack population in the SPC area, contrary to what was presumed before. It also estimated that the resource was very large and still widely underexploited, confirming the strong development potential of the skipjack fishery. A lead SSAP scientist advanced that the “big outcome of the project” was that it “established it was the world's largest tuna fishery”, estimating the population of skipjack tunas to about three million tonnes that could be harvested annually because “they replace themselves so quickly” (SSAP scientist, Australia, 15.02.21). For this interviewee, “nothing [related to fishing] could threaten the sustainability of the species”: most skipjack tunas would die ‘naturally’, i.e. not because of fishing. This conclusion did not preclude other possible issues regarding fisheries’ competitive interactions in particular. This concern required adjusting the “distribution of effort in accordance with the distribution of the resources” to maximise yields and avoid localised depletions, especially against the growing purse seine industry (Fakahau & Shepard, 1986, p. 55). Additionally, the SSAP’s finding that the resource was plentiful incidentally drove down the global market price of skipjack.

Hence, although the SSAP supported the idea that skipjack resources could hardly be overfished and needed not any particular conservation management measures, it did not pre-empt the need for careful management of the fishing activities from an economic perspective to ensure that Pacific Islands would derive the most benefits from skipjack exploitation. Results from the SSAP largely oriented management concerns toward economic rather than environmental dimensions of ‘sustainability’. Illustrating this idea, a member of the SSAP felt that the programme accompanied and even contributed to the development of the skipjack fisheries:

The Skipjack Survey really got things started and popularised. At the time [it began], there were only one or two US purse seiners in the region and twenty-five or so Japanese purse seiners. When we finished the programme three years later, there was like eighty or so US purse seiners, moving from the Eastern to the Western Pacific. The whole US fleet moved. The enthusiasm, the catches, everything skyrocketed. (former SSAP scientist G., US, 16.02.21)

Tagging campaigns continued to be an important surveillance apparatus for collecting data on offshore fish. Other programmes followed to study skipjack tunas further and also target other tuna (yellowfin, albacore and bigeye) or billfish species (see Figure 14). In parallel, the objective of the following tagging programmes widened from “find[ing] out more about this huge unknown resource” to “determining the intensity of fishing in an age of fishing era” (SSAP scientist G., US, 16.02.21). The SSAP and its tagging programme embodied a transition from the ‘discovery’ of tuna resources to the development and management of their exploitation.



2. The Collection of Fisheries Statistics: a ‘Fisheries-Dependent’ Data Collection Scheme

i. The Centralised Collection of Harmonised Fisheries Statistics

Results of the SSAP were presented to the Pacific Islands at SPC’s Twelfth RTMF in 1980. SPC members considered the programme a success, bringing new knowledge on skipjack tunas and baitfish resources to the region, enhancing awareness and training in tuna fisheries, and granting larger recognition for the involvement of Pacific Islands in tuna research and management at the international level. Against that background, SPC members discussed the “future regional requirements for fisheries research for highly migratory species” to consider the continuation of the regional tuna programme (SPC, 1980, p. 3). This time, their concerns extended beyond skipjack tunas to look into and take stock of other tuna species and billfishes of commercial importance.

The SSAP and its epistemic and organisational design and scientists served as a stepping stone for configuring the new and wider Tuna and Billfish Assessment Programme (TBAP).¹²¹ The SSAP team exposed several possible research priorities for this new programme to SPC’s RTMF. Importantly, they suggested the development of two research apparatuses, namely a “regional statistical programme” and the “coordination of observer programmes on distant water fishing vessels” to “assist in the collection

¹²¹ The species targeted at that time were yellowfin, bigeye and albacore tunas, of black, blue, and striped marlins, and of sailfishes and swordfishes.

of biological information”, amongst other things (Expert Committee on Tropical Skipjack, 1980, p. 3). Despite early interests in fisheries statistics, it was only by the end of the 1970s, with the growth of the tuna fishery and the development of the SSAP, that the timing seemed right to implement such a statistical programme. Tagging programmes were expensive and could not provide enough data. Conversely, statistics that were not previously available at the time of the SSAP now existed thanks to the development of the tuna fishing industry and its associated ‘commercial’ surveillance: “The data was being collected, there now was a fishery and the fishery was secure, it was growing, and the countries were more interested. There was a real opportunity to collect serious data, which there wasn’t when we started.” (SSAP scientist, Australia, 15.02.21). Additionally, the unfolding of the SSAP tagging programme made such statistics critical to facilitate the analysis of tag release and recapture information.

Establishing regional fisheries statistics was ranked the top priority for the upcoming TBAP, providing that it would form the underlying infrastructure of the other research components (SPC, 1980). The statistical approach and the wide distribution of tunas called for “a common database” and, as a consequence, “the standardisation of the data collected and a method of collection” (SPC, 1973, p. 34). Tuna experts consulted to set up the programme recommended that the TBAP focus on the *routine* collection of catch and effort data, using a standard form adapted from the one already used in Papua New Guinea and developed by R. Kearney’s research team. They also designated SPC as a relevant institution to process and disseminate regional statistics. The decision to have SPC coordinate such a statistical programme was motivated by several factors. SPC was the existing institution with the largest geographical coverage. Its inclusive membership would, therefore, facilitate access to EEZ waters and permit research efforts to cover much of tuna and billfish habitat. The centralisation of the fisheries statistics by a regional institution like SPC also addressed the lack of technical and human capacities of many Pacific Islands, not yet or only freshly independent, to conduct such work. Finally, the devolution of this role to SPC was also attributable to R. Kearney himself, who was particularly influential in making the case for the statistical programme and for SPC to become the recipient of the data under his lead:

Kearney was very ambitious. He had the idea of a tuna programme to further the analysis of the tagging data. He flooded the idea of SPC receiving the catch data from both domestic and DWFNs and of compiling and analysing that data. [...] Most Pacific Islands countries did not have the manpower or budget to even begin to compile logsheet data. SPC put a lot of effort into that; it became the basis of a lot of their work. (SSAP scientist G., US, 16.02.21)

This compilation work turned SPC into a “calculation centre” (Latour, 1987) gathering in a single location inscriptions produced remotely and across the wide Pacific Ocean.

ii. The Formalisation of the Logsheet Apparatus: Delegating Surveillance Work and Reducing Fisheries into Data

Another important step in the operationalisation of regional fisheries statistics took place in 1978 when the Expert Committee on Tropical Skipjack convened an Ad Hoc Meeting to draft “standard form[s]” (see Figure 15) for fishers to fill out to cover the activities of “each of the major oceanic fisheries operating in the SPC area” – i.e. the pole and line, purse seine and longline fisheries – for “scientific purposes” (SPC, 1979, p. 2). The forms, whose name would eventually stabilise as ‘logsheets’, would simultaneously permit the surveying and surveillance of tuna populations and fishing activities to assess the state and evolution of the resource. Fishers, therefore, became the main surveillance agents involved in the collection of ‘scientific’ information by reporting on their fishing activities – thereby placing them in a boundary position of surveillance agent and subject, which would be a source of tensions in the logsheet apparatus (cf. Chapter 7). Tuna experts suggested that the Pacific Islands make the logsheet conditional to the obtention of a fishing license, especially for foreign fishers, to increase their data collection reach.

Before this meeting, countries collected different data individually (Former SPC fisheries officer working at that time, Noumea, 07.05.21). Drawing on the precedent discussions related to fisheries statistics, the Expert Committee prioritised collecting daily catch and effort data (in distinction, for instance, to collecting environmental and ecological data). Catch and effort data were necessary to analyse tagging data, fisheries interactions and assess fish stocks – i.e. to address the three main priorities of the TBAP. Complementary oceanographic and ecological studies were left to other scientific organisations, which induced a division of scientific labour and epistemic separations across various scientific institutions – still influential to date. If the TBAP sought to manage and conserve offshore fish resources, the French Overseas Scientific and Technical Research Office based in New Caledonia invested in a more ‘commercial’ form of surveillance to improve fishing efficiency and foster industrial development in New Caledonia:

At that time, IRD [then the French Overseas Scientific and Technical Research Office] just had more money for that sort of things [aerial surveys]. For some reasons, they focused on technology for tuna fisheries: echo sounding, they also did a lot of work in satellite spot. Everybody was talking about satellite spot for tuna fisheries and France was really oriented to applying technology to tuna fisheries. The satellite information was more oriented to oceanography, to find areas of high productivity and to be able to forecast on a general basis or at specific times when the tuna fishing might be good because of upwelling, phytoplankton, etc. For the aerial observations, IRD actually hired a New Zealand guy [...]. He could fly around most of the EEZ and relay information to the fishing fleets on tuna school concentrations. It was largely oriented toward attracting fishing vessels to New Caledonia to develop the fishery. It was kind of different from an assessment point of view; it was more for locating schools of tunas. (SSAP scientist G., US, 16.02.21)

As mentioned by that interviewee, such a division of scientific efforts also largely reflected the respective financial capacities of each institute. SPC did not have the money to conduct such technology-intensive research, which also explains its focus on fisheries statistics and the devolution of this work to fishers.

The logsheets devised by the Ad Hoc Meeting would become a longstanding knowledge infrastructure, embedding specific categorisations of tuna fisheries that still exist today. For instance, the Ad Hoc Meeting prioritised commercial over artisanal fisheries, as the former appeared more fitted to the provision of catch and effort statistics. Due to their more centralised and administrative organisation, industrial – and still mostly foreign – fishing fleets were described as more apt to supply accurate and continuous catch and effort information. The logsheet apparatus, reliant on fishers' surveillance skills, privileged those already invested in such activity for their commercial interests. Later, the regional collection of artisanal tuna fisheries statistics would be attributed to SPC's Coastal Fisheries Division (created in the late 1980s). This induced a persistent institutional and epistemic split even though these surveillance apparatuses target the same tuna species.

The logsheet adapted pre-existing forms already used in certain Pacific Islands. For coastal (and essentially locally-based) pole-and-line vessels, the Expert Committee took up those of the Papua New Guinean fisheries administration. Long-range pole-and-liners and longliners' logsheets relied on Japanese forms, given that Japanese fishers, outnumbering other fishers, represented the main source of fisheries statistics. The regionalisation of national forms was largely attributable to path dependency, both to ensure coherence with previous statistics and to mitigate pre-existing practices of fishers: "It was stressed that major changes in format in the Japanese form would necessitate changing what the fishermen currently reported, and that this would be detrimental to obtaining consistent data." (SPC, 1979, p. 3)

These forms were adopted in 1979 as an interim measure to constitute the regional fisheries statistics database. Since then, they have been revised regularly (e.g. to add new species of interest, such as bigeye or albacore tunas in the late 1980s and bycatch species). However, these subsequent alterations only partially remodel the forms. They only applied incremental changes to the initial logsheets (e.g. adding new species of interest such as bigeye or albacore tunas), whose influence would persist over time (Bowker & Star, 2000).

iii. Database Developments and Networking – Scalar Articulations

The TBAP officially started in 1981, under the lead of R. Kearney at SPC and with external funding from Australia, France, New Zealand, and the US. Core to the programme was the “coordination of national statistical programmes and [...] the centralised accumulation of all available fisheries statistics from both coastal states and distant-water fishing nations”, which would bring “much of the information necessary” for the purposes of assessing “optimum yields” and give governments information supporting “sound fisheries development and resource management” and should therefore be “in a format readily usable by fisheries planners” (SPC, 1981b, p. 1).

The centralisation of fisheries statistics pursued two main objectives. One was the provision of “summaries, specified tabulations and graphical displays of the data” for each Pacific Island country and territory as a “service function” that could help them *visualise* and manage the offshore fisheries in their waters (SPC, 1984a, p. 1). In that respect, the TBAP provided the Pacific Islands with ‘state-istics’ for them to administer their territories (see Desrosières, 2016). The second objective was scientific, to permit the TBAP to access a “vast amount of details essential to the understanding of the dynamics of the tuna fisheries of the region and for the compilation of a regional database [...] from which analyses of the status of the stocks can be carried out” (SPC, 1984a, p. 1). The fisheries statistics database aimed to support, on one side, a regional tuna fisheries science interested in the study of the resource and, on the other side, national management objectives, scaled down to the territorial scale and targeting the sovereign management of the resource and the tuna fishers. The database and its statistics were instituted as a boundary information infrastructure shared between different stakeholders and serving multiple purposes.

From its beginning, the TBAP bought the necessary (especially computing) equipment, developed an information system to enter and manage fisheries data, recruited scientists and technicians, and started receiving and processing catch and effort data submitted by the Pacific Islands. In the programme’s first years, over half of the TBAP staff worked on developing the database to accumulate fisheries statistics and expand their coverage. The TBAP Fishery Statistics Project compiled two main sources of data: raw data from logsheets provided by domestic fishing vessels or foreign fishing vessels engaged in access agreements with Pacific Islands and already processed and aggregated data provided by DWFNs or international organisations (SPC, 1984a). This surveillance endeavour was highly labour-intensive and eventually became a full project in its own right (SPC Secretariat, 1991).

As part of this regional fishery statistics programme, SPC assisted the Pacific Islands in developing national statistics programmes that were also supposed to feed the regional one (SPC, 1982b). This consisted of training Pacific Island fisheries officers in fisheries statistics and installing national tuna fishery databases (SPC, 1982b). It also required finding a balance between harmonising the statistical programmes for the regional tuna research programme while accommodating local management

interests and needs. SPC customised local statistics systems to the individual needs of the Pacific Islands. Guam, for instance, expressed interest in monitoring transshipment operations of foreign vessels; Solomon Islands in following both foreign and domestic fisheries; and Fiji in focusing on foreign fishing activities, its local pole-and-line tuna fishery and its bait fishery (SCTB, 1990).

Fiji commenced monitoring its fishery by collecting and computerising daily catch data from pole-and-line, longline and purse seine vessels operating in its waters from 1981 (SPC, 1982a, 1983a). Domestic fishers, joint venture vessels, and licensed foreign fishing boats started forwarding logsheets monthly to the Fisheries Service Research Unit for local and ‘basic’ analysis using a computer unit provided under New Zealand Grant Aid (SPC, 1983a).¹²² SPC would also receive these data for further processing, analysis and summary. In New Caledonia, the collection of fisheries statistics seems to have emerged through the 1980s to improve the knowledge of offshore commercial species’ distribution and biology, assess the potential of the EEZ, and support the management of its resources (ORSTOM, 1982). By 1990, SPC provided its logsheet forms to the New Caledonian Fisheries Service to collect data from the Japanese pole-and-line vessels operating in the EEZ (SCTB, 1990) and helped the Territory build a customised fisheries database the year after.

iv. Completing Fisheries Statistics with Market Information

SPC’s regional fisheries statistics programme largely focused on assessing and monitoring tuna resources, leaving aside other economic aspects of the fisheries and their supply chains (e.g. market prices, operational costs, etc.). However, given their interest in managing tuna fisheries to extract the most economic benefit from them, those aspects were pivotal for the Pacific Islands: not only did they need to assess the size of their fish resource but also to estimate their economic value and therefore the profitability of fishing activities. FFA took the lead on economic and legal research in the late 1970s to address that shortcoming with its Regional Research and Development Programme. It addressed its members’ request for “in-depth information on the economics of foreign tuna fishing, processing and marketing as background for the levying of access fees under terms of bilateral agreements” in conjunction with the creation of their EEZ (Fakahau & Shepard, 1986, p. 66). This instituted another longstanding epistemic and institutional divide in the study of tuna fisheries, partially splitting the ‘fish’ dimension of fisheries from its socio-economic dimension.

To assist the bargaining capacity of the Pacific Islands against the DWFNs in pricing fishing access fees, FFA worked on establishing “information gathering procedures and analytical approaches to relate volumes of foreign catches, economics of vessel operations and market prices” (Fakahau & Shepard, 1986, p. 66). With that mandate, FFA became equally interested in catch and effort information and devised another logsheet form for its member countries. This duplicated SPC’s logsheet apparatus (cf.

¹²² However, such analysis would not cover economics and consumption aspects because of the “absence of an economic capability within the Division” (S. P. Sharma, 1988).

Section III), with the aim this time to assess the economic profitability of fishing activities. Additionally, FFA's legal research provided "background for assisting member countries to develop bilateral agreements with distant water fishing nations and for the framing of domestic fisheries legislation to meet local needs and to provide national legal frameworks for international arrangements" (Fakahau & Shepard, 1986, p. 66).

As a young institution with narrower human and financial capacities than SPC, FFA's undertakings were much slower to emerge and comparatively less systematic and centralised. The institution progressively specialised and consolidated through the 1980s.

3. The Fishery Observer and Port Sampling Apparatuses

i. The Development and Standardisation of Fishery Observer Programmes

In parallel to the creation of the regional statistics programme, Pacific Island representatives also recognised the "importance of, and need for, a uniform approach to the collection of scientific information" gathered under national fishery observer programmes (SPC, 1983d, p. 1). Such a 'scientific' objective was integrated into the TBAP, acknowledging the relevance of observer programmes to "assist in the collection of biological information as part of their duties" and that a "common format for this information would be highly desirable" (SPC, 1983d, p. 1). Although fishery observers were initially ranked a low priority, "considerable efforts" were made through the decade to consolidate and coordinate this surveillance apparatus at the regional scale (SPC, 1983d, p. 1).

The first formal onboard fishery observer programme appeared in 1974 in the US to collect data on dolphin bycatch and support the 'dolphin safe' tuna certification (Brooke, 2015; Drakopoulos, 2019). The programme implied placing human observers on board tuna fishing vessels to report on fishing gear and dolphin bycatch so that the US administration could manage dolphin mortality. Fishery observers permitted the collection of 'fisheries-independent data', i.e. not provided by the fishers themselves. In the South Pacific region, national fishery observer programmes emerged in the late 1970s, concomitantly to certain Pacific Islands' EEZ declarations. New Zealand and the Solomon Islands started their respective programmes in 1978, and the Federated States of Micronesia in 1979. Observers were initially placed on (generally foreign) fishing vessels to peer into these distant and unknown 'black boxes', i.e. to observe and learn about fishing operations, especially in the case of the more recent purse seine technique: "Originally, the observer programme was an exploration of the unknown. Nobody really knew what was going on; we wanted to know more about the fishery." (SSAP scientist and fisheries observer, US, 16.02.21). Progressively, some of these programmes grew and diversified beyond the mere exploration of fishing activities to support scientific or compliance investigations.

Observing the pluralisation of emerging national programmes, SPC convened representatives of its member states to brainstorm a formal and regionally harmonised fisheries observer programme (New

Zealand Delegation of SPC, 1982). Table 2 shows the diversity of the participants' expectations regarding fishery observer programmes.

Country	Objectives for observer programmes
Australia	<ol style="list-style-type: none"> 1) To maintain the integrity, assist with the completion and check the accuracy of the data recorded in logbooks 2) To undertake other duties as required, e.g. collection of catch composition data, length data, biological specimens
Federated States of Micronesia	<ol style="list-style-type: none"> 1) To familiarise with activities on vessels 2) To collect research and catch data
Fiji	To monitor joint venture fishing fleet activities recording data on species composition of catch
New Zealand	To gather fishery, biological and oceanographic data from the skipjack fishing fleet from which reliable data of any kind was not forthcoming
Niue	To ensure the sovereignty of Niuean waters
Northern Mariana Islands	<ol style="list-style-type: none"> 1) To obtain fishery data and socio-economic records (family incomes, social structure) 2) To monitor fishing activities and enforce fishing regulations

Table 2: Summary of the answers provided by SPC member States at the 1982 Workshop on Fishery Observer Programmes.¹²³ Adapted by the author from (New Zealand Delegation of SPC, 1982)

Onboard fishery observers could play many roles, ranging from strictly 'scientific' interests to rule enforcement prerogatives (see also Chapter 7). These various problematisations would result in equally different views on the programme designs or the desired profile of observers. For instance, the Australian programme sought a "broad coverage of the fishing fleet, i.e. by boarding many vessels frequently and repetitively" while adding a focus on the "areas presenting greater political problems" (New Zealand Delegation of SPC, 1982, p. 4). The Federated States of Micronesia aimed to place observers to cover the full range of the foreign vessels operating in their waters and deemed it more important to recruit observers experienced in commercial fisheries rather than observers with "any formal scientific training" (New Zealand Delegation of SPC, 1982, p. 7). On the contrary, the Northern Marianas recommended hiring "fishery technicians, fishery specialists, and biologists", while Tuvalu favoured "established government staff" (New Zealand Delegation of SPC, 1982, p. 8).

¹²³ I adapted the presentation and selected only a few cases to illustrate the variety of positions regarding observer programmes.

The 1982 workshop outlined the usefulness of the fishery observers for the TBAP regional fishery statistics database. Observers could alleviate uncertainty in fisheries statistics provided by the fishing industry, which were potentially unreliable: “It is clear from the above country responses that reliable national fisheries statistics are few and far between. [...] There are few opportunities to check the validity of statistics being obtained from distant water fishing nations.” (New Zealand Delegation of SPC, 1982, p. 15). The workshop concluded that the primary requirements for observer programmes should be to “improve the quality of the data being submitted by the DWFNs” and “also assist in general enforcement issues” (New Zealand Delegation of SPC, 1982, p. 1). Hence, observers would first serve to *control* the logsheet apparatus and the surveillance efforts devolved to the fishing industry, working as a ‘meta-surveillance’ apparatus surveilling the surveillance agents. This task rapidly became their top priority: “At the beginning of the observer data, only the catch data were carefully analysed by SPC” (SSAP scientist and fisheries observer, US, 16.02.21). This also permitted a back-and-forth exchange between the ‘field’ and land-based scientists and managers where logsheet forms were developed, reporting on the “problems associated with the use of the standard SPC catch form” (Gillett, 1986, p. 19). Observers also served to collect additional information and, therefore, complete the logsheet apparatus to support a more comprehensive vision of the tuna fisheries.

The 1982 workshop suggested that SPC assist the Pacific Islands in developing fishery observer programmes and coordinating them at the regional scale. To that effect, SPC recruited an observer coordinator and a small team of professional observers to go to sea, train national observers, participate in collecting scientific data and improving the knowledge of fishing operations upon request of member countries:

I was told that I should go as an observer on a Japanese vessel. I spent time on three Japanese vessels as an observer. There was some work in Papua New Guinea but I think we were the first observers to have an idea of the value of observer programmes. Then I went on a US purse seiner. This gave me enough to start thinking about what a larger observer programme could and should do. (SSAP scientist and fisheries observer, US, 16.02.21)

These expeditions permitted operationalising fishery observers and building an “intimate knowledge” of the tuna fisheries (Gillett, 1986, p. 1). This, in turn, served to identify the data that could be collected and to initiate the progressive formalisation of observer programmes in the Pacific Islands in coordination with the national level. SPC’s position regarding the observer programmes unequivocally – and exclusively – put to the fore scientific concerns. This condition was deemed necessary to secure access to the fishing vessels and permit the proper conduct of the scientific activity, as SPC observer R. Gillett explained in one of his reports:

SPC observers board fishing vessels at the courtesy of the vessel operators, and the reliability of the information gathered by the observers depends on the willing cooperation of the vessel’s crew. Therefore, SPC observers make no attempt to obtain

information which could be used for surveillance or enforcement purposes. (Gillett, 1986, p. iii)

This quotation shows that the observer surveillance apparatus depended on fishers' cooperation to function. SPC further argued that, against the "dual objective of data collection and surveillance", "the latter [...] was seen as being outside SPC's mandate" (SPC, 1983b, p. 7). Hence, the observer projects supervised at the regional level by SPC remained officially, at least, geared around alleged 'scientific' objectives of assessing and monitoring the state of fish resources.

In 1992, the South Pacific Regional Tuna Research Project, later renamed the South Pacific Regional Tuna Resource Assessment and Monitoring Project (SPRTRAMP), provided funding from the European Commission to the TBAP for five years to develop a more "continuous monitoring of the fishery and research" and support "regional, sub-regional and national tuna fisheries management" (SCTB, 1992b, p. 2). SPRTRAMP intended to contribute to the general objectives of the TBAP and paid specific attention to "*scientific* observer programmes" (SCTB, 1992b, p. 1, my emphasis) and port sampling programmes (see below). SPC's current regional observer advisor, who has worked in this field for several decades, confirmed in hindsight the scientific orientation of the SPRTRAMP observer programme, describing it as "an observer programme that was only science" (SPC fishery observer programme advisor, Noumea, 04.03.21). Under SPRTRAMP and its "scientific observer programme", SPC recruited four observers, described by a former SPC fisheries officer of that time as "high-price, college-educated, technical people, and even scientists in some cases" (former SPC officer, Noumea, 04.05.21), another sign of the research-orientation of the programme. Those profiles made the programme highly expensive and limited in size. The high costs of implementing observer programmes, associated with the difficulty and reluctance of the Pacific Islands to cover for those, curbed their development despite widespread interest in this surveillance apparatus. It took several years, along with the intensification of fisheries management and compliance concerns, to fortify fishery observer programmes at the national level and join both research and enforcement objectives.

In parallel to (and even preceding) SPC's observer programme, another sub-regional programme saw the light of day under the coordination of FFA. In 1987, 16 FFA members concluded a multilateral access treaty with the US to oversee the access of US purse seiners to their EEZs (see Chapter 6). This 'US Multilateral Treaty' imposed the mandatory coverage of 20% of the US purse seine trips by fishery observers and devolved the programme's cost to the US administration and US fishing companies, following a 'user pays' principle. This delegation strategy permitted the Pacific Islands to alleviate their surveillance costs. This arrangement gave birth to the first significant and formal observer programme of the region. Only this time, it first aimed to verify compliance with the terms of access of the US Multilateral Treaty. Hence, the programme defined three objectives for fishery observers: "(a) Monitoring the activities and operations (onboard as well as in the Treaty Area); (b) Collection of scientific data; and (c) Reporting on compliance" (FFA, 1990a, p. 5). Like SPC's programme, it verified

fishers' logsheets, collected scientific information *and* looked into compliance issues with the Treaty's regulations (in particular access fee payments).

The programme started under the management of FFA and strengthened once funding from Australia came up to support the recruitment of an observer coordinator. SPC also contributed to this programme, providing training to the newly recruited observers. Appraising that the employment of scientists was not cost-effective, it was decided that "these people [SPC scientific observers] should train *local* people as observers to lower the cost and increase the number of people observing" (former SPC officer, Noumea, 04.05.21). Data provided by observers fed a database constituted by FFA, which would also regularly send to SPC the "data relating to scientific requirements" in support of the TBAP.

These disparate regional efforts eventually converged, partly to address the technical needs of the database for standardised information (SPC fishery observer programmes advisor, Noumea, 04.03.21). The harmonisation and standardisation of the various observer programmes was also an economical strategy, to make the surveillance apparatus more cost-effective:

With these two different objectives [collecting information for stock assessment to provide scientific advice or for monitoring, control and surveillance and extraction of economic benefits], there was not enough resources to run simultaneously two programmes. There was a realisation that one programme would have to assume both roles. It was practical. There was a realisation that one person would have to collect both kinds of information. (SPRTRAMP observer, US, 16.02.21)

Observers, therefore, were established as a boundary surveillance apparatus, collecting various types of data, some of them multipotent, to serve various scientific, regulatory and coercive purposes. To permit this merging, a committee that would become the Data Collection Committee was formed between SPC and FFA in 1995 to devise common forms across the South Pacific region. The committee started meeting regularly to update the various forms associated with the surveillance of tuna fisheries: observer forms, logsheets, port sampling forms, etc. Observer forms grew denser along the process, attesting to their expanding roles: "Originally, the observer did nothing. When I did it, I had the same sheet as the captain and captured the information simultaneously. When the programme became more formalised, the observer logbook was constantly revised. There came to be Form A, B, C, D... to add information on the vessels sighted, on plastic pollution..." (SPRTRAMP observer, US, 16.02.21). Further developments in tuna fisheries governance and management eventually led to the formalisation in 2007 of a "Regional Observer Programme", setting minimum standards for sub-regional and national observer programmes to ensure their harmonisation (cf. Chapter 6).

ii. Coordinated Port Sampling

Another pillar of tuna fisheries research and resource monitoring efforts consisted of port sampling programmes. The TBAP started investigating the possibility of developing and coordinating port

sampling campaigns in 1986 to gather information by placing samplers in landing ports and recording data from fishing vessels when they returned to the shore. Here, too, the programme drew on pre-existing port sampling initiatives. The TBAP advocated for port sampling by outlining its multipotency:

Port sampling provides accurate information at relatively low cost on size and species composition of catches. It provides an opportunity to cross-check true catches with those reported on logsheets enabling more accurate interpretation of logsheet data. Examination of unloading statistics allows direct calculation of percentage coverage of the catches by logsheet reporting. Port samplers also have the opportunity to collect biological samples for specific programmes. Finally, port sampling allows Tuna Programme staff to have direct contact and closer cooperation with the fish-producing sector and to conduct such routine tasks as logsheet distribution and observer placement. [...] Further, such a programme would depend heavily on the willing cooperation of the fishing industry. (SPC Secretariat, 1986c, p. 4)

Like fishery observer programmes, port sampling could serve both as a complementary surveillance apparatus to collect additional data and as a ‘meta-surveillance’ apparatus to control the fishers’ logsheets. The quotation points to another important motive underlying the setting of such surveillance apparatuses, besides that of controlling tuna fisheries despite their distant operations: to mitigate the (social) distance between managers, scientists and the fishing industry. Surveillance is not merely about overseeing the fisheries – understood as ‘seeing from above’ – but also enrolling surveillance subjects understood as fully-fledged participants in this surveillance.

The TBAP proposal received favourable opinions from the Pacific Islands. The concretisation of this ambition was propelled once again by the signature of the US Multilateral Treaty, which stipulated that the catch at unloading be made available to Pacific Island authorities for sampling purposes. SPC provided guidelines on the objectives and methods for such a programme “presumed to be for scientific purpose” (SPC Secretariat, 1987b, p. 1). The resulting programme aimed to (in order of priority) verify and improve the accuracy of logsheets, provide information on vessel attributes, collect biological samples, and serve as a contact point for the tagging programme to improve tag recaptures. Port sampling data would then feed SPC’s regional database to assist scientific research.

Most port sampling programmes appeared in the early 1990s (SPC, 1994a). These included sub-regional programmes such as one targeting the South albacore tuna fishery and national sampling programmes, e.g. in the Federated States of Micronesia, Fiji, New Caledonia, Palau, etc. (SCTB, 1993b). In Fiji, port sampling started in 1991 to record Taiwanese longliners’ catch unloaded for the PAFCO cannery. Then, sampling targeted the local longline fishery, with a sampler trained by SPC and collecting tuna length and weight measurements for SPC and Fiji’s Fisheries Division (SCTB, 1993b). In New Caledonia, sampling first targeted albacore from 1990 and then yellowfin and bigeye from 1992, collecting length data and body samples for biological studies. Given the geographical location of SPC, its staff directly conducted the sampling every week before this work was internalised by the Territory’s fisheries service in 1993 (Service Territorial de la Marine Marchande et des Pêches Maritimes, 1994).

In 1994, a regional workshop took place to bolster port sampling and its coordination between the Pacific Islands. With the support of SPC, the Pacific Islands worked on the completion and standardisation of data collection forms (SPC, 1994a). They identified that port sampling should focus on collecting unloading weights and length frequency data for each caught species. Weight information was multipotent as it could support stock assessment, logsheet verification or monitoring “industry trends” (SPC, 1994a, p. 2). Length frequency data were useful for stock assessment, providing information on tuna populations’ recruitment and reproductive potential. Following the workshop, SPC produced a port sampling manual under SPRTRAMP and engaged in technical advice, financial assistance, training, etc., attesting to the progressive professionalisation and institutionalisation of this apparatus (SPC, 1996).

4. The Consolidation of Tuna Fisheries Research at the Regional Level: The Oceanic Fisheries Programme

The growth of fisheries research led by SPC and the diversification and consolidation of associated surveillance apparatuses brought an organisational restructuring. In the mid-1980s, SPC members expressed their interest in more permanently consolidating the tuna research programme and its associated surveillance efforts of fish stocks (including tagging programmes, fisheries statistics programmes, observer and port sampling programmes). Indeed, tuna research funding remained insecure and reliant on extra-budgetary contributions from Australia, France and New Zealand. Without such long-lasting effort, it was deemed that “the region would be put back in the position it was before the Skipjack Programme started” (SPC, 1983b, p. 7).

In the early 1990s, the TBAP was renamed the Oceanic Fisheries Programme (OFP), which still exists to date, to continue “providing scientific advice and analysis in support of the region’s tuna fishery management efforts” (Preston, 1997, p. 52) and guarantee a *continued* and *durable* production of knowledge on oceanic fisheries. Part of SPC’s core funding was devolved to the programme and Papua New Guinea was the first Pacific Island country to contribute to the programme’s funding in 1994, showing the emerging although still unbalanced ‘internalisation’ of the programme and empowerment of the Pacific Islands. OFP integrated the various research and surveillance efforts related to the tuna fisheries in the region (see Figure 16) (SCTB, 1994). For instance, research on albacore tuna, which had previously been conducted in a separate working group, was integrated to the broader work areas of OFP. The latter was initially structured along four main threads: statistics and monitoring, biological research, stock assessment and modelling, and reporting and liaison. These granted SPC distinct and complementary roles regarding surveillance. The organisation would manage infrastructural and multipotent ‘statistics and monitoring’ information, mobilise and complete this information to develop the biological surveillance of offshore fish (with its ‘biological research’ and ‘stock assessment and modelling’ activities) and support national governments with the science-based management of their

fisheries ('reporting and liaison' division). To date still, OFP participates in the coordination of the various surveillance apparatuses – fishery observers, tagging, logsheets, port sampling – to work on their complementarity and integration with one another and accumulate and manage at the technical level the resulting data.

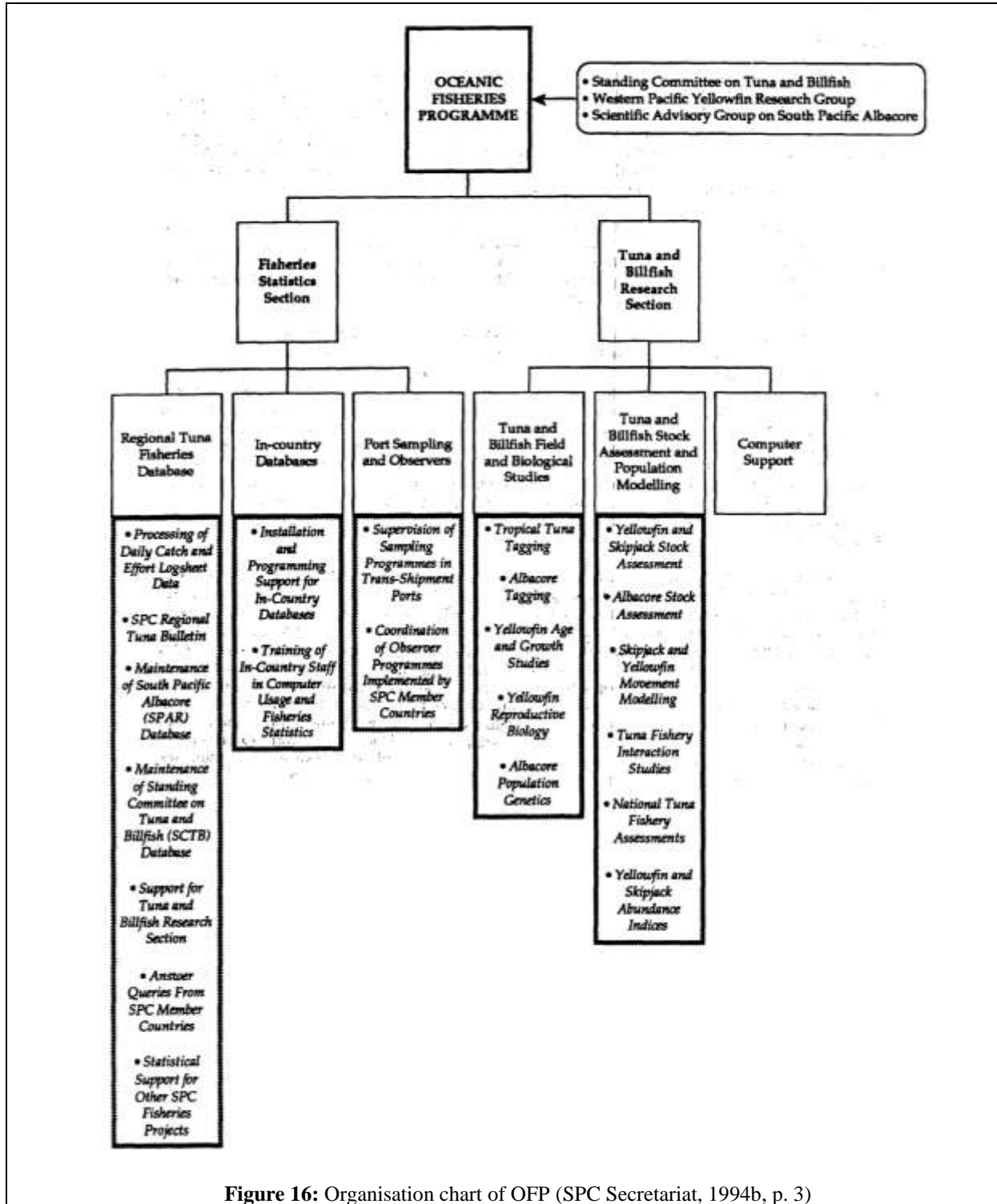


Figure 16: Organisation chart of OFP (SPC Secretariat, 1994b, p. 3)

III. A Regional Turn for Tuna Fisheries Research and Management? Governance Disputes and Boundary-Work around Tuna Fisheries Surveillance

In this third section, I describe how the general transformations exposed in Section I intertwined with the creation of the surveillance apparatuses supporting tuna fisheries research and management retraced in Section II. Growing economic competition and political tensions concerning offshore fish resources largely weighed on creating these apparatuses, whose utility, organisational structure and governance led to considerable debates. Disputes arose regarding who should participate in and control the apparatuses and their associated data and what use the latter should serve – precisely because they could serve many more usages than the biological assessment of offshore fish stocks only. These conflicts reflected wider political disputes, especially between the Pacific Islands and the DWFNs, and relocated them to data management issues. Hence, this section ‘re-politicises’ the previous one, showing that establishing these ‘techno-scientific’ apparatuses under SPC’s umbrella was far from uncontested. It required complex institutional and technical arrangements to arrange a (fragile) cooperation between the various stakeholders and hold together their diverging interests.

1. Cooperating for Science: The Regionalisation of Tuna Fisheries Research in the South Pacific Region

Given the scale and cost of the tagging project planned under the SSAP, international cooperation rapidly appeared indispensable for several reasons. Surely, biological considerations motivated the regional scale of the skipjack tuna tagging campaign to cover the fish’s habitat. The scientific nature of the project also contributed to the import of international and collaborative ideals of scientific research into the project. Financial, practical and human constraints and political agendas also weighed in on the project’s governance, leading to the latter having a peculiar status within SPC.

R. Kearney started working on the scientific design of the SSAP in the early 1970s, i.e. at a time when the Pacific Islands had limited fishery science expertise. As an expatriate ‘scientific entrepreneur’¹²⁴ ambitious to advance *general* knowledge on skipjack tunas and set up one of the largest tagging programmes in the world, he rapidly sought advice from his peers, consulting fellow scientists selected for their expertise in tuna research and tagging rather than for their regional affiliation. Early on, he consulted some of the most eminent (mostly American or British) names of ‘modern’ fishery

¹²⁴ R. Kearney was a particularly influential figure in leading the early developments of tuna fisheries research. He managed much of the early research programmes and produced most of the reports for SPC and for the Pacific Island Forum members accessible in SPC’s digital archives. This explains his central position in this section.

science, such as R. Beverton, S. Holt,¹²⁵ J. Gulland from FAO or J. Joseph from IATTC, who had been involved in other tuna tagging projects led in other oceanic regions. Scientific ontologies, methods and epistemologies to study tunas propagated from one ocean to the other and from one fish species to the other. In particular, American views on tunas and the need for an international approach to their research and management diffused through these individual connections. A SSAP scientist conceded that the project “accepted more of J. Joseph’s philosophies” because he had “been so much help to getting the [SSAP] project going in the first place” and explained that “the Americans were, in those days extremely influential if you wanted to get science and recruit people” (SSAP scientist Y., Noumea, 27.08.14). The pivotal position of the US in tuna fishery science – evidenced in the constitution of the SSAP team which included “a lot of Americans”, according to that same interviewee – conveyed its influence well beyond its waters and into international negotiations on the Law of the Sea (cf. Section I.3).

These personal scientific connections simultaneously facilitated institutional and financial ties. Those were particularly necessary given the enormous budget required to tag skipjack tunas through the widest ocean in the world, exceeding US\$1 million for each year of the project’s duration. Despite widespread interest in the project, no single stakeholder was ready to cover such a budget. Scientific and friendly ties between R. Kearney and J. Joseph permitted them to reach the US State Department and convince the US to rally the SSAP (Judd, 2016b).

By that stage, the institutional positioning of the SSAP had not yet been clarified. The successful mobilisation of complementary donors did not merely stem from intimate friendships and scientific interests but also from strategic and pragmatic considerations – sometimes indirectly related to skipjack tunas. Those considerations contributed to placing the SSAP under SPC despite SPC’s internal reluctance regarding the project. SPC was encountering serious financial difficulties. Some lead figures of the institution feared that the SSAP’s considerable cost would siphon the remaining budget off for fisheries matters, deemed less important than health-related agendas, for instance (Judd, 2016b). R. Kearney considered, however, that SPC was the most relevant institution to host the project from a scientific point of view. Being the most inclusive regional organisation, it offered a vast research area that could better fit skipjack’s distribution and the ‘natural’ organisation of the offshore environment regardless of states’ maritime boundaries and human political systems at sea.

France supported this institutional configuration, albeit for different reasons. The programme provided the French government a good opportunity to try and mend its reputation, which was severely damaged by its nuclear tests in French Polynesia (Judd, 2016a). The country was adamant about having the programme attached to SPC and its New Caledonian headquarters, especially because the South Pacific Forum member countries were increasingly criticising SPC. They had started relocating some of

¹²⁵ R. Beverton and S. Holt are frequently considered by fisheries scientists as founding figures of their discipline for having developed a particularly influential population model.

its programmes (e.g. health and agriculture) under the Forum's supervision in Fiji, away from the influence of the former colonial powers. Nonetheless, France was critical to the success of the SSAP, given its funding capacity and the large water volumes covered by its Pacific Island territories' EEZs.¹²⁶

The tagging project required access to tunas' territory *and* the fishers who would recapture the tagged fish. This implied enrolling the main fishing fleets and their associated nations, particularly Japan. However, Japan was not an SPC member and refused to fund an international organisation it was not affiliated with. This, combined with SPC's inability and reluctance to fund the project and France and SPC's dwindling reputations, called for an alternative arrangement, resulting in only partially attaching the SSAP to SPC. The SSAP became SPC's first-ever extra-budgetary project, an administrative and financial subtlety that accommodated these political hurdles. Hence, R. Kearney and not SPC controlled the SSAP budget (SSAP scientist, Noumea, 27.08.14), as he was viewed as a scientific and seemingly less political figure. This outward positioning persisted until 1986.

The scale and success of the SSAP gave a strong visibility to the programme and the region. The tuna tagging fieldwork activities, combined with scientific discourses claiming that there was only one population of skipjack tunas swimming through the Pacific Island waters, unleashed the regionalisation of tuna research on a longer term. The mobile skipjack tunas conveyed geopolitical connections as they swam from one Pacific Island to another. The SSAP gave the Pacific Islands a strong insight into the benefits of cooperating and their capacities to become a new centre of tuna fisheries and associated scientific research. The design of the first tagging campaigns precisely served to survey the Pacific waters while simultaneously uniting its associated coastal countries around a shared resource:

I think the Skipjack programme started as all of the countries got involved, all equally involved – no-one favoured, we worked in every country's waters. Everybody got a stock assessment report, everybody got a baitfish report. We did the lot equally in every country and then we put it all together: 'Fellas, this is what you own collectively.' [...] We never tried to partition it out and gave them the basis for a unification that overrode the basis for individual disagreement. (SSAP scientist, Australia, 23.02.21)

Additionally, the programme greatly revitalised the status of SPC and permitted the institution to establish its expertise regarding tuna fisheries and become a regional centre for tuna data.¹²⁷

The SSAP endorsed a 'commoning' process transcending scientific considerations to encompass management dimensions. R. Kearney promptly viewed the SSAP and its regional approach as a preparatory stage to creating a larger regional fisheries organisation, inspired by the worldwide

¹²⁶ Results of the SSAP eventually showed that French waters in the Pacific were not particularly rich with skipjack tunas but this aspect was unknown in 1975. The SSAP scientific team presumed that French marine territory was so vast that it would be highly influential in the study of skipjack tunas and could not be overlooked by the tagging operation.

¹²⁷ It also contributed to transforming the functioning of the organisation, which multiplied extra-budgetary projects after the SSAP.

multiplication of regional fisheries and the IATTC model¹²⁸ in particular (Kearney, 1976a, p. 1). In parallel to UNCLOS negotiations, R. Kearney published a series of reports through the 1970s, advocating a collective approach to tuna fisheries research *and* management. When the South Pacific Forum discussed the prefiguration of FFA, R. Kearney was asked to draft a proposal because of its role in the SSAP and its expertise in the field. He suggested a regional organisation bringing together coastal and fishing states to cover tuna stocks entirely while optimising surveillance and management costs. He proposed an organisation supporting the collection and compilation of fisheries statistics and biological data, scientific research, the adoption of management and conservation measures, fisheries development, and regional surveillance activities.¹²⁹ Such organisation mirrored that promoted by the US and Japan regarding tuna fisheries in UNCLOS negotiations to keep a foothold in their governance under the argument that tunas are ‘highly migratory’ and could therefore not be governed at the national level and territorial scale.

As a matter of fact, the SSAP had rather evidenced that skipjack tunas were “vagile”, i.e. highly mobile rather than “highly migratory” (SSAP scientist, Noumea, 27.08.14). A few years later, SPC fishery scientists R. Hilborn and J. Sibert mitigated tunas’ migratory ‘nature’. They argued that the emphasis on their mobility reflected scientists’ penchant for the exceptionalism and the internationalism of science more than the most common behaviour of those fishes (Hilborn & Sibert, 1987). To them, internationalising tuna research was decisive in addressing its high costs, but this did not imply that national management could not be appropriate for sufficiently wide EEZs. The SSAP team, however, found at the time that the vagile/migratory distinction “would not serve any purpose so it was OK to say that they are highly migratory” (SSAP scientist, Noumea, 27.08.14). Scientific results could be bent for the sake of politics, leading jurists, managers and fishery scientists to have distinct definitions of what ‘highly migratory’ actually implies (see also Chapter 8).

2. Fractures in International Cooperation and the Politics of Tuna Fisheries Data

i. The Failed Internationalisation of Tuna Fisheries Management and the Multiplication of Regional Fisheries Organisations

However, the international cooperation laid out by the SSAP and its institutional arrangement was precarious. As mentioned in Section I.3, tensions between the Pacific Islands and DWFNs were thriving in parallel to the programme’s implementation. This curbed R. Kearney’s expectations to enhance the regional tuna programme toward a regional fishery management organisation. The Pacific Islands

¹²⁸ cf. Section I.1.i

¹²⁹ This proposal outlined a regional fishery institution much more alike the Western and Central Pacific Fisheries Commission (WCPFC), which would take shape in 2004 – see Chapter 6.

refused to co-govern tuna fisheries they claimed as theirs in their EEZs with DWFNs, which contrarily refused to ascertain the Pacific Islands' sovereignty over the tuna fish. Instead of becoming the regional management organisation R. Kearney promoted, FFA became a regional body serving the Pacific Islands countries and their sovereign and economic development aspirations (cf. Section I.3.iv). This led R. Kearney to refuse the directing position he was offered at FFA. He preferred staying at SPC, which better reflected his convictions regarding how tuna fisheries should be governed and managed from a *biological* perspective. An SSAP scientist explained that R. Kearney deplored the fact that FFA could not cover "the whole of the [tuna] area" (SSAP scientist, Noumea, 27.08.14). Although this configuration could make sense from a national economy perspective, R. Kearney "was not an economist, nor [...] a political scientist" and was only interested in seeing the "fisheries developed and being managed, soundly managed" (SSAP scientist, Noumea, 27.08.14). R. Kearney conveyed a modernist understanding of tuna fisheries, distinguishing a common interest in conserving and managing 'nature' independently from individual socio-economic interests relating to tunas.

The positive exposure of the SSAP sparked institutional competition to take over the programme and its continuation. SPC's role regarding tuna research at the regional level had not been ascertained (and even less so concerning fisheries management), given the fixed-term duration and outward position of the SSAP. Several organisations attempted to take over the programme. FAO reportedly attempted to "make a takeover bid" to "get a foothold in the Pacific" (SSAP scientist, Noumea, 27.08.14). The most controversial attempt was that made by FFA after the agency was created. FFA had the overlapping mandate to "collect, analyse, evaluate and disseminate to Parties relevant statistical and biological information" on the region's highly migratory species (FFA, 1979, p. 3). Growing discontentment of the Pacific Islands against SPC and FFA's interest in consolidating its institutional existence led the agency to try to "take over coastal fisheries as well as oceanic programmes" (Former FFA director, Australia, 03.06.21), including the well-established and data-rich SSAP.

This attempt received strong opposition from donors like France and Japan, who refused to see the programme move to an organisation they were not affiliated with. R. Kearney also vehemently resisted this move, arguing that FFA lacked the technical skills and material equipment to manage the programme and process its associated data (contrary to SPC). He dreaded that the institutional change would dwarf the programme's membership and capacity to collect data and cover the entire oceanic basin and fishing fleet – and therefore lessen its ability to produce relevant fisheries research: "The non-FFA countries would not have given FFA their data" (SSAP scientist, Australia, 23.02.21). Finally, the feud between SPC and FFA also stemmed from professional and institutional competition:

SPC and FFA at the international level pretended to be so polite and gave the illusion of cooperation when they actually hated each other. They went on for ten years, largely because of the personal motivations of the two directors. A bit like the US and the Soviet Union during the Cold War. They just didn't want to share the data and

cooperate; they wanted to use all the resources to enhance their programmes. It started out of personal competition between the two heads of the tuna programmes. When these two people changed, part of the institutional culture was to give up nothing to the other institution. (SSAP scientist, US, 16.02.21)

These disputes reflected and provided a new locus of expression for the dissensions between the Pacific Islands, the DWFNs and the former colonial powers, which became even more acute upon the conclusion of the SSAP and the prefiguration of its prolongation and expansion with the TBAP. These conflicts attest that scientific biological research on tunas certainly was not ‘apolitical’ and was contrarily well entrenched in inter-state power relations. Indeed, in the context of international sovereign issues over the ‘highly migratory’ fish species, tuna fisheries data swiftly became an important source of bargaining power between coastal and fishing states. Sovereign conflicts over tuna resources entailed disputes over the control of tuna fisheries surveillance apparatuses and related knowledge production capacity. The governance of these apparatuses was, in turn, largely shaped by the political economy of fisheries information and the associated structure of the tuna fishing industry.

ii. **Political Data: Governance Issues Relating to Fisheries Data**

The overlap of SPC and FFA regarding tuna fisheries data led to several regional meetings to consider regional institutional (re)arrangements. SPC’s and FFA’s members agreed on the importance of a research and development programme on highly migratory species – the TBAP – and concluded in 1980 that the “existing framework of the SPC Skipjack and Tuna Programmes and the FFA were adequate in the short term”, postponing the decision of creating a broader regional fisheries organisation.

Starting in 1981, the TBAP focused on creating the regional fishery statistics database while still abiding by the same regional approach as the SSAP. In parallel, FFA collected fisheries data for its member countries and transmitted them to SPC for processing. In addition, SPC also gathered other available data from its additional member countries or its tagging programme. However, the TBAP regional statistical programme rapidly stumbled against the limited alliance between fishing and coastal nations. The reterritorialisation of the ocean in relation to UNCLOS negotiations was at odds with the commoning approach initiated under the SSAP in the name of science. With the progressive consolidation of the EEZs and the introduction of fishing access fees for foreign fishing vessels, DWFNs rapidly saw their interest in withholding their logsheet information to bargain for their involvement in management decisions (Lodge, 1991a). Incidentally, this reaction partially derived from the SSAP study results, which had helped the Pacific Islands realise the economic value of the tuna fisheries in their EEZs:

One of the things that wasn’t all that positive of an outcome is that we reanalysed all of the Japanese longline data and broke it up according to the SPC countries, based on our map [of the EEZs] that we’d drawn. [...] We reanalysed the Japanese data and partitioned it out into the countries, and the Japanese didn’t like it one bit, because it

made the countries realise how much fish Japan was catching. [...] They used to produce the ‘yellow books’, they were called, which were their annual catch statistics by area. They stopped producing them after we analysed it. Nominally, that was a disservice to science because they stopped producing – but they didn’t stop collecting it [...] but they stopped publishing it. (SSAP scientist, Australia, 23.02.21)

Although the SSAP allegedly developed the biological surveillance of tuna, it simultaneously contributed to the economic surveillance of its associated fishers for regulatory dimensions. Additionally, because the SSAP showed skipjack resources to be plentiful and not in (immediate) need of conservation measures, it only accentuated the economic rather than biological value of its fisheries data: “The information service role of providing data that member countries either themselves or through FFA wanted to manipulate for the management of the foreign fleet and to negotiate the maximum access fees assumed greater importance than the long-term research role” (Curtin, 1987, p. 17). ‘Scientific’ data collected under the SSAP were multipotent. Initially devised for commonly shared ‘biological’ considerations, their utility was increasingly shifting toward serving national economic interests. The use of catch and effort data “for purposes other than biology” made DWFNs even more reluctant to share them (Curtin, 1987, p. 17). Antagonisms on that topic became even more prevalent after the introduction of a new access fee scheme, switching from a lump sum payment payable in advance to a proportional payment system indexed to the value of the landed catch in order to more accurately tax the value of the harvested tuna fish. Although DWFNs like Japan found this system more advantageous for its fishers who would only pay for what they managed to catch, it also contributed to making the catch data particularly ‘valuable’, not only from a scientific point of view to assess stocks but also from an enforcement point of view to bolster the Pacific Islands’ control over foreign fishers and DWFNs.

The boundary position of the logsheet apparatus inserted tensions in its functioning. The strategy of the Pacific Islands to condition the issuance of fishing licenses to the provision of the fishers’ logsheets only “polarised the relationship between DWFNs and coastal States” (SPC Secretariat, 1986a, p. 9) while raising new concerns for the accuracy and reliability of the logsheet data recorded. It could not solve either the limited coverage of the fishing operations occurring outside the Pacific Islands’ EEZs, i.e. in the high seas. This implied that the TBAP regional fisheries statistics database contained quantitative and geographical gaps in its coverage of the extent and distribution of tuna catches (see Figure 17). TBAP lead coordinator R. Kearney estimated that only 35% of the total catch taken in the SPC area was declared to SPC and integrated into the regional database (SPC, 1983b). He attributed this to the fact that statistics were used for purposes “other than in the *common* interest of total resource assessment” (my emphasis), thereby exacerbating conflicts of interest between resource users and consequently impeding the “free exchange of reliable statistics” (Kearney, 1983b, p. 95). The enclosure of the South Pacific Ocean entailed data enclosures at odds with scientific imperatives of ‘open-access’ and productive of ignorance. The commoning of the resource and its knowledge were intrinsically linked, given that “before the implementation of 200-mile zones and the introduction of licence fees for

foreign fishing vessels, statistics were relatively unbiased and freely available” (Kearney, 1983b, p. 95). Other assessments shared similar views, concluding that the dual utilisation of fisheries statistics hampered the proper enrolment of DWFNs and their fishers in the apparatus and, as a consequence, the very possibility for the surveillance apparatus to satisfy its scientific function. Science’s universalism and conservation objectives permitted and/or required cooperation incompatible with economic development and competition interests:

It is often possible to obtain the full cooperation of fishermen for supplying information for stock assessment since they can perceive that this is in their long-term interest. It is only natural that they should balk when the data may directly affect their current earnings. (SPC Secretariat, 1986a, p. 9)

TABLE 2. HIGH SEAS AREAS WITHIN SPC REGION - DATA HELD OR AVAILABLE TO THE TUNA AND BILLFISH ASSESSMENT PROGRAMME

	1984	1980-83	Prior to 1980	Remarks
US purse-seine	P	**	Limited fishing; data available on some vessels in PFDF reports	
Japan purse-seine	Some general summaries available*			
" pole-and-line	*	*	Summaries	Data were published as 1° square summaries up to 1979
" longline	*	*	Summaries	Data were published as 5° square summaries up to 1980
Korea longline	Summaries	Summaries	Summaries	Summaries for earlier years being revised
Taiwan longline	Summaries	Summaries	Summaries	Data have been published as 5° squares since 1977
Others	No data available to SPC			
Footnotes				
P = Monthly 1° square summaries within agreement area; general summaries from other high seas areas.				
* = Many data have been collected, but currently not available.				
** = Some partial, general summaries have been made available to SPC. Monthly 1° square summaries are available to countries with access agreement, but currently cannot be released to SPC. There is also detailed information on that portion of the fleet covered in Pacific Fisheries Development Foundation (PFDF) reports.				

Figure 17: Synthesis of the catch and effort data for the high seas in the SPC area made available or not to the TBAP (SPC, 1984b, p. 13)

The missing statistical information was central in the discussions between the Pacific Islands and the TBAP team, the topic invariably figuring high in the annual TBAP reports from the early 1980s. The conflated utilisation of the data for distinct and seemingly incompatible purposes stemmed, for R. Kearney, from the very configuration of the TBAP, sitting awkwardly astride SPC and FFA and serving both biological considerations and cost-efficiency objectives in the absence of a more comprehensive

regional fisheries agency. The statistical programme's hybrid structure and boundary position presented inherent "inadequacy" (SPC, 1983e, p. 6) and obtaining comprehensive statistics would require a governance rearrangement to permit "the full cooperation of *all* parties involved in the fisheries" (SPC, 1983e) – i.e. to 'de-hybridise' the apparatus. This implied the use of the data only for "the conservation of the resources to provide maximum yields", ensuring that "all contracting parties are equally involved in the decision-making leading to any management measures for conservation purposes" and protecting the confidentiality of the fisheries data (SPC, 1983e, p. 6). Such integrative governance would require opening the TBAP beyond SPC members to welcome influential DWFNs, "at least Japan and Korea" (SPC, 1983e, p. 6). Integration was also strategic to attract financial contributions from the DWFNs to the costly regional tuna research programmes.

In 1984, anticipating the upcoming ending of the TBAP and its follow-up, SPC and FFA co-organised a Meeting of coastal States and distant-water fishing Nations¹³⁰ to explore ways of obtaining more input from the DWFNs (SPC, 1984c). The period also coincided with an important staffing renewal within the TBAP, with the departure of most of the senior staff, including R. Kearney. This was the first joint meeting between the Pacific Islands and DWFNs since 1978, after the disputed creation of FFA – and yet, it still reflected a similar configuration between the two sides. Certain Pacific Islands confirmed their "great concern that the maximum sustainable yield cannot be calculated due to insufficient data" (SPC, 1984b, p. 5). However, countries like Tonga, Solomon Islands and Western Samoa also shared their "strong reservations that an expanded Tuna Programme which included DWFNs would tend to be less responsive to needs of small island countries" and opposed, once again, the option of setting a broader-based fisheries organisation (SPC, 1984b, p. 9). In echo with the FFA creation negotiations, the Pacific Islands were worried that including DWFNs would alter their control of the programme. They also resisted the presumption that in the absence of a regional fisheries management organisation, the tuna stocks were not or could not be managed. The meeting improved cooperation with the American Tuna Association and Japan (at least in discourse), but it left unresolved, in practice, the wider cooperation issue between coastal and fishing states.

In that context, FFA commanded an assessment of the "fisheries research needs in the region" to consultants Fakahau and Shepard to assist its members "in their consideration of the future of the SPC Tuna and Billfish Programme" (Fakahau & Shepard, 1986, p. 2). Their report mitigated R. Kearney's analysis that the TBAP statistical programme had mostly served the interests of the coastal States over those of the DWFNs. On the contrary, certain Pacific Islands had grown more estranged from the TBAP for several reasons. Contrary to the 'picturesque' and 'shining' sea-going tagging campaigns of the SSAP, which generated great enthusiasm in the region, the TBAP, dealing with logsheets, databases and

¹³⁰ Those included the US, Japan, France, Mexico. Indonesia attended as an observer. It also involved international fisheries organisations like FAO, IATTC and ICCAT.

highly technical statistical analysis, was far less popular. Additionally, it provided little practical information that could be of direct use for the Pacific Islands to develop their tuna fisheries. The information produced by the SSAP was “too general” in scope and scale (Fakahau & Shepard, 1986, p. 64). By delegating tuna research to a regional programme, “member countries ha[d] not developed their own technical capabilities in the tuna field to any extent; very few countries ha[d] technical officers dedicated to working on tuna problems” (Fakahau & Shepard, 1986, p. 89). This delegation also led many Pacific Island governments to focus on their *inshore* waters and small-scale fisheries (including artisanal, near-shore, and tuna fisheries), a topic that the SSAP or the TBAP did not investigate. This focus on their artisanal fisheries intensified their worry that foreign industrial fishers hurt their development and should, therefore, be controlled. More fundamentally, the relations between the regional and national levels were falling off because of diverging knowledge interests relating to tuna fisheries. The TBAP, led by expatriate scientists who decided on most of the technical content of the programme, appeared more interested in advancing academic science and ‘universal’ knowledge rather than in providing applicable knowledge to the Pacific Island fishery services:

On the other hand, the Programme’s highly skilled expatriate scientists’ natural interests were in the development and testing of hypotheses regarding the population dynamics and behaviour of tuna, and not in the routine production of catch statistics reports. This is not just an academic interest; the scientists felt that development of a workable conceptual framework for tuna population dynamics was absolutely essential if assessments of the effects of fishing and other factors on the stocks were ever to be made. Practical Island fisheries officers, on the other hand, were puzzled by the sophisticated and theoretical methodological scientific papers being produced, and often failed to understand their relevance. (Fakahau & Shepard, 1986, p. 64)

Reciprocally, the TBAP officers felt that they received “little guidance” (Fakahau & Shepard, 1986, p. 59) from the Pacific Island fisheries officers and that the latter did not use the programme enough. Although the Regional Technical Meeting on Fisheries was supposed to provide the stage for the member countries to express their opinions on the programme, TBAP scientists found it did not provide “genuine technical direction” as it was enmeshed in “the politics of the region” (Fakahau & Shepard, 1986, p. 59). The regional approach of the project contributed to bringing the Pacific Islands closer together, but it also created a disconnection between SPC and its Pacific Island member countries.

The report produced for FFA is particularly interesting in that it evidenced multiple understandings (and conflicting ones) of ‘fisheries research’ – a tension well reflected in the functioning of its associated surveillance apparatuses. Those spanned from “ivory-tower studies of abstract biological problems” to “any activity associated with the handling of facts relevant to fisheries, including exploratory fishing; gear development and processing; collection of catch and effort statistics; analyses of economic and sociological data associated with harvesting, processing and marketing; studies of fish biology and ecology; surveillance technology; and development of fisheries law” (Fakahau & Shepard, 1986, p. 12). Against this diversity ranging from ‘fundamental’ to ‘applied’ and regulatory science, the consultants

defined research as “the collection and investigation of facts required to facilitate fisheries management and development”, whose principal “information gathering activity” consists of “monitoring” (Fakahau & Shepard, 1986, p. 8). Such a definition closely resembles the one I adopted for ‘surveillance’ and supports my suggestion that scientific activities may also entail an affiliate to some form of surveillance (cf. Chapter 2).

Therefore, SPC’s fundamental approach to tuna research with the TBAP had diverged from the Pacific Islands’ immediate preoccupations. On the contrary, FFA was becoming more popular amongst its member countries. As the organisation progressively developed its research and surveillance capacities, it became a more serious competitor to SPC.

iii. Sharing or Duplicating Surveillance Apparatuses? Partitioning the Offshore Ecosystem and its Data

In parallel to FFA’s investigations on tuna research, a governing body of SPC, the Committee of Representatives of Governments and Administrations (CRGA), demanded two consultants, R. Herr and T. Curtin, to conduct an independent review of the TBAP and find ways to secure more data and funding from the DWFNs despite the opposition of the Pacific Islands to grant them full membership of the research programme. One alternative, short-term solution consisted in the restoration of an Expert Committee, similar to the SSAP Expert Committee on Skipjack Tuna and then largely dominated DWFNs’ experts (cf. Section II.1.ii). Following this recommendation, the CRGA decided to create the Standing Committee on Tuna and Billfish in 1986 to facilitate discussions and cooperation on fisheries data with fisheries experts from the DWFNs. However, the CRGA was mostly dominated by the former colonial authorities and did not consult the Pacific Islands. The decision, therefore, turned out highly controversial in the context of internal divisions within SPC between the Pacific Islands and the colonial countries. Immediately, representatives of some Pacific Islands objected to this Standing Committee and its composition at SPC’s Eighteenth RTMF. Tonga and Papua New Guinea deplored the lack of Pacific Island experts within the Standing Committee and the domination of experts *foreign* to the region, even though the latter had dramatically improved its expertise thanks to FFA (SPC, 1986).¹³¹

At that same meeting, Papua New Guinea shared its intention to send its logsheets to FFA instead of SPC, outlining the “sensitive” nature of their data (SPC, 1986, p. 13). That same year, South Pacific Forum members also commanded FFA to develop and operate “a regional database for the conservation and management of the offshore tuna resources of the region” (Curtin, 1987, p. 23). The database would host data from various sources, including logsheets from foreign and domestic vessels, port sampling data, market data, and scientific research and economic studies. As observed by consultant T. Curtin, “it

¹³¹ In the same spirit, a few years later, some Pacific Island countries like Western Samoa deplored that the SPRTRAMP project had been submitted for funding to the European Community without prior approval of the RTMF (Commission, 1990).

would appear that the scope and source of the data, the purposes for which it would be used and the resources required to manage the system *mirror the TBAP database management function*” (Curtin, 1987, p. 24, my emphasis). This announcement sparked immediate reactions: Australia and New Zealand expressed their fear that this duplicative undertaking would only induce technical degradations to the regional database. In the following years, SPC decried the project as a “misuse of resources” that would “ultimately reduce the credibility of both the SPC and the FFA” (SPC Secretariat, 1987a, p. 2):

There are numerous problems of judgement and interpretation required to create a database. It would be impossible to ensure that the contents of the two databases are identical. [...] The consequence of database duplication is the loss of the most important reason to have a database in the first place – credibility. It is essential to be able to state with confidence that the database accurately reflects. (SPC Secretariat, 1987a, p. 2)

In this statement, SPC acknowledged the social construction underlying the development of this technical instrument and its fear that the project would only further reduce its access to fisheries data. It consequently argued for remaining the only “calculation centre” (Latour, 1987) on tuna fisheries in the region. Although arguments were mostly technical, they evidently bore wider political struggles for the control of knowledge infrastructures. Issues pertaining to the duplication of surveillance efforts also applied to the observer programmes, with both SPC and FFA developing these surveillance activities in parallel (cf. Section II of this chapter). Boundary surveillance apparatuses, shared between various stakeholders and serving different ends, raised tensions. However, so did the separation of these various forms of surveillance across duplicated and unshared surveillance apparatuses.

Other institutional overlaps became conspicuous between fisheries and environmental agencies, which were also concerned with fisheries matters. This became evident at the regional level when a SPREP representative exposed this issue at SPC’s Eighteenth RTMF in 1986 and suggested that SPREP work on fisheries-related issues otherwise unfunded. A Tongan representative agreed that there was a need for a clearer “definition of boundaries of fisheries and SPREP spheres of involvement” (SPC, 1986, p. 47). However, the same representative also criticised that some SPREP personnel conveyed “inappropriate concepts and attitudes in relation to fisheries issues”, disclosing blooming tensions between nature conservation and tuna fisheries development (SPC, 1986, p. 47). This came as parallel discussions were happening to build another regional information system for marine resources in general. Given the predominant role of FFA and SPC in regard to oceanic fisheries and the confidential nature of the industrial catch and effort data, it was decided to leave the matter of oceanic fisheries aside from the rest of the marine resources data (SPC et al., 1987). This partitioning of informational infrastructure led to demarcating tuna fisheries from biodiversity concerns by extracting tuna fisheries-related information from the rest of the marine ecosystems. Such an institutional and technical division would largely perform the epistemological and political disconnection (Bowker & Star, 2000) between tuna fisheries management and marine biodiversity conservation (cf. Chapter 8).

3. Boundary-work in Tuna Fisheries Surveillance: Compromising by Demarcating

i. Demarcating SPC and FFA, Science and Management, ‘Nature’ and ‘Culture’

Institutional tensions between FFA and SPC progressively cleared up through the 1990s, thanks to several factors, including a staff turnover, data protection policies and a “boundary work”¹³² (Gieryn, 1983) enabling the articulation of stakeholders (especially FFA and SPC) by drawing social, symbolic, and material boundaries between the institutions, their occupations and within the surveillance apparatuses. Such boundary work permitted the fragile assembling of conflicting stakeholders while retaining their divisions.

From the onset, the TBAP team worked for tuna science to be inclusive to collect enough data and cover tunas’ distribution. They believed that inclusion required neutrality, which itself required, at the symbolic and institutional level, to demarcate ‘science’ from ‘politics’ and ‘nature’ from ‘economics’: “[We] wanted to keep the science separate from the management because management was going to be political, so the goal was to have science being apolitical, as we had done all along.” (TBAP lead scientist, Australia, 23.02.21). To that effect, these scientists used discursive and technical strategies:

[We] tried to negotiate with [FFA] to have control of the data. [We] said we would analyse the data for them because SPC had the capability to do it, they didn’t, and it would be stupid to duplicate the efforts. [...] We couldn’t have a gap in the data. Otherwise, someone could come along and do that analysis and then you’d be in conflict over whether the results are right or wrong. (TBAP lead scientist, Noumea, 27.08.14)

That same scientist pursued, in another interview:

And [we] said [to FFA]: “You stick to the economics and the development of Pacific Island States, and we [SPC] will stick to the international tuna fisheries side of things, regardless of who’s involved. And I can deal equally with Tuvalu and the United States because *we’re not talking politics. I’m talking about fisheries.*” [...] We kept out of things such as IUU fishing even though we were interested in it. We were concerned about it because of the fish disappearing to Taiwan or wherever and that were creating errors in all of our data. It was a scientific problem too, and we were quite happy to work out how much it was a problem. But I wasn’t prepared to be involved in what to do about that and drop bombs or whatever you’d want to do. I was happy to advise on the issue’s impacts but not to lead surveillance programmes. That’s what management agencies are for. (TBAP lead scientist, Australia, 23.02.21)

¹³² The concept of “boundary work” was used to discuss scientists’ strategies to demarcate science from non-science and claim control and ownership of a particular field of knowledge and practices. Since then, the concept has expanded to discuss the efforts of individuals or collectives to influence the boundaries and demarcations between groups, occupations or organisation, thereby influencing collaboration, inclusion and exclusion processes between entities, and shaping power relations between the latter. This concept offers a processual and constructivist understanding of social and organisational boundaries (Langley et al., 2019).

These quotations deserve several comments. First, the interviewee distinguishes various types of surveillance: a ‘scientific’ surveillance concerned with ‘fisheries’ understood in their biological dimension (i.e. outside of politics), a ‘regulatory’ surveillance concerned with politics and economics, and a ‘coercive’ surveillance concerned with enforcement and policing of IUU fishing. These various forms of surveillance are divided across several databases to perform their demarcation despite their interconnections. In particular, the ‘coercive’ surveillance of IUU fishing was separated from the ‘scientific’ surveillance of fisheries, even though it could be important to the latter. Second, that scientist leverages the technical expertise of SPC in data management to legitimate its control of the information infrastructures and secure its access to fisheries data. This point, particularly analysed in chapters 7-9, outlines the authority of infrastructure ‘experts’ – i.e. those who have the technical and cognitive ability to maintain, operate and use the infrastructure – in controlling them and shaping associated knowledge production. Finally, the interviewee mentions that making SPC the sole authoritative voice was strategic to limit the potential for scientific controversies (although inherent to the functioning of academic science) and permit collective political action regarding tuna fisheries. Although aiming for multilateral collaboration in tuna fisheries research, this TBAP member also aimed for a centralised, monopolistic and heavily controlled approach to science. Such structure prevails to date and is largely specific to this oceanic region (see also Chapter 8).

A similar neutralising boundary work occurred for the TBAP Standing Committee on Tuna and Billfish, whose creation became possible by circumscribing its mandate to ‘technical’ advice only. The credibility of science and its neutrality was instrumental to making surveillance possible by ‘dismissing’ its political dimension.

The staff turnover at SPC and FFA and the partial alleviation of the tensions between DWFNs and the Pacific Islands with the progressive recognition of the EEZs helped what initially was a competitive boundary work to become more collaborative. The boundary established between SPC and FFA and between ‘science’ and ‘management’ became a space of encounter and cooperation. ‘Science’ and ‘management’ would remain autonomous but also feed one another, management being science-based and science becoming more applied and useful to policy-makers. Despite the Forum members’ reservations against SPC, the new SPC’s and FFA’s directors fostered their collaboration by exchanging information more regularly from 1987-1988 to improve the quality of the database and avoid duplicating their efforts (SPC, 1987a):

I worked really hard to build strong relations with SPC because fisheries management is like a chain: if one of the links breaks, it’s less effective. If you’ve got rubbish data, you’ve got bad assessments. (Former FFA director, Australia, 03.06.21)

For this interviewee, the collaboration between SPC and FFA, and between stock assessment and fisheries management, was necessary to consolidate and legitimise both sides. Collaboration emerged out of the technical rather than political level by building inter-professional relations:

They started to have annual colloquiums between the two institutions. At the technical level, there were requirements for cooperation between engineers and technicians, then they started to swap employees between computer system managers, etc. which caused a greater understanding and now it's actually really good. (Former SPC fisheries officer, US, 16.02.21)

The intensification of staff circulation and communications facilitated inter-institution cooperation regarding the regional fisheries database, port sampling and fishery observer programmes (SPC Secretariat, 1994a). In parallel, SPC also undertook to reconsolidate its relations with the national administrations of the Pacific Islands, providing them with support services in building national fisheries databases, providing them with quarterly data summaries or undertaking stock assessments at the national scale (SPC, 1992b).

The clarification of the respective statuses and prerogatives of SPC and FFA progressively repositioned SPC and its tuna programme to a unique position of “research and advice” in the institutional landscape of the region (SPC Secretariat, 1991, p. 12). This turned SPC into an expert agency involved in the production, not of ‘fundamental’ academic knowledge, but of “regulatory knowledge” (Jasanoff, 2004) assisting fisheries management. Such evolution is well in line with the transformations brought up by S. Jasanoff regarding the tighter relations between scientific research and public policies in the 1970s, especially concerning environmental regulations (Jasanoff, 1992). Regulatory science works as an intermediary type of science aside from academic research and policy-making, producing knowledge relevant to regulators in a politicised environment to support the regulation of risks. The rise of regulatory science paired with the emergence of specific expert agencies producing scientific assessments and quantitative evidence (Demortain, 2017b, p. 141). SPC would consequently become a “boundary organisation” (Guston, 1999) mixing industrial, bureaucratic and academic environments to legitimise the adoption of policy measures (Demortain, 2017b).

ii. The Restructuration of the Regional Database: Demarcating Multiple Surveillances within Information Infrastructures

These exchanges permitted to address the controversial duplication of the regional fisheries database and its conflicting utilisations for “management”, understood “in its broadest sense and includ[ing] activities ranging from access negotiation to surveillance”, and “stock evaluation” (SPC Secretariat, 1987c, p. 6). It was acknowledged that “in the initial stages of establishing the logsheet processing mechanism at the SPC, there was insufficient attention given to *the complete range of potential uses of the data*” (SPC Secretariat, 1987c, p. 6). Fisheries statistics had been conceived for fisheries scientific

concerns but rapidly turned out to be more multipotent than planned initially. Joint reflections commenced between SPC and FFA to identify the end uses of the regional database more clearly and adjust its content accordingly.

The discussions about the regional fisheries database led to both a commoning and partitioning operation, mirroring the institutional demarcation. In 1987, SPC identified that the main issue between SPC and FFA and between ‘scientific’ surveillance and ‘regulatory’ and ‘coercive’ surveillances related not so much to the content of the data than to their “timeliness” and “speed of access” (SPC Secretariat, 1987c, p. 6). Although data could possibly serve multiple usages, there were still distinct requirements depending on their final utilisation (see Figure 18): FFA required access on a “day-to-day basis” for its ‘management’-related activities while SPC could use data “only available after a significant time lag” to assess fish stocks (SPC Secretariat, 1987c, p. 6).

Data Source	Component	Age	Use
Surveillance	Sightings	1 day	Enforcement; Validation
Telex Reports	EEZ Entry	1 day	Enforcement
	EEZ Exit	1 day	Enforcement
	Weekly	1 – 7 days	Enforcement; Conservation
Log Sheets	Catch & Effort	3 – 6 months	Stock Evaluation; Revenue Estimation
Observer Reports	Surveillance	3 months	Enforcement
	Daily Activities		Validation; Effort Estimation
	Biological Data		Stock Evaluation; Revenue Estimation
Port Sampling	Landings	1 week	Revenue Estimation; Validation
	Biological Data	3 months	Stock Evaluation
Research Cruises	Various	6 – 12 months	Stock Evaluation
Regional Register	Various		Enforcement; Licensing; Validation

Figure 18: Existing Fisheries Data and their surveillance usages as identified by SPC for the Nineteenth Regional Technical Meeting on Fisheries in 1987 (SPC Secretariat, 1987c, p. 3)

The two organisations agreed that a division, rather than a duplication, of labour would be more productive, “provided there is coordination and cooperation” in developing a *shared* SPC-FFA regional database (SPC Secretariat, 1987c, p. 12). A shared database could accommodate various purposes and strengthen inter-institutional cooperation while retaining only one authoritative database. Correspondingly, the “current arrangement in which some data components are maintained at the SPC (i.e. logsheets) and others at the FFA (i.e. vessel register, surveillance data)¹³³ [was] a logical division of labour based on technical requirements of the work programmes of the two organisations” (SPC Secretariat, 1987a, p. 12). This division of labour and information infrastructures enacted the division between these various forms of surveillance.

¹³³ See Chapter 6

Complementarily to this shared FFA-SPC database, the Standing Committee on Tuna and Billfish suggested creating a *common* regional database “for research and monitoring purposes” only, consisting this time of aggregated fisheries data (instead of detailed daily logsheets) provided voluntarily by all fishing nations, including the DWFNs, and available to all contributors (SPC, 1989, p. 18-19). This *scientific* “Standing Committee Database” would be separate from the “Regional Tuna Fisheries Database” developed by SPC and FFA while still contributing “significantly to the database of daily fishing currently maintained by the SPC” and thereby supporting stock assessment efforts (SPC, 1989, p. 18-19). From the 1990s, the database started receiving data from the US, Taiwan, and Korea, along with Pacific Island countries such as Fiji, Papua New Guinea and the Solomon Islands. Data aggregation and condition of reciprocated access to the data constituted two main strategies to convince the DWFNs and the Pacific Islands to collaborate around that database. The third strategy was to demarcate this knowledge infrastructure as “purely scientific”, outlining that “other considerations should not affect the overriding importance of promoting scientific cooperation and the collection of complete statistics on the tuna fisheries of the region” (SPC, 1989, p. 18-19). Although serving ‘universal’ and ‘scientific’ purposes, the data contained in the database were not common property. On the contrary, each State retained sovereign ownership of its data and could define its data protection requirements regarding their temporal and geographical aggregation (SPC, 1988). Hence, fisheries data became sharable for scientific purposes once their commercial value was formally recognised and protected by rules of access and sharing (see also Chapter 7).

Collaborative strategies around fisheries data at the technical level were fundamental to address the coexistence of other tuna fisheries-related institutions while circumventing the political divisions and the refusal of the Pacific Islands to create a ‘broad-based’ international fisheries management organisation with the DWFNs. Collaboration also extended to other oceanic regions after it was agreed that SPC would exchange “aggregated data” and “ideas and research results” on oceanic fisheries with other regional tuna fisheries organisations such as IATTC or the Indo-Pacific Tuna Development and Management Programme to overcome political boundaries that did not match those of tunas in the Pacific Ocean. Data flows permitted connections that could not be established between countries regarding the governance of the ocean and its resources.

Conclusion

This chapter delineated a second stage in the evolution of tuna fisheries and their surveillance. From the 1970s, the expansion of tuna fisheries ‘boomed’, igniting growing competition between fishing and coastal states, as well as emerging sustainability concerns. At the time, fisheries conservation chiefly aimed to ensure the perennial maximisation of natural resource exploitation. In that context, coastal states laid territorial claims over adjacent offshore spaces to capture and conserve offshore fish resources. For the Pacific Islands, the territorial opportunity brought up by UNCLOS negotiations was

pivotal to support their decolonisation process. Expanding their marine territory by proclaiming their EEZs provided a promising avenue to territorialise the tuna resources and support their domestic economy and political affirmation. Fishing nations seeking to retain ‘open access’ to the sea and its tuna fishing grounds largely contested this territorial move. Ensuing disputes aroused on appropriate governance schemes and instruments to manage the mobile tuna fish within or across state boundaries.

In that tense geopolitical context, some main tuna fisheries surveillance apparatuses were deployed and consolidated over the 1970s-1980s to give the Pacific Islands a general understanding of the extent of the tuna resources and assess their ‘optimal’ exploitation threshold. These apparatuses prioritised collecting information that could back the development of tuna fisheries science in the South Pacific region to understand tuna population dynamics and assess tuna stocks. Scientific, strategic and pragmatic considerations led to designing such ‘scientific’ surveillance at the regional scale under SPC to cover the full range of tuna fish’s habitat, distributing surveillance efforts across various (including distant fishing) countries, surveillance agents and instruments and centralising fisheries information in a regional fisheries database. Surveillance relied on several apparatuses assembled to collect complementary information and control information accuracy.

As the emancipation of the Pacific Islands progressed, parallel surveillance endeavours appeared under their lead to collect information on the commercial value of the fisheries and erect economic management measures – initially to price fishing access fees paid by foreign fishers. These endeavours led by FFA partly overlapped with those developed by SPC, evidencing the multipotency of the fisheries’ statistics data (particularly those providing catch and effort information). The conflicting roles of surveillance data led to the duplication of surveillance efforts or sparked competition between institutions to gain control of the surveillance apparatuses and their data.

This multipotent feature caused much tension regarding data usage and surveillance apparatuses’ governance and funding. These conflicts were embedded in wider considerations regarding the governance and management of tuna fisheries. The Pacific Islands wished to assert themselves against the DWFNs and (some former) colonial powers regarding tuna fisheries management. They wanted to establish a sovereign government of tuna fisheries in their waters. On the contrary, DWFNs and colonial powers sought to retain their influence in the governance of tuna fisheries by promoting international cooperation in surveillance *and* management. Tuna fisheries scientists also defended such a cooperative approach to optimise ‘scientific’ surveillance efforts, which could not only be led at the sub-regional or national scale. Surveillance apparatuses were quartered between the Pacific Islands and DWFNs and colonial powers, between the requirements of biological research and economic research, and between the regional conservation of tuna stocks and the national and economic management of tuna fishing activities.

These disputes entailed a complex boundary work to demarcate and articulate these various dimensions of surveillance and associated informational requirements. Stakeholders defined (this time from an emic perspective) ‘science’ as producing a ‘universal’ and ‘neutral’ knowledge on tuna stocks and ‘monitoring’ as the associated surveillance practice. ‘Surveillance’, on the contrary, was related to ‘management’, including both the negotiation of fishing access rules and rule enforcement. Under these definitions, science and monitoring activities were placed under SPC, which had the most comprehensive membership, to inform stock conservation with fisheries scientific research. Surveillance was attributed to FFA to assist the Pacific Islands in management and enforcement at the national level. These demarcations, admittedly fragile and necessitating continuous boundary work to remain in existence, permitted the coordination of FFA and SPC around the surveillance apparatuses. These demarcations were further enacted in the very structure of the information infrastructures underpinning tuna fisheries surveillance. This permitted these infrastructures to perform the boundaries resulting from these compromises. FFA managed information relevant to (economic) management and enforcement aspects for the Pacific Islands. Boundary surveillance information on catch and effort belonging to the Pacific Island countries members of FFA were technically managed by SPC and shared with FFA. Finally, SPC held another database permitting a wider membership (including, in particular, cooperative DFWNs) under two conditions: that it would only serve ‘scientific’ purposes and that data would be subjected to access rules that retained countries’ sovereign authority over their data.

These surveillance developments resulted in specific framings and categorisations of the offshore world and its surveillance. They instituted divisions between, for instance, offshore industrial fisheries and inshore artisanal fisheries, tuna fisheries and marine biodiversity, monitoring and surveillance, science and management, etc. These divisions were burrowed in the information infrastructures underlying the surveillance apparatuses. Consequently, they locked in a situated framing of the offshore world that still weighs in contemporary times since these infrastructures and surveillance apparatuses remain the pillars of today’s tuna fisheries surveillance. These infrastructures perform these divisions in scientific and political arenas and bear epistemological and ontological consequences on how the offshore world is known, conceived and managed (Bowker & Star, 2000).

This era permitted the establishment and consolidation of scientific research on oceanic fisheries in the region to assess the extent and state of offshore fish resources. This would, however, only satisfy one preoccupation of the Pacific Islands to territorialise and order their EEZs. As this chapter started unveiling, they also sought to establish regulations and effectively control fishing activities still mostly conducted by foreign actors. The development of tuna fisheries science allowed for “measuring land”, but complementary techniques were needed for “controlling terrain”, following S. Elden’s reading of territory-making processes (Elden, 2010). These involved establishing rules and ‘coercive’ surveillance apparatuses to enforce these rules, examined in the following chapter.

CHAPTER 6. Ordering the Marine Territory: Rule-Making and Enforcement

The surveillance of the tuna resources did not suffice for the Pacific Islands to seize control of their newly claimed marine territories and order offshore spaces, entities and processes. They would also have to establish rules and enforcement mechanisms to produce these territories effectively. With this chapter, therefore, I focus on the complementary development of such rules and the associated ‘regulatory’ surveillance that informs their design, as well as on the development of a ‘coercive’ type of surveillance to verify compliance and enforce these rules.

The first section historically overlaps with Chapter 5 as it resumes from the Exclusive Economic Zones (EEZs) proclamations. It describes how the legal and material specificities of the EEZs led to a specific conceptualisation of ‘offshore territory’ – as a partial territory, with porous boundaries and limited state sovereignty. These features made the Pacific Islands’ territorial projects particularly susceptible to contestations and evasion strategies by the Distant Water Fishing Nations (DWFNs) and their fishers, which heavily resisted these new boundaries and associated rules of access.

In a second section, the chapter analyses the legal, institutional and technical strategies deployed by the Pacific Islands through the 1980s-1990s to secure their EEZs and the tuna resources and regulate (mostly foreign) fisheries-related flows and mobilities. I evidence the strategic and pragmatic regional cooperation and coordination between the Pacific Islands to produce original regional spaces of harmonised regulations and surveillance practices to strengthen their national maritime boundaries. This regional approach permitted the Pacific Islands to (partially) accommodate the mobile and reticular organisation of the tuna fisheries by projecting their regulatory, surveillance and enforcement efforts beyond their national jurisdictions. This second section also unpacks the establishment of some main ‘coercive’ surveillance apparatuses to support law enforcement, combining regional patrol operations, fisheries observers and Vessel Monitoring Systems (VMS) under the supervision of a regional surveillance centre. Against the challenges of surveilling offshore spaces and fisheries, the Pacific Islands shared and delegated part of the surveillance activities to other actors, including surveillance subjects, to improve their capacities of surveilling and enforcing at a distance – therefore making surveillance ‘more-than-sovereign’. I discuss how these politico-legal, institutional and technical practices rearticulate territory, sovereignty, surveillance and policing power in novel ways, resulting from the encounter of ‘territory’ with the offshore tuna fisheries.

In the last section, I examine the more contemporary re-appraisal of offshore spaces as marine ecosystems and the influence of biodiversity conservation concerns on the revival and ‘ecologisation’ of territorial processes at sea at the turn of the 21st century. I discuss two main consequences resulting

from these transformations. On the one hand, environmental concerns led to an ‘ecologisation’ of fisheries management. They resulted in the production of a new and wider regional territory ruled not by a sovereign state but by an intergovernmental organisation managing the region’s oceanic fisheries. On the other hand, conservation concerns fostered new territorial endeavours to establish ‘conservation territories’ reserved to more-than-human marine lives. Both these territorial trends affiliate with more complex governance schemes and frictionally collide with the previous regime established in the wake of the EEZ creation around tuna fisheries, while raising again the practical challenge of legitimising, surveilling and enforcing these new territories.

I. Territorial Disputes and Rule Enforcement Challenges

The declaration by the Pacific Islands occurred from the late 1970s through the 1980s, concomitantly to the unfolding of the international negotiations on the Law of the Sea. This section reviews the conclusion of the latter negotiations. It discusses how the new United Nations Convention on the Law of the Sea (UNCLOS) adapted conventional legal understandings of territory to marine spaces and the historical context surrounding the negotiations. Under the convention, coastal states could only claim porous territorial zones under their jurisdiction and partial sovereignty in the liminal and transitional EEZ, chiefly framed as a marine environment filled with natural resources to conserve and exploit. In the South Pacific region, the Pacific Islands’ attempts to establish such EEZs and assert sovereign rights over associated tuna resources were strongly resisted by DWFNs like the US and Japan. The Pacific Islands endeavoured to develop their national surveillance and enforcement capabilities to enact their claims and control foreign fishing vessels. However, the national development of maritime surveillance centres and patrolling apparatuses was particularly challenging and only provided limited ‘coercive’ surveillance capacities to detect and sanction illicit fishing activities.

1. International Legal Compromises: A Marine Understanding of Territory

UNCLOS III negotiations spanned from 1973 to 1982, and it took another decade before the resulting convention entered into force. The ensuing text was chiefly concerned with territorial conflicts and boundary-making at sea rather than fisheries management alone, which was consequently framed through this territorial lens. The adoption of the convention marked the “Westphalian moment for the world maritime sphere” and expanded the (land-based) modern state system over marine spaces (Ryan, 2019, p. 1067). However, this projection also comprised several adaptations: UNCLOS created a series of territorial units with ever-decreasing jurisdictional authority, inducing an entirely ‘marine’ territorial regime with boundaries more porous than on land. UNCLOS answered the question of whether or not marine spaces could be territorialised like terrestrial ones by adapting what territorialisation would entail. Only the territorial sea (12 nm) delimited a relatively conventional territorial zone over which

coastal states would have full sovereignty. The contiguous zone (24 nm) extended states' prerogatives in customs, fiscal immigration and sanitary laws, providing a "buffer zone" to support the enforcement of laws applying to the territorial sea (Ryan, 2019, p. 1068). The EEZ provided sovereign rights to explore, exploit and protect the marine environment.

Such a complex regime partly derives from UNCLOS' faltering over the EEZs and tuna fisheries management. This resulted in an original, yet fragile and fuzzy, compromise stemming from the frictions between coastal and fishing nations engaged in a frontier process around those spaces and resources. The convention created a *sui generis* status for the EEZ to recognise what was becoming customary law already, i.e. the expanded jurisdiction of coastal states over 200 nm adjacent waters. However, it simultaneously reduced the jurisdictional reach of such claims to exclusive rights on marine resources. The EEZ would not be a fully sovereign territory but a liminal and transitional territorial area. It would become an "economic zone" – a name telling of a "capitalist logic where the sea is functionally exploited as a resource rather than politically occupied as a territory" (Campling & Colas, 2021, p. 780). Following geographer S. Elden's thinking about territory, UNCLOS framed offshore spaces as a 'land' (impoverished to an economic resource framed by notions of property rights and rent) and reduced the notion of territory to its political-economic dimension (Elden, 2010). In that respect, the EEZ category can be read as supporting the "functional territorialisation" (Lambach, 2021, p. 1) of offshore spaces by coastal states, i.e. a territorialisation narrowed down to the exploitation and conservation of offshore environments' natural resources and distinct from the fully sovereign state territory.

Under UNCLOS, states' marine territories were made porous to retain some of the *Mare Liberum* doctrine. For instance, the convention recognised the right of 'innocent passage' after the US championed this principle to enable its military vessels to navigate in the Cold War era. In the EEZs, coastal states obtained exclusive but not exclusionary rights (Strating & Wallis, 2022): if they could prevent a fishing vessel from fishing in their EEZs, they could not prevent an 'innocent' vessel from entering them so long that they were not "prejudicial to the peace, good order or security of the coastal state" (art. 19 of UNCLOS).

In detailing what 'innocent' was and was not, these provisions established new understandings of security at sea – although they did not openly address maritime security *per se* since such terminology would only penetrate international institutions in the 2000s (Bueger, 2015b). Traditionally, security at sea had been concerned with national security and protecting the state's territorial integrity (Bueger, 2015b). It mainly related to naval warfare, seapower and state survival. UNCLOS extended this understanding of security by including environmental and economic considerations relating to customs, fiscal immigration, sanitary laws, pollution and fisheries. With this specific problematisation of order and security, UNCLOS granted coastal states enhanced policing powers over marine spaces to produce such security and ensure order at sea. Coastal states could police crimes affecting their land security and

relating to customs, immigration or sanitary matters. They could also police crimes that would disturb the economic potential of the sea, understood as an environment filled with natural resources and referring to pollution and fisheries conservation issues (Ryan, 2019).¹³⁴ These considerations reflect the historical context under which UNCLOS was established and the emerging tensions between the economic exploitation of the marine environment and the utilitarian conservation of its resources. The convention established a “purely maritime form of security” (Ryan, 2019, p. 1067), resembling, to some extent, M. Foucault’s conceptualisation of security (Foucault, 2004). It sought to order an open world by regulating rather than forbidding flows (of non-resident and more-than-human populations of tunas and humans, vessels, and capital) to ensure the good development of the ocean’s economic potential.

However, UNCLOS only partially resolved inter-state disputes over the offshore world. First, the US refused to ratify the convention. Moreover, the convention left room for conflicting interpretations amongst states, especially on tuna fisheries and the requirements for their multilateral management. Requiring state cooperation in the conservation and optimum use of fish stocks, the convention blurred coastal states’ right to control their territory and the resources within exclusively (Havice, 2018). Finally, it provided little specifications regarding associated policing powers. Only Article 73 of the convention referred to rule enforcement, authorising foreign vessels’ boarding, inspection, arrest and judicial proceedings to ensure compliance without further detail (see Palma-Robles, 2015). Maritime boundaries were porous and so was the legal framework applying to tuna fisheries.

The right of innocent passage aroused particular concerns amongst the Pacific Islands. With their new EEZ boundaries striating most of the Western and Central Pacific Ocean (WCPO), foreign fishing vessels wishing to access one state’s EEZ would likely need to traverse that of one or several other states and consequently use the right of innocent passage. However, especially in the case of pole-and-line and purse seine fishing vessels that mostly operate at cruising speed and can swiftly set and remove their fishing gear, “it is (...) extremely difficult to differentiate between periods of searching for fish and innocent travelling”, fisheries expert R. Kearney explained to SPC member countries (Kearney, 1977c, p. 14). This principle contributed to complicating, in practice, coastal states’ control of their EEZs. Fishing vessels, whose circulations could be categorised as ‘innocent’ or illegally fishing, immediately became an important maritime threat to the Pacific Islands. The latter identified, at the 1980 South Pacific Conference, the intrusion of foreign fishers and poaching issues as their main economic and political concern (Van Dyke & Haftel, 1981).

Hence, the codification of the EEZ by UNCLOS did not suffice to enact the Pacific Islands’ capture of their adjacent offshore spaces and resources. International law alone could not ‘make’ their marine territories.

¹³⁴ However, it also lessened their rights to sanction them (Manoa, 2008; Palma-Robles, 2015).

2. Territorial Disputes in the South Pacific Ocean

i. Establishing Maritime Boundaries with Fishing Access Agreements

In parallel to UNCLOS negotiations and after the convention's adoption, the Pacific Islands endeavoured to regulate fishing access to their newly claimed EEZs by concluding fishing access agreements with the DWFNs. For the Pacific Islands, fishing access agreements supported several objectives. From an economic perspective, they would bring economic revenues in exchange for letting foreign fishers exploit their waters. From a resource management perspective, the agreements could also introduce rules to frame foreign fishing activities *within* their waters, e.g., by forbidding specific fishing gear or areas. Closed areas mostly served to preserve fishing grounds for local artisanal fishing populations or to privilege domestically-based tuna fishing vessels, in the case of the Pacific Islands attempting to develop their domestic industries. From a political perspective, the agreements served to have the foreign parties recognise the EEZs. Last, access agreements would contain reporting requirements and compel fishers to record and declare their catch to support the surveillance efforts of the Pacific Islands. The access agreements provided an instrument colliding various dimensions to produce the EEZs.

This mechanism was fragile, at best. The territorial recognition was only bilateral, with a weak legal status and subject to the agreement's duration and renewal. The authority of the Pacific Islands could not be imposed unilaterally but had to be negotiated with particular groups and, therefore, to be co-produced with them. The agreements were established against adverse fishing stakeholders with powerful negotiating capacities. The US and Japan, in particular, being the two dominant players in the worldwide tuna industry and having little interest in seeing their access to the tuna fishing grounds suddenly restricted, immediately challenged the territorial claims of the Pacific Islands. The slow and fuzzy consolidation of the EEZs in international law, combined with the specific geophysical features of the spaces at stake, the ecological characteristics of the tuna fish and the political economy of the tuna industry, provided a fertile ground for these DWFNs to exploit loopholes in the territorialisation of the Pacific Islands and maintain 'breaches' in their bordering attempts.

ii. Japanese Resistance

Japan rapidly agreed to negotiate access agreements with some Pacific Islands to maintain its foothold in the region's fishing grounds and protect its international reputation (Schurman, 1998). The Japanese government concluded an inaugural access agreement with Papua New Guinea in 1978. By 1981, it had signed bilateral agreements with nine Pacific Island countries and territories. With these arrangements, Japan agreed to recognise, on a case-by-case basis, the right of these Pacific Islands to exert jurisdiction over their EEZs. However, this recognition was mostly symbolic and did not extend

to the tuna fish in those spaces: Japan actively curbed any attempt by the Pacific Islands to restrain its fishing activities and associated economic benefits.

Japan devised several strategies to downplay the Pacific Islands' empowerment over tuna fish and dominate fishing access negotiations, well analysed by sociologist R. Schurman (Schurman, 1998). It used diplomatic influence and development aid policies to leverage advantageous access conditions. It also exploited the mobility of tuna resources to stir competition and play the Pacific Islands off against each other, refusing to engage in multilateral negotiations. Because tunas could not be contained in a single EEZ and were swimming across jurisdictions, the Pacific Islands could not *individually* prevent Japanese fishers from capturing tunas. The transnational quality of the targeted resource impaired the ability of individual Pacific Islands to enclose it credibly. More importantly, Japan strategically exploited and even enhanced the limited surveillance capacities of the Pacific Islands to escape their control, at several levels. The country insisted on designing the logsheet form that its fishers would have to fill to report their catch to the Pacific Islands as part of their licensing requirements. Keeping control of the form permitted Japan to downplay the ability of the Pacific Islands to compile data on the economic profitability of fishing activities and to bargain access fees accordingly. Devising distinct logsheets for each of the Pacific Islands further hampered their ability to collect data that could help them assess tuna stocks at the regional level. Hence, Japan strategically sought to retain exclusive knowledge of the tuna fisheries and keep the Pacific Islands in ignorance. As a result, negotiated access fees never exceeded 5% of the total catch revenues made by Japan (Havice, 2010), showing how well it succeeded in safeguarding its interests against the Pacific Islands.

Noting their poor revenues, certain Pacific Islands endeavoured to change the design of their access fees. Initially, access fees consisted of a lump sum system in which Japan paid, at the beginning of a licensing period, a certain amount based on the expected value of their future landed catches. Such an estimate was difficult to calculate, considering the Pacific Islands' limited information on fish stocks and fishing profitability. However, it had also appeared easier to administer and implement for the young, low-capacitated and relatively inexperienced Pacific Island fisheries agencies (Doulman, 1990c; Wright, 1990). The lump sum system guaranteed that enforcement costs would not "outweigh the probable benefits" of selling fishing licenses, as argued by fisheries expert R. Kearney (Kearney, 1976a). Hence, fisheries management instruments were devised while considering the associated surveillance and enforcement costs and capacities of the Pacific Islands.

In 1979, both Papua New Guinea and the Solomon Islands decided to switch to a proportional access fee system and indexed fees to the value of landed catch to more accurately reflect the actual value of the tuna harvest. Other Pacific Islands converted to this system in the following years (e.g. Federated States of Micronesia, Kiribati, Marshall Islands). Japan agreed to this system, considering it was "fairer" to only pay for what was effectively caught. Therefore, the system could account for market fluctuations

and catch fluctuations caused by tuna fish movements across the ocean (FFA, 1990c). Such a system implied cumbersome administering as it required collecting information on the location and catch of every fishing trip of every fishing vessel. This greatly augmented the need for accurate catch and effort logsheets and, therefore, the capacity to control them. Surveillance of fishing activities and fishers' reporting practices became central, as reported by an FFA officer: "Fees, and the supply of catch data, are focal issues in fisheries access negotiations" (Wright, 1990, p. 6). This reliance on fishers' self-surveillance caused immediate distrust amongst Pacific Islands like Palau, which refused to engage in such a system: "We believe that, regrettably, whenever fee levels are in any way related to catch levels there will be an incentive to under-report. [...] That rectification may come about only with improved surveillance." (FFA, 1991a, p. 8). Various notifications of Japanese fishers' resistance to paying access fees supported Palau's concerns. FFA members voiced that skippers' "history of compliance especially in terms of data provision [was] not good" and they reminded Japan that "*deliberate* under-reporting [was] still an offence and in contravention of the terms and conditions of access" (FFA, 1992c, p. 13, my emphasis).¹³⁵ Australia reported, in court:

The [Japanese fishing] master admitted under oath that he was instructed by his head office to under-report the catch by 20-30 percent. The [FFA] member countries realise that if the DWFNs are going to act in blatant disregard of the laws and terms and conditions of access in a fairly well patrolled Zone then their behaviour in the less well patrolled Zones can fairly safely be assumed to be "worse". (FFA, 1992c, p. 14)

Fishing access agreements raised the issue of illegal fishing and underreporting and called for improved 'coercive' surveillance to enforce the agreements. Underreporting constituted a double concern to fisheries management for the Pacific Islands: not only did it induce a loss of access fee revenues, but it also imperilled their capacity to surveil fish stocks. At stake were not only the tuna resources but also informational resources.

Tensions between the Pacific Islands and Japan escalated through the 1980s prior to the entry into force of UNCLOS. Relations between Japan and the Pacific Islands ended up being "generally strained", with "several agreements broken off", according to FFA Deputy Director (Doulman, 1990c, p. 16; 5). These conflicts partly caused the Pacific Islands' refusal to engage in an international tuna fisheries management organisation involving DWFNs like Japan. Not only did they wish to retain sovereignty of their EEZ's resources but they also believed that Japan would only dominate the organisation and continue to advance its national interests over the collective intent to conserve tuna stocks.

iii. US Resistance and the 'Tuna Wars'

The US obstruction to the territorialisation of the South Pacific offshore waters and fish by the Pacific Islands was even more unabashed and antagonising than that of Japan. The country engaged in "tuna

¹³⁵ Similar issues of deliberate underreporting were also evidenced amongst Taiwanese and Korean skippers.

wars” with various countries on both sides of the Pacific Ocean, including the Pacific Islands (Rasmussen, 1981, p. 755).¹³⁶ The Cold War context and internal lobbying from its domestic tuna fishing industry led the US to adamantly refuse to endorse the creation of the EEZs and the ratification of UNCLOS (cf. Chapter 5). This position made it impossible for the US government to negotiate access agreements with individual coastal countries. To bypass this logic, the American Tuna Association conceded to conclude *multilateral* access agreements, e.g. with the Federated States of Micronesia, Marshall Islands and Palau in 1981-1982 (Havice, 2018). Such a strategy permitted the US fishing industry to circumvent the entanglement of fishing and sovereign issues and maintain their fishing activities regardless. However, the Pacific Islands rapidly found that the US fishing vessels avoided compliance, under-reported their catch, and delayed the provision of their logsheet data and, therefore, the payment of their charges (Doulman, 1990c; Teiwaki 1987 in Havice, 2018). Again, the rate of return from fisheries access was very low for the concerned Pacific Islands. Negotiations between the US and the Pacific Islands were rocky, often stalled, and failed.

This did not prevent the US fishing vessels from upholding their fishing activities with the support of their government, in complete disregard of the Pacific Islands’ jurisdictional claims. Starting in 1982 with Papua New Guinea, the conflicts further intensified and propagated to other Pacific Island countries such as Solomon Islands, Kiribati or the Federated States of Micronesia. The Solomon Islands was infuriated by the US’s behaviour and particularly mindful of protecting its locally-based tuna fishing fleet, which was one of the largest in the Pacific Islands.¹³⁷ The country resorted to the combined use of legal action and force to enforce its policing power and enact its property claims over tunas. It arrested and confiscated several US tuna fishing vessels operating in its EEZ without a fishing license and took them to its national court for sanction. These arrests simultaneously served to deter other foreign fishing vessels from operating illegally in the Solomon Islands’ waters (Tsamenyi, 2009).

However, the US immediately chastised this sanction and leveraged its economic and diplomatic power as a backlash to the Solomon Islands’ sovereign action. Not only did it reject the condemnation of the American fishers by the Court of Solomon Islands and refuse to pay the penalties, but it also retaliated with market and aid sanctions. In 1984, the US imposed an embargo on the importation of fish products coming from the Solomon Islands, thereby closing access to the latter’s largest market, which accounted at that time about ten percent of their total export earnings (Campling & Colas, 2021). This dispute between the Solomon Islands and the US, taking on the appearance of a ‘traditional’ national security conflict involving interstate confrontations, high-level politics and military forces in territorial and sovereign disputes, entangled tuna fisheries with maritime security matters (DeSombre, 2019).

¹³⁶ Similar ‘tuna wars’ and territorial conflicts relating to EEZ proclamations had already opposed the US against other coastal countries like Canada or Mexico.

¹³⁷ However, this industry still mostly consisted of joint ventures with Japanese interests and was therefore not entirely under the Solomon Islands’ sovereignty.

3. Challenges of Traditional Surveillance and Enforcement Mechanisms in the Offshore Realm

i. The Constrained Development of National Maritime Surveillance Apparatuses

Disputed jurisdiction over the EEZ and associated tuna resources required the Pacific Islands to build up their capacities in enforcing and materialising boundaries that were not otherwise readily complied with by DWFNs and their fishers. Upon the proclamation of their political autonomy and EEZs, the Pacific Islands initiated the development of their regulatory framework and enforcement capacities. Initial strategies focused on poaching threats and relied on building “traditional” “cops and robbers” approaches (G. Moore, 1987, online). Those involved *in situ* patrols for policing the sea, i.e. detecting and physically inspecting fishing vessels, and the establishment of maritime surveillance centres.

Developments in this domain were slow and relatively uneven, shaped by each Pacific Island state’s political, economic and technical constraints (Bergin, 1988). Reviewing some of these developments allows me to outline the challenges of such a traditional law enforcement approach when applied to offshore spaces. It also evidences some shared and significant features that constrained the development of the ‘coercive’ surveillance of the offshore world and contributed to a specific configuration of maritime security practices. The development of ‘coercive’ surveillance apparatuses largely hinged on a form of ‘bricolage’ (Odin & Thuderoz, 2010). Such surveillance resulted in being largely opportunistic, multipurpose, and distributed across various state and non-state actors to make the most of scarce surveillance resources. Constructing the Pacific Islands’ political and legal sovereignty relied on not-fully sovereign policing apparatuses.

The Pacific Island countries with the highest stakes in the tuna fisheries, like Papua New Guinea, the Solomon Islands and Fiji, tended to develop their surveillance capacities the fastest. In the case of Fiji, the country set out its first legal bases shortly before the proclamation of its EEZ in 1981. Early provisions regarding offshore spaces and fisheries appeared in 1977-1978, with the passing of the Marine Spaces Act that delimited Fiji’s maritime boundaries and introduced regulations for foreign fishing vessels, comprising, in particular, registering and reporting requirements. However, a more comprehensive legal licensing framework only emerged in 1990, and mechanisms to enforce this legal framework took even longer to surface. Before that era, fisheries in Fiji were virtually uncontrolled by governmental authorities considering there was no rule-enforcement mechanism.

Concomitantly adopting the Marine Spaces Act and anticipating the introduction of new surveillance and law enforcement prerogatives by UNCLOS, Fiji established its Royal Fiji Navy in 1975 (Natuva, 2021). Prior to the independence of the country in 1970, naval affairs had been managed and operated by Great Britain in coordination with New Zealand and Australia for about a century before the colonial government withdrew its naval forces and relocated them to Suez in 1968 (Fox, 2021). To compensate

for this disengagement, Fiji assembled disparate and often externally sourced technologies and persons to build its naval capacities and enforce its regulations. Australia and New Zealand maintained their support by conducting aerial patrols and training Fijian people to populate naval troops. Maritime surveillance capacities were hardly independent. Additionally, Fiji acquired from the US two minesweepers decommissioned after World War II and converted them into patrol vessels. However, those had limited navigational capacities and could only conduct brief incursions in the EEZ (Brown, 1989; Natuva, 2021).

Rapidly, the Fiji Navy's roles expanded to take on some features of what naval historian G. Till described as a "post-modern navy", addressing a risk spectrum wider than the "traditional warfighting spectrum" comprising nuclear deterrence, power projection and "competitive gunboat diplomacy" (Till, 2013) and prefiguring more contemporary forms of Maritime Security (see Boşilcă et al., 2022). Patrol vessels supported Fiji's search and rescue commitment to the Safety of Life at Sea (SOLAS) Convention, humanitarian assistance to the country's outer islands, and hydrographic surveys. In 1982, the country established a maritime surveillance centre controlled by the Defence Force to monitor all commercial fishing vessels and yachts present in the area, drawing on radio and telephone reports from vessels and aircraft.¹³⁸ Hence, the surveillance centre, patrol vessels, and navy workforce did not only engage in fisheries surveillance and enforcement. They constituted a boundary informational and operational apparatus supporting plural nation-building dimensions (Tarte, 2010).

New Caledonia, as a French Territory, could rely on France's more developed military resources – but was also subjected to a metropolitan power with interests of its own, which largely overflowed those of the Territory. In the wake of World War II, France had almost withdrawn from the South Pacific region and reallocated its naval resources to Indochina and African territories. Therefore, the French navy initially deployed in New Caledonia and French Polynesia naval units of little military value to conduct "sovereignty missions" only and at their most basic level before progressively re-engaging in the region (Vaisset, 2017, p. 202). However, this involvement first concerned nuclear testing rather than the surveillance of tuna fisheries. From 1960, four former Canadian minesweepers were positioned in the two territories before they were replaced by patrol vessels more specifically geared for maritime surveillance, with *La Glorieuse* and *La Moqueuse*, two "P400-class" patrol vessels,¹³⁹ in service since 1987 and appointed to police the EEZ of New Caledonia. Those patrol boats were commissioned in 1982 in connection with the adoption of UNCLOS.

¹³⁸ Fiji maritime surveillance centre became in 2017 Fiji Maritime Surveillance and Rescue Coordination Centre, after the formal institutionalisation of the national rescue coordination centre in charge of search and rescue operations. The centre also plays an important informational role as it broadcasts maritime safety information on radio to all vessels operating in Fiji waters since 2010 (Fox, 2021).

¹³⁹ Those were still in operation when I was in New Caledonia in 2019 but were decommissioned in 2023, as part of a fleet renewal programme.

Although the Pacific Islands claimed jurisdiction over extensive water volumes, they could hardly access and patrol their new marine territories, especially for the more remote offshore waters, due to a lack of resources and adapted technologies. Surveillance technologies were mostly sourced by entities external to the state, including foreign military powers and commercial entities chartering their commercial aircraft, for instance. Patrolling technologies were often inadequate to the South Pacific Ocean and to surveilling offshore waters. Finally, in the context of limited resources and plural state interests at sea, these surveillance apparatuses had to serve and be shared amongst many different purposes. For many other Pacific Islands, fisheries surveillance capabilities remained even more limited despite the creation of their EEZs. Countries like Tuvalu and Kiribati had no internal surveillance capacity by the late 1980s, and neither Niue nor Nauru had any patrolling capacity by 1999 (FFA, 1999).

ii. **Surveillance and ‘Blue Diplomacy’: The Pacific Patrol Boat Programme**

Despite the political empowerment of the Pacific Islands, the implementation of their sovereignty was hardly independent, as I have just shown. The construction of maritime surveillance and enforcement capacities had to turn to external support and was, therefore, not exclusively sovereign. Rather, it was subjected to and traversed by foreign and geopolitical strategies that framed its development. The Pacific Patrol Boat (PPB) programme pioneered by Australia, which greatly contributed to vesting the Pacific Islands with patrolling capacities, attests to this phenomenon.

The PPB programme provided the most influential aid programme in fisheries and maritime surveillance to the Pacific Islands. Australia announced the idea in 1976 before the South Pacific Forum, after the country shared its desire to increase support to the newly independent Pacific Island countries by funding maritime “surveillance programmes” (Doulman, 1990a). This intent largely served Australia’s national security policies. In the 1980s, its regional position was increasingly challenged, with some Pacific Islands affiliating it with other larger and *external* powers. The South Pacific region was also undergoing political turbulences, including urban riots in Vanuatu, separatist movements Papua New Guinea, independence movements in New Caledonia and political coups in Fiji. Finally, the looming presence of the Soviet Union and its ambition to strengthen its maritime power, including in the field of tuna fisheries, concerned Australia the most (Fry, 1991). These considerations led the country to adopt new foreign policies to nurture its relations with the Pacific Islands, providing that the regional “insecure environment, political instability and stagnant economies could impact adversely on Australia’s position as a South Pacific country”, FFA Deputy Director relayed (Doulman, 1990a, p. 12). This context led Australia (as well as New Zealand and the US) to reappraise the connections between security, economic development and inter-state cooperation. Hence, Australia acknowledged the specific reliance of the Pacific Islands on the ocean and tuna fisheries, prefiguring more contemporary understandings of maritime security.

Australia's security reorientations led the country to provide economic assistance to the Pacific Islands, use the South Pacific Forum as an arena to forge a regional security consensus, improve bilateral diplomacy and cooperate in defence-related matters.¹⁴⁰ Australia increased its surveillance investments in the region in 1986 by doubling its *regional* maritime patrol operations (from five to ten a year), supplemented by aerial patrols (Bergin, 1988).¹⁴¹ Such extraterritorial surveillance efforts were made at the cost of the surveillance of the Australian EEZ. However, this projection also enabled Australia to better understand the wider regional maritime environment and serve its domestic security interests.

After reviewing the surveillance needs of the region's EEZs in collaboration with New Zealand, Australia launched the PPB programme in 1983 under its wider Defence cooperation programme (Bergin & Bateman, 1999). The programme aimed to provide patrol vessels to the coastal nations. The South Pacific Forum member countries ordered the patrol boats as their maritime surveillance agenda progressed – starting with the Solomon Islands, Vanuatu and Western Samoa in 1987. Vessels were adapted to their needs and constraints, privileging, for instance, commercial rather than military designs that would be easier to operate and maintain. They were also built as multipurpose vessels, primarily capable of supporting not only fisheries policing but also additional maritime security and safety concerns relating to disaster relief, medical evacuation, search and rescue, customs, drugs, or even “environmental monitoring” (Bergin & Bateman, 1999, p. 561). The vessels were attributed to the police or military forces¹⁴² rather than the fisheries agencies, embedding tuna fisheries ‘coercive’ surveillance in maritime security and sovereignty-building aspects.

The PPB programme was instrumental in building offshore policing capacity in the region. According to Australian scholars A. Bergin and S. Bateman, “without the PPB, there would be virtually no offshore policing in the region” (Bergin & Bateman, 1999, p. 563). The programme fuelled a “sense of reassurance” regarding the ocean thanks to the provision of a “uniform para-military or military presence” used for “border operations”: the grey colour of the vessels gave the impression of “mini-warships”, serving as a “badge of sovereignty” for the Pacific Island countries despite their commercial design (Bergin & Bateman, 1999, p. 565). In complement, the Australian Royal Navy, in collaboration with New Zealand, provided technical advisors to train and assist the Pacific Islands in surveillance operations (FFA, 1990d). Later, the PPB programme was renamed the “Pacific Maritime Security Programme” to protect marine resources *and* the sovereignty of the Pacific Islands, intertwining the latter with the former.

¹⁴⁰ This involvement in the South Pacific Forum constituted a first step in promoting a regional approach to national maritime security (cf. Section II).

¹⁴¹ New Zealand also conducted about fifteen patrol campaigns per year.

¹⁴² Vessels were attributed to military forces in the countries having such resource, i.e. Fiji, Papua New Guinea and Tonga.

A. Bergin and S. Bateman's analysis, however, disregards the 'blue diplomacy' underlying the programme. Even though it supported the sovereign development of the Pacific Islands, it also aimed to influence its direction, as attested in the case of Fiji. In 1989, the country ordered four boats, the delivery of which was suspended as a diplomatic sanction from Australia after a military coup d'état in 1987, along with the cessation of its aerial surveillance support (Fox, 2021). The vessels were eventually delivered in 1994 and 1995 after relationships were restored. Relationships were suspended again between 2006 and 2013 because of another coup d'état. This pushed Fiji to engage, in turn, 'blue diplomacy' strategies by establishing new relations with China and Russia to obtain training and equipment. In 2016, relations between Fiji and Australia resumed with the PPB Replacement project, planning to replace two patrol boats in 2022 and 2023 in Fiji (Fox, 2021).

Notwithstanding, the programme contributed to securing maritime boundaries and homogenising policing practices throughout the region – a strategy that would become central for the Pacific Islands in the following decades (cf Section II). Training provided to Pacific Island fisheries and surveillance authorities allowed for “the development of a harmonised model for the management of surveillance operations rooms”, likely prefiguring “the standard for larger regional surveillance operations” (FFA, 2005, p. 11). Similarly, Australia and New Zealand supported the development of national surveillance centres, starting in the Solomon Islands and Vanuatu in 1988 (FFA, 1990d). Those served to coordinate surveillance resources and information at the national level and also contributed to establishing the nodes of a more regional network, thereby planting the seeds of a regional fisheries surveillance infrastructure that would progress in the following years. FFA Deputy Director estimated that thanks to the launch of the programme, it was “likely that the incidence of illegal fishing by DWFN vessels in the EEZs of FFA member countries has declined and countries have been able to apprehend violators that would have gone undetected in the past” (Doulman, 1990a, p. 13). Between 1983 and 1999, 23 patrol ships were built and distributed to 11 FFA member countries.

However, this programme alone could not suffice to tackle the challenge of policing the tuna fisheries in the Pacific Islands' EEZs. Kiribati, having the largest EEZ in the FFA area (3.6 million square kilometres), only had one patrol vessel supplied by the PPB programme. In other cases, despite the availability of patrol vessels, the countries lacked the resources to operate them continuously, including fuel, victuals, or crew members (FFA, 1999). Palau's national maritime surveillance report evoked “acute funding difficulties” in 1990 (FFA, 1990d, p. 2). Despite the apparent interest of the Pacific Island authorities, amplified after some highly publicised fishing vessel arrests, maritime surveillance development remained low in their agendas as costs were felt to exceed surveillance benefits. Australian security and defence scholar A. Bergin attributed this to the fact that “most of the countries lack[ed] both an industrial base to support the level of expenditure and an infrastructure to support an extensive surveillance programme” (Bergin, 1988, p. 471). Hence, the Pacific Islands faced impediments similar

to establishing domestic tuna industries: their offshore waters required industrial capacities to be exploited, surveilled, and controlled, of which they were short.

Minding the astronomical costs required to patrol their extensive EEZs, the Pacific Islands resorted to alternative strategies, as their national financial, material and technical capacities were too limited to effectively police their marine areas and the behaviour of foreign fishers. In particular, they relied on regional cooperation and coordination and developed legal, institutional and technical mechanisms to enforce fisheries regulations at a distance and “without force” (Aqorau, 2000; G. Moore, 1987).

II. Pragmatic Regionalisation in Support of National Sovereignty

This section describes these legal, institutional and technical strategies cooperatively developed by the Pacific Islands to assert control of their respective EEZs and associated fishing activities. To address their national limitations, they adopted a regionalist strategy, i.e. a political strategy to coordinate and cooperate across the region to consolidate their political weight against the DWFNs and their fishers. They established a series of multilateral arrangements establishing the framework for such cooperation in fisheries management and enforcement, assembling their EEZs to make a coherent regional space without overriding their sovereign primacy and national boundaries. Rather, the regional harmonisation very much sought to secure and enact the EEZs. I then unpack the institutional and technical mechanisms established to operationalise these arrangements and develop offshore (‘regulatory’ and ‘coercive’) surveillance capacities at the regional level, thereby disarticulating surveillance and enforcement powers and political and legal powers in original ways.

1. Regulatory Instruments: Developing and Harmonising Rules to Order the Tuna Fisheries

Already, when the South Pacific Forum members jointly publicised their intent to establish their EEZ with the 1976 Nauru Declaration, they acknowledged that such endeavour would “call for coordination and cooperation on a regional basis” in managing and policing tuna fisheries to “secure rights to control these resources”.¹⁴³ Pooling their limited resources appeared as the way forward to perform these territories. Representatives of Papua New Guinea and Fiji, heavily invested in UNCLOS negotiations, strongly advocated for regional cooperation in environmental conservation and fisheries management in particular. Gathering the Pacific Islands would create a stronger, strategic, spatial entity. In that sense, the South Pacific region was deliberately performed by the Pacific Islands to uphold their position against other countries (Gruby & Campbell, 2013). Even larger countries like New Zealand agreed to

¹⁴³ Seventh South Pacific Forum meeting: <https://forumsec.org/publications/south-pacific-forum-meeting-law-sea-spec-headquarters-suva-13-14-october-1976>, accessed: 29.05.24

enforcement challenges in the EEZs and recognised that without a regional approach, “surveillance of the vast areas of the ocean within the region would be impossible, let alone policing them”. The meeting concluded on the value of regional cooperation regarding both regulatory and enforcement matters:

The Forum Leaders recognise the value of a coordinated approach in these negotiations with distant-water fishing countries that now operate in the area. It will also be necessary to develop a capability for maritime surveillance and policing. The problems involved in this can best be tackled through joint or cooperative action.¹⁴⁴

Fisheries experts, too, promoted regional cooperation. SPC scientist R. Kearney argued that cooperation would provide the Pacific Islands with the “added power of a common interest block” against the DWFNs and minimise surveillance efforts (Kearney, 1977b, p. 14). Cooperation would permit the production of a regional zone with fewer boundaries to police, make illegal fishing in the central areas of the region “extremely hazardous”, and avoid duplicating surveillance facilities:

If the individual coastal states of the core area [...] adopt independent policies on the licensing of foreign vessels, then the problem of access to the waters of coastal states [...] becomes more extreme and the difficulties and costs of enforcing “innocent passage” could well cause major international problems in the region. A regional approach to licensing [...] and to surveillance [...] appears the most likely way to ensure access to, and optimum utilisation, of the natural resource. (Kearney, 1977b, p. 14)

These considerations framed the creation of the Forum Fisheries Agency (FFA) in 1979, conceived to assist the Pacific Islands with ‘regulatory’ and ‘coercive’ surveillance of fishing activities (cf. Chapter 5), as explained in the Port Moresby Declaration announcing its creation:

[The members of the South Pacific Forum] recognise that the coastal states of the South Pacific have an immediate and continuing need for information and advice concerning the living resources in the region and the ways and means of securing maximum benefits from them as well as for an effective instrument to coordinate policies in this field, and that management of resources moving over vast areas, control of their exploitation, surveillance and policing and collection of adequate statistical and other information require coordination by a regional agency.¹⁴⁵

In parallel and with the support of FFA, the Pacific Islands established a series of multilateral treaties and agreements to frame their cooperation at the regional level. These regulatory instruments sought to harmonise fisheries management policies and regulations on the one hand and to codify a framework for cooperation in surveillance between the Pacific Islands on the other hand. Adopted through the

¹⁴⁴ Seventh South Pacific Forum meeting: <https://forumsec.org/publications/south-pacific-forum-meeting-law-sea-spec-headquarters-suva-13-14-october-1976>, accessed: 29.05.24

¹⁴⁵ <https://www.forumsec.org/1977/08/29/8th-south-pacific-forum-port-moresby-papua-new-guinea-29-31-august-1977/>, accessed: 22.09.23

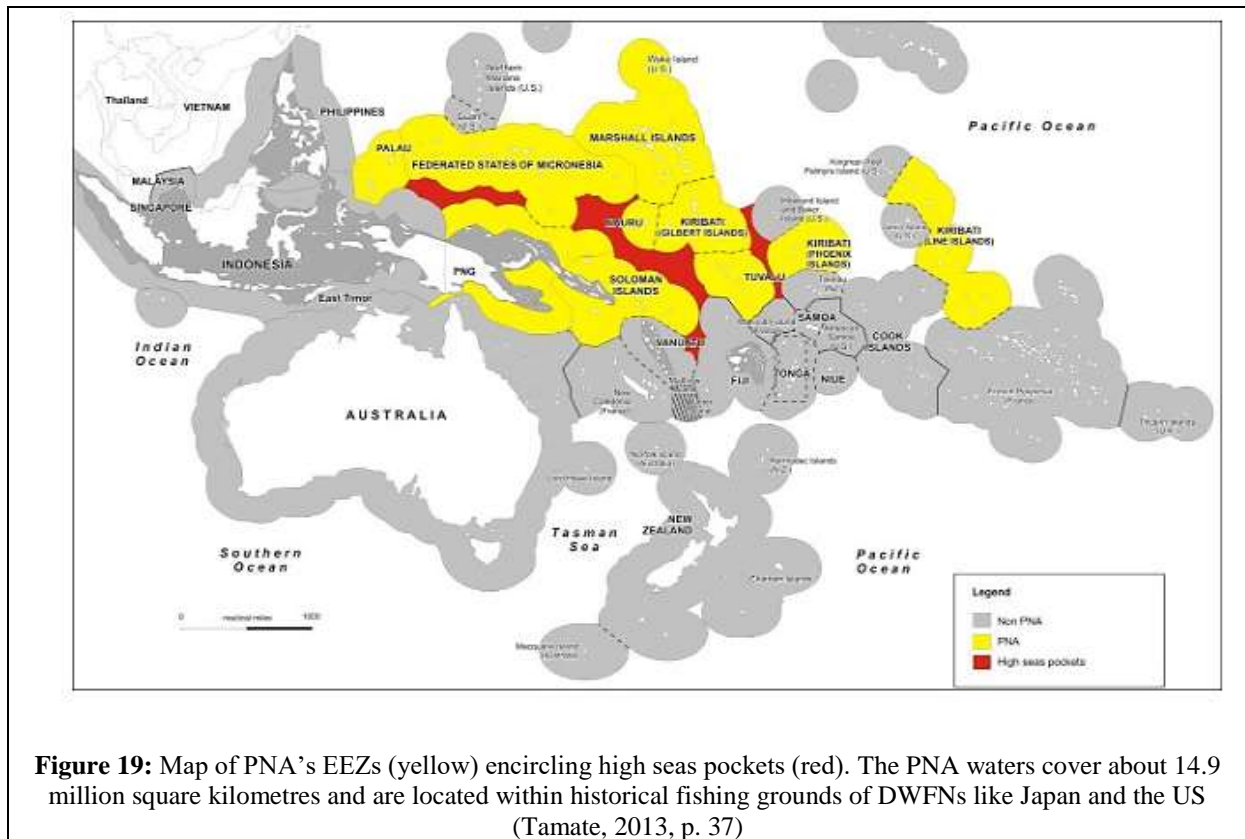
1980s-1990s, these arrangements evidenced the growing regulation of tuna fisheries as part of the Pacific Islands' attempts to order their EEZs.

i. The Nauru Agreement: Harmonising Fishing Access Regulations

Wary that the Forum's considerations I just evoked would be slow to progress given the number and diversity of members involved, a more homogeneous sub-group of FFA countries¹⁴⁶ started to work together to assert and protect their sovereign rights over their EEZs and against the foreign fishing vessels operating in their waters (Doulman, 1986). This subgroup of Parties to the Nauru Agreement (PNA) signed in 1981 the Nauru Agreement Concerning the Cooperation in the Management of Fisheries of Common Interest ('Nauru Agreement').

PNA comprised neighbouring countries that supposedly shared common tuna stocks and harboured the region's most 'productive' waters. Their combined EEZs enclosed most of the fishing grounds exploited by the DWFNs. Their geographical distribution also encircled several high seas pockets (see Figure 19), which they viewed as particularly threatening to their EEZs. The high seas, remaining under the open access regime, were framed by the Pacific Islands as the main issue to secure their EEZ boundaries: "It has become very clear that high seas fishing, carried out incidentally to fishing in-zone [i.e. in the EEZ], poses problems from a point of view of surveillance, enforcement and management of in-zone activity", PNA explained (FFA, 1993, p. 6). The proximity of the high seas pockets facilitated the intrusion of foreign fishers at the edge of the EEZs, who could pretend to be in international waters and, therefore, conceal their catch from the PNA countries and not pay for it. The high-seas were described as a-territorial "enclaves" providing "convenient sanctuaries from which 'rogue' FFV [foreign fishing vessels] can illegally access the resources of adjacent EEZs with little likelihood of detection or apprehension" (Preston, 1997, p. 48). This observation pushed the Pacific Islands to project their management and surveillance concerns *beyond* their EEZs and into the high seas.

¹⁴⁶ Including the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea and the Solomon Islands



The Nauru Agreement comprised several commitments. The countries agreed to grant preferential access to Pacific Islands' fishing vessels to support the development of domestic fishing industries in the region. They also adopted harmonised Minimum Uniform Terms and Conditions (MTCs) to license foreign fishing vessels. The MTCs strategy was subsequently adopted by the wider FFA group in 1982. Harmonised fishing access rules would prevent the DWFNs from downscaling access fees by engaging a competitive bid process between neighbouring countries (Tamate, 2013). It also permitted the PNA to enhance and harmonise surveillance and logsheet reporting requirements imposed on foreign fishers and improve their coverage of the fisheries. Improving surveillance capacity was one of the main aims of the agreement, as explained by a Palauan representative: "The MTCs were devised, after extensive and detailed consultations, to improve the accuracy of data so that we will be in a better position to pursue the twin goals of conservation and optimum utilisation." (FFA, 1991a, p. 23).

The MTCs planned to impose fisheries observers and the completion of *standardised* logsheets to collect multipotent fisheries information supporting stock assessment, access fee pricing and fee payment control. Other provisions requiring the timely reporting of entry and exit of the EEZ or standard vessel identification further aimed to consolidate 'coercive' surveillance capacities. The burden of surveillance was partly delegated to the surveillance subjects themselves by making fishers report on their doings. Another important innovation to delegate the burden of surveillance and enforcement was

the introduction of the concept of “flag state or fishermen’s associations responsibility”.¹⁴⁷ Already in use in other regions such as the European Community, it planned that “the flag States or organisations having authority over a foreign fishing vessel take such measures as are necessary to ensure compliance by such vessel with the relevant fisheries laws of the Parties” (Nauru Agreement, art. II). PNA used this principle to devolve the financial and practical burden of rule enforcement to other intermediary actors, be they flag state administrations or fishing associations, to compensate their limited capacities to do so themselves.¹⁴⁸

These developments led to the creation of a pivotal instrument: the Regional Register of Fishing Vessels. This register would poll information on foreign fishing vessels operating in the region and their characteristics (e.g. ownership, fishing master’s identity, gear, storage capacity, historical catch and fishing areas, etc.).¹⁴⁹ Only fishing vessels deemed to be in ‘good standing’ after this register could be licensed to fish in any EEZ of the FFA region. By 1991-1992, the register already contained about six hundred fishing vessels.¹⁵⁰ Four vessels (from Japan and Korea) had been suspended for fishing in Australia, Tuvalu and Papua New Guinea without authorisation (Brown, 1993c). The register permitted the Pacific Islands to sanction illegal behaviours without having to be at sea to arrest fishing vessels:

... recognising the relatively large size of the EEZs of the majority of FFA member countries and their limited surface patrol assets, it is not always possible to arrange a coordinated surveillance effort of that nature. As a result, most fisheries infringements detected by aerial surveillance patrols operating alone have been pursued using the threat of suspension on the Regional Register of Foreign Fishing Vessels as a form of *long-arm enforcement* to encourage vessel owners to negotiate a settlement. In the last three years, this process has been used against 13 foreign fishing vessels, resulting in the payment of more than USD1.5 million in order to settle cases brought against the vessels concerned. (FFA, 1994a, p. 12)

The ‘long-arm enforcement’ expression is telling of the Pacific Islands’ attempts to *extend* the reach of their control at a and despite the distance.

As a surveillance apparatus providing information on fishing activities, the register could also support other scientific or regulatory purposes. This is evidenced by its various descriptions in regional reports as a “regulatory”, “compliance”, “enforcement” and “monitoring” mechanism, suggesting its

¹⁴⁷ Nauru Agreement: <https://faolex.fao.org/docs/pdf/mul5181.pdf> (accessed: 02.10.23)

¹⁴⁸ Obviously, such delegative strategy would not suffice to ensure compliance to management measures. The limits of the flag state approach would shortly be evidenced with the emerging “flag of convenience” problematic. Although the strategy would remain important in the Pacific Islands’ management strategies, the progressive recognition of the “ineffectiveness of traditional approaches to enforcement and the inability of flag States to enforce international conservation and management measures” (Aqorau, 2001a) led to the development of additional mechanisms and governance restructuration – see Section III.

¹⁴⁹ The conceptualisation of such instrument came from wider discussions under the 1977 FAO Committee on Fisheries, concerned with assisting ‘Developing Coastal States’ in the management and development of fisheries in their EEZs. Proposals to develop a *global* register of foreign fishing vessels did not come to fruition but was taken up at the regional scale, firstly in the South Pacific region.

¹⁵⁰ However, estimates of the total number of foreign fishing vessels operating in the region amounted twice this figure.

multipotency. These objectives collided at times, as reported in discussions on the type of data to be included in the register database:

The Regional Register of Fishing Vessels is maintained by the Forum Fisheries Agency (FFA) to keep track of DWFN fishing vessels harvesting tuna, billfish and other pelagic species within the FFA region. [...] Data forms are submitted and updated annually to the FFA that includes a considerable amount of technical data on gear and vessel attributes. The type and amount of technical data collected by the Regional Register has been a subject of debate for some time. *Generally speaking, scientists, fishery managers, enforcement agencies and politicians desire different types of information at various levels of precision.* (Itano, 2002, p. 1)

These debates attest to the inherent challenges of designing boundary surveillance apparatuses that could simultaneously serve multiple purposes in a satisfying manner (Fortané, 2015).

The MTCs and the regional register are regularly depicted as the first creations of what would be considered a constitutive feature of the South Pacific region's trademark concerning fisheries management, i.e. strong regional cooperation and harmonisation. They laid the foundation of a regional "pragmatic space" delineating a (non-continuous) zone of a harmonised regulatory regime "to address a particular problem" mainly related to foreign tuna fishing vessels (Bueger, 2020b, p. 14). This zone was not integrated; rather, it served to support the consolidation of the EEZs, i.e. to bolster their respective existence without overriding the Pacific Islands' sovereign political power and national boundaries.

Regionalism, rather than integral regionalisation, made these cooperative strategies more fragile. For long, the MTCs were incorporated in *some* access agreements and national legislations, and their implementation was slow or incomplete (G. Moore, 1987). On the one hand, the DWFNs attempted to resist the MTCs. Japan objected to the Regional Register, arguing that it had not been consulted and felt no obligation to feed this database. It was only after the mid-1980s, during the "third period" of Japanese bilateral access agreements, in which "both parties became more realistic and cooperative in their demands", that the MTCs started being included in agreements between Japan and several Pacific Island countries (Matsuda, 1990 in Lodge, 1992, p. 9).¹⁵¹ On the other hand, the great disparity in economic situations and bargaining power of the Pacific Islands complicated their ability to enact the MTCs individually. Sociologist R. Schurman identified some impediments to their implementation (Schurman, 1998). The higher dependence on access fees of some Pacific Islands compared to others made them reluctant to terminate an access agreement because of the MTCs. Additionally, including MTCs in access agreements rather than national laws weakened their status and enabled the DWFNs to negotiate away certain MTCs. An FFA officer reported that the Government of Taiwan refused the MTCs when negotiating with the Federated States of Micronesia and claimed that "as Papua New Guinea had not

¹⁵¹ The countries included: Australia, New Zealand, Kiribati, Solomon Islands, Marshall Islands, Tuvalu, Papua New Guinea (although it broke off in 1987), Federated States of Micronesia, and Palau (with several break-offs).

insisted on them in recently signed agreements with Taiwanese companies, it was inappropriate for Federated States of Micronesia to do so” (Lodge, 1992, p. 10). Against these challenges, certain Pacific Islands like Kiribati started resenting the system and questioning their commitment to the MTCs (Lodge, 1992). Inter-state solidarity remained frail, abiding by C. Bueger’s argument that “pragmatic spaces” tend to be relatively fragile (Bueger, 2020b). It took over a decade before the multilateral political commitments were implemented at the national level and the concrete impacts of cooperation and harmonisation in fisheries management could become sensible (Schurman, 1998).

ii. The US Multilateral Treaty

From the mid-1980s, the relations between the Pacific Islands and the US eventually resumed after the ‘Tuna Wars’. The US, alarmed by the increased presence of the Soviet Union in the region, dramatically shifted its position toward the Pacific Islands. The Soviet Union had just signed its first access agreement with Kiribati in 1985, swiftly followed by another with Vanuatu. Fiji and Papua New Guinea were also interested in selling fishing licenses to the Soviet fishing fleets (Tarte, 2021). These rapprochements, interpreted by the US government as a “security risk” (Doulman, 1990c, p. 14; see also Havice, 2018), pushed the US to mend its relations with the Pacific Islands. As a consequence, the US government and its tuna fishing industry agreed to negotiate conditions of access to their EEZ waters and conclude, after lengthy discussions, the Multilateral Treaty on Fisheries between the Government of Certain Pacific Islands States and the Government of the United States of America (‘US Multilateral Treaty’). The treaty authorised regulated but unlimited access for up to 50 US purse seiners in the EEZs of 16 FFA member countries¹⁵² in exchange for access fees and development aid (Havice, 2010). Fees had a lower threshold limitation but were otherwise indexed to the value of the catch to “compensate for increases in fish prices over the duration of the treaty” (Doulman, 1990c, p. 14).

The collective nature of the treaty permitted the US to remain consistent with its national legislation stating that tuna resources required international management. At the same time, however, the treaty enabled the Pacific Islands to obtain explicit recognition from the US of their jurisdiction and rights to regulate fisheries access within their EEZs – i.e. of their political and territorial claims. Hence, the treaty accommodated, more than it reconciled, the two positions regarding the territory-sovereignty link over tuna resources (Havice, 2018). The US Multilateral Treaty constituted a “key security achievement” satisfying distinct security imperatives of both sides of the parties (Tarte, 2021, p. 8). The treaty permitted the Pacific Islands to secure unprecedented financial returns while guaranteeing fishing access to the US – and effectively led to the non-renewal of fishing agreements with the Soviet Union. This agreement was long seen as one of the most successful and lucrative empowerment of Pacific Islands

¹⁵² These included: Australia, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu.

concerning tuna fisheries (Campling & Colás, 2018), providing the highest rate of return compared to other licensing agreements (10% instead of an average of 4%) (Uwate & Kawai, 1990).

The treaty greatly contributed to developing and implementing tuna fisheries and maritime surveillance. It led to the effective implementation, for the first time, of many MTCs evoked in the previous sub-section. Hence, it required US purse seiners to supply daily catch records and comply with port sampling and onboard fisheries observer programmes. The parties agreed to have 20% of the fishing trips covered by fisheries observers, which greatly developed this surveillance apparatus (cf. Chapter 5). The treaty also enacted the ‘flag state enforcement’ concept by arranging for infringement investigations to be conducted by – and, therefore, delegated to – the US authorities at the request of and in coordination with a Pacific Island party. Part of the policing process would be conducted by the US but *under the authority and jurisdiction* of the Pacific Islands. In the same spirit of delegation, the treaty also arranged that parts of the observer programme costs would be attributed to fishing operators, who would have to cover observers’ costs while on board. The treaty greatly emphasised the ‘coercive’ role of observers, who would have to verify fishers’ compliance with the treaty and who were also “encourage[d] [...] to report sightings and activities of other foreign fishing vessels observed during trips aboard US vessels” ” (FFA, 1998b, p. 8). This strategy turned the US purse seiners into opportunistic patrol vessels to support the Pacific Islands in maritime surveillance.

Importantly, the US Multilateral Treaty applied to US purse seiners as they were fishing in both the parties’ EEZs and the high seas pockets. Therefore, it produced a new regulatory space that combined FFA members’ EEZs *and* high sea waters. It permitted the Pacific Islands to project their surveillance and regulations beyond their national jurisdictions and into international waters. Not only could the Pacific Islands collect information on the high seas, but they could also prosecute US fishers’ infractions: “Many countries ha[d] for example enacted legislation allowing them to prosecute for offences against observers on US purse seiners while in the high seas, once the vessel concerned enter[ed] national waters.” (Brown, 1990, p. 2). Surveillance and enforcement extended to the high seas to support the management of EEZs, in disarticulation with ownership and sovereignty claims over these spaces. Such a strategy echoes what security scholar B. Ryan described as a new spatial thinking in marine governance, characterised as “a non-linear, fluid and, when operationalised, oceanic conceptualisation of risk-driven spatial management”, which he found to be distinctive of contemporary maritime security practices (Ryan, 2019, p. 1061). Such a regime led to policing specific behaviours beyond national boundaries and over non-national entities.

The Pacific Islands endeavoured to replicate the scheme of the US Multilateral Treaty with Japan and the European Economic Community, without success (Doulman, 1990c). The implementation of the treaty also showed limitations, partly attributable to the specific materiality of maritime boundaries:

One of the initial problems was that most [US] captains were not absolutely certain about the exact extent of member countries zones and consequently would inadvertently misreport the position of their catches. This was largely due to the fact that most member countries had not delimited their EEZs and fisheries waters at the time the Treaty entered into force [in 1988]. This difficulty has been resolved in part by the adoption of provisional treaty lines (PTLs) which has made the reporting of positions much more certain. (Lodge, 1991b, p. 9)

As its implementation progressed, the treaty permitted the very first “coverage of the American purse seiners”, which was impossible before, given the US’ denial of the Pacific Islands’ EEZs (SCTB, 1990, p. 2). It also enhanced the surveillance of other foreign fishing fleets thanks to onboard observers or licensed US purse seiners reporting “possible illegal fishing activity by Taiwanese and Korean vessels” (FFA, 1991c, p. 9). This attests to the emergence of informal surveillance agents, i.e. *certain* tuna fishers interested in securing their access rights to the resource against their competitors, in the Pacific Islands’ tuna fisheries surveillance assemblage. These reports, in turn, were “extremely useful for the planning of aerial and surface patrols” and “provided the basis for successful Regional Register action being taken against vessels involved in illegal fishing activity” (Brown, 1993b, p. 6). Again, surveillance was partly delegated and opportunist, exploiting fishers’ presence in the offshore terrain to patrol the fishing grounds.

As a side effect, the treaty improved the understanding of the wider tuna fisheries and the suspected extent of illegal fishing activities. Enhanced catch reporting by the US fishers provided “fisheries managers from the South Pacific with some useful material with which to compare the data submitted by other fleets operating in the region” (FFA, 1998b, p. 3). From the early 1990s, this facilitated cross-checking the other foreign fishing fleets’ declarations and evidenced important reporting gaps. A 1992 study conducted by SPC compiling DWFNs’ available catch and effort data since the early 1980s provided a rough estimate of “non-reporting and under-reporting of catches by Western Pacific purse seiners” (SCTB, 1992a, p. 6). It found that with the US Multilateral Treaty, the coverage of the US purse seine fleet became “nearly complete”. In comparison, it assessed that the coverage of Korean and Taiwanese catches over the 1980s amounted to about 20% only and advanced that “the low coverage of catches by Korean vessels is due primarily to non-reporting, while, for Taiwanese vessels, low coverage is primarily due to under-reporting” (SCTB, 1992a, p. 6). These findings only pushed illegal fishing issues higher on the Pacific Islands’ agendas while also re-problematising the latter. In addition to combatting the illegal intrusion of foreign fishing vessels in their waters, they became more concerned with the misreporting practices of *licensed* vessels (Lodge, 1991b).

iii. The Wellington Convention to Ban Driftnet Fishing

Efforts of the Pacific Islands to control their EEZs and the tuna fisheries only magnified through the 1990s. This came partly in reaction to the substantial increase in fishing effort, predominantly driven by

the surge of the purse seine industry and the rising driftnet¹⁵³ fishery targeting South Pacific albacore tunas. Concerns were growing to ensure stock conservation and sustainable exploitation. These new uncertainties laid “the beginnings of a desire by FFA countries to take a more pro-active approach to introducing management measures to secure the sustainability of the tuna resource” (Richards, 1997, p. 1). The problem of fisheries management was reframed. It no longer was only about securing access fee revenues but also about ensuring that the resources would not be overexploited and collapse: “A decade ago fisheries development plans were still being made without reference to ecological limits and international economic issues” (SPC & FFA, 1996, p. 6).

Conservation preoccupations first pertained to the main exploited tuna stocks but progressively became more ‘ecological’, i.e. conceptualising the wider marine ecosystems and interspecies connections. ‘Bycatch’ was coming to the fore of global fisheries management agendas, problematising the incidental capture of tuna-associated fish. This consideration reached the South Pacific region as well. The tuna fishing industry would catch while targeting tuna a “diverse assemblage of non-target oceanic species” of “up to 60 species including several types of billfish (marlins, sailfish and swordfish), sharks and other oceanic fish species, and occasionally, marine reptiles and even seabirds”, accounting in some cases for “nearly half the catch” (Preston, 1997, p. 40). Bycatch raised concern from both an environmental and economic point of view, with governments and environmental groups starting to describe the phenomenon as a “potential waste” of food and economic revenues for coastal communities and game fishers (SCTB, 1993a, p. 1). Marlins, sailfish, wahoo, mahi mahi and certain sharks were of interest in certain Pacific Islands, such as New Caledonia and Fiji, that had locally-based sport fisheries and were interested in developing this economic sector as well (Preston, 1997, p. 42). Initially, bycatch issues were mainly framed as a waste of natural *resources*.

In the South Pacific, attention first turned to the driftnet fishery whose drifting nets¹⁵⁴ would unselectively entangle and capture various marine species. Because the fishery caught popular species like dolphins, it also facilitated the mobilisation of environmental associations and the media drawing an “emotive” portrait of the driftnet as a “wall of death” (SCTB, 1993a, p. 1). ‘Ghost nets’, i.e. nets left or lost at sea, also represented a hazard to shipping vessels and marine animals. Witnessing the arrival of many new Japanese and Taiwanese driftnet vessels in the region, Australia, New Zealand and Papua New Guinea called for banning the technique in the areas under jurisdiction of the region. Despite Japan’s resistance, the Pacific Islands adopted in 1989 the Convention for the Prohibition of the Use of Long Driftnets in the South Pacific (‘Wellington Convention’).¹⁵⁵ It forbid driftnet fishing in the EEZs

¹⁵³ This fishing technique deploys vertical nets with floats left to drift in the waters to catch fish.

¹⁵⁴ In that era, the driftnet typically in use in the South Pacific region were about 20-55 km in length and 15 m in depth (Doulman, 1990b).

¹⁵⁵ Fourteen FFA member countries had signed the Convention when it entered into force in 1991. So did France for its French territories. Yet, again, it took time for the provisions to be incorporated in domestic legislations and implemented at the national level. By 1994, only nine signatories had adapted their national regulations accordingly (FFA, 1994c).

of the signatory parties, denied access to any driftnet-related vessel (including fishing, supply or transshipment vessels) and prevented tuna canneries from purchasing driftnet catch (Doulman, 1990b).

However, contrary to what the PNA group could do for the purse seine fishery, much of the driftnet fishery operated in high sea areas, so the conservation and management measures adopted by the Pacific Islands for their EEZs did not suffice to cover the range of the stock and protect the South Albacore tunas from driftnet fishing operations effectively. Between 1989 and 1991, FFA engaged with the DWFNs to discuss the establishment of a more comprehensive international management regime for albacore tuna, covering the entire range of the stocks (therefore including the high seas) and all associated gear types (Richards, 1994b). This attempt was unsuccessful, however.¹⁵⁶ The DWFNs seized this opportunity to advocate anew for creating an international management regime encompassing *all* tuna species to which they would be parties and stumbled against the continuous refusal of the Pacific Islands to co-manage tuna stocks with them.

iv. The Palau Arrangement and the Federated States of Micronesia Arrangement to Manage the Purse Seine Fishery

The growth of the purse seine industry in the 1990s particularly concerned the PNA member countries. Right from the inception of the Nauru Agreement (cf. Section II.1.i), these countries had agreed to cooperate in managing the purse seine fishery operating in their waters. Papua New Guinea had suggested delimiting a sub-regional “management area” whose fishing access would be regulated by a centralised licensing system, redistributing access fees based on catch location. However, other PNA countries were reluctant to surrender their sovereign authority to such a regional system. A regionalisation approach that was too integrative threatened their main interest in consolidating their sovereignty.

Through the 1980s, the PNA countries continued to privilege bilateral fishing access agreements. This only led to the multiplication of licensed purse seiners, rising from 94 to 166 between 1983 and 1989 and causing more vivid concern for their management. Such concern was economic: oversupply risked depressing global tuna market prices and levelling down access fees (Doulman, 1990c). Additionally, purse seiners adversely affected the longline fishery’s profitability by catching juvenile and lower-value tunas. In 1992, the PNA group adopted the Palau Arrangement for the Management of the Western Pacific Fishery (‘Palau Arrangement’). The arrangement planned to decrease the number of purse seine licenses delivered by the PNA countries by 20%, hoping that capping licenses would “increase competition and thus raise access fees”, creating scarcity to derive an economic rent (Lodge,

¹⁵⁶ The Wellington Convention still contributed to raise the topic at the global level. In the wake of the convention, the UN adopted similar resolutions to limit driftnet fishing, with the active advocacy of the South Pacific countries in the process. In 1991, the UN consequently instituted a worldwide moratorium on driftnet fishing (Richards, 1994b), therefore upscaling to the global scale this regional initiative.

1998, p. 26).¹⁵⁷ This decision, however, intensified the risk of illegal fishing and the need for improved surveillance and enforcement capacities:

There are several anticipated developments in the South Pacific that will influence the way in which the FFA and the member countries plan and carry out the enforcement role. [...] It is therefore essential that the issues be monitored and the enforcement plan amended to deal with the current circumstances. The Parties to the Nauru Agreement (PNA) have agreed to limit the number of foreign licenses that are issued for their zones. As soon as the demand for licenses exceed the limit there will be increased incentives to fish illegally. The level of activity and resultant enforcement response must be closely monitored to ensure this situation does not get out of hand. (Brown, 1993a, p. 2)

In complement, to support their ambition to develop their domestic tuna industries, the PNA countries adopted in 1994 the Federated States of Micronesia Arrangement for Regional Fisheries Access ('FSM Arrangement'), granting preferential fishing access (including lower access fees) to fishing vessels based in the PNA countries. This strategy also aimed at making locally-based fishing operations more attractive and enticing foreign investments. Vessels meeting licensing criteria and guaranteeing that they make "a genuine commitment to the development of the domestic tuna industry in the region" (Wright, 1995, p. 7) could obtain a license to access *all* the EEZs of the PNA group. This regional access was more attractive to fishers, as it would open many more fishing grounds at once by making maritime boundaries more porous. The arrangement also aimed to overcome foreign fishing operations' 'distant' nature by attracting them to the PNA countries' shores and incorporating them in their territories.

In 1999, PNA members revamped the 1992 Palau Arrangement. They introduced more effective control mechanisms for the purse seine industry, whose catch had only kept growing thanks to technological innovations in fishing efficiency. Managing the number of fishing vessels did not account for fishing "effort creep" (cf. Chapter 8). Economic gains derived from the license cap had not matched PNA's expectations either. These setbacks led to replacing the Palau Arrangement with the Vessel Day Scheme implemented in 2007. The scheme switched from controlling the number of fishing licenses to the number of 'purse seine days', i.e. the number of fishing vessels' days at sea. A review of the agreement commanded by the PNA advised that a catch quota system would be the best regulatory approach to protect the tuna stocks effectively. However, the PNA members found that available data and monitoring capacities would not permit the enforcement of such a scheme. Using days at sea appeared to compromise management imperatives and enforcement capacities, which co-produced each other. As part of the Vessel Day Scheme, PNA also prohibited any licensed fishing vessel from fishing

¹⁵⁷ This management measure reportedly did not rely on any "sound scientific or economic grounds" (Lodge, 1998). There is no evidence that the strategy effectively succeeded.

in the high sea pockets to attract fishing efforts to their EEZs, i.e. in waters where they could charge access fees (Campling and Havice 2014b).

PNA's strategies greatly increased the members' economic returns from tuna fishing activities. More noticeably, it permitted to strengthen their sovereignty inside their marine territories, across their EEZs, and, like for the US Multilateral Treaty, into international waters designated no state's property. Following scholar E. Havice, this induced a more-than-territorial sovereignty, permitting the PNA countries to expand their influence over ocean spaces outside their territorial zones (Havice, 2018).

v. The Revision of the Minimum Terms and Conditions for Licensing

Surveillance considerations to implement the purse seine fishery management measures led to revising the MTCs in 1990, anticipating growing illegal fishing activities, "particularly those from undisciplined Asian fleets" (Doulman, 1991a, p. 21). These revisions introduced new mechanisms to order the region's tuna fisheries.

One measure focused on regulating at-sea transshipment, i.e. the transfer of catch from a fishing vessel to a 'mothership' at sea to unload the fishing vessel and allow it to continue its fishing activities. At-sea transshipment occurred far from sight and knowledge and facilitated the obfuscation of illicit fishing activities. The practice fuelled economic, environmental and epistemic concerns. It facilitated overfishing and market oversupplying. More important for my focus on surveillance, it provided an evasion mechanism to the 'scientific', 'regulatory' and 'coercive' surveillances of tuna fisheries. By magnifying the "potential for increased under-reporting and non-reporting of catch taken in-zone" (FFA, 1993, p. 7), it complicated the tracking of fishing operations and distorted the calculation of a 'fishing trip', an important parameter used for both stock assessment and access fee valuation (FFA, 1998b). The new MTC prohibited at-sea transshipment in EEZs and high seas and only authorised transshipment in "designated ports" (FFA, 1998a, p. 6). Again, this measure permitted the Pacific Islands to project their control over their maritime boundaries while attracting fishing activities to their shores. The measure was partly economic to galvanise port activities in the region. Surveillance interests also drove it: tying transshipment activities to their ports facilitated the deployment of port sampling and observer programmes to verify catch and surveil transshipping operations (FFA, 1998b). In-port transshipment mitigated foreign fishing vessels' remoteness and 'offshoring' behaviour.

A second MTC measure instructed licensed foreign fishing vessels to report on their high seas catch when their fishing campaigns occurred both in a Pacific Island's EEZ and high seas waters. Knowledge outside the Pacific Islands' territories was necessary to control and order their waters. DWFNs resisted the measure, arguing that high seas data could only be supplied to "competent international management organisations open to *full participation* by coastal states and fishing nations" (Kenilorea, 1992, p. 5, my emphasis). Against these objections, the Pacific Islands contrarily advanced that this requirement was not "in any way to extend coastal State jurisdiction over the high seas; nor [was] it to seek to regulate or

limit fishing on the high seas” (Kenilorea, 1992, p. 5), thereby disentangling knowledge of the high seas and its territorialisation. Instead, the data would only serve to manage the tuna stocks “within their respective zones” (Kenilorea, 1992, p. 5). The measure, once instituted (and whose very institution attests to the progressive empowerment of the Pacific Islands against the DWFNs), did contribute to improving the quantity and quality high seas catch reporting through the 1990s: hence, “in 1994, the SPC advised that Taiwan reported 96 per cent of its total catch and Korea reported 92 per cent” (FFA, 1998b, p. 4). Likewise, updates in MTCs arranged for onboard fisheries observers to cover fishing activities on the high seas (when they used to be limited to the EEZs).

vi. **The Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement**

Collaborative efforts between the Pacific Islands were also concerned with strengthening their policing capacities to back the enforcement of the various treaties and arrangements they had arranged and with improving their capacities to patrol their EEZs and detect illicit behaviours. The most fundamental milestone in that regard was the conclusion of the 1992 Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region (‘Niue treaty’), which opened the door to sharing surveillance capacities and allowing *reciprocal* enforcement.

The treaty aimed to allow a Party to “extend its fisheries surveillance and law enforcement activities” in the waters of another Party *in accordance with* the latter’s national laws and regulations (Niue Treaty, art. VI).¹⁵⁸ It enabled signatories to cooperate in providing surveillance personnel, vessels or aircraft and conduct fisheries surveillance and law enforcement activities in each other’s waters. The treaty conceived a “Regional Fisheries Surveillance and Law Enforcement Flag” for fisheries surveillance patrols (Niue Treaty, Annex 1). Cooperation could also apply to prosecution procedures and exchange of information (e.g. on the location and movements of foreign fishing vessels). Surveillance and enforcement capacities of one country could thus serve to enforce the legal regime of another signatory. Such a strategy would facilitate detecting and tracking fishing vessels *across* jurisdictions. FFA legal officer F. Amoa insistently outlined, however, that the treaty did not provide for an extension of sovereign jurisdiction over marine spaces but only for surveillance practice:

Article 73 of LOSC [Law of the Sea Convention] allows the coastal State, in exercise of its sovereign rights in the EEZ, to take measures to ensure compliance by foreign vessels in the EEZ with coastal States laws and regulations. Such measures may include boarding, inspection, arrest and judicial proceedings. [...] The coastal State has no right, except in exercise of the right of hot pursuit, to stop and inspect vessels in waters under the jurisdiction of another State. Thus State A has no right to stop, search or arrest a vessel in State B’s waters for a breach of State A’s laws. The purpose of the Treaty is therefore not to extend the boundaries of international law. Thus it will still not be possible, under the Treaty, for a country to enforce its own laws in the EEZ

¹⁵⁸ <https://faolex.fao.org/docs/pdf/mul5116.pdf> (accessed: 08.09.24)

of another country. The purpose of the Treaty is to enable countries in the region to make the best use of the available surveillance equipment by giving vessels and personnel of A the authority to enforce the laws of B. (Amoa, 1999, p. 6)

The Niue treaty sketched new articulations between various dimensions of state sovereignty and across distinct zones. At the legal level, maritime boundaries remained untarnished. In practice, however, those were blurred with surveillance and enforcement practices of a given state expanding to another jurisdiction. This strategy produced another “pragmatic space” (Bueger, 2020b) that decoupled the sovereign political-legal power from its policing resources. Those were articulated at a regional scale and made transnational. This decoupling and the mobilisation of non-sovereign enforcement apparatuses was a pragmatic answer to assert sovereignty at the legal and political level. Surveillance was made ‘more-than-territorial’ and could expand beyond a single state’s jurisdiction. Law enforcement, in turn, was made ‘more-than-sovereign’, relying on other states and actors to enact a country’s authority.

The Treaty’s implementation was limited, however. Only a few bilateral agreements to operationalise the treaty and were limited to data exchange (e.g. licensing information, vessels’ characteristics, owner and operation history, logsheet information, etc.). Data sharing appeared less burdensome financially than sharing (scarce) surveillance assets (Obed, 2003). Data could travel more easily than patrol ships. One reason advanced by FFA officer T. Aqorau for the slow progression of the Niue Treaty was the “complexity of the legal structure within which such arrangements would have to be implemented” given the variety of fisheries laws of the Pacific Islands: “Enforcement officers operating in the waters of another country would have to be familiar with the latter’s fisheries laws, and this might well prove to be an overly burdensome requirement” (Aqorau, 2003, p. 91). More generally, the Niue Treaty had left great uncertainty regarding operational issues such as command and control, the extent of authority, the use of force and the conduct of hot pursuit (Goodman, 2013) – i.e. regarding the actual articulation of sovereign jurisdiction with policing power. The original disjunction of legal authority and enforcement practice enabled the scheme’s adoption while weakening its implementation.

After reasserting their economic interest in tuna fisheries in the 2007 Vava’u Declaration, Pacific Islands Forum¹⁵⁹ members committed to improving the operationalisation of the Niue Treaty. They adopted in 2012 the Agreement on Strengthening the Implementation of the Niue Treaty to improve their efforts in combating Illegal, Unreported and Unregulated (IUU) fishing. The agreement appointed a ‘National Authority’ in each signatory party to administer the agreement and established an information system “mostly for compliance purposes” (SPC chief data scientist, Noumea, 22.11.19). It also detailed the framework for sharing patrol vessels, aircraft, officers, data, etc. to maximise the operational range of surveillance and enforcement resources.¹⁶⁰ Exchanged data would include license

¹⁵⁹ The South Pacific Forum became the Pacific Islands Forum in 1999, to better represent the geography of its member countries.

¹⁶⁰ For instance, the treaty enables “an officer from one country to take action as an authorised officer from another country”. With regard to hot pursuit, the treaty authorises to maintain hot pursuit in another state’s territorial waters with its

lists, vessels' movements, observer data, boarding reports, port inspection reports, logsheet data, lists of vessels and persons of interest, prosecution reports, etc.

Many of these data can support more than fisheries law enforcement, as explained by FFA: "While addressing illegal, unreported and unregulated fishing, or IUU fishing, is a key focus of the NTSA [Niue Treaty Subsidiary Arrangement], it is also used for wider maritime law enforcement purposes."¹⁶¹ This statement outlines the multipotency of fisheries surveillance to support 'wider' security prerogatives. Discussions prefiguring the treaty rightly "noted the value of extending the terms of the Treaty [...] to cover other matters such as customs, marine pollution, narcotics, search and rescue, disaster relief and environmental matters" (FFA, 1992a, p. 4). Fisheries and their data were increasingly embedded in wider maritime security aspects. In return, cooperation in fisheries law enforcement influenced new approaches to maritime security. For legal and security scholar R. Warner, the development of cooperative maritime surveillance and enforcement in the South Pacific region started in the field of tuna fisheries and paved the way for additional cooperative efforts in other sectors (Warner, 2008). The Pacific Islands Forum started in 2007 examining the potential of the Niue Treaty rationale for other law enforcement activities to combat transnational crime threats. However, "some countries have been reluctant" to share their surveillance information, showing that regional cooperation remains a continuous work in the making (SPC chief data scientist, Noumea, 22.11.19).

vii. The Minute of Agreement on Cooperation in Fisheries Monitoring and Surveillance with the US and the Lacey Act

Cooperation also progressed beyond the Pacific Islands Forum membership, as shown by the signing of a Minute of Agreement on Cooperation in Fisheries Monitoring and Surveillance with the US to ensure cooperation "in all matters relating to fisheries compliance in the Western and South Pacific" (FFA, 1998b, p. 7). The agreement covered the exchange of surveillance information and allowed the US to take action against vessels violating FFA member countries' conservation and management measures (FFA, 1998b, p. 7). It also formalised relations between FFA, the US national Marine Fisheries Service and the US Coast Guard, provisioning in particular that the US Marine Fisheries Service would supply personnel to FFA to advise and train in fisheries enforcement (Richards, 1999b).

This agreement permitted FFA countries to obtain support from the US authorities in prosecuting foreign fishing vessel operators having perpetrated an offence in their EEZ if they happened to enter a US port. The "pragmatic space" (Bueger, 2020b) constructed by the Pacific Islands for surveillance and

permission, to reduce the ability of a fishing vessel to escape and seek refuge in the territorial waters of another country. Parties may also carry out in-port MCS activities at the request of another Party (e.g. monitoring landing or transshipment, inspecting a vessel or seizing its catch).

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https://www.youtube.com/watch?v=sTVsAxZ76yc&ab_channel=AustralianFisheriesManagementAuthority%28AFMA%29
(accessed: 08.09.24)

enforcement purposes became more reticular, strategically adjusting to the organisation of the tuna fisheries. In 1993, the US National Marine Fisheries Service, the US Coast Guard and the Territorial Natural Resources Agencies started “an aggressive campaign of boarding and investigation of the fishing activities of both foreign and domestic fishing vessels engaged in the South Pacific tuna fisheries” (FFA, 1995a, p. 3). Although vessel prosecutions by the US would not provide any financial compensation to the Pacific Islands, it strengthened their sanctioning capacity, reach of action and deterrence capacity. Certain Pacific Islands adopted similar schemes: Papua New Guinea and the Solomon Islands integrated into their national legislation provisions allowing the prosecution of fishing vessel operators importing fish caught illegally in the EEZ of another FFA member country (FFA, 1998b).

viii. The Multi-Dimensional and Extra-Territorial Regulation of Tuna Fisheries

The various arrangements I have described so far aimed to manage fisheries through the lens of natural resource management to provide maximum socio-economic benefits to the Pacific Islands while ensuring the stocks’ sustainability. From the 1990s, there came the realisation that other dimensions of fisheries management relating to labour and safety had been neglected. Not only offshore spaces were to be ordered, but also the fish supply chain.

a. Labour and Safety at Sea

In the 1990s, the professionalisation of maritime activities and labour regulations had progressed as part of a wider process to order the oceans. Safety aspects were first tackled by the SOLAS Convention, adopted in 1914¹⁶² in the wake of the sinking of the *Titanic* vessel and establishing minimum standards for merchant vessels. After World War II, the creation of the International Maritime Organisation (IMO) pushed forward international safety and pollution regulations. Following the 1967 *Torrey Canyon* oil spill disaster, safety at sea and environmental concerns intersected and led to the adoption of the 1973 International Convention for the Prevention of Pollution from Ships (MARPOL).¹⁶³

Fisheries long remained outside the purview of these conventions despite being a ‘maritime’ sector. Safety and labour standards and obligations were low internationally or nationally due to the sector’s organisational features and specific stereotypes weighing on the sector. An SPC Legal Advisor deplored before the Pacific Islands’ fisheries representatives the persistent and detrimental representation of fisheries as an unruly activity, with fishers portrayed as “hardy, individualistic people who would not take well rules and regulations” and only desirous to make the most profits (SPC, 1999b, p. 1). To him, the lack of regulation only reflected misplaced perceptions of fishers as the epitome of liberal and libertarian sea users, refusing regulation to maintain the unconstrained commercial exploitation of the

¹⁶² The Convention was reviewed several times after, with the latest Convention adopted in 1974.

¹⁶³ <https://www.imo.org/en/About/HistoryOfIMO/Pages/Default.aspx> (accessed: 30.01.24)

ocean and abiding by a ‘freedom of the sea’ ethos. Such a view only provided a pretext to hide the reluctance of public authorities to “pay for the training” (SPC, 1999b, p. 1).

Administrative structures also curbed fisheries management from a labour and safety perspective. The ‘more-than-human’ fisheries, comprising both ‘human’ dimensions of labour and ‘natural’ dimensions of fish populations’ biology and ecology, made them sit awkwardly astride several agencies – an observation that would rapidly fuel reflections on the need for a more integrated approach to fisheries management. Most debates on fisheries management had focused on fish stocks. Fisheries administrations were concerned with managing the exploitation of the fish resource. Labour and safety aspects appeared outside their scope, falling under that of other administrations with little sector knowledge. On the contrary, ‘maritime’ administrations had an overtly anthropocentric and ‘factory-like’ stance on the ocean. These agencies, supposedly concerned with the safety of all seafarers, had difficulties accounting for fisheries’ specific organisational and technical features, which appeared “so different from the cargo handling and transport activities encountered in merchant shipping” (SPC, 2001, p. 3). The diversity of the fishery sector, comprising many different vessel designs and types of operation, initially impinged on the inclusion of fishing vessels in the SOLAS Convention (Plaza Montero & Lopez Pulido, 2012).¹⁶⁴ In a review of convention, SPC fisheries officers J. Hogan and L. Chapman argued that the globalised and reticular organisation of offshore fisheries hindered the legal and practical implementation of safety rules:

The nature of fisheries presents logistical problems. There is no consistency in how fishing vessels are licensed. Some foreign fishing vessels are licensed as members of an association, with which individual PICTs have standing access agreements. In such instances, the licence and registration application for the various vessels are undertaken by the association, whose headquarters might be in Tokyo, Kaohung, or Seoul. [...] The vessels are usually on the fishing grounds, and licences are normally issued to foreign fishing vessels without any physical inspection. It does not make sense, either logistically or economically, to require foreign fishing vessels to enter port before they can be licensed, as most do not make port calls, and have the capacity to spend months at a time at sea before they unload their catch. [...] Regardless of vessel’s flag, the highly mobile and migratory nature of the fishing industry would present immense logistical problems [...]. (Hogan & Chapman, 2005, p. 26)

SPC adviser A. Scotland mentioned that, in many Pacific Islands, there was “competition for jurisdiction between maritime departments and those agencies responsible for fisheries”, resulting in the absence of “standards for the safety of fishing vessels and no standards for the training of fishing vessel crews” (Scotland, 1998, p. 5). For the Food and Agriculture Organisation (FAO), “the effect of this dilemma is

¹⁶⁴ In 1977, an International Convention for the Safety of Fishing Vessels, or Torremolinos Convention, was adopted and provided the very first international convention on safety devoted to fishing vessels over 24m-long. However, the Convention was not ratified because many States found it too strict (Plaza Montero & Lopez Pulido, 2012).

that in many countries, the issue of fishing vessel safety is falling between the fisheries and maritime administrations” (SPC, 2001, p. 3). Tuna fishers were ‘offshore’ the public administrations.

Even in their industrial stage, fisheries remained a ‘wilder’ activity compared to the Fordist-like organisation of the shipping sector. The profession remained little or improperly regulated: in Fiji, labour law did not thoroughly address fishing labour arrangements and “very few of the Fiji crew really understood their contracts” (Gillett, 1997b, p. 3). Although more Pacific Islanders were getting involved in the fishing industry either on foreign or domestic fishing vessels, many were “untrained, or ha[d] been trained in an ad hoc fashion” (SPC Secretariat, 1992, p. 1). In most cases, crew regulations only related “to the chain of command, disciplinary processes and minimum performance standards for the crew” (SPC, 1995, p. 3), applying coercive rather than protective forms of control on fishers in the name of productivity.

Nonetheless, accidents were becoming more numerous under the joint influence of technological innovations and productivity imperatives. As competition for fish intensified, so did ‘risky’ behaviours. There were reports of foreign fishing vessels looking like “rust buckets, leaking like sieves” and domestic fishing vessels lost at sea because of cyclones or for their “motor failed” (SPC, 1999b, p. 1). Emerging statistics helped make the issue more visible:¹⁶⁵ “A recent article in *National Fisherman* (May 1997) stated that: ‘Statistically, a higher percentage of people die in commercial fishing than in any other occupation in America.’ According to the Bureau of Labour Statistics, you’re 20 times more likely to get killed fishing than mining coal.” (Beverly, 1997, p. 29). The recognition that fishing was one of the most dangerous professions because it was unregulated consolidated. SPC Legal Advisor pleaded: “A fishing vessel is a ship. It is just a ship with a special mission.” (SPC, 1999b, p. 1) Such a call was even more receivable against the appreciation that fishing employment was particularly important for the Pacific populations. The growing involvement of *locals* in the tuna fisheries led the Pacific Island authorities to consider their welfare and labour rights in addition to the protection of the tuna stocks.

A few Pacific Islands (including Fiji¹⁶⁶ and New Caledonia) started to develop formal, but varied, training schemes at the national level. In 1994, the Pacific Islands’ authorities suggested SPC to look into the creation of a *standardised* training certification scheme for the region, favouring once again a regional strategy to pool their resources and advance this issue. SPC held a series of workshop on “standardised certification for Pacific Island fishing vessel crews” and the development of a “Pacific Island Qualified Fishing Deckhand certificate” (SPC, 1994b, p. v). These efforts drew on pre-existing national, regional and international programmes, including the 1978 International Standards of Training Certification and Watchkeeping for Seafarers, the SOLAS Convention, the Code of Safety for fishermen

¹⁶⁵ Lack of data at the international level on safety issues in fisheries had also contributed to the slowing of international standard adoption.

¹⁶⁶ Fiji created a Fisheries Training School within its Maritime Training School, incorporating fisheries in the wider maritime affairs while also acknowledging their specificity.

and fishing vessels of IMO, or the South Pacific Maritime Code. The latter had been established in 1977 to develop “uniform maritime standards” for members of the South Pacific Forum “with respect to the certification of seagoing personnel from those countries and the operation of ships and their equipment within the Pacific region” (SPC, 1999a, p. 2). Safety was addressed at two levels: professional, with crew training, and technical, with vessel requirements. The Code was updated in 1995. In 1999, the SPC Regional Maritime Programme cooperated with the Fisheries Training Section to “produce competency-based training packages leading to formal qualifications for officers and crew on fishing vessels” (SPC, 1999a, p. 2). Again, the regional approach was mostly technical: it was left to the national administrations to decide on the incorporation of these recommendations in their national legislation.

b. Food Safety

The rise of health and food safety concerns also led to new regulations in tuna fisheries. In the 1990s, the food industry endured several sanitary crises (e.g. mad cow, avian influenza), which raised food safety concerns and expanded ‘traceability’ (i.e. surveillance) practices to animals and throughout the food supply chains. These new risks also penetrated the fishing industry and gave birth to additional forms of extra-territorial regulations, dominated this time by consumer countries. Dominant importing countries like the US and the EU started introducing “more effective and restrictive food safety procedures and standards” guiding their inspection and evaluation of fish products, to abide by “the increasing demand on the part of consumers for safe, healthy and socially responsible foods and processes” (Movick, 1995, p. 34). This brought new constraints to the tuna fisheries and the Pacific Island authorities, showing a complexifying governance of fisheries and rising ‘bottom-up’ influences.

In the US, the 1995 Seafood Regulation adopted Hazard Analysis and Critical Control Point (HACCP) programmes to limit food safety hazards through processing operations. Rapidly, these programmes came “to mean food safety in the food industry *throughout the world*”, a fisheries expert explained to the Pacific Islands (McEachern, 1995, p. 32), showing the ability of national US policies to influence the global structure of fish industries. If the Pacific Islands had devised strategies to project their sovereign authority beyond their national jurisdictions, other countries would also wield extra-territorial power on the Pacific Islands’ jurisdictions and mitigate their sovereignty over the fisheries. With their respective domestic regulations and economic power, consumer countries such as the US and the EU could also constrain and shape fisheries management at a distance.

The HACCP system provided a risk-based assessment of fish products, drawing on monitoring and auditing practices to inspect and control food quality, safety, and compliance with established standards. This system required surveilling and controlling ‘critical points’ along the production process where quality and safety hazards are the highest. The HACCP system permitted a form of ‘long-arm’ and ‘bottom-up’ government of the supply chain by the US, acting at a distance on fishers and processors, setting standards on plant constructions, operations and products, and delegating much of the associated

surveillance work to the companies themselves and the export countries. It also contributed to strengthen (or even make emerge) surveillance operations in other countries.

Similarly, the EU promulgated a new certification system for export countries, ensuring that food producers would follow its guidelines and standards. Export countries had to develop ‘quality management systems’ to monitor compliance – and, therefore, develop their surveillance of the tuna supply chain. This required the Pacific Islands to have their industrial facilities (e.g. canneries and other processing plants) inspected by the EU, designate a ‘Competent Authority’ in their administrations to inspect and certify each consignment exported to the EU, and adjust their national legislations (Chapman, 2002). This was challenging to the Pacific Islands’ administrations, as evidenced in this report by a SPC fisheries development officer in the case of Fiji:

The problem is that there is no actual Competent Authority in Fiji, nor is there any legislation in place at present to support the establishment of a Competent Authority. This means that the inspections and certifications that are currently taking place are very dubious. In fact, if an EU inspector came through, they may stop any further exports of product to the EU until everything is in place. As a matter of urgency, the Fisheries Division and the Health Department need to get together to first work out whether the Competent Authority best fits under the health or fisheries legislation. Once decided, the legislation needs to be amended and the Competent Authority established. (Chapman, 2002, p. 32)

The report and its semantics attest to the intensification of ‘coercive’ surveillance and inspection of the fishing industry and the complex administrative partitioning it entailed, in that case, between the Fisheries Division and the Health Department of Fiji. The EU system also established a reticular governance of the industry, redefining the sovereign authority of the Pacific Islands over its domestic companies, because it permitted certain companies – such as Fiji’s PAFCO cannery – to “deal directly” with the EU inspectors “outside any local government legislation” (Chapman, 2002, p. 32).

These transformations increased interest in market-based and trade-related instruments to manage the tuna industry. Certification and labelling schemes were developed in addition to more traditional regulatory, administrative and economic policy instruments (Haward, 2004). Certification permitted governmental authorities to improve their control of the industry while fostering companies’ interest in surveillance to gain a “competitive advantage” from “delivering a higher-quality product” (Movick, 1995, p. 37). Surveillance became a token for control and an economic value-creating instrument that was interesting for the surveillance subjects themselves, i.e., the companies (cf. Chapter 7).

ix. From the Regional to the National: Legal Ordering of the EEZ in Fiji and New Caledonia

Regional cooperation and coordination in tuna fisheries regulations and policies was a pragmatic and political strategy for the Pacific Islands, but it did not override nation-states. Treaties and agreements

had to be incorporated in national legislations and plans— which was not always readily done, as I have shown through the various arrangements. Additionally, each signatory could develop further measures, linked to their respective interests or commitments to other international arrangements. By 1999, “most, if not all countries, ha[d] some form of fisheries development plan, although there [were] often general in nature” (FFA, 1999, p. 17). If “management plans”, on the contrary, were “not as common” (FFA, 1999, p. 17), they were progressing to become more comprehensive, i.e. constrain and regulate instead of chiefly expanding fishing activities. Describing these specificities for each Pacific Island would exceed the scope of this thesis, so I will ground this investigation by providing more details on the ruling of the EEZs through my two specific case studies in Fiji and New Caledonia.

a. Fiji

In the 1990s, Fiji placed “an increasing emphasis on management and control of resources” and adopted a Fisheries Sector Development Plan (Richards, 1994a, p. xv). The plan sought to develop tuna fisheries to alleviate pressure on inshore fisheries, improve tuna exports, “regulate and control all fisheries on the principles of optimum utilisation and long term sustainability”, and “encourage the implementation of sound business management methods” (Richards, 1994a, p. xv). The plan kept an emphasis on fisheries development but also on its sustainable management and fish resource conservation.

The country introduced new national offshore licensing regulations in 1990 (Fiji Government, 1990). Additional provisions aimed at nationalising the tuna industry, e.g. by stating that “new licence applications, for vessels over 11 meters in length, will only be considered for vessels which have at least 30% local financial share in the vessel ownership or chartering arrangement” (S. Sharma, 1993, p. 2). This provision defined a ‘domestic’ fishing vessel as a vessel “registered in Fiji or the operation of which are based in Fiji and which is wholly owned by a Fiji citizen or a company, incorporated in Fiji, which is at least 30% owned by Fiji citizens” (B. Campbell, 1993, p. 14). Foreign fishing vessels were prohibited from fishing in territorial and internal Fijian waters (Manoa, 2008). In 1994, Fiji set a Total Allowable Catch (TAC) for the major tuna species and a maximal number of vessel licences to control fishing effort.¹⁶⁷ The measure was devised with the support of the FAO and SPC, which conducted biological assessments of the resources. However, the government retained a TAC largely above their scientific recommendations (OFP, 2003; SCTB, 1996).¹⁶⁸ In 2002, Fiji adopted a National Tuna Development and Management Plan whose implementation debuted the year after, under the supervision of the newly created Offshore Fisheries Division, which comprised in 2008 33 officers tasked with law

¹⁶⁷ The total number of longliners was limited to 80 and the TAC for tunas were set to 3,000t for albacore; 2,000t for yellowfin and 2,000 for bigeye.

¹⁶⁸ See also Chapter 8 for more discussions on that topic. Various interviewees mentioned that this decision as highly controversial, referring to corruption issues that would however require additional research to properly analyse. This permits, nevertheless, to point to the disarticulation between science and politics and the somewhat limited role of regulatory scientific knowledge in policy-making processes.

enforcement (including licensing, dockside boarding, inspection and investigation), data analysis and observers management (Manoa, 2008).

In line with its regional commitments and with assistance from FFA, Fiji's legislations and policies were progressively updated to incorporate catch reporting requirements, onboard observer accommodation requirements, compulsory port inspections, flag marking, etc. (B. Campbell, 1993). The country also set its framework for punishing offences and the amount of associated fines (B. Campbell, 1993). Besides the economic and environmental management of the tuna fisheries, Fiji progressively strengthened its regulatory safety framework (e.g. with the creation of the Fisheries Training School and of sea safety certificates, or with regulation defining minimum sizes for offshore fishing vessels). These management measures set the initial framework for Fiji to exert effective control of its EEZ and the fishers operating within. Today, Fiji's tuna fisheries are managed by the Ministry of Fisheries and its Offshore Fisheries Division and the legal framework mainly draws on the 2012 Offshore Fisheries Act and the 2014 Offshore Fisheries Management Decree, while a Fisheries Management Development plan was adopted for the 2020 decade.

b. New Caledonia

In New Caledonia, the 1990s saw heightened tensions regarding the Territory's status against the French State. This situation redefined administrative jurisdictions in 1995, and partitioned maritime matters between several administrative levels and divisions, making ocean governance all the more complex. This considerably delayed the development of a proper fisheries policy (Service Territorial de la Marine Marchande et des Pêches Maritimes, 1995). The first fisheries policy relating to the EEZ passed in 2001, following a significant increase in the domestic tuna fleet (Etaix-Bonnin, 2003).¹⁶⁹ The policy dealt with licensing and monitoring and permitted the New Caledonian government to set a TAC and other technical management measures imposing restrictions on fishing gear, zones or target species:

We did not have any fishery policy before 2000/2001. Our fishery policy, as such, with a formal text, etc. only came at that time. It is around that time that the New Caledonian government obtained jurisdiction for the management of the EEZ and therefore said: we want a precise regulatory framework. So a text was developed. Before 2000, logsheet were produced on a voluntary basis by the fishing fleets, and there was no licensing system for locally-based fishing vessels. It was only for the foreign vessels. We still had a good coverage, the fishers played along in providing us with their logsheets because they knew it was used for stock assessment. [...] Then, with the fishery policy, it became mandatory, there were the logsheets, the observer programme, the VMS, it all happened in the wake of the policy. (Former fisheries manager of New Caledonia, Noumea, 11.09.19)

The quotation attests to the seminal role of the tuna fisheries policy in supporting the appropriation of the EEZ. That same interviewee added: "There was a turn with the new jurisdiction of New Caledonia

¹⁶⁹ The New Caledonian tuna fleet comprised fourteen vessels in 2000 and 25 longliners in 2002, thanks to the creation of new fishing companies.

with respect to resource management from 1999, and with the fishery policy. *That is when we could gain power.*” (Former fisheries manager, Noumea, 11.09.19). New Caledonia progressively aligned with several regional standards established by FFA and SPC, to benefit from the regionalist strategy while preserving its autonomy on specific matters. The Territory even became a full member of the Pacific Islands Forum in 2016, attesting to its growing integration in the region created by the Pacific Islands.

2. Institutional Instruments: A Regional Agency to Assist with Fisheries Management, Surveillance and Enforcement

FFA became pivotal in advising, administering and implementing many of these arrangements’ provisions and permitting, in practice, the operationalisation of regional cooperation. For instance, the agency managed the Regional Register of fishing vessels and the fisheries observer programme of the US Multilateral Treaty. The organisation only had advisory powers and was conceived as an instrument to support the Pacific Islands in tuna fisheries management and control and in translating paper-based commitments into effective practices and instruments. On its inception, FFA chiefly concentrated on developing and harmonising policies and legislations before turning its efforts to regional surveillance and enforcement more resolutely in the mid-1980s.

In 1986, FFA adopted a formal Regional Surveillance Programme (FFA, 1991c). Under this programme, fisheries surveillance officers of FFA member countries would convene annually to decide FFA’s upcoming activities and exchange information with one another to further regional cooperation. Funding the programme was a hurdle. Australia and New Zealand, both members of FFA, were major contributors. However, the programme relied on complementary (and non-perennial) external funding, expertise, and equipment. In the early stage of the programme, funding came from the Canadian aid agency, which was part of its programme to assist ‘developing ‘coastal and island nations in managing ocean resources.’¹⁷⁰ The funding permitted the recruitment of an enforcement advisor, a Canadian expert charged to “begin the process of coordinating the enforcement programmes of the various member states” (Brown, 1993a, p. 1).¹⁷¹

At a regional surveillance meeting in 1990, FFA members agreed to establish a regional network of national surveillance centres, of which FFA would be the central node. The Pacific Islands privileged a distributed and networked approach over a fully integrated system to retain their political power. FFA was commissioned to support the consolidation of regulatory surveillance and enforcement requirements, improve communication between the Pacific Islands, offer harmonised training and

¹⁷⁰ Canada was a leading nation in the development of fisheries management initiatives, especially for high sea fisheries. This stemmed from the collapse of the straddling cod stocks in the Northwest Atlantic, believed to have been caused by overfishing in the high seas, and which led to the collapse of Canada’s offshore fleet in the mid-1980s and early 1990s (FFA, 1993).

¹⁷¹ He was later replaced by a surveillance officer *from* the region in 1990.

investigate “joint and reciprocal surveillance and enforcement activities” (FFA, 1990b, p. 2). The agency would also serve as a “coordinator” of the aerial, maritime, computing and human components constituting such a surveillance assemblage (FFA, 1991c, p. 1). These efforts consolidated through the 1990s and are described in the following subsections.

The agency’s organisational structure was reviewed against the growing importance of ‘coercive’ surveillance activities in FFA. Leaving the umbrella of the legal service, surveillance and enforcement activities were fully institutionalised under the Monitoring, Control, Surveillance (MCS) Division, mostly funded by Australia with the mandate to “reinforce member countries’ capacity to achieve compliance by fishing operators with national regulations and regional arrangements licence conditions” (FFA, 1998b, p. 2). This reorganisation also reflects the incorporation within FFA of novel considerations relating to surveillance and enforcement in fisheries and elaborated at the global level, mainly under FAO.

Upon adopting UNCLOS, many coastal states faced similar impediments to the Pacific Islands to develop and ensure the proper implementation of fisheries conservation and management measures. In that context, FAO launched an expert consultation to discuss MCS systems to assist with fisheries management. The organisation promoted, in particular, regional approaches similar to what the South Pacific region was concurrently developing. The concept of MCS spread through fisheries management institutions, as evidenced in FFA’s internal structure. MCS was conceived as the “implementing arm” of fisheries management, to enforce rules and address illegal fishing activities. The definition of MCS specified monitoring as the “continuous requirement of the measurements of fishing effort characteristics and resource yields”, control as the “regulatory conditions under which the exploitation of the resource may be conducted” and surveillance as the “degree and types of observations required to maintain compliance with the regulatory controls imposed on fishing activities” (Doulman, 1994, online). The concept brought together the ‘technical’ dimension of surveillance (i.e. data collection) with legislative and policing (i.e. enforcement-related) dimensions (S. M. Garcia et al., 2014). It was elaborated to bring to the fore the importance of ‘coercive’ surveillance, long overlooked against the heavy focus on ‘scientific’ and ‘regulatory’ surveillances only, as explained by this FAO expert:

In the past, officials often reflected the view that fisheries management includes only the biological studies for resource assessment and development of management plans, and there the process ends. [...] The support for data collection and policing of fishers and the industry to ensure appropriate input into future fisheries management plans, and the successful realisation of these plans, was low. Now, there is a growing awareness of the declining condition of the environment and a greater acceptance of the need for investment in the implementation (MCS) of natural resource management plans, including those for fisheries. (Flewellling, 1999, online)

The concept of MCS is interesting because it distinguishes while intertwining the notions of ‘monitoring’, ‘control’ and ‘surveillance’. Monitoring was defined in an open-ended and relatively

neutral fashion, while surveillance explicitly related to policing fishers and ensuring compliance with management (or ‘control’) rules. By providing information on fishing effort characteristics, monitoring could underpin both scientific efforts and surveillance – showing its multipotency and explaining its intertwining in the MCS concept. In return, the policing of fishers and the industry aimed to ensure compliance to the rules *and* the proper data collection and monitoring of the fisheries.

A year after its creation, the FFA’s MCS division, involving six professionals assisted by fisheries and defence experts from the US and Australia, launched an integrated programme of regional fisheries surveillance to develop and coordinate national and regional MCS programmes. If SPC was the “calculation centre” (Latour, 1987) of fisheries science for the region, FFA became the calculation centre of ‘coercive’ surveillance activities. FFA provided a “clearinghouse for information from various sources about the activities of foreign fishing vessels in the EEZs of FFA members” and “direct support to surveillance operations” (Richards, 2004, p. 7). This led to the creation of an “operation centre” responsible for the “daily collation and dissemination of information and fisheries management purposes”, aggregating “incoming data from member countries and other sources” in a regional database shared back to each nation to “facilitate the effective deployment of enforcement resources” (Brown, 1993a, p. 2-3). The database would hold information on fishing vessels’ licensing status, offence history, fishing positions, etc. Progressively, the database was completed with a “case law” information system, permitting member countries to access court decisions and gain help in “dealing with complex issues of principles in fisheries matters” (Brown, 1993a).

Having a regional surveillance centre permitted to optimise limited information technology resources in particular, as explained by this former FFA Director:

Interviewee: I think also they realised they didn’t have the computing power, mostly, to keep up with all the data so they needed somebody to coordinate the observer programmes, the logbooks, and do all those things. SPC and FFA were able to provide that to the national services [...]

Interviewer: Did countries also have their own systems of surveillance and monitoring?

Interviewee: Not much. They were beginning to get their own computers. It was very primitive in those days. The information would be displayed simultaneously in the centre and in the countries, but it took a long time to get the training right, the exchange of data to work well enough. FFA were better at seeing and telling the countries when they had an incursion [of unlicensed fishing vessels].

The central node of the regional surveillance network, located in FFA’s headquarters, developed far more rapidly than the national nodes across the Pacific Islands.

3. Technical Instruments

The Pacific Islands relied on several techniques in complement to their regulatory instruments. Mapping their EEZs and establishing surveillance and enforcement apparatuses were pivotal to knowing, controlling and performing their territorial claims over offshore spaces and tuna resources. The main apparatuses included regional patrolling operations, onboard and in-port fisheries observers and Vessel Monitoring Systems (VMS). Because I have already covered fisheries observers in Chapter 5, I will only describe the other apparatuses.

i. Boundary-Making at Sea

The first area of focus for FFA to support the establishment of the Pacific Islands' EEZs was the proper delimitation of their boundaries. Boundary-making was not just a discursive act but also necessitated technical operations. According to the agency, the entry into force of UNCLOS in 1994 reportedly placed “additional pressure for coastal states to define their maritime boundaries” and required coastal countries to provide “either charts or a list of coordinates defining outer limits” of their EEZs (FFA, 1994a, p. 14). The unequivocal delimitation of maritime boundaries was the preliminary and fundamental step for the Pacific Islands to exert control over the EEZs as unclear boundaries impeded their policing and enforcement. Nevertheless, the Pacific Islands had “limited resources, in terms of funds and survey and cartographic expertise” (FFA, 1994a, p. 14). Although the Pacific Islands were swift to proclaim their EEZs in line with UNCLOS negotiations, by the 1990s, “very little, however, ha[d] been done towards accurately defining and delimiting the precise extent of the economic zones” (Lodge, 1991b, p. 17), and few boundaries had been settled between neighbouring territories.

The technical requirements of UNCLOS placed a great burden on coastal countries. Establishing boundaries necessitated access to maritime data, the production of databases and maps, and concluding agreements with neighbouring countries when EEZ boundaries would overlap. However, similarly to fisheries data, the geography of maritime data was not centred on the Pacific Islands. Data were largely produced and stored outside their administrations in the hydrographic offices of the former colonial powers (Amoa, 1996). Furthermore, data were often outdated, incomplete or in an inappropriate format against UNCLOS' requirements.

The fastest countries in the region to officialise their boundaries were those endowed with the necessary technical and legal resources: Australia and New Zealand, then the Pacific Islands still administered by colonial powers. For the independent Pacific Islands, the process was cumbersome. In the case of Fiji, archipelagic baselines were determined from “rather dated hydrographic charts based on surveys between 1854 and 1962, and with no identifiable geodetic datum”, and “negotiations with France in the mid-1980s revealed discrepancies in the location of some of the base points for the archipelagic baselines” (Amoa, 1996, p. iii): many geographic data needed to be reviewed. These factors

were not only sources of uncertainty for sovereignty and rule enforcement but also, in some cases, of territorial disputes, as many of the EEZ boundaries had to be negotiated with neighbouring countries. FFA identified that 33 delimitation agreements, out of the 48 common boundaries to be delimited, had to be concluded.

Fiji's EEZ claim, for instance, faltered against Tonga's counter-claim over the Minerva Reefs (Song, 2019). This dispute is worth telling because it evidences the clash of conflicting territorialities and cultural representations of marine spaces. Tonga's claim was supported by longstanding evidence of Tongan presence by the reefs, with records of fishing activities and shipwrecks. In 1971, the US Ocean Life Research Foundation considered the reefs, located in the high seas, to be '*terra nullius*' and endeavoured to claim and build them into an atoll to create the sovereign 'micronation' of the Republic of Minerva (Menefee, 1994; Song, 2019). This undertaking was part of a wider utopic and libertarian imperialism, imagining and performing the ocean as a new socio-political frontier to escape, in this particular case, "high taxes, riots, drugs and crimes" (Song, 2019, p. 421). Beacons, flags, stamps and even coins served to mark and symbolise this territorial appropriation. The claim immediately sparked reactions amongst the neighbouring Pacific Islands. Tonga advanced its jurisdiction over the atoll and adjacent waters. Legal debates ensued, discussing the possibility, under international law, of appropriating such topographic structure, which would be regularly submerged with tidal water movements, and whether this could entail territorial sea rights. The project of the Republic of Minerva collapsed because of tensions amongst its founding members. However, following the adoption of UNCLOS, the Minerva Reefs suddenly fell within the zone that Fiji could claim, sparking yet another legal question on the jurisdiction of this oceanic tract.

France and Vanuatu similarly laid competing claims over the Matthew and Hunter Islands and their allegedly fish-rich associated waters. Incidentally, this conflict further complicated Fiji's capacity to settle its maritime boundaries with these two neighbouring countries. The case of the New Caledonia-Vanuatu dissensus, still very present to date (see also Chapter 9), also attests to the complex collision of indigenous histories, colonial processes, customary and (inter)national legal regimes, and conflicting territorialities between Western modern states' suffusing international diplomacy and Indigenous and Oceanian's ones. France claimed Matthew and Hunter Islands as part of its historical colonial undertaking. For long, the two islands were administered as part of the Anglo-French condominium of New Hebrides before they were attached to the New Caledonia administration by the French, with agreement from Great Britain (Maclellan, 2022). Upon its independence, Vanuatu claimed sovereignty over the two islands based on geological grounds and indigenous historical ties. Importantly, Indigenous political representatives and customary authorities of New Caledonia officially acknowledged these socio-cultural connections in the 2009 Kéamu Accord (David, 2011; Song & Mosses, 2018).

These territorial disputes also illustrate the existence of legal uncertainties regarding ‘natural’ categories mobilised in UNCLOS and the (im)precise characterisation of topographic terms such as ‘islands’ and ‘rocks’ and their propensity to permit human habitation or economic life.¹⁷² FFA reported, for instance, that there was legal uncertainty on the “extent to which uninhabited islands, such as the United States’ possessions in the Pacific, should be entitled to generate 200-mile exclusive economic zones”. Territorial claims were disputed in various ways, either in international negotiations or by producing maps and (un)marking the physical spaces at stake. France, for instance, installed a ‘plaque’ and held a Bastille Day ceremony to assert its sovereignty on Hunter Islands, while ni-Vanuatu chiefs replaced the French plaque with leaves, food and kava (MacLellan, 2022). ‘Coercive’ surveillance was also instrumental in occupying and claiming those spaces: the French navy would patrol around Matthew and Hunter Islands and even seized a Vanuatu-licensed fishing vessel operating in these disputed waters. In the case of Fiji, disputes with Tonga escalated with the destruction by Fiji of navigational beacons set up by Tonga on the Minerva Reefs in 2011, while Tonga regularly patrols the Minerva Reefs since 1972 (Song, 2019).

The EEZ momentum introduced a dual movement, contributing to magnifying regional cooperation that competing boundary claims would simultaneously thwart. The formal delimitation of maritime boundaries appeared all the more necessary, not only to abide by UNCLOS requirements but also to “remove a possible source of conflict from the division of access fees under regional fisheries access agreements [...] and other marine matters” (FFA, 1992b, p. 5). To address this impediment, FFA conducted a Maritime Boundaries Delimitation programme funded by the European Community to “provide countries with the necessary data needed for marine boundary negotiations, including accurate lists of coordinates and maps showing the physical features of the region as well as to provide appropriate training” (FFA, 1992b, p. 4). The programme comprised a series of Maritime Boundary Delimitation Workshops undertaken by FFA’s legal service to give “the relevant officials with an appreciation of the complex nature of the legal principles and negotiations of maritime boundaries delimitation” (Amoa, 1996, p. 6). FFA dispensed legal and technical support to assist the Pacific Islands in negotiating their boundaries. In particular, FFA worked to acquire, assess and compile for the Pacific Islands the necessary survey data, complementarily to its law support programme working to incorporate and adapt national regulations regarding the EEZs and offshore fisheries (Amoa, 1996).

ii. Regional Patrolling Operations

In line with the conclusion of the Minute of Agreement on Cooperation in Fisheries Monitoring and Surveillance with the US (cf. Section II.1.vii), the Pacific Islands strengthened their cooperation with (mostly formerly colonial) military powers to build their patrolling capacities. Against the virtual lack

¹⁷² It is interesting also to note how the delimitation of the ocean relied on terrestrial features, attesting to the persistence of a land-based perspective to think the marine worlds.

of aerial capacities of most Pacific Islands, aside from occasional locally-based air charter companies, an agreement arranged that FFA would henceforward act as the coordinating agency for the air forces supplied by Australia, New Zealand and France with the creation of an informal annual regional aerial surveillance meeting for the concerned personnel from 1992 (Richards, 1997). The role of FFA as the central coordinating actor partially reversed the power balance that used to prevail (cf. Section I.3). However, the Pacific Islands would still be reliant on the specific interests, policies and strategies of the partnering countries providing their surveillance assets.

Australia and New Zealand respectively provided, in the late 1990s, about 750 and 500 hours of aerial surveillance per year to fly over the region; France about 90 hours annually to surveil the Cook Islands, Fiji and Vanuatu, and the US also contributed on occasion to aerial surveillance operations (Richards, 1999b). For reference, Figure 20 shows the estimated number of hours required to fully cover each member’s EEZ with aerial surveillance methods. Cooperation also included surface patrol operations. Australia’s Pacific Patrol Boat Programme, launched in the 1980s and mentioned above, was renamed the “Maritime Surveillance Programme” and has remained the main instrument for surface patrolling operations in the EEZs of the Pacific Islands.

ANNEX C

Hours Required to Give 100% Coverage to FFA Member EEZ's

<u>Country</u>	<u>Hours</u>
Cook Islands	60
Fiji	42
Kiribati	161 (Gilbert, Phoenix, and Line)
Marshall Islands	102
Federated States of Micronesia	143
Nauru	12
Niue	15
Palau	25
Papua New Guinea	102
Solomon Islands	55
Tonga	30
Tuvalu	40
Vanuatu	25
Western Samoa	4

Figure 20: Number of hours estimated by FFA for a surveillance flight to fully cover each EEZ of the FFA member countries. Source: (FFA, 1992d, p. 28)

In 1992, New Zealand, Australia and France formalised their support to the South Pacific Region with the 'FRANZ Arrangement', initially devised to provide the Pacific Islands with disaster and relief assistance and humanitarian support before extending the arrangement to maritime fisheries surveillance and IUU fishing issues (formalised in 2006). Cooperation between the three countries also included defence training and collective military exercises in the region (Fisher, 2013). In 1998, with the US, the four countries constituted the Quadrilateral Defence Coordination Group ('QUAD') to coordinate aerial and maritime surveillance with FFA. The QUAD gathered defence and security agencies to strengthen maritime surveillance and address illegal fishing activities. Under the coordination of FFA, the QUAD would supply personnel, vessels and aircraft to conduct surveillance operations every year.

Before the annual planning of aerial surveillance activities, FFA's MCS Division would consult its member countries on their aerial surveillance requirements and transmit them to the Australian and New Zealand air forces, along with surveillance information. France, not a member of FFA, continued to privilege bilateral approaches to aerial surveillance (Richards, 1999b). In the late 1990s, however, the country became interested in mending its diplomatic relations with the Pacific Islands. Although mostly focused on its Overseas Territories, France increased its multilateral aid to the other Pacific Islands. To compensate for its highly controversial nuclear testing programmes, it focused on environmental, climate and fisheries surveillance matters (Fisher, 2013). These alliances resulted in the regular conduct of regional and joint fisheries surveillance operations involving the QUAD members and FFA to patrol the EEZs of the Pacific Islands and inspect fishing vessels (see Chapter 9).

iii. Technological Innovations in 'Remote' Surveillance

The Pacific Islands also hinged against technological innovations in remote sensing and information technologies to consolidate their MCS capacities. Those offered a promising 'technological fix' to address their limited capacity to patrol their offshore waters. Satellite developments provided new prospects to connect the land and the sea through the sky and collect information at and despite the distance. For the South Pacific region, VMS or radar technologies fuelled unprecedented expectations to build up their surveillance capacities:

An additional problem is that MCS resources in the WCP [Western and Central Pacific] are limited, such that it will be difficult to enforce compliance with management measures implemented under the arrangement for the high seas. One way of overcoming this problem may be by increasing the level of technology in support of MCS. The current use of satellite-based vessel monitoring systems and satellite imagery, combined with synthetic aperture radar and over-the-horizon radar now being developed, will *revolutionise* the manner in which MCS are conducted. These technologies are expected to *significantly enhance* the cost-effectiveness of existing MCS resources such as aerial and maritime surveillance assets. (FFA, 1998a, p. 5, my emphasis)

a. Vessel Monitoring Systems

One pivotal innovation was, without a doubt, the development of VMS, permitting the tracking of vessels at sea. By placing a transponder on the fishing vessels, VMS devices could emit information on their position, speed and direction at regular intervals and on a near real-time basis to a land-based monitoring station. This technology permitted offshore mobilities to become ‘visible’ from the shore for the first time. Dubbed the “eye in the sky”, VMS was swiftly described by FFA officers as a “sophisticated” and “cutting-edge” tool for “surveillance and monitoring”, capable of providing important information in a cost-effective fashion and particularly valuable to “improve compliance, surveillance and data retrieval in the field of fisheries management” (Amoa, 1996, p. 9; Richards, 1998, p. 2). The system alleviated the challenging, costly, and hefty acquisition of information by patrolling the sea or the air and brought into perspective the possibility of automated surveillance “without human intervention” (Marshall, 1995, p. 4). From the onset, VMS was understood as “one tool among many” rather than an all-replacing and self-sufficient MCS mechanism, to be “integrated with other conventional compliance activities, such as observer programmes, port of unloading checks and aerial and surface surveillance programmes” (Marshall, 1995, p. 4). VMS added a new dimension to the wider and composite surveillance assemblage and contributed to its consolidation.

Fisheries authorities expected that VMS would greatly contribute to the surveillance of fisheries in several regards (scientific, regulatory and disciplinary), as explained by FFA to its member countries (Marshall, 1995). General VMS information could help provide a better general understanding of the region’s fishing activities and their patterns. It could help cross-check and verify fishers’ catch reports and improve compliance to access fee payments: “Before VMS, they [the fishers] claimed that a lot of the fish was taken in the high seas, and suddenly, with VMS, we could see where they were. It made compliance much easier; there was less illegal fishing and an increase in income.” (Former FFA Deputy Director, Australia, 03.06.21). The timeliness of VMS, recording *ongoing* activities at sea, could also greatly assist policing operations and “more effectively target other surveillance resources such as aircraft and patrol vessels” (Marshall, 1995, p. 4).

Against these enticing technological promises, the Pacific Islands invested in this new surveillance avenue. By the early 1990s, there were several national and sub-regional VMS programmes in the region, but regional cooperation rapidly appeared, once again, as the way forward. Cooperation seemed strategic both at the technical and political levels to pool technical, human, and informational resources and avoid foreign fishers’ evasion to other waters if only one country implemented VMS in its waters. The first regional consultations were held amongst FFA members in 1991, but the process was lengthy because of technical and political hurdles that delayed its adoption to 1997.

With funding from Australia, FFA launched a Regional Vessel Monitoring Project as part of its Regional Surveillance and Enforcement Programme, thereby demonstrating the dominant ‘coercive’

purpose of VMS. The agency investigated the legal and technical aspects of VMS. At the legal level, VMS raised new issues of data security and intellectual property and the judicial value of VMS information in prosecuting procedures. At the technical level, the deployment of VMS required the creation of a monitoring centre equipped with computers and information systems to receive and store VMS data. Regarding the transponders' acquisition, the Pacific Islands again opted for the 'user pays' principle to make VMS more cost-effective by delegating costs to the surveillance subjects, i.e. the fishing operators. Recognising that regionalisation and centralisation would, from a technical perspective, give "the system a robustness that would not be achievable under a fragmented system" (Richards, 1999a, p. 2), it was decided that FFA would manage and administer VMS on behalf of its member countries. VMS information was mapped out in the surveillance centre of the agency and became one of its foundational surveillance apparatuses (Field notes, online PIF conference *Our Fish, Our Future*, 23.11.20).

VMS required the development of a networked infrastructure across countries and terrestrial, extra-atmospheric and marine spaces. This complex organisation mitigated the independence and full control of the Pacific Islands over this surveillance system. It introduced intricate interdependencies between actors with varied interests. In particular, if technological innovations lured the Pacific Islands with alternative surveillance possibilities to patrol ships and planes, they too were embedded in, and reflected, geographical disparities in access to technologies. VMS relied on a complicated, yet hardly visible, satellite infrastructure of which the Pacific Islands were not sovereign. For instance, the first selected system drew on the Argos system, "a global satellite-based location and data system for the collection of environmental data" (Richards, 1999a, p. 6), established by the French Space Agency, US space and oceanographic agencies, and the National Space Development Agency of Japan. Argos relied on a network of US satellites and two global processing centres based in Japan and Australia, which would process the satellite data and manage their distribution to users. Because the satellites were not established specifically to support VMS in the South Pacific Region, they did not entirely satisfy the specific needs of the Pacific Islands in that regard. As explained by FFA to its members, it was quite the contrary given that the region was a 'blind spot' of satellite coverage, which considerably curtailed the promises of real-time coverage of fishing vessels at sea:

Argos, being orbital over the polar region, provides the least number of position fixes for vessels located near the equator, where much of the fishing takes place in the Western and Central Pacific. This can result in predictable and sometimes large gaps in coverage – the best promised is 70 minutes between reports and the worst could be several hours. This is a major risk for fisheries compliance applications. (Richards, 1999a, p. 6)

The ambition of the Pacific Islands to implement VMS-based surveillance also encountered political resistance. VMS "was a very hard sale" (Former FFA Director, Australia, 03.06.21). Japan, in particular,

long resisted the FFA VMS.¹⁷³ It complained that FFA VMS was introduced as a “unilateral decision” (Richards, 1999a, p. 10) and advanced legal and technical arguments to counter its implementation, even more so in international waters. Japan used several discursive strategies to hinder VMS deployment to curb (while demonstrating) its multipotency. First, it drew on its experience with its own national VMS programme. It argued that VMS was useful but that its “real value [...] lies in its application to data gathering for sound conservation and management, *rather than enforcement*” (FFA, 1995b, p. 8). VMS could be effective “only if fishermen cooperate and too much emphasis on enforcement is likely to make fishermen uncooperative” (FFA, 1995b, p. 8). Such argument reflects the continuous strategy exposed in Chapter 5 of certain DWFNs to depoliticise surveillance by reducing it to a neutral data-gathering activity serving common interests relating to a common resource in order to refute the sovereign claims of the Pacific Islands on tunas. The Pacific Islands interpreted Japan’s technical arguments as the mere camouflaging of its “determination to extend its high seas flag State rights into the EEZs of FFA member countries” (Richards, 1999a, p. 9). VMS had only become one more locus of expression of the opposition between the DWFNs and the Pacific Islands, which weighed in on its development.

The second half of Japan’s argument on fishers’ cooperation and VMS’s multipotency also invites additional comments on the functioning of the surveillance apparatuses, which are central to the main arguments of this thesis. Although VMS was supposed to contribute to the surveillance of fishers and their self-reporting practices, it still relied on them to function: fishing companies had to pay for the transponders and install them on the fishing vessels. Surveillance could not be imposed in a linear and top-down fashion by coastal states and did require, on the contrary, the careful enrolment of the various components of the surveillance assemblage, including its surveillance subjects: the fishing state governments, fishing companies and the fishers themselves (see Chapter 7).

In that respect, the multipotency of VMS simultaneously permitted *and* introduced tensions in the functioning of the surveillance apparatus (see also Chapter 7). VMS could serve various forms of surveillance to support scientific studies and stock assessments, the definition of management measures, the enforcement of the licensing conditions set out by the Pacific Islands, and the detection of illegal fishing activities. It could also contribute to safety at sea, considering that “many VMS technologies offer a Global Maritime Distress Signalling System capability, which is seen by VMS users worldwide as a major asset in the event of catastrophe” or because it could deliver “timely weather information”, an aspect deemed “attractive to vessel operators in the FFA region” (Marshall, 1995, p. 4; Richards, 1999c, p. 12). It could also “be used by the vessel owners to provide a communications facility *for their own purposes*, concurrent with, *and independent of*, any monitoring by a fisheries authority” (Marshall, 1995, p. 4, my emphasis). VMS could help with commercial considerations, permitting that “vessels can be contacted and directed to target aggregations of fish” (Richards, 1999c, p. 13).

¹⁷³ The US or Korea also manifested their reluctance to the FFA VMS.

Conceiving VMS as a boundary apparatus was favourable, if not essential, to the enrolment and mobilisation of the surveillance subjects and to convince fishing operators to buy the technology. Australia reported from its own national experience that “VMS had demonstrated a high level of acceptance by fishermen, despite initial opposition, *through a combination of commercial, social and maritime safety benefits*” (FFA, 1995c, p. 9). However, as made apparent by Japan’s opposition, it was also precisely that multipotent nature that created tensions around the technology’s deployment and the control of the surveillance apparatus and its data. This became once again evident when Japan offered the Pacific Islands to release the VMS data or at least “that part of it approved for release by the Japan Fisheries Agency” (Richards, 1999a, p. 10) stemming from its own national VMS programme and used to monitor the operations of the Japanese fishing fleets globally. For the Pacific Islands, this proposal constituted an evasion strategy for Japan to circumvent their surveillance by agreeing to a surveillance apparatus while attempting to control it. FFA countries refused, advancing sovereign and technical considerations:

The legal basis for the FFA VMS as a compliance tool in the EEZs of FFA member countries derives from the sovereign rights and enforcement powers of coastal States in their EEZs as granted by UNCLOS. [...] The data collected by the FFA member countries from Japanese fishing vessels operating in their EEZs belongs to the member countries as coastal States. Since the FFA member countries already have use of a cost-effective VMS in their EEZs in the form of the FFA VMS, there appears to be no reason this data should be collected on their behalf by Japan as a flag State, and then have to enter into contractual arrangements with the Japan Fisheries Agency to obtain it. (FFA, 1998b, p. 11)

Although the Pacific Islands did delegate a large part of the surveillance burden to other actors, including DWFNs and their fishing industry, they sought to retain control of the surveillance apparatuses – at least of their associated data, for lack of control of their means of production.

These disputes slowed down the formal adoption of VMS in the region. Eventually, in 1997, FFA members made it mandatory for fishing vessels to obtain a ‘good standing’ status in the Regional Register. Fiji passed its domestic regulation on VMS in 2002 (Manoa, 2008). Non-FFA Pacific Islands also followed, as was the case for New Caledonia, which made VMS compulsory in 2004 (SPC, 2004) and became operational the year after. However, in practice, implementing VMS at the national and regional levels took about a decade to materialise. The full VMS coverage of the fishing fleets operating in the region was only reached in the late 2000s (SPC chief data scientist, Noumea, 21.11.19).

b. The Improvement of Regional Communications and Data Mobilities

Collecting information did not suffice to build up an effective MCS apparatus. The information had to circulate like the fishing vessels did for regional cooperation to be efficient. Concomitantly, FFA devoted much of its efforts to improving information systems and the communications network between the Pacific Islands. This aimed to facilitate inter-state information sharing and establish a regional

surveillance network, articulating national surveillance nodes with one another and to the agency's regional surveillance centre. Information and communication systems were expected to bring "a quantum leap in the management of foreign fishing vessels in the South Pacific" (FFA, 1991c, p. 8) because they would permit access to the data in a more timely manner. This time factor was particularly important for 'coercive' surveillance (cf. Chapter 5) but would also be largely appreciable for stock assessments, considering that "up-to-date data are preferable to the largely historical information currently available to fisheries administrators", FFA argued (Marshall, 1995, p. 4). These technological improvements would also contribute to circulating "secure" information, as fisheries data confidentiality and security were becoming a mounting concern given their role in 'coercive' surveillance.

FFA started developing its Fisheries Management Information System, a multipurpose database for economic analysis, research, surveillance and enforcement (Taufao, 1995). In 1983, the agency bought its first mini-computer hosting the Regional Register and progressively upgraded the system (FFA, 1992e). These efforts were made in articulation with those of SPC to improve the compatibility of their respective information systems (cf. Chapter 5). The resulting "Regional Tuna Meta-Database", also called the "Regional Tuna Fisheries Database" in a later stage, was to be shared but "used for different purposes by the two organisations, in line with the mandates given to them by member countries" (FFA & SPC, 1992, p. 3).

One influential input was the inclusion of "Zones and Mapping Subsystems" that permitted a "greater appreciation by member countries of the value of analysing fisheries data using spatial distributing techniques": "overlaying fishing effort and catch data on maps of island boundaries and exclusive economic zones of member countries has unlimited use for scientists, fisheries managers, surveillance and enforcement personnel" (Taufao, 1994, p. 1). This attested to, but also contributed to, the increasing spatialisation and visualisation of the ocean, marine territories and offshore activities through surveillance techniques. The quotation also confirms once again the multipotency of this surveillance instrument. Inter-island communication was improved by the development of satellite communication technologies and computers (FFA, 1996). Without such an infrastructure, exchanging data and implementing MCS instruments such as the Regional Register were impossible. Public communication services in the region used to be "relatively poor and expensive" (FFA, 1994a, p. 13) and were one cause of miscommunicated data and gaps in the regional databases (Chapman, 2002).

The Pacific Islands first used the American PEACESAT satellite communication system. In 1992, the Australian Ministry of Defence funded the Maritime Surveillance Communication Network programme to link the national surveillance and operation centres of the Pacific Islands to each other and to the FFA regional surveillance centre. This time, the network used the satellite system Inmarsat (for International Maritime Satellite Organisation), a worldwide communication system built for the maritime community in the late 1970s for safety purposes. Once again, fisheries' surveillance

developments involved foreign actors, drew on pre-existing surveillance apparatuses, and contributed to intertwining fisheries with military, maritime security and safety dimensions. The Maritime Surveillance Communications Network permitted the Pacific Island national centres to access FFA Fisheries Management Information System and exchange “voice, data and telex communications” (FFA, 1994a, p. 14). FFA could send each member country the weekly position and catch reports of the US purse seiners (relating to the US Multilateral Treaty) and monthly updates of the Regional Register. Exchanges were horizontal too, e.g. with Fiji reporting to do “its best trying to develop a system to ensure that these neighbouring countries [Vanuatu, Solomon and Tuvalu] also have access to the relevant catch information” (Amoe, 2004, p. 8).

4. The Human Aspects of MCS: Training and Professionalising Surveillance and Enforcement Agents

MCS developments could not be entirely technological. They also relied on human labour. Building MCS necessitated training and capacity-building efforts to professionalise fisheries, surveillance, and enforcement authorities, just like the fishing industry was undergoing professionalisation regarding safety at sea or food quality requirements. The Pacific Islands had only recently constituted their fisheries and maritime surveillance administrations and operational divisions, and their law departments and courts were not well acquainted with fisheries-related cases. SPC fisheries development adviser L. Chapman evidenced, after a field trip to Fiji, the need for “on-the-job training in some fields of surveillance and compliance, including prosecution workshops, evidence collecting, and verification of catch records” to “ensure that officers know how to conduct their surveillance activities accurately, as come of this work may lead to prosecution, with appeals from the defence side” (Chapman, 2002, p. 28). MCS would be useful to deter illegal activities and to retrieve economic revenues from associated offences if they were successfully prosecuted, a consultant reported to FFA:

The fines generated by successful prosecution of illegal fishing activity can represent significant income to some countries. According the FFA [sic], in 1996 there were 25 cases reported involving illegal fishing activity within the FFA member nations. Twelve of these cases have been closed with successful prosecutions and collection of fines. Approximately US\$3.9 million was collected in fines and vessel forfeitures for those cases. (Gillett, 1997a, p. 20)

The training of national administration officers applied to legal, technical and operational aspects of surveillance and enforcement, from operations at sea to data management and to prosecution in court, and was provided by FFA and cooperating countries like Australia, New Zealand or the US. It contributed to harmonise MCS know-hows, procedures and practices across the region. Hence, FFA reported that training permitted “the development of a harmonised model for the management of surveillance operations rooms” and anticipated that they could potentially “become the standard for the larger regional surveillance operations” (FFA, 2005, p. 11). This latter quotation hints at the underlying

strategy of the FFA group to become a standard in MCS matters and influence wider and ulterior developments in fisheries management in the wider Western and Central Pacific region (cf. Section III).

In 1990, its Regional Fisheries Surveillance Programme began offering “surveillance fellowships” for national surveillance officers to spend time in the surveillance facilities of sponsoring countries like Canada or Australia and the FFA regional centre. Some fellowships also sent national officers to visit the surveillance centres of other Pacific Islands. For example, F. Viala, officer of the Fiji Fisheries Division, completed a one-week attachment to the FFA surveillance centre and a one-week attachment to the Vanuatu surveillance centre in 1993. These mobilities and gatherings helped unify practices, create interpersonal connections, and further cement regional cooperation between the various agents. FFA and fisheries, military and legal employees of the US and Australia provided boarding, inspection, information technologies and prosecution courses to the national police, fisheries (including observers and port samplers), navy and justice departments of the Pacific Islands. FFA worked to “provide a common base of knowledge and guidance for Fisheries Officers and Surveillance Officers” (Laxton, 1995, p. 3).¹⁷⁴ Courses comprised theoretical aspects of the legal prerogatives of UNCLOS and the various regional, sub-regional and national regulatory frameworks and practical exercises. These included maritime surveillance exercises at sea or ‘mock trials’ so that officers could learn how to gather and use evidence usable in court and know what to look for “when you open the freezer of the fishing boat” or “when the file lands on your desk” (FFA, 1994b, p. 6). Training encompassed the entire chain of operations, from surveillance to prosecution, to build an effective chain of enforcement, as explained to candidates during a prosecution workshop:

Law enforcement officers will not successfully prosecute the master and crew of a fishing vessel if they are not prepared for the prosecution process. Prosecution is not just the prosecutor presenting his case to the judge. Prosecution is not just the policeman gathering evidence on the position of the vessel. It is not just the case of the marine biologist counting and identifying the number and species of tuna on-board the fishing vessel. *Prosecution is team work.* It is the marine biologist, the police officer and the prosecutor working as a team to produce a well-prepared case for the judge to decide. [...] Ladies and gentlemen, there is a line from a song that says ‘For united we stand, and divided we fall’. It is simple enough what its message is. We have strength as a team and we are weak, as individuals. Each department working separately in mounting a prosecution will inevitably have weaknesses and will fall. [...] It is indeed my sincere hope that one of the outcomes of this workshop is the formulation of a *cooperative working relationship amongst the officials of the various departments involved with fisheries prosecutions* (FFA, 1994b, p. 6, my emphasis)

¹⁷⁴ The manual described surveillance as “the close observation and supervision by a coastal nation to ensure and protect the State’s sovereign rights over its Exclusive Economic Zone” in the aim “to be confident that foreign vessels and FFVs [foreign fishing vessels] within the zone are obeying all treaties or agreements in force” (Laxton, 1995, p. 3). This definition of surveillance attests to its disciplinary and territory-making role. These tools provided very practical and operational information on dockside boarding, or on the retrieval of information from VMS devices.

This allocation eloquently outlines the many people and agencies whose work needed to be assembled, beyond fisheries administrations alone, to ensure the proper control of the fisheries in an integrated fashion. In Fiji, for instance, boarding inspections checked compliance not only with fisheries regulations but also customs, immigration and sanitary laws (Manoa, 2008). This simultaneously slowed, however, the consolidation of such a partnership. SPC reported that “limited coordination and cooperation between national agencies responsible for MCS, including fisheries, police, customs and the defence forces frequently constrain[ed] outcomes within individual countries, (SPC, 2002, p. 26). If regionalisation in fisheries management and coordination between fisheries administrations in the South Pacific region had improved (although it was not a smooth process either), inter-agency cooperation at the national level had its challenges (cf. Chapter 9).

*

The establishment of the Pacific Islands’ jurisdictions over their EEZs and the effective enactment of the latter required lengthy and substantial political, legal and technical efforts to formalise maritime boundaries, establish rules of access and use, and enforce compliance with those rules (see Figure 21). These efforts aimed to order their marine waters and associated fisheries. Given the opposition of the DWFNs, the limited capacities of the Pacific Islands in overseeing their vast and porous marine territories, and the fleeting behaviours of the populations inhabiting these spaces (and including both tunas and – mostly foreign – fishers), the Pacific Islands, devised original strategies to develop their ‘coercive’ surveillance and law enforcement capacities with minimal investments.

The 1980s-1990s saw the proliferation of multilateral arrangements between the Pacific Islands and, to a more limited extent, with partnering DWFNs like the US to regulate fishing activities and improve surveillance capacities. Fisheries regulation mainly sought to manage the tuna resource and its exploitation. However, additional labour and safety dimensions of fisheries as a maritime activity also progressively emerged. The proliferation of agreements, addressing multiple dimensions at once and erecting various multilateral and bilateral alliances, attests to the ‘messiness’ of the process. These convolutions stemmed from their partial co-production with external actors like the DWFNs and tensions between the Pacific Islands in establishing multilateral cooperation without surrendering their sovereignty. The process resulted in pursuing regionalism rather than a fully integrative regionalisation of fisheries management to consolidate rather than merge the EEZs and the Pacific Islands’ sovereign rights over their waters and tuna resources. This simultaneously weakened the reach of their arrangements, with cooperation and coordination in the regulatory and technical realms being conditioned to individual states’ willingness to implement them.

These agreements addressed three main aspects of territory-making: ruling, enforcement and, in support of these two dimensions, surveillance. Improving the capacity to collect fisheries information was at the core of many of these arrangements to support ‘regulatory’ and ‘coercive’ objectives. One

strategy was to alleviate the burden of surveillance by delegating it to surveillance subjects to surveil at a distance. Fishers had to report on their activities; fishing industries had to cover the costs of fisheries observer programmes; and DWFNs had to assist with compliance controls under the ‘flag state responsibility’ concept. Another strategy consisted of pooling and sharing limited surveillance resources at the regional level under FFA’s supervision and with the support of external military powers to consolidate the Pacific Islands’ control over their national waters and tuna fisheries. Cooperation in surveillance also led to sharing surveillance and enforcement capacities between the Pacific Islands, making offshore surveillance resolutely ‘more-than-sovereign’.

These arrangements contributed to harmonising the Pacific Islands’ EEZs and producing regional “pragmatic spaces” (Bueger, 2020b) of coordinated management and surveillance practices. In some cases, maritime boundaries were made more porous to facilitate the mobility of certain fishing vessels across the Pacific Islands’s EEZs – as was the case with the US Multilateral Treaty or for the PNA group, which provided licenses granting access to several EEZs at once. However, these boundaries were very much preserved to redistribute access fees accordingly. In those respects, the cooperation and coordination of the Pacific Islands did not result in the production of a larger territory but rather in the (fragile) assemblage of their state territories for limited and practical purposes – hence the notion of ‘pragmatic space’.

To consolidate the EEZs, the Pacific Islands projected their regulatory and policing powers into the high seas to follow fishing vessels beyond their national jurisdictions. Such projection was limited to foreign fishing vessels licensed to their waters, but it contributed to augment both the regulating and surveillance reach of the Pacific Islands. The mobility of tuna and their fishers “blur[red] the territorial insides and the outsides of sovereign power”, making sovereignty more-than-territorial (Havice, 2018, p. 1292). These developments provided original and complex articulations between the Pacific Islands states and their marine territory, in reaction to the reticular organisation of tuna fisheries, which required ‘reinventing’ traditional conceptions of territory. These findings help think of sovereignty and territory as negotiated and dynamic processes constantly (re)defined by multiple actors, including the tuna fish, and resulting in specific and somewhat fragile compromises (Havice, 2018; Le Meur & Mawyer, 2022).

Although praiseworthy, the Pacific Islands’ efforts remained too narrow to be fully efficient. IUU fishing continued to soar and threaten the Pacific Islands’ fisheries management efforts, as stated by a Pacific Island delegate at the Ninth Regional Fisheries Surveillance Officers Meeting in 1996:

Although we are perhaps somewhat boastful of our accomplishments, we are also cognisant of our shortcomings. Surface surveillance is managed by only two patrol boats. Increased fishing in our region and more and more transshipment from our ports tax already limited resources. [...] Even with the help of the NMFS [National Marine Fisheries Service of the US], the US Coast Guard, and FFA we realise that we are only catching a few of the actual violators. Under reporting, falsifying catch data and

general non-compliance with record keeping requirements appears epidemic. (FFA, 1996 cited in Aqorau, 2000, p. 63)

The EEZ and the South Pacific region, which were understood as (area-based) government technologies, did not suffice to harness tunas and tuna fishers. They only provided a 'holed' and patchy coverage of marine spaces that could not cover the broader, hypermobile and reticular organisation of (more-than-human) populations. These findings led to the resumption of governance and management negotiations with the DWFNs, reworked by new contextual elements described in the following section.

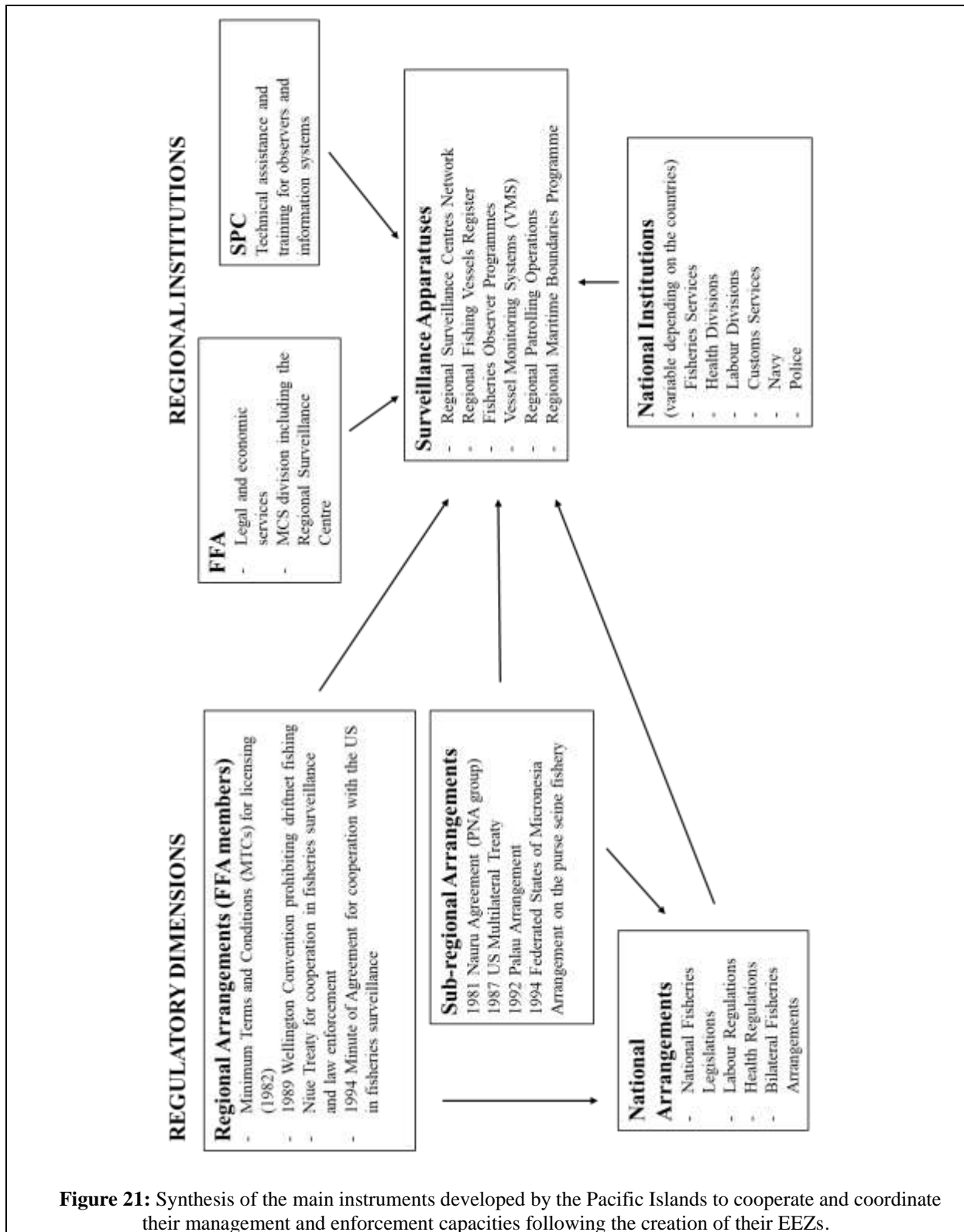


Figure 21: Synthesis of the main instruments developed by the Pacific Islands to cooperate and coordinate their management and enforcement capacities following the creation of their EEZs.

III. Beyond the State and Beyond Tuna: The 'Ecologisation' of Offshore Territory

The cooperative endeavours of the Pacific Islands greatly enhanced their grip on their EEZ and tuna resources. However, the territorialisation of tuna resources remained only partly successful as the fish and their fishers would continue to move in and out of their joint EEZs and into the high seas. In addition, through the 1990s, environmental issues renewed the conceptualisation of offshore spaces from spaces filled with natural resources to spaces inhabited by ecosystems and marine biodiversity. Such a reinterpretation of the ocean reoriented offshore territorial practices in two parallel and partially colliding ways. On the one hand, the 'ecologisation' of fisheries management and the high seas issue led to renegotiating tuna fisheries management and adopting a new governance and management framework. This resulted in the creation of a regional fisheries management organisation involving both the Pacific Islands and the DWFNs and responsible for managing tuna fisheries across the entire range of tunas' habitat – i.e. across a much wider zone than the EEZ. On the other hand, ecosystem considerations fostered the rise of new territorial endeavours to reserve offshore spaces for more-than-human marine populations by creating Marine Protected Areas (MPAs). In both cases, the notion of territory and its relation to the state was reworked against the frictions these processes entailed. If it intensifies the striation of the EEZs and the high seas, the 'ecologisation' of offshore territorialisation raises, again, practical challenges to surveilling and implementing these new territorial constructs.

1. The 'Ecologisation' of International Ocean and Fisheries Management Arrangements

Ulterior developments regarding the South Pacific tuna fisheries require moving back to global arenas where novel instruments were devised following the entry into force of UNCLOS in 1994. As I have said, UNCLOS did not provide clear legal solutions to the contentious issue of tuna fisheries management and the role of DWFNs in their governance. Despite introducing fisheries management measures, coastal states like the Pacific Islands voiced their worries concerning high-sea fishing activities, which they viewed as diminishing the effectiveness of their conservation and management efforts and as a loss to their domestic economy. International negotiations resumed to focus specifically on managing straddling and highly migratory fish species and the high seas. Hence, in the previous era had largely dealt with the EEZ spaces, the 1990s marked the advent of a 'high-seas era'.

In parallel, environmental considerations were evolving, too. Climate change and biodiversity conservation established new environmental agendas compared to stock conservation and maritime pollution issues, which had underlaid UNCLOS negotiations. These concerns would reach the fisheries sector and contribute to its 'ecologisation' while also inducing wider transformations in ocean management by calling for more integrated management approaches. At stake was not only the

conservation of fish resources but the conservation of marine biodiversity in general and associated *ecosystems*. Marine spaces were not framed as resource spaces only but as lively, relational and multi-specific environments to be protected in their own right.

Following the seminal 1992 Convention on Biological Diversity, Agenda 21 set out a non-binding action plan to achieve sustainable development and protect the oceans. It promoted “multi-species management and other approaches that take into account the relationships among species” (Agenda 21, §17.45).¹⁷⁵ On the one hand, these considerations accentuated the focus on fish stock conservation and overfishing. Hence, Agenda 21 pointed out the “inadequate” management of high seas fisheries caused by “problems of unregulated fishing, overcapitalisation, excessive fleet size, vessel reflagging to escape controls, insufficiently selective gear, unreliable databases and lack of sufficient cooperation between states” (§17.45). On the other hand, biodiversity conservation and ecosystem considerations led to a new paradigm for fisheries science and management: the ‘ecosystem approach to fisheries’, formalised in 2003 by FAO as “a practical way to implement sustainable development principle”.¹⁷⁶ This new approach incorporated reflections from the 1972 United Nations Conference on the Human Environment and the 1992 Earth Summit¹⁷⁷ and recognised the “systemic nature of fisheries” by reframing them as a “complex system” rather than “a simple interaction between a stock, a fleet and a market” (Grafton et al., 2010, p. 89).

i. The United Nations Fish Stocks Agreement

Following Agenda 21, a series of multilateral negotiations spanned from 1993 to 1995 to address transboundary fish stock management in a context of revived inter-state tensions, with some coastal states threatening once again to unilaterally extend their jurisdiction to compensate for the lack of appropriate fisheries management mechanism (Bjørndal & Munro, 2003). Territorial disputes over the offshore fish resources were looming once again. FFA countries were deeply involved in those meetings, hoping they would help order the high seas (Tarte, 2009). These eventuated in adopting the 1995 UN Fish Stock Agreement (UNFSA), which constituted a landmark in implementing UNCLOS by formulating a global and binding framework for the management of tuna fisheries. It instituted the creation of international fisheries management regimes and inserted new limits to the ‘freedom of fishing’ ruling the high seas.

¹⁷⁵ <https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf> (accessed: 09.09.24). The Pacific Islands adopted in 2001 a Regional Ocean Policy consistent with Agenda 21 to build an integrated approach to ocean management.

¹⁷⁶ <https://www.fao.org/fishery/en/eaf-net/about/what-is-eaf> (accessed: 19.03.2024). There are various definitions for these concepts, but the main idea of promoting more holistic forms of management remains consistent through their diversity.

¹⁷⁷ Formally called the United Nations Conference on Environment and Development, the Earth Summit, interested in sustainable development, paved the way to the binding Framework Convention on Climate Change and the Convention on Biological Diversity and to Agenda 21. One main input from the Summit was to formulate the need for integrating and balancing economic, social and environmental dimensions.

The UNFSA clarified cooperation prerogatives between fishing and coastal states by imposing that “only those States which are members of such an organisation [a regional or subregional international fisheries management organisation] [...] shall have access to the fishery resources” (Art. 8-4).¹⁷⁸ It incorporated the precautionary approach¹⁷⁹ derived from the Earth Summit by requiring the setting of science-based ‘target reference points’ and ‘limit reference points’ to guide management objectives.¹⁸⁰ The UNFSA also inserted a ‘principle of compatibility’ to harmonise fisheries management through the oceanic basins: management measures relating to the high seas and the EEZs should be compatible and adopt identical or similar standards. This principle addressed that states’ marine territories, as defined under UNCLOS, mismatched fish mobilities and that there was a need to better account for fish’s utilisation of marine spaces. However, like UNCLOS, the UNFSA remained fairly evasive about how such compatibility should be implemented and which management standard, of the high seas or the EEZs, should prevail over the other (Aqorau & Bergin, 1998).

The agreement also brought new MCS requirements, “radically depart[ing] from the traditional approaches to enforcement”, according to FFA (Aqorau, 2001a, p. 6). Recognising that reliance on flag state control did not suffice to enforce conservation and management measures effectively, it redefined the jurisdictional competencies of states regarding enforcement on the high seas, making it a *shared* responsibility between flag, port and coastal states. In that respect, the UNFSA provided new procedures permitting non-flag states to board, inspect and arrest fishing vessels on the high seas, providing that they are members of regional fisheries management organisations (Lodge, 1993).

ii. The FAO Code of Conduct for Responsible Fisheries

Additional international arrangements complemented the UNFSA to address more specific fisheries management issues and formalise, in particular, the IUU fishing issue. FAO took the lead on that topic with the FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas. To curb the growing use of ‘flag of convenience’ strategies¹⁸¹ by fishing industry members, the agreement re-emphasised flag state control and the need for extending surveillance efforts on the high seas.

¹⁷⁸ https://www.un.org/oceancapacity/sites/www.un.org.oceancapacity/files/files/Projects/UNFSA/docs/unfsa_text-eng.pdf (accessed: 09.09.24)

¹⁷⁹ Contrary to the strategy developed by the US (cf. Chapter 5 and Finley, 2011), the “absence of scientific certainty” could no longer be used as “a reason for failing to take conservation and management measures”. With UNFSA, the burden of proof no longer stood on the shoulders of those wishing to introduce conservation measures, but on those wishing to increase fisheries exploitation (Preston, 1997).

¹⁸⁰ The target reference point defines biomass and fishing pressure levels that would allow for optimal harvest – in connection to the traditional concept of the maximum sustainable yield. The limit reference point concept, however, emphasises conservation imperatives by defining a threshold beyond which the state of the fishery and/or the resource is undesirable and should be avoided.

¹⁸¹ Such strategy refers to the practice for a fishing vessel to register in another country and fly its flag. Commonly, the flag country would be selected because it is less stringent in fisheries management and enforcement.

The 1995 FAO Code of Conduct for Responsible Fisheries was more influential. It set voluntary ‘sustainable’ and ‘responsible’ fisheries management principles and developed International Plans of Action (IPOA). These instruments formalised IUU fishing as a major international problem requiring MCS developments and innovations (Christensen, 2016). The concept of IUU fishing derived from the Earth Summit and was first coined as a legal and political concept in 1997 by the Commission for the Conservation of Antarctic Marine Living Resources. It was formally described and popularised in the FAO International Plan of Action to Prevent, Deter, and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU) in 2001.¹⁸² The problematisation of IUU fishing did not unveil any new phenomenon *per se*, but it permitted to encompass the span of threats weighing on fish stocks, marine ecosystems, ‘legitimate’ fishers and coastal state sovereignty (Matuzals & al in Grafton & al 2010) – a framing that has also raised numerous criticisms, questioning the detrimental effect of IUU discourses and regulations on non-industrial, small-scale fisheries in particular (e.g. Song et al., 2020). The concept also contributed to upscaling the problem globally: IUU fishing was no longer considered a threat to individual states. Instead, it was framed as a complex and globalised issue, calling for integrated and galvanised international cooperation and efforts (Baird, 2021).

The problematisation of IUU fishing as a global issue led to thinking about fisheries management globally and establishing new connections between actors and places. One innovation from this re-problematisation was reorganising states’ roles in fisheries and associated supply chains. The FAO Code of Conduct and its plans of action emphasised the role of flag states, coastal states *and* port states in enforcement, and warranted that port countries inspect foreign fishing vessels when they enter their ports. The role of port states intensified in the following decades, leading to the binding 2009 Agreement on Port State Measures. This would carry important consequences for countries like Fiji, which harbours one of the most important ports in the South Pacific region and welcomes many fishing vessels transshipping or offloading their catches. As a port state, the country started collecting “unloading data from non-licensed vessels discharging their catches” in its ports in the early 2000s (OFP, 2003).

Market states, too, were vested with increased responsibilities to combat IUU fishing. As I mentioned, the US and the EU had already influenced fisheries management at a distance for food safety reasons (cf. Section I.1.viii.b). This time, market states would do so to fight IUU fishing. The IPOA-IUU encouraged states to develop MCS procedures throughout the entire fish supply chains, from fishing to the final destination – thereby extending surveillance and enforcement considerations far beyond the EEZ waters and up to consumer markets. This strategy led to new management instruments

¹⁸² According to the IPOA-IUU, illegal fishing refers to fishing activities occurring in a state’s territorial waters without its permission or in contravention of its laws, and to fishing on the high seas by a state-flagged vessel in contravention of laws and obligations agreed to between two or more states through a Regional Fisheries Management Organisation (RFMO). Unreported fishing refers to the non-reporting or misreporting of catches in contravention to national or regional regulations and procedures. Unregulated fishing covers fishing activities by vessels without nationality or by state-flagged vessels in waters where the state is not party to an RFMO, and fishing in waters where no management measures exist and which is inconsistent with international responsibilities to conserve fish stocks (Christensen, 2016).

such as trade or catch documentation schemes or labelling schemes (cf. Chapter 7). Not only (consumer) state actors would gain a growing influence on fisheries, but consumer individuals themselves – especially in the European and American markets. Those were becoming a driving force of surveillance imperatives, calling along with environmental NGOs for more transparency in the food chain production and in the fishery sector (Potts & Haward, 2007). This new phenomenon, paired with the emergence of (chiefly private and eco-)labelling instruments, subjected fish production to greater scrutiny from non-governmental actors as well. After the Earth Summit recognised the value of labelling schemes, the creation of the Marine Stewardship Council (MSC) label in 1996 represented an (eminently criticised) milestone in the development of eco-labelling for environmental protection (Potts & Haward, 2007, see also Ponte, 2008). The MSC label was a non-governmental endeavour resulting from the association of the World Wide Fund for Nature (WWF) and Unilever, one of the largest consumer product conglomerates, after the collapse of the Atlantic northwest cod fishery in 1992.

Hence, the progressive 'ecologisation' of fisheries management agendas and the incorporation of biodiversity conservation concerns reframed the conceptualisation of fisheries management *beyond* individual states. Increasingly, fisheries management were problematised as a global issue, involving multiple governmental and non-governmental actors and calling for more integrated approaches to address their reticular organisation and overcome the 'territorial trap'.

2. A New Management Regime for the Tuna Fisheries of the Western and Central Pacific Ocean

i. Resuming Multilateral Negotiations to Institutionalise Coastal and Fishing States' Cooperation

The adoption of the binding UNFSA and the wider global transformations I just mentioned reignited the ancient debate between the Pacific Islands and the DWFNs on the need to cooperate to manage the tuna stocks in the South Pacific region. The resuming of these discussions, crisscrossed by enduring disputes since the 1970s, eventually resulted in a new governing and territorial construct for tuna fisheries management. They led to the establishment of a Regional Fisheries Management Organisation (RFMO) with authority to manage offshore fisheries in the region, producing a new "functional territory" (Lambach, 2021) focused on offshore fisheries and encompassing half of the Pacific Ocean, including the high seas. Such a territory would cover offshore spaces more exhaustively than the assemblage of the Pacific Islands' EEZs. However, this territorial construct was not be under an individual state's authority but under that of an inter-governmental organisation.

The UNFSA required states to cooperate to conserve straddling and highly migratory fish stocks *throughout their entire migratory range* and make fisheries management in the EEZs and the high seas compatible. This time, the spatial management of tuna stocks had to abide by biological considerations.

This implied a scalar shift: tuna fisheries management had to encompass the wider Western and Central Pacific Ocean (WCPO) and span EEZs and high seas rather than the South Pacific Islands' EEZs alone. Governance, too, had to change as it had to include all states with a “real interest in the fisheries” (UNFSA, Art.8-3), i.e. both fishing and coastal states.

If the UNFSA certainly was the stepping stone to the resumption of the negotiations between the Pacific Islands and the DWFNs on creating an RFMO, additional elements also contributed to shifting the Pacific Islands' stance on involving the DWFNs in tuna fisheries management. Despite their longstanding ambition to affirm their sovereign rights on their EEZs and tuna resources and their great progress in improving their management capacities, they concluded that their approach had remained too limited. In 1994, an FFA review exposed that the Pacific Islands' management and institutional arrangements “did not meet the new international standards” (Aqorau, 2001b, p. 12). The arrangements were not sufficiently “integrated” and could not curb overexploitation risks precisely because of governance issues and limited membership (Aqorau, 2001b, p. 11). The exclusion of DWFNs from management institutions prevented the Pacific Islands from regulating and constraining their fishing effort comprehensively: “The health of the tuna stocks was due to the robust nature of the resource, and not attributable to the measures put in place by the Pacific Island States” (Aqorau, 2001b, p. 11). These limits made it necessary to re-think the inclusion of the DWFNs and think beyond the EEZs to secure the latter and tuna resources, which was still the main drive of the Pacific Islands (Tarte, 1999). This time, however, they were more confident in their bargaining power against the DWFNs. Even though their regionalist strategies did not suffice, they strengthened their influence. They fathomed that they could negotiate a profitable agreement and influence the management of the high seas by expanding the management standards they had collaboratively developed for their EEZs and the South Pacific region:

Discussions [...] suggest that FFA member countries have a very good chance of extending many current in-zone arrangements to the high seas. It is in the best interests of FFA member countries that this situation be maintained during future [...] negotiations, so that any new MCS mechanisms which are developed under the proposed regional arrangement build on the current strong compliance environment in place in the EEZs of FFA member countries. (FFA, 1998a, p. 5)

With these considerations in mind and fearing that the DWFNs might otherwise initiate – and lead – the creation of the RFMO required by UNFSA (Tarte, 2001), the Pacific Islands Forum members called for a multilateral conference gathering fishing and coastal states to devise the co-governing not only of offshore resources but of the more general ‘ocean’:

This conference is important also because we are meeting barely a fortnight after the entry into force of the 1982 United Nations Convention on the Law of the Sea – an event of prime importance, as it will move the international community to a new, enhanced level of *collective commitment to establish order in the oceans*. A central element in this new order is the protection and preservation of the world's oceans and the sustainable use of marine resources. (FFA, 1995c, p. i, my emphasis)

Discussions started in 1994, with the first Multilateral High-Level Conference bringing together, and for the first time since the early 1980s, the Pacific Islands and the DWFNs (SPC & FFA, 1996).¹⁸³ After a lengthy series of meetings, well detailed by legal scientist S. Tarte (Tarte, 1999, 2001, 2009), the negotiations resulted in the adoption of the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean ('WCPF Convention') in 2000. This Convention was the first in the world to incorporate and implement the UNFSA, therefore turning the WCPO into a 'laboratory' for this new international fisheries regime (Tarte, 1999).

The Convention included the precautionary approach and the compatibility principle of the UNFSA and the ecosystem approach preconised by FAO (cf. Section III.1). It provided for "much higher controls on High Seas fishing than other regional treaties" and stated for the first time "clear obligations to achieve protection of biodiversity" (Aqorau, 2003, p. 104). Biodiversity protection, along with waste and pollution-related provisions or the consideration of artisanal and subsistence fishers' interests, set the foundations of a more holistic approach to fisheries management (Opnai et al., 2002). It also acknowledged that "smaller island developing States have unique needs"¹⁸⁴ requiring special financial, scientific and technological assistance, thereby granting the Pacific Islands some of the advantages they had fought for (Opnai et al., 2002).

The convention led to the establishment of a regional commission tasked with establishing "compatible conservation and management measures" (WCPF Convention, Art. 9). In particular, the Western and Central Pacific Fisheries Commission (WCPFC) would have to determine "the total allowable catch or total level of fishing effort" and develop criteria for its allocation (WCPF Convention, Art. 10): for the first time, there would be restrictions on fishing efforts in the region (Aqorau, 2001a, p. 12). In that aim, the Commission could adopt, *upon consensus* of its members, various measures regulating the quantity and size of catch, the level of fishing effort and capacity (e.g. number of vessels, types and sizes), or fishing areas and periods. The Commission would also be important in monitoring fisheries, scientific research, and MCS. It was vested with setting standards for collecting and exchanging fisheries data, supervising scientific research and establishing MCS and enforcement mechanisms. MCS measures would serve the three main prerogatives of enforcing conservation and management measures, stopping IUU fishing and controlling and improving fisheries information – i.e. prerogatives relating to the enforcement of rules, the sanctioning of deviant behaviours, and the 'meta-surveillance' of monitoring activities. To assist the governing Commission with these prerogatives, the Convention established two subsidiary bodies, including a Scientific Committee and a Technical and

¹⁸³ The conference involved the Pacific Islands, including Australia and New Zealand, along with the DWFNs operating in the region: the US, Japan, Korea, Taiwan, China and Philippines.

¹⁸⁴ WCPF Convention, p.1 : <https://www.wcpfc.int/doc/convention-conservation-and-management-highly-migratory-fish-stocks-western-and-central-pacific> (accessed: 10.09.24)

Compliance Committee, involving representatives of each member of the Commission.¹⁸⁵ These subsidiary bodies once again institutionalised the demarcation and articulation between the spheres of science, governing and policing.

Adopting the convention and creating the commission established a new and wider (incorporating high-sea waters, in particular) “functional territory” (Lambach, 2021) over the WCPO, devoted to fisheries management and granting the commission an overarching legal authority over nation-states. Hence, the WCPFC’s conservation and management measures would be binding for member states. Surveillance was instrumental for WCPFC to control tuna fisheries in the WCPO. The commission levelled up much of the pre-existing mechanisms to surveil tuna fisheries. Member countries must provide fisheries information to WCPFC so that this new ruling entity can compile catch and effort statistics, assess fish stocks, and control the proper implementation of management measures. The Commission became the new legally binding standard-setter and central repository of fisheries data collection. This inter-governmental actor, contrary to the Pacific Islands’ hurdle, could obtain information covering the entire WCPO and fishing activities of its members, including coastal and fishing countries, jurisdictional waters and the high seas.

The Commission harmonised regional management and established a “homogenous enforcement and surveillance regime” (Aqorau, 2000, p. 62). It retained a strong responsibility for flag states (while also mentioning the role of port states in inspection and transshipment) given the “lack of resources available to coastal States for MCS activity” (FFA, 1998a, p. 6). To address the flag state responsibility principle’s limits, the Convention permitted that, under certain conditions, a coastal state could board and inspect a fishing vessel if it were believed to have illegally fished in its waters. For the first time, Pacific Island representatives could board and inspect a foreign fishing vessel on the high seas. The WCPFC also scaled up some of the Pacific Islands’ MCS instruments such as a fishing vessel register, VMS requirements or a Regional Fisheries Observer Programme.

ii. Frictional Negotiations: The Western and Central Pacific Fisheries Commission as a Compromise Between Coastal and Fishing Nations

However, the path to the creation of the WCPFC was lengthy and tortuous. Negotiations between the Pacific Islands and the DWFNs spanned from 1994 to 2000 to agree on the convention. It took another three years of discussions and seven additional Preparatory Conferences to set up the commission. Because of these “frictions” (Tsing, 2011), the UNFSA could not merely be transposed to

¹⁸⁵ These subsidiary bodies existed alongside a Secretariat, a Finance and Administration Committee and another subsidiary body called the “Northern Committee”, which was established to make conservation and management recommendations on fish stocks inhabiting the northern part of the WCPO (see below).

the WCPO but was transformed against the region's specificities, granting the WCPFC outstanding features in comparison to other tuna-related RFMOs and producing a specific territorial form.

If the dialogue between the Pacific Islands and the DWFNs had resumed, it remained highly acrimonious and riddled with persistent disagreements on fisheries governance and EEZ status. These contentions suffused almost every step and item of the negotiation process (e.g. on funding mechanisms, decision-making procedures, membership, etc.). Various scholars have recounted these debates in detail (e.g. Tarte, 1999, 2009; Henriksen et al., 2005). Therefore, I shall only cover those relating to my interest in the territorialisation and surveillance of offshore spaces and tuna fisheries.

The FFA group maintained its collective approach to weigh in on the negotiations more effectively. Another sign of the empowerment of the Pacific Islands against the DWFNs is made evident in the fact that negotiations were chaired by Fijian ambassador S. Nandan, who had also played a role in UNCLOS and UNFSA negotiations and been appointed Head of the International Seabed Authority. Nevertheless, DWFNs' resistance capacity, particularly Japan's, was still high. For instance, when the first Convention draft was discussed, Japan announced that it would financially support the Pacific Islands' delegations with which it had fishing agreements for them to attend the conference. The mere possibility of attending the negotiations was unequal, as many Pacific Islands had to rely on donations from Australia and New Zealand. Multilateralism was precarious (Tarte, 1999). Wary of being rushed into a cooperative arrangement with the DWFNs that would imperil their sovereign rights over their EEZs and the tuna resources and waiting to see the conclusions of the UNFSA negotiations (that unfolded in parallel), the Pacific Islands attempted to limit the discussions to 'technical' aspects. Hence, the first round of negotiations focused on 'science and compliance' rather than 'broader management' aspects to improve the collection and dissemination of fisheries data. However, Japan, which had always been eager to see the creation of an RFMO of which it would be a member, immediately argued that such issues could only be solved with a formal arrangement and hastened the negotiation process. This resulted in a halftone compromise, with many participants criticising the resulting Convention and several important matters left to be solved by the Commission once it became operational (Henriksen et al., 2005).

Several points were particularly contentious. First and foremost was the ambiguous 'principle of compatibility' of the UNFSA and the controversy on whether the Commission should set the pace for managing the Pacific Islands' EEZs or if, conversely, EEZ management should influence high-sea management. This provided an obvious anchor to the sustained opposition between the Pacific Islands' interest in preserving their sovereign authority and the DWFNs' attempt to gain authority on the entire oceanic region and its tuna stocks, regardless of the EEZ boundaries. At stake, once again, was the exact status of the EEZs, the understanding of the ocean as a mosaic of EEZ and high-sea patches or as a 'smoother' and integrated management area, and the exact articulation of the RFMO with national powers. The issue could not be resolved throughout the negotiations. The resulting convention remained

evasive regarding the extent of the Commission's authority in EEZ waters and which measure, from the Commission or a coastal state, should take precedence in case of conflict: the two types of territory would coexist and overlap along fuzzy jurisdictional boundaries. This problem was rapidly embodied in the subjacent issue of allocating fishing rights between the Commission's members. The Pacific Islands argued for safeguarding their sovereign rights to set and distribute their total allowable catch *within their respective EEZ*, leaving the Commission in charge of distributing fishing rights only on the high seas. On the contrary, the DWFNs advocated for the TAC to be allocated by the Commission alone, without differentiating the high seas from the EEZs. Again, the conclusion to this debate was left open for ulterior discussions (Henriksen et al., 2005).

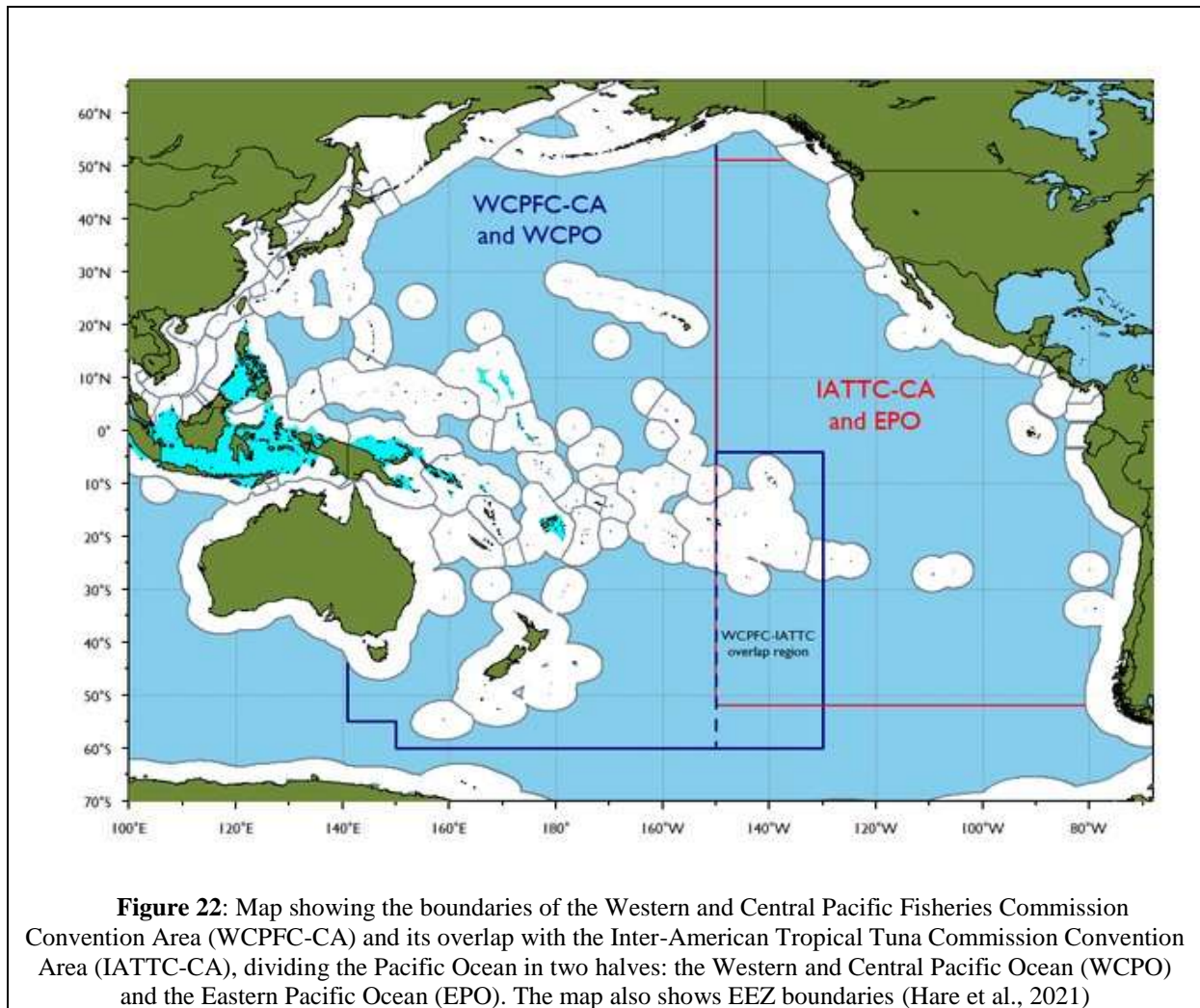
Other sensitive subjects demonstrate the negotiated and tortuous construction of WCPFC's functional territory. Defining the new boundaries of the Convention Area was a stormy topic. The FFA group advocated for a Convention Area covering the distribution of the four main tuna species. It also favoured an area that limited membership and remained centred on the WCPO without expanding eastward too much. Finally, it wished for an area that would not meddle with territorial disputes between Japan and Russia or Taiwan/Chinese Taipei and China – whose waters inopportunately sheltered spawning and nursing grounds and therefore constituted pivotal places for managing tuna stocks (Hu, 2014). Australia, New Zealand, and the US argued for an open zone that could accommodate the distribution of other fish species if needed. Japan lobbied to have the northern Pacific waters under a separate regime, and eventually succeeded in creating a sub-area overseen by a 'Northern Committee' with restricted membership. It also pleaded to have its EEZ excluded from the Convention Area, like Indonesia and Papua New Guinea, which wished to exclude their archipelagic waters from WCPFC's territory. Hence, although WCPFC was initiated to permit the sustainable management of the straddling and migratory fish stocks throughout their entire range – i.e. to take into account the boundaries drawn by fish and their mobilities – “in the main, the debate revolved around political issues (such as the inclusion of waters around Taiwan), legal issues (such as the inclusion of archipelagic waters), and the relationship of the Convention Area with adjacent management organisations, particularly the IATTC”, a SPC scientist observed while he was attending the negotiations (Hampton, 1999, p. 2).

The Convention Area emanating from the negotiations compromised between these biological and political dimensions. This new territorial construct eventuated in a gigantic area (see Figure 22), covering almost 20% of the Earth's surface¹⁸⁶, overlapping another RFMO's territory – and whose geographical characteristics only prolonged the relatively “abstract and placeless” understanding of marine spaces that predominate in the global state regime of the ocean (Bush & Mol, 2015, p. 27). The WCPO managed by the Commission remained a “flat, placeless, and mathematical, spatially equivalent across its extent” space, defined by “coordinates of longitude and latitude and ranges of depth”

¹⁸⁶ <https://www.wcpfc.int/frequently-asked-questions-and-brochures> (accessed: 21.02.24)

(Cardwell & Thornton, 2015, p. 161). Unresolved controversies left the western and northern boundaries of the Convention Area undetermined. As a result, WCPFC's territory only partially accommodated tunas' habitat. SPC fishery scientists found that the area did not incorporate important places for bigeye, skipjack and yellowfin tunas, which would "pose significant problems for the Commission" in effectively managing these fish stocks (SCTB, 1999, p. 69). This would become especially important for bigeye tuna, with growing scientific evidence of a Pacific-wide stock, therefore requiring careful cooperation and articulation with the Inter-American Tropical Tuna Commission (IATTC), the neighbouring and overlapping RFMO (cf. Chapter 8).

Debates on creating the WCPFC also pertained to the legal definition of what could constitute a 'fishing entity' and the membership conditions – i.e. defining the territory's 'population'. For instance, debates touched upon the status of carrier vessels (used for transshipment) as 'fishing entities' and the authority of the commission over those. The convention also had to find legal strategies to incorporate all relevant stakeholders without prejudice to their legal and political status. Discussions pertained to non-independent Pacific Islands vested with vast EEZs but without sovereign authority (e.g. New Caledonia) and disputed territories like Taiwan with a prominent fishing fleet. Geopolitics, the complexification of fisheries organisation and the continuous emergence of actors other than nation-states raised new governance questions. These were resolved by demarcating different membership categories between member states, cooperating non-members, (non-sovereign) 'participatory territories' and 'observers', which included intergovernmental or non-governmental organisations.



The creation of the Commission’s subsidiary bodies to assist with scientific research and MCS raised anew the thorny status of pre-existing regional organisations – SPC and FFA in particular. Some DWFNs continued to criticise FFA for being a regional fisheries management organisation. On the other hand, FFA member countries asserted that they would retain the agency because it provided “key services” otherwise not addressed by WCPFC (SPC, 2002, p. 36). A Memorandum of Understanding was eventually signed between FFA and WCPFC to coordinate their activities. In 2008, FFA was also designated as the commission’s VMS service provider. The WCPFC would not erase the Pacific Islands’ regional system but would rather superimpose it.

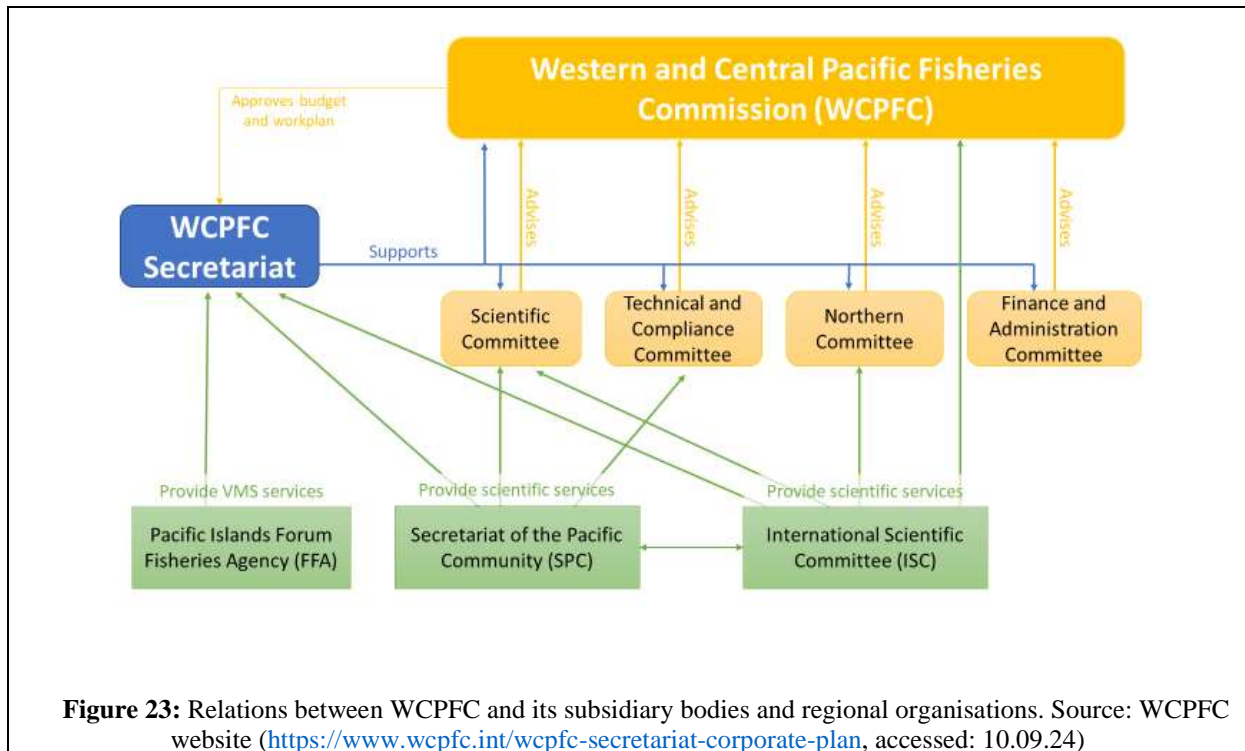
Regarding scientific research, Japan wished for an equal participation of WCPFC members in supervising scientific efforts to ensure that it could have a say in defining research and ‘scientific’ surveillance strategies - a position attesting to the highly political dimension of this “regulatory science” (Jasanoff, 1995; see also Chapter 8). On the contrary, FFA countries wished to see the Oceanic Fisheries Programme of SPC continue to form the core of scientific advice and services to the commission given its “well-established research programmes and associated core of expertise” (SPC, 2002, p. 36).

Ultimately, SPC was confirmed as the commission's Science Services Provider and Data Manager, along with the International Scientific Committee that would deal with the separate northern tuna stocks. SPC became responsible for conducting stock assessments for the Commission *under the supervision* of the WCPFC Scientific Committee, which would involve every member country. Hence, DWFNs could also have a say on SPC's scientific research conducted for the commission. As WCPFC's scientific provider, SPC obtained improved access to fisheries data from both coastal and fishing nations and over both the EEZs and the high seas. However, because SPC also retained its support function to the Pacific Islands, it induced an internal (and sometimes challenging) split for the organisation. SPC was put in a boundary position between its double-binding duties to the WCPFC and the Pacific Islands:

[WCPFC] has made our work a lot more interesting purely because we've got a lot more data than before so we could conduct the stock assessments, etc. [...] It's provided a lot more work for us; we're not just serving our members but also the others. [...] It's a bit of a challenge sometimes, because our mandate before that was to serve member countries, and now we have this other thing to serve the Commission as well and try and do the same. [...] That divides our work internally. What we deal with is data: we're able to partition data that's used for WCPFC from data used for country work. Although it's all the same database, but with different rules for access. (SPC chief data scientist, 22.11.19, Noumea)

The resulting RFMO and its complex organisation (see Figure 23) did not satisfy many of the participants in the negotiations. Countries like Korea and Japan (frustrated by the geographic span and limited autonomy of the Northern Committee and by the convention's references to the UNFSA, which it had not ratified) voted against it. China, France and Tonga abstained. The FFA group regretted the many concessions made to reach a consensus. Despite these many reservations, WCPFC saw the day of light in 2004,¹⁸⁷ with headquarters in the Federated States of Micronesia. Since its operationalisation, the Commission has passed many legally-binding conservation and management measures and non-binding 'resolutions' to regulate fishing activities and surveillance requirements.

¹⁸⁷ Members of the Commission include: Australia, China, Canada, Cook Islands, European Union, Federated States of Micronesia, Fiji, France, Indonesia, Japan, Kiribati, Republic of Korea, Republic of Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Philippines, Samoa, Solomon Islands, Chinese Taipei, Tonga, Tuvalu, United States of America, Vanuatu. The Commission also includes "Participating Territories": American Samoa, Commonwealth of the Northern Mariana Islands, French Polynesia, Guam, New Caledonia, Tokelau, Wallis and Futuna; and "Cooperating non-members": Curacao, Ecuador, El Salvador, Liberia, Nicaragua, Panama, Thailand, Vietnam.



This functional territorial construct, establishing the WCPFC as the ruling authority over oceanic fisheries in the WCPFC Convention Area, results from introducing ecological concerns in fisheries management considerations. Hence, several interviewees found that WCPFC is a “bycatch commission, it is no longer a commission to manage tuna” (Representative of the Fiji Fishing Industry Association, Suva, 25.06.19) and that tuna management is more and more “framed by bycatch considerations” (Tuna fisheries scientist, France, 11.07.19). The reconceptualisation of offshore spaces as spaces of natural resources *and* ecosystems challenged the territorial scheme previously established by UNCLOS and resonated with coastal states’ preoccupations against IUU fishing and high-sea fishing. The EEZs were too small of territorial units to manage the mobile tuna fisheries effectively. The re-problematism of fisheries management as a global issue accommodated their reticular organisation and contributed to outlining the need for novel forms of governance beyond the EEZ and the nation-states. These interpretations, reworked by the Pacific Islands and the DWFNs, resulted in retaining an area-based management approach to fisheries, only enlarged to the WCPO scale. As this approach collided with the system previously established by UNCLOS and the Pacific Islands, it resulted in a complex multi-scalar and multi-level governance regime with all those systems awkwardly cohabiting with one another.

3. Territorialising Offshore Ecosystems: The Rise of ‘Conservation Territories’

The rise of global environmental agendas ‘ecologised’ fisheries management and ocean management more generally. Fisheries were not the only sector impacted. These agendas problematised the ocean as

a complex socio-ecosystem necessitating to replace siloed management approaches by holistic ones. Such a requirement was made explicit by the Pacific Islands Forum members at the 2002 World Summit on Sustainable Development. This fostered novel territorial endeavours to support the 'ecosystem-based management' of the oceans. In this case, territory provided a political technology aiming not so much to govern tuna resources through space than to conserve marine (socio-)ecosystems thanks to the creation of 'conservation territories' (Zimmerer, 2006).

The affirmation of marine biodiversity conservation prerogatives took a visible turn in the mid-2000s, opening the door to a "biodiversity decade" and making ocean governance further more complex and polycentric (S. M. Garcia et al., 2014, p. 8). The conservation sector, which 'turned' to the sea in the 1990s, transposed its traditional management instruments, including protected areas, to the ocean (see, e.g. Wells et al., 2016). It promoted and developed area-based instruments to support integrated management and marine ecosystem protection. Various types of Marine Protected Areas (MPAs) emerged, more or less permissive of anthropic activities and with more or less inclusive governance schemes, to reserve marine spaces for other-than-human lives.

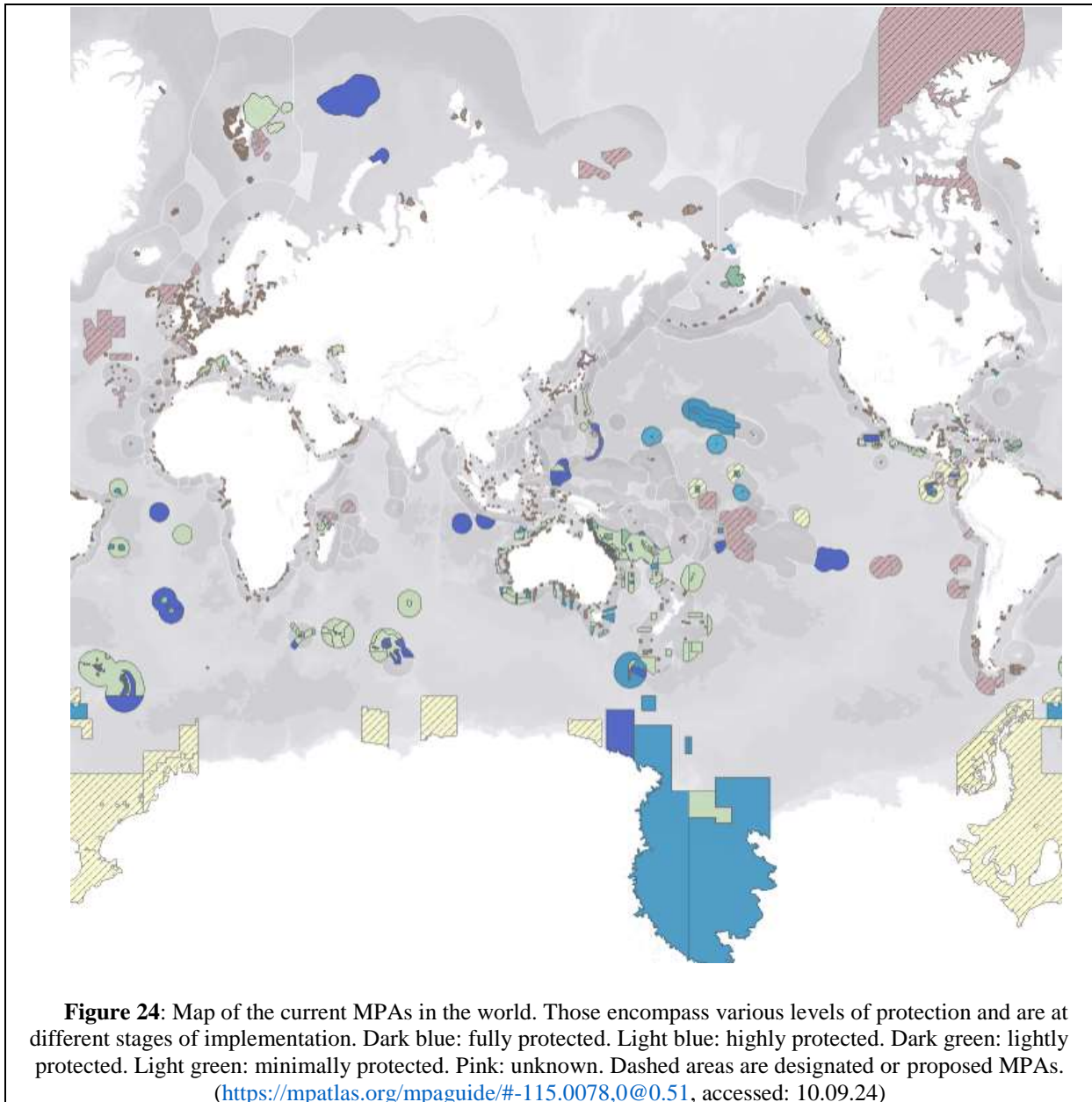
From the 2010s, MPA developments noticeably expanded to offshore ecosystems after NGOs such as The Pew Charitable Trusts, Greenpeace, and Conservation International lobbied for the creation of integrally protected 'large-scale MPAs' supposedly adapted to the pelagic ecosystems (Alger & Dauvergne, 2017a). In 2005, Greenpeace shared a position paper at a WCPFC meeting to plead that "the overall effectiveness of effort restrictions in relation to the WCPO tuna fisheries could be considerably enhanced by designating no-take marine reserves" before adding that "tuna species, however, are highly mobile and to be effective, marine reserves need to encompass an adequate and significant proportion of the critical habitat or some spatio-temporal stability" (Greenpeace International, 2005, p. 5). For the conservation sector, large-scale MPAs could "protect entire ecosystems, particularly habitats that are not typically part of nearshore MPAs, such as the deep sea, seamounts and pelagic realms" and cover the (extensive) habitat of "highly mobile species such as tunas, billfish, sharks and other targeted fisheries species, as well as sea turtles, marine mammals, seabirds and other pelagic species, which are taken as bycatch in pelagic fisheries" (Friedlander et al., 2016).

These campaigns collided with coastal states' interests in territorialising offshore spaces and provided new arguments to back these endeavours with environmental arguments. Instead of asserting their 'special interest' in fish resources, nation-states could now advance their environmental leadership on the international stage (Leenhardt et al., 2013; Le Meur et al., 2018), this time with the support of conservationists rather than fisheries experts. This resulted in numerous governmental commitments to advance MPAs at the international level. In 2010, parties to the Convention on Biological Diversity established Aichi Target 11, aiming to have at least 10% of worldwide coastal and marine areas conserved by 2020 – an objective reaffirmed in the UN Sustainable Development Goals. Such a target

further increased in 2022 when 80 countries, including France and Fiji, committed at the One Ocean Summit to protect 30% of marine waters by 2030.

These political engagements caused an uproar in the creation of MPAs. In 2017, the UN claimed that the spatial extent of MPAs had more than doubled since 2010 (Humphreys & Clark, 2020).¹⁸⁸ This expansion was largely attributable to the creation of large-scale MPAs, mostly in the Pacific Ocean (see Figure 24). The MPA momentum attests to an “extensification” of zoning processes, in the case of (few) MPAs covering high-seas areas, and an “intensification” of such processes in national waters (Ryan, 2019) – especially in the EEZs, where boundaries multiply, which turns them into more complex and regulated spaces. These evolutions revive and transform surveillance imperatives while simultaneously being driven by new technoscientific promises in the maritime surveillance field. Indeed, the renewed interest in area-based technologies of government in relation to the offshore world is also supported by a new socio-technical imaginary rooted in recent mapping and surveillance technology developments, re-opening new promises regarding the possibility of effectively ‘making’ territory at sea (see, e.g. Toonen & Bush, 2018; see also chapters 8 and 9).

¹⁸⁸ Although such quantification is subject to controversy, given the lack of universally agreed definition on MPAs.



Offshore MPA proclamations have raised new territorial disputes and challenges and enliven competing understandings of sovereignty regarding the ocean's ecological futures (Bambridge et al., 2021). The legitimacy of these territorial claims has raised substantial concerns about "ocean grabbing" (Bennett et al., 2015) and the exclusion of ocean users such as fishers from marine spaces. When MPAs are set within EEZs, such disputes do not oppose the state to external and foreign entities but to internal and domestic ones – and fishing ones especially. Offshore MPAs also raised anew the challenges of enacting such conservation territories in practice and the need for surveillance information and legal instruments to support their establishment and enforcement (i.e. to identify and map their boundaries, set regulatory measures and control compliance). Although these territorialisation endeavours pursued distinct motives compared to the previous era, they have raised similar challenges regarding their

legitimacy and effective materialisation, considering the specific features and materiality of the territories at stake. On the one hand, pelagic ecosystems remain poorly known, and there has been extensive scientific controversy on the relevance of large-scale MPAs to protect them. The relevance of area-based approaches to control vast, mobile and dynamic entities remains an intact question (e.g. see Kaplan et al., 2010). On the other hand, the capacity to adequately surveil and enforce remote and vast conservation territories resurfaced: many critics chastised the recently created large-scale MPAs for being mere “paper parks”, i.e. parks existing only on paper and not in the ‘field’ (e.g. Rife et al., 2013).

These territorial constructions spark new surveillance efforts, which intersect with tuna fisheries surveillance but are not equivalent either. The ‘scientific’ and ‘regulatory’ surveillance of MPAs is not concerned with commercial fish stocks but with marine biodiversity and ecosystem functioning. The ‘coercive’ surveillance of MPAs focuses on fishing activities henceforth (often controversially) made illegal but must also address threats deriving from other sectors such as the shipping or tourism industries. Actors behind such surveillance also differ, involving, in addition to ‘traditional’ actors of maritime and fisheries surveillance, environmental agencies and, sometimes, NGOs. For instance, Greenpeace conducted at-sea patrols to fight IUU fishing in the South Pacific Region and even arrested some fishing vessels¹⁸⁹ (WWF representative, Suva, 05.07.19). More recently, NGOs have invested in information technologies to partake in maritime surveillance from a distance, with a strong (although not exclusive) focus on IUU fishing and MPAs. NGOs Ocean and SkyTruth, for instance, partnered with Google to set up Global Fishing Watch in the 2010s, an initiative drawing on big data analysis and machine-learning techniques to combat IUU fishing and “improve effective designation and management of marine protected areas and other effective area-based conservation measures”.¹⁹⁰ Global Fishing Watch set foot in the South Pacific region in 2021 to assist FFA and the Pacific Islands in strengthening their MCS capacities (Global Fishing Watch representative, Suva, 05.10.21).

Both Fiji and New Caledonia have engaged in offshore MPA developments and intensified the regulation of their respective EEZs in the name of biodiversity conservation and ecosystem-based management. Although these developments are recent and very much in progress, they support the production and appropriation of their EEZs, while raising similar territory-making challenges mainly related to surveillance. However, these endeavours also collide with the pre-existing EEZ organisation, mostly related to tuna fisheries. I suggest that these frictions result in re-conceptualising offshore MPAs and the EEZs – and therefore, the understanding and production of offshore territory.

¹⁸⁹ The NGO has since left the region to reallocate its efforts to other regions.

¹⁹⁰ <https://globalfishingwatch.org/about-us/> (accessed: 18.03.2024)

i. New Caledonia

New Caledonia partook in the large-scale MPA momentum by proclaiming in 2014 the Natural Park of the Coral Sea, which would span its entire EEZ. Hence, the 'economic zone' was overlaid by a 'conservation zone'. The creation of the Park initially aimed to improve New Caledonia's regional integration by consolidating its relations with Australia and the Cook Islands (New Caledonian Government representative, Noumea, 07.06.21). It also contributed to France's international conservation commitments and was supported by the Pew Charitable Trust NGO as part of its project to develop no-take MPAs (Dégremont, 2022).

The park's creation outlined (and aimed to protect) New Caledonia's outstanding biodiversity. This biodiversity has been identified as one of the main resources and heritage of the Territory's EEZ, after sustained research and prospection¹⁹¹ showed that it was not "a very productive milieu: there are many species, in terms of biodiversity, it's great, but in terms of economic resources, it's not" (Former New Caledonian fisheries officer, Noumea, 09.10.19). Besides the domestic tuna fishing industry, comprising a small fleet averaging 20 longliners, New Caledonia's EEZ has remained little exploited to date,¹⁹² and therefore relatively unregulated, except for the fisheries sector:

Before [the park's creation], no one was managing the marine territory. Only the Navy would police it for regal dimensions, but activities were not managed. Now, the marine territory exists at the institutional level because an MPA exists, with a manager. We moved from managing biodiversity to managing the territory, by considering that the territorial approach would permit to manage biodiversity. a representative of the French Biodiversity Agency explained about the Coral Sea Natural Park of New Caledonia (Field notes, French Biodiversity Agency representative, Noumea, oct. 2019).

The EEZ's appropriation had remained limited to tuna resources. Another interviewee confirmed that the EEZ had largely remained 'offshore' for the public authorities and the New Caledonian people more generally and that the park's creation intended to reignite interest in the EEZ and improve its integration into New Caledonia's territory:

One stake [of the park] is appropriation. The New Caledonian EEZ was not known. You ask people, here, they stop at the reef barrier, basically. It's a physical barrier and people think it's like that. How can they fathom that... it's 400, 500 km, even more, further, up to the maritime boundary with Australie? [...] The park is also a tool to develop awareness and appropriation of maritime spaces so that people are more aware of the heritage they have. [...] It's funny because at first, people told me: no one cares, there's nothing there. And now, when I go to the management meetings, it is *their* park. The stakeholders: fishers, NGOs... The challenge, now, is for the rest of

¹⁹¹ In particular, following the creation of its EEZ, New Caledonia conducted a longstanding research and development programme called ZoNéCo to prospect and manage its marine resources (<https://www.zoneco.nc/>, accessed: 12.09.24).

¹⁹² This is also because much of New Caledonia's economy relies on nickel mining. Hence, this Territory has been less reliant on marine resources than other Pacific Islands.

the population to become aware. (Marine scientist and member of the Park's Scientific Committee, Noumea, 08.10.19)

Placing the almost 'virgin' EEZ under environmental protection seemed relatively smooth considering how limited human activities are: "There was no economic stakes so it was relatively easy to say: we don't go to the Chesterfield. Because there's no one, only a few leisure people." (Park Scientific Committee representative, Noumea, 28.08.19). The fishing industry, however, rapidly voiced its opposition to the creation of no-take areas if they were to close some of their fishing grounds and hinder their fishing activities, highly dependent on being able to move across vast areas to follow tuna movements. The creation of a conservation territory overlaid the fishing industry's appropriation of the EEZ. This time, territorial disputes were internal, opposing environmental NGOs, public authorities and the fishing industry, compared to the previous era opposing New Caledonia to DWFNs and foreign fishers. A fishing company manager criticised the relevance of no-take MPAs to protect offshore ecosystems and his opposition to seeing his access to offshore waters being restricted: "Spatial management makes no sense when we consider the offshore realm and pelagic fish. [...] At the moment, some say we need XXL reserves. Pew does, let's say it. [...] They say we will put 30% of the zone in a glass bell. There's no way." (Fishing company manager, Noumea, 21.10.19). He pursued by arguing that the fishing fleet had already committed to sustainable management measures (e.g. limiting fishing effort and mitigating bycatch), which he found more relevant to frame tuna fishing activities than area-based instruments. His interview unveiled political conflicts over New Caledonia's offshore water usage and controversies over appropriate management instruments for the offshore world. The conservation-exploitation tension was further complexified with parallel aspirations to develop New Caledonia's Blue Economy from public authorities and sectors relating to tourism, biotechnology, shipping, research, renewable energy, etc. These perspectives resulted in creating a Maritime Cluster association in 2014, concomitantly to the Park's creation, to gather economic actors interested in the EEZ.

Colliding claims over the EEZ led to conceiving the park as a 'managed marine area' rather than a no-take MPA reserved for more-than-human lives. Although the park would include a network of reserves protecting specific places and seascape features (e.g. remote reefs, high islands, seamounts and pelagic areas, see Figure 25),¹⁹³ it would still allow for human activities and economic exploitation as long as they are 'sustainable', such as the domestic tuna fishing fleet – which was integrated to the park governance by joining the management committee, besides conservation NGOs. The latter complained that established reserves in the park only covered places where longliners do not operate in order to

¹⁹³ These reserves first targeted remote reefs and did not impact the fishing industry. Updates on the impact of the latest reserves, covering pelagic waters and proclaimed in 2023, are needed to further investigate the relations between the fishing industry and MPA developments in New Caledonia.

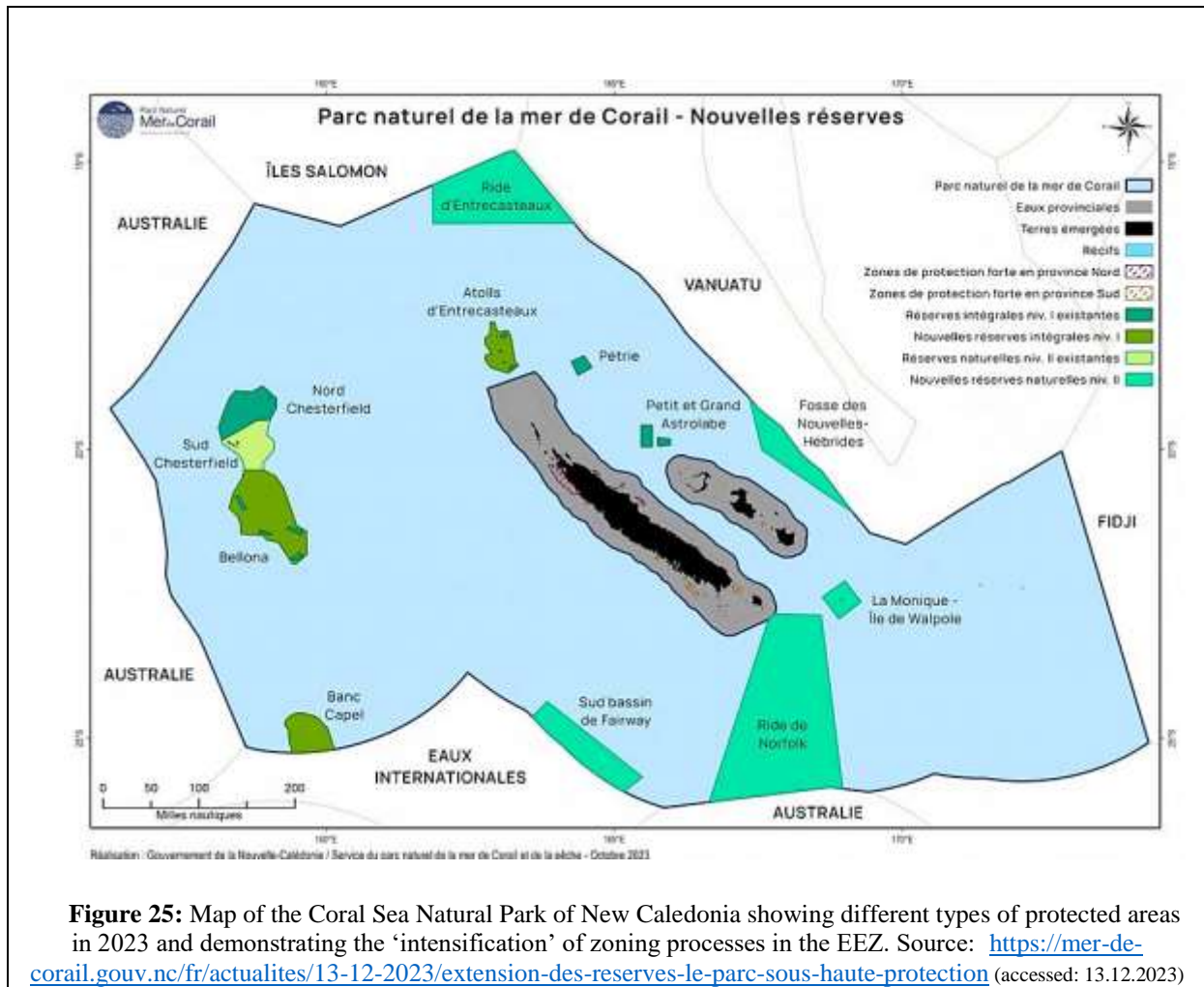
mitigate their impacts on the sector¹⁹⁴ – suggesting the articulation rather than replacement of the two territorialisation processes.

The concept of MPA was shaped against the pre-existing territorial configuration of New Caledonia's EEZ and produced an 'ecologised' territory with a complexifying governance involving various sectors and actors interested in these offshore spaces. The park's creation attests to the ambition to control and appropriate these offshore spaces in a more integrated fashion, beyond (and with) tuna and marine biodiversity, to produce a more comprehensive (rather than functional) territory. The launch of research on the cultural dimensions of the park further attests to the ambition of improving its integration and making it less estranged from New Caledonia's human and land-based population – a strategy particularly important in a context of a pending referendum on the Territory's independence: "The first idea, I think, was: exceptional biodiversity, let's create something. [...] Where we really had a lacuna was in the cultural realm. So we've launched some research [...]. On toponyms, emblematic species, on islands' archaeology." (Government officer responsible for the park, Noumea, 06.05.21).

The materialisation of the park was slow and is still in progress. For long, the Coral Sea Natural Park provided an apt illustration of the 'paper park' phenomenon: "It was a political announcement [...]. We first created an empty shell [...]. Regulation appeared at a second stage." The process was similar and equally challenging to producing the EEZ: surveillance (to support regulation and enforcement), legal instruments, and institutional arrangements were needed to effect it. After the proclamation of the park, knowledge acquisition was erected as a priority to define its management (Government officer responsible for the park, Noumea, 06.05.21). Political tensions slowed the adoption of a governance structure and management plan, which took three years to emerge and establish first access and usage rules. Surveillance is lacking: New Caledonia's EEZ remains poorly known (although it is far better known than other Pacific Islands), and several inside MPAs were established without relying on scientific information on marine ecosystems (Member of the Park's scientific committee, Noumea, 28.08.19). The park long lacked enforcement capacities (cf. Chapter 9). It was only in 2022 that the park's authorities reportedly "laid the first brick of its surveillance system" with the launch of an application permitting the (both 'regulatory' and 'coercive') surveillance of maritime traffic.¹⁹⁵

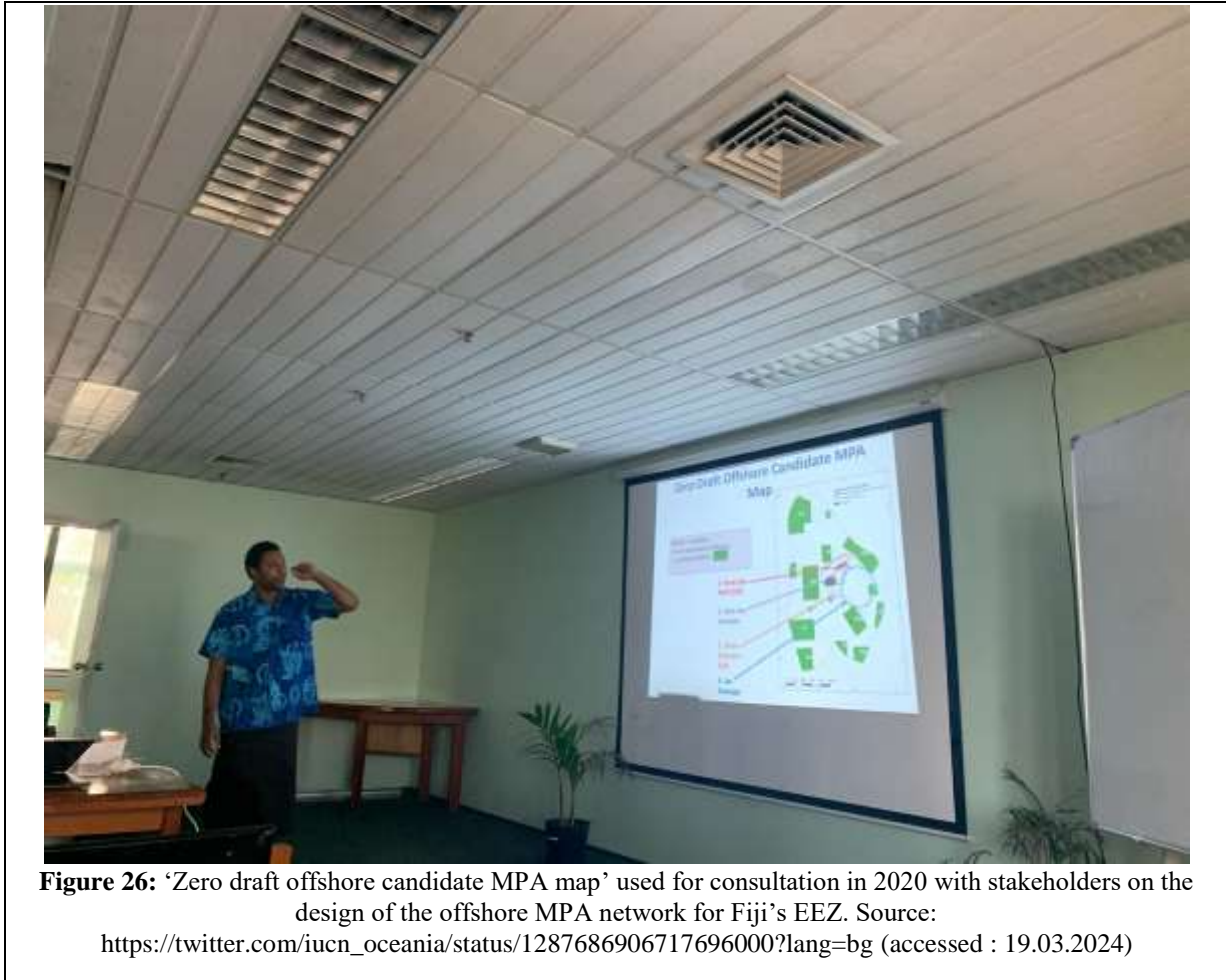
¹⁹⁴ See this article by actu-environnement: <https://www.actu-environnement.com/ae/news/parc-naturel-mer-corail-protection-forte-43312.php4> (accessed: 07.10.24)

¹⁹⁵ <https://mer-de-corail.gouv.nc/fr/actualites/20-01-2022/le-parc-pose-la-premiere-brique-de-son-systeme-de-surveillance> (accessed: 18.03.2024)



ii. Fiji

Fiji’s government committed to establishing fully no-take MPAs over 30% of its marine waters (including its EEZ) in 2010. However, ten years later, no MPA had been established in these offshore waters. The Government only elaborated in 2020 a ‘Zero draft offshore candidate MPA map’ (see Figure 26) with the support of the International Union for the Conservation of Nature (IUCN), other NGOs and regional organisations and started organising a round of consultancies with stakeholders, including coastal communities and the fishing industry, slowed by the Covid-19 pandemic. As one of the main users of Fiji’s EEZ, the fishing industry obtained an individual and “closed” consultation (IUCN representative, Suva, 23.02.21).



Like in New Caledonia, the tuna fishing industry vividly opposed the creation of no-take areas in Fiji's EEZ, expressing similar criticisms against the relevance of such measure when applied to the specific offshore ecosystems and concerns for the economic impacts it would have on their (fragile) economic profitability. A fishing company owner recounted in a post-interview email:

The Tuna Association put a list of reasons why the MPAs were not a good idea [...]. They included the fact, unknown to the attendees, that a longline can drift up to 20km after setting, and if we were to avoid being prosecuted for a longline drifting into an MPA, we would have to allow a 20km buffer zone after an MPA. This would have the effect of increasing the no-take area from 30% to 40%. In addition to that nonsense, the exclusion of fully owned Domestic boats from some of the most productive areas (near seamounts and islands) mistakenly assumed that fish are scattered evenly over the EEZ and that a 30% (actually 40%) reduction in fishable area was only 30%... When you consider that fishing boats rely on productive areas (we call them super markets where fish tend to concentrate) excluding a few of them from being fished, turns the MPAs into probably 50% of the EEZ. (Fishing company owner, Suva, 29.04.21)

This quotation first suggests, once again, the tension of placing fixed maritime boundaries against 'drifting' mobilities characterising the longline fishing industry. It also attests to distinct understandings

and representations of offshore waters between governmental authorities, chiefly understanding these worlds as homogeneous and relatively static – i.e. as a ‘conventional’ territory, and fishing actors who distinguish various places at sea, including the particularly productive ‘supermarkets’. Additionally, at the governmental level, it was unclear which agency should implement the MPA commitment – evidencing the existence of divisions in ‘the’ Fiji state entity between the ministries of Environment, Fisheries and Foreign Affairs – which made the MPA commitment in the first place. As explained by a WWF representative involved in the process, who should be in charge of offshore MPAs remains to be defined (WWF member, Suva, 05.07.19).

Many of these developments occurred during and were hampered by the Covid-19 pandemic. Although their resolutions remain unclear, they attest, like for New Caledonia, to the tensions the creation of conservation territories raises. Contrary to New Caledonia, however, Fiji’s tuna fishing industry is far bigger and more important to the country’s economy. There are signs that the Fijian Government has, too, attempted to accommodate its MPA commitments with its tuna fishing interests. A marine spatial planning project manager mentioned that the government had asked for MPA proposals that would mitigate the closures’ impact on the tuna fishing industry’s important fishing grounds (GIZ representative, Suva, 19.07.19). More visibly, in 2020, noting that there had been no progress in establishing offshore MPAs, the Fijian Government retained this goal but committed more generally to the ‘100% sustainable management’ of its EEZ by 2030 and developed a National Ocean Policy for the 2020-2030 decade. Such a strategy resembles that of New Caledonia. The development of this policy was part of the Government’s efforts to better integrate its marine management efforts (Consultant involved in the policy-making process, Suva, 27.02.20). That same consultant explained how these political reorientations partly reframed MPAs to accommodate biodiversity conservation and economic exploitation:

The thinking, now, under the 100% sustainable management, is for a much more strategic view of area-based management tools. [...] They move away from thinking about MPAs [...] onto more thinking of them as broad strategic *assets of the nation*. In a way, if we remove the term MPA, it will be much easier because then we will use the much preferred term of MMAs [marine managed areas]. That opens it up to less knowledge baggage as MPAs have, and it opens it up to this more diverse and broader thinking on what area-based management tools and MMAs could do for the country.

Abiding by this new logic, the National Ocean Policy was placed under the Ministry of Economy: “a more powerful ministry than Fisheries or Environment” and with the benefit of being “non-sectoral” (Consultant involved in the elaboration of the policy, Suva, 27.02.20). Likewise, to establish the policy, Fiji sought “a relatively neutral organisation” and obtained aid from the World Bank, instead of turning to environmental NGOs (Consultant, Suva, 27.02.20).

This explanation evidences that the country retained spatial instruments as relevant for managing offshore spaces and ecosystems in an integrated fashion. However, it also redefined what ‘conservation

territories' could be: i.e. a technology to manage *socio-ecosystems* rather than 'non-human' ecosystems. In that respect, the cases of both Fiji and New Caledonia can be read as converging to Marine Spatial Planning approaches, including but not restricted to the establishment of no-take MPAs and attempting to balance exploitation and conservation objectives by using the territorial technology to organise access and usages in space and time in an integrated and more exhaustive fashion. The practical conditions for enacting such endeavour raise anew surveillance challenges – and largely draw on pre-existing surveillance infrastructures relating, in particular, to tuna fisheries surveillance (cf. Chapter 8 and 9).

Conclusion

This chapter explored territory-making over offshore spaces and entities, focusing on the role of legal and institutional instruments and surveillance techniques in supporting and shaping such an endeavour in two successive historical contexts. The legal specificities of the EEZ concept, reducing the offshore territory to a “functional territory” (Lambach, 2021) of natural resources, and the material and political-economic features of the associated spaces and tuna fisheries made the effective creation of the EEZs particularly challenging and easily disputable. Applying the territorial technology to highly mobile fish, fishing vessels, and capital led to ‘re-inventing’ traditional understandings of territory, and articulating state sovereignty, policing power and territory in original ways.

As a first stage, the Pacific Islands devised regional strategies to enact their claims over their EEZs and tuna resources by establishing boundaries at sea, rules of access and usage, and rule enforcement mechanisms. Surveillance was instrumental to all these stages. The Pacific Islands assembled their EEZs and surveillance resources to consolidate their political and ruling power. This strategy produced a wider, although patchy and fractured by high seas enclaves, regional space of harmonised regulations and shared surveillance and enforcement capacities. Those were also partly projected beyond national boundaries and into the high seas to secure the EEZs and tuna resources, embedding tuna fisheries in general maritime security considerations. This regional assemblage was complex and relatively fragile, framed by continuous negotiations between the Pacific Islands and with the DWFNs in a dynamic context. Against the difficulties and costs of accessing, patrolling and policing their gigantic EEZs, the Pacific Islands devised complementary enforcement mechanisms to surveil and control tuna fisheries at a distance and despite the distance, and to reduce such distance by attracting fishing vessels to their shores. As a result of these efforts, the Pacific Islands managed to extend their sovereignty beyond their territory to surveil and regulate (only some) foreign fishing activities on the high seas. Surveillance and enforcement capacities, on the contrary, became more-than-sovereign, thereby mitigating the Pacific Islands' sovereignty over surveillance and policing activities: these would remain dependent on non-state or foreign state actors to enable, but also limit, control over the tuna fisheries.

In a second stage, offshore territorial endeavours were ‘ecologised’ and reframed by new environmental problematics – partly deriving from the limited territorialisation of tuna fisheries and the

ineffectiveness of the EEZ instrument in ensuring their conservation and sustainable management. Conservation issues expanded beyond fish stocks to the broader marine ecosystems and revived and reshaped the territorialisation of an offshore world now populated with many more various entities. This created a much larger functional territory seeking to encompass tuna fisheries' spatial extent in a more exhaustive fashion and ruled by an intergovernmental fisheries management organisation. It also led to creating new functional territories devoted to biodiversity conservation and attempting to reserve offshore spaces for more-than-human lives. These constructs transformed the conventional relations between the territory and the state. They complexified territorial governance while also struggling against the practical challenges of acting over the vast, remote, poorly known and mobile offshore worlds. These new functional territories additionally stumbled against the pre-existing territorial regime established by the Pacific Islands under UNCLOS regarding their EEZs and tuna fisheries. Frictions stemming from these 'awkward' encounters between competing territorial approaches shaped territorialisation processes: WCPFC's territory would cohabit with the EEZ regime in an uncertain and unstable fashion and could not cover the entire range of tuna stocks as it initially aimed to. Conservation territories were reinvented into 'marine managed areas' to conciliate conservation and exploitation interests, eventually partaking in intensifying the appropriation and regulation of the EEZs.

From the 1970s, coastal states have attempted to project and apply a relatively conventional and land-informed understanding of territory as a political technology to control offshore waters for environmental reasons – with the environment first understood as a natural resource to manage and conserve for utilitarian reasons and then as a complex entanglement of living and non-living, human and non-human entities to protect for 'more-than-economic' reasons. However, the territorial approach could not be transposed straightforwardly because of marine spaces' specific materiality, legal regime and political economy. Frictions with those peculiar features resulted in the production of "pragmatic spaces" (Bueger, 2020b) of surveillance and in a specific territorial construct, more porous and diffuse than the conventional state's territory. This phenomenon can be described following the refraction concept used in physics: the projection of the territory deviated from its original conception as it moved from the land to the sea and changed milieu.

PART III

Fishing for Information

Offshore Surveillance Infrastructures and Practices

The previous section historicised the creation of some main formal surveillance apparatuses for the Pacific Islands to surveil tuna fisheries: logsheet reporting by fishers, fisheries observers, vessel monitoring systems, patrolling operations, tuna tagging and biological sampling campaigns. Each of these apparatuses works as an “oligopticon” (Latour & Hermant, 1998), providing partial vantage points in tuna fisheries with situated gaze and methods. They were brought together within a wider surveillance assemblage, also comprising *ad hoc* surveillance practices, to support the territorialisation of offshore spaces and their associated tuna resources. Offshore surveillance serves various ‘scientific’, ‘regulatory’ and ‘coercive’ functions to provide information on the tuna resources, management decision-making processes and rule enforcement.

In describing the design of these apparatuses, I evidenced specific features of offshore surveillance, which I characterised as multipotent, opportunistic, delegated, and shared. These dimensions produce “boundary apparatuses” (Fortané, 2015) torn between different stakeholders with particular relations to surveillance. Understanding how this boundary position affects offshore surveillance by affording and simultaneously constraining its existence and functioning is the core of this second and final part. In the following three chapters, I examine how offshore surveillance *works*, in and through practice(s) and how the concrete encounter of ‘surveillance’ with the material offshore world shapes its unfolding and usages – in particular, that of producing the offshore territory. I approach surveillance as an activity requiring labour and techniques to collect, circulate and make fisheries information ‘speak’. It is necessary to look into the making of offshore surveillance to comprehend what makes it hold or, on the contrary, what discombobulates its functioning and the type of power and (in)action it relates to.

The three following chapters are articulated around three main tuna fisheries surveillance infrastructures, i.e. three types of offshore vessels granting access to the offshore world and from which most of the information used in tuna fisheries surveillance is collected. Vessels are a matter that “enable the movement of other matter” (Larkin, 2013, p. 329) – of surveillance agents/subjects and informational support in particular. Chapter 7 focuses on the functioning of the main surveillance apparatuses deployed on fishing vessels: logsheets, fisheries observers and vessel monitoring systems, and examines how ‘commercial’ forms of surveillance emerge in parallel and/or in intersection with these formal apparatuses. Chapter 8 looks into scientific apparatuses involving tuna tagging programmes and biological sampling operations linked to oceanographic vessels to collect complementary information on offshore ecosystems. It analyses the work underlying such ‘scientific’ surveillance to improve knowledge of the offshore world and inform management policies. Chapter 9 finally considers the patrol vessel supporting states’ maritime surveillance and policing operations to order the ocean and investigates how the more-than-human offshore environment transforms policing practices. These chapters unfold an unremitting tension between the need for flexible offshore surveillance apparatuses capable of adapting to the ‘turbulent’ offshore world, enrolling their operators and supporting multiple functions, and the rigidity of underlying offshore surveillance infrastructures.

CHAPTER 7. Catching Information from and on Fishing Vessels

In this chapter, I first discuss the role of the fishing vessel infrastructure in permitting but also restraining access to offshore spaces, making the ‘open’ ocean a rather closed world. I make visible its functioning under the work of its operators, first to navigate and fish offshore, and how these features constrain its additional role as a surveillance platform. I then evidence the prominence of surveillance practices developed by fishers and fishing companies to support the exploitation of an uncertain resource, organise the tuna supply chain and manage labour. In a third section, I examine the functioning of regulatory surveillance apparatuses imposed by fisheries authorities on fishers, including logsheet reporting, hosting fisheries observers and vessel monitoring systems (VMS). These ‘boundary surveillance apparatuses’ endure unremitting tensions of assembling various actors, interests and practices to exist and make surveillance possible while simultaneously being unable to satisfy these different stakeholders’ objectives. These tensions result in the production of ignorance. They also spark disputes around data access and the sharing modalities of these surveillance apparatuses, which lead to their duplication and intensification of surveillance workload when unresolved. In the final section of this chapter, I focus on the emergence of additional surveillance apparatuses attempting to reconcile companies, fisheries authorities and consumers’ interests around certification and traceability schemes.

I. Closed Access to the Open Ocean: A Fishing and Surveillance Infrastructure

Although offshore spaces long remained under the ‘open access’ regime of the *Mare Liberum* doctrine, they have never been open in practice. Access to the extensive offshore vessel technology and knowledge to operate the latter and navigate a hazardous environment make the offshore environment a very closed and exclusionary world. Fishing vessels and those who are on board are major entities populating this closed world and, therefore, provide critical infrastructures to access it. The fishing vessel is central to offshore surveillance and hosts many of its surveillance apparatuses. It bears a double status, blurring the divide between surveillance agents and subjects: not only does it represent one of the main subjects of surveillance, but it also provides one of the main infrastructures for collecting information on tuna fisheries and the wider offshore worlds. However, the fishing vessel is, first and foremost, an infrastructure underlying and conditioning fishing activities. This section provides a detailed description of the fishing vessel complex considering to enlighten both what is placed under surveillance and what underlies surveillance practices. I first look into its material components and then into its (human) operators to understand how this shapes fishing and surveillance activities. This preliminary comprehension of the infrastructure is necessary to understand what causes some of the

tensions traversing offshore surveillance that I discuss in the subsequent segments of this chapter. I also show that, with respect to the fishing vessel, surveillance also arises out of safety and commercial reasons to make the industrial exploitation of tuna economically viable.

1. The Fishing Vessel as an Infrastructure of Tuna Fisheries and Offshore Surveillance

The first infrastructure underlying offshore surveillance practices is initially directed to fishing. In that respect, offshore surveillance hinges upon a pre-existing infrastructure enrolled in an inherently socio-technical operation to transform ‘wild’ tunas into commodities. Technology is integral to tuna fishing. In Fiji, the (rare female) owner of *Longline 1*, the only vessel of her fishing company, complained “how hard it is to only have one boat” after telling me that her vessel had been undergoing a technical and safety survey for the past five weeks preceding our interview (*Longline 1* owner, Suva, 21.06.19). Fishing operations completely shut down for the survey and associated technical revisions, leaving the crew on hold for so long that some had left to work for other companies.

Tuna fishing requires access to heavy and onerous instruments (see Figure 27), not affordable to anyone. As retraced in Chapter 4, technological innovations in fishing vessel design largely framed tuna fisheries developments to access hazardous and increasingly remote offshore waters and in fishing gear and refrigerating mechanisms to catch and preserve an elusive and highly perishable commodity. Mechanical progress was greatly influential in permitting the very existence of the tuna industry, if only to cover the distance from the shore to the fishing grounds, thanks to the motorisation of the vessels.¹⁹⁶ In New Caledonia, leaving the lagoon to reach offshore waters requires at least a few hours of navigation. The local fishing industry generally steams for a full day to reach their first fishing grounds, and sometimes over two days “if you go very far, to the Chesterfield” (Onboard fisheries observer, Noumea, 28.08.23). In Fiji, industrial fishers similarly reported at least one or two days of “steaming time”, as they call it, before they start fishing in the Exclusive Economic Zone (EEZ). Transit time can take up to a week of navigation, as reported by anthropologist T. Shigefuji in the case of the Hawaiian longline industry (Shigefuji, 2021). Most fishers aim to minimise steaming time, to save on fuel, vessel longevity, money and time. However, in Fiji, several fishing companies complained that steaming time only increased with tuna scarcity: “As there are less and less tunas, they tend to concentrate even more. [...] Before I only had to go two miles off Suva to fish, and now I need to go four to five hundred miles off before I can set.” (Owner and captain of fishing company F., Suva, 17.07.19).

¹⁹⁶ Such distance can vary, depending on local oceanographic features and on the movements of the fish as well as on local regulations.

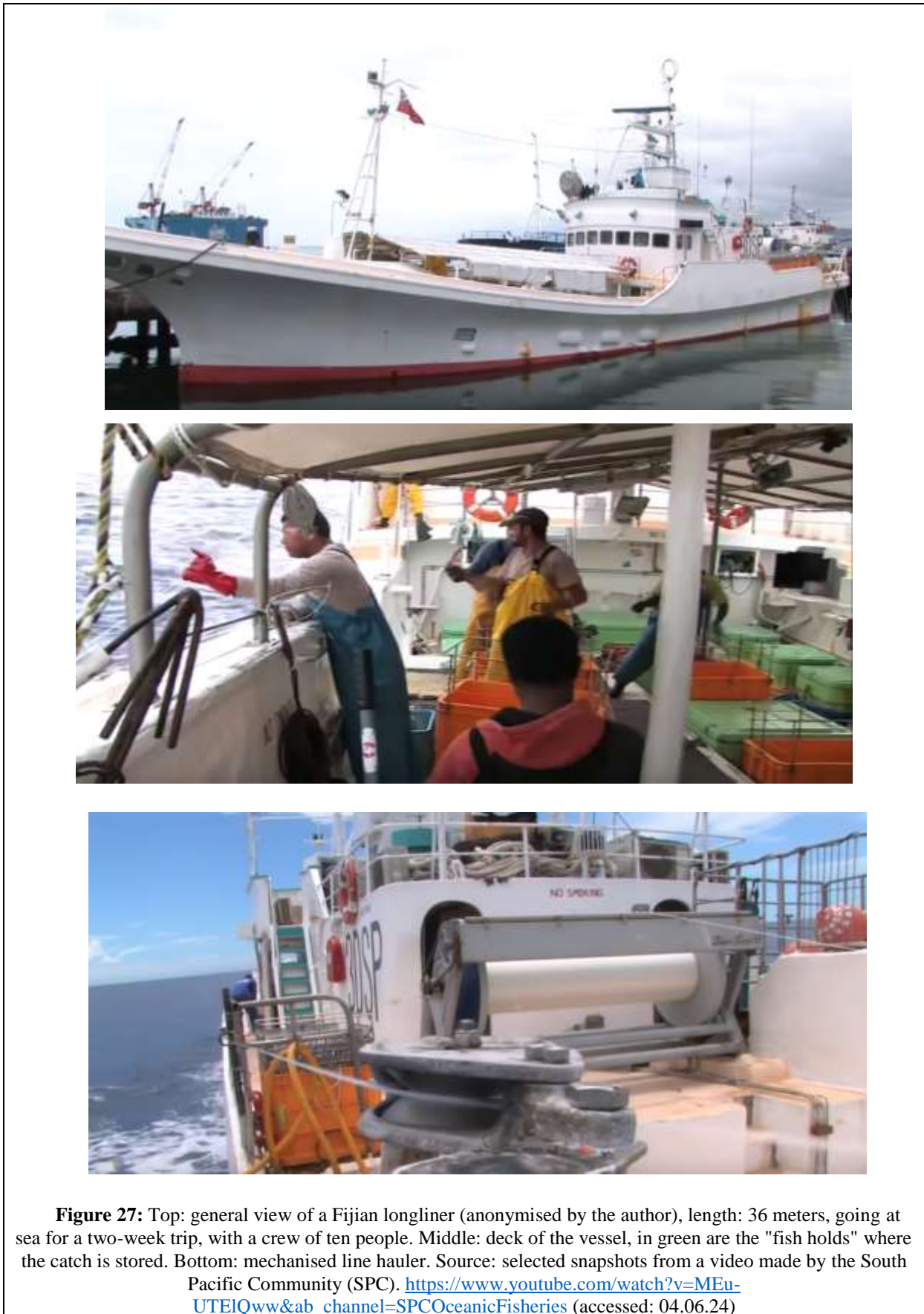


Figure 27: Top: general view of a Fijian longliner (anonymised by the author), length: 36 meters, going at sea for a two-week trip, with a crew of ten people. Middle: deck of the vessel, in green are the "fish holds" where the catch is stored. Bottom: mechanised line hauler. Source: selected snapshots from a video made by the South Pacific Community (SPC). https://www.youtube.com/watch?v=MEu-UTEIQww&ab_channel=SPCOceanicFisheries (accessed: 04.06.24)

The fishing vessel also conditions *safe* access to the offshore waters. Offshore navigation is intrinsically risky. In the South Pacific region, tuna fisheries are riddled with stories of at-sea accidents caused by ill-designed vessels:

I went to Kiribati. [...] There was an Australian man there [...]. He got a grant to build mini longline boats. He got an outrigger with one engine. [...] They went fishing but it did not go well because of the weather, and they had numerous breakdowns. I wrote a report about that. [...] I wrote the boat was horrible. [...] Look into Samoa. There's a guy from Sweden who designed small boats, really nice for fishing close to shore or in the lagoon. One of the boats was a catamaran. [...] Somebody in Western Samoa picked up the idea and did it in aluminium instead of wood. [...] In the first boom years of these catamarans, 800 fishermen died. For a very small country. It was a disaster. (Former SPC fisheries development officer, Noumea, 04.05.21)

Going offshore requires – and therefore should be left to those who have access to – appropriate equipment: “The vessels that go to these [offshore] fishing grounds should be equipped in offshore gear” (Game fisher Y., Noumea, 16.10.19). ‘Appropriate’ gear is first and foremost a matter of size as undersized vessels are too unstable to stand strong waves. Vessel size is often used as a token for safety in maritime safety regulations, which shapes offshore access and mobilities. In Fiji, *Longline 1* owner explained that her vessel is too small (18 m long) to be allowed in the EEZ by the Maritime Safety Authority. Her vessel can only navigate Fiji’s archipelagic waters, even though her fishing license also encompasses the EEZ waters (*Longline 1* owner, Suva, 21.06.19).¹⁹⁷ Vessel size is not the only criterium at play regarding maritime safety. In addition to life jackets and boats, communication and localisation devices such as radios and Automatic Identification Systems (AIS) have progressed to mitigate the risk of collision at sea and support search and rescue operations. These technologies make vessels amenable to surveillance by enabling safety operators and other vessels at sea to track a vessel’s movements or check on the crew. Safety measures constitute an instrument of risk management, to protect the employees while enabling industrial development (Bourg et al., 2013) and are a major reason for developing offshore surveillance as a form of ‘protective’ surveillance.

Gear age and quality matter, too, in maritime safety. Despite many improvements in fishing vessel technologies, infrastructure failures remain frequent, especially in the Pacific Islands, where economic conditions can hamper the acquisition of up-to-date vessels and where technologies are rarely locally accessible. In Fiji, many longliners were second-hand vessels. Vessels are rather long-living technologies, and those I visited in 2019 were acquired in the 1990s. These “old vessels need more repairs and often have problems at sea and need to be towed back to Suva, which involves additional costs” (Fiji Fishing Industry Association (FFIA) representative, Suva, 25.06.19). Even newer vessels have many breakdowns. A colleague experienced many technical issues during a fishing campaign in

¹⁹⁷ These regulations relating to vessel size also aim to safeguard the closer fishing grounds to the local, smaller, fishers. Size determines distance to the shore, not only for safety but also for political reasons.

New Caledonia, including a failing satellite compass and a leak in the cabin, despite the vessel being six months old only (Personal communication with a scientist, Montpellier, 14.05.19).

Offshore mobilities are largely shaped by the vessel's design. Fuel and fish storage capacities, along with the refrigerating technology available on board, constrain how far and how long the vessel can go to sea. *Longline 1* goes at sea for two weeks because "they don't have enough freshwater tank capacity to go at sea longer" (*Longline 1* owner, Suva, 21.06.19). Another Fijian company opted for larger vessels (> 30m long) equipped with freezers to fish longer and farther into the high seas (Field notes, presentation of fishing company R., Suva, May 2019). Only 19 out of 60 vessels of the Fiji fleet are energy-efficient enough to fish in the high sea pockets (Field notes, Fiji Seascape Symposium, online, 21.04.22). Fishing vessels coincidentally constrain the geography of offshore surveillance.

On the vessel, resources are scarce and finite. If the vessel allows for human presence at sea, it also constitutes an isolated and autonomous place akin to the 'spaceship earth' metaphor. These features weigh heavily on onboard social order and practices. Being rescued can take days. Even though "sometimes the vessel runs out of water" (Crewmate A., Suva, 09.12.21), most captains are reluctant to return to the shore before the fishing campaign is completed, because of the financial losses this would cause. Space allocation is most often subjected to economic (and not surveillance) imperatives and prioritises fish storage. Especially on smaller vessels, this leaves little space for the rest, e.g. amenities. Living conditions are Spartan, to say the least, which largely influences who can be on board and interpersonal relations. *Longline 1* owner described that the Japanese, who built her vessel, "are all about working so they do not care for facilities" (*Longline 1* owner, Suva, 21.06.19). There is no place for intimacy. The only shower is an outdoor hosepipe, which prevents her from "hiring women because the boat is too small and there is no indoor shower". Even though Fiji attempts to increase the proportion of women in the tuna fishing sector, vessel design hinders gender mixing because of "the lack of basic facilities on board vessels to ensure women's safety and well-being".¹⁹⁸

Technology's agency in affording offshore fishing is well present in fishers' minds. *Longline 1* owner boasted "how a great catching boat [her vessel] is" because "she only consumes 600 litres of fuel per day and has very good catch" compared to other companies that have "massive boats, consuming over 1,000 litres a day" (*Longline 1* owner, Suva, 21.06.19). In her view, a good vessel is an economically profitable one. A New Caledonian captain referred to the work of his vessel: "We're going to swap the power generator. This one has worked for three days, so I'll let it rest for a bit and put the other to work".¹⁹⁹ These quotations describe the vessel and its constituents as a central (and even gendered, in

¹⁹⁸ <https://www.wfpacific.org/2370237%2FWWF-and-partners-launch-Gender-Mainstreaming-in-Fiji-Offshore-Tuna-Industry-Report> (accessed: 01.05.24). In 2022, a Fijian company attempted for the first time, with the support of FFA, a fishing campaign conducted by an "all-female deck crew" (FFA Facebook page, 13.06.22).

¹⁹⁹ https://www.youtube.com/watch?v=bpIhxFNxAhk&ab_channel=CALEDONIA (accessed: 24.04.24).

the English language) actant of fishing operations, an entity that ‘works’ and needs to ‘rest’, and highlight the crucial dependence of the humans on the machine (see also Artaud, 2023).

However, offshore fishing technologies come at costs, which raises high barriers to entering the tuna industry and makes the latter highly exclusionary:

If you want to go catching highly migratory resources, you need more resources: bigger boats, the technology, the skills to be able to do that. While coastal resources are easy to access. That’s why we say commercial fishing is quite new, because the technology is quite expensive, we are not able to afford it, the cost is very expensive. Infrastructure are needed. The fishing boats are not cheap at all in the standards of PICTs [Pacific Island Countries and Territories]. [...] It requires a lot of expertise, money and resources. (Former fishing captain and company manager, Suva, 24.06.19)

These costs partly explain the complex financial arrangements behind many fishing companies, often involving several partners to permit the necessary investments.²⁰⁰ In Fiji, the owner of one of the oldest fishing companies told me the background of his enterprise:

[X] is a family business based in New Zealand. We’ve been involved in Fiji since 1981. [...] So, we set up in Fiji in 1981, and then it was a 100% New Zealand company. But the Fiji government gradually increased the local shareholding requirement, from initially nothing to 30% to 51% finally. So, we then had to gather in local shareholders who had no money. Today, that’s our position. In fact, New Zealand only has 18% shareholding directly in the company. That’s the only foreign one. The other shareholding is Fijian. But mainly because I was awarded a Fiji passport: I hold a New Zealand and Fiji passport. (Owner of Fishing Company R., New Zealand, 13.06.19)

Fishing equipment costs are considerable to most Pacific Islanders. For this company, abiding by the Fijian state licensing requirements was only possible because a foreign shareholder obtained the Fijian nationality. Other types of arrangements include chartering strategies. These complex configurations tend to blur what constitutes a ‘domestic’ vessel – and following, what regulations and surveillance imperatives apply to it. Involving multiple stakeholders, chartering practices create reticular and often invisible connections that participate in the ‘offshored’, seemingly detached and a-territorial, status of the vessels and potentially facilitate jurisdictional evasion strategies, the regional Forum Fisheries Agency (FFA) reported:

In 2016, 50 vessels were registered to Fiji flag by 15 Fiji companies that are believed to have some direct or indirect connection to China. [...] The government of China considers all these companies and the vessels connected to them to be beyond its national jurisdiction. [...] When a vessel is chartered, typically flag-state

²⁰⁰ Because of these costs, it is also frequent that safety regulations are bypassed to avoid dismissing a non-conform vessel and purchasing a new one.

responsibility transfers to the chartering state, as well as catch attribution. This can be murky though. (Campling et al., 2017, p. 173)

This organisation makes surveillance all the more complex and yet, all the more pivotal (cf. Chapter 9).

Besides initial investments in fishing equipment, operational and maintenance costs are also considerable. Longliners consume large amounts of fuel (600 litres a day for an 18m-long vessel; over 1,000 litres a day for a vessel longer than 30m), and the rough conditions experienced by the vessel at sea and the relative fragility of the technology require continuous care and repair. Maintenance in the Pacific Islands is particularly challenging because of their peripheral position in industrial sectors and explains why technological innovations may fail to be adopted: “Our engines are old, and we could use more efficient engines, but then there’s a problem of maintaining them in the Pacific if they get more sophisticated. It’s not like St. Malo, let’s say, where you’ve got all the spare plugs and lots of backups.” (Owner of Fijian fishing company R., Suva, 13.06.19).

The cumbersome costs of offshore fishing fuel calculative risk-management strategies to reach a (fragile) commercial equilibrium between operational costs and fishing efficiency. Accommodating the irremediable tension between industrial imperatives for steady, foreseeable and organised production and the need for flexibility and adaptation against unpredictable resource results in deploying a ‘commercial’ form of surveillance (cf. Section II).

2. Operating the Fishing Vessel Infrastructure

If fishing technology is a defining feature of the industry, this infrastructure cannot work independently and requires human labour and maintenance work to function (Star & Ruhleder, 1996; Denis & Pontille, 2012). Offshore navigation and longline fishing are highly labour-intensive and occupy much of the crew’s time and efforts, leaving little time and space for surveillance activities (see also Section III). Although longliners may target various fishing grounds and operate for variable amounts of time at sea, the same succession of operations structures the fishing campaign (see Figure 28). Before the fishing trip starts, the vessel is checked and supplied with bait, ice, water, and food. After steaming to a fishing ground, ‘setting’ starts. Baits are placed on the hooks of the branch lines, themselves attached to the main line, and drowned in the water by deck crewmates while the captain keeps the vessel moving. At regular intervals, decided by the fishing master (also the captain in the case of Fiji and New Caledonia), floats and float lines are placed on the main line to keep it afloat, place the baits at specific depths, and facilitate its retrieving. The setting operation takes five to seven hours for a 30m-long vessel deploying about 3,000-4,000 hooks. The setting is done with a “line shooter” that unfolds the line and dictates the work rhythm of the crew. Crewmates have to adapt to the pace of the machine, like in a factory, not to be injured:

We have to work with the timer. Once it beeps, we have to clip and bait the hook at the same time and then release it. I think the time goes off every five seconds so we have to work within that interval. I missed that alarm because I was smoking and it resulted in the hook tearing my flesh. (Fijian Crewmate B., Suva, 15.12.21)

After setting, the longline is left to drift for a period determined by the fishing captain to give time to the fish to take the bait. This also gives rest time to the crew before the most demanding hauling operation. Hauling usually starts in the late afternoon and lasts for 8-12 hours up until the following morning, depending on the success of the set. The operation requires all crewmates to be on deck to fetch the main line from the water with the help of a mechanised 'line hauler'. What has been caught is always a surprise until the fish leaves the black-boxed waters and inter-set variations can be very high. If the line brings protected or non-economically interesting species, it is cut to release the fish back into the water. When it brings valued fish, a crewmate gaffs the fish near the head so as not to damage the valuable flesh. Branch lines and float lines are unclipped from the mainline and stowed back ready for the next set. Again, timing and gestures have to be perfect to avoid any accident. Unfavourable weather conditions, hooks and the fish themselves (e.g. live sharks) can make the operations very hazardous.

As fish are landed, crew members prepare them for storage. Processing includes spiking, bleeding, gilling, gutting and cleaning. These operations require quick and carefully executed gestures that largely condition the quality – and therefore economic value – of the fish product. These operations, taking place on the moving, unstable and sleeper deck of the vessel, are risky, too: “When we go on a fishing vessel, we are also risking our lives because some of the equipment that we use are very sharp. We also need to take a good rest and sleep well because your body and your mind need to coordinate. I injured myself during the process.” (Crewmate B., Suva, 15.12.21). Fishers have to adapt to the vessel, the ocean and the fish body. Fish quality is not so much indexed to the fish itself than to its careful manipulation and preparation by fishers. Tunas, in particular, must be treated “with great care” and held like “babies” despite their heavy weight, as several Fijian crewmates and captains explained to me.

After processing, crewmates place the catch in refrigerated fish holds to preserve the fish fresh until the vessel returns to port for offloading. This part requires the parsimonious use of (limited) space and ice. It also implies working in “very cold” conditions: “We were provided with warm clothes, jackets, long pants and protective footwear but after a while I can feel my hands shaking while holding the shovel.” (Crewmate A., Suva, 09.12.21). In general, fish are ordered and stored based on their economic value. Valuable Yellowfin tunas are kept separate from the “miscellaneous” fish which would “damage the fish”, a New Caledonian crewmate explained: “The better you store it, the better you sell it.”²⁰¹ Catch conservation mostly depends on temperature to maintain the fish in a state as close as possible to its living conditions. Once hauled, fish should not stay on deck for more than ten minutes or bacteria might contaminate them (Fijian Captain J., Suva, 10.07.19). Tuna commodities are not merely extracted from

²⁰¹https://www.youtube.com/watch?v=bpIhxFNXAhk&ab_channel=CALEDONIA (accessed: 03.05.24)

the sea but very much *produced* by a series of human practices: “We have to *make* fish, as we say”, a New Caledonian captain explained (my emphasis).²⁰² These practices aim to catch the fish and tone down human impact on the latter: “When the fresh fish are offloaded, it’s like we just got them out of the ocean, they look really fresh.” (Crewmate B., Suva, 15.12.21).

After this step, the captain decides to either stay in the same fishing area or to move elsewhere if the catch has not been satisfactory. Then, the process resumes daily. For a two-week-long fishing campaign, there can be about twelve fishing sets. Larger, distant-water fishing longliners can repeat this sequence of operations for months up to over a year. Operating the fishing vessel is not just a matter of fishing, however. Depending on the size of the crew, positions onboard are more or less specialised (and hierarchised), but there can be crewmembers devoted only to operating the vessel as a navigational infrastructure: engineers, sometimes a cook – and who do not necessarily partake in fishing. Hence, the fishing vessel is a navigational tool, a fishing tool, a subject of surveillance and a surveillance platform all at once.

²⁰² https://www.youtube.com/watch?v=bpIhxFNXAhk&ab_channel=CALEDONIA (accessed: 03.05.24)



Figure 28: Selected snapshot from a promotional video made by a Fijian fishing company, showing some of the main steps of a longline fishing operation. Video provided to me by the manager of the fishing company (26.06.19).

The work of tuna fishing is collective, rough, and risky. The job is “difficult”, which makes it “closed”, invisible and largely “unknown” (Manager of fishing company P., Noumea, 02.11.21). The longline fishery weaves together seafarers that it detaches from the shore, and/or are already largely detached from the shore. In a Fijian company, fishers conduct eight fishing trips of about twenty days at sea – meaning they spend about half the year offshore. After a fishing campaign ends, they only have one to two days on land (and in port, caring for the vessel) before they leave again. The industry, therefore, appears to attract people who are often isolated, uneducated and in dire need of money – i.e. already on the margins of society. Offshore fishing is not just a matter of physical distancing but also of social distancing. In New Caledonia, fishers are for the majority Indigenous people with little or no education, as explained by the manager of Fishing Company N. (Noumea, 21.10.19): “... our social role is for people who have not succeeded in school [..].” Funded by the public authorities, this company felt vested with a “social role” of supplying jobs to the local population, in addition to its economic imperatives. The manager of Company P. also confirmed recruiting, training, and providing employment opportunities to ‘outsiders’:

We also facilitate social mobility in New Caledonia, because we get a lot of young people, a lot of people who have no education or are in the margins of society. We also have prisoners, we have everything. Europeans, coming to the wharf with their bag, saying: “I was a fisher there, do you have a job for me?” (Manager of Fishing Company P., Noumea, 02.11.21)

Relying on people with few ties on land is also easier to keep them working. Hence, several (non-Indigenous) company managers in Fiji claimed that Indigenous Fijians were little attracted by the profession, which they found too isolating. Fiji’s tuna industry is highly multinational and recruits many expatriates who are already detached from their personal ties (FFIA representative, Suva, 25.06.19).

The fishing vessel plays many roles in circulating across offshore spaces, fishing marine animals and producing fish commodities and supporting surveillance activities while being subjected to surveillance efforts. It constitutes an isolated infrastructure, highly closed and exclusionary, operated by a narrow range of ‘infrastructure experts’, themselves relatively isolated and involved in multiple activities.

II. Surveillance and Fish-Finding Operations

As a surveillance platform, the fishing vessel first supports surveillance activities deployed by the industry itself. Fishing captains and companies collect information on fish, fishers, the marine environment, competing companies, and more to support the capture and trading of fish. Surveillance first aims to reduce the uncertainty of finding fish. It also aims to make fishing safer, at least to the extent of maintaining production up and running. This section examines these surveillance practices, which are more or less formalised, primarily private and which interweave ‘commercial’, ‘protective’ and ‘coercive’ modes of surveillance.

1. The Art of Trac(k)ing Tuna: Surveillance of the Self and the Environment

i. Fishing as an Art: The Central Role of Captains' Tacit Knowledge

Fisheries are often associated to agriculture but in agriculture, there are barbed wires, locations, we know how many heads there are, we know where they are. Similarly, when we cultivate a field, we know where we're going to plant, where it is. Here [with fishing], we are really dependent on nature and also on the technical skills of the personnel. Of fishers in particular. (Manager of a processing company, Noumea, 25.01.22)

The 'making' of tuna commodities is a collective enterprise, but the art of finding fish and overseeing its onboard processing largely falls on the shoulders of the fishing captain. It is the captain's role to find signs of its presence at sea, track its movements attract it to the hook, and be the 'conductor' of the boat and crew (Shigefuji, 2021). Captains' reputations often serve as tokens of fish quality and help organise trading operations along the supply chain by building consumer trust. Reputation provides a degree of stability to a supplying segment whose quantities and qualities fluctuate over time. A processing plant manager who buys catch from local fishing companies admitted:

The captain, for sure, plays a big role in the quality of the fish that arrives. Depending on the captains – we're used to it – there are times we say: "Oh, it's this captain, it's going to be less nice." Other times, we're happy, because it's Pierre, etc. (Manager of a processing factory, Noumea, 25.01.22)

Similarly, in Fiji, another processing plant manager mentioned that vessel's reputation and past performances framed price negotiations to buy catch (Manager of fishing and processing company S., Suva, 26.06.19).

If the captain is the leading figure of the fishing operation, there is no institutionalised training for tuna fishing in Fiji and New Caledonia. Although fishers must now pass formal certifications, especially to become captains, schooling provided by Maritime Schools chiefly addresses safety and navigational dimensions rather than fishing skills per se. A Fijian captain told me his Maritime School training taught him "about navigation, rope work, deck work... but not about fishing" (Captain R., Suva, 13.06.19).

Tuna fishing is a "serious art", according to a lead historical figure in Fiji's domestic tuna industry (Southwick, 2011). This phrasing suggests that fishing is a craft that relies on practical, experienced, embodied forms of knowledge. Fishing for tuna draws on "tacit knowledge" and "know-how" (Polanyi, 1966; Collins, 2010). One becomes a fisher by doing rather than learning formalised and theoretical knowledge at school: "Learning takes place in the field." (Owner of fishing company R., Suva, 13.06.19). Abiding by this statement, Fijian Captain R. described how he "stole his knowledge" from the captain he used to work for as a crewmate: "Captains would not teach me how to fish so I would

wake up, go to the back after the shooting and count hooks, how many seconds between hooks, the length of the line... I worked with different captains and then applied.” (Fishing captain R., Suva, 04.07.19). Tacit knowledge is hardly formalisable and is passed by direct observation, imitation, and peer-to-peer exchanges. Fishing companies can also contribute to the practical training of the fishers, especially for those managed by former fishing captains. In that case, the transmission of fishing knowledge remains endogenous to the fishing industry and enclosed in a (fairly hermetic) community of practices. In New Caledonia, such a ‘fisher-manager’ explained: “We train them ourselves [our captains]. We identify those who have the stature for it and that’s how it goes. [...] We don’t care if the guy has the education level for this or that.” (Manager of fishing company N., Noumea, 21.10.19). Such training allows for the company to diffuse its preferred standards, e.g. by teaching the crew the Japanese “Ike Jime” method to process the fish and produce sashimi-quality tunas.

The belief that fishing can only be learned in the field, with other peers, accounts for the poor esteem, and even dismissal, by the industry of the governmental attempts to institutionalise the maritime training of fishers. The owner of Company R. exposed that it was now mandatory for captains to go through the Maritime School of Fiji National University, but that it only resulted in producing a new generation of captains with “no fishing experience at all” – when before, captains “used to have the experience but not the diploma” (Owner of Fishing F., New Zealand, 13.06.19). Current certifications do not properly reflect what makes a ‘good’ fisher. In New Caledonia, a manager complained that these regulations only impeded their capacity to recruit the necessary workforce and put additional financial pressure on the industry because of the costs associated with such training:

It’s easy to find the workforce, but very difficult to get certificates. [...] We’re being hassled to the bone by the AFMAR [fisheries authorities] who want to apply the metropolitan regulations, which are completely unsuitable here and which New Caledonia doesn’t have the means to enforce. [...] According to the legislator, we should only have engineers onboard. For fishing. [...]. Our captains, they come from the tribes, and they’re excellent, mark my word! They don’t necessarily have the school level and French is their second language. What are we going to demand from them [...]? To take courses on company management and ship stability? As if the guy, after all this time, didn’t know how to balance his 20-m-long vessel on which he has spent so many years. What nonsense is it? (Manager of Company N., Noumea, 21.10.19)

This quotation points to inadequate maritime labour regulations regarding the tuna fishing industry and the ‘offshored’ and outward status of fishers who are not ‘engineers’. The informal ‘art’ of fishing is at odds with bureaucratic organisation. The excerpt also demonstrates tensions with a distant and ‘blind’ management from the metropole, mismatching local ambitions of employment developments.

The centrality of tacit knowledge makes fishing expertise a highly individual skill. “Every captain has his own way” (Manager of fishing company N., Noumea, 21.10.19). In Fiji, those ways were largely described to me in connection to the captain’s nationality – hinting at the endogenous organisation of

fishing by companies and fleets. Captain J. would use a six-meter-long float rope against ten to twelve meters for Korean captains based in Fiji: “The Koreans have very different styles of making the fishing gear, the branch lines, etc. For instance, they use reflecting tubes to cover the silver of the hooks” (Fijian Captain J., Suva, 10.07.19). He found the technique too hard for his crew, time-consuming, and expensive. This testimony confirms the personal, practical, relatively horizontal, peer-based, and experiential development of fishing expertise, relying on trials, errors and attunement to specific contexts, peoples’ abilities and the fish. “It’s a try-and-see approach” (Captain J., Suva, 10.07.19).

ii. Self-Surveillance Practices: The Captain’s Personal Logbook

To support this ‘try-and-see approach’ and find tunas, captains rely on an array of – relatively informal, little formalised and highly individualised – surveillance practices, combining the surveillance of the marine fish and their environment with surveillance of the self.

Surveillance practices depend on the type of fishery – on the gear used to catch the tuna and the type of tuna (species and age) targeted. Direct fish sighting is difficult, yet possible at times for the pole-and-line and purse seine fisheries which are surface fisheries. These fishing vessels were initially oriented by ‘fish spotters’²⁰³ standing on the ‘flybridge’ with binoculars to look for fish schools surfacing to feed or for birds (Southwick, 2011). Against the difficulty of using direct observation to see underwater, fishers rely on other signs. They may interpret “traces” (Ingold, 2010) of their presence, i.e. marks made by their movements at the surface of the water: e.g. water particles can produce a ‘foaming effect’ caused by the fish’s agitation. Fishers also ‘spy’ on birds as they feed on fish, turning them into surveillant agents that can directly observe the fish or their traces: “The speed of the birds, of certain species, indicate that there may be prey and therefore tunas” (SPC fisheries scientist D., Noumea, 02.10.19). However, birds are only cues and not proof of fish’s presence.

Because it targets deeper-swimming fishes and sets hooks as deep as several hundred meters below the surface, the longline fishery faces very different constraints – arguably more challenging – than the purse seine or pole-and-line fishery. Finding requires identifying the latitude and longitude of the fishing ground and its depth. Direct observation of the fish is impossible, and reliance on birds is not as relevant: “We have no imagery for that” (Manager of fishing company N., Noumea, 21.10.19). ‘Under’ the water, fish leave no traces.²⁰⁴ Fishers must find other strategies to interpret fish presence despite negligible experimental information. Longline fishers have developed an index-based epistemology that is conjectural and indirect, drawing on signs of different natures and largely past-driven (Ginzburg, 1980). To address tunas’ invisibility and reduce the risk of steaming for nothing, longline captains rely first and

²⁰³ An interviewee told me that these “fish spotters” were also called “spies” in the purse seine industry. This expression attests to the idea that humans surveil and spy on the birds to gather ‘intelligence’ on where the fish may be.

²⁰⁴ See however Chapter 8 with scientific developments attempting to analyse DNA traces left by fishers in seawater. Those traces, however, are not usable for fishing operations.

foremost on tracking their personal fishing history, i.e., on producing their own traces. Such recording practices, central in scientific work (Latour, 1987) were heavily encouraged by SPC fishery scientists when they assisted the region with tuna fishery development. The production of records was deemed essential to improve the productivity of fishing operations and make it profitable:

We strongly advise fishermen [...] to develop the habit, on every trip, of jotting in a notebook the following information: Date – Fishing grounds – Weather – Catch (specifying as far as possible the proportion of small, medium or large-sized tuna). These notes will ultimately provide the fishermen with interesting data and knowledge of seasonal variations in the yields of their fishing grounds, thus enabling them to cut down the number of unproductive days. (Angot & Criou, 1961, p. 13)

Self-surveillance practices are now common and even central to the work of longline captains. Here, surveillance is not standardised or imposed. It is willingly performed as a tool for knowledge and fishing to support commercial performance. These logbooks (see Figure 29) are private and personalised. Recorded information depends on the captain and may be more or less detailed, e.g. regarding weather conditions or specific (usually less commercially valuable) species.



Figure 29: A New Caledonian captain showing his personal logbook to a journalist in a documentary on longline fishing. Selected snapshot from a documentary. Source:

https://www.youtube.com/watch?v=bplhxFNxAhk&t=383s&ab_channel=CALEDONIA (accessed : 08.05.24)

A Fijian captain explained he would fill his logbook during the casting of the line but also “right on time during hauling: the crew measures and I write down” (Captain R., Suva, 04.07.19). He showed me a notebook, smaller than his hand, where he had written with a pencil the details of his trip – at least those relating to fishing performances: dates, locations, setting parameters (e.g. hook numbers, distance between buoys), number and weight of tunas that were hauled back onboard after each set. This form of

surveillance is eminently ‘commercial’: captains do not only record where, what, and how many fish were found, but they also track the wider economic details of their fishing operations to assess the cost of catching these fish and evaluate the economic profitability of their fishing operation (e.g. the number of hooks used, the quantity of fuel burnt, presence of sharks biting and devaluating the catch, packaging used to preserve the fish’s quality...) (Former longline fisher, Suva, 24.06.19). The logbook apparatus also permits the captain to surveil the marine environment and its fluctuations, in a region where tuna distribution is seasonal because of large-scale oceanographic features like El Nino/El Nina episodes. Recorded oceanographic features also guide fishers to privileged places at sea: in Fiji, several captains reported looking for seamounts²⁰⁵ to target bigeye and yellowfin tunas. Hence, the logbook first assists with finding tunas. “We, captains, have our own tally book [...] It is a point of reference for us when looking for fish and locating good fishing grounds.” (Captain S., Suva, 20.12.21). Captains record past good and bad spots and return to the best ones, presuming some repetition and regularity in the behavioural patterns of the oceanic environment and fish.

Noticeably, the captain’s log can extend beyond at-sea operations to continue tracking tunas after unloading and into the processing plant – attesting once again to its ‘commercial’ orientation. Once the vessel returns to port, the catch is offloaded and moved to the processing plant. There, fish are recorded, “graded” according to their quality, weighed and prepared to be sold down the supply chain. As I attended such an event, I could see the captain record these operations on his logbook: “Captains keep track of their catch even once it has landed”, a processing employee explained (Field notes, processing operation, Suva, 03.07.19). This step helps the captain track the economic quality of his catch and verify the number of exported fish to ensure that he gets paid accordingly, given that his company remunerates him with a percentage of the catch he brings back to the shore. In that case, what started as a form of self-surveillance to guide the captain’s fishing and commercial practices also supports a ‘bottom-up’ form of surveillance, permitting the captain to control his employer’s remuneration practices: “Reporting is not that bad because I like having everything recorded actually. You get paid for what you report and as the reporting has become more accurate, it reflects in the pay. I tended to underreport before that.” (Captain J., Suva, 10.07.19). This attitude also reveals, as much as it aims to address, some divisions within the ‘fishing entity’ (that I loosely referred to as ‘fishers’ in the previous chapters) and between ‘offshore’ employees and ‘onshore’ employers. In Fiji, additional ethnical, cultural and gender differences heightened these divisions, even in domestic companies. This contributed to an internal climate of distrust (going both ways, as I will show below). One company owner, himself a Fijian and New Zealander, remarked:

²⁰⁵ A seamount is a submarine mountain raising from the ocean floor without reaching the water surface.

There are virtually no Indo-Fijians²⁰⁶ in the sea, it's a very strange mix in the Fiji fishing companies in that the administration is done by Indo-Fijians, with a very high predominance of women in these roles. But not by [indigenous] Fijians themselves. [Indigenous] Fijians are the ones who go to sea. And this creates a problem, a division within the company because you have the administration talking Hindi; you have the fishers talking Fijian and both sides are all stupid; they don't respect each other. (Owner of fishing company R., New Zealand, 13.06.19)

iii. **« Fish-Finding » Technologies: Instrumented Environmental Surveillance**

These fish-finding practices remain highly uncertain. The repeatability of past fishing successes has become even less reliable now that climate change and declining tuna stocks are said to alter tunas' behaviours. Several captains reported their difficulties in finding tuna in their historical fishing grounds. Additional fish-finding strategies complement the logbook apparatus.

Fishing technologies, especially information and communication technologies, play an increasing role in assisting captains in their fish-finding operations and making the commercial exploitation of uncertain offshore resources more fluid. Improved binoculars, sonars, or radars that help with bird-spotting have enhanced fishers' visual capacities for surface fisheries. The purse seine industry may also use helicopters to scan oceanic waters more efficiently from the air. This fishery is, without a doubt, the most technology-driven one. A representative of Spanish service company K., which offers "technological solutions for more efficient and sustainable fishing", told me that purse seiners could have up to two million euro-worth of equipment to help with fish-finding (Representative of service company K., Suva, 09.07.19). This service proposal hints at an underlying (and in this case, foreign) surveillance economy emerging in the fisheries sector. The company recently set foot in Fiji to work across the region, showing that the latter has been identified as a promising market for such surveillance technologies. Fishing technologies contribute not only to a 'commercial' form of surveillance; they also partake in building another commercial sector based on surveillance.

In the past decades, the most dramatic technological transformation in the tuna fishing industry has undisputedly consisted of developing drifting Fish Aggregation Devices (dFADs) for the purse seine fishery.²⁰⁷ These mobile devices exploit tunas' tendency to aggregate below floating objects at sea, making them more catchable than 'free' tuna schools, as they are called by the fishery sector. Hence,

²⁰⁶ The unofficial term "Indo-Fijians" refers to the community of Fijian nationals of Indian lineage, in distinction to Indigenous Fijians. The first Indian settlers arrived in Fiji as laborers under British colonial establishment, and the community represents a subsequent part of the total population (37.5% in 2007 according to the Fiji Bureau of Statistics, before the government stopped its ethnic surveys). The history of Fiji has been largely structured these inter-ethnic divisions, discriminations and exclusions, which entailed in particular political coups (e.g. see Sutherland, 1992).

²⁰⁷ dFADs have to be distinguished from anchored FADs, which are grounded in the seafloor and tend to be deployed in nearshore waters and used by smaller-scale tuna fishers. Although I could not access this sector directly, given that such fishery does not occur in Fiji and New Caledonia, I will still shed some light on that topic to provide some comparative perspective with the longline fishery, and because the purse seine industry is at the forefront of much economic, scientific and management concerns (see also Chapter 8). See the work of M. Airaud for an anthropological analysis of the purse seine industry in relation to dFADs in the Indian Ocean (Airaud, forthcoming).

dFADs affect (to an unclear extent, to date) one main influential feature of tuna resources, i.e. their mobility. dFADs have profoundly increased the purse seine industry's productivity and are now extensively used by the fishing fleets. It was estimated in 2017 that 40% of the Western and Central Pacific Ocean (WCPO) purse seine catch was dFAD-associated (Havice et al., 2019). The industrial use of dFADs started in the 1970s, with Japanese fishers attaching reflectors and radio beacons to track floating logs. From the 1990s, companies began to build floating objects themselves and equip them with additional sensors collecting and regularly transmitting²⁰⁸ georeferenced oceanographic and biological data. Hence, the latest generation of dFADs comprises satellite tracking buoys and echosounders that provide information on the location and movements of the dFADs and its immediate marine environment (currents, wind, temperature, chlorophyll concentration... as well as the presence and scale of biomass around it). SPC estimated that 30,000 - 65,000 dFADs equipped with echosounders were deployed yearly in the WCPO by the purse seine industry (SPC fishery scientist L., 18.11.19).

Echosounders provide intermittent and partial signs of fish presence and quantity. Their information does not – yet – permit the identification of the species, the exact quantity or the ongoing presence of fish under the dFADs (SPC fishery scientist L., Noumea, 18.11.19). Despite these limitations, dFADs still contribute to surveilling the ocean and its fish, as well as attracting and luring them. They facilitate the connection between distanced fishers and their target fish. It is frequent to hear that dFADs have turned fishers from hunters into gatherers (Reyes & Airaud, 2022), making offshore spaces akin to a field or a pasture. They provide surveillance information that helps fishers rationalise their mobilities, allowing them to calculate the opportunity cost of steaming to a specific dFAD and minimising the risk of deploying their gear only to find no fish at all:

They don't fish randomly anymore. The purse seiners know if under this or that dFAD, there is a lot of fish or not. They don't bother to look for what we call the 'free schools' anymore. Now, they almost have their trip planned already. They know that one day of navigation, they go, harvest everything and move to the next. It has evolved in that direction, a lot. [...] It really allowed for optimisation. (SPC scientist D., Noumea, 02.10.19)

dFADs transform fishing captains' jobs: "Before, fishing relied on the skill of the captain and now captains have to become analysts", a representative of the European fisheries delegation in the Pacific joked (EU delegation representative, Suva, 14.06.19). Captains look not so much at the sea than at the vessel's computer screen, which displays dFADs' locations and their associated information. The expertise of a purse seine captain is now indexed to his capacity of reading and analysing dFAD information in relation to his personal knowledge of the sea.

²⁰⁸ According to a SPC fishery scientist working on dFADs, echosounders send information two times a day (SPC fishery scientist J., Noumea, 11.11.19).

While purse seiners surround surface-swimming schools of tuna with their nets, longliners catch deeper-swimming fish along fishing lines and cannot, therefore, use dFADs. Longline fishers still have increased their onboard electronics too, although to a less dramatic extent. Vessel equipment now often involves devices to probe the ocean, such as thermometers to measure sea temperature or echo-sounders to obtain information on current direction and velocity or to locate oceanographic features like seamounts. These instruments help fishers ‘read’ the marine environment to detect likely fish habitats – rather than fish biomass directly. Improved charts and Global Positioning Systems (GPS) facilitate captains’ recording of their movements and fishing set or seamount locations. GPS-equipped buoys also help the captain position and track his mainline that can span over a hundred kilometres: “The end of the line is over the horizon, which is about twelve miles or something. [...] You can’t see it. More recently, we have GPS buoys, a very sophisticated system to know where the line is.” (Owner of Fijian fishing company R., New Zealand, 13.06.19). Not only do longline fishers target an invisible resource, but they also rely on a fishing apparatus they cannot see either.

Many longlining innovations concern fish-luring and obfuscation strategies rather than fish-finding per se. Fishing implies a form of hide and seek game “between the fishing gear and the fish”: “Sometimes, the fish is here but you don’t know it it’s here, if it’s going to eat [the bait] or if you need another bait to lure it more.” (Onboard fisheries observer, Noumea, 15.11.21). Fishing is not just about co-presence, it is about creating effective contact with the fish and the hook – which requires a specific regime of (in)visibility. Some captains use specific lights to make the baited hook more attractive, while baits must be carefully hooked to mask the mortal instrument from the fish’s sight.

Compared to the purse seine industry, the longline fishery remains, to a large extent, much more “artisanal” and low-technology, as worded by several interviewees:

I’d say they’re the ones that have evolved the least regarding technology. They’ve improved the lines, increased the number of hooks, that sort of things, to improve setting, hauling, all that. With regard to the captain, the experience, I think that’s where it still the most... traditional, I don’t know, but simple as in less technologically-assisted. (SPC scientist D., Noumea, 02.10.19)

Technology appears as a sign of industry. Considering that the longline industry also catches lesser quantities, ‘produces’ fish commodities one by one, hook by hook, and is far more varied than the purse seine industry, the lesser reliance on technology fuels common discourses portraying the longline fishery as less industrial than the purse seine one – and, therefore, harder to surveil (cf. section III).

Several reasons can be advanced for the lesser reliance of longliners on fishing technologies compared to purse seiners. First, technological progress has not developed as much. Economic considerations are at play, too, with some companies objecting to investing in costly technologies. A fisheries technology company observed that “the longline industry is very cheap compared to the purse seine, it does not want to spend a dime in technology”: “all the devices are old, even for the navigation

equipment, they do not invest and are very poorly equipped” (Representative of service company K., Suva, 09.07.19). The more diverse longline fishery comprises small companies with lesser investment capabilities. In Fiji, many companies were facing economic hardship caused by rising operational costs and declining catches. Another reason could relate to cultural and customary differences regarding technology – hinting to possibly various ‘fishing ethos’. The same interviewee added: “Korean captains are also happier to use the [GPS-equipped] buoys, etc. because they know how to use it, they are more technology-oriented and curious. They want to experiment with it, while Fijians use the technology but are not very curious, they are afraid of it and try to avoid it.” SPC scientists, too, when they model fishing activities, divide fishers into national fishing fleets, presuming that they have similar ways of operating (cf. Chapter 8). More than an essentialist perspective on fishers and their relation to technology, those cultural ways of doing could reflect situated histories of industrial developments also framed by national institutional and regulatory frameworks. In that case, the ‘technological appetite’ of Korean fishers would reflect the more industrial organisation of the Korean tuna fishing fleet.

2. Networked Surveillance and Espionage at Sea – Between Cooperation and Competition

The fishing industry is known as an information industry. Everybody is looking and watching and talking; there is a considerable amount of information passing. Lots of lies and tips being told all the time. (Owner of a Fijian fishing company, New Zealand, 13.06.19)

As portrayed in the quotation heading this section, fishing is an activity requiring and entailing surveillance and managing information circulation. Fishers do not just look for fish, birds or specific water temperatures. They also actively surveil other longliners at sea.

i. Cooperative Surveillance

“Communication is essential to finding fish in the open ocean”, scholars P. Ward and S. Hindmarsh observed while studying Japanese longline practices (Ward & Hindmarsh, 2007, p. 503). A company manager, who partook in several fishing campaigns, reported that “they [the captains] talk a lot on the radio”: “The first thing they talk about on the radio is ‘How is your catch?’, and that’s also how they know where to fish.” (*Longline 1* owner, Suva, 21.06.19). It is frequent for longline vessels to operate in ‘fleets’ to find their fishing grounds, within the same company or sometimes with vessels from other companies. This strategy turns the *network* of fishing vessels at sea into a surveillance infrastructure used to cover and probe oceanic waters for tuna. In the industry, “there is competition, but there is a lot of sharing of information, in Fiji there is at least” precisely because competition remains limited: “There were roughly 120 vessels and now we are only 60, so there is a far closer liaison within the Fiji EEZ”

(Owner of fishing company R., online, 13.06.19).²⁰⁹ Cooperation also depends on reciprocity in sharing catch reports, interpersonal affinities between captains and companies, or complementary spatial regulations: in Fiji, a company whose vessels fished in the archipelagic waters cooperated with one fishing in the EEZ, permitting them to share information on both sides of the boundary without being able to compete with one another (Fishing operation manager of company R., Suva, 27.06.19).

Such cooperative and networked surveillance is informal and remains fragile. Competition and information withholding resurface as soon as economic conditions tighten. One Fijian company observed: “They [the captains] used to work closely; all captains are friends, and they would talk to each other. They still talk, but these days, as their survival is at stake because there’s more pressure, collaboration declines, now they rather talk to complain to each other instead” (Owner of fishing company F., Suva, 17.07.19).

ii. Competition and Espionage

Information-sharing is not always consensual and reciprocal. Spying strategies occur, deliberately or opportunistically. Those are largely contrived by communication devices that also influence how information circulates. Radio is the most used communication system at sea, yet it is not secured and “anyone can hear the others’ discussions” (*Longline 1* owner, Suva, 21.06.19). That interviewee added: “Some captains know who to tell and who not to, but they often forget that other people are listening, so they still talk about their catch, the weather, etc.” As a result, captains may deploy evasion strategies to avoid eavesdropping. In Fiji, Chinese captains would switch to Chinese when exchanging catch information, so they would not be understood by non-Chinese captains (*Longline 1* owner, Suva, 21.06.19). Some captains use “different [radio] frequencies [...] so that the others cannot listen” (Former longline fisher, Suva, 24.06.19). A Fijian captain confessed to underreporting his catch: “Here, fishing is all about helping each other; you help your own company and sometimes other companies if they are friendly. But I always hide the exact number of fish I have because I don’t want to attract others and risk crossing lines. It’s best when you fish alone.” (Captain R., Suva, 13.06.19).

Again, fishers track traces of their peers’ doings. AIS georeferencing information, originally intended to mitigate collision risks by publicly emitting vessels’ positions at sea, has been rerouted to spy on competitors and see where other fishers are fishing. This new regime of visibility can entail disruptive interactions between fishers – and between different fishing communities, too. In New Caledonia, a company manager reported disputes over fishing grounds between the tuna industry and the game fishing community, afforded by the AIS technology: local game fishers, now able to ‘see’ the longliners, would sometimes cross the reef barrier and cut their lines to defend what they claimed to be “*their* fish”: “Now, with this [AIS] application, they really have the means to come and find the longline and pillage

²⁰⁹ The same observation applied in New Caledonia, where competition is even more narrow.

the thing.” (Manager of fishing company N., Noumea, 21.10.19). AIS information supports opportunistic surveillance usages and becomes multipotent. This creates tensions with its original aim of ‘protective’ surveillance. To escape visibility, fishers play hide and seek, this time not with fish but with their peers: “Some people turn them [the AIS signals] off because they don’t like the information being propagated. Then if you want to fish, sometimes, turn it off if you don’t want people to know. Everybody does that. [laughters]” (Owner of Fijian fishing company R., online, 13.06.19).²¹⁰ Sharing information can support finding fish, but it also risks magnifying competition locally:

There can be up to two or three boats in the same place. We communicate with one another before the shooting so that we avoid being parallel and tangling our lines. I respect who arrives first. I ask what his plan is, and I adapt because I don’t want to risk an accident. But you can’t ask others to leave, everyone wants to catch first. But now, the rule of priority goes to whoever arrived first is not really respected. People have become too desperate to catch fish. [...] As the information circulates, you can have many boats in the same area and it’s like Diwali²¹¹ here! (Captain J., Suva, 10.07.19)

Communication – through radio or AIS – serves multiple usages; it is not just about finding the fishing grounds but also about coordinating once in place to effectively and safely fish, in an environment where things are mobile and hard to control.

3. Networked Surveillance (2): Fishing From and/or with the Shore

Offshore surveillance *by the fishing industry* is not just a captains’ affair. It is increasingly part of the onshore personnel managerial activities of longline fishing companies. Shore-based surveillance by the companies is profoundly commercial in objective – an objective that encompasses other forms of ‘protective’ and ‘coercive’ surveillances to maximise economic profitability by minimising uncertainties. Surveillance serves to support fishing operations at sea, police and control employees’ behaviour, and make the circulation of commodities and trading processes more fluid. Surveillance, connecting the labourers of the sea to their onshore managers, becomes the key to the management of the fishing company in a capitalist economy (Giddens, 1987).

i. Establishing Onshore-Offshore Connections to Facilitate Surveillance

Fishing companies have grown a great interest in communication technologies. Service company K. representative noted that the longline sector was more interested in investing in messaging systems than echo-sounders (Representative of company K., Suva, 09.07.19). In Fiji, most of her work consisted of

²¹⁰ There are similar phenomena in the case of the purse seine fishery, especially regarding dFADs also often equipped with satellite-positioning technologies. Some fishers remove the GPS equipment to ‘steal’ the dFAD from the company that installed it in the first place. As a result, some companies have developed dFADs that “are made to not be visible anymore” (SPC fishery scientist L., Noumea, 18.11.19)

²¹¹ Diwali is a Hindu festival celebrated with many illuminations. Here, the image refers to the lights of the many fishing vessels that illuminate a fishing ground.

providing locally-based companies with “broadband connectivity for email and phone communications” to enable communication with fishers at sea. These companies sought tools to help them overcome their distance to ‘offshored’ employees who otherwise operate disconnectedly.

Today, companies no longer have to wait for the return of their vessels to know about the fishing trips. Information circulates in a timelier manner. Links between a fishing company’s offshore and onshore parts have dramatically intensified. Whether by radio, mobile phone, fax or email, the onshore personnel demand captains to report on their fishing operations while at sea. The technology choice depends on the vessel’s operational distance to the shore, its cost, and the type of information it can transmit (image, text, voice – see Figure 30). A Fijian company whose vessels fish in territorial waters, closer to the shore, relies on radio and phone devices to provide vocal reports, then transcribed by the onshore personnel on paper (Manager of fishing company S., Suva, 26.06.19). Another company fishing in the more remote Fijian EEZ and adjacent international waters opted for a more advanced and integrated system to supplement the radio one. Radio remains important as “it allows personal contact”, but when the weather is bad, “they often have trouble hearing clearly”, the fishing operations manager explained (Operations manager of company R., Suva, 27.06.19). The additional satellite-based systems his company subscribed to combine the “Advanced Track” tool (a name telling of its surveillance orientation) with an emailing system, which permits non-oral communication with the vessel. The emailing system permits the reception of computerised information from the captains at sea following a template tailored for the company. However, emails imply a time lag compared to radio: the company only obtains them once a day. As for the Advanced Track system, it permits the shore-based personnel to “see the vessel, on the computer” (Operations manager of company R., Suva, 27.06.19). ‘Seeing’ the vessel means visualising on a map the coordinates emitted by the GPS equipment of the longliner (see Figure 31) and the fishing line buoys. The information is delivered automatically daily to the company and accessible on demand (Owner of company R., online, 13.06.19).

Thanks to these new communication devices, the onshore personnel receive daily reports from their captains on “what they are catching, and they also give temperature information, things like that” (Owner of Fijian fishing company R., online, 13.06.19). Information provided by the captains is more or less detailed, depending on the company. They first pertain to the location of fish and can contain additional dimensions that are also important for the production of tuna commodities, such as the temperature of the refrigeration system.

II. Surveillance and Fish-Finding Operations

From: Fiji shipoperations
Sent: Thursday, June 27, 2019 7:52 AM
To:
Subject: Catch Report..27/06/2019

S2 Port *Portion*

S3 1923E7921 STMG,F/650L,F/H:1C-3.9,2C-6.1,4P-1.0,M/E:RPM/1100,OP/40,FW/68,GB/1.4,AUX1:RPM/1900,OP/75,FW/76,COMP1:SP/1.0,OP/3.2,DP/12.0,ETD-1510HRS,AOK.
yellow Fur Kg

S5 2015S17944E-Yx16,Ax17,WHLS-15HDS,FC651L,R/COMP#1-SP1.0,OP60,DP180,#2-SP1.0,OP3.4,DP170,ME-RPM1100,OP60,FWT53,PTAUX1800,OP68,FWT52, FH-TEMP#2STBD-1.0,#2C-1.0,#2PT-2.0,#3C BRINE,STMG TO NEW F/G.ALL OK.

S6 17497745 SHTNG OK,F780L,CP1/SPO.3 OP2.8 DP198 GP28 GT-4.6,CP2/SPO.2 OP50 DP198 GP61 GT1.2,AUX1-OP62 FW68,M/E-RPM1200 OP62 FW78,F/H:6P&S8-CHILLING

S9 18247639E,FC1350LTRS,COMP,ME,AUX SAME,FH 1C-1.0,STHG OK.

SX Port *Big Eye* *AKA... Kg* *uhh* *Sail* *Small Tuna*

SX1 2105w17928.b2x30,y2x50,,20.a22x390,mh7x35,olx3,salx10,pagx5-.f.con-666Ltrs.f.h.temp-3p-2,2p brine,..M.E-rpm 900,op 44,fw 45..rpm 1850,op 52,ot 75,fw 66..Shtg a.o.k..
Fuel used

S12 1906E7436 Y2x46,A25x375,MH7x35,ONx8,OP2x35,SPRx10,SKJ3x12. F-1001L

KQ 1128S 17424E FC1330 BP-30.4 BC-30.5 BS-44.7 F1-41.6 F2-42.3 F3-32.5 F4-42.5 F5-40.0 I/H-23.8 B7X200, Y10X170, A25X375, BM3X120

LA Port *other into Compressor operating Pressures*
Fish Hold Temps

1

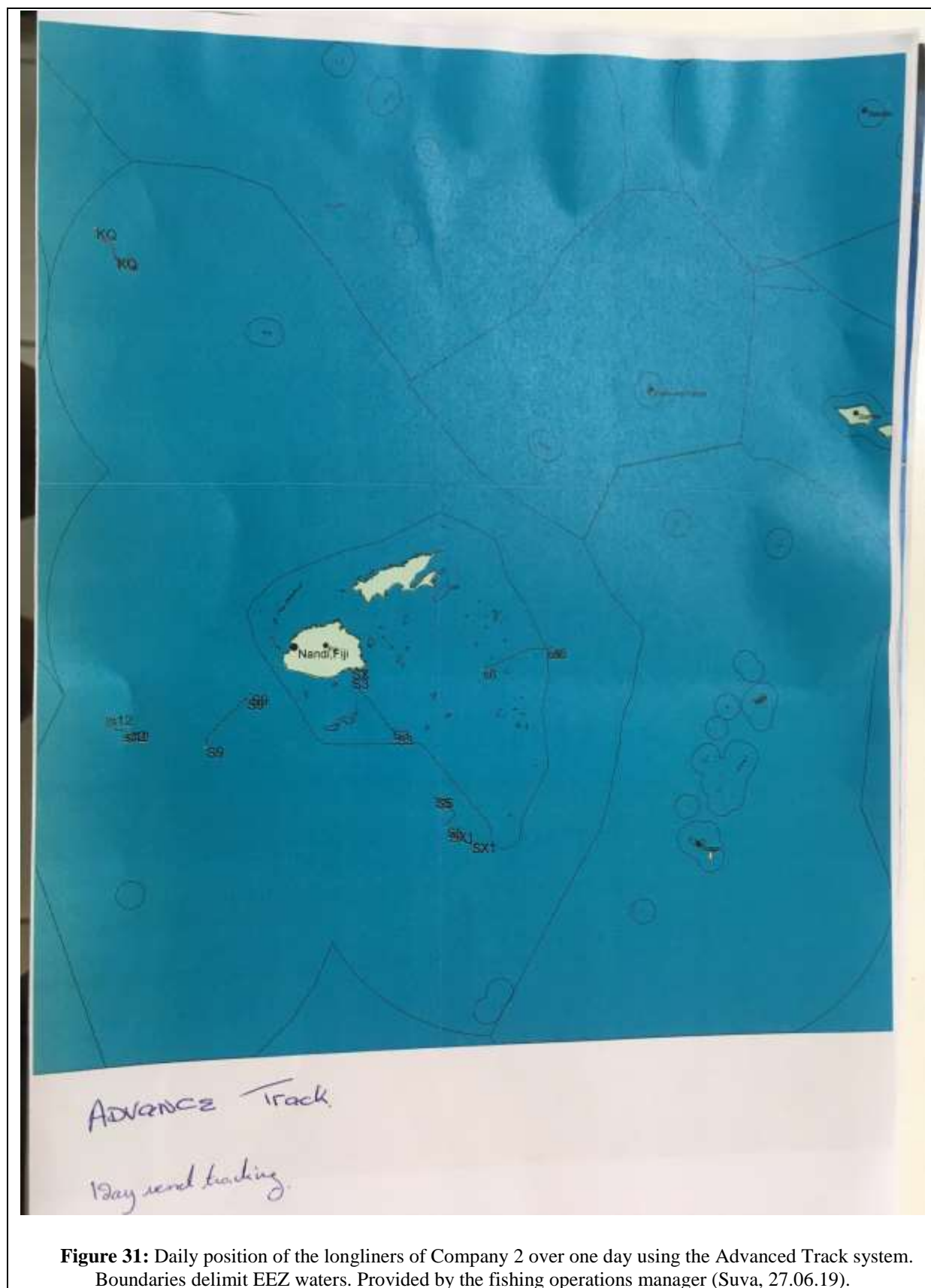


Figure 31: Daily position of the longliners of Company 2 over one day using the Advanced Track system. Boundaries delimit EEZ waters. Provided by the fishing operations manager (Suva, 27.06.19).

Interestingly, companies carefully regulate the social onshore-offshore connections permitted by communication technologies. Service company K. promotes one benefit of these communication technologies as enabling crews to communicate with their families, thereby providing a “good way for companies to convince fishers to go for longer trips, otherwise, they would not want it” (Representative of service company K., Suva, 09.07.19). Such a perspective is not particularly enticing for this company manager:

We’re currently considering installing a Wi-Fi system, with the satellite phones. But the issue is that we have six people onboard, and if they know that, they will communicate a lot [...]. And we perfectly know how it works: “my father just died”, “my uncle just died”, and every time they will come back [to the shore]. [...] Communications with the families risk to disturb the fishing campaigns. (Manager of New Caledonian fishing company P., Noumea, 02.11.21)

What chiefly concerns the companies – and explains their purchase of these systems in the first place – is the reception of operational information necessary to produce tuna commodities. On the contrary, other forms of disconnections and offshoring are willingly maintained for labour productivity.

ii. Assisting Fishing Operations

One immediate benefit from improved communications with the fishers pertains to safety: “The [email communication] system is good because if a vessel has a problem, we can communicate directly with it [...] so it’s also more useful for safety” (Fishing operations manager, Suva, 27.06.19). Companies also use these reports to assist the ‘networked’ fishing strategy of their fleets. With these practices, fishing knowledge becomes embedded in organisations and managerial forms of knowledge and intervention rather than in the individual captain – a configuration characteristic of industrial production (Johnsen et al., 2009).

After receiving captains’ individual reports, the companies I interviewed would redistribute this information to their fleets operating at sea and the vessels about to start a fishing trip. Communication goes both ways. The redistribution of catch information facilitates the coordination of the fishing fleet and the passing of tips on good fishing grounds. In that sense, the onshore personnel play an increasing role in the fishing trip, although to a variable extent. In New Caledonia, a fishery observer depicted how a company’s fleet would scatter across the EEZ to increase their chance of finding tunas before aggregating in the same tuna-rich area and the role of the company in guiding the process:

The fishing companies tend to work in an empirical way. [...] As soon as they find a good fishing spot, they’ll send other boats there. [...] It depends on the companies, but the general approach can be: the company says “that’s where it’s happening”. (Onboard observer, Noumea, 14.10.19)

The company’s centralisation of the catch reports turns the latter into a conductor supervising its fleet’s mobilities. Companies may also share information with other companies and may bypass or

overpass its captains' cooperative networks: "Now, everybody onshore knows, it's not just [my fishing operator] anymore, or [my company], but also [company X] as they share catch reports." (Captain J., Suva, 10.07.19). Disclosure of such information is informal and carefully regulated by the company to safeguard its competitive advantage: "Rather, they discuss, they do not actually share the raw data" (FFIA representative, Suva, 25.06.19). Companies use catch reports to interpret fishing histories, in a similar fashion to what captains do using their personal records, only this time at the fleet level. These activities support a more scientific and administrative approach to fishing operation management to enhance fishing performances: "Of course, we do statistical analyses, we're the ones doing it." (Manager of company N., Noumea, 21.10.19).

The mobilisation of statistical instruments to order fishing operations appeared more limited in smaller-scale, more 'artisanal' companies. Fijian company S., which relied on radio reporting and paper-based transcriptions of the daily catch reports, revealed that it did not conduct formal quantitative and time-series analyses because the paper format of the data was too cumbersome (Manager of company S., Suva, 26.06.19). However, this company was also digitalising its management practices, with the assistance of the Fijian start-up company C., specialised in digital technologies and data analytics. Fishing company S. explained how this could help formalise what remained mostly experiential:

Once you have your data in here [the database], we'll be able to make a trend also, see which month we caught the most of this particular fish. We're not able to do that as of now, we don't have a full database on this full information, in one place. We have the information [catch and effort data] but it's scattered on paper. We just have lots of papers. [...] We don't analyse it on a computer but of course, through our experience, we know which month we'll get more fish, less fish, which month we'll get more albacore, more tuna... But this information is not available in a formal way. (Manager of fishing company S., Suva, 26.06.19)

These analytical tools would help with locating fish and also with managing employees by tracking captains' and vessels' performances:

Interviewee: I'd be happy if I could get my own boat information in a database.

Interviewer: You'd like the information by boat?

Interviewee: Yes, that's utterly important. By boat, by date, so I can see the performance of my boat as well. It's very different from one boat to another. The difference would be the captain himself. The boat also, in a certain way, the size of the boat also matters. [...] You want to analyse where we did wrong if a boat does not perform well.

Fishing company R. showed similar ambition. The operations manager once used the Advanced Track system (which geolocates the company's fishing vessels and lines at sea) to "analyse the data of [Fishing Vessel X], to track the past activities of a very good captain" (Operations manager of company R., Suva,

27.06.19). However, he only did that “out of curiosity”, having many other responsibilities. Surveillance requires labour, instruments and know-how that are not always companies’ priorities.

Another reason for the stronger influence of the onshore personnel in fishing operations is their improved (Internet) access to complementary information, AIS, meteorological and oceanographic ones in particular, that they can provide to the fishers, who are more isolated at sea. In addition to weather forecasts, which are influential for navigation safety and fishing, the fishing industry mobilises proliferating satellite information on oceanographic parameters to identify the most favourable locations for tunas. As the ocean is increasingly translated into satellite measurements, the fishing sector attempts to identify likely habitats and, therefore, the likely presence of the fish.

In 2019, the Fijian company R. had just subscribed to Orbmap, a service provided by a US company, and costing FJ\$1,000 per month, to access various “fish finding maps” (Owner of fishing company R., New Zealand, 13.06.19). These maps show various oceanic parameters, including plankton masses, sea surface temperature, sea surface height anomalies, surface currents, thermocline, salinity, wind, etc. (see Figure 32). Although the information “is not just used by fishermen but also by scientists, etc.”, the software provides information supposedly informative of tuna concentrations: “Tunas prefer warmer spots, of about 17°C.” (Fishing operations manager, Suva, 27.06.19). Regarding plankton, that interviewee explained that “fish are not so much in areas with high plankton levels but rather around the edges”. Before my eyes, he asked the computer to display the position of his company’s vessels as well as the contours of the plankton masses and generate “fishing recommendations”. The computer added circles on the map, suggesting where to fish. A couple of minutes later, the company’s assistant manager entered the office, saying she just communicated with a captain, who had been talking to other captains, only to find that fishing was not good anywhere. Maybe there was a good fishing spot in a high sea pocket around Fiji, so she wanted to ask the operations manager to check on Orbmap “what is going on in this area to see if they have to go there”, in case she would have to alert the immigration and customs services that her fishers were about to leave Fijian waters. This scene demonstrates the complex and distributed organisation of fishing operations and how companies use technologies to improve fish finding as well as to smoothen regulations’ striations on maritime mobilities.

The environmental information these maps provide is then distributed back to the fishers at sea. It is not just the companies that depend on the information relayed by the fishers, but also the captains who rely on information provided by the onshore personnel:

We’re looking at these maps every morning at about 5:30 in the morning. [...] Usually 8am, we pass the recommendations to our fleet. [...] [Showing me a map:] So we sent the vessels there, on the edge of that hot water. Because we believe the fish is in that hot water area. And he has done very well. (Operations manager of company R., Suva, 27.06.19)

That operations manager joked that he was like an “onshore captain”. He reported that more captains came to him before their fishing trip to ask for the information and his opinion. He also told me how once, he assisted a captain with “poor performances” and managed to “keep the boat fishing for fourteen days just by looking at the data” and make it “one of the top boats” (Operations manager of company R., Suva, 27.06.19). The fact that he was also a fisher was seen as a necessity, still. In New Caledonia, trials assisted by SPC to pilot fishing campaigns from the shore had shown “disastrous results”, leading to the conclusion that it was “maybe a good idea only if there is a fish master onshore” (Beverly, 2005, p. 8). Onshore-based ‘fishers’ and offshore fishers detain complementary knowledge – experiential and analytical – because they access distinct sources of information – directly at sea, indirectly from the sky.

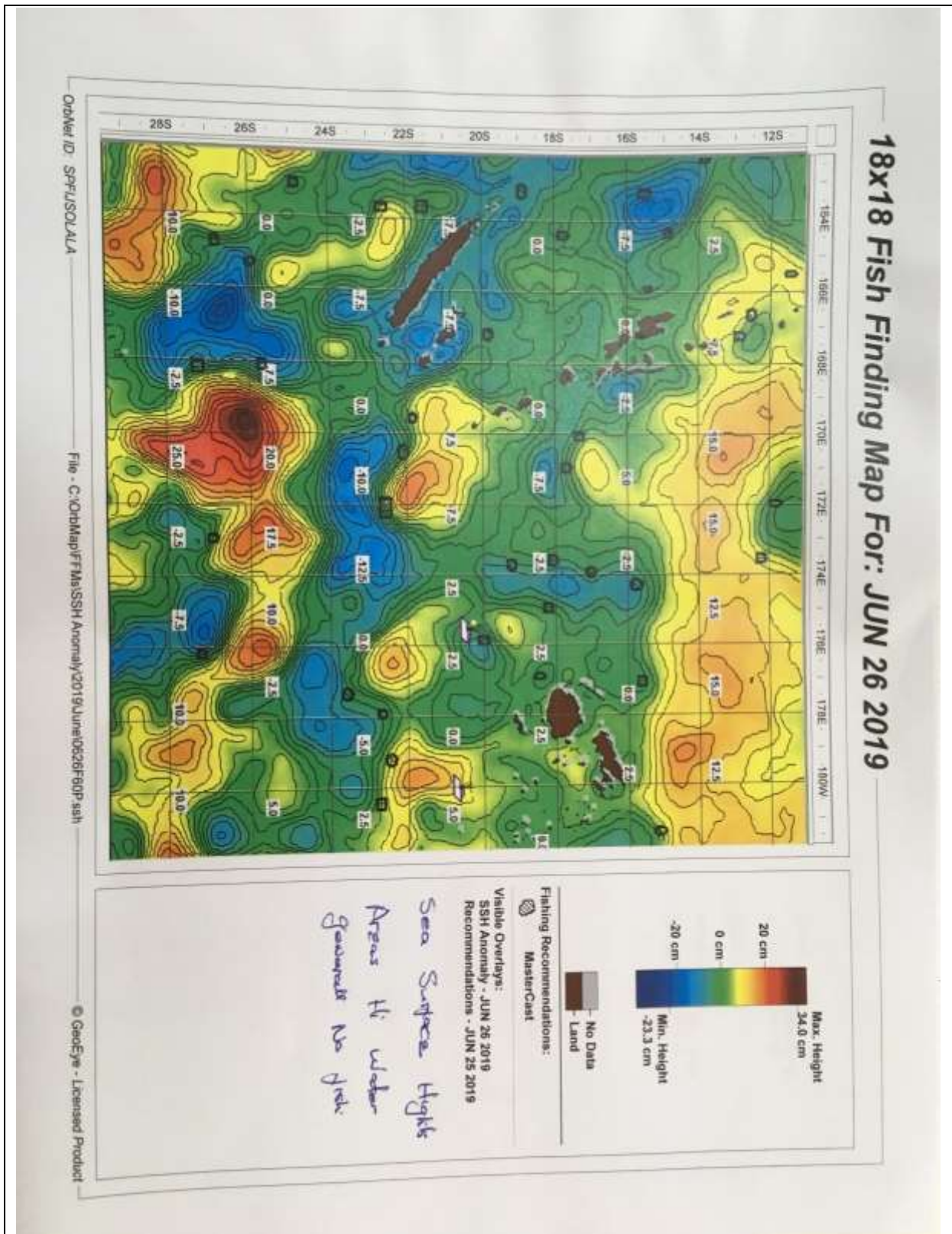


Figure 32: ‘Fish Finding Map’ provided by the OrbMap software showing the ‘sea surface height anomalies’ around Fiji. Picture taken by the author during an interview with a fishing operations manager of a Fijian fishing company.

Once again, I could observe mixed feelings regarding these technologies. These tools often serve several open-ended purposes and are not always tailored to the customers' needs. In the case of Orbmap, the system is not specifically devised for fisheries and its design did not exactly match the needs of fishing company R. The fishing operations manager explained that maps were predefined by the (US) company, which had divided the Pacific Ocean into several square units, and that Fijian waters spanned across several of those. Solomon waters were not included, although its company would fish there.

Besides their design, the overall efficiency of these maps remains uncertain. If, against declining tuna catch and global environmental changes, their attractiveness grows, on the other side, these tools are expensive and heighten already high operational costs. A New Caledonian company ended its subscription to such a service, which it found too costly compared to the unproved fishing efficiency it permitted. In Fiji, another company owner and former captain confessed to having little faith in these tools: "Talking is more efficient, more accurate. You can have all the conditions in one place, and despite that, there can be no fish to be found." (Owner of fishing company F., Suva, 17.07.19). Maps suggest the possibility of fish rather than prove its occurrence. For captain J., another downside is that these "fish finding maps" do not specify what type of fish he would find. All interviewees agreed that these tools could not replace the knowledge gained in the field. They contribute to the wider surveillance assemblage deployed to fish but do not override them. Hence, the fishing operations manager of company R. preferred to describe himself as a mere "adviser": "I am only an assistant; the decision relies on the captain's hands." (Operations manager of company R., Suva, 27.06.19). This positioning also derived from the fact that captains' wages depend on their catch and that he preferred not to be blamed if his recommendations did not match the captains' expectations: what is at stake here is also a matter of responsibility and accountability in governing fishing operations.

iii. Supervising the 'Good' Conduct of the Fishers

Improved communications with the vessel also enable the fishing companies to enhance their 'coercive' surveillance capacities. Companies oversee the activities of their employees at sea to ensure that they do fish, do not steal, and do not imperil the value of the fish with careless manipulations – i.e. that they do their work 'properly'. Surveillance imperatives varied depending on the companies. Defiance seemed higher in the Fijian companies, where high crew turnover, strained economic circumstances and ethnic differences intensified labour divisions within the companies, between offshore employees and onshore managers, and the need for such 'coercive' surveillance.

Offshore labour specificities shape these surveillance imperatives. Contracts tend to be short-term. Skilled positions like engineers and captains can run for several months or a year, but crewmates' contracts are frequently on a per-campaign basis. This organisation seems to match the aspirations of some Indigenous Fijian crewmates, who partake in a few fishing campaigns, make money and return to their home village, envisioning fishing as an *ad hoc* occupation rather than a sustained profession:

“Fijians do not want to stay too long at sea; they only go fishing when they want money but do not see it as a career.” (*Longline 1* (Indigenous-Fijian) owner, Suva, 21.06.19). Against the rigidity of the industrial fishing infrastructures, flexible labour structures are a major strategy for companies to accommodate and react to the uncertain tuna resource. However, as a counterpart to this strategy, flexibility may weigh on the smooth functioning of the industry. Crewing fluctuations make fishing operations more complex: “Every time there’s a new crew, I have to teach them about safety matters and about handling the fish properly as if it was a small baby.” (Captain R., Suva, 04.07.19).

Remuneration policies also influence employer-employee relations. If most fishers I interviewed found that tuna fishing was more lucrative than other maritime jobs (e.g. shipping), some found that, considering the risk of the profession and the lengthy working hours, they were “not getting enough” (Crewmate A, Suva, 15.12.21). Several companies, whether in Fiji or New Caledonia, had a remuneration system involving a fixed salary and a catch-indexed bonus, providing an economic incentive for fishers to bring back as much fish as possible. Two Fijian companies had recently changed the system to cut down operational costs, indexing remunerations (of the crew or the captain only) to the catch. Additionally, it is customary in many companies, both in Fiji and New Caledonia, to complement employees’ revenues with a share of the catch or shark fins to sell. However, in Fiji, several companies stopped these two remuneration practices under the joint effect of shark conservation regulations forbidding shark finning and economic hardships (Fijian Crewmate C., Suva, 20.12.21). These salary cuts inflated the crew's fish-stealing acts – and the companies’ necessity to surveil that they did not.

Control by the companies happens upon the return of the fishing vessel. In Fiji, I could witness a “quality control” and “manager of everything” agent, as he told me, overlook the crew transferring their catch from the vessel to the truck carrying the fish to the processing plant “to make sure that they handle the fish properly and do not steal anything” (Field notes, unloading and processing operations, Suva, 03.07.19). On that day, the company’s owner was also present, for once. Again, I could see him open one of the shark-bitten fish bags, serving as complementary payment for the crew. The general manager inspected the bag and retrieved “nice mahi mahi” that was mixed with the “shark bites” and cut into pieces to blend with the rest. The company would regularly perform such “random checks”. Checks were not so random, as they targeted boats “more prone” to stealing more thoroughly. These offences can lead to the suspension of the crew for up to two weeks. The company used surveillance not only to detect and sanction offences, i.e. as an instrument of knowledge but also as an instrument of control in itself. At landing, the onshore personnel would also record the catch on paper. One company manager confessed that these data were not analysed by the company and that they were only used to “scare the fishers and prevent them from stealing some of the catch”. This strategy abides by M. Foucault’s Panopticon metaphor and disciplinary power of surveillance, whereby the company draws on the

detering power of the gaze to induce (and internalise) self-discipline and self-control among offshore employees (Foucault, 1975).

Offshore-onshore communications, through daily exchanges with the vessels at sea, enable the expansion of ‘coercive’ surveillance beyond the shore and making it more continuous and timelier: “All companies need to have some way of monitoring their vessels to know what they are doing; if they are fishing or just cruising” (Operations manager of Fijian fishing company R., Suva, 27.06.19). That same interviewee, also in charge of interpreting the satellite maps, added that these tools could also opportunistically assist his surveillance of the fishers at sea, even though this was not their primary usage. One map on wind conditions, unavailable to the crew, could help him verify the says of the fishers: by looking at the map, he could “know if the crew lie when they say the wind is too strong to set gear” (Operations manager of Fijian fishing company R., Suva, 27.06.19).

Remote control from the shore has increased but remains incomplete in addressing fishers’ evasion strategies. Some captains would shoot their line as close to the shore as possible, leave the boat to go to the closest villages to “drink kava²¹² before the hauling”, and pay the local communities with part of the catch for their kava (Captain J., Suva, 10.07.19). Captain J. reported that it was common to misreport to the companies, too: “Some captains would report catching 0.5 ton when they actually had one, and report the other half the day after, like that they were able to have a day off in the islands, as they were paid daily.” A Food and Agriculture Organisation (FAO) representative involved in a surveillance development project with the Fiji fishing industry mentioned “this problem of tuna catch disappearing from some vessel” after being transshipped “to some smaller boat that would take it somewhere else in Fiji” (FAO MCS consultant, online, 08.03.21). Several of these strategies pre-dated the new remuneration policies of companies indexing the captain’s (and only his) wage to his catch. This scheme *delegated* the burden of surveillance and coercion on the captain, further statutorily isolating him from the crew and transforming onboard relations. Captain J. described:

Now, the captain is the only one on the boat to care for export. It has become more difficult to handle the crew. I need to keep an eye on them to make sure that they avoid bycatch,²¹³ that they handle the fish properly to avoid bruises etc. I have to yell at them sometimes, more than before. (Interview with Fijian captain J., Suva, 10.07.19)

The captain is turned into an ‘*in situ*’ mediator for onshore managers to control their employees at a distance.

²¹² Kava is a common beverage consumed in Fiji.

²¹³ “Bycatch” here refers to the category used by the Fijian industry to designate non-export fish, especially tunas of lower quality.

i. Making the Global Market More Fluid

Surveillance by the fishing industry is not only about finding fish and controlling employees but also about ensuring the smooth circulation of fish commodities through the supply chain and connecting producers and (distant) consumers. Surveillance helps with planning and logistics: the timelier collection and passing of catch information also supports “the integrated management of the supply chain as a total system, from purchasing and production to packaging and final delivery” (Danyluk, 2018, p. 631).

Given the elusiveness of the resource, the longline fishery production fluctuates over time. This challenge passes on through the supply chain and makes the management of stocks and flows a complex task, both temporally and geographically. A New Caledonian processor explained the marketing difficulties caused by catch seasonal variations (both in quantities and species):

During the high season, we might get 900 to 1,000 large pieces per boat, whereas in the low season, there can be fewer than 100 fish per boat. [...] Commercially, it’s challenging to focus on a single product that’s only available for two months, so we stockpile and sell in the following months. [...] We can only find solutions by exporting the surplus. [...] Additionally, there are delays: we used to receive a container in a week, but now it takes almost a month, necessitating storage. [...] There are market fluctuations. [...] Depending on the quality, prices can rise or fall. [...] That’s where we must ensure that any losses incurred at one point in the year are offset at another, given the uncertainty of what we’ll have at any given time. I can’t predict what I’ll have tomorrow or next month. So, that’s how it’s done! (New Caledonian processing company manager, Noumea, 25.01.22)²¹⁴

Logistics, implying managing the circulation of goods and related information, is a first-hand preoccupation for the fresh tuna market in particular, for which time is the main factor degrading the tuna commodity and causing value depreciation: “As the fish travels, it loses quality so the grade is only good for a couple of days.” (Field notes, tuna grader, processing operation, Suva, 03.07.19).

Captains’ daily catch reports, therefore, also serve those logistical imperatives. The timely communication of catch and other production information from the fishing vessel to the shore-based market actors contributes to accommodating production with storing and selling constraints – especially in Fiji, where most of the industry aims to *export* to foreign markets. Against the high demand and necessity to bring fresh fish to the sashimi consumer as fast as possible and against the high variability of the production segment, part of the catch is bought before it is even landed:

That’s how fishing companies work, nowadays! There’s a lot of demand, everybody wants to buy! [...] It’s a negotiation. There’s a vessel coming next week, so they are talking to us now. They give us an indication of the quantities of what they are carrying, and based on that information, we negotiate. [...] My customer tells me in

²¹⁴ Contrary to the Fijian industry, more concerned by observed declines in catch, the New Caledonian tuna fishing industry struggles with the narrow absorption capacity of its domestic market. Increasing the industry would only exacerbate this issue, hence the limited size of the domestic fleet.

advance: ‘We need this fish, this size...’ and based on that we negotiate. [...] Before the vessels arrive, at least we know what fish is coming in that vessel. That information is important in terms of booking for the freight and export, the logistics for it. (Manager of processing company S., Suva, 26.06.19)

As this quotation mentions, the information also supports the subsequent organisation of fish’s ‘onshore mobilities’ (and aerial ones). Exports are also shaped by flight schedules, which influence the temporality of the fishing operations. The timely circulation of information attunes these various sectors and makes global fish movements and producer-customer connections more fluid.

III. Formal Surveillance by Fisheries Authorities

Company managers are not the only actors interested in drawing connections with the offshore world and surveilling fishe(r)s. State authorities, too, have devised surveillance requirements to collect regulatory information supporting fisheries management and control that fishers comply with management rules. Surveillance begins from the shore, as the return of the fishing vessels to port provides the most obvious opportunity to collect information about the fishing trip. However, this strategy only offers an *ex-post* view of the trip and cannot fully substitute for at-sea surveillance. To address this shortcoming, governmental authorities have delegated the task of surveillance to the fishers by imposing logsheet reporting, thereby turning them into (self)-surveillance agents, and have also placed fisheries observers and vessel monitoring systems on board the fishing vessels.

1. State Surveillance from the Shore and its Limits

In July 2019, I attended an offloading operation in Suva (Field notes, 03.07.19). At dawn, as two longliners returned from their fishing campaign and started unloading their catch to a truck on shore, I witnessed several government representatives attending the operation, overseeing and recording information on the process. One “Enforcement and Surveillance fisheries officer” looked at the logsheet provided by the captain (cf. Section III.2), verifying that the bycatch had been properly recorded. Only two fish individuals of two different species had been logged although the officer did observe more during the unloading. In Fijian, the officer told the crew they should have recorded them all. She did not sanction the fishers and rather privileged a pedagogical approach so that fishers would improve their reporting for the next fishing trip. In Fiji, fisheries officers are more lenient with Fijian fishers than foreign ones, even though their compliance rate has been assessed to be lower (Manoa, 2008).

By 2019, the Fiji Ministry of Fisheries had about 30 officers – a fairly large team relative to the region – tasked with boarding and inspecting *every* fishing vessel unloading in Fiji’s ports. Officers are placed “wherever the fishing vessels go” and “check their [the fishers’] logsheets, check other things on board, including looking at the vessel official, looking at their gear, making sure that the gears are all marked, [...] there’s a whole list of requirements that can be found in our regulations.” (Fiji Ministry of

Fisheries representatives, Suva, 09.08.21). These officers have two main roles. One is to inspect that vessels abide by the Fijian state's rules and detect and sanction potential offences. Another one is to compare what comes out of the vessel and what has been reported by the fishers. In that case, the fisheries officer oversees the fishers' surveillance activities – which I qualify as a form of 'meta-surveillance', i.e. an additional layer of surveillance to control surveillance practices.

Fisheries authorities are not the only Fijian government's representatives to attend the fishing vessels' return. A Health compliance officer from Fiji Ministry of Health was also present on that morning to collect fish samples and check for compliance with EU and US sanitary standards (Cf. Chapter 6 and Section IV). Finally, a port sampler was there to record unloading weights (i.e. the total amounts of each species unloaded from the vessel) and fish lengths, only for Fiji's domestic vessels (see Figure 33). Only a sample of the unloaded fish can be measured "because that would take too much time" otherwise (Former port sampler, Suva, 08.07.19). At times, the port sampler can record details of the export destination, collect biological samples (e.g. muscle, stomach, gonads, ...) or retrieve potential tags placed on fish under the tuna tagging programme. Port sampling serves to collect primary 'scientific' information²¹⁵ and cross-check data supplied by the fishing industry. More recently, port samplers in five Pacific Island countries, including Fiji, started trialling the new Onshore digital application developed by SPC to facilitate data recording, circulation and storage into its main Tufman 2 database:

Onshore is a port sampling facilitating tool. Before, port sampling was on pen and paper, then it was sent to the country office where it may or not be entered in digital format. There were multiple steps and potential for error. Now the app has data quality checks in place for different species. It flags if the length and weight of tuna is outside the normal range. The data collection process is easier with the tablets, it increases efficiency and traceability of the fish caught and of the data itself, it can be linked to logbook records and will encourage more countries to develop sampling. Also, people feel more professional and can use the tablet during spare time so it's part of the success of the app. (Field notes, workshop presentation by a Fiji Ministry of Fisheries officer, Noumea, 12.11.19)

²¹⁵ The data collected by the port sampling programme serve various, yet mostly scientific, purposes: to estimate total catches by gear type and country; to verify logsheet data; and to "raise" length frequency samples and estimate the catch by length interval for the fleet²¹⁵ (Commission, 1994, p. 2). This latter information is used in stock assessment exercises. The distribution of the catch according to length intervals is used to derive estimates of stock recruitment and of the reproductive potential of the population affected by fishing operations.



Figure 33: Officers of the Ministry of Fisheries performing checks at offloading (Ministry of Fisheries Facebook Page, 19.02.20)

As one can see from this short description,²¹⁶ many shore-based officers come to the vessel to conduct specific surveillance activities, each with his/her own mandate and interest. Three main prerogatives stand out: one form of ‘coercive’ surveillance, where compliance is verified by various governmental agencies (e.g. Ministry of Fisheries, Ministry of Health); one form of ‘scientific’ surveillance, to collect information for stock assessment and ecosystem monitoring; and one form of ‘meta-surveillance’, to verify the accuracy of data collected at sea by the fishers. The first two prerogatives – compliance and ecosystem/stock monitoring – show many limitations, however, in enabling the first-hand collection of information on fishing activities. Some of these limitations derive from the geographical peculiarities of the tuna fisheries in the Pacific Ocean. A SPC fishery scientist explained that shore-based surveillance in the WCPO implied convoluted and limiting logistics compared to other oceanic regions:

Roughly speaking, in each ocean, you may have three ports at most [...] so it’s fairly easy. [...] In the WCPO, you have, I don’t know, forty different ports. It’s complicated to do port sampling. What’s more, transshipping at sea is authorised, which is not the case in the Atlantic and Indian Oceans. (SPC scientist L., Noumea, 18.11.19)

²¹⁶ I only have limited information on this shore-based surveillance as I focused more on at-sea surveillance activities. A more thorough analysis of the port sampling and/or land-based inspection programmes would require additional investigations.

The outstanding scale of the Pacific tuna fisheries is challenging, and so are its seasonal variations, which make tuna fisheries all the more mobile:

The spatial distribution of purse seine catches varies greatly from year to year, being influenced by oceanographic conditions associated with the El Nino-La Nina cycle. As a result, the location of purse seine landings and transshipments can vary greatly. It is therefore difficult for PICTs to establish port sampling infrastructure in individual ports when no unloading might occur there for periods of one year or more. [...] On the other hand, it is difficult to establish a port sampling presence in a particular port at short notice when a large number of vessels begins to unload there. (Hampton, 2003, p. 12)

This quotation highlights the many human, material, and financial dimensions underlying onshore surveillance and evidences the rigidity of these infrastructures at odds with the dynamic tuna fisheries.

Shore-based surveillance weaknesses also depend on the individual rigour of surveillance agents. SPC and the FFA reported that port samplers did not always use the correct official reporting forms (SPC & FFA, 2016). Compliance inspection, under the leadership of national administrations, also varies in practice according to the officer's personal commitment and the vessel's profile under surveillance. If "to be done properly, you would have to check everything", inspection is not always so thorough in practice:

Most of the time, you stay in the captain's wheel house, checking for the display of the license, where they have been fishing and if it matches their fishing grounds. It's pretty much up to you how you do your inspection. [...] If the vessel is high risk, you sometimes check the fish holds to see that there's no shark, no illegal species, but you don't check for every fish. If you are very thorough, you check the captain's logbook on everything that happened during the trip, but there's never any verification of every fish that is collected. (Former Samoan fisheries enforcement and surveillance officer, Suva, 08.07.19)

That interviewee described a risk-based strategy prioritising 'riskier' vessels and particular legal concerns – such as the catch of illegal species – rather than an exhaustive inspection.

Most importantly, a fundamental limitation of shore-based surveillance is that it only provides an *a posteriori* insight into the fishing campaign. However, much happens in between fishing and unloading. Observing what comes out of the fishing vessel does not indicate where and when a specific fish was captured at sea – two information essential for both science and compliance. Unloaded fish are not in their original states: the deep-frozen tuna longline fishery, for instance, brings back "highly dressed fish (i.e. lacking head and tails)", which makes species "harder to identify" (SPC & FFA, 2016, p. 110). Similarly, "when marlin are unloaded at port, the trunk, and the loss of colour in the epidermis make it very difficult to identify the species" (Sharples et al., 2000, p. 2). It is also impossible to know the initial weight of fish, although this is a piece of valuable information for stock assessment.

Onshore surveillance does not enable government authorities to collect all the data necessary for their regulatory and coercive objectives. Shore-based surveillance cannot dispense with some form of at-sea surveillance. In the following section, I investigate one primary and principal apparatus of such sea-based surveillance: the fishers' logsheets.

2. Collecting Information from Fishers at Sea: The Logsheets Apparatus

Against the intrinsic limitations of onshore surveillance, fisheries authorities opportunistically rely on the main available infrastructure granting access to the sea and the tuna fishery, i.e., fishing vessels and fishers. The fishing vessel and its operators become not only an infrastructure for the tuna industry and fish supply chain but also an infrastructure for state offshore surveillance. The state partly delegates the task of surveillance by mandating fishers to report specific information about their fishing activities on formalised logsheets.²¹⁷ With this apparatus, which encompasses not only the paper form but also the wider and heterogeneous ensemble of technologies, indicators, actors, etc., the tuna industry becomes both a subject of surveillance (to know fishers' doings) and an agent of surveillance (collecting information about the fishers *and* the fish) all at once.

In this section, I describe the practical implementation of this surveillance apparatus and the challenges of translating the offshore world into data passing from at-sea fishers to shore-based institutions. I also discuss the dual role of surveillance agent/subject placed on the shoulders of the fishers. I examine how the multipotent and shared characteristics of the logsheets impact the functioning of this apparatus. The logsheet is a proper illustration of a "boundary apparatus" (Fortané, 2015) whose functioning relies on the articulation of various actors with various problematisations, motivations, epistemologies, and know-how. The coexistence of these multiple investments is further complicated by the blurred surveillance agent/subject demarcation, which limits the effective "interessement" and "enrolment" of these actors (Callon, 1984).²¹⁸ The logsheet makes visible an offshore world thanks to the surveillance work of different actors with their own and sometimes competing or even antagonistic interests. This tension structures the functioning of the surveillance apparatus, as it is both the condition for its existence and constrains its ability to produce surveillance information. This boundary position supports the production of offshore knowledge while simultaneously producing forms of ignorance precisely caused by the frictional coexistence of incompatible forms of surveillance.

²¹⁷ In Chapter 5, I retraced the historical introduction of this apparatus. I mentioned that there were various terms to refer to these logs. Here, I use "logsheets" to refer to the mandatory log required by fisheries institutions, in distinction to "logbooks", which I use to refer to the private logs of the fishers.

²¹⁸ The notion of interessement, for sociologist M. Callon, is one of the steps in creating alliances and permitting collective action around a specific problematic. Such step consists in 'interesting' actors identified as necessary to address the problem and encompasses the range of actions to have them involved, attribute them specific identities and roles, and agree on a common problematisation. Enrolling actors refers to the successful attribution of identities and roles to these actors.

i. Designing and Circulating Logsheet Forms Across the Pacific Ocean

a. Reducing the South Pacific Ocean Tuna Fisheries into Standard Indicators

In the WCPO, the logsheet apparatus is under the overarching authority of the Western and Central Pacific Fisheries Commission (WCPFC), the regional fisheries management organisation. Member countries must provide logsheet data for their fleets, which are entered in a database managed by SPC on behalf of the Commission. For the commission, these data serve two main objectives: to “meet both the requirements for compliance and for SPC stock assessment, from a science perspective” (Former FFA director, Australia, 03.06.21). These objectives orient the type of information that needs to be collected and its circulation. The WCPFC has set minimum and mandatory data requirements but leaves it to the member countries to establish their logsheets, allowing for the co-existence of diverse forms. This permits the countries to conserve some degree of authority over the scheme, which also serves national prerogatives, and maintain some continuity with their ways of doing prior to the creation of the Commission. However, this flexibility comes at a cost as it makes centralising the logsheet into the regional database more cumbersome. SPC database manager reported the technical challenges in operating the WCPFC database because countries provide “very poorly formatted Excel files”, use different “species codes” or “write in different languages” (SPC database manager, Noumea, 13.11.19).

As seen in Chapter 5, FFA and SPC set standard logsheet forms in 1995 to accommodate both scientific and compliance purposes and be used throughout the Pacific Islands, as part of the latter’s regionalist strategy. These forms are regularly updated to incorporate new requirements from the WCPFC or the Pacific Islands and are, for the most part, paper-based (see Figure 34). With these spreadsheets, countries demand fishing vessel captains to record information on each of their fishing trips and fishing sets, their vessel, their mobilities, the type and quantities of fish caught, etc. In what follows, I operate an “infrastructural inversion” (Bowker, 1994, p. 10) to uncover some of the initial considerations that informed the logsheet design. This allows for unpacking some of the specific conventions, standards and indicators used to qualify, reduce and make legible the tuna fisheries, especially for actors not at sea (Bowker & Star, 2000; Bouleau & Deuffic, 2016).

The SPC/FFA logsheet drew on pre-existing forms and indicators used to describe fisheries and measure ‘catch’ and ‘effort’ especially. It incorporated the ways of doing and knowing of other communities of knowledge and practice, i.e. those devised by ‘modern’ (managerial) fisheries science for the Northern Atlantic fisheries and backing against population dynamics (Telesca, 2017). Still, it had to be adapted to the specificities of the tuna fisheries and the WCPO itself. One influential difference was of a scalar nature: establishing a *common* language to speak of such a vast, international and multicultural world was a challenge. Should the logsheet privilege a universal language, less mastered by the surveillance agents (the fishers), or favour reporting accuracy and dealing with diversity?

There are many examples of such dilemma, of which I will only give a few. Language was the most prominent issue. Using an English logsheet was rapidly abandoned because many fishers did not master it. The use of generic codes to describe fish species was dropped after it appeared that it led to errors amongst fishers who did not learn the codes correctly (SCTB, 1995b). The issue was not just one of language but also of the plural fish nomenclatures existing to describe the offshore world: “For example, black marlin (shirokajiki) is referred to in Japanese as ‘white’ marlin and blue marlin (kurokajiki) as ‘black’ marlin.” (Sharples et al., 2000, p. 2). Different labels entail confusion, but also reflect the co-existence of distinct epistemic and even ontological communities: “There isn’t a word in the Tongan language for each of the marlin species.” (Sharples et al., 2000, p. 2). Eventually, SPC and FFA decided to allow for diversity by translating forms in the most common languages²¹⁹ and use the most common vernacular names.

Metrics, too, were debated. Fishers reported fish weights using Anglo-American measures or the metric system, and it was often unclear who used which (SPC Secretariat, 1986b). Some quantified catch in numbers of fish individuals, others in volumes or weights (SCTB, 2001). Time reporting also caused some problems, given that the WCPO spreads across several time zones that one fishing vessel could cross during a single fishing campaign. The choice to use Coordinated Universal Time, port time or nautical time, raised repeated debates:

The general and often strong opposition to the use of nautical time on logsheets was accepted, and the group agreed to revert to the use of UTC time on all logsheet. The meeting noted however, that there have been problems with UTC time recording in the past, most especially on PS [purse seine] vessels where while the UTC time may have been correctly recorded (as read from the GPS or other instrumentation) the date may be incorrectly recorded (intentionally or otherwise) with the Pacific date and not the UTC date. (SPC & FFA, 2016, p. 9)

²¹⁹ English, French, Japanese, Korean, Mandarin, Spanish

To be “consistent with [...] VMS data recording”, the meeting preconised that year to “revert to UTC time”, privileging coherence between various surveillance apparatuses so that they could be attuned with one another (SPC & FFA, 2016, p. 9).

The form’s materiality also weighs on the apparatus’ design. The paper format, itself influenced by the fishing vessel’s limited space, constrains what can be known and circulated from the vessel to the shore: “The lettering on the A4 logbooks is perhaps small in place, but size A4 paper is convenient in that the logbooks take up considerably less space than they would in size A3 [...], which has been used for certain logbooks in the past” (SPC & FFA, 1995, p. 3). The adoption of A4 sheets was also justified at the time by the fact that many Pacific Islands did “not have the facility to photocopy the current A3 forms” (SPC & FFA, 1995, p. 7). In 2016, the Data Collection Committee reported that “there was no more room on the paper copy form” to add additional cells and report on interactions with whale sharks and cetaceans (SPC & FFA, 2016, p. 10).

b. Putting the Immutable Mobile Logsheet into Circulation: Material Considerations

The logsheet apparatus is relevant for science and management only if it can cover enough of the fishing activities. A SPC fisheries scientist preconised to WCPFC: “Logsheet data need to cover a high proportion of the total catch in order for it to be considered representative. Coverage rates in excess of 80% would likely be considered acceptable.” (Hampton, 2003, p. 3). However, networking the apparatus across a large-scale fishery operating in a large-scale region raises significant challenges.

First, it requires diffusing the forms across the thousands of fishing vessels in the WCPO. To do so, SPC provides the SPC/FFA template to the Pacific Islands fisheries authorities, which are then in charge of distributing it to the industry. This layered organisation can hinder the propagation of the logsheet: “We still have ten-year-old forms being used by certain captains. They really struggle to have the last forms adopted.” (SPC database manager, Noumea, 13.11.19). Retrieving the logsheet to incorporate it into the final database is also cumbersome, preventing timely surveillance. There is a long chain of transmission – and labour – from the vessel to the central database and across the South Pacific “sea of islands” (Hau’Ofa, 1994). There can be months or even years before the logsheet information reaches the database. The fishing vessel must return to port for the logsheet to reach the shore, which can take over a year for some distant-water longliners (Former SPC chief scientist, Noumea, 07.05.21). Onshore, the logsheets must be collected by national fisheries authorities. Depending on the country, the fishing companies are allowed a certain number of days before the transfer occurs. Then, fisheries services must transcribe the paper-based information into SPC’s Tufman 2 database. The process takes time and is largely conditioned by the human capacities of the Pacific Islands administrations.²²⁰

²²⁰ Some countries like Nauru, which lack the human capacity to do the transcription work themselves, send the forms to SPC and delegate the work to the latter (personal communication with a Nauru fisheries officer and USP student, Suva, 10.07.19).

The logsheet circulation was largely redefined over time by technological aspects. In the early days, the Pacific Islands had little access to computing technologies that could stand their “tropical conditions” (SPC’s first computer had to be placed in an air-conditioned room), and little capacity to maintain those infrastructures: “remoteness to service facilities is a reality [for these territories]” (Allinson & Carlot, 1992, p. 5). Internet connection was limited and limiting. As a consequence, logsheet mobilities depended on postal services and aerial traffic. The database was initially decentralised into many national databases split between the different Pacific Islands, which then had to be physically retrieved and brought back to SPC to build a central and regional database (SPC database manager, Noumea, 13.11.19). Progressive advances in communication and information technologies have contributed to smoothening logsheet circulations between the various components of this surveillance apparatus. Current ‘e-reporting’ developments, transitioning logsheets from paper forms to digital ones, are fuelling new perspectives to facilitate logsheet reporting and dissemination and make surveillance more fluid. Digital logsheets, filled by fishers using tablets, promise to collect “data quickly and efficiently” and mitigate content limitations imposed by the A4 format (SPC & FFA, 2016, p. 130). Although e-reporting was only in trial during my field investigations, it sparked great interest amongst regional and national authorities: New Caledonia committed to shift to e-reporting entirely; WCPFC established minimum standards in 2016 to allow and enable the practice; and SPC developed the Onboard application to support its implementation across the Pacific Islands.

E-reporting, as part of a wider digitalisation of surveillance, participates in a new “socio-technical imaginary” (Jasanoff & Kim, 2015) whereby digital surveillance would become real-time, automatic and labour-free. It would facilitate fishers’ reporting work and suppress the lengthy (and error-prone) transcription phase to incorporate paper-based data into the digital database:

These new technologies, if they are properly implemented, they allow you to create data automatically, with minimum effort for the crew, so it becomes really interesting. I talked about it with a fisher, I told him: “If you had a system that would allow you not to fill in the logsheet...” and the guy looked at me with wide eyes saying: “It’d be great, yeah!” (SPC e-reporting coordinator, Noumea, 15.03.21)

This enthusiasm was tempered by other actors:

To be honest, we won’t save much time because we’d still have to follow up to verify. [...] There inevitably has to be a follow-up check, so it takes us just as much time. As for the captains, honestly, I don't really know... Maybe they find it more annoying to use a tablet than paper. Especially since the captains are a bit older, and some of them aren't necessarily motivated. (New Caledonian fisheries officer L., Noumea, 07.07.21)

This quotation attests to two important things relating to the practice of surveillance and the capacity of technological innovations to improve it: a (variable, depending on the captains) degree of inertia and “path dependency” (David, 1985) among the surveillance agents, and issues of control and responsibility

for and over the data – that cannot simply be solved with a ‘technological fix’. I show in Section III.2.iii that resistance to e-reporting is not just technological and practical but also derives from political disputes around data ownership and access.

c. Recruiting Fishers: A Combination of Coercion, Seduction and Compromises

More crucially perhaps, designing the logsheet apparatus necessitates to ensure the effective “interessement” and “enrolment” (Callon, 1986) of the fishers, as they constitute the main operating agents of the apparatus. The first strategy of fisheries authorities was to use legal and coercive powers. Governments turned logsheet data into a non-monetary form of payment, in exchange for a fishing license. In Fiji, vessels must transmit their logsheets within 72 hours to the Ministry of Fisheries. Failure to comply may result in the suspension or cancellation of the fishing license, or in a fine (Manoa, 2008). A former SPC fisheries officer reminisced about the beginning of the logsheet apparatus in the region:

At first, captains didn’t want to have to write everything down. It was extra work, when longline is already difficult work. [...] There was a thought that somebody could use their information, it would not be confidential. [...] S. [a Hawaiian longline captain] for instance, he doesn’t want people to know where he’s fishing. It’s taken him years to figure out everything, so he would be horrified to have people know. [...] But depending on the country, the government can control that. When I was longline fishing in Hawaii, for a joke, after I came back from a trip, the guy from Fisheries [authorities] asked for my report and I said: “No, I’m not giving it to you.” He said: “Then you’re not going fishing again.” I said: “I’m just kidding.” But they have that power: you don’t give the report, you don’t fish. (Former SPC officer, Noumea, 04.05.21)

This quotation illustrates the reluctance of captains to report on their activities, in order to protect their expertise in a competitive environment structured by commercial imperatives. It also hints at the intrinsic limitation of coercion: that of being efficient only if the state has the capacity to enforce it effectively, a capacity which again necessitates and relies on its (‘meta’-)surveillance capacities.

This fragility entailed various considerations to make the reporting requirement also interesting for the fishing industry and elicit compliance. Early meetings of the SPC/FFA Data Collection Committee reflected on how to make the logsheet useful to the fishers, suggesting for instance the production of duplicates so that fishers could also benefit from the surveillance apparatus: “It was noted that promoting the notion that books of logsheets can be produced with carbon-copies would be a *selling point* to fishermen.” (SPC & FFA, 1995, p. 7, my emphasis). In Fiji, there are “four or five carbon copies of the SPC logsheet: one for the captain, one for the company, two for the Ministry of Fisheries and one for SPC” (Representative of service company C., Suva, 25.06.19).

Another strategy was producing information that could also interest the industry. Hence, if fishers ‘buy’ their fishing access with data, the governments similarly buy these data by producing statistical

analyses and studies returned to the industry. This was prominent in New Caledonia,²²¹ where the fisheries authorities and the fishing industry worked closely together to maintain the economic profitability of the sector. A fisheries officer explained that they would produce quarterly and yearly reports at the Territorial level so that individual companies could compare their “performances against the rest of the industry” (Manager of fishing company N., Noumea, 21.10.19). The fisheries service could also conduct *ad hoc* analyses on demand from the industry: “There was one question on yields, because fishers started observing a decline in yields in quarterly and annual syntheses. [...] I’m still working on it, I’ve started an analysis on yields since 2000. [...] They’ve asked us if we could do something.” (Fisheries officer L., Noumea, 07.07.21). From the onset, the New Caledonian system had been conceived to help fishers improve their activities and knowledge of the offshore environment by providing large-scale information to the companies:

Regularly, there would be a restitution of all the observer and logsheet data so that the entire fleet could have a better view of the past year and of our knowledge of the EEZ. *We needed the fishers to feel like they were active participants in management, rather than merely being subjected to it.* [...] Indeed, by being part of the entire reflection and management process, it was important to keep in mind that the fishermen were providing information that should be returned to them with added environmental value. We aimed to achieve this from the very beginning. (Former fisheries manager, Noumea, 11.09.19, my emphasis)

In this case, the strategy was also to incorporate fishers in the governance of fisheries and the EEZ, acknowledging their influence and the need to share power with them for surveillance to be practicable.

Finally, having the fishing industry comply with the logsheet requirement necessitated to *compromise*. Compromise firstly applied to the status of the logsheet data, and to agreeing to protect their commercial value and confidentiality. The logsheet aimed to serve ‘scientific’ and ‘coercive’ forms of surveillance for the fisheries authorities, but they were also inherently ‘commercial’. This implied acknowledging and sharing ownership of the logsheet with the fishing companies for the sake of commercial secrecy. Access to logsheet data is, therefore, regulated by tight and complex access rules, depending on the actor’s identity of the actor and the use of the data. In New Caledonia, an oceanographer explained the restrictions he faced to access the Territory’s logsheet data, even though he was working with SPC on this specific project:

The agreement they [the fisheries service] have with the fishers is not to diffuse the data. As soon as we publish an article, no one must be able to tell the exact location where fishing took place. Maybe a map with a 100km grid will pass, but certainly not with all the points. The AFMAR [the fisheries service] will not authorise something

²²¹ I will show below that this was less clear in the case of Fiji, where relations between the industry and the government were more convoluted.

the fishers don't want, that's the agreement they have with the fishers. (Oceanographer, Noumea, 28.08.19)

Data transmission is limited even *within* the state administration, e.g. regarding financial data: "It is similar to a doctor-patient relationship between the company and the Ministry of Fisheries. Some companies do not want to show how well they are performing, because information is power." (FFIA representative, Suva, 25.06.19). These commercial compromises influenced the very design of the logsheet, as attested in the initial debates to devise the standard form:

In the item 'Activity Code', recording various codes on types of set is required [...]. There descriptions are too detailed. Such detailed information is sort of confidential for each fisherman and seems to be useless for the purpose of research or enforcement. Therefore, Japan requests the SPC to unify the code 1-4 into only one code 'Set'. (SCTB, 1995a, p. 18)

The industry (or its representatives) can plead to remove information from the logsheet or, on the contrary, include indicators serving its interests. In Fiji, the owner of fishing company F. told me about his growing interest in mahi mahi, a common bycatch of the longline fishery:

I made a deal with [the Ministry of] Fisheries to protect mahi mahi [...] by restricting who could enter the fishery: you'd have to be 100% Fijian company to be allowed to fish. [...] I extended the logsheet by adding more information. How many sharks you get, how many heads and shark bites, water temperature. I send them to SPC and Fisheries. I added the information to assess the damages caused by sharks and whales. Recently I concluded an agreement with Fisheries. They help me protect the mahi mahi fishery and I supply all the data I can. (Owner of Fijian fishing company F., Suva, 17.07.19)

The provision of data by the industry also gives the latter some bargaining power. Similarly, the New Caledonian logsheet was under revision upon the industry's request to collect information on depredation by killer whales, to track « how many heads were bitten off » and help the industry mitigate the phenomenon (Fisheries officer L., Noumea, 07.07.21). If surveillance is often presented as a subjectification and domination process of the group subjected to surveillance and public policies and resistance to that process (Demortain, 2019), here, it appears that, because of this reliance on surveillance subjects, surveillance cannot be so unequivocal. Rather, because they are information co-producers, fishers and the fishing industry also become, to some extent, empowered.

Practical feasibility is another cause for compromise. The implementation of the logsheet apparatus requires assessing the type and quantity of data that can realistically be requested from fishers – and the data that would be better obtained through alternative methods. There are many instances of information that are not collected because they are deemed impractical or because fishers do not have the appropriate means and/or skills. Surveillance trade-offs require prioritising certain information but also considering

their quality. As a result of these trade-offs, the apparatus inconspicuously favours certain surveillance objectives over others:

There's a compromise as to the level of what you can ask the skipper to record. I think the most important is that they accurately report the catch. The other information [e.g. thermocline] is important for the science but not necessarily for the management, so I think that's the difference. Measuring the fish does not directly feed in the management; it feeds into the science and the scientific advice then feeds into management. (SPC chief data scientist, Noumea, 22.11.19)

Even though the logsheet apparatus was initially designed to be multipotent, this quotation provides evidence of unbalances in the sharing of the apparatus, which still favours certain usages over others. On the logsheet, fish species and their quantities are reported in an aggregated fashion, per fishing set – partly because it would be impractical for fishers to record every fish one by one. Although those come out of the water one by one, in the case of the longline fishery, the logsheet blends those distinct fish individuals into a homogeneous group weighing x kilogrammes and comprising y individuals. These ways of accounting for 'nature' convey, bridge and favour capitalist and technoscientific understandings of the ocean as a commodity, understood and transcribed in terms of fish biomass and stocks and of populations rather than individuals (Höhler & Ziegler, 2010; Telesca, 2017). The logsheet accommodates the different visions of the sea of the fisheries scientists, managers and industrialists. In so doing, it locks in specific ways of representing the offshore ecosystems, which can hardly be circumvented by other actors that do not have the capacity to produce alternative data.

ii. Filling the Logsheet: Turning Fishers into Surveillant Agents

The logsheet apparatus demands that fishers become the very (self-)surveillance agents of the tuna fisheries. This section investigates how the triple role of fishers – surveillance subject, agent and fisher – affects the functioning of the apparatus by subjecting fishers to contradictory imperatives. It is commonly admitted (and has been evidenced) that logsheet data may not be accurate and that fishers may deploy deceptive or evasion strategies of non-/mis-/under-reporting – either to steal part of the catch (cf. Section II.3) or obfuscate non-compliance with fisheries regulations (e.g. the catch of protected species). The logsheet merges 'scientific', 'regulatory' and 'coercive' forms of surveillance and turns fishers into surveillance agent, subject and "bycatch" (Sandbrook et al., 2018). It would, however, be over-simplistic to attribute reporting issues solely to 'deviant' fishers and their supposed propensity to cheat. It is also the boundary position of the surveillance apparatus that produces forms of "involuntary ignorance" (Dedieu & Jouzel, 2015).

a. *Skilled Fishers, Unskilled Surveillants?*

The logsheet apparatus backs onto the ability of captains to accurately report on their fishing activities, i.e. onto their ability to conduct surveillance activities even though they are not professional surveillance agents. Skilled fishers, firstly relying on tacit forms of knowledge (cf. Section II.1), are not

trained to fill the logsheets. The ‘amateur’ profile of fishers in bureaucratic surveillance work – in the sense of non-professional (cf. Kohler, 2005) – is also seen by fisheries scientists and managers as an inherent source of fragility for an apparatus that remains, in essence, opportunistic: “No data set is perfect, especially here [in the WCPO], where you have thousands of skippers reporting with various competencies what they have. You just have to accept it.” (SPC chief data scientist, Noumea, 22.11.19). The multitude of surveillance agents at play also makes supervision and standardisation more difficult. The longline fishery, more numerous and diverse than the purse seine industry, is the epitome of this limitation. “Longline data are [more] chaotic” (SPC fisheries scientist J., Noumea, 01.04.21). These uncertain administrative skills and alleged ignorance may provide an evasion or passive resistance strategy to the fishers (see Scott, 1985). However, even in New Caledonia where relations between the industry and the authorities are very good and where such forms of resistance are supposedly more limited, reporting errors exist.

Certain fields of the logsheet are more prone to errors than others. Some fields are interpreted differently by captains. For instance, the field to record the length of the longline is either read as the distance between two buoys or as the total length of the line (SPC Secretariat, 1986b). The set location field often contains mistakes, even from the fisheries officers, because of the many figures informing geographical coordinates: “We’re not machines [...], because the figures, for location, it’s not easy.” (Fisheries officer M., Noumea, 14.07.21). Nevertheless, the accuracy of this information is particularly crucial for compliance aspects: “If they are not in the right EEZ, and sometimes it doesn’t take much, if they’re close to a boundary, and it can cause an issue with the Commission.” (SPC database manager, Noumea, 13.11.19). This makes distinguishing between an acceptable ‘human’ mistake from a punishable deception difficult.²²² Captains sometimes forget to fill certain fields on time and do it *ex-post*, not always accurately: “Sometimes, they forget to write down the number of hooks, but we find an arrangement, we calculate with the average number of the previous campaign.” (Fisheries officer L., Noumea, 07.07.21). This quotation illustrates that the logsheets do not always provide ‘raw’ information and can be corrected by managers or scientists, making surveillance a (sometimes invisibly) collective endeavour. At times, a captain himself can also infer plausible information, which makes distinguishing ‘raw’ data from estimated data harder to track. The same manager added: “I think there is redundancy for certain data. For instance, the number of hooks they report, it’s often always the same. Do they use the same number every time they fish? We don’t know.”²²³ (Fisheries officer L., Noumea, 07.07.21). This quotation evidences the difficulty, for the authorities, to verify catch data. They can only suspect plausible errors.

²²² VMS has become particularly helpful in verifying position reporting as the device independently signals at regular times the position of the vessel. Yet, comparing the two sources of information is not easy and bulletproof and requires many complex calculations and interpretations.

²²³ SPC constantly emphasises in its recommendations to fishers that it is better to have missing data than made-up data, yet fishers may be told off for submitting incomplete logsheets so the recommendation is not always followed.

b. Multiple and Distorted Visions at (and of the) Sea

Another important cause of reporting errors derives from the fact that fishers are first and foremost focused on ‘making’ fish rather than monitoring tuna fisheries. ‘Making’ fish and reporting are hardly compatible activities considering the intensity and hazardousness of tuna fishing. For the owner of *Longline 1*, accurate reporting is unsuited to the reality of offshore fishing operations:

Longliners, we don’t know what’s happening under water. Sometimes, the line crosses a school of fish that start eating the line. It gets violent, there’s a great acceleration, all the men need to start hauling, it takes a lot of concentration. The captain is not sitting in his cabin, he’s yelling to the crew, to make sure that the fish do not escape, to make sure that none of the boys will fall off the boat. [...] He controls the boat, at the same time he makes sure the crew doesn’t haul the line too fast. They don’t have time to fill in the logsheet at the same time. [...] There’s no time to record the data, it’s not underreporting, simply a lack of time to record properly. Fisheries think it’s underreporting but it’s not, really. (*Longline 1* owner, Suva, 21.06.19)

The speed of hauling and processing operations necessary to safeguard fish’s freshness (cf. Section I.2) is at odds with the possibility of properly self-recording them. In some cases, the spatial organisation of the operations can hinder reporting activities. A captain explained that he would stay in the wheel cabin to control the vessel and that “it is difficult to oversee everything [on the deck] from the wheel cabin.”, he explained (Captain J., Suva, 10.07.19). As a consequence, it is frequent for the captain to rely on his crew. As the chain of surveillance stretches out, errors can propagate. Hence, crewmates can report a “brown shark” – a category that does not exist on the logsheet and that the captain has to interpret on his own, without actually witnessing what species came on board (Representative of traceability service company C., Suva, 25.06.19).

The scale of the industrial tuna fishing operations constitutes another challenge for captains in identifying species and recording quantities. Offshore surveillance stumbles against the thorny issue of surveilling the multitude: “Reporting is difficult; for instance, if you catch a school of yellowfin, you’re not always sure if you wrote every fish or not.” (Captain J., Suva, 10.07.19). These challenges strike even more in the purse seine industry, given the sheer amount of fish that can be captured in a set, and their aggregation in the net (SPC chief data scientist, Noumea, 22.11.19). Here, uncertainty concerns not only the mass and numbers of fish but also their species identity:

One of the issues we have in the purse seine fishery, it’s acknowledged that when you catch fifteen tons on a fishing operation, the skipper is required to report the catch per species, so for skipjack, yellowfin, bigeye. The reality is they can’t do that because you’ve got fifteen tons in a net and you can’t say there are four tons of bigeye tuna. The reason is that bigeye and yellowfin look very much the same [when they are young, which is the case when they are caught by purse seiners]. You need to be trained to distinguish that, so it’s acknowledged that when I record their logsheet, it’s not accurate. (SPC chief data scientist, Noumea, 22.11.19)

Volumes and density make fish identification difficult, especially for certain fish: juvenile yellowfin and bigeye tunas, billfish and sharks: “Blue marlin has stripes, so they assume it’s striped marlin” (SPC chief data scientist, Noumea, 22.11.19). Shark species are particularly difficult to differentiate, and the recent interdiction to haul those endangered fishes has further hindered their identification. In that case, the regulatory protection of sharks has become at odd with the possibility surveilling them, suggesting a tension between protecting and knowing (see also Chapter 8).

Measuring the fish is difficult onboard a fishing vessel, so most measurements are actually ‘guesstimated’ by the captains. For the purse seine fishery, fish quantities are assessed in volumes based on the net size. Because standard scales do not work on the three-dimensionally mobile fishing vessels, and because most longliners lack any equipment to weigh the fish, they, too, provide estimates. Now, rulers on board the vessels help measure the fish and convert length into weight thanks to conversion scales established by SPC scientists – but such conversion is not possible for every species:

Before, we didn’t have any ruler to measure the sizes, we’d eyeball and I’d underestimate. [...] Now we can measure mahi mahi but we wouldn’t know the weight still [for lack of conversion scale] so the estimate is still visual only. I was surprised to see how much a mahi mahi could weigh in the processing factory. (Fijian Captain J., Suva, 10.07.10)

Parts of these imprecisions in reporting are attributable to the practical difficulty of properly seeing every detail of the fishing operation and the catch. They also derive from the fact that fishers, fisheries managers and scientists bear different gazes on the offshore world, on what *counts* and should be *accounted for*. I already mentioned differences in nomenclatures, but these differences also guide and reflect the attention of the surveillance agents in the field. A fisheries officer acknowledged the intrinsic limitations of relying on fishers to obtain ecosystem information: “It’s still fishing data, after all. When fishers send you the logsheets, they’re only interested in what they’ve caught, which for them means what they brought on board and kept. Bycatch and discards hold only very marginal interest for them.” (Former New Caledonian fisheries officer, Noumea, 11.09.19).

Not every fish has the same visibility to the eyes of tuna fishers, who are chiefly interested in commercial fish. In contrast, fisheries managers and scientists are increasingly interested in bycatch and discards to evaluate the effects of fishing on marine ecosystems. I could witness a telling illustration of this phenomenon in Fiji as I accompanied the traceability service company C. (see also Section IV) to one of the longline vessels trialling a new monitoring system. Crewmates had been tasked by the company to tag “all the fish they’d caught” but had ended up tagging tunas only. The representative of company C. joked: “For fishers, ‘all the fish’ only means ‘all the tunas’!” (Field notes, traceability test, Suva, 25.06.19). An SPC scientist studying the purse seine fishery indicated that “unsuccessful sets [a set with “no fish, the fish escaped, or it was just a very small capture”] tend not to be recorded because they are not interesting for fishers”, even though the information would be valuable for scientists to

assess fishing effort (SPC scientist T., Noumea, 08.11.19). Information on the absence of fish has value to the scientist but far less for the fisher, for it brings him no money. The understanding of ‘bycatch’ also differs between the industry, fisheries managers, scientists or NGOs. In Fiji, “everything which is not exported is considered bycatch” (Field notes, unloading and processing operation, Suva, 03.07.19). Bycatch is understood from an economic perspective and encompasses a wider ensemble of fish, including certain tunas – which clashes with the definition used by NGOs (focusing firstly on incidental, non-commercial and endangered species) or by managers and scientists (for which bycatch designates non-target species but includes “secondary targets” that are commercialised).

Overall, it is generally admitted among fisheries authorities and scientists that logsheet data only poorly capture bycatch and discard information:

Data on both bycatch and discard levels in tuna fisheries are poor, for several reasons:
-vessel logsheet data in the main does not provide good detail on either issue, because:
- filling out logsheet is an unwelcome chore to most skippers, and getting any data at all is an uphill battle; - the main priority to date has been to obtain data needed for stock assessment of target species; - fishing vessel operators, already reluctant to report the details of their operations to a central authority, are even more reluctant to provide information on events and practices which they fear may have negative repercussions for themselves. (Preston, 1997, p. 43)

In addition to the limitations I just mentioned, these findings point to a persistent and irremediable tension induced by the multipotency of the logsheet apparatus and by the dual role of surveillance agents/subject of the fishing industry.

c. A Shared Infrastructure Torn Between Fishing and Reporting

We have to report more and more. What do you want us to do? Catch the fish or fill in all the data? (Longline I owner, Suva, 21.06.19)

In this head quotation, this Fijian fishing industry member complained that the industry bears two competing roles of fishing and reporting. The manager of fishing company S. also mentioned that “ten years ago, all we had to do was fish, and now we have to write, etc., it’s a difficult change.” (Field notes, certification workshop, Suva, 29.05.19). These testimonies reflect that the main tensions traversing the logsheet apparatus derive from misaligned prerogatives between surveillance agents (fishers) and surveillance authorities (fisheries managers and scientists). If the logsheet apparatus was partly designed to compromise with the industry’s interests to interesse and enrol the latter in conducting reporting work (cf. Section III.2.ii), such process has remained incomplete.

Reporting requirements imposed on the fishing industry have only thickened with growing scrutiny over the tuna fisheries. Environmental considerations and the rise of the data-intensive ecosystem-based management paradigm contributed to this phenomenon, necessitating to report on “many more species, on bycatch, on discards” (Manager of Fiji fishing company S., 26.06.19) — even though fisheries

authorities recognise data limitations. “That’s the downside of EBM [ecosystem-based management], because it requires more data, more scientific information. [...] People say that EBM makes fishermen’s job more complicated because they need to collect more data.” a tuna scientist admitted (Tuna scientist, Suva, 24.06.19). Besides the ‘ecologisation’ of tuna fisheries management, additional safety regulations also add to the pile of reporting requirements.

Hence, logsheets have become more comprehensive, asking about additional species or “distance between floats”. Other reporting duties have also been developed and applied to the fishers. In Fiji, for instance, fishers must also submit “landings data” at the end of every fishing trip. They must send weekly reports to the Ministry of Fisheries of their position and catch throughout the fishing campaign. They must send daily reports to Maritime Safety authorities while they are at sea. A representative of Fiji Fishing Industry Association, who used to work for the Ministry of Fisheries, admitted to this reporting overload:

I did not really see much problem with the industry because I had the viewpoint of the government. But now that I’m more involved in the industry, I better understand their issues, the industry has to comply with so many regulations and agencies. They have to comply with, and report to, [Ministry of] Fisheries, Maritime Safety, customs, trade, health people... They each have their own way of doing things, it makes the process more complicated. Officers at Fisheries are trained at the university, they don’t understand the sector, they’ve never seen the fishing industry side. They always demand for data, everybody wants data, but they don’t communicate. (FFIA representative, Suva, 25.06.19)

One reason for the multiplication of surveillance streams stems from the lack of inter-agency communication as this interviewee explained: “They all ask for the same data but there’s no centralisation, there’s no sharing of the data, Fisheries [authorities] don’t communicate it [the logsheets] to the other ministries.” The design of a shared and multipotent apparatus, compromising with the fishing industry to make surveillance practicable, appears to have partially failed because of its limited sharing, which entails duplication and surveillance work overload for the fishers.

The intensification of reporting causes growing discontentment. It can even affect some companies’ fishing strategies. In New Caledonia, company N. ceased to operate in the neighbouring high sea waters to alleviate its reporting duties: “We were getting even more hassled with paperwork, this and that, the stuff from the Pacific Islands Forum, it required a lot more documents... Forget about it, we decided to stay within the New Caledonian zone.” (Manager of fishing company N., Noumea, 21.10.19). *Longline I* owner expressed feeling caught between the reporting requirements and feasibility and complained about the burden surveillance puts on the industry’s shoulders:

You have to make sure that your records are accurate because if there is a difference between your catch data and the offloading, it does not look good for the vessel, it’s qualified as underreporting. But [Ministry of] Fisheries, and the other agencies, they

don't understand how difficult reporting is, because they're not at sea. Only fishers should manage fisheries, because only fishers can understand what it's like. (*Longline I* owner, Suva, 21.06.19)

Similarly to the FFIA representative, she questioned the legitimate governance of tuna fisheries and criticised the inadequate management of the fisheries by 'non-fishers'. This stance was also shared by the owner of fishing company F., who found the intensification of reporting demands particularly infuriating, considering that there was "nothing left to monitor" (Owner of fishing company F., Suva, 17.07.19). He was highly critical of Fiji's (mis)management policies which he thought underestimated stock decline and caused overcapacity by granting too many licenses:

This flailing about sustainability talks, electronic monitoring, capacity building in the fish catch monitoring sector is a farce. They can do all the monitoring they like, electronic or viewing the crystal ball... The end result will be a big report revealing what we have known for years: gross overfishing has destroyed the profitability, and therefore sustainability, of the industry. These measures will not bring the dead back to life. Only a drastic and immediate reduction in vessel numbers will do that. And we all know that's not going to happen. (Owner of fishing company F., Suva, 17.07.19)

His remark resonates with the work of law and geography scholar I. Braverman on the environmental surveillance of coral bleaching, which highlighted the gap between the extensive efforts deployed to anticipate catastrophe and the absence of regulatory response (Braverman, 2017). She argued that (scientific) surveillance only entailed more surveillance and even undermined political power by acting as a "busy noise that distracts from the real working of power" (Braverman, 2017, p. 22). Surveillance thus becomes a means to depoliticise the contemporary ecological crisis, diverting attention "through a preoccupation with calculation and temporary solutions" (Braverman, 2017, p. 26, see also Chapter 8).

iii. A Frictional Boundary Apparatus: Shared Surveillance or Failure to Share?

The logsheet apparatus was devised as a multipotent and shared boundary apparatus. This entails friction, which affects its functioning and its ability to support the production of knowledge regarding the offshore world. The boundary position of the apparatus articulates but also puts in competition various and sometimes incompatible perceptions, interests and skills of the actors involved in the production of logsheet data, which shapes what can be known and what is left unknown. In this section I show that these frictions and the failed 'commoning' of surveillance information eventually results in the duplication and redundancy of surveillance efforts and apparatuses.

a. Boundary Apparatus, Misaligned Interests?

Completing the logsheets raises many practical tensions between the act of fishing and surveilling. These tensions are further exacerbated by the fact that the interests – and ensuing informational needs – of fishers and fisheries authorities are only imperfectly aligned. The design of the logsheet permits the collection of information that has limited interest for the fishers: "The logsheet is just for the Ministry

of Fisheries. I do it to comply by the rules but it's of no use to me." (Fishing captain R., Suva, 27.06.19). Logsheets focus on monitoring (in an aggregated fashion) catch, bycatch and discards to verify compliance and assess stocks. Fishers' personal logbooks record information that permits them to enhance their profits by tracking their fishing practices and their catch until the point of selling. Similarly, the fishing companies only show limited interest in the logsheet data and see this form of surveillance as a helpful contribution rather than as a useful practice for their industrial operations:

Interviewee: Let's say it's part of our social role! [Laughter] To contribute to the advancement of knowledge. The thing is, we're not opposed to that at all. There's only one thing we disagree with: it shouldn't be a burden for us. We're willing to help, but it has to remain reasonable.

Interviewer: Is it really just about providing a service?

Interviewee: Of course not, we're interested obviously, we take advantage of knowledge but I mean... it shouldn't become burdensome because as of now we haven't really seen any returns that... (Manager of New Caledonian fishing company N., Noumea, 21.10.19)

This testimony highlights that, theoretically, the industry should benefit from the knowledge produced thanks to the logsheet surveillance apparatus. In practice, such benefits have remained fairly inexistent. Many industry representatives felt that scientific research from logsheet data was at odds with the knowledge they effectively needed to manage fishing operations. Mismatches were of scalar, temporal and thematic nature. The manager of fishing company N. explained that SPC studies, most often considering the WCPO to cover the distributive area of the tuna stocks, were too large in scale for their needs: "If they have interesting things to say to us, we're interested but... SPC has very wide objectives, that do not concern us. [...] Data are pretty global, and when I ask where I need to go to fish, no one can answer me." (Manager of fishing company N., Noumea, 21.10.19). Another industry member found that SPC provided outdated knowledge considering the slow delivery of the logsheets to the regional database: "Their information is running years behind." (Owner of Fijian fishing company R., Suva, 13.06.19). Several industry representatives complained that stock assessments only considered the biological viability of the resource, leaving aside the economic dimensions of 'sustainable development' (owner of Fijian fishing company F., Suva ; owner of New Caledonian fishing company N., Noumea, 21.10.19; owner of Fijian fishing company R., Suva, 13.06.19).

One evidence of the failure to fully interesse and enrol the fishers is that the logsheets have in no way supplanted their own surveillance practices through their personal logbooks. Despite fishers' complaints regarding reporting work, one can observe the duplication of fishing logs. If the different logs seemingly contain similar information on catch and effort, their co-existence attests to distinct usages and orientations: "Some captains have three logs. It depends on the level of details some are just for fish and gear, or because you have illegal activities. Some also keep logs for their own flag states, as

the US purse seiners do. It depends on the focus of the logsheet.” (Former SPC officer, Noumea, 04.05.21). The captain’s personal logbook remains his privileged log: “Further, it has long been apparent that many logbooks are not filled out by crewmembers; rather, they are transcribed from the fishing master’s logbook at the fishing company’s headquarters or by the vessel agent. This practice is widespread, particularly among Asian fleets.” (SCTB, 1995a, p. 2).

The existence of these tensions has been recognised by management institutions, at least at the sub-regional level. An FFA representative asked to consider more frontally “whether the current information in the data forms is *useful for the commercial sector*” and said it was “necessary to look at reducing user difficulty and integrating different requirements (i.e. science, compliance *and possibly industry*)” (SPC & FFA, 2016, p. 4, my emphasis). Considerations on the need to better integrate surveillance requirements within a shared surveillance apparatus continue and strengthen, even though I showed that such a perspective seems inherently limited.

b. Whose Data? Frictional Data Circulations

Duplication is also visible in other *loci* relating to data circulation and management. I described in Section III.2.i the practical and technological hurdles to circulate the logsheets from vessels to fisheries authorities to the regional database, and the new perspectives brought up by e-reporting to facilitate this section of the data lifecycle. The convoluted, layered and frictional circulation of the logsheet data is, however, not attributable to technical dimensions only. The smooth centralisation of the data is hindered by subjacent political struggles to access those data, raising issues of data ownership and control – and through that, of control over fish and their associated fisheries. This, in turn, affects the functioning of the apparatus and entails, once again, the duplication of surveillance efforts.

Fisheries data politics have shaped the design of the regional Tufman 2 database. From an external perspective, SPC database seems to embody a central, regional and shared repository when, in fact, it is internally fractured and striated following strict access rules that reflect and enact the complex articulations of the industry, national authorities, regional organisations and other actors attempting to access fisheries data (see also Chapter 5):

If they license a foreign vessel or a domestic fleet, the national administrations own the data. [...] Those countries have advised or authorised us [SPC] to release their data to other entities based on this data-sharing or dissemination rules. [...] FFA is also authorised to see certain amounts of data. When we get requests from outside, sometimes we get a request from an NGO, we always have to refer back to the countries on whether or not we can release the data. [...] We put together a public domain dataset. It’s hardly aggregated and all the countries have agreed that this level of aggregation is deemed OK to be in the domain, the 5° square catch estimate for instance. [...] The reason for that is that we get a lot of data outside the SPC membership; we get data from Japan, Korea, US... and that’s aggregated. (SPC chief data scientist, Noumea, 22.11.19)

National administrations own the logsheet data of their fleets and waters – attesting to the fact that the logsheet surveillance apparatus is, *prima facie*, a governing instrument of the state. Sovereignty over fisheries data becomes a token for its sovereign rights over the EEZ and the tuna resources. States control what can be done or not with their data and by whom: “normally, for NGOs working with the countries, it’s accepted but for NGOs working independently, their request [to access the data] won’t be” (SPC chief data scientist, Noumea, 22.11.19). Fishing companies can only access the logsheet data derived from their own fishing activities, in ‘payment’ for their cooperation in the activity of surveillance. Support organisations like SPC and FFA access those data upon permission from their members, for specific utilisations. The only people entitled to full access to the entirety of the logsheet data are a few stock assessment scientists at SPC: “That’s what Japan actually required for us to use their data. Only six people can log in and access these data, which can only be used for very specific purposes.” (SPC chief data scientist, Noumea, 22.11.19). Other requests to access WCPFC database need to be unanimously validated by WCPFC member countries.

States remain the prime (but not exclusive) users of the logsheet data, which they mobilise for two purposes: to “inform the fisheries commission on what’s going on in [their] EEZ and therefore satisfy the Commission’s disposition” and “improve [their] knowledge of [their] EEZ” to manage their fisheries and waters (Former New Caledonian fisheries manager, Noumea, 11.09.19). Reporting duties to the Commission put the national authorities in the dual position of surveilling their fisheries while also being surveilled by the Commission and the other member countries – thereby providing an incentive for deception and fraud. In Fiji, a private surveillance operator working with the Ministry of Fisheries observed how “protective of these data” the ministry was: “They don’t want me to be in the data center, in case they don’t declare shark catch. They wouldn’t want this information to be disclosed to an outsider like me. I think it’s because the government would rather deal with the industry themselves.” (Representative of digital service company K., Suva, 09.07.19). Although this assertion is hard to verify, it suggests that the Fijian government would rather manage the industry in a sovereign fashion than at the regional level with WCPFC, in line with the historical developments described in Chapter 6.

These dualisms and conflicting interests lead to the duplication of surveillance databases and the multiplication of associated surveillance efforts by fisheries agencies:

The monitoring of fishing activities is my primary responsibility. The bulk of my work involves collecting the logbooks produced by the captains, entering the data into a database, and analysing it quarterly to create brief summaries, followed by annual summaries. These summaries cover the entire sector and are distributed to the fishing company owners and the Offshore Fishing Observatory, which includes the Provinces and the Government, for regulatory monitoring. *We have a dual entry system: an Excel entry that stays in-house for the quarterly and annual summaries, and another entry into a software called TUFMAN 2, hosted by the SPC, which is used for stock status studies for the WCPFC. I enter the data twice.* (New Caledonian fisheries officer L., Noumea, 07.07.21, my emphasis)

Long reliant and subjected to external forces regarding data management and knowledge production, the Pacific Islands appear to grow their independence in that regard and internalise surveillance:

Users [national administrations] are more and more demanding to produce their own reports. That we make the data available, so they can work with it, cross-reference is as they wish, have more flexibility. [...] There are more users requesting the raw data to create their own reports. (SPC database manager, Noumea, 13.11.19).²²⁴

E-reporting developments revealed these tensions over the status and dissemination rules of logsheet data. The frictions hindered the deployment of the surveillance technology. E-reporting not only changed the format of the logsheet from paper to digital, it simultaneously transformed the circulation path of the logsheet data, bypassing intermediaries to reach SPC database in a timelier manner. This caused reluctance and resistance to e-reporting over the disputed control of logsheet data and conflicting forms of surveillance:

Interviewee: The objective of the SPC is to have data flow from the boat directly into their database and then provide access to the database to the fishing companies and others who'd need it. The sticking point for Onboard with the government and AFMAR [Maritime Affairs] here is precisely this issue. Currently, the captain or the fishing company brings their logbooks to AFMAR, where they are deposited and countersigned to confirm receipt. Then, the logbooks are entered by AFMAR into a local Excel database and also into the TUFMAN database, which is managed by SPC. This process is lengthy, involving double entry, and there is even data entry by the fishing companies themselves. [...] This method ensures that data passes through AFMAR before reaching the SPC database.

This is where the problem arises for Onboard, AFMAR, and SPC, on that specific topic. If Onboard were to input data directly into TUFMAN, it would provide access to AFMAR and the fishing companies, but it'd bypass the AFMAR validation step. This validation is crucial because there is a legal obligation to report fishing data to obtain licenses, so having proof that logbooks have been submitted to AFMAR is important. [...] Additionally, there is a need to ensure that data integrated into the database cannot be modified before being validated.

Interviewer: In theory, if there are fewer copies, there should be fewer errors, right?

Interviewee: Fewer errors, yes, but not necessarily fewer modifications. Someone could still modify the data... [...] I'm talking about something that might never happen, but the captain could hand it to the fleet manager, who might say, "Oh, let's change this before sending it to the SPC." You have no way of knowing if that happens.

²²⁴ To satisfy their reporting obligations to the Commission, member states must supply their logsheets as well as produce yearly scientific and compliance reports, firstly using logsheet data, on their EEZ and fisheries. The Pacific Islands use the SPC-developed DORADO application, which assists with data analysis. Initially devised to satisfy the interests of the Commission at the regional level, the tool is increasingly appropriated by national administrations to also support the government of fisheries at the national level.

Interviewer: Because SPC doesn't perform the verification work that AFMAR does?

Interviewee: I don't think so; it's not its role. It's not an inspector. [...] It's also a matter of responsibility. (New Caledonian fisheries observer manager, Noumea, 14.10.19)

From this interview, one can see that e-reporting entails competition for priority access to the data as well as responsibilities and control, understood this time as verifying and vouching for the quality and integrity of the data. This struggle is partly attributable to the dual status of the state as both a governing body and a subject to WCPFC obligations.

In Fiji, there was also some discontentment regarding the new informational circuit induced by e-reporting. This time, criticisms came from the industry itself:

The problem with this app [...] is that all the data will directly go to SPC. The Ministry of Fisheries and companies will have to request it from SPC. Thus [fishing company S] prefers to use [our application] and keep ownership of the data. [...] With Onboard, the time lag will be reversed: SPC will have data on time, but the companies won't anymore, they will have to request it from SPC, it will take some time for the demand to be processed. It's very hard to get data from SPC. [...] SPC loves to receive the data and sit on it. (Service company C. representative, Suva, 25.06.19)

Access to the data from SPC for the industry is hindered by the fact that SPC is a support institution *for the governments*: “We don't work with private companies. We don't have a mechanism to work with the companies, that's another problem, unless, say, Fiji tells us to work with them. [...] It's our *raison d'être*, to serve the countries.” (SPC chief data scientist, Noumea, 13.11.19). According to the service company C., if Onboard were to become mandatory and data circulation were to remain the same, Company S. would likely keep the second application, inducing once again a duplication of the surveillance instrument – and work, as captains would then have to fill in two tablets instead of one because the sharing modalities of the apparatus would not satisfy the company's needs (Representative of company C., Suva, 25.06.19). At stake is not simply the right to access the data, but also defining who has priority access and how quickly they can obtain them.

3. Observing at Sea: The Onboard Fisheries Observer Apparatus

Against the intrinsic limitations of the logsheet apparatus to surveil the tuna fisheries, governmental authorities have devised an additional at-sea surveillance apparatus, also anchored in the fishing vessel infrastructure and drawing on onboard fisheries observers²²⁵ to produce ‘fisheries-independent’ information and address some of the intrinsic limitations of logsheets. In this section, I describe the functioning of such observation programmes and mitigate the alleged ‘independence’ of the information

²²⁵ Onboard observers must be distinguished from shore-based port observers (who can be the same persons), who will not be discussed in this section.

produced by these surveillance agents. I show that, once again, onboard observer programmes work as boundary apparatus, subjecting the observers to multiple binds and injunctions that challenge their ability to produce information that could fully serve ‘scientific’, ‘regulatory’, ‘coercive’ and ‘commercial’ objectives. As it puts observers in a complex, unsafe position, surveillance is not just an instrument for risk management but also becomes productive of new forms of risk. Additionally, this section further evidences the tendency of surveillance layering, with surveillance entailing furthermore surveillance, and the role of surveillance as part of a Blue Economy sector, whereby surveillance becomes an end in itself to create employment.

i. Rationale and Design of the Onboard Observer Apparatus

a. *A Regional and Multilevel Network of Onboard Observers*

Observers are frequently qualified as the “eyes and ears” of fisheries managers, scientists and compliance officers at sea.²²⁶ Observer data, though lesser in quantity than logsheet data, aim for quality and reliability, because they are produced by supposedly independent and qualified surveillance agents:

That’s the clearest volume metric we have for what is actually coming out [of the water] because of course you’ve got anyone who’s speeding though, just wants to get fish onboard [...]. So there’s a lot of value added of having trained eyes in the water that actually care about the difference in assessing species and that sort of things. (SPC genetician, Noumea, 12.02.21)

The system is under WCPFC’s aegis. The Commission adopted Conservation and Management Measure 2007-01 (revised in 2018) to establish standards for a Regional Observer Programme and monitor fishing vessels operating in international waters and those fishing in the waters of multiple coastal states. Consequently, the program does not cover fishing vessels operating exclusively within the waters of a single coastal state, which can instead be monitored by national observer programs. This is the case in New Caledonia, where the observer program and the data it collects are managed by the Territory.²²⁷ In Fiji, part of the fleet operating in the high seas is covered by the regional program, while the fleet operating within its jurisdiction is covered by its national program. Instead of having a unique regional programme, there is a diversity of national programmes accredited by the Commission and regularly audited, while their operational management remains under national jurisdiction.²²⁸ For the Pacific Islands, these programmes have been harmonised over time under their regionalist strategy, with the support of SPC and FFA. Hence, programmes like those of New Caledonia and Fiji essentially collect the same data, following more stringent standards than WCPFC’s, even though there are national

²²⁶ <https://www.spc.int/updates/blog/2021/05/observers-are-the-eyes-and-ears-of-fisheries-managers-scientists-and> (accessed: 05.07.24)

²²⁷ Conversely, an observer who is not affiliated to the regional programme cannot collect data on board a vessel that has left the EEZ. Legal boundaries shape where surveillance activities associated to this apparatus can take place.

²²⁸ In addition, there are two sub-regional observer programmes associated to the US Multilateral Treaty and to the FSM Arrangement of the PNA group (cf. Chapter 6).

variations in their functioning: “I use the standard forms of SPC [...] and I had my own, which results in a New Caledonia-specific workbook. For instance, I add a pre-departure briefing procedure and a post-return debriefing, which I integrated into SPC workbook.” (Observer programme manager, Noumea, 14.10.19)

Observers board fishing vessels, accompany the fishers during their campaigns, and record a wide range of information into “workbooks”, that comprise several forms and are far more comprehensive than the fishing captain’s logsheet forms (see Figure 35). The first form captures “general information” on the characteristics of the vessel, fishing gear and fishing practices (e.g. number of hooks). Other forms detail the catch, trans-shipment activities, discards, interactions with “Species of Special Interest” (e.g. birds or sharks), pollution incidents or any infractions that occurred during the fishing campaign.

CPS/FFA - OBSERVATEUR RÉGIONAL PALANGRE										FORMULAIRE LL-1	
INFORMATIONS GÉNÉRALES											
DÉTAILS DE LA MARÉE NOM : _____ DÉBUT DE LA MARÉE (DATE ET HEURE DU BORD) : J J M M A A S S H H NATIONALITÉ : _____ Numéro de matricule de l'observateur : _____ FIN DE LA MARÉE (DATE ET HEURE DU BORD) : J J M M A A S S H H NOM DU NAVIRE : _____ DÉPART SATELITE (DATE ET HEURE DU BORD) : J J M M A A S S H H PORT DE DÉPART (DU SATELITE) : _____											
NAVIRE PROPRIÉTAIRE DU NAVIRE : _____ Numéro d'immatriculation national : _____ Indicateur radio (RCE ou M) : _____ CONTRE DU NAVIRE : _____ Nom d'équipier : _____ N° : _____ PAVILLON : _____ MATRE DE PÊCHE : _____ Place d'équipier : _____ N° : _____ Capacité des tables à poissons : _____ NUMÉRIQUE DE PERMES DU LOUAGIER DE PÊCHE : _____ Longueur : _____ Jauge brute : _____						NATIONALITÉ DE L'ÉQUIPAGE CONTRE : _____ MATRE DE PÊCHE : _____ AUTRES MEMBRES D'ÉQUIPAGE : _____ AUTRES MEMBRES D'ÉQUIPAGE : _____ AUTRES MEMBRES D'ÉQUIPAGE : _____					
APPAREILLAGE ÉLECTRONIQUE											
GPS			UTILISATION			ECHOSONDÉUR			UTILISATION		
TABLE TRACANTE						CAPTEUR SST					
* NOUVEAU			UTILISATION			MARQUE			MODÈLE		
NOUVEAU											
SONAR											
RADIOSONOMETRE											
BOUEES OPS									Commentaire ?		
COURANTOMETRE - DOPPLER											
BATHY-THERMOGRAPHIE / SST											
VMS - 1			Système			ALC			Scalé (max) ?		
VMS - 2			Système			ALC			Scalé (max) ?		
SERVICES DE COMMUNICATION			SATELLITE			MOBILE			AUTRE		
AUTRE											
SERVICES D'INFORMATION			MÉTÉO			MONITEUR SATELLITE			AUTRE		
AUTRE											
ENGIN DE PÊCHE						MATÉRIEL DE SÉCURITÉ					
VIRE-LIGNE						GILET de SAUVETAGE					
VIRILIN DIAMONDON						FOURNI À L'OBSERVATEUR					
ÉLECTEUR DE LIGNE						TALLE AJUSTÉS					
LANCEUR D'APPÊT AUTOMATIQUE						ACCÈS (entouré une rigature)					
ÉQUIPAGE AUTOMATIQUE DES RIVROCONS						RIS (N°) Type Exp.					
BALANCE DE PÊSÉE						CANOTS de SAUVETAGE					
* NOUVEAU						CAPACITÉ					
MÉTÉRIEL						DATE D'INSPECTION (si applicable)					
DIAMÈTRE						MÉTÉRIEL DE CONSERVATION					
LIGNES						CONGÉLATION					
MÉTÉRIEL DES SAU-DE-LEGN						GLACE					
HABILLONS OFFNET						EAU DE MER RÉFROIDÉES / SALINITÉ					
ANNEXES, SAU-DE-LEGN						MÉLANGE EAU DE MER / GLACE					
ANNEXES, SAU-DE-LEGN						AUTRE CONDITIONNEMENT					
ANNEXES, SAU-DE-LEGN						ÉVACUATION DES DÉCHETS					
ANNEXES, SAU-DE-LEGN						O/N					
ANNEXES, SAU-DE-LEGN						Commentaire					
ANNEXES, SAU-DE-LEGN						Dans toutes les colonnes UTILISATION, noter : ALL - à tout le temps pendant la pêche TRA - uniquement en navigation OP - souvent, pendant la pêche SF - parfois, pendant la pêche RAH - occasionnel BR0 - hors d'état de marche, utilisé en temps normal NOL - First Use Only					

CPS/FFA PALANGRE - OBSERVATEUR RÉGIONAL
ÉCHANTILLONNAGE DES CAPTURES FORMULAIRE LL - 4

Version 2014

NOM DE L'OBSERVATEUR		NUMÉRO DE MAREE DE L'OBSERVATEUR		N° DE FLAQUE		PAGE SUR	
NOM DU NAVIRE		ÉQUIPEMENT DE MESURE		ÉCHANTILLONNAGE		Début du tirage - date et heure du bord	
				+ / -		Début du tirage - date	
						A A M M J J H S M S A A M M J J	

DÉTAIL DES CAPTURES

Heure du bord	N° nomenclon	Code espèce	Code interaction aqsh	Code état		Longueur (cm)		Code entrée	Sexe M, F, I, U	Commentaires / Traitement des SSI
				capturé	rejeté		Code			
1										
2										
3										
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Décompte ← Partiers observés (pour ce formulaire) Total

Version 2014 (1)

Figure 35: Extracts from the SPC/FFA workbook used by onboard fisheries observers. Source: supplied by a New Caledonian observer, Noumea, 15.11.21

WCPFC requires 5% of the longline fishing trips and 100% of the purse seine fishing trips to be observed. To abide by this regulation, New Caledonia has a programme initially funded and administered by SPC on behalf of the Territory before it was internalised by the Government in 2015. In 2019, the programme included two observers and one coordinator/observer, covering approximately 30 out of the 300 annual fishing trips of the local fleet (Programme manager, Noumea, 14.10.19). In Fiji, the programme is managed by the Ministry of Fisheries and included in 2020 7 national and 35 regional observers for a coverage rate of 23% (Ministry of Fisheries, Facebook post, 19.02.20).

b. A Multipotent, Delegative, Opportunistic and Boundary-Apparatus

The observer apparatus exhibits several of the offshore surveillance characteristics that I identified. It is opportunistic, as it relies on the pre-existing and already available fishing vessel infrastructure. It delegates some of the surveillance costs to the subjects of surveillance. More importantly, it is designed to be multipotent: “The ability to ask observers to do special projects is just huge!” an SPC scientist enthused (SPC scientist, Noumea, 12.02.21). At the WCPFC level, the programme aims to “collect verified catch data, other scientific data, and additional information related to the fishery from the Convention Area and to monitor the implementation of the conservation and management measures adopted by the Commission”.²²⁹ The observer apparatus serves a ‘meta-surveillance’ function to verify fishers’ surveillance data, a complementary scientific surveillance function to address what cannot be monitored with the logsheets, and a ‘coercive’ surveillance function.

Observers play many and continually evolving roles. They help correct the logsheet data: “It’s acknowledged that when they [fishing captains] report their logsheet, it’s not accurate. And that’s why we have observers going on board [...]. There’s a statistical model that actually takes the observer data samples and comes back and adjusts the logsheet reports of catch.” (SPC chief data scientist, Noumea, 22.11.19). Observer data also supplement fishers’ information: “There are many data points that are collected solely by observers,” e.g. transshipment activities (SPC database manager, Noumea, 13.11.19). Observers also partake in scientific research on offshore ecosystems and the environmental impacts of fishing. They notably provide “the main and often the only source of information for bycatch” (Field notes, SPC Ecossea workshop, Noumea, October 2019). This information can be used to assess stocks of species other than tunas, “primarily sharks, actually, which are the most commonly caught accidental species” (SPC marine scientist D., Noumea, 02.10.19). They also participate in tagging certain fish or collecting biological samples from fish to fuel SPC’s Tissue Bank.

Observers have become a main instrument for surveilling offshore ecosystems contrary to the logsheet which is primarily focused on commercial species:

²²⁹ <https://www.wcpfc.int/regional-observer-programme> (accessed: 05.07.24)

Someone who wants to work on even just one species across the Pacific, regardless of the date, couldn't do it because they couldn't afford to charter a boat to cover the Pacific or visit markets... Whereas here, we have access to this network of observers, so in terms of workforce, we have personnel across the Pacific, not too expensive because we don't charter boats, these are already commercial vessels (Observer manager, Noumea, 14.10.19)

Because observers are placed on a vessel infrastructure they do not control, their environmental surveillance capacities remain, however, opportunistic. Observers must adapt to fishing activities and mobilities. This only allows for a patchy and random observation of offshore environments, which only imperfectly satisfies research needs (see also Chapter 8):

There are squares within the EEZ where there are gaps, and we don't know why. [...] There are places we would like to visit, for example, in the southern part of the EEZ, where there are specific management measures. They hardly ever go there. There was one year when they went, but we weren't on board. We told them: "Next time you go there, let us know, and we'll place an observer." Ugh, it's really tough honestly! In fact, at the last moment, they'll change because a boat called, found fish, so they change direction. Anticipating fishing zones is really complicated. (Observer manager, Noumea, 14.10.19)

Despite these impediments, observers' role as agents of environmental surveillance expands under the parallel development of the ecosystem-based approach to fisheries management and Marine Protected Areas (MPAs). The New Caledonian Coral Sea Natural Park, for instance, has both reinforced and partially redirected observers' activities towards more comprehensive environmental monitoring of the marine territory, even though these missions remain occasional for the time being:

And thanks to the Park, we've been able to retain these observers because the observer programme has taken on a broader scope. [...] we developed an observer programme with a wider remit with the establishment of the Park. We also needed people to conduct campaigns that'd be more ecosystem and environment-oriented. [...] There was a seismic campaign, so on aspects not at all related to fishing [...]. One of our observers [from the Fisheries service] was able to embark at the time. [...] This has been one of the major assets in terms of knowledge in setting up the Park. (Former New Caledonian fisheries manager, Noumea, 11.09.19)

'Conventional' observer data are also mobilised in knowledge production to manage the marine environment: "Let's say that the data from the programme will potentially help manage certain areas of the Marine Park. I'm certainly thinking of the seamounts. [...] It's not the programme that's modifying its strategy for the Park, it's the data from the programme that will potentially provide management insights." (Observer manager, Noumea, 14.10.19). Observers data thus become (invisible) knowledge infrastructures embedded in the production of environmental managerial knowledge.

Observers also inform shore-based actors about fishers' practices and their evolution, particularly in the case of the purse seine fishery and its use of dFADs:

The observers provide a lot of information on the gear characteristics, the tonnage... [...] Probably in the future, when I identify important things, the programme [of observers] can evolve to add data; like two days ago, I asked about drones, it seems like people are starting to use drones to spot birds and schools of tuna. (SPC fishery scientist H., Noumea, 08.11.19)

Observers also support fisheries authorities in controlling compliance and combatting Illegal, Underreported and Unregulated (IUU) fishing. They must record any infractions committed on board by the crew. These reports are then used to address and sanction the infractions by national authorities or under WCPFC, depending on the fishing campaign's characteristics. The 'fishing vessel-onboard observer' complex also allows for the opportunistic creation of 'patrol boats' (having detection capacity only) to surveil maritime activities *beyond* the fishing vessel in question. Observers must record possible encounters with other vessels during fishing campaigns: "One of the aspects they care for is also surveillance. They are meant to do reports with regard to other vessels' activities, abandoned fishing gear, lost gear..." (SPC observer programme adviser, Noumea, 26.02.21). Although this 'patrolling' activity is not the observers' priority, it has helped detect, for instance, illegal Vietnamese 'blue boats' poaching in the Solomon Islands (Field notes, Tenth Pacific Nature Conference, online, 24.11.20).

Because they are in direct contact with fishers and help connect them to shore-based fishing authorities, observers can also be employed to raise awareness about governmental regulations and 'best practices'. This is particularly the case with the small and domestic fleet of New Caledonia, which facilitates the establishment of a fairly united collective with the observer and fishing authorities: "They [the observers] are also there to remind about best practices when you catch an emblematic species, a whole list of release procedures to keep the species alive. We have all sorts of guides, which generally interest the crew quite a bit when they're on board. All this is part of the observer's job to maintain this connection." (Observer manager, Noumea, 14.10.19).

Observers' information is of primary interest to fisheries scientists, managers, but it also interests fishing companies. In New Caledonia an observer report is "delivered to the captain and the vessel owner two or three days after the observation" to assist fishers in analysing their own fishing and commercial practices: "It basically allows them to adjust the depth of the line [...]. It gives indications to the captain, saying: here, you're not well-adjusted, so they adjust." (Observer manager, Noumea, 14.10.19). Simultaneously, it helps foster the industry's interest in this surveillance apparatus because it supports their 'coercive' surveillance capacities: "They give us information that we don't always have on board, about species that are released, how captains operate... There are captains who are more or less serious than others [...] So it's important to monitor the practice [...]." (Manager of fishing company P., Noumea, 02.11.21). More recently, observer data have also taken on new commercial value, linked to obtaining the Marine Stewardship Council (MSC) certification: "One very important use of the observer data in Fiji is for the Fiji MSC certifications of our albacore, bigeye and yellowfin tuna fisheries. The data collected by observers from MSC vessels help to assess the state of the fishery, determine impacts on

habitats, evaluate bycatch, and assess crewing and labour issues so that consumers and markets can make informed decisions” (Ministry of Fisheries, Facebook post, 12.11.21).

c. Competing Usages – Prioritising Certain (In)visibilities of the Sea

The multiplication of observers’ duties engenders competition over a limited resource. Over time, forms have multiplied and observers now have “an enormous number of things to record” while they “are one person on board, they can’t be everywhere” (SPC fishery scientist L., Noumea, 18.11.19). Prioritisations must be established, following practical and political rationales.

The reporting of catch, fish characteristics and fate constitutes the core of their observation activities. The other dimensions of observer programmes articulate around that spinal cord in a more or less stable manner, across time and space. For instance, information on marine pollution (e.g. lost equipment, discharge of galley water and rubbish) has remained in the margins of observers’ imperatives: “SPREP has tried to work on the topic, but they had mixed results because there were many incomplete reports, etc. Plastic was not a priority five years ago, so there’s a lot of missing information from observers’ logbooks.” (World Wide Fund for Nature (WWF) representative, Suva, 05.07.19). Observers are also limited in skills. Each new requirement necessitates training: “We try not to change them [the forms] too much actually, because behind that it involves redoing the training, changing the software, retraining all the observers, changing the debriefing processes...” (SPC database manager, Noumea, 13.11.19). The observer apparatus exhibits infrastructural rigidity, although it is intended to be multipotent and thus flexible.

These restrictions also affect surveillance activities central to resource management, i.e. the core of tuna fisheries management policies in the region. Many interviewees mentioned the discrepancy between the importance of biological sampling to assess fish stocks and its practical neglect by observers and programme managers: “Then, regarding tuna sampling, I think it’s supposed to be a high priority but they do very little of it... There’s still a big problem with the number of samplings carried out.” (SPC fishery scientist L., Noumea, 18.11.19). A programme manager attributed this lacuna to technical and material difficulties related to the observer’s skills, the design of the fishing vessel, and at-sea working conditions:

We’d like to have more campaigns where we have the means to sample pieces, organ samples. We do it, but it’s not enough. [Observer X] is comfortable with it; I’ve been trained for it and I’ve done a few. But we can’t afford to do it on every campaign because not all vessel configurations are the same, and on some, it’s really too complicated to take samples. [...] Sometimes the weather is too bad to be able to do this kind of sampling, so there are times when it’s not possible. (Observer programme manager, Noumea, 14.10.19)

Diminishing biological sampling efforts also reflect a political reorientation of certain observer programmes (such as those managed by FFA) and new trade-offs in the face of their multiple functions:

When I moved to SPC six years ago, someone else took the FFA job. It's not just a personality shift, but also a perception of the programme. Suddenly, they saw themselves as doing compliance work, management-type work, and so if you look at the number of samples we have, after that point, there's been a huge decline and now we're struggling to get scientific information. (SPC observer programme adviser, Noumea, 26.02.21).

These prioritisation efforts also affect how observers' placement aboard fishing vessels. Observer coverage of purse seiners is far greater than for the longline fishery, which does not even meet its 5% regulatory threshold. Again, the discrepancy derives from practical and political aspects. It is materially easier to observe the fewer WCPO purse seiners (about 250 vessels against over 3,000 longliners). They are larger vessels that can easily accommodate an additional individual on board. On the contrary, many longliners lack the physical space and necessary infrastructures to host observers. Their sanitary and safety conditions may be so poor that observers refuse to embark. While purse seiners are like "yachts", with individual cabins or "proper cooking facilities", "conditions onboard are very bad for longlines", so "observers do not really want to go, and the captains also do not want the observers" (EU fisheries delegate, Suva, 14.06.19). As a result, certain longliners completely escape this surveillance apparatus:

There are safety issues. You can't accommodate them if there's no free space for them, if you exceed the vessel's passenger capacity. So the main constraints were there, on accommodation, finding the right campaigns, with vessel owners for whom it wouldn't be too penalising [...]. (Former fisheries manager, Noumea, 11.09.19)

Today, one New Caledonian vessel still cannot welcome any observer (Observer programme manager, Noumea, 14.10.19). The quote demonstrates that safety considerations can become a hindrance to surveillance, and not just a cause for its development (cf. Section I.1). It also evidences the cost that such a system imposes on the industry. Thus, the industry's reluctance to accommodate observers is twofold: to avoid surveillance and the financial and operational costs of having a non-fisher on board.

These material aspects permit fishers *and* fisheries authorities to evade surveillance: "They can try to avoid placement [...] With 5% coverage, it tends to be the same boats [that are observed]." (SPC observer programme advisor, Noumea, 26.02.21). The very calculation of coverage is controversial: "The biggest problem is this uneven coverage of all fleets. [...] I don't think there's any penalty about biasing with the coverage. You also have to choose which unit you use for coverage. Australia, for instance, uses hooks, some countries use sea days, other countries use fishing days, other countries use trips, and some try to use number of boats." (SPC observer programme adviser, Noumea, 26.02.21). The number of hooks is the most accurate yet difficult-to-calculate indicator. Conversely, other indicators leave more room for authorities to escape scrutiny, an NGO criticised: "There's no use having an observer onboard if they don't fish for instance!" (WWF representative, Suva, 05.07.19).

Political orientations on the use of this surveillance apparatus also account for the coverage discrepancy between longliners and purse seiners. The 100% purse seine coverage imposed by WCPFC

stemmed from the ambition of the Parties to Nauru Agreement (PNA) to strengthen their ‘coercive’ surveillance and enforce their regulatory restriction of dFAD-fishing activities (SPC observer programme advisor, Noumea, 26.02.21).²³⁰ Such a ‘coercive’ priority emphasises economic risks over scientific needs, for which a more distributed and representative coverage would be more relevant:

The 100% coverage rate on purse seiners diverts efforts to this fishery, at the expense of longliners even though they have a lot of bycatch. [...] It doesn’t allow us to see the [tuna] population as a whole. There’s no need to have 100% observers on purse seiners, it would be better to transfer 20% to longliners. (SPC marine scientist V., Noumea, 04.10.19)

This remark evidences different and hardly compatible requirements between ‘scientific’ and ‘coercive’ surveillance: “With compliance, it’s not really science where you have confidence limits; it’s the more you have, the better it is.” (SPC observer programme advisor, Noumea, 26.02.21)

These political orientations vary over time and in countries. Many governments prioritise ‘coercive’ surveillance which brings more immediate management benefits than the scientific aspect, even though they are two sides of the same coin:

Coordinators and managers of the programme think there's kudos for an arrest [...]. When FFA arrest them and fine them, it's better. [...] You're the director of an agency and your ministry is asking what you're doing, it's best to say you arrested three boats and gave fines and seized boats. Instead, if you say you found three tags in fish, they will ask: “What does that mean?” (SPC observer programme advisor, Noumea, 26.02.21)

If PNA is very focused on compliance issues, New Caledonia, where fishing authorities and the (100% domestic) industry form a tight-knit collective, favours scientific dimensions and fishing assistance. Proof of this is that observers do not even fill in the GEN3 form reporting any problems and pressures experienced by the observer on board: “There are three of us in the team so we talk to each other, if there’s an issue, we try to talk directly with the captain, the vessel owner, etc., without going through paper procedures.” (Observer manager, Noumea, 21.05.21).

Prioritisation also depends on observers themselves, who co-define their professional identity (‘neutral’ observer, government agent, scientist, policemen) in interaction with programme managers and fishers. Most observers I interviewed highlighted the dual ‘scientific’ and ‘coercive’ dimensions of their jobs. Observer A. described a neutral role that “deals with the monitoring of the fishing vessel when it goes out at sea” and “record everything that is going on” (Fijian observer J., Suva, 05.10.21). Observer M. highlighted “science and compliance” dimensions while admitting his inclination for the former one and ranking compliance “second”:

²³⁰ Another motivation behind this 100% coverage requirement is to create employment, as I will explain below.

I'd prefer the role of looking at the science bit of my job [...]. I find the science bit of the work more relevant but being a Fisheries Observer under the Ministry of Fisheries, it is only right that we also monitor and ensure that the laws and regulations are being followed by fishing vessels. (Fijian observer M., Suva, 08.10.21)

Observer K. similarly declared being “80% scientist and 20% controller” (Fijian observer K., Suva, 20.12.21). For A., it is precisely the juxtaposition of the two roles that reinforces them: “I think they correlate with each other because if one is neglected, they tend to affect the efficiency of the other.” (Fijian regional observer A., Suva, 29.07.21). This statement is interesting because it points to an intrinsic characteristic of the apparatus: here, the dual purpose of the observer programme is seen as a condition for its functioning – even though it is also precisely what constrains it.

Observers' identity is also co-defined by fishers. In New Caledonia, observers are perceived as “scientists” and nicknamed “SPC” by the crew (Observer manager, Noumea, 21.05.21). In Fiji, on the contrary, “they see us as controller, not as scientists because they are very careful when they see observers” and observers are nicknamed “Matanitu”, i.e. Governor in Fijian (Observer K., Suva, 20.12.21) and regarded as “Police Officers” (Fijian observer M., Suva, 08.10.21).

Politics of Observer Data Management

Conflicts over the privileged utilisation of the observer apparatus occur at the data collection stage. They also influence the downstream circulation of observer data and the management of who should be allowed access and/or ownership of these surveillance data.

Like for logsheet data, carrying observer data from the fishing vessel to the central database and end-users is lengthy and logistically complex. Data quality checks further slow this process. After a fishing trip, observers meet with a “debriefing” to proof-read their workbook. The operation can last a few hours to several days depending on the quality of the workbook. Surveillance entails additional layers of (‘meta’-)surveillance, involving “people that observe observers” (SPC observer programme advisor, Noumea, 26.02.21) and, more recently, “debriefing assessors”:

Now, we work on assessing the debriefers as well because we saw biases in the debriefs as well. [...] One of the programme we had introduced a pay for observers, and if your data is good, you get paid more. Suddenly, we found there was a whole lot of 96% debriefing estimates, everyone got better! Sometimes, the morality is not always as it should be. [...] Because you have cases where the observer says: “Look, my friend, I really need to buy a cow; I really need the 95%”, and the debriefer says OK. (SPC observer programme advisor, Noumea, 26.02.21)

The effect of layered surveillance remains unclear. Sometimes, debriefing degrades rather than improves data quality, WWF suggested: “There has been evidence that some reports are changed, even at the national level. Reports are tempered with, so the information that reaches the regional level is completely different from the one the observer enters, from the raw data.” (WWF representative, Suva, 05.07.19).

For national programmes, observer data are transmitted to the national administrations and entered into a digital database. For regional programmes or member countries lacking national capacities to do so, data are sent to SPC, where a group of SPC agents (exclusively composed of Pacific Island women, embodying the ‘invisible workers’ and ‘*petites mains*’ of surveillance (e.g. see Dagiral & Peerbaye, 2012)) transcribe the paper or scanned workbooks into SPC database. This can take several months (see Figure 36). Through this process, certain data ‘disappear’: pole-and-line observer data, deemed of lesser priority than the purse seine and longline ones, are not integrated into the database. Debriefing data and observer journals, mostly containing textual information that is harder to code in the database, are only scanned to enable verification but left outside the end database.

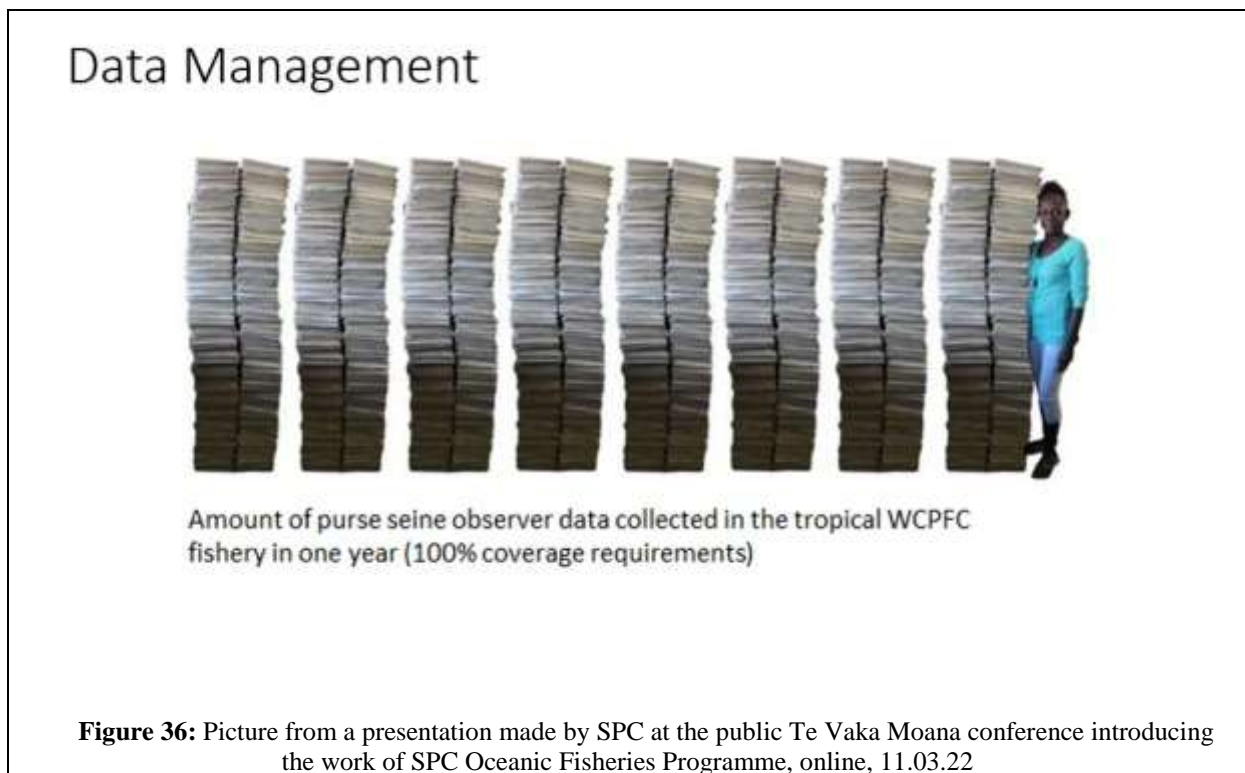


Figure 36: Picture from a presentation made by SPC at the public Te Vaka Moana conference introducing the work of SPC Oceanic Fisheries Programme, online, 11.03.22

From the central SPC database, data are shared following well-established access rules. Contrary to the logsheets, the industry is not granted access to observer data. Sub-regional organisations such as FFA, SPC and PNA can only access the data for specific, well-narrowed utilisations determined by member countries. The main users of observer data are the governments, which use them to produce the national scientific and compliance reports demanded by WCPFC, firstly to deal with “everything related to fishing regulation violations” (SPC database manager, Noumea, 13.11.19) – which may provide incentives for countries to alter observer data. Stakes are high, both from a regulatory and geopolitical perspective, as explained by a New Caledonian programme manager, after the Covid-19 pandemic affected the Territory’s observer coverage and imperilled its unscathed reputation: “For years, New Caledonia has always complied with the Commission’s rules. [...] And then, suddenly, we see the five

percent mandatory coverage arrive, we see the red flag coming, and we think: ‘Damned! We’ll get a slap on the wrist!’ And then your capacity to influence the discussions is undermined.” (Observer programme manager, Noumea, 21.05.21)

This helps understand why state authorities want to maintain sovereign control over the observer apparatus and thereby limit its sharing. Access to observer data is highly controlled by the national authorities. In New Caledonia, a scientist explained that he was refused access to the data to study marine birds’ feeding behaviour and bycatch because the data he demanded covered a period with “much bycatch [...] whereas usually there’s very little” (Field notes, discussion with a bird scientist at a SPC modelling workshop, Noumea, October 2019). Another interviewee indicated that PNA were “cautious of that sharing” and refused to send their observer data directly to SPC: “They print it out and send the PDF [...]. I don’t know if it’s too clean it or anything [...]. Again, it’s politics, the perceptions of the various aspects of the data collected are more driven at the national level and by the PNA, what their aspirations are, what their use are, what they want.” (SPC observer programme advisor, Noumea, 21.05.21). Several NGOs shared their difficulties in accessing bycatch or pollution data and criticised the closure and capture of what they esteemed should be public and therefore ‘commoned’: “it’s quite hard for us to access it [observer data] unless those governments give us access to all those data [...] and they’ll say it’s confidential data. [...] One thing that the government needs to understand is even if they have the authority to manage fisheries and to be the custodian of the resources, it’s still a publicly owned resource” (Global Fishing Watch representative, Suva, 05.10.21).

Struggles over observer data demonstrate the more general and inherent tension of a boundary surveillance apparatus, unable to fully support every form of surveillance and its associated requirements. This is well resumed by this FAO consultant involved in observer programmes:

If you use it as a compliance tool, and the data is used for that purpose, then the data is under the responsibility of the country in that case. Data becomes confidential because of the legal procedures that are in place to deal with them. The chain of custody becomes completely different: the state is the primary owner and controller of these data. All sorts of procedures have to be followed and you’d have to revise your laws to be able to use these data, to prosecute specific cases, etc. [...] For scientific purposes, you’d most probably have a different set up. For instance, SPC has a very important role in monitoring fisheries and gathering information. In that case, you’d set up a regional, centralised structured [...] and you’d have data streaming in this structure to be used for scientific purposes. Typically, from a scientific point of view, the scientists would want as much information as possible: what are the catches, species, discards, and so on. [...] From a compliance point of view, you could simplify this very much to have a more effective system in terms of cost-benefits. (FAO consultant, Roma, 17.03.21)

Observer programmes can only imperfectly serve their multiple orientations precisely because these require different designs, data management practices, and funding responsibilities and require different strategies to “interesse” and “enrol” (Callon, 1986) stakeholders (in the first place, the fishing industry).

These convoluted data politics result in ignorance production. Many data are barely used or unused because the Pacific Islands administrations do “not have the capacity to analyse the data by itself” (WWF representative, Suva, 05.07.19). WWF criticised that this prevented certain issues pertaining to crew safety, marine pollution or bycatch from being addressed: “The collection and analysis of the data is done by SPC for the main reporting elements outlined by WCPFC, but the reports do contain other elements, then why bother collecting those data if not analysed?” (WWF representative, Suva, 05.07.19).

ii. The Work of Observing at Sea

The many roles and uses of observer data cause friction in observers’ work. In what follows, I describe the labour of observing at sea and examine the consequences of these multiple binds and conflicting identities on observers’ work and data collection practices.

a. *An Offshore Profession*

The creation of observer programmes has led to an entirely new profession. The labour dimension of surveillance, in that case, has become pivotal not only to support knowledge and control of tuna fisheries but also to expand the Pacific Islands’ employment market and Blue Economy:

The real reason to increase observer coverage was employment, that’s the understorey to that. [...] Observers are all national observers. When I was at FFA, the members were very specific that I couldn’t employ someone directly, I had to go through the national programme so they create employment, that was the key point. (SPC observer programme adviser, Noumea, 26.02.21)

Surveillance is not only an enabler of the Blue Economy; it is also becoming a Blue Economic sector in its own right (Voyer et al., 2018). This confers an additional function to the apparatus.

The intensification of observer requirements has led to a proliferation of observer positions. In 2020, the South Pacific had approximately 800 observers from the Pacific Islands, primarily men aged 20 - 30 (SPC observer programme advisor, 26.02.21). Initially, many came from the fishing world, but their profile has diversified following the explosion of observer programmes. The use of observers for environmental surveillance has contributed to this change, for instance:

At the start, the first observers were often people who had previously dabbled in fishing, on this type of boat. [...] Then, the observers who were recruited were more versatile, they perhaps had more knowledge in terms of marine environment [...] perhaps less fishing-oriented, they had less of a fisher’s instinct! (Former New Caledonian fisheries manager, Noumea, 11.09.19)

Coming from the fishing sector can be an advantage as it may facilitate understanding and observation of fishing activities and demonstrates observers’ capacity to endure difficult, tiring and isolating working conditions like those of tuna fishers: “Psychologically, mentally, staying at sea for three months is not easy.” (Observer C., Noumea, 15.11.21). Changing observer profiles contributes to diversifying how

observers perceive their function and conceive their roles and professional identities. Amongst the eleven observers I could interview, most had not previously worked in the tuna industry and had just recently completed their studies or were still in school. Their motivations included interest in the art and craft of fishing, and/or interest in ocean management. Observer E. indicated that he primarily enjoyed “seeing different fishing methods and observing how they do their job” (Observer E., Vanuatu, 18.03.21). Others indicated that they appreciated learning more, through this profession, about the marine environment and the fish that inhabit it, and participating in caring for them.

The sudden increase of observers has contributed to structuring a weakly formalised profession, characteristic of an ‘offshore’ profession: poorly regulated by labour administrations. Thus, certain characteristics resonate with those I mentioned for tuna fishers in the first section of this chapter. Observers present the same features of disconnection, mobility and fluidity as the latter. The rigidity of New Caledonian labour law is poorly adapted to the ‘fluid’ specificities of offshore work:

Managing an observer programme is not simple. In an administrative framework like ours, there are always difficulties in employing people who work intermittently; these are status issues. In administration, we know about contractual workers, but contractual workers who work on one campaign, then you don't see them for a month, then they work again on another fifteen-day campaign... it's extremely complicated to set up. (Former fisheries manager, Noumea, 11.09.19)

The New Caledonian case is not isolated: “In many countries in the region, it’s somewhat similar, unless one takes many liberties with labour law” (Observer programme manager, Noumea, 14.10.19). Conversely, observers’ poor knowledge of observer institutions, particularly regional ones, is telling of the distance that separates offshore surveillance agents from surveillance authorities: “I think FFA and SPC give the same training, but maybe they have different interests. [...] I’m not sure, I don’t really see the difference, it’s beyond my understanding.” (Observer B., Kiribati, 14.05.21).

Offshore workers are pushed to the limits of state administrations, not only spatially but also regulatorily, which fragilizes the surveillance infrastructure. Concerns climaxed during the Covid-19 pandemic, when most observer programmes shut down. Governments worried about unemployment, and then it became difficult to resume the programme after many observers had switched jobs. Most are contracted on a fishing campaign basis: “In general, there is quite a high turnover” (Interview with an SPC scientist, Noumea, 02.10.19). For some observers, it is precisely this ‘offshored’ and fluid aspect that they appreciate, however: “Observer job is good, you are your own boss on your work [...]. Nobody can show your work, you are your own boss.” (Observer B., Kiribati, 14.05.21). This flexibility allows to “go back home more easily”, B. added. Others appreciate the adventurous side of the work (SPC observers programme advisor, Noumea, 26.02.21). The sector tends to professionalise progressively, nevertheless. Some observers are permanently employed by fishing authorities, as for some Fijian and New Caledonian observers. In Fiji, an observer indicated receiving FJ\$40/night of work, before a re-

evaluation of their salary took place in 2020, increasing this amount to FJ\$100, and also involving “superannuation and life insurance, all that” – thus attesting to the sector’s structuration (Fijian observer S., Suva, 29.07.21). When asked about the adequacy of his salary against the threats and risks associated with his job, he replied, however: “Oh no, it’s no match!” In New Caledonia, observers obtained in 2015 a formal status, with “more guarantees of security, insurance” (New Caledonian observer C., Noumea, 15.11.21).

Other sources of instability in the observer infrastructure stem from challenges inherent to the very practice of surveillance. Surveillance, which intends to be perennial, requires a longstanding infrastructure and the maintenance of a continuous and coherent set of practices, at odds with the high turnover, multiplication and diversification of observers:

There are ups and downs; sometimes people grow weary [...]. It's necessary to constantly maintain, over several years or even decades, the observers, the coordinators, the people who conduct debriefings, those who manage sending samples... [...] It may be that there are three trained observers, but they've changed professions, and there's no one left trained, so we have to return there, but there are ups and downs. (SPC marine scientist D., Noumea, 02.10.19)

Even at the level of a single observer, technical skills are not easy to maintain: “It depends on whether the observer does it once a year for ten years; he will be less proficient than the chap who does it ten times a year.” (SPC marine scientist D., Noumea, 02.10.19).

Against these challenges, observer training has strengthened thanks to a “quality control process [which] has allowed for the harmonisation of data over the past ten years” (Interview with SPC marine scientist V., Noumea, 04.10.19). There now is a training standard, developed by SPC and FFA and recognised by WCPFC: the Pacific Islands Regional Fisheries Observer (PIRFO) standard.²³¹ “Prior to [the 100% coverage], there was about 5% coverage on purse seine and less than 1% on longline. [...] We did a quick calculation of how many we needed; that was at least 465. We suddenly had to train them. [...] That’s why PIRFO developed around that time, 2008-2009.” (SPC observer programme advisor, Noumea, 26.02.21).²³² Comprising six to eight intensive weeks of training provided by SPC and FFA, observers learn to identify fish species, vessels’ characteristics, fisheries regulations, how to complete the workbook, maritime safety elements, and biological sampling protocols (on a voluntary basis only). The training is “very intense”, “squeezed into two months” (Observer B., Kiribati, 14.05.21), which does not entirely permit observers’ homogenisation and standardisation, however.

²³¹The training also covers the instruction of debriefers and debriefer assessors, which I will discuss below.

²³² New Caledonia joined this standard in 2020.

b. Practical Challenges – From Training to Practice, from the Shore to the Vessel

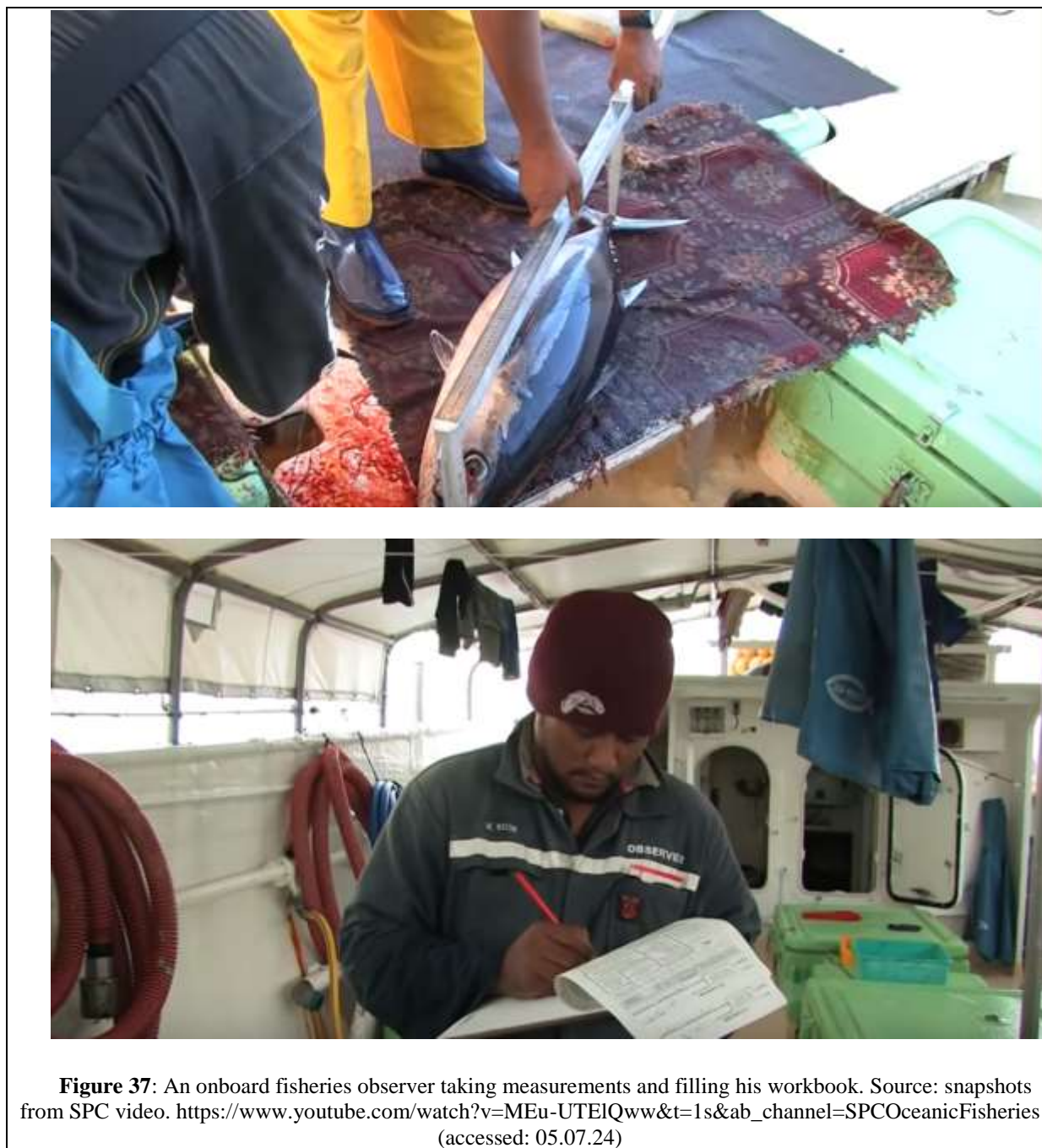
In the classroom, everything was targeted toward observer forms. Once you get on the vessel, you have to fill all the data. The difference is once you are on the boat, you're in the real world to collect data. (Observer E., Vanuatu, 18.03.21)

As suggested in this quotation, there is a (water)world that separates training from at-sea observing work. For A., onshore training “was a normal routine because there were no factors to counter what you’re learning” while at sea, “we encounter many problems that would prevent the observer from doing a good job. [...] At sea, it’s a very bipolar situation” (Observer A., Suva, 29.07.21).

I shall start by describing what “typical” fisheries observation looks like. When observers surveil, they must adapt to the rhythm of the fishers they observe: “As an observer, you have the same rhythm as them” (Observer, Noumea, 21.05.21). Aboard longliners, observers follow a schedule almost as intensive as the fishers’: they wake up to attend the setting early in the morning and note the position, start and end times of the operation. During this stage, observers can nevertheless take a break to fill their paper or digital forms neatly.²³³ It is especially during the hauling operation that observers must be present on the deck to continuously note each hook that is brought up and the associated catch: “And you count these hooks all day long, for eight or ten hours. You count them to know that, for example, an albacore arrived at the twelfth hook. You’re obliged to count the hooks, so mentally it’s a bit demanding!” (Observer manager, Noumea, 21.05.21). When fishing is good, a fish can come up “every two or three minutes if it’s coming up well”, the same interviewee specified. Observers identify the geographical coordinates and the species type; they measure the fish brought up using a calliper (see Figure 37), estimate its weight, and indicate the condition of the fish and its fate (retained on board, discarded alive or dead, etc.). They observe environmental conditions: the weather, the lunar cycle, the wind direction. They sample some fish, following upstream instructions from fisheries authorities and/or SPC.²³⁴ Observers also record information at the beginning of the fishing campaign on the vessel’s capacity, crew composition, characteristics of fishing equipment and maritime safety, and complete a trip report on the entire fishing trip. During the campaign, they also send weekly reports to the authorities and record any incidents and infractions noticed.

²³³ As with logsheets, the use of digital tools to fill in workbooks is developing. I will therefore not revisit this subject, which presents similar problems, preferring to focus on other issues of observer programmes.

²³⁴ In the case of purse seiners, the procedure is somewhat different to account for the specificities of this fishery. Notably, the observer estimates the volume of catches captured by the net, and samples a few fish to measure them. The surveillance is much more approximate, based on estimates and sampling because the volumes brought up by the seine do not allow for exhaustive coverage of the catches (Observer E., Vanuatu, 18.03.21).



Although observers are meant to be more qualified surveillance agents than fishers, there are still numerous sources of error. Tuna fishery regulations are not always mastered: “Some individual fields [in the workbook] expect the observers to have a finer background in the legal structure than they do. [...] That assumes they know all the CMM [Conservation and Management Measures], 60 or 70 now, I don’t know.” (SPC observer programme advisor, Noumea, 26.02.21). Observers are trained to identify species, but errors persist, particularly for bycatch species. These are not always brought on board and, thus, not clearly visible. Some are “cryptic species” difficult to distinguish (SPC marine scientist V., Noumea, 04.10.19). Some fish are damaged and/or predated by other fish, therefore hard to identify.

The ocean is a well of surprises: some species may not appear in the observers' learning booklet (Fijian regional observer A., Suva, 29.07.21). Experience plays a significant role in observers' identification skills of observers: "During my first time as an observer it was difficult [...]. You need to organise what kind of fish is dead, if it's a male or female... [...] Every species we find difficult to name, we can take a picture of that and bring it to share with our debriefer." (Observer B., Kiribati, 14.05.21).

Long working hours, the speed of fishing operations, the unstable movements of the boat and weather conditions weigh on fatigue and decreased attention: "It's a very tiring job because sometimes you lack sleep, it tends to take its toll on the observer" (Fijian regional observer A., Suva, 29.07.21). Working offshore is intrinsically challenging: "It's just the challenge of working on a boat, we have to keep bracing on one side of the boat in times of rough weather." (Observer K., Suva, 20.12.21). However close to the 'field', observers' capacity to see the sea remains partial. Elements stay at a distance, are mobile, often in the dark: "For example, GPS buoys are sometimes difficult [...], you can't see the GPS number for instance, during the night it's very difficult" (Observer B., Kiribati, 14.05.21).

Observers, supposedly neutral, are still subject to personal biases. Fish sampling, to take measurements in purse seine catches, is not exactly random, contrary to scientists' needs: "They tend to underestimate rare species and maybe oversample large fishes" (SPC fishery scientist T., Noumea, 08.11.19). Additionally, observers are not omniscient and cannot monitor everything, everywhere, at all times. While their attention is primarily focused on hauling operations, they cannot see what happens during their (e.g. sleeping) breaks.

Observers must work independently. Here, too, there are occurrences of observers relying on crew members to collect their data, thereby delegating part of their surveillance work to the surveillance subjects: "The catch data recorded by observers, most of the time, the observer asks the skipper" (SPC fisheries scientist J., Noumea, 11.11.19). An observer stated that "the crew are very helpful during the trip, they help me in the measurement of each piece if I'm not feeling OK, but I would observe them from a distance [...]" (Fijian regional observer A., Suva, 29.07.21). Information about fishing licences, vessel tonnage, or transshipment activities (particularly difficult to monitor as they straddle two vessels) is sometimes transcribed from information provided by the industry rather than independently verified by the observer: "So why have an observer collect that, if it's not independent, if they can't verify?" (SPC observer programme advisor, Noumea, 26.02.21).

Data collection difficulties partly derive from the fact that observers must perform their work without impacting that of the fishers. This is necessary to be accepted on board and observe the 'normal' course of fishing activities, even though the very act of surveillance transforms the subject of study: "You need to be on good terms with the fishers, so that there's no trouble because you board, you stay a month with them, so it can be tense. And then also, neutrality allows you not to get involved in the fishing activity [...] which could ultimately bias the result. The observer must be as neutral as possible in every sense of

the term” (Former fisheries manager, Noumea, 11.09.19). Measuring fish and sampling body parts are the activities most likely to slow down the fishers: “When we’re using the calliper, it takes time [...] When we’re measuring fish, this could disrupt the work of the crew as potentially there is a lot of fish that is landing on board, and this could create tensions between the observer and the crew” (Interview with observer A., Suva, 29.07.21). These aspects account for lower sampling efforts and shape sampling strategies: “I always say that I prefer to do it during the day, or at the beginning, because the guys are less tired, have more time to be patient [...]. When you get towards the end, everyone is more tired, the only idea they have in mind is to finish the work quickly” (Observer C., Noumea, 15.11.21).

Observer neutrality is a vain wish: observers and programme managers acknowledge the existence of an inevitable “observer effect” which “changes behaviours”: “It depends on the people [...] but I think a turtle will be better treated if it comes back alive when the observer is there” (Observer programme manager, Noumea, 14.10.19). If the visibility of the surveillance agent can have a positive effect from a compliance perspective, it plays a negative role from a scientific and regulatory perspective.

c. Social Challenges in Collecting Data and Observers’ Coping Strategies

Many of the challenges encountered by observers derive from their incorporation within the very subject of their surveillance. Their many and conflicting identities require them to carefully manage their position on board. This implies establishing the ‘right’ relational distance with crew members to balance the clashing imperatives of ‘scientific’ and ‘coercive’ surveillances: “No one likes observers; they don’t like someone observing. They want freedom of the seas. That’s the challenge of being an observer, to change the attitude. When you go onboard, no one likes you, talks to you, you need to change this attitude.” (Former SPC observer, US, 16.02.21).

Here, too, observers’ training is insufficient and provides little tips on how to behave with the crew, especially on compliance aspects (Observer K., Suva, 20.12.21). Observers must develop know-how and strategies individually to adapt to fluid working conditions. This implies, remaining at a distance from the surveillance subjects while also *cooperating* with them – suggesting that observer surveillance cannot unilaterally be imposed ‘from the top’:

During the training, the job seems very easy but actually, you need to use your common sense, your own personal behaviour. [...] That’s a point that’s not emphasised so much in the training. When you are in the job, you can see those differences, different races of people, how to understand, work with them and make them understand you, how to find a way to work with them [...]. I’ve been on Korean fishing vessels, Taiwanese, Chinese, Spanish vessels... [...] Collaboration is appreciating somebody even if you don’t know them. [...] I respect their privacy, I’m just an observer, I don’t give orders or directions onboard on what to do or not to do. (Observer B., Kiribati, 14.04.21).

Observers’ strategies to establish the appropriate degree of integration on the fishing vessel vary, depending on their personalities and their contextual placement. Some affirm their “neutral” status, as

promoted by certain managers, and distinguish “observing” from “surveilling”. The former term aims to (only imperfectly) neutralise the coercive dimension of their job – which is formalised by the fact that observers have no policing power indeed. Although their reports can entail policing consequences, observers have no inspecting or sanctioning authority. This was conceived as a *sine qua non* condition to produce the required data, especially for scientific purposes: “We must maintain a certain neutrality when we board, to collect objective data [...]. If you start being there as a policeman for the examining administration, it becomes more complicated” (Former observer, Noumea, 16.02.21).

Certain observers, therefore, maintain a strict distance away from the crew and remain as discreet as possible: “Most of the time, when I get in contact with the crew, they don’t respect you. It’s best to isolate yourself from the crew” (Observer E., Vanuatu, 18.03.21). Another similarly shared: “The strategy I normally use onboard is to keep to myself. [...] If I encounter anything out of the ordinary, then I’ll not make a fuss about it onboard while at sea but I’ll note them in my notebook and enter them into my Observer Workbook when the vessel reaches port” (Fijian observer M., Suva, 08.10.21). This concern for discretion shapes writing and reporting strategies, considering that it is hard to hide the workbook on board. To address that weakness, some wait until the end of the trip to record sensitive information. Another observer uses specific codes to make the workbook incomprehensible to anyone but himself: “You leave those [sensitive] information to when you’re back at port. You need to find ways to remember, write undetailed things... or in another language [...] or you use your own made-up language.” (Observer B., Kiribati, 14.04.21).

Other observers, on the contrary, seek to reduce their distance from the crew: “You have to find a way to bring yourself down to their level, even if you are a Prime Minister” (Observer K., Suva, 20.12.21). Another confirmed: “I think the observers themselves have to be friendly, love to socialise with the crew.” (Fijian regional observer A., Suva, 29.07.21). In that case, spatial proximity can become a relational resource: eating together and sleeping together help establish such connections – even though they can become perilous when those fail. One observer makes “good culinary recipes on board to maintain social cohesion on the boat” and helps with the vessel’s maintenance (Observer C., Noumea, 15.11.21). For another colleague, mealtime permits to raise awareness and reciprocal transparency: “Generally, I put my species identification guides on the table where everyone [...], people flick through them a bit, ask what you’re doing... At the moment, [Observer X] and I are working with a digital tablet [...] so the sailors are crazy about it, they’re intrigued by what [Observer X] is doing on his tablet [...]. They’re also curious to know what we’re doing” (Observer manager, Noumea, 21.05.21).

These tactics may imperil the required neutrality of observers, especially amongst those coming from the fishing sector: “It’s an advantage and a disadvantage. Sometimes, they have been crew and as observer, they go back to being crew, back into their role.” (SPC observers programme advisor, Noumea, 26.02.21). One indicated helping the crew in their fishing work before it became formally prohibited by

the observer programme: “At the very beginning [...] we embarked on amicable terms, at that time, so I worked with them.” (Observer C., Noumea, 15.11.21). Despite the interdiction, exceptions do occur in practice: “Normally we shouldn’t participate in fishing work, but when the relation is good, you lend a hand, and it actually contributes to the well-being of life on board, for everyone” (Observer manager, Noumea, 21.05.21). For observers, the main challenge, before that of surveilling – and to make surveillance possible – is to cohabit with their surveillance subjects.

Observers can contribute to the work of the fishers, but the reverse is also possible: “We realise that the person who is cutting the fish will say: wait, give me your calliper [...], I’ll measure then I’ll call out the measurement and you note it down. You’re integrated into the chain and you tell yourself that for this crew, it was less disruptive to have the calliper and do it himself [...] we adapt to the functioning of the crew on board” (Observer manager, Noumea, 21.05.21). Another indicated: “When I require information on the bridge, I ask them and they give it to me, but sometimes they don’t give me the exact information [...] I just pretend it’s OK and in my own spare time I can look at some logbook or logsheet.” (Observer B., Kiribati, 14.05.21). Cooperation with the fishers is strategic to ensure viable relations.

While proximity allows for a more harmonious coexistence between fishers and observers, it does not guarantee the quality of the observers’ work. The boundary between convivial and corrupted relations can be thin: “I know that I was also offered fish, but we’re not allowed to receive gifts from the crew. Afterwards, if it remains friendly, it stays on the boat, between us...” (Observer C., Noumea, 15.11.21). If this quotation suggests relatively innocent and friendly practices, there are regular accusations of and regional discussions under WCPFC on corruption amongst regional observers, collusion with fishers and non-reporting or mis-reporting malpractices (WCPFC, 2014).

The management of social distance to the crew is heavily influenced by the structure of the observer programmes. Most times, observers change vessels and crews, which forces them to readapt to different contexts constantly – and tends to promote distant relations to their surveillance subjects. The main difficulty identified by the observers I interviewed related to the challenges of working in a confined yet highly globalised environment. Observers reported that linguistic issues aggravated relations with the crew:

In Fiji, there are no translators on the Asian/Chinese vessels for the captain. Sometimes there is miscommunication and this can result in anger stirring up. Other vessels under the US flag have translators, which is good for us observers, because it’s easy to communicate the things we want to highlight. [...] So in the compliance part, we have to learn during training how to communicate with them if it’s possible. (Observer K., Suva, 20.12.21)

On the contrary, national programmes observing more limited and domestic fleets, as in New Caledonia, display more familiar, if not familial, relations – also facilitated by the emphasis placed on ‘scientific’ rather than ‘coercive’ surveillance: “I know them all because I’ve been boarding all the boats repeatedly

[...]. I know all the captains, the vessel managers, and all the personnel working around fishing in general” (Observer C., Noumea, 15.11.21). One of his recently arrived colleagues shared that he had “never worked in such good conditions, regarding the relations with the crew and captains” (Observer manager, Noumea, 21.05.21), insinuating that this is an exception rather than the norm.

d. A Risky Job: Surveilling to Manage Risk or Taking Risk to Surveil?

The design of the observer programmes, their training, the high professional turnover and the profile of the workforce do not facilitate the development of the relational know-how and coping strategies:

They're young post-secondary school individuals who are not comfortable with real-life situations. Asking them to observe illegal acts and expecting them to behave in a way that they can relay this information leading to conviction... Their training is too short for that, compared to someone who's trained in surveillance and policing. We ask a great deal of observers in the Pacific with regards to surveillance, even though they have no training in that area. [...] There should be a specific training, to know how to act as a surveillance officer. These are not at all the same trainings, surveillance officer and observer. (SPC e-monitoring and e-reporting coordinator, Noumea, 15.03.21)

This quotation evidences different forms of surveillance and surveillance agents requiring different types of expertise, know-how, statuses and powers. Observers were made ‘neutral’ observers to have them accepted on board and serve as a multipotent apparatus. This formal demarcation, blurred in practice, is simultaneously what puts observers at risk, however.

Despite their individual efforts to construct the ‘right’ distance to the crew, observers often remain associated with a policing power. As a consequence, they also become a subject of surveillance from the fishers: “Someone went through my stuff and read the journal because they want to find out what’s written in it, this kind of information is a threat to them” (Observer A., Suva, 29.07.21), even though it is illegal for the crew to consult observers’ workbooks. These tensions, long unaddressed by observer programme authorities, have recently gained public visibility after a series of dramatic events evidenced safety issues. At stake is not simply the integrity of observer data, but also more concerning issues of labour safety and human rights at sea:

About three years ago, there have been some incidents. There was a US observer in the East Pacific on a transship vessel and he disappeared. That’s where it all came from. WWF and a couple of organisation started to dig in observer disappearances. There’s a classic one in Papua New Guinea where they have an observer disappear off the boat and body parts found on the shore somewhere. So the vessel was arrested and the crew onboard, and then they were released and disappeared; that also caused quite a bit of fuss. [...] We also have observers dying from heat attacks even though they are young, that sort of things. [...] I mean the role perceived by the crew, the compliance role, probably has an influence. [...] We have a long history of pirates at sea. How are you going to change that? It’s a good place for people of low morals or criminals to run to. (SPC observer programme advisor, Noumea, 26.02.21)

Additional observer disappearances have been signalled since, in Kiribati or Fiji.²³⁵ The WCPO has become the oceanic region with the most complaints of observer harassment, abuse and even homicides. These complaints are often left unresolved and unprosecuted. An observer testified that authorities would only “sometimes”, “but not all the time”, deal with his GEN 3 form signalling such issues and that he felt “threatened most of the times” – which eventually led him to resign from his job (Observer A., Suva, 29.07.21). The Association for Professional Observers criticised the Fijian government for its lack of transparency when investigating an observer’s death at work:

In Fiji, we’re trying to get a death certificate for an observer and it’s unbelievable how difficult it is. [...] The US coastguard and Interpol offered to help with the investigation but don’t have the expertise clearly. [...] We found out that he was not paid a salary [...], he had no contract, no insurance. [...] It was a case of mechanical neglect [...]. The vessel kept fishing, they gave him clutches on a moving platform, he tripped, got an even worse injury and then he died, in his cabin. And they just kept fishing. That’s the story of tuna fishing. I guess it’s worst for the crew members. (Representative of the Association for Professional Observers, US, 25.03.21)

These issues appear to be disregarded by government authorities. One reason for this neglect is the ‘offshored’ position of this profession, straddling various countries and administrations and estranged to the police agencies. Because they work offshore, observers slip through regulations:

I got the reports of both agencies [of Fiji and the US] and they were conflicting: one said he died on the 16th of May, and the other one on the 20th. The difference is that on the 16th they kept fishing and kept him in the freezer. If he died on the 20th, according to their story, they say they were coming back to have him treated and he died on the way back. [...] They kept fishing without an observer, which is another problem because they’re supposed to have 100% coverage. (Representative of the Association for Professional Observers, US, 25.03.21)

Even in New Caledonia, where relations with the industry are fairly good, a tragic death shook the observer programme in 2015: “I was told he committed suicide but the investigation showed that it was an involuntary homicide. This incident got people think [...]. I think that’s one of the reasons why the Territory took charge of the programme, afterwards” (Observer C., Noumea, 15.11.21).

Corruption participates in authorities’ negligence. In a lengthy testimony before the US administration,²³⁶ regional Fijian observer S. Cagilaba exposed the many pressures he endured on US purse seiners to falsify his reports and conceal illegal catch or waste discharge. His testimony referred to corrupt fisheries officers colluding with certain captains, and blamed the Fijian administration for its

²³⁵ See, e.g. the investigation led by Human Rights at Sea (Human Rights at Sea, 2020) or (E. L. Garcia, 2024).

²³⁶ <https://www.congress.gov/116/meeting/house/110575/documents/HHRG-116-II15-20200227-SD005.pdf> (accessed: 22.06.24)

lack of support. Observer A. similarly observed “something fishy going on between them [observer coordinators] and the captain of the vessel” (Fijian regional observer A., Suva, 29.07.21).

Tuna fisheries surveillance emerged as an instrument of risk-management, firstly aiming to ensure the sustainability of the resource and its economic exploitation. The observer apparatus supporting such surveillance simultaneously puts at risk its own professional agents. Securing the (economic and environmental) sustainability of the tuna fisheries comes at the cost of ‘insecuring’ a segment of the Pacific Islands’ populations. This realisation, increasingly evidenced by NGOs and professional associations like Human Rights at Sea, WWF or the Association for Professional Observers, has led to emerging discussions on observer safety and, more generally, on labour and human rights in the offshore fishing industry. The offshore world has long been managed from a ‘natural’ resource perspective, leaving its social dimension atrophied. Following the aforementioned death of an observer, New Caledonia restructured its programme and strengthened safety requirements:

Before boarding, before they are apt to do so, observers complete the CMBS, the Basic Maritime Rescue Training Certificate. They undergo a medical examination to assess their navigational capacity and a psychological test. Now, every two years, they consult a psychologist to verify that everything is alright and that there won’t be any difficulty for them to go at sea for thirteen days. (Observer manager, Noumea, 21.05.21).

Measures also progress at the sub-regional level,²³⁷ with FFA member countries reinforcing their safety requirements with the support of SPC and FFA. Recognising the isolated and isolating status of observers at sea, their standards now require them to have individual safety equipment, such as a personal life beacon or a satellite phone, to facilitate communication with observer managers. However, these measures remain emergent and are not always implemented in practice, for lack of equipment.

iii. E-Monitoring Developments

Technological innovations have brought new perspectives to address observer safety and other limitations of the programmes. In particular, the deployment of surveillance cameras on board the fishing vessels may dramatically revamp the observer apparatus’ functioning – while reigniting political and professional tensions regarding the observer apparatus.

a. E-Monitoring Promises: Better Data, Safer Observers, Enhanced Multipotency

E-monitoring consists of a camera system placed aboard fishing vessels. Currently, video footage cannot be transmitted automatically – data transmission remains too costly considering the quantity and the volume of data the cameras produce. Instead, data are stored on servers and hard drives located on

²³⁷ At the regional level, WCPFC negotiations remain tense however, requiring consensus from all member parties and subject to resistances from countries like Japan.

the fishing vessel, to be physically retrieved in port at the end of the trip and analysed by a “dry observer” from a shore-based desk (see Figure 38). Although at an early stage, e-monitoring progressively includes artificial intelligence-based software to read and code the video footage, help with the automatic identification and measurement of fish, and fasten video analysis.



Figure 38: Picture of a ‘dry observer’ analysing the footage of a camera placed onboard a Fijian longline vessel. Source: Ministry of Fisheries Facebook post, 19.02.20

E-monitoring does not permit overcoming the physical and temporal distance separating fisheries authorities from the offshore fishing vessel, and watching the video is a lengthy and labour-intensive process. Nevertheless, it promises to remove many barriers that constrain ‘conventional’ observer programmes. It could improve the coverage of the fishing fleets by granting access to vessels that cannot host human observers on board – especially longliners. The integration of other probes, sensors and digital equipment fuels hopes of “automatically generating” fisheries data and “autonomously producing an exhaustive set of data” (SPC e-monitoring officer, Noumea, 17.02.21). For its promoters, e-monitoring produces more and better data.

E-monitoring raised great interest in the South Pacific region, evidenced by the existence of SPC positions specifically devoted to its deployment. SPC developed standards: “At first, it was SPC which engaged the process to establish standards. We focused very much on the scientific data that could be produced, their utility. Then, fairly later in the process, FFA, which deals with fisheries management

and legality, became involved in the process to make recommendations on MCS data” (SPC e-monitoring officer, Noumea, 17.02.21). Similar to the historical development of (human) observer programmes, the two organisations joined forces through the Data Collection Committee to develop e-monitoring standards in 2014.²³⁸ Again, the process demarcated and articulated the “scientific” and “MCS”, ‘scientific’ and ‘coercive’, dimensions of surveillance. Because the two institutions lack any regulatory power, these standards are suggestions left to be enforced by the Pacific Island national authorities and to influence WCPFC negotiations. The adoption of this new surveillance instrument does not depend only on technological considerations, for reasons I will detail throughout this section:

...we’ve been conducting tests for ten years, we’ve established standards, we know the technology does work, it can produce valuable data. But there’s no commitment at a high political level yet, that would permit to deploy this technology at a large scale, there are only a few trials here and there. (SPC e-monitoring officer, Noumea, 17.02.21)

E-monitoring has been tested, including in New Caledonia and Fiji. In New Caledonia, the test remained limited between 2015 and 2018 due to a lack of workforce. Furthermore, New Caledonia felt satisfied with its programme and did not feel the need to push the technology further: “For now, New Caledonia’s argument is to say that the coverage rate is superior to the rule, so we don’t need e-monitoring” (Observer manager, Noumea, 14.10.19).

In Fiji, there were two ongoing trials while I was there. The first one was a FAO project, funded by the Global Environmental Fund, in partnership with the Ministry of Fisheries and FFIA. It aimed to equip 50 Fiji-flagged vessels with three cameras each. The second trial was a private initiative of the international Bumble Bee seafood company to equip ten Chinese-flagged vessels fishing outside Fiji’s EEZ and three Fijian-flagged vessels, all based in Fiji (Representative of the e-monitoring service company K., Suva, 09.07.19).

Interest in e-monitoring grows amongst fisheries authorities, but also amongst other actors interested in fisheries information, e.g. border and police forces (SPC e-monitoring officer, Noumea, 17.02.21). More noticeable is the fishing industry’s interest in the technology, as exemplified by the Fijian trials. Some companies find it easier to accommodate cameras than human observers who “do not necessarily behave deontologically” (SPC e-monitoring officer, Noumea, 17.02.21). The technology also enables the companies to surveil their employees at sea in a coercive objective: “We liked it very much because [...] we’re looking at the footage for how the crew is handling the fish. [...] It’s also a security: fish is very valuable in Fiji and we lose a fair amount of fish when vessels come into ports, as they take fish for the villages and so on” (Owner of fishing company R., New Zealand, 13.06.19). It also supplies data

²³⁸ The committee first established standards to define what data should be collected. It then endeavoured to define standards on the minimum necessary equipment to have on board, on mechanisms to transmit e-monitoring data to analysis centres, on data protection, etc.

necessary for labelling and certification schemes, which grants them access to more lucrative markets (see also Section IV): “That’s why it’s well perceived by the industrial fleet, [...] markets demand where the fish comes from, how it was captured, etc.” (SPC e-monitoring officer, Noumea, 17.02.21). In Fiji, this aspect was particularly influential in interesting and enrolling the industry: e-monitoring provided a surveillance instrument permitting the industry to *see* employees as well as to *be seen* by consumers.

At the fishers’ level, e-monitoring appreciation was more ambivalent. Some crew members see the cameras as an “intrusion” (Owner of fishing company R., New Zealand, 13.06.19), filming “even when we are naked sometimes” (Fishing captain R., Suva, 06.07.19).²³⁹ For captains, however, lack of privacy was mitigated by the fact that the cameras also enabled them to “watch the crew during the hauling” from the wheel cabin and “check if someone falls over, the shooting time, etc.” (Captain J., Suva, 10.07.19). Another selling argument for the captains is the anticipated capacity to automatically collect fisheries data and, therefore, alleviate the burdensome logsheet reporting work: “Captains would only have to validate the data instead of producing them.” (SPC e-monitoring officer, Noumea, 17.02.21). The technology is also promoted as a safety instrument, beneficial to the crew altogether: “There could be an improved feeling of safety, knowing that if there’s a physical accident, they know it’s been recorded, as proof of the facts” (SPC e-monitoring officer, Noumea, 17.02.21). Safety, once again, becomes a major argument to legitimise the intensification of surveillance. This argument is double-edged as employers can also use it to control if “the crew [are] following the rules, using helmet, using the proper gear, under safe conditions” (FAO e-monitoring project manager, Roma, 17.03.21). Hence, like human observers, e-monitoring is multipotent:

For long, we believed they [science and compliance] were different things. They are slightly different, indeed, but at the same time, we rapidly realised it’s the same data. Today, an analyst who watches a video, he will produce data that’s useful both for science and compliance. [...] It’s just a matter of what analytical regime you’ll use, but then the underlying image will be the same. (SPC e-monitoring officer, Noumea, 17.02.21)

The technology even offers an enhanced multipotency, used as a selling argument for the service company selling it: “More people can watch the video with e-monitoring and can use it for different purposes, at it’s possible to clone the disk [with the footage]” (Representative of service company K., Suva, 09.07.19). This multipotency enables the enrolment and assembling of the many entities necessary for the apparatus to work. In particular, convincing the industry and the fishers of the value of e-monitoring is essential to the viability of the apparatus. Once again, the functioning of surveillance is

²³⁹ SPC e-monitoring officer described that privacy and personal data protection had not yet been discussed because the problematic “was not really identified” in the South Pacific region, except in French Polynesia where the topic had been raised (Interview, Noumea, 17.02.21).

heavily dependent on the surveillance subjects. At sea, the cameras are ‘detached’ from their maintenance operators and only the crewmembers can maintain the cameras operational.

Surveillance Frictions, Evasions and Politics

Multipotency entails frictions. The most expected resistance comes from the surveillance subjects. In Fiji, some crewmembers rapidly devised evasion tactics to avoid surveillance from the cameras: “We’ve had damage to the cameras, and cameras being covered, and various things like that. [...] They turn the cameras the other way or cover it, particularly if they’re about to take some fish to their village or friends, things like that.” (Owner of fishing company R., New Zealand, 13.06.19). These subversive actions have rapidly been proclaimed illegal and punishable, and alarm systems were added to the cameras to detect any malevolent act (Representative of service company K., Suva, 09.07.19). Nevertheless, more passive and hardly detectable strategies emerged, such as neglecting the maintenance of the cameras:²⁴⁰ “The crew would not clean the camera, they had very little instructions about their responsibilities regarding the cameras, they didn’t know what they’re supposed to do with it.” (Representative of service company K., Suva, 09.07.19)

Other sources of frictions during the Fijian trial revealed power struggles over the e-monitoring apparatus. The positioning of the cameras aboard the vessels was one of them, since it would define what could become visible or not, and what surveillance priorities would be or not: “You also see complaints about the blind angles: the three cameras did not have a full view of all the vessel” (FAO project manager, Roma, 17.03.21). Similarly, against the tedious work of watching week-long video footage, the analytical work of the ‘dry observers’ had to be targeted toward privileged concerns. In the case of the FAO project, initially conceived to combat IUU fishing, the Fijian government decided to orient data collection efforts towards “the setting and catching episodes” (Representative of service company K., Suva, 09.07.19). Cameras were placed to watch the deck, permitting to see the hauled fish up close. This implied that the cameras could not film transshipping operations. For the analysis of the videos, “dry observers” could “skip the rest of the video, so they don’t know what happens on board in between [setting and catching]” (Representative of service company K., Suva, 09.07.19). Although the cameras recorded unloading activities, those sections of the videos were never analysed. These configurations privilege the state surveillance of marine resources and the monitoring of what is extracted from the ocean but disregards interactions between vessels or crewmembers. These choices were disappointing for the fishing companies, which were particularly interested in monitoring transshipment and unloading operations to control that their employees did not steal part of the catch.

The predominance of specific surveillance usages also appears in e-monitoring data management. Institutional actors easily identify – and demarcate – the ‘scientific’ and ‘compliance’ functions of surveillance. To those, one must add the commercial and coercive interests of the fishing companies,

²⁴⁰ Salted seawater and wind rapidly blur the lens of the camera and degrade the quality of the video.

which are less clearly identified considering that surveillance deployment is most often thought of from the state perspective. However, considering the irreducible reliance of surveillance on the fishing industry, the latter's interests gain progressive acknowledgement:

Potentially, later, when the artificial intelligence systems will be well developed and able to produce massive quantities of data, we may have to focus our analytical efforts on “observation-type” data for science, or compliance, *or on data really useful to the fishing company*. [...] For the technology to be useful, it has to be accepted by everybody. It may be that industrial actors will want this technology to be useful for them too, maybe conflicts will come from that. (SPC e-monitoring officer, Noumea, 17.02.21, my emphasis)

Such tensions appeared rapidly in Fiji, where the project was initially established in collaboration between the authorities and the industry. Soon after the programme started, the Ministry of Fisheries “closed up once they started viewing the videos”, the project technician indicated (Representative of service company K., Suva, 09.07.19). This interviewee was forbidden access to the watch room to prevent her from seeing “things that she should not be seeing on those videos, especially regarding compliance”. The FAO project manager confirmed: “Fiji government is very reticent, they want to keep *complete control of the data*, they want to be able to review and analyse it before releasing it. I can understand their point of view, but it was a trial, there was an agreement that the data from this trial would not be used for prosecution. [...] The industry was very disappointed in not having access” (FAO project manager, Roma, 17.03.21). E-monitoring appealed to the Fijian fishing industry to increase its transparency, which was not the case for the fishing authorities. Rather, this attitude can be interpreted as the will of the Fijian government to build and affirm their sovereign control of their fisheries against the fishing industry and with respect to WCPFC. This sparked great discontentment within the industry: “Cameras are wanted by [Ministry of] Fisheries but we don't have access to that, they use the information for themselves.” (General manager of fishing company S., Suva, 26.06.19). However, it was precisely the insufficient recognition of the industry's expectation and of its commercial surveillance imperatives that led the e-monitoring trial to stall:

We reached this point where they [the Ministry of Fisheries] engaged very slowly, without collaborating with the fishing industry as much as they could have, whereas it had been propelled by the industry, initially. We realised that the Ministry of Fisheries and the industry did not get along so much, whereas this collaboration was fundamental. It highlighted the need for tight relations between the industry and the government. The industry can only be an actor if it can gain some benefit from it. (SPC e-monitoring advisor, Noumea, 17.02.21)

Hence, if the fishing industry was a driving force in the development of e-monitoring, it rapidly lost its influence as the surveillance system progressively became a boundary apparatus:

It was very much a market-incentive that was driving the Fijian industry. But when you go into the details of what data to collect, that's the implementation phase. You

involve organisations like SPC, who was very influential in the process of what to collect, what level of details, etc. That's also why it became very heavy for analysis, because it was SPC and its scientific focus. [...] You could say that our objective from Common Ocean [the FAO project] is primarily to use it for compliance purposes. But then it had very mixed objectives for science and compliance in practice, it became very tough on the Fiji people, a very heavy task, so it became very slow and that's why the industry started to complain about the whole process. (FAO project manager, Roma, 17.03.21)²⁴¹

Conflicts over e-monitoring usages and problematisation affected the perennial funding of this apparatus: "It [the FAO-sponsored project] finishes next months after almost five years. It's not going to be renewed unfortunately. In fact, it's a very hot topic at the moment about who is going to fund the continuing use of the cameras and their maintenance" (Owner of fishing company R., New Zealand, 13.06.19). Eventually, these conflicts resulted in the duplication of the surveillance apparatus, a phenomenon which I already evidenced in the case of the logsheet apparatus. Fishing company R., interested in e-monitoring to support its own commercial interests, decided to invest independently in such a camera system, this time tailored for its needs and financial resources: "[Fishing company R.] asked [my company] to develop a lighter version. [...] They don't have the same software as the Ministry of Fisheries because they can't do the reporting, but they can access the map and the videos to watch it" (Representative of service company K., Suva, 09.07.19). Duplication derives from underlying surveillance politics, limiting the possibility of a fully-shared surveillance apparatus:

I think we'll have the same issue with e-monitoring: who control the network that enables data sharing. In the Pacific fishing world, data are extremely sensitive, that's why we can have a captain with two applications. It's not the technology that limits data-sharing, nowadays, but rather the trust one can have in a system and how the secured datum is shared with the right person and not another. (SPC e-monitoring advisor, Noumea, 17.02.21)

Resistances to e-monitoring development also came from Pacific Island governments that feared the consequences of the technology for the observer labour market. As I mentioned, the progression of observer programmes largely aimed to provide employment to the populations. The promise of a 'labour-free' surveillance brought up by e-monitoring had little resonance. Improving the surveillance of the tuna fisheries is only *one* interest of these governments, and not necessarily the priority:

There are national aspirations. [...] Currently with the EM [e-monitoring], the perception of people at SPC is that it's great. And at the national level, it's more: ok, how is EM going to affect my mandate that is national employment and managing my fishery? [...] My point in the talk was that it's a first world problem to be more

²⁴¹ It seems that after a change of leadership within the Ministry of Fisheries, relations with the tuna industry improved and the latter's interests were taken into greater consideration (FFA representative, Honiara, 21.05.21). The Ministry advertised the funding of another e-monitoring project in 2021-2022, attentive to commercial objectives. The project reportedly "bolster[ed] its relationship with the FFIA membership and industry stakeholders in noting the values of the system not only as a compliance tool but more so that this tool is able to ensure that market standards for fishing and fish handling processes are maintained whilst the vessel is out at sea" (Ministry of Fisheries Facebook post, 10.09.21).

efficient. Getting employment is a third world problem. (SPC observer programme advisor, Noumea, 26.02.21)

Many observers were concerned that e-monitoring would make “their job disappear”, which fuelled a “feeling of competition with e-monitoring” (SPC e-monitoring advisor, Noumea, 17.02.21).

For certain promoters of e-monitoring, cameras could actually improve observers’ working conditions. The representative of service company K. advertised that observers can now “work from an office and not have to go on board but work 9 to 5” (Representative of company K., Suva, 09.07.19). This perspective is not appealing to everyone. Being at sea can be what onboard observers specifically look for: “Observers are used to being outdoors and, in the beginning, it did not work out very well. But as things streamlined [...], people started to come onboard and be willing to do that, to sit in an office and computer, but it’s very heavy task” (FAO e-monitoring project manager, Roma, 17.03.21). Watching and analysing the videos is “very repetitive and boring”, this interviewee added. An observer felt ambivalent and expressed doubts regarding the cameras’ capacity to do his work:

Personally, I would prefer both of them. In terms of staying on shore and analysing the data, it helps as you spend more time with your family [...]. I also prefer going out on board the vessel because in my experience, if something goes wrong with the recording, that’s when you really can’t get any actual data needed, so that’s why I actually prefer to go out at sea and record the data manually. (Onboard observer K., Suva, 20.12.21)

Indeed, cameras also bring their part of cecity compared to observers’ eyes. Besides potential technical issues, it is difficult to see the “size of the hooks, the type of the hooks” and identify cryptic species like sharks or juvenile tunas (Former SPC fisheries scientist, Australia, 07.05.21). These observations led to concluding that “those were just two different observation methods” (SPC e-monitoring officer, Noumea, 17.02.21). Following these considerations, e-monitoring was progressively reconceptualised to complement and enhance rather than replace human observers. With this approach, e-monitoring could help disjoint the various and conflicting forms of surveillances at play in the observer apparatus, and alleviate the associated tensions and their risk to observers’ safety:

Generally, what we said was that this e-monitoring is not to replace observers and that observers are actually the perfect vehicle to collect refined information for science, and the e-monitoring would be more to complement this. At the same time, we were also arguing that e-monitoring makes life easier for observers because they are relieved of this pressure to look into compliance issues and devote themselves completely to science, and not being under pressure from the crew and captains and operators. (FAO project manager, Roma, 17.03.21)

E-monitoring could also alleviate observers’ workload: “Observers’ prerogative would be to assess total catch and species composition” while cameras could help see, e.g. dFADs deployment: “It would reduce observers’ work, it could be super interesting” (SPC fisheries scientist L., Noumea, 18.11.19).

Rather than explicitly dissociating the coercive and scientific dimensions of surveillance, it seemed that some Pacific Islands, such as the PNA group, envisaged the technology as a means to surveil the observers:

They were proposing e-monitoring to supervise the observer on board and monitor their well-being, not at all in the sense of dissociating the two technical and scientific roles and compliance. [...] They don't want e-monitoring to allow this pure distinction for the time being. [...] Perhaps it's a matter of process, if a purse seiner does something forbidden, the country can take them to court and demand millions of dollars. [...] There is a legal pathway that allows for this fine to be reached; with e-monitoring, this is not yet settled. (SPC e-monitoring officer, Noumea, 17.02.21)

The cameras could contribute to observers' safety or controlling their work – and therefore support a form of surveillance balancing between protection and coercion: “They [observers] are being monitored from the office. [...] You have to be there to collect the data and if you're not there, they will surely know. [...] Before, our pay wasn't good and there was no camera, but now the salary has increased but it comes with a price” (Observer A., Suva, 29.07.21). In any case, e-monitoring contributes to complexifying the surveillance assemblage rather than replacing and integrating its constituents.

4. Tracking Fishing Vessels at Sea: Vessel Monitoring Systems

VMS is the last state-imposed surveillance apparatus taking place on board fishing vessels to enable tracking their mobilities at a distance and offshore-onshore connections. It has probably permitted the most dramatic transformation in tuna fisheries surveillance by permitting seeing on a digital map and in near real-time fishing vessels at sea: “Without the VMS, you were blind, so it was a huge change” (Former FFA director, Australia, 03.06.21). I retraced in Chapter 6 the historical technical and political hurdles in establishing this apparatus, showing how the technology deployment was negotiated around its multipotency, resisted by fishing nations such as Japan and reliant on external actors providing the technological infrastructure (satellite one in particular) underlying the apparatus. In this section, I briefly demonstrate that VMS displays similar features of offshore surveillance as the logsheets and observer programmes and nuance the extent to which it permits to surveil and control what happens at sea.

WCPFC has set regional standards that apply to the high seas. FFA members have also established sub-regional standards to frame VMS in their EEZs, in accordance with WCPFC's. New Caledonia set its own standards for its EEZ. These standards frame the minimum geographical accuracy of the coordinates provided by the system or the minimum position emission rate. Against the dependence of the system on third-party companies, these standards also specify which suppliers are authorised to frame the practices of private and mostly foreign service companies and associated surveillance market. The VMS technology must be integrated into a tamper-proof box. Enclosing, literally and figuratively, the technology in a black box (generally called the “blue box”) guarantees the production of ‘fisheries-independent’ data. The information is transmitted by satellite to the relevant governmental authorities

(fisheries agencies and, often, maritime surveillance centres), WCPFC when the vessel is in the high seas and FFA for its member countries.

Although VMS may seem a relatively straightforward surveillance technology, there are a number of frictions that constrain its functioning, resulting in a patchy rather than panoptic form of surveillance. First, the system is partly delegated to the fishing industry, which must cover its costs. The technology is costly – averaging US\$1,700-2,300 for the transponders (AFB, 2018) – especially for smaller longline companies, which only slowly acquired the device and resented the unfair burden it placed on their shoulders compared to larger and mostly distant-water fishing fleets (Manoa, 2008).

It is also a complex technology, which undergoes regular failure. New Caledonia, for instance, faced an obsolescence issue after the company supplying its VMS stopped maintaining it – outlining the government’s dependence on external surveillance workers having their own logic. The system is complex because it relies on a long chain of transmission and command: “It’s more annoying for the shipowners because sometimes it doesn’t work [...] so they call us to say that VMS isn’t working and then I call the Information Technology and Systems Department to say: ‘The VMS isn’t working!’” (VMS technical officer, Noumea, 13.09.19). Fishing authorities are heavily reliant on technicians who are able to manipulate the VMS and ‘make it talk’ – as explained by this fisheries inspection officer explaining that VMS check is the most challenging part of her inspection process when she boards vessels in port: “The only difficult thing to check was if the vessel MTU [Mobile Transmitting Unit] has been reporting properly. If it did not send positions, you need to interrogate the device and this requires technical skills” (Former fisheries inspection and compliance officer, Suva, 08.07.19). Such skills are pivotal in discriminating technical failure from sabotage.

VMS does not prevent illegal fishing per se. Some fishers may blatantly continue fishing illegally in certain zones if not effectively *caught* at sea (cf. Chapter 9): “Compliance with VMS has not prevented some operators from fishing illegally. [...] Despite being tracked and warned, the vessel continued its illegal operation until it was intercepted and arrested (Manoa, 2008, p. 108). Although VMS is supposed to be tamper-proof, some fishers have devised ways to escape the apparatus and exploit the possibility of technical failure: “Many vessels, what they do is they turn off their VMS,²⁴² and it’s a common practice that’s known to happen. When asked why their VMS is not switched on, they come up with excuses. Do they get charged for this? They don’t, but they should.” (Fijian fishing captain S., Suva, 20.12.21). However, not all fishers see the technology as an impediment. The same captain found VMS useful in assisting his compliance with fishing rules: “I think VMS is very helpful to us in monitoring our positions and course in terms of staying within the EEZ. Before, it was monitored from our office, and we would receive a fax a day later to warn us of our position at sea.” VMS does not only help

²⁴² This interviewee did not specify how they could turn off the VMS. However, certain fishers report that VMS signal can be disrupted by covering the box with a metal cover for instance.

onshore actors to see the ocean, it also helps those at sea to find their way in a “placeless ocean” (Bush & Mol, 2015, p. 27).

VMS data do not speak of illegal fishing activities for themselves either. Interpreting and translating VMS signals into sanctionable offences requires much analytical work. The technology only provides intermittent geographical positions. The vessel’s location says nothing about the vessel’s characteristic (e.g. tonnage, fishing gear) or what is effectively happening on board: “With VMS data, you have your line [on the map] but you don’t know exactly where your fishing activity took place” (SPC database manager, Noumea, 13.11.19). VMS does not prove illegal fishing activities. To confirm these suspicions, additional calculative practices are required to infer plausible fishing activities. For longliners, interpretation relies on the vessel’s speed: a boat slowing down or appearing to be ‘still’ – i.e. drifting – may indicate an ongoing fishing operation. Here, it is the absence of mobility which becomes suspicious and an object of control. Analysing such information is a tedious task, partly overcome by automating it. In New Caledonia, the Information Technology and System Department has developed a computerised alert tool to detect fishing operations or the crossing of administrative boundaries (e.g. EEZ boundaries or MPA boundaries) for the fisheries agency. Previously, the service was delegated to a French-based semi-private company, which cost “an arm and a leg and where it was pre-configured stuff” over which the Territory “had no control” (Department manager, Noumea, 13.09.19). However, these alerts are alerts only and not proofs. (Relative) immobility may be attributable to technological failure. Only additional and *in situ* checks can remove that uncertainty: the capacity to surveil and punish at a distance with VMS is hardly complete.

The VMS apparatus has been configured first and foremost as a ‘coercive’ surveillance technology for fisheries authorities to track fishers’ mobilities across maritime boundaries and surveil intrusions as much as extrusions: “If there’s no licence to go fishing in the high seas, it can be called IUU. [...] It’s the Ministry of Fisheries’ responsibility to check that none of the Fiji flag goes to the high seas if it’s not allowed to do so.

VMS data are closely protected as a result of a compromise with the industry to be able to surveil it while preserving the latter’s commercial interests in keeping their fishing strategies secret. As a consequence, VMS data remain in the hands of governments, which retain exclusive control of this surveillance apparatus and, more specifically, in the hands of fisheries agencies. The latter can then decide to share the information with other agencies, often invested in maritime surveillance and policing operations, as is the case in Fiji and New Caledonia. Hence, control and ownership of the data lie in the hands of the fisheries agencies, while the Navy and the search and rescue centres of these two Pacific Islands have access to the data to assist with protection and coercion. One evidence of the state’s primacy over this apparatus is that the fishing companies may be refused access to the data concerning their fleet,

even though commercial secrecy does not apply in that context. The diffusion of VMS data tends to be particularly narrow:

It was under request by letter to the Maritime Affairs Department, with very little chance of success! [Laughs] Potentially, there was SPC, to carry out specific studies and cross-check information against fishing or observer records. There could be WCPFC, which would request information for a technical committee. There was the gendarmerie, for break-ins, the public prosecutor [...] when there was a dispute about a vessel [...] We transmitted information on a weekly basis to the MRCC [Maritime Rescue Coordination Centre] [...]. So the data no longer made sense because it was out of data but it still enabled them to carry out studies. (Former VMS technical officer, Noumea, 13.09.19)

However, as evidenced in this quotation, VMS data may serve many more usages than state's 'coercive' or 'protective' surveillance. Scientists rely on these data to improve stock assessment and other ecosystem research. NGOs increasingly criticise data's inaccessibility, influential in surveilling the fishing industry *and* the fisheries authorities, i.e. in 'reversing' the flow of surveillance – suggesting emerging issues of informational justice (Gautreau, 2018):

We have no access to the data, we have to rely on institutions. [...] WWF is engaged in supporting transparency for VMS data, even if it's time-delayed for a couple of weeks. It's a public resource managed with public funds, so it should be made public. (WWF representative, New Zealand, 24.06.19)

Fishing companies are interested in the information to track their employees at sea and assist and/or control offshore fishing operations for commercial purposes. Unable to access VMS data, some of them have *duplicated* the system and invested in one of their own (Owner of fishing company R., New Zealand, 13.06.19). In addition, for some vessels straddling jurisdictions, there may be up to two regulatory transponders on board for lack of data-sharing procedures between countries:

The Spanish [fleet] have two VMS boxes, one emitting to Spain, the other to FFA. Usually, the vessels only have the one that sends the information to the flag state. The flag state fisheries monitoring centre then sends the information to the state whose EEZ is concerned by the fishing operation. However, such agreement could not be reached for the Pacific, FFA required that every boat has an FFA blue box installed. (EU fisheries delegate, Suva, 14.06.19)

VMS data management reflects power disputes between governments over tuna fisheries management. It becomes a new locus for the sovereign affirmation of the Pacific Islands against the Distant Water Fishing Nations (DWFNs).

IV. Traceability Apparatuses: Linking the Commercial and Environmental Values of Surveillance

As I showed in the previous sections, one inherent fragility of the formal surveillance apparatuses comes from the fact that they only imperfectly interesse and enrol the agents on which they rely, firstly the fishing companies and their fishing captains. Certification and traceability mechanisms, which also constitute surveillance apparatuses, can be read as an attempt to reconcile the interests of fisheries authorities, NGOs and consumers with the commercial imperatives of the tuna industry. This section examines some of these schemes and how they renew the conception, organisation and practices of surveillance while contributing to a new surveillance economy. This section also evidences how these new practices of surveillance draw on, and therefore remain dependent on, pre-existing surveillance apparatuses, which remain the main knowledge infrastructures documenting what happens at sea.

1. Certification Schemes and their Strategies

As I was conducting my fieldwork investigations, particularly in Fiji, I rapidly observed that traceability and certification were becoming central to the management of the tuna industry. As retraced in Chapter 6, this ‘bottom-up’ management appeared under the impulse of consumer countries, NGOs or private companies to permit consumers to make informed decisions on ‘sustainable’ seafood products. These mechanisms back onto surveillance to connect consumers to producers and enable the former to assess fish and fishing practices *from a distance*: they “allow the consumer to evaluate the fish while he does not see how it’s been made” (Field notes, FFA presentation at a traceability workshop, Suva, May 2019), by making foreign, offshore and inconspicuous practices visible.

i. (EU) Catch Documentation Schemes: Certifying the Legal Capture of Tuna

Certain traceability requirements have been imposed by consumer states to regulate the flows of fish commodities entering their territory, enabling these countries to weigh in fisheries management at a distance (cf. Chapter 6). At the crossroads of military and sanitary logic, this approach tracks animals with an ensemble of written traces as part of a new rationality of risk management (Fortané & Keck, 2015). In the case of tuna fisheries, however, it is not so much live animals than the dead that are tracked, as the former escape most surveillance efforts. Traceability helps consumer countries to erect barriers to control flows in a globalised world by surveilling networks rather than continuous areas (Figuíé et al., 2015).

The EU established a catch certification scheme (Regulation No 1005/2008), initially for (phyto)sanitary reasons and then, in 2010, to address IUU fishing concerns (Blaha, 2015). This enables

one of the largest markets for tuna products to audit flag, port and coastal states.²⁴³ Only the products certified by the flag state to have been legally captured are entitled access to the EU market. This market-based approach incorporates legal requirements into market rules and delegates the burden of surveillance and enforcement to the flag state. The EU may sanction a country with a ‘red card’ forbidding access to its market or a ‘yellow card’ requiring the exporting country to take legal and operational (and mainly surveillance-related) actions to strengthen fisheries management. Many Pacific Islands received a yellow card,²⁴⁴ including Fiji, in 2012, after a political upheaval (Campling et al., 2017): “That had a lot of impact on Fiji. Suddenly, they were under a lot of pressure to document and reform their laws, their management system, to put limit on their fishing capacities.” (FAO MCS consultant, Roma, 17.03.21). The yellow card was suspended in 2014 after Fiji updated its legislation and strengthened its MCS measures, notably with the 2012 Fiji Offshore Fisheries Management Decree and the 2014 Revised Fiji Plan of Action on IUU.

The EU system traces (as confirmed by the name of its platform TRACES) and produces traces of the legality of the tuna industry’s activities up to the fishing vessels against its European standards. As mentioned by an FFA traceability expert: “Fish gets illegal only on board, not in cold storage. The legality of fish is only when you do the fishing, it’s dependent on your license. When it comes on wharf, legal and illegal fish smell alike.” (Field notes, traceability workshop, Suva, May 2019). Surveillance and its quality become the main token to grant fish a distinct ‘smell’: “A key component for catch documentation is fish accountancy. So the data, but also the verifiability of the data.”, that FFA expert continued. Rather than implementing an entirely new surveillance system, this traceability mechanism aims to cross-check and ‘meta-surveil’ existing surveillance practice: at stake is not so much the effective control of fishing activities and fish commodities than the control of surveillance and fisheries data (Deleuze, 1990).

Catch certificate production rests on the Fijian government, which analyses a series of documents supplied by the tuna industry to verify compliance with fisheries and (phyto)sanitary regulations:²⁴⁵

Did you know that before fisheries products are exported, they go through a standard checking process by Fisheries Officers? Officers conduct certification checks in accordance with the Offshore Fisheries Management Act of 2012 and Offshore Fisheries Management Regulations 2014. The certification allows for product traceability from ‘hook to plate’ which is an important aspect of market demand in combatting Illegal, Unreported and Unregulated fishing. (Groupe interview with Ministry of Fisheries officers, Suva, 09.08.21)

²⁴³ For instance, an audit took place in Fiji in February 2019 to assess the albacore and yellowfin fisheries.

²⁴⁴ Among the other Pacific Islands that received a yellow card are Vanuatu, Papua New Guinea, Solomon Islands, Tuvalu.

²⁴⁵ These aspects straddle several agencies and contribute to duplicate reporting requirements for the industry (cf. Section III.2), since IUU standards are checked by the Ministry of Fisheries and (phyto)sanitary regulations by the Ministry of Health.

Hence, Fijian authorities must analyse logsheets, unloading summaries and other fishing campaign reports to “check the numbers and see if they make sense” (Field notes, traceability workshop, Suva, May 2019). These operations simultaneously contribute to Fijian authorities’ coercive power: “There’s a list of fines that we’re able to issue for any cases of underreporting or misreporting for that matter... because most of these vessels, if they want to export, they need our permits, so that’s another area where we will be vetting to see if there’s misreporting or underreporting.” (Groupe interview with Ministry of Fisheries officers, Suva, 09.08.21). The system mainly relies on controlling logsheets, which become decisive in accessing external and more lucrative markets. This provides an incentive for the industry to provide accurate log sheets, which, instead of being a burden only (cf. Section III.2), may now provide economic gains to the fishing company. This has been well understood by the Fijian industry which reportedly became “proactive and involved in the CDS [catch documentation scheme], mostly to ensure access to market” (SPC & FFA, 2016, p. 5).

However, this apparatus imposed by a particularly large and bureaucratic administration raises many issues for the Pacific Island administrations and the fishing industry, which must understand foreign regulations and surveillance standards not tailored to their context. A company supplying traceability services to the fishing industry confirmed: “The EU is probably the stricter one in terms of the data they require. [...] In terms of content, the EU is by far much more information” (Founder of service company C., Suva, 19.06.19). SPC, FFA and WWF increasingly support national administrations and domestic companies in acquiring this new ‘culture of surveillance’ and knowing “which documents to be asking of the industries for them to be able to do their traces”.²⁴⁶ If the EU traceability requirements intensify surveillance, they only do so for a portion of the tuna fishing industry since it only applies to the companies exporting fish to its market. Hence, out of the 95 longliners included in the Fiji national fleet (Ministry of Fisheries, 2022), only 20 vessels were “eligible to supply to the EU” and concerned by these new surveillance imperatives (Field notes, traceability workshop, Suva, May 2019).²⁴⁷

ii. The Marine Stewardship Council Label: Tracing the Supply Chain

The private MSC label is the most influential certification scheme in the Pacific Islands. Fiji was the first Pacific Island country to obtain it for its longline albacore tuna fishery in 2012 before its yellowfin fishery also became certified. The label then propagated throughout the region, with about “half a dozen fisheries in the Pacific [...] now certified” and eight more under assessment (Field notes, MSC representative presentation, Suva, May 2019). Combined with the EU catch documentation scheme, the MSC label permits maximising tuna added-value (Fieldnotes, traceability workshop, Suva, May 2019).

²⁴⁶ <https://www.wwfapacific.org/2364658/Tuna-industry-undergo-catch-certification-training-to-maintain-access-to-lucrative-EU-markets> (accessed: 07.07.24).

²⁴⁷ Additionally, not all fish onboard these vessels are “EU-approved” and concerned by these surveillance requirement.

The certification rests on a quinquennial audit of MSC standards conducted by independent companies, completed by annual controls. The standards initially focused on the tuna resource state before they expanded to bycatch mitigation and, more recently, dFAD management.²⁴⁸ Lately, the label also started considering social ‘sustainability’ dimensions by incorporating labour standards (e.g. child labour ban in 2016).²⁴⁹ These standards transform fisheries inspection: “What we’ve set for the onshore component: you need labour audit [...] unless you can demonstrate that you’re already compliant with other international indicators like the UN Convention on child labour” (Field notes, MSC representative presentation, Suva, May 2019).

The label has been designed to weigh on fisheries governance and management. Rather than seeking to influence fisheries administrations directly, like the EU documentation scheme, it attempts to influence fisheries management *through* the industry: “MSC uses certification as a bargaining tool for the countries and the industry to put pressure on WCPFC to adopt these [conservation and management] measures” (WWF representative, Suva, 05.07.19). This strategy acknowledges the influential role of the fishing industry in tuna fisheries governance as “the stewardship of the ocean” while simultaneously consolidating the relations between “the private sector, civil society organisations, and high representatives of the government” in recognition that “the ocean is something shared” (Field notes, EU delegate, traceability workshop, Suva, May 2019). This approach creates new inter-actor and inter-level dependencies and, therefore, tensions: “Reference points need to be set to get the MSC certification, but those settings are done at the international level. This raises timeline issues as the industry does not have the same timeline as WCPFC” (WWF representative, Suva, 05.07.19). The label connects the various stakeholders of the tuna fisheries, including the industry, national governments, WCPFC, etc. and reproblematises the ‘sustainable fisheries’ issue at a much larger scale and network: “Global fisheries, global stake, global stake, global players... It doesn’t take just the Ministry of Fisheries and the regional institutions. We need everyone: vessels, processors, middle men...” (Field notes, FFA MSC expert, traceability workshop, Suva, May 2019). As it redefines fisheries’ boundaries far beyond fishers, fishing gear and target fish, the label also redefines surveillance boundaries and places fisheries authorities or tuna processing industries under scrutiny as well. The entire supply chain needs to be certified, to enable the continuous and secured transmission of information guaranteeing the sustainability of fish products. This problematisation resulted in the creation of Chain of Custody standards in 2001, to “ensure that

²⁴⁸ In 2019, there was much debate regarding the MSC certification of the purse seine fishery. An MSC certification demarcates ‘free school’ fishing from dFAD-associated fishing, considered less sustainable. The soaring numbers of dFADs led to questioning the possibility for such “free schools” to even exist, considering that they fish are always close to a dFAD. The debate pertains to defining a ‘free’ fish for it to remain certifiable – and therefore more valuable from an economic perspective (SPC fisheries scientist J., Noumea, 11.11.19).

²⁴⁹ A representative of the Pacific Dialogue NGO, involved in the defence of human and labour rights at sea, disclosed how difficult it is to trace the ‘human’ dimension of the tuna fisheries: “It’s difficult to know who they [crewmates] work for, there are no record, no contract often. And it’s hard to blame a company without having any proof.” (Pacific Dialogue representative, 04.07.19).

products from the certified fishery can be traced back to the fishery” (Field notes, MSC representative, traceability workshop, Suva, May 2019).

Surveillance propagates through the supply chain but the latter’s very first segment, i.e. at-sea fishing operations, remain elusive. MSC is granted to an entity representing a *collective* of fishing operators (e.g. Fiji’s FFIA or the PNA office representing the PNA domestic purse seine industry) and partly obfuscating individual fishing practices taking place offshore:

Now, companies use groups at sea. The fish is only eligible until a point where it’s weighed. For the PNA for instance, the fish is only eligible once it gets weighed and separated in Bangkok when it lands. It just remains eligible while it’s on board. It’s not a perfect system. We came close to get CoC [chain of custody] while at sea but we could not figure it out. [...] As long as we rely on the fisher saying he caught the fish in such area, the fishery is not certified until it’s weighed. It will take a few years before we figure it out. We can’t see what’s going on at sea, so we consider it standard risk. (Field notes, MSC representative, traceability workshop, Suva, May 2019)

Traceability only effectively starts from the wharf. Regarding at-sea activities, MSC indicators continue to build upon pre-existing and fisheries-dependent surveillance practices, which are only burrowed in rather than replaced or strengthened by this novel surveillance apparatus.

As a matter of fact, many MSC indicators only build upon pre-existing surveillance practices, which are (invisibly and irreversibly) embedded in the label (Bowker, 2000). Instead of producing new information on/at sea, the MSC label grants them new meaning and (economic) value: “MSC assesses the impact of the fishery and verifies that the stock is healthy to deliver certification. For instance, for purse seine, it looks into assessment reports, logbooks, observer data, [...] and assesses the data against its standards” (Field notes, MSC representative, traceability workshop, Suva, May 2019). The same speaker admitted: “We use the information that’s available from the SPC logsheets. [...] The assessment is only as good as the data that go in, indeed.” Instead of guaranteeing the real sustainability of the fisheries, the label vouches for the existence of surveillance measures (still largely dependent on its (self-)surveillance subjects) without necessarily confirming their effective correlation.

iii. The New Caledonian Pêche Durable Label

If the MSC label has gained great prominence amongst the industries and authorities of many Pacific Islands, New Caledonia has preferred developing its own Territorial label, following a model established in France (Manager of fishing company N., 21.10.19). When asked about this choice, the same interviewee harshly replied: “Are you serious? Why? Because our label is a genuine guarantee for sustainable fishing. It is not the case at all with MSC, which is just a commercial label, where we buy the certification to the client.” This quotation recalls the numerous criticisms directed at MSC (e.g. see Ponte, 2012). It also outlines the underlying surveillance economy of those certification practices. For this interviewee, the MSC label loses value precisely because it is ‘bought’. Besides the quotation’s

reference to corruption, it is undeniable that the MSC certification is a particularly lengthy and costly process and, therefore, highly exclusionary. For the New Caledonian fishing fleet, these costs cannot be compensated since it mostly supplies the domestic market: “The MSC label is very costly. There are not so many operators here, so the cost-benefit balance for this label is not necessarily interesting. [...] You must pay for the certification, for the assessment, you need to pay an external person for the audit... it’s very costly” (New Caledonian fisheries officer, Noumea, 14.07.21).²⁵⁰ New Caledonia’s industry chiefly exports to Japan, based on a long-lasting trust built over time and therefore little dependent on external guarantees as those provided by MSC: “Japan, it’s historical. Actually, the fishery in New Caledonia started by selling licences to Japan, they’re the ones who trained, etc., there’s always been this connection with Japan. That’s where it’s the easiest: we don’t need any sanitary certificate, no nothing. [...] It really is a trust-based relationship” (Manager of a processing company, Noumea, 23.01.22).

This label acknowledges, rather than transforms, pre-existing fishing practices as part of a wider strategy to make the sector visible to domestic consumers. It provides a communication tool (see Figure 39) without adding value to fish products, however: “From a commercial perspective, it’s useless, it’s not recognised at the international level. [...] It’s a matter of recognition for the sector, so that when we say we’re a responsible fishery, we can prove it.” (Manager of fishing company N., Noumea, 21.10.19). Certifying the environmental sustainability of the industry was also essential for the industry to retain its role in the governance of the New Caledonian EEZ and the Coral Sea Natural Park and coexist with growing biodiversity conservation agendas: “It was fortunate [that we developed the label] because then the Park arrived, and the fact that we’d already implemented that beforehand [...], it gave us a certain legitimacy” (Manager of fishing company N., Noumea, 21.10.19)

²⁵⁰ In Fiji, the industry could only afford entering the MSC process with external funding assistance from the UE (Manager of Fijian fishing company R., New Zealand, 13.06.19).



Figure 39: Advertisement for the tuna fishing industry of New Caledonia, stamped with the Pêche Durable label. Source: Facebook Post of the Federation des Pêcheurs Hauturiers de Nouvelle Calédonie, 05.11.21

2. Retracing the Sea and its Fisheries: The Making of ‘Terroirs’ and ‘Sustainable’ Fishes

Traceability and certification apparatuses produce new categories of ‘fishers’ and ‘fish’. The MSC label or the EU documentation schemes hence demarcate “MSC fish” and “not MSC fish” or “EU-approved fish” and “not EU-approved fish” to use the Fijian fishing industry’s denominations. They also delineate new spaces of ‘sustainability’ and, therefore, trace new striations over the offshore world.

i. Demarcating ‘Sustainable’ Offshore Marine Spaces

Certification and traceability apparatuses provide new mechanisms to demarcate and integrate offshore spaces and national identities in a highly globalised market. Tunas no longer come from the loosely bounded ‘WCPO’ but from more specific fishing grounds certified as ‘sustainable’, which new

narratives around the notion of marine ‘terroirs’. The former Permanent Secretary of the Fiji Ministry of Fisheries introduced the MSC label as a tool to “brand Fiji” (Field notes, traceability workshop, Suva, May 2019). Such perspective is particularly appealing for this country where tuna captures remain comparatively low (and lower) than the rest of the region. Because the Fijian industry can hardly rely on an economy of quantity, it opted for an economy of quality. In that respect, the MSC label grants value to fishing grounds in the margins of the richest tuna fishing grounds in the equatorial waters. Similarly, the New Caledonian label aims to create a local attachment to the Coral Sea Natural Park and its tuna among New Caledonian consumers. Although tunas continue to spill over the territorial boundaries of coastal states, their labelling attests to continued – and renewed – attempts to ‘attach’ them to a specific territory (see also Chapter 8).

For Fiji, it is precisely the international dimension of the MSC label that supports the construction of its national identity as a sustainable and responsible fishing country, and the internationalisation of this reputation:

It’s all very well Fiji saying that we’re sustainable, but the EU buyers, they don’t know where Fiji is in the Pacific. So if we say fishing is sustainable, they won’t necessarily believe it. If Norway or New Zealand said that, they might do so. We actually need international accreditation far more than an established fishing nation with good reputation. [...] It would be very dangerous if the Pacific was brought in the same hustle as South-East Asia regarding child labour, etc. (Field notes, manager of fishing company R., traceability workshop, Suva, May 2019)

Noticeably, the ‘terroir-making’ opportunity raised by MSC contributes to simultaneously standardising offshore spaces and bringing them closer to one another across distance, in a reticular fashion, and demarcating them (Bear & Eden, 2008). The MSC label provides a standard of equivalence permitting consumers to read different and distant spaces alike by bringing these spaces together under similar sustainable requirements. At the same time, it increases space distinction within the same area, separating ‘MSC waters’ from the rest of the WCPO.

The MSC label demarcates new spaces of sustainability at sea – although, as I have mentioned in the previous section, its ability to effectively surveil fishing practices in those offshore spaces remains loose. These spaces articulate fish, fishers, fishing gear and specific offshore zones. Even though fish and fishers may move in and out of these zones, it is only when this assemblage occurs that the certification applies: in that sense, it delimitates a relational space (Bear & Eden, 2008). Hence, a fish loses its MSC eligibility once it leaves the zone, and so does a fisher. What matters is not only the identity of a fish and a fisher but also very much their (temporary) attachment to specific places. These places remain largely delineated following pre-existing management boundaries, e.g. Fiji’s EEZ and WCPFC’s Convention Area. If they do not institute new territories *per se*, they redefine their governance by opening the door to foreign non-governmental actors influencing these spaces’ rules and surveillance. ‘Terroir-making’ in that sense is largely driven by actors external to this very terroir.

ii. **From the ‘Tuna-Aggregate’ to the ‘Tuna-Individual’**

Traceability apparatuses draw on technologies that permit to “share information on fishing, the quality of fishing, the location of fishing, the time of fishing” and address market informational demands (SPC database manager, Noumea, 13.11.19). Recent approaches increasingly seek to *individualise* fish tracing, contrasting with the logsheet or observer surveillance apparatuses that still convey largely aggregated information over fish *stocks*, expressed in volumes and masses. Fishers’ log sheets and observers’ workbooks do not provide enough details to know what fish has been caught where after they have been mixed in the vessel’ fish holds (SPC database manager, Noumea, 13.11.19).

For many service companies building an economy around traceability and certification, the goal is now to fabricate and stamp individual fish that consumers can trace through the supply chain. “Every fish has a story”, service company C. promotes in order to sell its digital traceability technology (see Figure 40). At a traceability workshop, an MSC representative conveyed the same reasoning: MSC’s chain of custody grants the fish a “passport” that permits its “nationalisation”, i.e. its affiliation to a specific territory (or ‘terroir’), and its circulation across national borders by guaranteeing its identity and making it commensurable (Field notes, FFA MSC expert, traceability workshop, Suva, May 2019). Again, the label and its standards produce forms of equivalence, which simultaneously permit some degree of diversity at the international level as countries can maintain their national systems (see, e.g. Chavinskaia & Loconto, 2020): “Beyond [Fiji], market rules apply. The passport is for compliance with national standards. The visa is for compliance with [global] market requirements. Kiribati has a sovereign right to determine what’s good for them, they don’t follow Fiji’s rules.” (Field notes, FFA MSC expert, traceability workshop, Suva, May 2019).

Traceability systems also acknowledge that fish’s ‘life’ and mobilities outreaches the ocean to expand on land and in the air. Fish continue to “walk about” after they are caught, the FFA MSC expert described: “An albacore never dies, it only sleeps and gets frozen” (Field notes, FFA MSC expert, traceability workshop, Suva, May 2019). Similarly, the manager of a New Caledonian processing company confirmed her interest in the ‘life’ of the fish, even after they are dead. During unloading operations, she always asks the fishers: “How the fish is doing: well? Not well? [...] It’s the life of the fish” (Manager of a processing company, Noumea, 23.01.22). What a ‘fish’ actually is takes on new forms with traceability apparatuses and under commercial interests. If tunas (plural), as animals, die at the end of the hooks, tuna (singular), as a commodity, is enlivened.

These schemes only improve the visibility of certain fish. Several species escape these apparatuses because the cost of entering their certification would exceed the expected economic revenues deriving from it. As I asked a Fiji industry representative why skipjack tuna was not certified in Fiji, he replied: “Skipjack is not MSC-certified because we don’t catch much, and it’s not a good market. It’s just cans, so it’s not worth the trouble” (Field notes, traceability workshop, Suva, May 2019). In Fiji, the industry’s

interests in environmental traceability and certification are chiefly motivated by economic preoccupation to gain access to the highly-coveted European and American markets rather than purely ecological considerations. ‘Sustainable’ fishing attributes distinct values to fish lives based on their commercial profitability.



Figure 40: Seafood produced using a traceability apparatus. The QR code provides information on the ‘story’ of the fish and its conditions of production. Source: Facebook post of service company C., 15.07.20

iii. Making Offshore Humans Visible

Traceability and certification mechanisms also contribute to redefining humans’ identities against the growing realisation that the ‘human dimension’ of offshore worlds had long remained neglected. In New Caledonia, the “Pêche Durable” label firstly aims at providing *images* of the invisible offshore world, virtually unknown by the local population who hardly see or access the Territory’s EEZ:

Let’s say there’s a big lack of image for the offshore fishery. Caledonians don’t actually know what it is. They don’t know how it’s done, what technique is used, how it’s done. Some think it’s done with nets, trawls or, even worse, in the park. [...] It’s mainly for this, for the lack of image on the profession and the products. Our aim was really to inform people about the product and the role of fishermen. They’re called sentinels of the sea, and they’re the ones who occupy the most space, so if we want to watch over this space, we have to occupy it too. There’s also this role that isn’t necessarily well known. But I was also thinking about the fact that... people here often have a bad image of local products. [...] To me, that’s just bad marketing. (Fisheries officer M., Noumea, 14.07.21)

The label clarifies fishers' identities and their many roles. This quotation is interesting because it highlights their role as "sentinels", i.e. as offshore surveillance agents, and their role in supporting and permitting the effective territorialisation of the EEZ by physically occupying these remote spaces. The human figure of the fisher is felt to have been more influential in revaluing the offshore world to the eyes of the Caledonian population: "At first, we worked on the term 'pelagic' [for the label], but pelagic doesn't mean much to people. Caledonian fishers, it's simpler, you put a small tuna behind, and then it can also serve in anticipation for the coastal fishers" (Manager of a processing company, Noumea, 23.01.22). Integrating the EEZ into New Caledonia's territory was facilitated by showing its anthropic dimension (see also Chapter 6).

However, the visibility of the 'human' dimensions permitted by traceability schemes is only partial. In particular, the tuna fishing economy continues to escape transparency efforts. A WWF representative explained how the real challenge for traceability was "economic data":

A number of regional fisheries management organisations have called for improvements in economic data because if we are going to manage fisheries to an economic target reference point, we need to know how much the fisheries are making. We get estimates, aggregated information but no discrete information. That could help us to see what fishermen are claiming about fishing grounds, the claims of processors barely making margins, that kind of things. (WWF representative, New Zealand, 24.06.19)

The label romanticises the figure of the offshore fisher but the complex capitalistic organisation of the sector remains largely uncovered.

3. Establishing a New Economy and Culture of Surveillance

Traceability and certification schemes rely on the fishing industry's propensity to (self-)surveillance. As for the state surveillance apparatuses, their viability depends on their capacity to interesse and enrol the industry. The most appealing dimension is market access. However, traceability promoters also highlight additional assets deriving from intensified surveillance to nurture a new "culture of surveillance" amongst fishing companies, whereby surveillance becomes a new "way of life" (Lyon, 2018).

WWF, one such proponent, publicised: "If all of a sudden you know exactly how many kilogrammes of fish are coming out and in, you can determine whether you have any loss due to staff or inefficiencies in the supply chain. [...] I think there are positive incentives that have to be recognised beyond the additional costs" (WWF representative, New Zealand, 24.06.19). A service company selling digital traceability tools similarly advertised that its products could also help with "reducing operational costs, branding, etc." (Founder of service company C., 08.07.19). Their goal is to outline surveillance's multipotency and associated values to have the sector internalise surveillance activities and "develop a culture of data" which, as I have shown in Section II, may be very limited within certain fishing

companies (Fieldnotes, traceability workshop, Suva, May 2019). These actors actively partake in erecting a society of surveillance: “They [the company managers] don’t seem to see the use of that type of data. For them, they think fishing is just going out to sea and seeing where people are catching good fish and go there” (Founder of service company C., Suva, 08.07.19). To this interviewee, however, traceability data may offer many more options to the managers:

What we want to do is once they start recording the data digitally, is teach them how to use the data. [...] It’s easier to apply for border entry, when you have to give the crew’s nationality, etc. Also, to carry with the fish product, if you want to market a hundred percent local crew, for instance. [...] Customers can access the data through our platform and see the story of the product if they want. [...] We can map vessel records [...], it can be used to plan new trips. How easy it is to generate your permits too, for landing, etc. Anything you need to apply for in just a few clicks. (Founder of service company C., Suva, 08.07.19).

Traceability-related surveillance supports export operations and the more general organisational and coercive activities of fishing companies that I described in Section II. As I was conducting my investigations, these perspectives were only limited and at an early stage of development. A Fijian fishing company trialling the tools of service company C. explained that one particular issue related to a mismatch in surveillance coverage between ‘MSC vessels’ and ‘not-MSC’ ones: “The benefits we have with MSC are market benefits. But for the data, they’re only available for certain boats, and we would like to have the data for all the boats, for all the fish and not just for this [certified tuna] species” (Manager of company S., Suva, 26.06.19). Traceability demarcates ‘sustainable’ and ‘non-sustainable’ fish through surveillance: fish are sustainable because they are surveilled. Surveillance of the general fishing operations is only patchy, leaving ‘non-sustainable’ fish more invisible.

The interest of certain stakeholders in developing such a ‘culture of data’ relates to improving fisheries’ sustainable management but also to developing an emerging ‘blue’ economy of surveillance. Traceability and certification schemes involve many private actors, including auditing companies, service companies, etc., whose economic survival draws on the very existence of offshore surveillance. Perhaps most visible are the technical and service companies that emerge to support the development of surveillance from an operational perspective, offering their services to the industry or to governmental authorities. The recent creation of service company C. or the fresh arrival of Spanish service company K. in Fiji’s harbour, right beside the fishing companies’ offices and operation plants, attest to the emergence of a new market for surveillance operators: “Around the same time while I was at FFA, we were talking about traceability, catch documentation and the trade implications of that. That seemed like an opportunity for us and there was no one else doing similar work in the region so we started [C.] after I left FFA” (Founder of service company C., Suva, 08.07.19).

4. Transforming Surveillance Practices: Challenges and Resistances

Traceability and certification apparatuses transform surveillance strategies, stakes, standards – and practices. As I mentioned, they tend to draw on pre-existing surveillance apparatuses. The EU documentation scheme and MSC require “copies of logsheet for each trip, landing summary per trip, copy of invoice, of stock sheet, packing list, bill of lading, health certificate” amongst other elements (Ministry of Fisheries officers, Suva, 09.08.21). If they burrow these surveillance infrastructures within new apparatuses, they simultaneously alleviate part of the surveillance work: “It’s the same standards for EU and Fiji catch certificates, so fisheries officers only use a simple Excel spreadsheet containing all the data inside.” the interviewed officers detailed.

Nevertheless, the process is lengthy; it can take “two to three days” for Fijian authorities to issue the EU catch certificate (Field notes, Ministry of Fisheries officer, traceability workshop, Suva, May 2019). Although traceability aims to consider commercial imperatives, this delay hampers the latter by making logistics more complex and slowing down the mobility of a fragile commodity. This caused tensions between Fijian authorities and the industry, which complained that the former issued export permits too slowly (Ministry of Fisheries, Facebook post, 03.02.19). Hence, if traceability and certification apparatuses aim to improve the connections between the industry and the fisheries authorities, they partly fail to do so because of their heavy surveillance requirements.

Surveillance practice transformations mostly occur at the industry level, which is confronted with new (and external) ways of thinking, translating and organising the sector: “It was not easy for the Fiji Industry to understand the process, let alone to interpret the myriad of unusual acronyms which remain strange, even today” (Field notes, representative of fishing company R., traceability workshop, Fiji, May 2019). These schemes require new working habits for the industry: “Because of the certification, now, I can’t just focus on the boat and fishing it’s slowly coming, like a volcano. Now I need to be informed, understand MSC, traceability issues, etc.” (Owner of *Longline 1*, Suva, 10.07.19). The manager of fishing company R. further detailed the workload the label imposed on its company:

For traceability, we get the logsheet and crosscheck, even if we just eyeball, for a difference of maximum 5%. Based on that, we can collect the landing permit and offload the fish. We keep track of the data: if you have a hundred albacore, you need to be able to tell who they’ve been sold to. Then you’re issue a catch certificate and export permit. Crosschecks are made by [Ministries of] Fisheries and Health, mostly for cold chain. For the landing data, you need to bring all the documents to the MSC CoC [chain of custody] auditor, who checks where the fish go. They’re cabinets from New Zealand, Australia. MSC has a monitoring form and every company has to return the MSC template every month, to account for what’s been caught, what’s in stock, what’s sold. It’s a big job to do, it’s not easy. Fisheries want to implement this system for all fisheries but they’re short of staff. There’s no use of producing all this data if no one checks and analyses them. It’d require at least three people. (Field notes, general manager of company R., traceability workshop, Suva, May 2019)

As surveillance intensifies, it becomes a job in itself, which is for the time being largely assumed by employees piling up several responsibilities, for the industry and for the national administrations: “It [MSC] doubles up the documents. We have a person looking at all of MSC” (Manager of fishing company S., Suva, 26.06.19). The process leads to the production of information that is not always “checked” and “analysed”, as mentioned in the previous quotation. Traceability orients the focus on the mere existence of surveillance, whereby surveillance becomes an end in itself and a performative tool of ‘sustainability’ rather than an instrument of knowledge. The dramatic augmentation of surveillance requirements weighs more heavily on smaller operations, further evidencing the exclusionary dimension of the label (Field notes, MSC representative, traceability workshop, Suva, May 2019).

Fishers on their vessels, too, must adapt to these new requirements. As part of certain trials to improve at-sea traceability, fishers of company S. were asked to tag their catch to identify the fish, its species, its weight, and its capture location. Crewmembers had to be trained to place the tag and capture data in a tablet (Field notes, traceability test, Suva, 03.07.19). Some fishers complained that “tagging the fish requires more time on deck and it spoils the fish” (Officer of service company C., Suva, 03.07.19), or because they encountered technical issues (e.g. failure of the tablet or of the string gun to tag the fish). Again, this raised the question of determining if traceability-related surveillance necessitated the recruitment of a new employee devoted to this task or if it should be delegated to the crew (Field notes, traceability workshop, Suva, 2019) – i.e. if surveillance was effectively labour in its own right.

Traceability does not only transform data collection practices but also fishing practices more generally. The label imposes additional or stricter standards that also weigh on fishers’ operational practices (e.g., regarding bycatch mitigation) independently of the national regulations. As they establish new striations over marine spaces, these apparatuses can affect the geography of fishing and landing: “If you fish in Tuvalu, you can’t say that the Ministry of Fisheries controls you, which is mandatory to be MSC compliant. So, we forbid our vessels to fish in Tuvalu. We only have six vessels fishing in Tuvalu and they are excluded from landing at MSC” (Owner of fishing company R., New Zealand, 13.06.19). In Fiji, the port of Suva is now divided. Only one deck abides by MSC and EU requirements (especially regarding EU sanitary requirements) and must be used for unloading for the fishes to preserve their certified status. This can entail congestion issues (FFIA representative, Suva, 25.06.19). Certified fish need to be “identifiable and segregated” (Field notes, FFA MSC expert, traceability workshop, Suva, May 2019). This requires a spatial reorganisation of fish storage and mobilities, both on board and onshore. Fish must be sorted on board depending on their ‘MSC’ or ‘not-MSC’ category. Segregation must be maintained at landing; if not, the fish loses its MSC status. To do so, some companies use nets to separate tunas (see Figure 41). A not-MSC fish is only a short distance from MSC ones: fish categories are as porous as the physical boundaries that produce them. Company R. expressed doubts regarding the net technique because “people are tempted to cheat” and privileged the individual marking of fish using coloured tags (Field notes, general manager of company R., traceability workshop,

Suva, May 2019). In processing plants, where fish from several vessels can accumulate and be stored, sometimes for weeks, fish must remain sorted, too. This imperative for segregation makes the logistics of fish storage and circulation all the more complex, be it on board, where space is a limiting resource, or in shore-based cold rooms and throughout the factories: “The logistics, it’s all getting very strict now” (Manager of fishing and processing company S., Suva, 26.06.19).



Figure 41: Picture (by Roko Vuiyasawa, for the author) showing the unloaded catch of a Fijian longline vessel, with a net separating MSC fish from not MSC fish.

Surveillance requirements expand to actors unfamiliar with tracking and reporting work through the supply chain. Processing plants, in particular, must pay new attention to fish movements and quantities to ensure that flows of matter and data are coherent, especially after the fish has been cut and processed into several pieces (see Figure 42). This can be very complex depending on the type of processing operations at stake:

It’s not like putting a tag on something you manufacture in factories. You tag a fish with this code, which records the position and time of catching of the fish, then you bring it in Suva, and it’s tracked through the factory, and then it’s coded again. One piece of fish could end up in 4 pieces of fish, or if it is for fish fingers, it could end up in a thousand pieces, so how do you carry on the tracking? (Owner of fishing company R., New Zealand, 13.06.19).

This quotation highlights, once again, the idea that the fishing industry is not as controlled and controllable as any commodity “you manufacture in factories”. Processing plants largely partake in the

'black-boxing' (or 'offshoring') of the seafood supply chain: often, "weight is lost in this process", according to an FFA MSC expert (Field notes, traceability workshop, Suva, May 2019). Parts of the fish can be destroyed or damaged. Certain products, such as the "tuna flakes", mix residual parts of various fish and species, making traceability virtually impossible. Resistance also comes from employees who resist surveillance assignments: during a traceability trial, a tuna 'grader' assessing fish quality explained to his manager that he could not capture any data because he needed "both his hands" to grade the fish, and said that he would need someone "to assist him" (Field notes, processing operation, Suva, 03.07.19). To retrace the origin of the fish, many processing companies actually appear to do "backward calculations" (Field notes, traceability workshop, Suva, May 2019): "Data are often not recorded or poorly recorded. Data don't follow the product and are mostly paper-based. It provides flexibility to juggle supply and demand but they're easy to change so it makes fraud easier to commit" (Field notes, FFA MSC expert, traceability workshop, Suva, May 2019). Although traceability developments aim to combine sustainability and commercial imperatives, it is also precisely this rapprochement that weakens the apparatus and provides incentives to cheat.

Traceability only functions to the extent that it manages to enrol the entire supply chain and effectively connects all stakeholders to circulate information. Fijian companies investing in those apparatuses are well aware that their efforts to stamp their products as 'sustainable' may lose efficiency if their middle customers do not adopt similar practices as well. After a traceability experiment, service company C. noted: "It was successful to a degree but the problem is that a lot of the companies don't know where the fish ends up. [...] That's the issue with traceability: all the actors of the supply chain need to agree to use the system" (Founder of company C., Suva, 08.07.19).

Technological developments offering to centralise and fluidify the data collection and sharing processes imposed by traceability requirements raise anew the tricky issue of data and database control. Service company C. developed (digital) informational tools permitting the "the data is only entered once, instead of having the Ministry, the companies, etc. doing it." (Founder of company C., Suva, 08.07.19). However, there were resistances to the perspective of 'commoning' such database: "[Company X] was initially very interested in [our product] but they actually decided to develop their own system themselves, internally. People say that it is because they often do sketchy things, and want to have an internal system that they will be able to manipulate and tamper with more easily" (Officer of company C., Suva, 03.07.19). Traceability apparatuses only partially succeed in aligning the interests of fisheries management authorities, fishing companies and consumers around a consolidated and common surveillance.



Figure 42: Picture of a traceability trial in a Fijian processing plant, with employees capturing data on the catch. Source: Facebook post of traceability service company C., 21.09.20

Conclusion

In this chapter, I argued that the ‘open ocean’ is, in terms of accessibility, a closed world. Hence, the network of fishing vessels at sea constitutes the main probe to surveil and know the ocean. This results in opportunistically turning these navigational and fishing infrastructures into a surveillance platform connecting fishers to fish and shore-based actors to fish and fishers. These constraints lead to delegating surveillance to these infrastructure operators (i.e. the fishing industry and its fishers), designing multipotent apparatuses that can serve various scientific, regulatory, commercial and coercive usages to enrol the latter and optimise limited surveillance resources, and constituting boundary apparatuses. This boundary position connects distinct communities of actors while retaining their differences and conditions for the possible existence of surveillance apparatuses. Simultaneously, however, this boundary position creates friction and competition over the apparatus that produces certain forms of ignorance and/or leads to the disassemblage of its constituents. This can result in the duplication and reduction of offshore surveillance apparatuses. In that regard, tuna fisheries management concerns become very much related to informational management concerns. As this chapter evidenced, what is at stake is not only the organisation of fish and fishers mobilities but also very much so that of fisheries information. This highlights informational governance issues, concerned with how data are produced and flow and emulating competition over information access and control and for informational sovereignty amongst state and non-state actors (Mol, 2008; Toonen, 2013).

The chapter evidences that surveillance relies on a complex and thickening assemblage of surveillance actors, instruments and practices that accrete with one another rather than progressing linearly with technological innovations. Patchy apparatuses articulate with one another to produce a more complete view of offshore fisheries. More than merely completing one another, however, they may layer up, which irreversibly and invisibly burrows their standards and limitations (Bowker, 2000). Additionally, I have shown that surveillance technologies are not readily adopted for practical, financial and political reasons. Surveillance is not just a matter of knowing to orient action, and not everyone is equally interested in knowing when considering the associated costs of surveilling. Hence, although corporations are frequently presented as a central stage of surveillance developments (see, e.g. Lyon, 2014), I showed that the propensity of fishing companies to invest in surveillance and their yearning for surveillance technologies differs greatly and can be very limited. Conversely, surveillance can serve other aspects than knowledge production and orienting action or permitting control. Surveillance is also becoming an economic sector in its own right, where the labour it produces has more value than the knowledge it can create. Surveillance can, therefore, become an end in itself, to create employment, deter illicit actions (e.g. from employees stealing catch) or add value to commodities (e.g. with traceability schemes) thanks to its very existence.

CHAPTER 8. Surveilling the Offshore Environment from Scientific Vessels

Scientific vessels provide another pivotal infrastructure of offshore surveillance to complement the information derived from tuna fishing vessels. Fisheries scientists, physical oceanographers or marine ecologists go to sea to surveil marine animals, phytoplankton and water masses and produce a scientific understanding of this offshore ‘nature’. In this chapter, I investigate the role and practices of scientists in surveilling the more-than-human offshore environment for ‘scientific’ and ‘regulatory’ purposes.

I first examine the fieldwork practices of marine sciences and the practical challenges of collecting data at sea and on the sea and its marine animals. I discuss the structuring role of vessels as boundary infrastructures in shaping research communities and practices, and I evidence infrastructural, epistemic and professional divisions between at-sea fisheries scientists surveilling tunas and other scientific communities. I describe how at-sea tuna fisheries scientists, as tuna surveillance agents, stumble against the specific features of these animals and deploy ‘fluid’ scientific practices akin to those of tuna fishers – and dependent on them. These fluid practices conciliate infrastructural rigidity with the ocean’s fluidity and result in a patchy and reticular spatiality of surveillance.

I then turn to shore-based scientists and discuss the role of scientific models in assembling and completing disparate information on tunas and offshore ecosystem constituents to produce a more comprehensive ‘surveillance picture’ of the offshore environment at a distance. I describe tuna stock assessment models and the emergence of ecosystem models aiming to produce a more integrated knowledge of offshore environments as part of an ‘ecosystem turn’ to ocean science and management. I compare these models and their (in)capacity to inform certain (and particularly spatial) forms of management. These new modelling practices bring new convergences but also divergences between scientific communities trying to integrate various sources of information and account for multiple dimensions of the ocean. Parallel endeavours emanating from the field of fisheries science (concerned with fisheries management and from the field of marine ecology (concerned with biodiversity conservation) tend to produce distinct and fairly separate offshore *worlds* (Tsing, 2015). I show that the diversification of modelling practices, however, obfuscates the remanence, layering and burrowing of tuna fisheries surveillance infrastructures, which remain very much central and alive, and subjectly constrain and shape these representations of the offshore world.

Finally, I investigate how ‘scientific’ tuna surveillance is turned into a ‘regulatory’ form of surveillance to inform and support tuna fisheries management under the Western and Central Pacific Fisheries Commission (WCPFC). I discuss the specific position of stock assessment scientists as experts, producing an intermediary form of knowledge astride ‘science’ and ‘management’ and how this position

shapes offshore surveillance, the production of knowledge and ignorance and their role in informing, legitimising or hindering political decision-making. In particular, I explain how this regulatory status encloses fisheries scientists, the Western and Central Pacific Ocean (WCPO) region and its tunas from other communities and forms of knowledge and regions through various organisational, epistemic and infrastructural lock-ins. I show that these lock-ins produce various forms of ignorance and preclude ecosystem and territorial management forms.

I. Fluid Scientific Practices to Conduct Offshore Fieldwork

You can't be that rigid at sea.

(Fisheries scientist G., Noumea, 12.02.21)

In this section, I discuss offshore fieldwork (or ‘sea-work’) practices and their influence in shaping scientific communities of practice and knowledge. Historian of science R. Kohler contended that field practices are practices of place, whereby scientists must adapt to particular environments (Kohler, 2002). In that respect, offshore environments force to many adaptations considering their vastness, lability and difficult access. I first outline the pivotal role of oceanographic vessels as boundary infrastructures in shaping the ‘scientific’ surveillance of offshore environments and discuss these infrastructures’ influence on bridging or demarcating various scientific communities. I then describe the practicalities of the Tagging Tuna Programme, a main apparatus for the surveillance of tuna fish – and more. I describe the ‘fluid’ strategies and practices of tuna fisheries scientists at sea, blurring the divide between science and fishing, between scientists and fishers. I discuss how these field practices of surveillance shape the knowledge of tuna fish and offshore environments and entail a professional and epistemic division between offshore ‘scientific’ surveillance agents and onshore scientists and between fisheries science and other oceanographic disciplines.

1. Accessing the Offshore Field

i. Oceanographic Fieldwork: Fluid Usages of Rigid Scientific Infrastructures

Like most environmental sciences, oceanography primarily relies on observational data as opposed to in-lab experiments (Lehman, 2016a). Fieldwork and the central influence of vessels have long been, and remains to a large extent, a defining feature of oceanography (Adler, 2014).²⁵¹ Historian of science H. Rozwadowski argued that oceanography’s subfields are linked by the common practice of fieldwork, “by the act of going to sea than by a shared body of specialised knowledge or common methods”

²⁵¹ STS scholarship highlighted the difficulties of mapping disciplinary boundaries in oceanography, encompassing chemistry, biology, physics... This suggested its “distinctiveness from other field sciences” (Adler, 2014, p. 334). The blurred categorisation of oceanography further supports my description of offshore science as a ‘fluid’ science. Here, I use oceanography as a general category encompassing all ocean-oriented scientific disciplines and comprising various and partly overlapping subfields such as physical oceanography, marine ecology, fisheries science, etc.

(Rozwadowski, 1996, p. 409). Hence, oceanography comprises a “fragmented collection of marine sciences” partially connected by common fieldwork practices and vessel infrastructures (Adler, 2014, p. 335).

Despite the pre-eminence of fieldwork for oceanographers, access to the offshore field is particularly constrained. The offshore world’s ‘closedness’ (cf. Chapter 7) applies to scientists, too. From a political-legal perspective, the increased jurisdiction of offshore spaces conditions the geography of scientific surveillance: “When we go into EEZs, we have to ask for permission” (French Research Institute for Sustainable Development (IRD) physical oceanographer C., Noumea, 28.08.19). Since Palau made its Exclusive Economic Zone (EEZ) an integral reserve, scientists must “buy some [...] permit to access the place” and sample its waters (Pacific Community (SPC) marine scientist D., Noumea, 02.10.19), showing that biodiversity conservation regulations can hinder marine knowledge production. Because much of the oceanographic research capacity is dominated by foreign or distant state authorities, it is entrenched in fragile geopolitical equilibria: “For example, French ships are not welcome in Vanuatu because of the [territorial] issues around Matthew and Hunter. Vanuatu systematically turns away French ships, or there is often a lack of response. For example, it’s complicated for Japan to get access because it lacks a regional network.” (SPC fisheries scientist V., Noumea, 04.10.19).

From a practical perspective, offshore fieldwork demands navigational infrastructures equipped with instruments to observe, probe and sample an underwater and opaque world. Access to costly research vessels is an acute constraint, even more so for the South Pacific Islands. The high dependence of marine sciences on material infrastructures produces epistemic privileges and inequalities, with only a few nations leading this research at the global scale (Partelow et al., 2020). New Caledonia is one of the rare Pacific Islands to own an offshore oceanographic vessel, *Amborella*, a “multi-mission” vessel that the Government first uses for the “monitoring of the environment” in its EEZ and Coral Sea Natural Park.²⁵² The vessel also serves other purposes, e.g. maintaining the Territory’s meteorological stations.²⁵³ The Territory also benefits from the French Oceanographic Fleet’s assets, although it has little control over those. Before it was replaced by *Antea* in 2023, the fleet had positioned *Alis* in Noumea, another multi-mission vessel built in 1987 and capable of conducting physical, biological and bathymetrical campaigns across the region. A marine scientist complained, however, that the French Oceanographic Fleet overlooked New Caledonia and provided the Territory with “outdated” and inadequate equipment, finding *Alis* relatively unsafe, especially during winter times (IRD scientist, Noumea, 02.10.19).²⁵⁴ This observation mitigates New Caledonia’s oceanographic capacities and shows its peripheral position in

²⁵² Coral Sea Natural Park website: <https://mer-de-corail.gouv.nc/en/missions-understand/scientific-campaigns> (accessed: 25.09.24)

²⁵³ Coral Sea Natural Park website: <https://mer-de-corail.gouv.nc/fr/missions-du-parc-comprendre/campagnes-scientifiques> (accessed: 27.07.24)

²⁵⁴ *Alis* has recently been replaced by *Antea* to renew the fleet.

the French State's oceanographic prerogatives. *L'Atalante*, an 85-m long "multidisciplinary" and "polyvalent" ship in operation since 1989, completes these oceanographic means.²⁵⁵ Nonetheless, *L'Atalante* works worldwide and only provides sporadic support to regional oceanographic research, visiting the South Pacific Ocean every four years on average.

Oceanographic vessels are longstanding infrastructures. Given their cost ("a boat like *Alis* is worth €50 million" (IRD scientist, Noumea, 02.10.19)) and the difficulty of renewing them, they are characterised by and promoted for their 'polyvalence' or, as I have been using through this dissertation, 'multipotence' – a term which better outlines their plural, but also potential roles. This fluidity of uses accommodates scarce and rigid infrastructural resources with diverse and competing demands from marine scientists. Like a fishing vessel constitutes a means of transport, a fishing instrument and a surveillance platform at once, oceanographic vessels play many roles. They provide field access, constitute a scientific platform, a survey instrument and a field-based laboratory and play the role of an "invisible technician" (Adler, 2014, p. 355; 338). They also offer a space of co-presence for various scientists (geologists, physicists, ecologists, taxonomists, etc.), seafaring officers and crew. Vessels' design shapes scientific lives, practices, professional networks and therefore how the offshore environment can be surveilled and known:

L'Atalante is capable of much longer campaigns but cannot do trawling [...]. We take *Alis* [...], but there are only six of us, and after three weeks we can't take it any more. Whereas *L'Atalante*, after three weeks, well... you're on a big boat, you've got lots of people, plenty of space, so it's fine, you're not suffocating. [...] On *L'Atalante*, you've got 30 people and big multidisciplinary campaigns, which cost more. [...] I think it's easier to have *Alis*, but it greatly limits your objectives. You can't work 24 hours a day, but the ocean doesn't stop at night or during the day. On *L'Atalante*, you have a crew that does rotations so you could do that. (IRD physical oceanographer C., Noumea, 28.08.19)

Research communities must adapt to the vessel and its surveillance affordances, facilitating certain uses and collaborations over others. The size of the vessel and its equipment condition research methods and multidisciplinary coexistence. As mentioned by this interviewee, vessel access is highly competitive and shaped by scientific and political agendas.

Because access to oceanographic vessels is limited and competitive and because oceanographic expeditions are costly, most scientists attempt to opportunistically join or insert their data collection requirements into ongoing expeditions. These strategies turn the vessel into a boundary surveillance infrastructure. In 2019, *L'Atalante* came to 'explore' New Caledonia's seamounts, presumed to be

²⁵⁵ French Oceanographic Fleet website: <https://www.flotteoceanographique.fr/Nos-moyens/Navires-engins-et-equipements-mobiles/Navires-hauturiers/L-Atalante> (accessed: 27.07.24)

biodiversity hotspots.²⁵⁶ The Kanadeep 2 campaign²⁵⁷ was interdisciplinary by design, involving taxonomists, geologists and marine ecologists to study seamount organisms and habitats. As I visited the vessel prior to the expedition, I saw several scientists from SPC and IRD visit the mission leader to ask if the mission could also opportunistically contribute to their respective research projects by collecting information on whales or by turning the vessel's echosounder when they would be at sea (Field notes, visit of *L'Atalante*, Noumea, 04.09.19).²⁵⁸ Limited oceanographic resources may create friction between competing scientific communities and their research projects, but they can also elicit interdisciplinary and inter-institutional collaboration and contribute to integrate scientific efforts: "This network concept is particularly important in the region", SPC scientist V. explained over the visit, in reference to the Pacific Islands' regionalist strategy of 'commoning' limited surveillance resources (Field notes, visit of *L'Atalante*, Noumea, 04.09.19).

However, co-presence on board oceanographic vessels does not suffice to bridge epistemic divisions between marine sciences: "Collaboration is difficult [between research on the water column and on the seabed], it's not the same people, not the same observation methods, even with [physical oceanographer X], even though the discussion has been going on for five years. Those who work on whales only look at fish, only at big fish, they're not really interested in biodiversity." (Field notes, visit of *L'Atalante*, discussion with a demersal marine biologist, Noumea, 04.09.19). This quotation evidences the existence of various epistemic communities and the challenges of overcoming these divisions to 'produce' a common and integrated ocean.

Access to the offshore field and fieldwork practices are not simply conditioned by vessels. They also evolve with surveillance technologies which undergo great transformations. Satellite technologies have largely 'revolutionised' the field of physical oceanography, in particular. By remotely collecting near-real-time scans of oceans' temperatures or chlorophyll concentrations, satellites have alleviated physical oceanographers' dependence on fieldwork and permitted them to acquire a remote and synoptic view of the global ocean (Lehman, 2018). They have greatly helped physical oceanographers understand and model large-scale ocean and climate dynamics. If satellites have permitted physical oceanographers to represent the ocean as a "volume of flows", they have hardly helped marine biologists and ecologists represent it as a "web of life", however (Benson, 2012, p. 860). Most marine animals, unless equipped with satellite tags, escape satellite surveillance. Marine ecologists or fishery scientists remain very much constrained by oceanographic campaigns:

²⁵⁶ Seamounts are submarine mountains.

²⁵⁷ French Oceanographic Fleet website: <https://www.flotteoceanographique.fr/en/News/Kanadeep2.-Explorer-les-monts-sous-marins> (accessed: 25.09.24)

²⁵⁸ Such opportunistic strategies expand beyond research vessels, as more and more scientists can also draw on fishing, shipping and military vessels to collect marine information.

For this [pelagic] ecosystem, we have no other means of observation than to go out to sea. [...] The great advantage we have [as climatologists] is that we have satellites. Every day, at a resolution of one kilometre, you can see the temperature all over the planet, every day. We don't have the equivalent for the entire marine ecosystem. [...] Above the plants, the zooplankton, the carnivores, *you have no other way to observe than going out to sea.* (IRD physical oceanographer C., Noumea, 28.08.19, my emphasis)

Still, remote-sensing information may influence biologists' practices by guiding their field mobilities. Just like certain fishers mobilise satellite information to guide their tuna searching activities (c. Chapter 7), scientific fieldworkers may now trace temperature and chlorophyll variations to orient their sampling strategies:

I have access to an environmental parameter that allows me to say that this corner looks like that corner. It makes me want to go and see this or that spot because it's different. *Whereas before satellites, I'd just go and look at things at random.* (IRD physical oceanographer C., Noumea, 28.08.19, my emphasis)

Despite the enduring challenge of surveilling offshore animals, technological innovations broaden surveillance perspectives. Classically, offshore animal surveillance relied on information provided by seafarers (mostly fishers), direct visual observation of surface animals from oceanographic vessels and sampling thanks to fishing operations. Hence, the scientific study of offshore animals shared common practices with those of fishers. The observation of marine organisms long relied on extracting the latter from their environment and, more often than not, killing them. Still, the capacity to observe marine animals *alive and in context* remains a strong bottleneck for marine biologists: "That's the problem. Unfortunately, when we get the fish back, it's usually dead. [...] We have much less information than terrestrial ecology." (IRD tuna fisheries scientist G., Sète, 30.03.19). For this interviewee, the marine environment presents intrinsic challenge to its surveillance and scientific study.

Contemporary developments in cameras, tagging, acoustic and genetic technologies bring new perspectives to peer into the 'water column' and grasp elusive organisms 'in context'. These new surveillance technologies simultaneously transform modalities of field access and observation. By measuring acoustic intensity, sonars and echo sounders help locate fish presence. These technologies exploit new sensory paths drawing on sound rather than sight to enable *immersive* access into the opaque ocean and spot elusive fish (Helmreich, 2016). Scientists can now 'listen' to marine organisms' presence and movements and read their 'acoustic signatures' on echogrammes. Acoustic technologies permit an open look into the ocean as they can "sample many things in the water column" (SPC scientist A., Noumea, 18.09.19). Environmental Desoxyribonucleic Acid (DNA) is another fast-growing technique, using seawater samples to indirectly observe marine organisms's presence based on the DNA traces they leave in their environment. The ocean becomes an archive and a substance that carries material memories of animals' existence and presence (Helmreich, 2019). This forensic-evoking technique permits detecting marine organisms without being in the 'right place at the right time' and fuels new

hopes of ‘seeing’ previously undetectable – and therefore largely unconsidered in management and conservations efforts – marine organisms and illuminating a “dark diversity” (Boussarie et al., 2018). Simultaneously, those techniques hold new prospects to alleviate marine biologists’ dependence on ‘conventional’ environmental surveillance infrastructure – in particular those associated to fisheries:

Before, we either had fisheries data or camera data and both are complicated. With fisheries, you have only species you fish and data are not reliable and we only have data where fishers go, so it’s annoying. [...] Environmental DNA is very integrative: we capture what comes at night, what’s elusive [...] We have a much wider range of species than before. (Marine ecologist, Montpellier, 08.10.20)

Such surveillance technologies are a work in progress, at this stage. Translating acoustic or DNA signatures remains complicated because of ‘noisy’ signals or because many of the species are actually unknown and, therefore, unidentifiable (SPC scientist A., Noumea, 18.09.19). They only complexify the surveillance assemblage but do not replace pre-existing surveillance apparatuses and practices.

ii. A Fishing Vessel to Conduct Tuna Fisheries Science

If shared oceanographic vessels facilitate connections across the various disciplinary subfields of oceanography science, it is noticeable that tuna fisheries scientific fieldwork operates in relative isolation from these other at-sea campaigns. This contributes to isolating tuna fisheries science from other oceanographic communities while bringing it closer to the fishing industry.

Fisheries science²⁵⁹ is certainly the field that has taken the greatest interest in tunas, primarily to survey their abundance and distribution and monitor their evolution. As a discipline, it arose in the mid-19th century in North Atlantic countries to look into the growth and development of commercial fish and fish populations and understand catch fluctuations (Hubbard, 2017). Like many offshore organisms, tunas’ features appear to make them inherently resistant to surveillance practices. Every scientist I interviewed invariably outlined the challenge of studying tuna fish populations compared to coastal or demersal fish:

I don’t feel like it’s the most progressive field [tuna fisheries science]. I think that’s just due a lot in part to the difficulty of getting, of actually catching these things [tuna fish] and learning about them inside aquarium experiments. We can’t really do it. [...] I feel there are some of the best people in fish science working on tuna. *But I feel that these limits are almost enforced by the species itself, their behavioural traits: their fast-moving approach to life. It makes it hard.* (SPC fisheries biologist E., Noumea, 19.11.19, my emphasis)

²⁵⁹ Fisheries science encompasses an “interdisciplinary array of scientific approaches” (Hubbard, 2017, p. 4), spanning genetics, population demographics, marine ecology, physical oceanography, etc. and varies across time and places. I therefore use the term in a relatively loose fashion, and will discuss more precisely throughout this chapter its fluctuating boundaries. I also privilege, when possible, the categories used by the interviewees to describe their own disciplinary label.

The material, human and financial costs of sampling tuna populations throughout the WCPO make such a scientific undertaking too “big” (Price, 2019) to be considered. Tuna fisheries scientists idealised a surveillance protocol that could grid the Pacific Ocean in a systematic and standardised fashion across space and time by “having more boats out at once, with perfectly equally trained scientists onboard, season after season, year after year” (SPC fisheries geneticist G., Noumea, 12.02.21), to ensure that “you don’t sample the same population twice as they are moving around the ocean” (SPC chief fisheries scientist, Noumea, 20.05.20). Considering the WCPO’s sheer immensity and tunas’ mobility, this is wishful thinking. Hence, tuna fisheries scientists firstly rely on information provided by fishing vessels (cf. Chapter 7), which inform not only fishing activities but tuna populations more generally: “Unfortunately for us, tropical tunas, because the ocean surface is enormous, we have no alternative but to use commercial data” (IRD tuna fisheries scientist G., Sète, 30.03.19). Fishers are “often the only samplers of the offshore ecosystems” (IRD marine ecologist K., Sète, 14.03.19), providing the most extensive available surveillance infrastructure in space and time.

To complement this information, tuna fisheries managers and scientists have built another surveillance apparatus to collect complementary information on fish’s biology and ecology in the field: the Pacific Tuna Tagging Programme. Implemented by SPC under WCPFC, the programme supports the assessment and surveillance of the WCPO tuna stocks. It is particularly valued by tuna fisheries scientists for it permits to surveil the offshore environment ‘independently’ from the fishing industry. It represents tuna fisheries scientists’ main experiment, whereby the ocean becomes a research laboratory (cf. Adler, 2014): “It’s one of the things that we have complete control over, as opposed to trusting external entities.” (SPC fisheries geneticist G., Noumea, 12.02.21) and it produces “the only independent scientific validation of what the models are trying to predict.” (SPC chief fisheries scientist P., Noumea, 20.05.20). I will show through this section that such ‘independence’ to fisheries must be nuanced.

The Pacific Tuna Tagging Programme derives from the 1977 Skipjack Survey and Stock Assessment Programme (cf. Chapter 5) and has conducted annual regional expeditions since 2006. It constitutes a formalised surveillance apparatus in comparison to many oceanographic campaigns occurring on an *ad hoc* basis. These efforts are an “integral part of monitoring” and aim to understand “the status and population movements of the regional tropical tuna stocks” by collecting information on “animal population size, mortality, movement (spatial stock structure), and growth”.²⁶⁰ This apparatus draws on the capture-mark-recapture method used by population ecologists to assess the size of an animal population and gain insights into fish’s lives at sea, i.e. *in context*. Every year, SPC sends a hybrid team of scientists and fishers to capture, tag, and release fish back into the sea so that fishers can recapture them (see Figure 43). As fish are caught, they are also weighed, measured and sexed. The cruises also

²⁶⁰ SPC website: <https://fame.spc.int/pelagic-ecosystems-and-species/pacific-tuna-tagging-programme> (accessed: 25.07.24)

sample fish's body parts (e.g. gonads, stomach, muscles, otoliths...) to fill SPC's regional Tissue Bank and conduct various analyses on fish's biology, diet, genetics, etc.²⁶¹ The tagging programme collects multipotent information whose main, initial purpose, however, is to understand tuna populations' size, mortality, structure and growth.

When the first Pacific tuna tagging operation occurred in the late 1970s, SPC had to find an adequate vessel to catch, tag, and release skipjack tunas. Therefore, a skipjack fishing vessel and its crew appeared particularly apt for the task. SPC chartered a Japanese pole-and-line vessel (Judd, 2016a) – a first cue of the proximity between fisheries science and the fishing sector. Pole-and-line fishing was widespread, contrary to oceanographic vessels, which were scarcer than today. It is also one of the rare techniques enabling the capture of fish while keeping it *alive*. Simultaneously, however, the technique brings constraints: it is not adapted to catching other tuna species. It requires regular access to coastal fishing grounds to catch baitfish – and, therefore, cannot take place too far offshore.²⁶² To extend tagging to other species and regions, SPC now also relies on a Hawaiian longline fishing vessel turned into a “multi-purpose vessel” equipped with several fishing gears that permit the capture of yellowfin and bigeye tunas.²⁶³ Both these vessels have been redesigned to accommodate scientific needs (e.g. laboratory space but also improved amenities), resulting in hybrid ‘scientific fishing’ vessels.

²⁶¹ Fisheries observers also contribute to the tissue bank, cf. Chapter 7.

²⁶² Hence, this fishing vessel enables tagging in Papua New Guinea and Solomon Islands, but is far less adapted for countries like Marshall Islands and Kiribati where bait resources are scarcer.

²⁶³ SPC website: <https://fame.spc.int/pelagic-ecosystems-and-species/pacific-tuna-tagging-programme> (accessed: 26.07.24). Fishing gears include dangles (short trolling lines), rods and reels to enable capturing tunas alive, still.



Figure 43: (Anonymised) snapshots from a video provided after an interview with a SPC fisheries scientist from a Central Pacific tagging cruise (Noumea, 12.02.21). Top: dangler fishing targeting surface swimming bigeye and yellowfin tunas. Middle: Caught tuna placed on the table for measurement. Bottom: Release of a tagged tuna.

The Pacific Tuna Tagging Programme currently alternates between two types of campaigns. The Western Pacific missions tag skipjack tunas from a pole-and-line vessel around the Solomon Islands, Papua New Guinea, Palau and the Federated States of Micronesia. The Central Pacific missions mainly target yellowfin and bigeye tunas using the Hawaiian longliner further east and in the centre of the Pacific Ocean. Most skipjack tunas are tagged with ‘conventional’ plastic (and cheapest) tags placed on tunas’ dorsal fins. Those tags only inform where the fish was caught, released, and recaptured. Technological improvements in sensors and computing initially deriving from the intersection of wildlife management and the military (Benson, 2010) have resulted in more informative tags, including sonic, archival and satellite tags colloquially called “spies”.²⁶⁴ These tags provide more numerous and precise information on tunas’ movements and their immediate surroundings. In that respect, tagging contributes to tracking tunas *and* offshore environments *through their gaze* (Whitney, 2014; Haggerty & Trotter, 2015). Certain scientists thus suggest turning tagged animals into environmental surveillance agents to collect information along the poorly known ‘water column’: “Tags from different animals could be used to get data on salinity, depth, profiles... if we enlarge the spectrum of animals. [...] *Animals would serve as platforms for sensors.*”, a researcher suggested during a workshop on ocean ‘scientific’ surveillance (Field notes, Subsea observation workshop, Noumea, Sept. 2019). However, those tags are far more expensive and complex to attach to fish, considering they require surgical operations. Archival and satellite tags have, therefore, predominantly been used on bigeye tunas to improve the monitoring of “the most threatened [tuna] species” (SPC tagging scientist D., Noumea, 02.10.19).²⁶⁵

If the tagging cruises first aim to tag and sample tunas, they also host additional research projects that opportunistically exploit these sea-going expeditions. The capacity of contributing to other research is constrained by the infrastructure’s basis. The 2020 tagging cruise contributed to a shark tagging programme, trialled genetic sampling, and started studying fish behaviour around drifting Fish Aggregating Devices (dFADs). Hence, if research expands beyond traditional tuna stock assessment activities, they remain related to tuna fisheries. This collaborative approach largely draws on the scientific collaborative ideal but still remain centred around the fisheries science community:

Basically, everyone who has an existing project in the oceanic fisheries that has something to do with tunas or any species and who would benefit from having more samples this year. [...] Everyone gets in a room together, saying what agenda they have. [...] The scientific community: you actually need to have that community. A lot

²⁶⁴ Sonic tags emit radio signals that can be detected within a certain range by a receiver attached for instance to a dFAD or other types of buoys. Archival tags are miniature digital data recorders that take regular measurements of pressure, temperature, light intensity parameters. They permit to follow fish’s movements consistently. The geographical position is derived from light intensity parameters, but tends to lose precision when calculating latitudinal coordinates, especially close to the Equator: “We are accurate to a maximum of one degree, which is still about 100 km.” (A tagging cruise manager, Noumea, 22.10.19). Satellite tags record the same information as archival tags, but automatically leave the fish body and resurface after a pre-set amount of time. These tags are easier to retrieve but they alter fish’s behaviour by acting like a “buoy” (A tagging cruise manager, Noumea, 22.10.19).

²⁶⁵ The last tagging cruises have also focused on placing acoustic tags on Bigeye tunas to study their behaviour around dFADs.

of those are just other people's projects that come to request from us for extra help. (SPC geneticist G., Noumea, 12.02.21)

The tuna tagging programme requires “the use of specific platforms which are not commonly available”.²⁶⁶ Its historical trajectory and tagging practicalities partly explain why tuna fisheries fieldwork has been isolated from other offshore oceanographic research. SPC still uses adapted pole-and-line and longline fishing vessels to guarantee some standardisation and comparability in its tagging protocol. As these vessels are costly, SPC only charters them, and therefore depends on commercial fishing operators. However, it is becoming harder to secure access to those vessels against the drastic diminution of the pole-and-line fishery: “There are only three or four pole-and-line vessels left in the Pacific, so it's a bit complicated.” (SPC tagging and sampling scientist D., Noumea, 03.10.19). Likewise, the Hawaiian longline vessel and its captain were about to retire in 2019. The upcoming disappearance of its research infrastructures led SPC to initiate a “boat project because it's getting more and more complicated to get a tagging platform” (SPC tagging scientist D., Noumea, 03.10.19). Unable to afford an oceanographic vessel on its own, SPC devised a ‘fluid’ strategy to conceive a multipotent fisheries surveillance platform to rally support:

[SPC]'s trying to put something in place so that we don't have an SPC boat but one that's shared with IRD, IFREMER [French Research Institute for the Exploitation of the Sea], the government, the Provinces... all those who have a need. To try and have a boat that's as versatile as possible so that everyone's happy at the best price. (SPC tagging scientist D., Noumea, 03.10.19)

Since this interview in 2019, the project now promotes the acquisition of a Pacific “fisheries science vessel” (see Figure 44), providing an “adaptable” infrastructure supporting tuna tagging but also oceanic ecosystem and deep-sea ecosystem monitoring, climate change monitoring, etc.²⁶⁷ Making the vessel a boundary infrastructure is a necessary condition for its establishment. The project offers infrastructural rapprochements between tuna fisheries science and other oceanographic research communities. Although this remains to be seen, it is plausible that such a shared infrastructure could contribute to bridging the divide, at least in the field, between tuna fisheries scientists, physical oceanographers or marine ecologists in ocean surveillance.

²⁶⁶ SPC website: <https://fame.spc.int/pelagic-ecosystems-and-species/pacific-tuna-tagging-programme> (accessed: 26.07.24)

²⁶⁷ SPC website: <https://fame.spc.int/ecosystems-and-marine-biology/pacificsciencevessel> (accessed: 26.07.24)

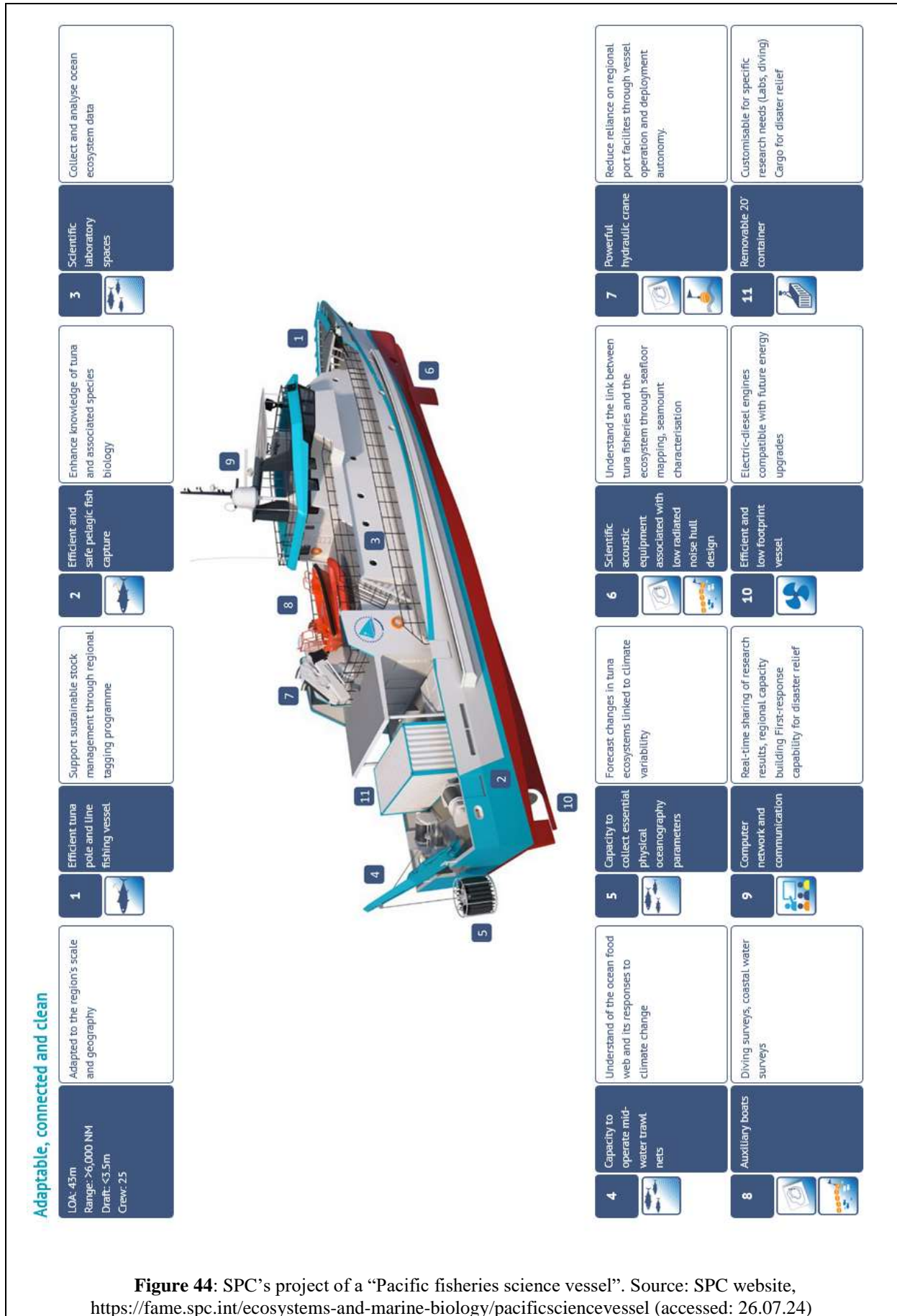


Figure 44: SPC’s project of a “Pacific fisheries science vessel”. Source: SPC website, <https://fame.spc.int/ecosystems-and-marine-biology/pacificsciencevessel> (accessed: 26.07.24)

2. Tuna Tagging in a More-than-Human Environment

Tuna taggers must adapt to their research vessels and even more to their field and subject of study. The surveillance of animals brings its specific stakes, knowledge, techniques, actors and human-animal relations – while transforming the latter in return (Fortané & Keck, 2015). To accommodate the ‘liveliness’ of tuna fish and offshore ecosystems, tuna fisheries scientists adopt distinctive fluid professional identities, practices and epistemologies, straddling science and fishing.

i. Blurred Boundaries between Scientists and Fishers

Tagging is, first and foremost, a fish-finding and catching operation which, therefore, draws on fishing know-how. Hence, tagging brings scientists and fishers together, on the same vessel and through common practices and knowledge. The Western Pacific cruises recruit the chartered pole-and-liner’s commercial fishing crew to catch skipjack. The Central Pacific cruises rely on (leisure) “real fishermen” selected for their rare expertise in dangling “because there aren’t 40 people who can reel in 20-30 kilo tuna all night long” (SPC tagging scientist D., Noumea, 02.10.19). The rapprochement between scientists and fishers goes further than spatial co-presence: during the tagging cruise, scientists become fishers and conversely. Fluctuating professional positions and skill transfer are essential to react swiftly to the field’s fluctuations: “I was an onboard researcher, so I was organising [the campaign] and the genetic specialist. And then, when I was onboard, I was a biological sampler, a fisherman [...]. Basically, everyone was a fisherman, and everyone was a scientist.” (Fisheries geneticist G., Noumea, 12.02.21). The ability to combine those two roles is highly valued. SPC’s tagging campaigns are mostly managed by people straddling and entangling fishing and science. One historical figure of the programme is a trained biologist but has also worked as a professional fisher and fisheries observer before he joined SPC to manage the cruises (SPC tagging manager, Noumea, 22.10.19). Another cruise leader explained that he was selected precisely because of his dual profile:

Another part of the background that I think is critical is that I’ve been a fisherman all my life: the science part of the job is important, but fishing and understanding fish and fishermen is as if, if not more, important than the science part of it [...]. At the end of the day, it’s just a lot of fishing [...]. That’s why fishermen scientists get invited on that one. (Tagging cruise leader, Hawaii, 25.02.21)

Few people have such a hybrid profile. The value placed on tuna taggers’ ‘fishing’ identity leads to specific forms of exclusion and entails a strong demarcation between at-sea fieldworkers and shore-based scientists analysing tagging data. For a cruise manager, retaining the same team of fieldworkers is an asset to mitigate the ‘tagger effect’, i.e. the likelihood that tunas will not survive the tagging procedure of less proficient taggers (Leroy et al., 2015). Several SPC scientists found, however, that the criteria to join the tagging team were murky and rather reflected socio-cultural biases on who can access the offshore field and will aptly stand the rough conditions of offshore tuna fishing. A data analyst

recounted his trouble convincing the tagging campaign manager to come on board because the latter “hasn’t done a Ph.D. thesis, etc. so he tends to [consider me] an ‘intellectual’” more likely to stay on land (SPC scientist J., Noumea, 15.11.19). This testimony evidences labour division and hierarchy in scientific work and performs an epistemic and relational divide to the ocean between fieldworkers. ‘Scientists’, with a thesis, tend to remain onshore while fieldworkers conduct the technical work of surveillance, i.e. of collecting data at sea. The number of women on board is also fairly recent and remains limited (to one or two), especially compared to scientific campaigns in other oceanographic fields. Tuna fisheries fieldwork remains circumscribed to a narrow ‘clique’ dominated by fishing-oriented profiles and evidencing a persisting “scientific heroism” ideology in this field science (Oreskes, 1996). As I will show through this section, this strongly influences how tunas are surveilled.

Fluid fieldwork practices and identities contribute to demarcating tuna fisheries science from other oceanographic communities, according to a geneticist who partook in both types of expeditions:

The oceanographic cruises, I feel, are more glamourised [...]. Like in the movies: this is a research vessel, you have microscopes onboard, you’re working with chemicals, etc. [...] Whereas this is: you’re out in fish gut, and that’s what you get. [...] One is more structured, and the other one is, like I said, everyone is playing every role. [...] Everything is *interwoven*, when you have only ten people on the boat, *you don’t have these nice little divides* between the laboratory and the living quarters. Everybody got liver on my genetic samples under the table, for example, and that was just part of life. *Everybody has to be fluid with each other* [...] (SPC fisheries geneticist G., Noumea, 12.02.21, my emphasis)

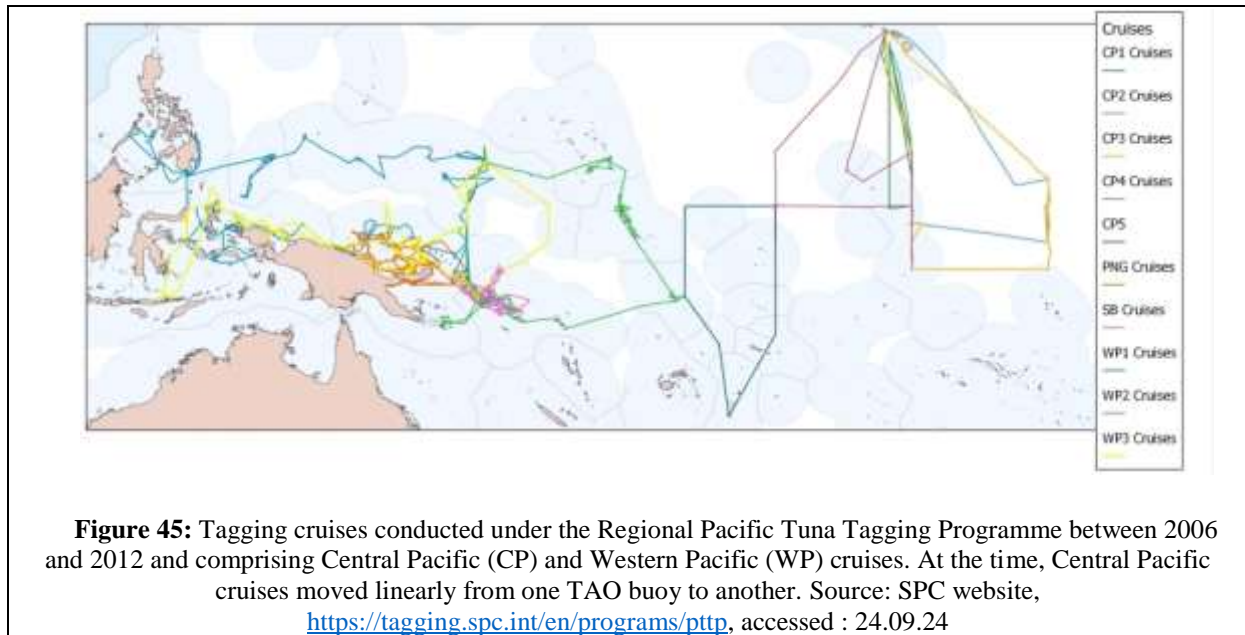
In tuna fisheries scientific campaigns, boundaries – professional, spatial, epistemic – are more blurred and porous than in other disciplines closer to the ideal archetype of modern experimental science.

ii. Adapting to the Offshore Environment

This flexibility results from adaptations to the offshore field and tuna fish. Although tagging is the main ‘experiment’ of tuna fisheries scientists, it hardly occurs in a controlled environment. Offshore fieldworkers must adapt to the weather, water movements, the fish, and their own bodies. A geneticist recounted being seasick for days and adapting her protocol several times because of the weather conditions: “I was careful not to have expectations. [...] There were nights where you make that decision that everything is going to get wet, everything is going to get contaminated,²⁶⁸ it’s not a night for genetics.” (SPC fisheries geneticist G., Noumea, 12.02.21). When conditions are difficult, “it’s hard to catch schools, [...] then the baits die quicker when conditions are bad because the boat moves and they break up [...] When conditions change, the fish generally get off the dFADs and come back afterwards.” (SPC tagging scientist J., Noumea, 11.11.19).

²⁶⁸ Here, the interviewee is referring to her genetic samples, which must not come into contact with each other or they will ‘contaminate’ each other.

Fieldworkers must adapt to the fish they attempt to study. First, they must find it. For long, SPC scientists opportunistically relied on ‘TAO buoys’, i.e. those measuring stations anchored throughout the Pacific Ocean for meteorological purposes: “They served as FADs for us, there was a whole mission programme that made as many TAO buoys as possible, it made a big loop.” (SPC tagging scientist, Noumea, 03.10.19). Meteorological surveillance infrastructures were opportunistically re-routed for surveilling tunas and TAO buoys’ positions dictated linear trajectories for the cruises (see Figure 45).



In the last few years, against the proliferation of drifting FADs, tuna taggers have changed their strategy to adopt the same fish-searching strategies as the purse seine industry: “We have signed agreements [with company X] for them to give us positions and echo sounder data under the FADs so that we can also optimise our campaign and the number of fish released.” (SPC tagging technician D., Noumea, 03.10.19). dFADs are increasingly used by tuna fisheries scientists to assist with tagging operations, but also to investigate dFADs’ influence on fish behaviour and offshore ecosystems more generally. Hence, dFADs are turned by scientists as a fishing technology but also as a study subject and as a scientific platform equipped with various sensors to probe dFADs’ surroundings. During a tagging cruise, acoustic tags were placed on fish to surveil their movements close to dFADs, to understand why tunas mysteriously aggregate around those artefacts and assess their influence on tunas’ mobilities – and the risk for dFADs to ‘trap’ tunas.²⁶⁹ Echosounders placed on dFADs are also used to spot fish presence and potentially identify them. This interest establishes new rapprochements between the fishing industry, fisheries scientists, and private companies developing fishing technologies. These companies foster the development of a new, private-led fishery science interested not in assessing stocks but in

²⁶⁹ This behavioural trait remains unknown to date (e.g. see Reyes & Airaud, 2022).

patenting acoustic-interpretative algorithms to support the fishing industry's 'sustainable' commercial development by identifying dFAD-associated fish based on their acoustic signature. Finally, certain scientists wish to turn these fishing infrastructures into opportunistic and boundary surveillance infrastructures to study tunas but also offshore ecosystems more generally. The network of dFADs could constitute “*drifting* monitoring stations for science” and crisscross pelagic ecosystems and their multiple dimensions to an unprecedented scale: “Using that information as an observation system, it could help not just with fishery stuff but also with tracking like ocean current, temperature changes, heatwaves...” (SPC scientist E., Noumea, 19.11.19).

In the case of the Pacific Tuna Tagging Programme, using dFADs as fishing instruments has helped optimise the cruises' trajectories by mitigating the uncertainty of finding any fish – a necessity considering that tuna fisheries scientists, like fishers, are subject to economic and productivity imperatives: “It's a lot of travelling time, between two TAO buoys for example, you can have three days at sea. And when you get to the TAO buoy, there are no fish. [...] I couldn't say the exact cost of the missions, but it was hundreds of thousands of euros [...]. We had to adapt and try to optimise this type of assignment and make it profitable.” (SPC tagging technician D., Noumea, 03.10.19). As a result, the tagging cruises' geography has become more unpredictable and reticular, adapting to drifting artefacts, currents and fluctuating environmental conditions:

You need to constantly keep an eye on which dFAD you want to go to based on echosounder detections that are reported, the current speed, water temperature, sometimes other oceanographic factors. You need also to consider not just the dFAD you're pursuing but also the following days, one day, three days after that. It's a complex decision-making process. [...] In the future, I think [...] there won't be a cruise track per se but a general area of interest, and then fishing dFADs within that area. (Tagging cruise leader, Hawaii, 25.02.21)

This change has organisational and epistemic consequences. The cruise would tag more fish on the TAO buoys in fewer places. In contrast, with dFADs, “we put fewer tags on many more stations. [...] So *from an analytical standpoint*, I think it's a really interesting exercise because no one knows what will happen.” (Tagging cruise leader, Hawaii, 25.02.21, my emphasis).

Tagging also implies adapting to lively animals. Like many fishers, tagging scientists complained about sharks, which unsettle tagging operations – and locations: “Some of the dFADs were unfishable because they were so many sharks, they jeopardise your catch. They are extremely annoying and persistent [...].” (Tagging cruise leader, Hawaii, 25.02.21). Sharks' behaviour leaves no option but to move to another dFAD. Tuna taggers must also learn to care for the fish they catch, as their intent is to keep them alive and well so they can be released back to the ocean and resume their 'normal' life. This is a challenge, considering how tunas are fished: “By the time you've got the fish onboard, you drag it very fast through a lot of water, and then you have it up onboard, it's stressed, half drowned... These fish are not going to be happy if you push them back into water.” (SPC fisheries geneticist G., Noumea,

12.02.21). Once onboard, tuna taggers must quickly evaluate fish's condition to assess their capacity to stand a tagging operation and survive upon release. They must manipulate fish quickly yet carefully to retain them in good status, and therefore anticipate and attune to their reactions. Fishers and taggers examine "how docile the fish is, if it's excited or if it's really tired" or if "it's bleeding, shark-bitten, eye-damaged..." and decide if the fish can undergo surgery to place archival or satellite tags: "You don't want to have half a suture in and lose this thousand-dollar tag hanging out of the fish's belly." (SPC tagger G., Noumea, 12.02.21; Tagging cruise leader, Hawaii, 25.02.21). In that respect, tagging is not a generic, formalised and rigid *technê* but rather a *mêtis*, rooted in local experience and acquired through practice to adapt and react to a perpetually changing environment and fish (Scott, 1998; Artaud, 2023). Again, fishing expertise is said to be pivotal to develop such *mêtis*:

But I think that more important than the fishing technique is that, when you handle the fish, you get used to it and that's useful for tagging. When you handle many tunas, you get used to the way they move, the way they are going to move, and you can react to that. [...] I think the hardest is correctly placing the tag on a sometimes very moving fish. And that goes back to knowing how to handle them: you know when the fish will stop moving for a second, you insert the tag and then it starts moving again. (Tagging cruise leader, Hawaii, 25.02.21).

Skipjacks are the most challenging because "they are the most active on the table" (Tagging cruise leader, Hawaii, 25.02.21): "It's hard even to get a conventional tag in them because they are these little vibrating masses of muscles. Trying to do a surgery is... not likely you're going to find a skipjack that will *comply* for that role", a tagger explained, suggesting fish's agency in affording tagging operations (SPC fisheries geneticist G., Noumea, 12.02.21). On the contrary, "bigeyes are easiest, they are very docile and calm" (Tagging cruise leader, Hawaii, 25.02.21). Albacore tunas are "too weak" (Fisheries scientist J., Noumea, 11.11.19) and have been "extremely difficult to tag at a level that could be included in stock assessments" (Field notes, tagging cruise preparatory meeting, Noumea, 16.02.21). Hence, not all fish can be captured by the tagging surveillance apparatus. Fish's unpredictable 'compliance' with fishing and tagging operations against the rigid organisation of the tagging cruises leads the tagging team to tag as many fish of any kind as they can to optimise their fieldwork. Rather than abiding by a strict experimental protocol, tagging scientists privilege an opportunistic and fluid strategy to collect as much data as possible: "In any case, it's fishing, so we tag everything, no matter what comes on board, as long as it's in good condition. All the data is useful." (SPC tagging scientist D., Noumea, 03.10.19). Tagging is about fishing – for fish *and* data. Data become an end in themselves rather than a means to an end, accumulating as matters of potential interests rather than raw matters of fact (Devictor & Bensaude-Vincent, 2016). Successful tagging does not guarantee successful surveillance: fish may

escape the apparatus once released back into the water, e.g., if it is never recaptured or loses its tag at sea.²⁷⁰

Fishing for data leads to opportunistically sampling every fish not healthy enough to stand the tagging procedure, to pull out all the stops of conducting fieldwork and capturing marine animals: “The ones that come injured or are not going to survive if we toss them back, those are the ones that we biologically sample as a way to recover the value of the animal – in some way, it’s a valuable resource. [...] It’s more efficient than: ‘Sorry, we killed something, over it goes.’”²⁷¹ Producing data compensates for killing marine organisms.²⁷² Tuna scientists must surrender to the unpredictability and uncontrollability of their field by improvising and agreeing to collect data opportunistically.

iii. **An Incomplete Surveillance Apparatus? Dependence on the Fishing Industry**

Proximity and dependence on fishers expand beyond the scientific vessel, which only provides one segment of the surveillance infrastructure underlying the tagging programme – and, to a certain extent, the biological sampling programme. Access to dFADs’ locations and echosounder data necessitates interesting and enrolling (Callon, 1986) fishing companies so they share *their* surveillance resources. This influences the timing of the tagging cruises that occur during the regulatory closure of dFAD-fishing so as not to disturb the fishing industry. ‘Scientific’ surveillance adapts to the fishing industry:

We specifically went out at that time because there’s a closure in the fishery so it’s not like we’re competing with the actual companies. [...] I mean it wouldn’t hurt them anyway but there’s this myth that if you go and tag fish, then they scatter and tell their friends and everybody bugs off the FADs and then the next boat that comes along gets nothing. [...] Out of decency, we try not to interfere with other boats that might be in the area. (SPC fisheries geneticist G., Noumea, 12.02.21)

Fishing companies’ interest in cooperating with the Pacific Tuna Tagging Programme is mainly reputational. SPC created a sign for companies to publicise their contribution: “For the companies, it’s good to be involved in stock monitoring and scientific campaigns [...]. dFADs are controversial, so if they can contribute a little to science...” (SPC tagging scientist J., Noumea, 01.04.21). As dFADs are opportunistically turned into a scientific surveillance apparatus, they acquire a new status. Simultaneously, scientific surveillance becomes useful to the industry’s commercial interests: “It’s an easy win for MSC certification [...]”, scientist J. added. The tagging apparatus relies on many entities to be functional. However, it only appeals to companies targeting markets responsive to environmental certification schemes: “It’s hard to motivate Asian fleets. It’s a lot of e-mails to send out to charm people,

²⁷⁰ SPC taggers therefore place a second ‘conventional’ tag on fishes to calculate the risk of tag loss.

²⁷¹ This interviewee said that during her last tagging campaign, 6,000 fish were tagged and 500 were biologically sampled, giving an idea of the ratio of fish killed.

²⁷² See also the work of historian of science E. Benson on the development of animal tracking and the associated ethical controversies (Benson, 2010).

not really research.” (Fisheries scientist J., Noumea, 01.04.21). Surveillance is essential to tuna fisheries science but also implies activities dismissed as ‘not really research’ by this interviewee: in this case, the tagging apparatus necessitates informal and poorly valued “dirty work” (Denis & Pontille, 2012, p. 8), yet essential to enable the collaborative network on which it depends (Nardi & Engeström, 1999). His view reflects the frequent categorisation of data collection work as an invisible technical labour rather than science (Shapin, 1989).

More crucially, tuna fisheries scientists depend on fishers aboard their fishing vessels to recover the tags. The tagging programme has established an awareness and remuneration mechanism to encourage fishers to inform SPC when they catch a tagged fish. SPC asks anyone who finds a mark, whether on a boat or in a processing plant, to return a form (giving the location, species, measurements of the fish, type of mark, etc.) in exchange for a monetary reward ranging from US\$10-250 depending on the type of the mark. Marks are hard to trace and may appear a long way from where they were released, attesting to the complex movements of the tuna around the globe, both at sea and offshore: “This week, we got an email from a guy in Spain who works in a cannery, to say that he’d found one of our GPSs but that it had been cut in half when he cut the fish up. [...] I guess it was transshipped.” (SPC fisheries scientist J., Noumea, 01.04.21). However, it remains “very difficult to find the marks” (SPC tagging scientist J., Noumea, 01.04.21) as fishers or processors do not pay attention or interest.

SPC scientists try various methods to overcome these shortcomings. They develop experiments to calculate non-reporting rates by asking fisheries observers to place false tags on fishing vessels and monitor whether or not the crew reports them. SPC has also tried to enrol fishers in environmental surveillance with gamification strategies:

I have a friend in England who makes video games on his phone. [...] We had an interview with him to find out more about how to attract people to play a game [...] so we launched a new reward system that’s a bit more collective. Every time you find a mark, you get a reward, but so does the boat, the whole crew. We have a season-long competition. The boat that finds the most marks is entered into a lottery. The idea is to change attitudes. (SPC fisheries scientist J., Noumea, 01.04.21)

SPC has also tried to anticipate the tag recovery locations to orient its awareness-raising and mobilisation efforts in a risk-based logic prioritising surveillance efforts: “We’re starting to create a system where every time we have tags recaptured by a boat, we look in a database to identify boats that were in the same area at the same time, we send them emails, or we wait for them in port to say that there are likely to be tags on board.” (SPC fisheries scientist J., Noumea, 01.04.21).

The tagging apparatus hardly provides an entirely ‘fisheries-independent’ vision of offshore environments. Tuna surveillance via tagging is subject to fishers’ mobilities that do not exactly reflect those of the fish. The apparatus still intertwines the surveillance of tunas with that of their fishers. Tuna fisheries scientists are well aware of their dependence on the tuna industry to collect their ‘fisheries-

independent' tagging data and attempt to come closer to the industry, which has been identified as a central player in the surveillance, knowledge, and management of tuna resources. Tuna fisheries scientists attempt to build a trans-epistemic collective (Knorr-Cetina, 1982) involving scientists and non-scientists in the 'scientific' surveillance of tunas. Hence, at a tagging cruise meeting, a researcher asked: "We really need good points of contact connections with managers, people in canneries, etc. [...] Any idea on how to get the tagging system up and running? Any idea on how to strengthen this network?" (Field notes, preparatory meeting of the tuna tagging cruise, Noumea, 10.02.21). For another scientist, "it's the future, to work with the industry, because governments..." (SPC fisheries scientist J., Noumea, 01.04.21). This scientist outlines the limited state power in developing tuna surveillance compared to the fishing industry's pivotal role in enabling it.

3. The Blank Spaces of Surveillance: Reticular and Patchy Data Collection at Sea

Data collected under the Tuna Tagging Programme leave many gaps in fish and spaces, which are neglected for practical, epistemic, political and economic reasons. This results in a reticular and patchy surveillance akin to an "oligoptic" (Latour & Hermant, 1998). Contrary to a panoptic view, seeing everything everywhere, or a synoptic view enabling one to capture everything at a glance, the oligoptic gaze only makes certain elements visible by carefully tracing their movements. However, the tagging cruises' design raises criticisms amongst SPC tuna fisheries scientists, evidencing epistemic divides between field surveillance agents and data analysts on land.

Tagging and sampling efforts tend to be redundant in space. Instead of surveying the breadth of tunas' habitat across the Pacific Ocean, taggers focus on the most important fishing grounds. The political and economic focus on skipjack tunas and the purse seine fishery has led tagging campaigns to target the 'Warm Pool' area, which only imperfectly captures other tuna species that are more subject to overexploitation concerns. The Central Pacific cruises only manage to capture specific parts of the bigeye and yellowfin populations: "We mostly tag small yellowfins and bigeyes, so we don't have a good representation of the mortality across the sizes of the fish, which is often more important because the small ones are not the ones that are fished." (SPC chief fisheries scientist P., Noumea, 20.05.20). Part of these biases derive from the greater elusiveness of certain fish. Fishing gear can only capture tunas swimming at the depth they reach. This induces 'cohort blindness' whereby certain parts of tuna populations escape surveillance:

Because we are going out with jigging and all these different types of gear, you get a lot of types of fish, but the fishery will only pick up certain age groups. You tag fish and if they are big enough, they will just kind of *disappear* and no fishery will effectively collect them again so a lot of those tags don't get returned. (SPC fisheries geneticist G., Noumea, 12.02.21, my emphasis)

Blanks are also temporal, as tagging campaigns always occur at the same time of the year. While this allows for time comparison, it prevents accounting for seasonal variations' influence on fish.

More invisible surveillance biases derive from the prevalence of a 'fishing ethos' among fieldworkers. Like other marine biologists and ecologists, sea-going tuna fisheries scientists talked about the *psychological* hurdle of being at sea and coming up empty-handed. Offshore fieldwork is too challenging to cope with the idea of 'failure', i.e. of not observing marine animals. 'Success', for fieldworkers, consists of tagging "as many fish as possible" (SPC tagging scientist J., Noumea, 11.11.19). Tagging scientist J. deplored that the cruises' leaders "only think in terms of numbers, they just want to tag as many fish as possible when it might be more interesting to focus on specific places" (SPC scientist J., Noumea, 11.11.19). Desk-based scientists have a different appreciation of the 'null' value: "Fishers don't like fishing where there's no fish. Scientists want fishers to fish where there's no fish because they need the information of zero. Absences are just as valuable as presences." (SPC modelling scientist N., Noumea, 15.11.19). For onshore scientists looking at *data*, 'seeing nothing' is equally informative as 'seeing something'. For fishers and scientists in the field, surveillance only becomes informative if it captures something. The psychological hurdle of offshore fieldwork also derives from the inherent challenge of surveillance work. Maintaining scientists' interest and attention at sea on the long term is difficult: "We're fed up with seeing nothing. The sampling methods are such that [...] it wouldn't work, people would exhaust themselves before. [...] It's very hard to keep scientists interested in these things." (IRD physical oceanographer C., Noumea, 28.08.19). Once again, surveillance work is presented as relatively unrewarding for scientists driven by additional professional interests and imperatives (e.g. publishing). However, this dissociation of data collection work and knowledge production work entails epistemological divides (Bowker, 2000).

Economic rationales further comfort quantitative indicators of success: "It's really tough to get money for a tagging programme because you've got to demonstrate something to the people funding the project, and that's demonstrated by: 'We tagged 10,000 fish, we tagged 20,000 fish.' [...] And it's not going to do that if you tag fish in areas where no one fishes, and that's a fundamental problem." (SPC fisheries scientist N., Noumea, 15.11.19). Again, visions of surveillance (quantitative vs. representative) differ between scientists who analyse tagging data to assess tuna stocks and funders, depending on whether surveillance is understood as the successful collection of information or as the successful production of knowledge deriving from this information:

If you tag really close to where the high fishing pressure is, it might not be representative of the entire population. So I think it would probably be better to try and spread out where you tag throughout the entire range, but it makes it logistically much more difficult. There is the risk that if you go to the area with less abundance, you tag fish and they are never caught. Or that you don't actually tag fish because you can't find them. I understand it's more of a risk not to tag in your high fishing zone. But I think it's probably better from a statistical standpoint to try to sample your

overall population instead of just being like: we want the most tag returns. (SPC modeller M., Noumea, 20.11.19)

Criticisms against the blanks of tagging surveillance ramify beyond the scientific community. Some fishing industry members and fishing nations located on the *periphery* of fishing and tagging hotspots complained that tagging strategies masked shifting tuna distributions:

Skipjack schools have contracted in the centre, yet Fiji is located in the fringes. Fringes contract. SPC does not do its assessment in the right spots: they only tag in the centre, which will remain full the longest. They only start understanding that now, but they had a false reading of the situation because they would always do the tagging and the assessment in the same spot. (Owner of fishing company F., Suva, 17.07.19)

A tagging scientist agreed to this ‘contraction range’ hypothesis: “There is a density-dependency effect. If we concentrate all the [fishing] effort in this region, it attracts all the fish around it, which replace them and therefore mask the restriction in the distribution of tuna.” (SPC tagging scientist J, Noumea, 11.11.19). Hence, the apparatus’ design maintains some forms of ignorance on tuna stocks’ evolution.

II. Assembling Data, Modelling the Ocean, Burrowing Surveillance Infrastructures

The previous section mentioned some divisions between offshore and onshore scientists. I prolong these reflections as I now focus on the work of onshore scientists in using surveillance information and modelling the offshore environment. Given the challenge of surveilling offshore ecosystems in the field and the many limitations of marine data, modelling has become a fundamental part of oceanographers’ practices to support the ‘scientific’ surveillance of offshore ecosystems. Models serve to make sense of the data by assembling them. They also contribute to surveillance by calculating (see Aykut & Nadaï, 2019) and, therefore, *producing* rather than merely collecting complementary data. These models attest to as much as they contribute to expanding a “modelling reason”,²⁷³ whereby models become pivotal to navigating an uncertain world despite their fragilities (Boullier et al., 2021, p. 11). These models offer a ‘picture’ and embody visions of what offshore worlds may be, will be and/or should be. I first focus on tuna fisheries models deriving from tuna fisheries surveillance data (mainly tagging, observer and logsheet data) to assess tuna stocks. I then discuss the emergence of new models following calls to develop ecosystem approaches and discuss how these reconfigure research communities’ networks and practices. I show that these models provide new layers of surveillance infrastructures while invisibly and irreversibly burrowing heterogeneous datasets and situated visions of the ocean (Bowker, 2000).

²⁷³ This expression aims to interrogate both the rationality of drawing on mathematical models despite their limitations and the reasons to produce such models.

1. From Fieldwork to Desk-Work: Epistemic Divisions Within Fisheries Science

One reason to rely on models is not to depend entirely on data because the latter are doubtful, costly or not yet produced (Boullier et al., 2021). These adjectives aptly apply to tuna fisheries data. Modelling constitutes an adaptative response from tuna fisheries scientists to surveil offshore environments despite the challenges of surveilling them in the field. This strategy permits surveillance to operate onshore, *at and despite distance* from the field (e.g. see Edwards, 2010; Lehman, 2016b). Quantitative modelling approaches have long been prevalent in fisheries science, starting from the 1930s when fisheries biologists began to produce quantitative dynamic population models from fish measurements (Hubbard, 2017). Population dynamic modelling progressively became dominant. It marginalised other, more naturalist approaches interested in researching biological and physical influences on fish' habitats and reproduction, resulting in the isolation of field scientists (Telesca, 2017). Quantitative models grew and culminated in the 1980s-2000s "Golden Age" era, significantly advancing population dynamic models, uncertainty treatment, and heterogeneous datasets integration (Quinn Ii, 2003, p. 366). It seems generally accepted amongst fisheries scientists "dealing with population problems that mathematics is an indispensable tool in their studies" (Quinn Ii, 2003, p. 354). The method is essential to deal with *populations*, especially when those consist of marine and mobile animals:

R.: I think fisheries is one of the modelling-intensive areas of ecology.

F.: Terrestrial natural resource management is much easier, if you go into forestry [which informed fisheries science development, cf. Section III.1], you can actually go count your trees. But fisheries are dominated by huge uncertainties. You never actually know how many fishes there are, what they are doing, where they are.

R.: Counting fish is just like counting trees except you can't see them! Or you can, but they move around! [Laughter]

F.: So, you need to develop a whole bunch of other approaches to natural resource management that account for all those uncertainties.

(Two SPC fisheries modellers, Noumea, 08.11.19)

Modelling methods have complexified and diversified with available data, mathematical tools and computing power. These changes have transformed professionals, scientific practices and stock assessment methods. In the first place, they significantly contributed to relocating fisheries science onshore. At the turn of the 1980s, fisheries scientists turned their efforts away from at-sea fieldwork towards the digital world: "The modelling turnaround between the 1980s and the 2000s was very detached from the field; people never went out on a boat. Now there's a comeback, we realise that we

need empirical data to calibrate the models, but very few people have both skills, it's become too specialised." (Field notes, SPC scientist, Ecosea workshop, Noumea, Oct. 2019).

The division of labour between data collectors, managers, and analysts is visible within the SPC Oceanic Fisheries Programme's organisation. The Data Management division manages SPC's databases and develops digital tools. It chiefly involves computer and data technicians who do not necessarily have a background in fisheries. The Fisheries and Ecosystem Monitoring and Analysis (FEMA) division manages the observer programmes, the tagging programme, the biological sampling programme, and the tissue bank and conducts research projects on offshore ecosystems. Finally, the Stock Assessment and Modelling (SAM) section is responsible for developing and running stock assessment models on behalf of WCPFC (cf. Section III). It is staffed by fisheries scientists specialising in mathematics, statistics and modelling. The first two divisions mostly (although not exclusively) support the work of the SAM section in the ultimate objective of assessing and surveilling tuna stock states over time: "Everyone adds their little stone to the edifice so that, in the end, the stock assessment section has the best possible data to refine their models." (FEMA marine biologist D., Noumea, 03.10.19). These three divisions demarcate and articulate distinct areas of work and epistemic communities supporting the scientific study of oceanic fisheries, especially between FEMA and SAM. Fisheries biologists, ecologists, geneticists, taxonomists, and tagging fieldworkers are separated from statisticians and mathematicians, and data collection and accumulation from knowledge production. According to FEMA biologist D., direct collaborations are rare, primarily informal or informational, i.e., through data circulation from one section to the other.

This labour organisation bears influential consequences on knowledge production and the disconnections between fieldwork and computer work. Some fisheries scientists regretted that modellers were 'losing ground' with the ocean and its fish: "It's not the same work at all. They are modellers, statisticians. [...] These people have never seen a real tuna in their lives, except on a plate." (FEMA marine biologist D., Noumea, 03.10.19). A modeller who had recently joined SPC's tuna research programme after working on lobster fisheries in the US seemed to confirm such an impression. As I asked her about the challenge of shifting species and region of study, she replied: "It doesn't matter, I just work with figures." (Field notes, Ecosea workshop, Noumea, Oct. 2019). For some modellers, however, lack of access to the offshore environment was an impediment to their work:

When I was working with the tagging database, I've been trying to filter the data to use them in the growth model for bigeye [...]. And I had questions about how they measure fish [...]. When you look at the database, about 20% of the fish decrease in size from when they're released to when they're recaptured. I was trying to figure out why that is. I looked at the videos of people when they're measuring it [...]. It'd be much better if I could actually just be there and see it myself. (SPC modeller M., Noumea, 20.11.19)

Unlike tuna taggers, modellers do not interact with the lively ocean but with the ocean's "data double" (Haggerty & Ericson, 2000; see also Lehman, 2016a), i.e. with figures to be manipulated and experimented within models. The divide only nurtures models' fragility and the divergence between the physical and the digital offshore world.

2. Tuna Stock Assessment Models: Producing Digital Tunas and Enclosing Tuna Animals

Several families of models exist to estimate fish stocks. This diversity stems from the fisheries data that were historically and geographically available when they were developed. Hence, stock assessment models incorporate, to some extent, the context in which they were developed before they propagate to other contexts. Like fieldwork, models too are "practices of places" (Kohler, 2002) that entail as much as they reflect a specific geography of science.²⁷⁴

If you look at the stock assessment models used globally, they followed this package called Stock Synthesis from the US, and then that moved through the world. It's all written to the American fisheries situation. [...] Then, in New Zealand, they developed a method called CASAL. In Europe, they very much came down to a Virtual Population Analysis.²⁷⁵ And then you have this small pocket here, using MFCL. (SPC modeller R., Noumea, 08.11.19)

As explained, SPC mainly uses Multifan-CL (MFCL) to assess WCPO tuna stocks. This model established in and for the region contributes to demarcating, isolating and enclosing 'this small pocket' comprising tuna fisheries scientists and also WCPO waters and tunas. Hence, MFCL 'counts' tunas in the WCPO while Stock Synthesis 'counts' tunas in the Eastern Pacific Ocean, thereby inducing a split between the two oceanic regions. The two models derive from specific technoscientific trajectories for which one cannot assess if the regional split is grounded in reality or abstraction:

The other commissions do not have the same database. There are biological differences between the commissions, but the scientific basis for these differences is unknown. Natural mortality differs from one commission to another. This is a key issue, but no one knows how to measure it. It is defined by marking or by biological criteria based on growth, but there is no effective method for estimating it. (IRD tuna fisheries scientist A., France, 11.07.19)

This testimony outlines the entanglement of diversity in 'nature' and diversity in scientific practices, methods and informational infrastructures. It suggests that tuna stock assessment science is not universal

²⁷⁴ Models are also 'practices of time': for instance, the structure of the MFCL model reflects that it was built in the 1990s (FEMA fisheries scientist E., Noumea, 19.11.19).

²⁷⁵ The term "virtual population analysis" is eloquent of the fact that modelling produce 'virtual realities'. That method derives from historical data the past fish population (therefore reconstructed) in order to explain observed catches at a given time.

but place-based, entrenched in biological and epistemic diversity but also specific information infrastructures and scientific methods, which *perform* the WCPO and its tunas.

MFCL is mainly developed by statistician D. Fournier, head of a statistical model development company, and SPC fisheries modellers J. Sibert and J. Hampton since the 1990s. The model was devised to conduct stock assessments in a context where fish age data were inexistent and had to be estimated from fish length data, as was the case in the tuna fisheries logsheet supplied to SPC. MFCL was first used to assess the South Pacific albacore tuna stock and now supports most of WCPFC's stock assessments. The model builds a comprehensive picture based on partial information on tunas: "Based on the inputs you provide, it *recreates* a population that best fits those data."²⁷⁶ (SPC modeller N., Noumea, 15.11.19).

Modelling the population first requires 'cleaning' available data and addressing the sources of uncertainties deriving from their very collection. The cleaning step addresses "all the different human elements that can go wrong" (FEMA geneticist G., Noumea, 12.02.21): it attempts to remove contextual elements that influenced data production and made them 'imperfect'. It consists in correcting data or calculating their uncertainty. Data correction is done in connection with SPC's data management team, especially for logsheet and observer data, because they "have a lot of expertise in collecting data from all the different countries, they have indications and understandings of where it's difficult to collect data." (SAM modeller N., Noumea, 15.11.19). The data management team retains some knowledge of the context of data collection, which tends to disappear in the databases (Bowker, 2000). Hence, it bridges fieldwork and analytical work, surveillance agents in the field and remote surveillance data interpreters. In the database, automatic alarms help detect 'outlier' data that call for crosschecking – e.g. if a reported fish length appears outside the normal range. These alarms smoothen data diversity and reflect specific visions of what data, but also the reality they speak of, should look like. Confidence given to fisheries data is indexed to countries and their perceived ability to implement fisheries surveillance apparatuses properly: "For some fisheries, we just don't believe in the effort. So, we have the model estimate the effort to have the effort match the catch." (SAM modeller N., Noumea, 15.11.19). Hence, data correction may already hinge on modelling practices. In other cases, data are created based on expert judgment, e.g. to inform longliners' number of hooks between floats used before the 2000s: "Before that, there were heaps of gaps. [...] So we used expert opinion, we went to [SPC chief data scientist] who knows everything, he pretty much gave us... He filled in the blanks before 1980. [...] So we combined like a model and expert opinion." (SPC fisheries scientist E., Noumea, 19.11.19). Removing the 'human elements that can go wrong' in data collection involves human activities that can also 'go wrong' but whose authors are granted enhanced authority. These modelling operations blur the divide between empirical observations and calculated estimations (Armatte & Dalmedico, 2004),

²⁷⁶ The population in question is actually only the subset of the wider tuna population that interacts with fishing gear.

especially considering that several SAM modellers using these data confessed to having little idea of the cleaning process operations – also evidencing the invisible work of database construction and maintenance (Dagiral & Peerbaye, 2012).

Scientists also develop procedures to calculate data uncertainty, such as in the case of tagging data: “There’s a lot of modelling that goes into it. [...] There’s a probability attached to how much of those [tagged fish] are going onboard, there’s a probability attached to the noticing of the tag, and... it’s a lot of maths! [Laughter] People make a major part of their career out of it.” (FEMA geneticist G., Noumea, 12.02.21). Again, these practices layer and blur distinct sources of uncertainty regarding data’s accuracy and assumptions on how fish and humans behave.

Another step in modelling consist of “figur[ing] out variables, basically” (FEMA geneticist G., Noumea, 12.02.21) and estimating parameters like growth rate or natural mortality. Indeed, despite the scale of tuna fisheries surveillance and research, much remains to be known about tunas:

In terms of behaviour and biology alone, identifying where tuna spawn and reproduce, we still know very little about their behaviour, migrations, and so on. [...] Ultimately, vertical behaviour, migration and all that, this issue has been around for 20-30 years, and it hasn’t been resolved. [...] Whereas all the growth and fundamental biology issues are the first questions we’ve had [...], and we’ve been looking at stuff like that for a hundred years or more. [...] Finally, I think the questions are still more or less the same. (SAM fisheries scientist L., Noumea, 18.11.19)

These unknowns leave scientists with no other options than to draw assumptions that weigh strongly on stock assessment results. For instance, a recent reassessment of bigeye’s growth curve completely shifted the diagnostic of its stock from being close to overexploitation to being in a sustainable state. MFCL long used the growth curve estimate used by the Inter-American Tropical Tuna Commission (IATTC) for the Eastern bigeye tuna stock until new fish ageing methods suggested that “bigeye tuna in the Western Pacific live more than twice as long as previously thought [...] and they don’t grow as big as their counterparts in the Eastern Pacific”.²⁷⁷

Unpacking the breadth of the modelling operations at stake would require more research but I will outline certain features that were particularly discussed at the time of my fieldwork and that give insight into the making of such a model – and how such a model contributes to ‘making’ the offshore environment. As mentioned, fisheries scientists first rely on catch and effort information provided by commercial fisheries. One fundamental assumption in stock assessment science is that fishing efficiency is indexed to fish abundance and can serve as its proxy. Hence, fishery scientists mostly rely on the Catch Per Unit Effort (CPUE) indicator to track stock status evolution: if, against a given fishing effort, fishing catch falls, it is inferred that the fish stock is declining.²⁷⁸ The CPUE indicator only provides

²⁷⁷ <https://www.csiro.au/en/news/All/Articles/2022/May/bigeye-tuna> (accessed: 20.07.24)

²⁷⁸ This indicator is also widely used amongst fishing companies and fishers.

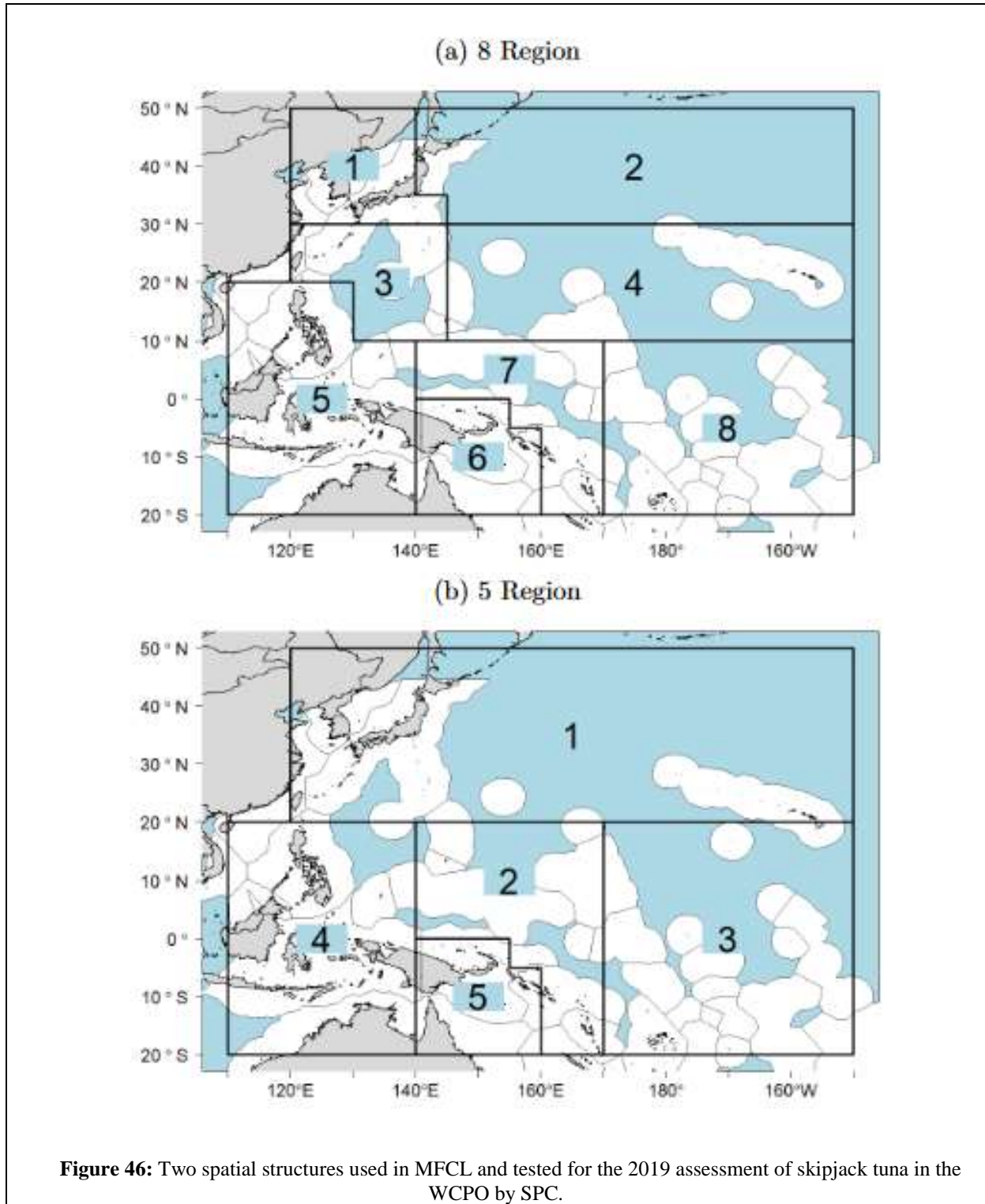
indirect signs of fish's existence as there may be "a lot of reasons why the proportionality between your index and your stock might not exist" (SAM modeller T., Noumea, 08.11.19). Fishing activities are framed by more factors than fish's presence alone. Additionally, the absence of catch is hardly proof of the absence of fish: the indicator stumbles against the unremitting challenge of distinguishing absence and elusiveness.

To ensure that fish catch speaks of fish abundance rather than fishing intensity, fisheries scientists must find ways to calculate and standardise "fishing effort" to "remove the vessel and the gear effect from the actual abundance signal" (SPC modeller N., Noumea, 15.11.19). The practice aims to withdraw the sociotechnical component of fisheries to retain only their 'natural' component. However, defining and calculating fishing effort, i.e. accurately describing and accounting for the many social and technical dimensions at stake in fishing operations, has proven particularly challenging in the case of the fast-evolving and increasingly efficient purse seine industry. Although the fishery accounts for the most tuna catch in the region, SPC scientists have not been able to establish a standardised CPUE indicator. The unaccounted increased efficiency of purse seine fishing, referred to as "effort creep", challenges the assumed relation between reported catch and fish abundance: increased purse seine catches reflect the increased efficiency of the industry using dFADs or helicopters to capture tunas rather than an increased fish abundance and may conceal its possible decline (SPC modeller N., Noumea, 15.11.19). A scientist was recruited by SPC to devise ways to calculate purse seine fishing effort. In the meantime, skipjack tuna stock assessment models retain their historical CPUE parameter indexed on the Japanese pole-and-line fishery. The gradual disappearance and spatial contraction of this fishery, currently accounting for a small fraction of skipjack catch and operating in a small area of the WCPO, has lost its representativeness: "Because if all your fishing is taking place in a very small portion, then your index isn't going to be representative of the entire model's region, it's only going to be representative of that area where the fishing takes place." (SPC modeller N., Noumea, 15.11.19). This strategy makes the pole-and-line CPUE 'speak' for tuna populations more than it can. This is particularly worrying considering the influence of the purse seine industry on skipjack tunas, assessed in a 'healthy' state. As fishing intensity increases and skipjack catch alike, many – managers and scientists compounded – continue to envision skipjack as the "cockroach of the sea"²⁷⁹ and a particularly resistant, if not inexhaustible, resource. Modellers, however, appeared less at ease with this statement as they identify more precisely stock assessments' weaknesses and multi-layered uncertainties: "Skipjack is the most important and gives me the most trouble. I'm really worried that there's something wrong with the model, that we've completely missed the assessment.", a scientist confessed (FEMA fisheries scientist and modeller J., Noumea, 11.11.19).

²⁷⁹ Such expression was used by several interviewees.

Another main source of concerns regarding stock assessment models relates to tunas' 'stock structure', i.e. the division of tunas amongst various subpopulations with varying interactions. Despite longstanding research on the topic, there is little knowledge of tunas' spatial organisation (e.g. spawning areas and spawning area fidelity). As a consequence, tunas are most often depicted as forming a homogeneous population "spread throughout" (SAM modeller F., Noumea, 08.11.19). Most stock assessment models treat fish populations as a homogeneous unit and the ocean as a uniform 'box' inhabited by equally uniform fish with the same vulnerability to fishing activities. This is a strong assumption that may neglect influential relations between tunas and their environment and influence the spatial management of the resource: "At the moment, for bigeye, we're concerned that there might be a localised stock around Australia, they're sort of spawning in that area. As that stock gets fished down, it can compromise the broader population." (SAM modeller F., Noumea, 08.11.19). Additional technical constraints have also contributed to overlooking tuna stock structures.

Considering the importance of the topic, MFCL has developed to incorporate 'spatially explicit' features and improve stock structures' description, allowing for the inclusion of sub-populations and more complex population dynamics modelling. MFCL provides an intermediary option as it permits the division of the WCPO into sub-regions that are connected or isolated from one another based on fish movements informed by tagging data. This feature accounts for the fact that fish move and mix heterogeneously and that fishers operate differently across the ocean. It still assumes, however, that fish are biologically the same across the ocean, as "biological processes such as growth and natural mortality are assumed to be common among regions" (MFCL manual, 2018). In MFCL, stocks are therefore structured along regions that reflect "some degree of spatial homogeneity in the population", depending on oceanographic, ecological, or fishing patterns (see Figure 46). It, therefore, permits describing tunas' spatial organisation at a finer, although still very coarse, scale.



Tuna stocks' structure is mainly informed by tagging data. As a scientific experiment, the tagging apparatus relies on the strong hypothesis that tagged tunas are representational of their entire populations and can serve as models for the other invisible fish, i.e. that a tagged tuna can represent any and every tuna. Tagging 'produces' an "experimental sub-population" that can be monitored and modelled (Leroy et al., 2015). Several conditions must be met for this hypothesis to hold. To be 'representative', a fish

must not be recaptured too soon after its release to lose its particular association with the tagging event and revert to being just ‘any’ fish. Hence, fish recaptured less than three months after being tagged are not included in MFCL. The three-month threshold is somewhat arbitrary and accommodates theoretical imperatives with technical needs: it is “a trade-off between having enough time and freedom but also enough data” (FEMA scientist J., Noumea, 15.11.19). Given its major influence on stock assessment results, this parameter is regularly discussed within the SPC team. MFCL is very sensitive to the tagging data, especially for skipjack assessment: “[Modeller X] redid the stock assessment model this year and added tagging data from 2017. With only 100-200 more tags in the model, the estimated biomass for the Pacific fell by 20%.” (FEMA scientist J., Noumea, 15.11.19).

The representativeness assumption makes the skewed tagging strategy at sea (cf. Section I.5) even more problematic: tagged fish risks to “represent the spatial distribution of fishing gears with differing selectivities, tag mixing assumptions and management regimes” rather than other fish (B. R. Moore et al., 2020, p. 2). Hence, “from available data, it is currently not possible to define the stock structure of any of the four tuna species” (B. R. Moore et al., 2020, p. 10). Noticeably, tagging data’s inability to properly inform stock structure derives from the fact that the tagging programme is a boundary surveillance apparatus: “This is partly because these studies were not *designed solely* to provide information on stock structure, but to assess *a range of parameters* for use in stock assessments, including movement and mixing, estimations of growth rates, natural and fishing mortality and abundance.” (B. R. Moore et al., 2020, p. 15, my emphasis).

The subregions used in MFCL to account for fish stock structure do not exclusively ‘map’ fish’ spatial organisation. They embed additional considerations that blur animals’ lives with sociotechnical influences. First, the regions reflect the geography of surveillance and available information, considering that “there is little point in defining a region for which there is little data to provide information on the dynamics of that sub-population” (MFCL manual).²⁸⁰ The patchy distribution of surveillance data constrains the model’s granularity. Modellers can delineate far more subregions for tuna species than oceanic sharks, for which surveillance data are far scarcer. Again, calculative practices come into play to presume spatial correlations, “extrapolate to areas you haven’t sampled”, and fill the blank spaces of patchy and reticular at-sea surveillance. The subregions also reflect computing capacities: “For skipjack, there would be models that I would run that would take a day or more to run. [...] Bigeye is one of the very slow models; it can take up to three days for the model to run.” (SAM modeller M., Noumea, 20.11.19). These considerations and trade-offs pile up and are embedded in the model, which retains “hidden traces of [its] own past” (Bowker, 2000; see also Edwards, 2010). Several modellers admitted in interviews that they did not know how these regions had been established:

²⁸⁰ Regions can also consider socio-political factors relevant for management considerations (cf. Section III).

It's fairly arbitrary, I think. [...] *Again, that's not a precise science.* It'd be nice to have a set of criteria to say: you take this into account, and this, and this. But it really ends up being a compromise between whoever is in the room deciding on the regional structure. [...] For the regional structure, you're going to want people who are doing the model [...], people really familiar with the biology of the stock, who might have some *intuition* in the environmental relationships that might drive differences in size or age across space. [...] And then sometimes, you want to take into consideration the fisheries that are operating, and also maybe management boundaries.²⁸¹ (SPC modeller N., Noumea, 15.11.19)

Personal subjectivities and expert judgment are central to making stock assessment models, even though they tend to be invisible. Although MFLC is meant to make the spatial distribution and structure of tunas 'explicit', the resulting cartography of tunas' spatial organisation remains rough, abstract and at a large scale, as evidenced by Figure 46. Such a representation of offshore fish constituting an even 'biomass' within large and static regions is highly questionable: "Stock assessment modellers see each squared region as representative of a homogeneous biomass, whereas it doesn't work like that!" (FEMA fisheries scientist J., Noumea, 11.11.19). MFCL conveys a relatively uniform understanding of the offshore world (Bush & Mol, 2015), in which spatial variations escape stock assessment modelling practices. Fisheries science does not produce knowledge instruments that can inform *spatial* management and, therefore, support the territorialisation of tuna fish.

Recent developments in genetics and molecular marking techniques have opened a promising avenue to clarify tuna stock. For a geneticist, his field could reconfigure the territorial possibilities regarding tunas:

We can assign a fish to a population with an accuracy of up to 95% to say where the fish came from. [...] The technique was developed by Australia in 2015, and they said they could tell the difference between Australian tuna and American tuna. This information allows us [...] for example to see if a Solomon's fish belongs to the same population as Kiribati, but it's actually much more complicated than expected. (University of the South Pacific (USP) marine geneticist, Suva, 16.07.19)

He further suggested that genetics could improve tuna traceability and partake in fighting Illegal, Unreported and Unregulated (IUU) fishing by permitting the identification of fish commodities' origin. However, integrating genetic results within stock assessment models is challenging. This geneticist shared that he initially encountered high scepticism from SPC modellers who were fairly hermetic to this new community of practice and knowledge (USP marine geneticist, Suva, 16.07.19). For a stock assessment scientist, "genetics tends to overestimate the multiplicity of independent stocks" and "has not been very conclusive for stocks" (IRD tuna fisheries scientist, France, 11.07.19). He found that genetics input was "not yet usable for assessment and management purposes" because it did not provide

²⁸¹ This interviewee cited swordfish as an example. Tagging data indicate different movements between two parts of the Tasman Sea. The boundary introduced into the model reflects this difference but "also lines up very conveniently with Australia's management region", he said.

concordant information with tagging information: this scientist would dismiss alternative and contradictory knowledge to avoid scientific controversy. Another scientist explained that temporal scale mismatches hindered the integration of stock assessment scientists' and geneticists' knowledge:

Classically, in genetics, they look at much larger time scales [...]. So they have models that work quite well for looking at species or population differentiation on large time scales, which are very different from ours, as we want to look at demographic population dynamics now and in the years to come. [...] It does make it difficult to translate the information between the two." (IRD fisheries scientist K., Sète, 14.03.19)

In the past few years, however, SPC has eventually integrated genetic research to its oceanic fisheries programme to help clarify tuna stock structure.

Even without integrating genetic information, stock assessment models like MFCL are part of, and have become, a "vast machine" (Edwards, 2010). It takes six to eight months for SPC fisheries scientists to conduct a single stock assessment. MFCL integrates more and increasingly heterogeneous datasets of observed and estimated data and parameters to assess oceanic fish stocks. Complexity entails invisibility, with very few people actually understanding how the model is built and works. Proliferating estimates and distance to observed phenomena justify contemporary calls for a 'return to the field' that I mentioned. For fisheries scientist J., stock assessment modelling resembles witchcraft more than science. He described it as a "voodoo" practice because it is pervaded by opaque expert judgment: "Sometimes, I have the impression that we correct the data as we feel, which we shouldn't do." (SPC fisheries scientist J., Noumea, 11.11.19). SAM modeller F. confessed having "no idea what he's doing" to imply that he had "no idea how many fish there are in the ocean" (Field notes, Ecosea modelling workshop, personal discussion, Noumea, Oct. 2019). His testimony does not outline a lack of modelling proficiency so much that it refers to such exercise's inherent complexity and uncertainties. Intensive quantitative modelling is not so much a reflection of tuna fisheries scientists' "trust in numbers" (Porter, 1992) than their only strategy to produce at least some knowledge on particularly elusive animal populations. Stock assessment models are 'colossuses with feet of clay'. However, they have also provided – and, to a certain extent, continue to provide – "the best knowledge we are going to get" if not the only knowledge we are going to get about tuna populations, for which experiments are hardly doable (Edwards, 2010, p. 439).

As I was investigating tuna surveillance and stock assessment practices, several modellers felt that assessment models were reaching their limits and there were emergent discussions to incorporate more recent innovations in tuna biology science and statistics.²⁸² These considerations seemed to question the

²⁸² Certain tuna fisheries scientists have attempted to integrate genetic information to refine stock structure in stock assessment models. Others have incorporated "random effects" features so that their model can allow for more variability in the ways individual tunas are represented (e.g. variability in individual growth rate, instead of applying a fixed growth rate to every tuna fish).

models' design rather than their role as the main instrument of knowledge of tuna fisheries. The acknowledgement of the models' limits was practical more than epistemological. Models like MFCL have largely evolved under the lead of their initial developers, who are these infrastructures' main, if not the sole, experts. As this generation of modellers is on the verge of retiring, maintaining these knowledge infrastructures is an acute problem: "No one else really knows how the model works, how to further develop it. They may have to switch to other models because of that, but there'll be discussions on this transitioning process; it may influence the way data are collected, the way tagging data are used, etc." (FEMA fisheries scientist E., Noumea, 19.11.19). This dependence on models' authors suggests how much of a black box they have become – and how much a new model could reverberate on surveillance practices in return. It also demonstrates the hefty influence of a few individuals in defining how the world's largest tuna populations would be surveyed, monitored and assessed.

3. Putting Fish Back into Context: Ecosystem Models

Stock assessment models have become major tools of offshore environmental surveillance. However, they have also failed to account for fluctuations in fish populations and prevent fish stock collapse, such as in the case of cod stocks. Scientific and environmental criticisms pointed to inadequacies in stock assessment approaches and called for a paradigm shift toward an 'ecosystem approach' to fisheries (Hubbard, 2017). These considerations have led scientific models to consider not only "the target species" but "the ecosystem as a whole" and surveillance efforts to collect "the data for all living resources affected by fishing": "We're not only looking at the catch data for non-target, but also the quality of the ocean, how climate change impacts migration, abundance, distribution of tunas..." (USP marine scientist, Suva, 24.06.19). These efforts to develop an ecosystem approach reflect as much as they support the ambition to know and control the environment as a whole.

i. From Fish Stocks to Oceanic Ecosystems

The creation of SPC's FEMA division in the early 2000s attests to the 'ecologisation' of tuna fisheries science and the growing importance of ecosystem approaches *through the lens* of fisheries science and its epistemic regime. The team initially comprised three fisheries scientists chiefly concerned with tuna resources (One of the first FEMA scientists, Noumea, 04.10.19). One took charge of tuna tagging and biological research to improve knowledge of tuna growth and ageing. The other two investigated tunas' relations with their environment at the crossroads of fisheries science, physical oceanography and marine ecology by examining the influence of topography, climatic variations, currents and trophic interactions on tuna population dynamics. Since then, the team has grown significantly, reaching around 15 people in 2019 and involving additional disciplines related to fisheries science: genetics, animal behaviour, and marine taxonomy. Current research areas deepen these threads

by looking into tunas' behaviour and genetics, tunas' relations with seamounts, trophic relations with micronekton and zooplankton organisms²⁸³ and climatic influences on fish populations.

Ecosystem approaches lead to collaborating with new disciplines. In that respect, FEMA and SAM, which used to be very divided when stock assessment was the main target, seem to operate such a rapprochement, especially amongst younger scientists:

When I arrived [...], I found that the two teams were a bit disconnected, Stock Assessment and Modelling and FEMA, and there was very little inter-division cooperation. But over the last year or two, I've seen it more and more. [...] With these [ecosystem] questions, one team will overlap a little with what's being done in another team, with positions like mine, [X or Y]. It makes it possible to build that bridge. These are *interdisciplinary* questions [...] with either data or research questions that are thought through in one team and that will be able to influence what is done in the other. (SAM fisheries scientist L., Noumea, 18.11.19, my emphasis)

Collaboration forms around new research questions and data, which become boundary objects articulating heterogeneous scientific communities (Bowker et al., 2016). FEMA also expands 'horizontal' connections with other institutions and disciplines less directly concerned with tuna resource management: "We can work with people who can provide us with data that have nothing to do with stock assessment. Or we've sent shark samples to the University [X]: this data will never be used for stock assessment." (FEMA marine biologist D., Noumea, 03.10.19). At a FEMA ecosystem modelling workshop, a physicist from SPC's geoscience division was invited: "This is the first time that SPC's geoscience committee and the fisheries committee have worked together." (Field notes, Ecosea workshop, Noumea, Oct. 2019). For a marine ecologist, "more and more programmes are being developed along these lines, with cross-fertilisation between climatologists and biologists" (IRD marine ecologist E., Noumea, 03.09.19).

Cross-fertilisation is not even, however, and can be rather one-sided. For an IRD physical oceanographer, it was mostly initiated by biologists, attempting to study marine animals *via* their environment: "You have several types of modelling for stocks [...] on the high seas, at least for tuna. You have deterministic models that need climate forcing [...] so they have to look for climate people." (IRD physical oceanographer C., Noumea, 28.08.19). Physical oceanography provides an underlying infrastructure for biological research: "In this case, the physicist is putting himself at the service of biology. That's how it's often seen, as a basic forcing, where physics structures the ecosystem." (IRD physical oceanographer C., Noumea, 28.08.19). Conversely, a marine biologist specialising in phytoplankton deplored that climatologists and physical oceanographers continued to overlook biological aspects in their models: "For a very long time, oceanography was dominated by physicists.

²⁸³ "Micronekton" designates a group of various marine species characterised by their small size (ranging from 2 to 20 cm). The group forms an intermediary trophic level feeding on zooplankton and preyed upon by larger predators like tunas. In that case, research on micronekton derives from historical efforts by SPC to improve the knowledge of tuna distribution.

Biologists were nobodies until the 2000s, easily. Now, at the last IPCC [Intergovernmental Panel on Climate Change] meeting I attended in Marseille, the IPCC is still dominated by physicists.” (IRD marine biologist B., Noumea, 02.10.19). Marine biologists appear unable to produce a knowledge that matches physical oceanographers’ epistemic standards. A physical oceanographer attending a FEMA workshop found its ecosystem models “very complicated” with many more “assumptions compared to physics” (Field notes, Ecosea workshop, Noumea, Oct. 2019). If marine sciences are progressively ‘climatised’ (Aykut et al., 2017) and integrate the knowledge produced by climate scientists, the capacity of other environmental disciplines to influence climate research appears more limited.

Ecosystem research progression within SPC and tuna fisheries science should be mitigated. Most FEMA’s positions and research are project-funded, “so the team is very variable, there is not necessarily a long-term strategy: the contribution from [SPC member] countries is really minimal and goes straight into administration” (FEMA scientist V., Noumea, 04.10.19). This weak institutionalisation contributes to the fluid enactment of ecosystem research and associated surveillance efforts. The latter remain fairly *ad hoc*, especially compared to the stabilised surveillance of tuna stocks with logsheet, observer and tagging apparatuses. FEMA scientist V. explained that her research shifted with “the fashion of the moment” because it is “not easy to do monitoring” (Field notes, Ecosea workshop, Noumea, Oct. 2019) – a testimony hinting again at the overlooked status of surveillance in research work.

As mentioned by FEMA scientist V., ecosystem research under SPC is little funded by the organisation’s member countries. Hence, ecosystem research is very much subjected to external actors like the Global Fund for Environment, the EU or conservation NGOs, which also frame the ‘ecologisation’ of fisheries science and oceanographic research. These actors orient research questions and collaborations toward biodiversity conservation and climate change, beyond fish resource management. A seabird ecologist recounted that his collaboration with FEMA under the Biopelagos research project, focusing on the pelagic ecosystems of New Caledonia’s EEZ, was shaped by the EU’s interest in biodiversity conservation: “[FEMA fisheries scientist X] wanted to respond to the call for proposals with a project on micronekton.²⁸⁴ As the call was very conservation-oriented, she rightly judged that she was more likely to interest the donor by associating a biological interest group for conservation, typically seabirds.” (IRD marine ecologist E., Noumea, 03.09.19). This FEMA scientist has a longstanding interest in micronekton to understand tunas’ distribution and explore the fisheries potential of these organisms. However, micronekton research long was a “hard sale” and could only be funded once it integrated “bycatch monitoring and climate change” dimensions (FEMA scientist, Noumea, 04.10.19).

²⁸⁴ Micronekton is a group of marine species characterised by their small size (ranging 2-20 cm). The group forms an intermediary trophic level feeding on zooplankton and preyed upon by larger predators like tunas. In that case, research on micronekton derives from historical efforts by SPC to improve the knowledge of tuna distribution.

If SPC's FEMA division provides the lifeblood of offshore "ecosystem monitoring" in the WCPO region, according to one of its members (FEMA scientist V., Noumea, 04.10.19), other and relatively disconnected epistemic communities also contribute to the surveillance and study of offshore ecosystems. During my fieldwork, several projects were developed in New Caledonia's waters with but also without the FEMA team. There were various projects surveilling whales, manta rays or seamount biodiversity, led by marine ecologists from different institutions (e.g. IRD, the French Museum of Natural History, University of Montpellier) and in relation with conservation NGOs (e.g. Opérations Cétacés) and regional environmental agencies like the Pacific Regional Environment Programme (SPREP).²⁸⁵ These endeavours develop an ecosystem approach to ocean surveillance, this time not through the lens of tuna fisheries and fisheries science but through the lens of biodiversity conservation and marine ecology. They sought not so much to support fisheries management policies than to inform the Coral Sea Natural Park's conservation policies by identifying important habitats to place under protection.

Hence, the ecosystem approach principle remains vague and results in varied practical translations: "At one point, we were talking about the ecosystem approach to fisheries, which is a good concept, but I would still like someone to define it to me. I have my own idea, and someone else will have their own idea... they're all just banners." (IRD tuna fisheries scientist G., Sète, 30.03.19). At this stage, ecosystem approaches seem to diversify rather than integrate marine scientific practices: "A number of tools have been developed to analyse multispecies interactions, but no consensus exists on using a single methodology", a SPC scientist observed (Allain, 2001, p. 4). Scientific communities and research efforts on offshore ecosystems consequently remain "fairly scattered" (FEMA fisheries scientist V., Noumea, 04.10.19) and, through their models, produce distinct offshore worlds which coexist and compete on expertise markets (Aykut & Nadaï, 2019).

ii. Surveilling Bycatch Species

Early ecosystem efforts in tuna fisheries science have focused on bycatch issues and opened up stock assessments beyond the main commercial species: "Many people summarise ecosystem-based management as bycatch management, including in international texts and under pressure from NGOs." (FEMA scientist V., Noumea, 04.10.19). SPC now performs stock assessments for many more species than tuna species alone, including swordfish, marlins, and sharks, at the demand of WCPFC's member countries. More recently, the Pacific Islands expressed interest in assessing stocks for mahi mahi and wahoo (Field notes, Ecosea workshop, Noumea, Oct. 2019). In that case, bycatch concerns make new marine lives visible but do not bring any epistemic rupture as they retain fisheries science's methods, instruments and concepts. This reflects an 'ecologisation' of fisheries science, i.e. an extension of

²⁸⁵ See for instance the Seamounts project (<https://umr-entropie.ird.nc/index.php/portfolio/projets-en-cours/projet-seamounts>, accessed: 25.09.24),

‘conventional’ fisheries science and management approaches to other dimensions of offshore ecosystems, more than it attests to a ‘globalisation’ of biodiversity conservation, i.e. a sectoral expansion and imposition of its associated political, ethical and epistemic framework (see Aykut et al., 2017). Hence, the focus remains on population dynamics; SPC continues to use MFCL and Stock Synthesis to assess bycatch species stocks. These new stock assessment efforts still apply to species with commercial value, like marlins or swordfish, and emblematic species, like sharks – at the boundary of biodiversity conservation and commercial interests. These practices separate animal species vested with a “political life” for economic or conservation reasons from those having a “mere biological life”, which are made “killable” (Braverman, 2015, p. 496), e.g. in the case of secondary target species like wahoo.

Under that framing, stock assessment challenges remain and are even accentuated. Bycatch data collection is scarcer and more sporadic than for tunas:

Sharks are the worst in terms of data. Lack of data, and there’s really high uncertainty in the catch history [...], it was not a high priority so you have no idea what the historical removals were, and a lot of the conservation measures now prevent you from bringing sharks onboard. So you’re not getting observations of sharks that are caught, you don’t know how many of those sharks are dying [...]. (Field notes, Ecosea workshop, Noumea, Oct. 2019)

SPC’s assessments draw on data provided by tuna fisheries surveillance apparatuses (especially observer data) that are not optimised for that purpose (cf. Chapter 5). This opportunistic use imperfectly serves the expansion of stock assessment efforts to non-tuna species.

The surveillance of ‘emblematic’ bycatch species like sharks, but also turtles or seabirds, is also conducted by parallel endeavours led by marine ecologists or conservation NGOs. However, these endeavours are largely separate from SPC’s efforts and do not permit to form of a wider bycatch surveillance assemblage, hinting at the failed integration of the two epistemic communities:

Interviewee: Like shark research: I find that people working on sharks don’t look at anything else. And the type of papers that get published by shark research are super basic. [...]

Interviewer: But you just look at tunas, it’s the same, no?

Interviewee: Yes, true, it’s the same! Totally! [...] Regarding your question about the potential for collaborating across areas, around the same ecological questions, there’s so much more room for that, genuinely.

(FEMA scientist E., Noumea, 19.11.19)

For this scientist, lack of collaboration derived from the prevalence of “massive egos” inducing the formation of a “real clique of people” both in tuna fisheries science and in shark ecology – in addition to distinct disciplinary approaches, research instruments (including vessel infrastructures) and

professional networks. This analysis consolidates the idea that offshore worlds are produced as closed worlds and maintained as such, resulting in the production of separate offshore worlds.

iii. Seapodym: A Spatial Model of Tunas in their Environment

One of the main offshore ecosystem models developed and used by SPC is the Spatial Ecosystem and Population Dynamics Model (Seapodym). This model describes the spatial dynamics of fish populations as a function of environmental variations. Understanding tunas' relations with their marine environment is a longstanding research question for explaining or even predicting fish distributions in space and time, which stumbles against the fluidity of offshore ecosystems: "A reef fish, you can map the reef, the reefs don't change. But in the ocean, temperatures, mixed layer depths... all these things change all the time, depending on covariates. So the fish are moving all around, are never in the same place." (SAM chief scientist P., Noumea, 20.05.20). Because MFCL's structure was too rigid to integrate oceanic and climatic parameters (SPC chief scientist of SAM, Noumea, 20.05.20), it seemed more adapted to build an entirely new model. Seapodym emerged in 1995 within SPC before following its lead developer to Collecte Localisation Satellites (CLS), an "Earth observation and monitoring" company devoted to *environmental* (rather than fisheries) surveillance.²⁸⁶

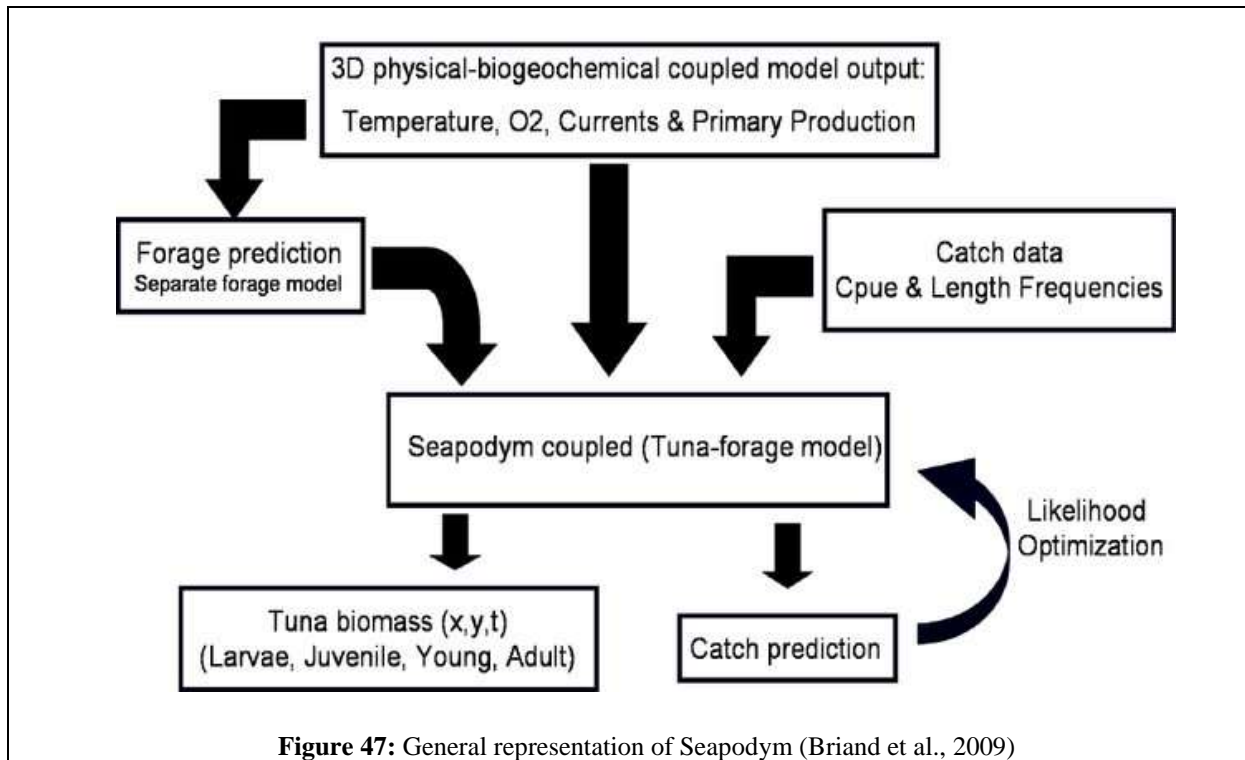
Stock assessment models like MFCL 'count' tuna fish but do not account for spatio-temporal variations: stock assessment scientists "know that it [stock spatial structure] is linked to certain things like climate and fishing techniques, but they don't go and look at the processes" (Physical oceanographer C., Noumea, 28.08.19). Seapodym, on the contrary, links tunas' biomass distribution to spatial and temporal oceanic variations. The ocean ceases to be a homogeneous black box enclosing monospecific fish stocks and becomes a complex articulation of physical and biological building blocks. The model also grants the ocean a future, thanks to its forecasting features, and represents predator-prey interactions. The granularity of the model remains coarse, however: Seapodym models a 'biomass' rather than fish individuals, and the 'predator' group only consists of tunas. Additionally, in comparison to MFCL, the 'socio-technical' dimensions of fisheries are simplified (SAM modeller N., Noumea, 15.11.19): "MFLC and the stock assessment models [...] do a gross simplification of the biology, the ecology, the spatial structure, but they are drilling down more into the fishery side of things, because from a management perspective, you want to be able to model the effects of the fishing pressure." (SAM modelling scientist M., Noumea, 20.11.19). For instance, Seapodym's forecasts assume fishing to remain "constant" because it is "so difficult to have forecast of what the fisheries are going to do", even if "realistically the fisheries will evolve and there will be other impacts to consider", such as changes in target species (Field notes, Ecosea workshop, Noumea, Oct. 2019).

²⁸⁶ CLS is known for supplying Argos environmental satellite data and is a central and historical actor of environmental surveillance (e.g. see Benson, 2012). The displacement of Seapodym from SPC to CLS has led to its privatisation and made the model particularly expensive for SPC (FEMA scientist V., Noumea, 04.10.19).

Seapodym provides a new ecosystem tool but also rearranges, incorporates and burrows pre-existing informational and knowledge infrastructures (see Figure 47). Seapodym retains traces of its attachment to fisheries science and commercial fisheries management. The model focuses on commercial fish species and bounds the marine ecosystem to these species' ecosystem only (Field notes, Ecosea workshop, personal discussion with a Seapodym developer, Noumea, Oct. 2019). Additionally, it only rearranges pre-existing surveillance data into a new surveillance picture, or "data image", of offshore ecosystems, thereby burrowing and blending observations and interpretations (Edwards, 2010, p. 283). Seapodym "is not really a single model" (Field notes, Subsea observatory workshop, Seapodym presentation, Noumea, Sept. 2019). Rather, it couples and layers physical-biogeochemical models, including temperature, currents, oxygen, primary production... and submodels of prey fish, tunas and their fisheries derived from tuna fisheries surveillance data. Tunas' ecological niche becomes a "data niche", whereby "records" from different surveys are aggregated and turned into (decontextualised) "data", blurring their theoretical background (Devictor & Bensaude-Vincent, 2016, p. 9).

Like MFCL, Seapodym has become a highly complex and opaque tool, mainly if not exclusively mastered by its developers: "Unless you're [creator X] or [creator X'], no one really knows how to use it." (SAM modeller N., Noumea, 15.11.19). An MFCL user outlined the blurred boundary between calculated estimates and empirical observations: "It makes really cool graphs and figures [...] and it's sometimes somewhat realistic but it's hard to tell [...] what underlying data is driving the model. Is it really the observed catch [...], or is it just your predicted biomass?" (Modeller M., Noumea, 20.11.19). Recently, the Seapodym team produced a "global zooplankton and micronekton model-based product".²⁸⁷ The model did not match an alternative micronekton model built on acoustic observations. However, it was impossible to distinguish which of the two models, relying on distinct epistemic approaches, was more accurate and if discrepancies derived from miscalibrated acoustic sensors or invalid modelling assumptions (Field notes, Ecosea workshop, Noumea, Oct. 2019). Not only is it difficult to integrate various forms of knowledge to develop ecosystem modelling, but it is also difficult to compare them. This opacity, however, does not prevent Seapodym from being burrowed, too, in other research. For instance, a study interested in seabirds-tunas relations used Seapodym's projections of tuna distribution for lack of alternative accessible empirical data (e.g. see Miller et al., 2018).

²⁸⁷ <http://www.seapodym.eu/zooplankton-and-micronekton-model-for-cmems-now-available/> (accessed: 30.07.24)



The model has generated great interest amongst WCPO fisheries scientists and managers. It has been used to study skipjack, yellowfin and bigeye population dynamics as a function of fishing *and* environmental conditions and help distinguish anthropic and non-anthropic influences on fish catch fluctuations. In its early days, the model explored the effect of the El Nino Southern Oscillation on skipjack catches to inform purse seine fishery management. More recently, the model has been used to anticipate the possible effects of climate change on tuna distributions (see Figure 48). Seapodym’s spatial approach has also raised interest in spatial planning.²⁸⁸ The model is explicitly developed as a tool of scientific knowledge *and* for decision-making by permitting the testing of different fishing policies and environmental change scenarios (Cartwright, 2008).

The climate change orientation attests to the “climatisation” (Aykut et al., 2017) of fisheries science and management. The topic helps SPC attract funding for its research. For the Pacific Island governments, ‘ecosystem’ interest in Seapodym first reflects their political and economic concern for managing tuna resources. Indeed, Seapodym projected tunas’ relocation to the east and south of the Pacific Ocean. The resource redistribution across EEZ and high sea jurisdictions could heavily influence the Pacific Islands’ political weight in tuna fisheries management: “If we’re producing a forecast that clearly indicates that distribution will take advantage of some EEZs or high seas, we need to recognise

²⁸⁸ SPC website: <https://fame.spc.int/ecosystem-and-multispecies-modelling/seapodym> (accessed: 29.07.24)

Other similar environmental models are also developed to support fish-finding operations by locating likely fishing grounds.

that this information can also be used by fishing companies and impact the licences economically.” (Field notes, Ecosea workshop, Noumea, Oct. 2019).

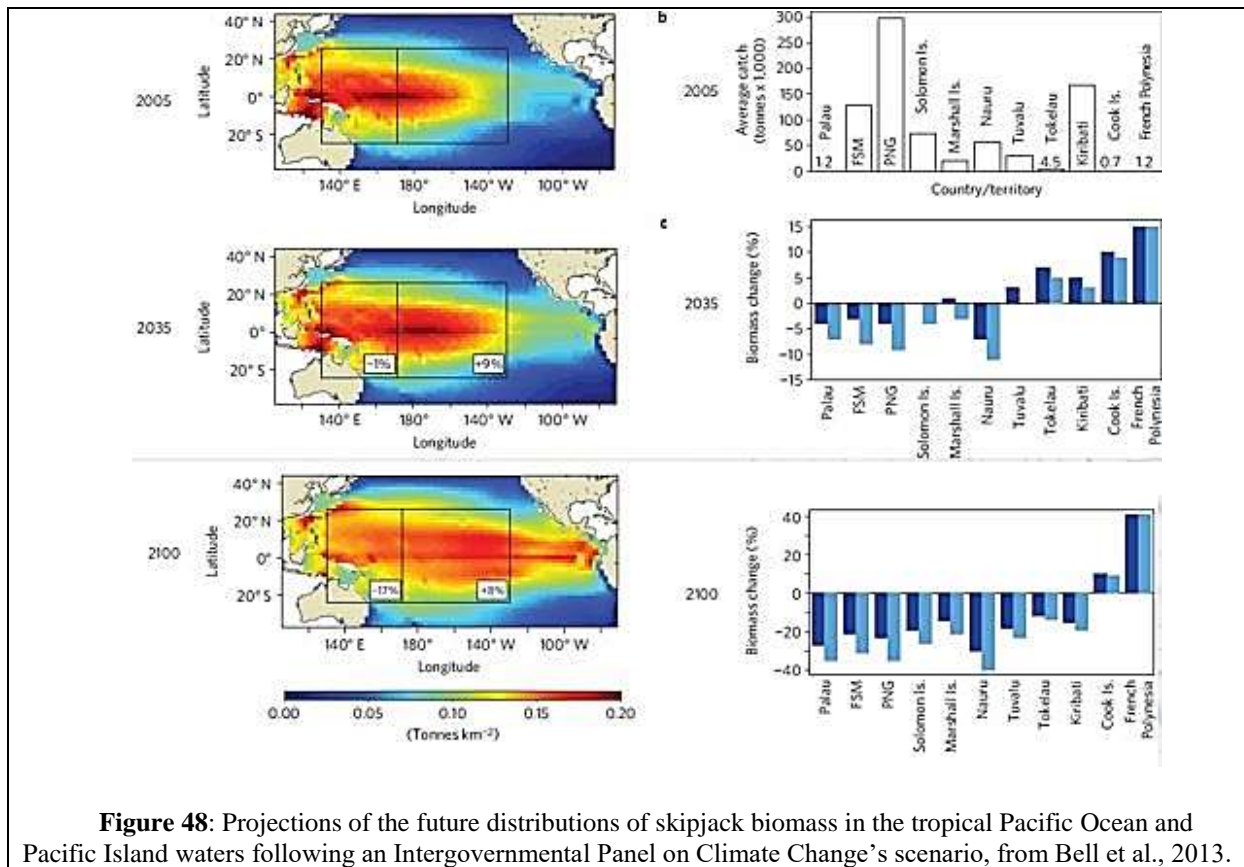
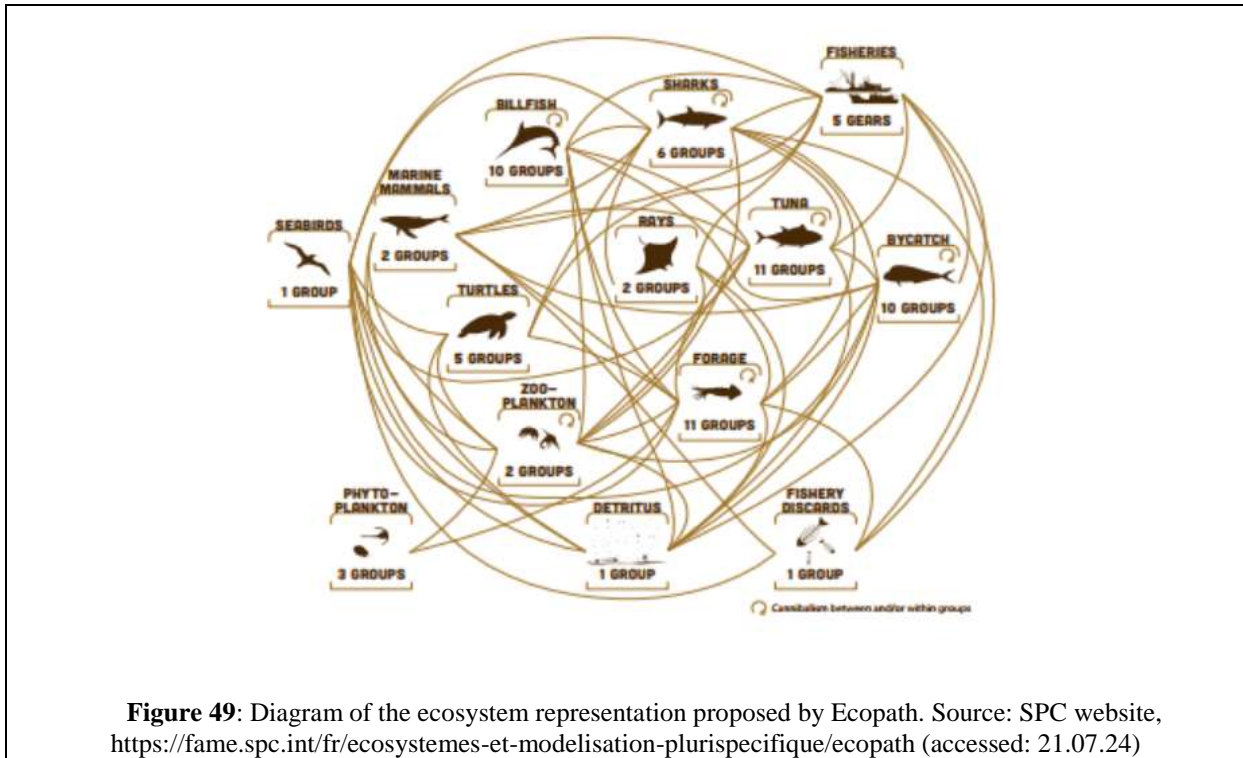


Figure 48: Projections of the future distributions of skipjack biomass in the tropical Pacific Ocean and Pacific Island waters following an Intergovernmental Panel on Climate Change’s scenario, from Bell et al., 2013.

iv. Ecopath: Modelling Inter-Specific Interactions

The other main WCPO offshore ecosystem modelling development relates to the Ecopath model. Ecopath was the first ever developed ecosystem model to investigate fisheries’ influence on trophic interactions and cascading effects of fishing activities (Field notes, Ecosea workshop, personal discussion with Seapodym developer, Noumea, Oct. 2019). It was initially developed by the US National Oceanic and Atmospheric Administration and the University of Hawaii before it was further developed by D. Pauly’s team at the University of British Columbia. D. Pauly is an eminent fishery scientist renowned for alerting about overfishing, dismissing ‘conventional’ fisheries science’s stock assessment methods, and promoting ecosystem approaches and Marine Protected Area (MPA) developments.

Ecopath divides ecosystems into ‘functional groups’ based on organisms’ ecological role and describes their interactions as predatory relations – with fishers framed as superior predators at the top of the trophic scale (see Figure 49). Ecopath’s ocean is populated with many more marine lives establishing complex networks of interactions (e.g. including cannibalist foraging behaviours) than MFLC or Seapodym’s ocean. However, population structures or environmental parameters like temperatures and currents are discounted compared to the latter.



Because Ecopath has “smaller data requirements”²⁸⁹ than other ecosystem models and has many optional features, it has become the most widespread ecosystem model (Coll et al., 2009). Additional features like Ecosim and Ecospace provide a “time dynamic simulation module for policy exploration” and a “spatial and temporal dynamic module primarily designed for exploring impact and placement of protected areas”.²⁹⁰ If the model was originally devised to support the ‘ecologisation’ of fisheries science, it has since been mobilised by users other than fisheries scientists and for various purposes, e.g. assessing ecosystem recovery after an oil spill, determining MPA location, or assessing climate change effects.²⁹¹

SPC started using Ecopath in 2002 to describe the WCPO pelagic ecosystem’s food web dynamics, initially focusing on the Warm Pool region under a Global Environmental Fund project (Allain, 2001). From 2010 onwards, SPC used the model to explore fishing and environmental impacts on pelagic ecosystems. Under SPC’s lead, Ecopath has remained related to ‘conventional’ fisheries management concerns, i.e. “to maximise yields but [...] also to limit the impact on the environment” (FEMA scientist V., Noumea, 04.10.19). Like Seapodym and MFCL, Ecopath aims to support decision-making. SPC consulted its member countries’ fisheries services to identify the “functional groups” to be included in the model (Field notes, Ecosea workshop, Noumea, Oct. 2019). Those were mostly concerned with

²⁸⁹ Ecopath website: <https://celebrating200years.noaa.gov/breakthroughs/ecopath/welcome.html#use> (accessed: 29.07.24)
²⁹⁰ Ecopath website: <https://celebrating200years.noaa.gov/breakthroughs/ecopath/welcome.html#use> (accessed: 29.07.24)
²⁹¹ Ecopath website: <https://celebrating200years.noaa.gov/breakthroughs/ecopath/welcome.html#use> (accessed: 29.07.24)

emblematic bycatch and commercial species, retaining a fisheries-oriented framing of offshore ecosystems.

Such framing of offshore ecosystems does not only derive from fisheries managers' political influence. Like for Seapodym, Ecopath is constrained by available information and knowledge infrastructures. As a result, it draws on and burrows pre-established offshore fisheries surveillance infrastructures. For instance, it uses tuna and billfish stock assessment results produced by MFCL: "Ecopath is just interested in the biomass, which MFCL provides. MFCL has the best data, so it's the model with the most confidence.", an Ecopath expert explained (Field notes, Ecosea workshop, Noumea, Oct. 2019). For bycatch, it uses fisheries observer data. To inform inter-species relations, modellers use diet information from SPC's tissue bank and fisheries observers' and tuna taggers' samples. This reliance on limited and fisheries-dependent surveillance infrastructures constrains the definition of the possible 'functional groups' and the way offshore ecosystems can be modelled: "all rays are basically grouped into one group [...], there's not really the data to have a time-series of anything other than 'manta and mobulids' [...]", a fisheries scientist explained (Field notes, Ecosea workshop, Noumea, Oct. 2019).

The apparent diversity of offshore ecosystem models obfuscates the remanence of longstanding, limited, and limiting offshore fisheries surveillance apparatuses, which continue to provide the main source of information for running these models and, therefore, counter-balance the diversification of ecosystem modelling practices: "I thought it was interesting that the stock assessments were the most certain parts, that they were like super enthusiastic that we have that data. [...] I'd like to know what other Ecopath models are based on if they don't have assessments[...]" (SAM modeller M., Noumea, 20.11.19). This interviewee questions the very possibility of ecosystem models to even exist independently from tuna fisheries surveillance infrastructures, i.e. the very possibility of knowing the offshore world independently from its exploitation. More than the re-utilisation of tuna fisheries surveillance infrastructures, it is also the layering of models and their many assumptions and uncertainties that raise concerns. If ecosystem approaches emerged partly in rejection to 'conventional' stock assessment models, the latter are still alive and invisibly embedded under additional model layers:

The parametrisation of Ecopath or Seapodym, they're parametrised from the results of single-species models [...]. We know the biomass of skipjack but... we don't know the biomass! You just take it from someone else's model! [laughter] [...] but which one are they putting in? We have many models with many biomasses, none of them are right so how do you pick out this one over the other? (SAM modeller S., Noumea, 08.11.19)

These modelling operations burrow but also 'misuse' MFCL by simplifying some of its associated uncertainties. As described by P. Edwards regarding climate modelling practices, the boundary between data and model blurs as the output of one model becomes the input of another one: to some extent, the

underlying model becomes the object of study rather than the offshore environment itself (Edwards, 2010). This creates irreversible and diffuse lock-ins in how offshore ecosystems are represented and thought of (Bowker, 2000).

v. Replacing Humans in Ecosystem Approaches

While ecosystem models like Seapodym and Ecopath offer a vision of the ocean enriched beyond tunas, they remain relatively ‘non-human’. An ecosystem scientist noted that ecosystem fisheries models “stop at the physico-chemical and biological part; there is no integration of the human and economic aspects: the models are incomplete” (FEMA scientist V., Noumea, 04.10.19). An IRD fisheries geographer deplored what he perceived as a general evolution in fisheries science, over-focusing on fisheries’ ‘natural’ components and not enough on its ‘social’ dimensions – a division that largely structured the debate between the DWFNs and the Pacific Islands regarding tuna fisheries management (cf. Chapter 5). For this fisheries geographer, the ecosystem approach to fisheries has progressed at the cost of reducing the understanding of fisheries as a socio-natural system:

He [D. Pauly] did some great ecosystem modelling, except that fishers became super-predators, and the social dynamic of fishers was not considered. The ecosystem approach to fisheries brings a lot to the table in terms of ecosystems, but is a step backwards compared to the ‘fishing system’ approach that existed in the past, when we had a more global vision, with less emphasis on ecosystems but much more on the social and economic aspects. (Field notes, personal discussion with an IRD fisheries geographer, Noumea, Oct. 2019).

Similarly, he continued, anthropogenic pressures such as pollution have only recently begun to be considered. Such a ‘non-human’ ecosystem stance risks consolidating representations of the offshore world as a frontier space outside society and masking certain management problems. Because socio-cultural fisheries dimensions are pivotal to the Pacific Islands, ecosystem approaches more attuned to economic considerations timidly emerge, such as with this marine scientists’ research:

My Ph.D. is to look more comprehensively at how we can apply EBM [Ecosystem-Based Management] consistently [...]. I developed a management framework, a planning process taking into account the social, economic, cultural impacts of fisheries. [...] I was trying to compare these countries [Solomon Islands, Fiji, Kiribati, Tuvalu...] and how they implement some elements of EBM and generate profits using that [...]: income generation through access agreement, employment... (Marine scientist, Suva, 24.06.19).

He felt that this approach would resonate more strongly amongst Pacific Island governments and their ‘Blue Economy’ interests.

vi. Mapping Marine Biodiversity

Besides the ecosystem approaches developed by tuna fisheries scientists, other scientific communities also attempt to produce models and maps of offshore ecosystems. Those provide complementary sources of information while remaining very much reliant and dependent on tuna fisheries surveillance infrastructures.

With the rise of ecosystem considerations, tuna fisheries scientists are no longer the only ones to look at tuna. Other scientists have turned to tunas, with entirely different framings. One marine ecologist examined tuna fisheries through the perspective of climate change:

When a tuna dies and sinks [...] that's stored carbon. We're doing a hypothetical study: if it hadn't been fished, it would have sunk to the bottom of the ocean and we're estimating the deficit. [...] The idea is really new, people in fisheries don't think like that, they think in terms of stocks, models and fisheries management. [...] It's a new way to see species, as massive carbon sequestration entities. (Marine ecologist, Montpellier, 08.10.20)

His project is *independent* of tuna fisheries scientists while bringing a new perspective on fisheries management: "We took the best of what fisheries science had to offer [...]. We work with all these people affiliated to IRD, SPC, etc. They don't know about it, we don't have direct connections, but there are these world databases, they feed them, and we retrieve the information." (Marine ecologist, Montpellier, 08.10.20). Although this scientist and his team offer new epistemological and even ontological perspectives on tunas, it is noticeable that their work relies on *limited* access to the informational infrastructures of tuna fisheries scientists. His carbon sequestration assessment drew on aggregated (public) rather than 'raw' (confidential) bigeye and skipjack catch information.

Regarding the study of offshore ecosystems, there have been two extensive attempts in Fiji and New Caledonia to produce maps of their EEZs' biodiversity and ecosystems, and which can be read as attempts to build national representations of the marine environment to 'nationalise' and territorialise nature. These endeavours marginally involved fisheries scientists but were led by environmental agencies and marine ecologists interested in ecosystem management and biodiversity conservation. In Fiji, such maps were traced under the MACBIO project by SPREP, the International Union for the Conservation of Nature (IUCN) and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) to inform Marine Spatial Planning (MSP) and MPA identification.²⁹² Similarly, to prefigure the Coral Sea Natural Park, the Government of New Caledonia and the French Agency of Marine Protected Areas commanded a Strategic Analysis of New Caledonia's Maritime Space (Gardes et al., 2014), which sought to "create a biodiversity map" (IRD physical oceanographer C., Noumea, 28.08.19, see Figure 50) and identify "functional zones" for marine species (IFREMER marine ecologist, Noumea, 08.10.19).

²⁹² MACBIO website: <http://macbio-pacific.info/fiji/> (accessed: 25.09.24)

Rather than developing offshore environmental surveillance, the two endeavours integrated all available environmental information. Interestingly, representatives of both endeavours all reported similar difficulties in gathering environmental data, showing the lack of formalised pelagic ecosystem surveillance in the two EEZs:

What was very difficult was collecting the information. [...] It existed but it was scattered, everyone had their own set of data [...]. For example, for the pelagic environment, we wanted to characterise the diversity of the pelagic environment. You don't have any monitoring on this, no one is monitoring the whole EEZ. [...] We started from the available indicators, from data that we could spatialise. [...] The data was either that of the researchers or that of SPC. (IFREMER marine ecologist invested in the Regional Strategic Analysis, Noumea, 08.10.19)

Data are scattered between different institutions, including foreign ones, reflecting the offshore surveillance fragmentation across various communities and raising issues of data ownership, following a scientific structure typical of tropical marine sciences (Partelow et al., 2020):

All of the information collected beyond the fringing reefs belongs to others. [...] As soon as you go offshore, you're very much at the mercy of those organisations that hold the data [...]. Fiji is very poor at getting them together so it doesn't know what's out there. [...] There is data but it has very limited ownership by the country [...]. (Marine consultant, Suva, 27.02.20)

According to a marine ecologist involved in New Caledonia's strategic analysis, biological data were more difficult to retrieve than geological ones (IFREMER marine ecologist, Noumea, 08.10.19). Certain data were kept confidential by fisheries agencies or individual scientists securing their data for scientific publications. Despite the universal and commoning approach supposedly underlying the scientific ethos, many scientists hinder data circulation for professional reasons (Evans, 2010). The possibility of knowing the offshore ecosystem is not just an issue of data collection but also one of sharing and circulating these data for various utilisations (e.g. Gautreau & Noucher, 2016).

The mapping exercise struggled against data that were too scarce to spatialise or obtained through various techniques at different times and, therefore, difficult to assemblage (Marine ecologist and author of the Strategic Analysis, Noumea, 08.10.19). Turning survey "records", produced following specific objectives and in their ecological contexts, into data that can be aggregated on a two-dimensional chart is challenging: contrary to global climate, for instance, biodiversity research largely struggles with "data diversity" (Devictor & Bensaude-Vincent, 2016, p. 17). Regarding pelagic ecosystems, most information came from tuna fisheries surveillance apparatuses and satellite information on physical parameters and phytoplankton. Despite being a hotspot of marine biodiversity and conservation concerns, the South Pacific region remains peripheral to offshore ecosystem 'scientific' surveillance efforts besides those concerned with tuna fisheries:

Interviewee: It's very hard to motivate people to work here, because of family constraints and so on. It's a long way away, you have to be away for a long time, everything is expensive, and the slightest manipulation costs you the earth. [...] It's going to be hard to make up for the lack of knowledge, even though the stakes are clearly high... With climate change, the Pacific is one of the driving forces behind the world's climate. The biodiversity crisis is in the Pacific. Here at the IRD, it looks big, but there are 15 full researchers at the most.

Interviewer: Is SPC a driving force?

Interviewee: In certain areas, such as fisheries, no doubt. But not in other areas. SPC has no one for the biodiversity crisis.

Resulting maps of the EEZs' environments did not so much represent offshore biodiversity as the geography of environmental surveillance:

I would almost say that the biodiversity index is the number of scientific publications in a place. [...] One really interesting map is the one showing publication numbers per area. You'll see 50 publications in Chesterfield, 10 there... That's almost the biodiversity map for me. Given the state of the data and given that we don't really know... (IRD physical oceanographer C., Noumea, 28.08.19).

A marine ecologist feared that limited knowledge would take on ontological dimensions on the state of marine biodiversity amongst policy-makers and that the latter would only protect areas that had been studied (Field notes, visit of *L'Atalante*, Noumea, 04.09.19).

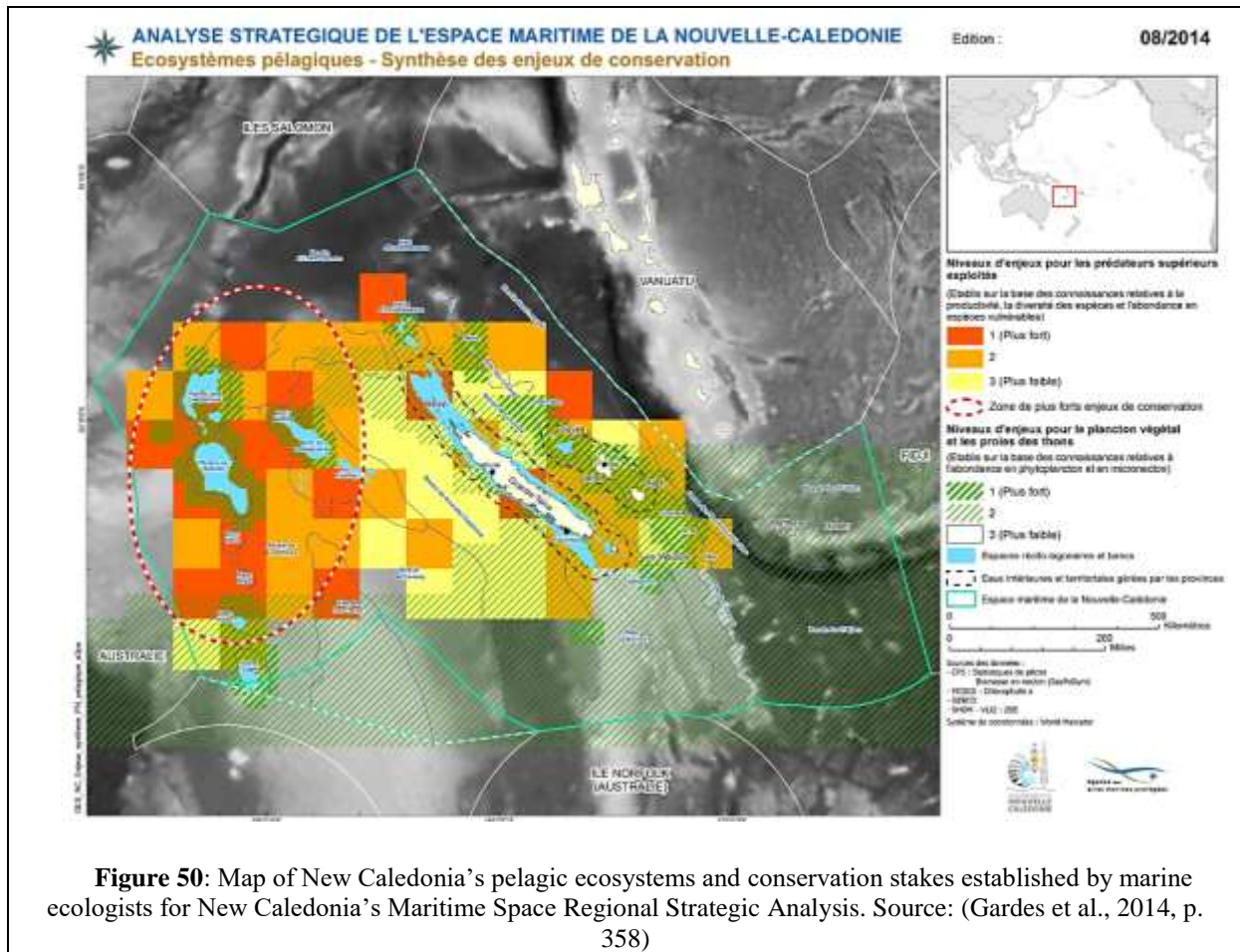


Figure 50: Map of New Caledonia's pelagic ecosystems and conservation stakes established by marine ecologists for New Caledonia's Maritime Space Regional Strategic Analysis. Source: (Gardes et al., 2014, p. 358)

To address surveillance lacunae on offshore ecosystems, SPC and IRD implemented the Biopelagos project between 2016 and 2019 to investigate the pelagic ecosystems of New Caledonia and Wallis and Futuna. The project involved physical oceanographers, marine ecologists, and fisheries scientists conducting joint oceanographic campaigns across the two EEZs to acquire additional information on their physical, chemical, and biological dimensions. The project aimed, in particular, to study phytoplankton, zooplankton, micronekton organisms, and seabirds to complete already existing physical and tuna fisheries information. Biopelagos offered to develop spatial models of these organisms' distribution across the two EEZs to support spatial ecosystem management – i.e. to support the territorialisation of the EEZs and their environment. However, the project could not satisfy this objective because of scalar mismatches with tuna fisheries science and physical oceanography. A physical oceanographer recounted that the surveillance protocol was too fluid and occurred at a small scale:

When you look at New Caledonia, you can understand certain aspects of resident species, the relationship between small fish and physics. But when you want to understand the relationship between top predators, which are on a much larger scale and travel thousands of kilometres, there's a mismatch between the scales. [...] The sampling we did was so disparate [...] You don't see the big trends, like there's more food there because that's the way physics works. [...] There are things where we're not at all at the right scale to understand the deterministic relationships between what

we think is theoretically valid. [...] It's true if you take a planet and say to yourself that the quantity of food is linked to the quantity of plants, zooplankton and therefore to the quantity of small fish and top predators. [...] then if you break that down spatially and go locally, it's not like that at all because the species are mobile, the physics at a given moment... That's why we use large models to try and understand it. (IRD physical oceanographer C., Noumea, 28.08.19)

For this scientist, ecosystem sampling needed to occur on a regional scale to see sensible geographical differences emerge and integrate them with fisheries and physical oceanography's surveillance apparatuses and knowledge. The knowledge and underlying infrastructures produced by these disciplines do not permit to inform national management concerns:

We think we don't have the data; that the data doesn't allow us to say that at our small scale. In New Caledonia, too, what's special is that the variations aren't great. [...] Whereas on a Pacific scale, you really have areas where you don't catch yellowfin and large areas where yellowfin accumulates, so we're thinking it's a lot easier to link up the large-scale structures, what we call the major oceanic provinces. (IRD physical oceanographer C., Noumea, 28.08.19)

Bridging available knowledge on the different offshore ecosystem constituents and between physical oceanography, tuna fisheries science and marine ecology led the Biopelagos research team to revise their scientific protocol and upscale their oceanographic campaigns to the WCPO region to make samples along transects spanning as far as French Polynesia and Papua New Guinea to enhance contrasts and abide by tuna fisheries science's and physical oceanography's information infrastructures.

III. Regulatory Offshore Surveillance

As evidenced in the previous section, tuna and offshore ecosystem surveillance is not only about producing scientific knowledge. It also informs decision-making processes to support a 'science-based' management approach. This advisory role shapes the making of science and associated surveillance practices. Environmental surveillance, hence, is not just 'scientific' but eminently 'regulatory'. I now explore the co-production of regulatory surveillance and offshore management to complete the previous section's more internalist perspective (Armatte & Dalmedico, 2004). I provide evidence of epistemic, infrastructural and political lock-ins that contribute to certain forms of ignorance and enclosures and account for persisting disconnections between tuna fisheries management and biodiversity conservation.

1. Fisheries Scientists as Experts: Navigating between Science and Surveillance

From its origin, fisheries science has served as a 'science of government'. Funding mostly came from governments, which oriented fisheries scientists' research agendas toward maximising yields for much of the 20th century (Hubbard, 2014). This governing orientation is also visible in the very content of the discipline. Fisheries science derived from German human demographic studies and scientific forestry –

two disciplines foundational to the construction of the German Nation, providing ‘state-istics’ (Desrosières, 2016; Louckx, 2017) to support the construction and ‘rational’ management of its (more-than-human) populations and territory. Fisheries science framed fish *stock* as “capital supply” to support states’ economic growth and their aspirations to control commodities at sea (Telesca, 2017, p. 146). These origins place fisheries science astride the scientific description of ‘nature’ and the production of administrative and prescriptive knowledge for political action, itself combining scientific norms with those of the rational modern state (Desrosières, 2016). In that respect, fisheries science can be read as a regulatory science (cf. Chapter 5), i.e. a science driven by risk assessment and providing expert knowledge more than elucidating fundamental questions or innovating (Joly, 2016; Demortain, 2017a). Regulatory science has consolidated since the 1970s, especially regarding environmental regulations (Jasanoff, 1992). It entails specific ways of doing science and producing knowledge and pairs with the emergence of expert agencies producing scientific assessment and quantitative evidence, and mixing industrial, bureaucratic and academic environments to legitimise the adoption of policy measures.

i. The Demarcation of Fisheries Science as Regulatory Science

Quantification often requires infrastructures that tend to be large bureaucracies’ privilege. In the case of tunas, such bureaucracy exceeded the national level to become region: counting tuna was too big of an endeavour for one state alone. Although the regionalisation of tuna fisheries management and the multilateralisation of their governance have complexified the relations between fisheries scientists and governments, tuna fisheries science remains central in managing tuna fisheries by producing stock assessments. Those constitute the scientific basis for determining Conservation and Management Measures, despite the many criticisms against their failure to account for and prevent the collapse of important fisheries. Every year, WCPFC’s Scientific Committee convenes to discuss, validate and adopt updated stock assessments upstream from regulatory negotiations.

Stock assessments are produced by SPC, the Commission’s main scientific provider and, therefore, main expert agency. SPC’s central and quasi-monopolistic position is fairly specific to the WCPO region and derives from the trajectory of the WCPFC’s establishment (cf. Chapter 6).²⁹³ A modeller values such a narrow and homogeneous scientific community and the proximity to the management sphere compared to other fisheries management organisations:

ICES [the International Council for the Exploration of the Sea, a regional fisheries organisation in the North Atlantic] is a massive organisation that takes information from all over Europe. [...] They have a big process for taking all the national sciences, following it through ICES. [...] Here, we have a much smaller group of people: just

²⁹³ Such a centralised model resembles more that of the US Food and Drug Administration than the more plural regulatory model of the European Union, to refer to the comparative study by P. Joly on international regulatory science (Joly, 2016).

our office, really, doing the assessments and providing the analyses and advices that go straight to WCPFC. (SAM modeller R., Noumea, 08.11.19)

Within SPC, stock assessment modellers are the only perennial positions secured through WCPFC funding: stock assessment is the only sustained activity because of its regulatory function. As a consequence, stock assessors' work prerogatives, content and pace are very much driven by WCPFC and its Scientific Committee: "My workload is pretty much governed by that and the Scientific Committee in August" (SAM scientist F., Noumea, 08.11.19). The proximity of fisheries science to management came as a surprise and a defining characteristic of the discipline for a scientist who transitioned from marine ecology to tuna fisheries science:

I had the impression that it was a different world, just the way we look at science, the way we study. In ecology, there's a lot of basic science and not necessarily any need for applications behind it. [...] It's much more independent I think. Not that fisheries science isn't independent, but [...] I think there are times when the boundaries are less clear. [...] Clearly, in other research institutes, for other researchers, you clearly feel a somewhat pro-fisheries direction. [...] But otherwise, it's really this need to have an application behind it that is very strong among fisheries scientists. (SAM fisheries scientist L., Noumea, 18.11.19)

This observation illustrates the unremitting tension in scientific expertise and regulatory science, deemed to lack independence precisely because it endures the influence of non-scientific actors – resulting in a form of 'impure' science (Dedieu & Jouzel, 2015; Demortain, 2017a).

WCPFC's annual schedule puts strong pressure on stock assessors to submit their yearly estimates on time. The latter spend over half their year "preparing the data for the stock assessment", "exploring different scenarios and configurations", and drawing up their final reports for the WCPFC scientific committee (SAM modeller M., Noumea, 20.11.19). These aspects are not very enticing for many scientists, which makes it hard to safekeep the necessary workforce: "It's the same story with all the stock assessment scientists, because it's ultra stressful and depressing. [...] And you work so hard, it's not very rewarding for them", FEMA scientist J. explained after the departure of one stock assessor (FEMA scientist J., Noumea, 01.04.21). The continuous assessment of tuna stocks, building on recursive activities and incremental modelling adjustments, resembles more an administrative or engineering activity than an academic one (Armatte & Dalmedico, 2004). Scientists consider 'regulatory' tuna stock surveillance as unrewarding and outside the professional standards of academic science. This demarcation is also drawn on the other side of the boundary by scientists of other disciplines. Physical oceanographer C. described SPC's stock assessment work: "It not really research, it's operational." (IRD scientist C., Noumea, 28.08.19). One argument for this demarcation draws on the distinctive production of regulatory scientists compared to academic ones. Academic researchers are "there to publish" (FEMA marine biologist D., Noumea, 02.10.19). However, tuna fisheries science first produces 'technical reports' for WCPFC and national fisheries administrations. If publishing is coming to the fore for FEMA

scientists involved in ecosystem research, stock assessors have little time to publish: “If we decide to do it [publish], it’s always well received [...] but I think it’s also linked, in our Stock Assessment and Modelling team, to the great pressure we have on the scientific committee [...]. And you don’t have the time during that period to do scientific communication.” (SAM scientist L., Noumea, 18.11.19).

ii. **An Epistemically and Geographically Bounded ‘Scientific’ Surveillance of Tunas**

This organisational divide isolates the scientific community involved in the regulatory surveillance of the WCPO tunas from broader environmental surveillance efforts. Different publication strategies between fisheries stock assessors and other scientists contribute to isolating fisheries science from other disciplines *and* the WCPO fisheries science community from other regions:

After all, I think it’s a shame. I think there’s very high-quality research at SPC, which is ultimately going to remain within a circle, even though there are a lot of fisheries scientists who look at the technical papers – and there are very high-quality technical papers. But for many scientists too, as long as it’s not peer-reviewed... (SAM scientist L., Noumea, 18.11.19)

Technical reports are not peer-reviewed and do not circulate along the same paths as scientific publications. SPC’s technical reports are shared with WCPFC members rather than the global scientific community. This is common for regulatory science, mobilised to address ‘local’ situations at odds with academic science’ universalist aspirations (Demortain, 2017a). Lack of scientific visibility makes the WCPO region more invisible: “It devalues the WCPO because what is happening here in terms of science is less visible. It gives the impression that it is less important even though it is the most important ocean basin.” (SAM scientist L., Noumea, 18.11.19). This simultaneously affects external actors’ propensity to research the WCPO and produce regionally-relevant knowledge. Taking the example of the International Seafood Sustainability Foundation, scientist L. added: “They do a lot of testing at sea, but fewer are done in the WCPO, so if they were to find solutions, it wouldn’t be suitable for our ocean. [...] It’s a bit of a shame.” (SAM scientist L., Noumea, 18.11.19). The proximity between SPC and WCPFC and the limited dissemination of SPC’s scientific results frame *regional* forms of regulatory science conducive to international demarcations and divergences (Joly, 2016) while performing the construction of the WCPO region and WCPO tunas.

The subordination, if not integration, of fisheries science in management institutions, can come at the expense of its integration with other scientific disciplines and reinforce epistemic divides regarding the surveillance of offshore environments. In New Caledonia, a marine ecologist reviewing all available scientific knowledge on the Territory’s seamounts stumbled against the enclosure of fisheries scientific knowledge in fisheries administrations. Fisheries reports were held separately in New Caledonia’s fisheries agency and many were confidential because they used protected commercial fisheries

information. Tuna fisheries regulatory science, following distinct standards than academic science, was far less accessible and shared:

Interviewee: I had a lot of trouble finding information about wildlife. [...] You have all the published literature. Admittedly, some journals charge a fee, but [...] you can always get hold of the papers. But the [fisheries] reports are very obscure. Fortunately, [X] worked with me and was a bit of an insider in the Maritime Affairs Department. So, she got lots of reports from colleagues. I'd never even have known it existed, and frankly, plenty are kept private too. [...] You can see from the references [...] that the whole fishing section, which was done by [X] and is quite large, almost all the references are reports. The whales and benthic fauna section, on the other hand, is much more in the form of [scientific] publications.

Interviewer: Fisheries-related research is not done by scientific institutions but by the Maritime Affairs Department?

Interviewee: Yes, you can write that down! [laughter] It's true, I think it's funny.

(IRD marine ecologist, Noumea, 09.09.19)

This separation accentuates the dissociation between commercial fish and other marine organisms and between fisheries management and biodiversity conservation. On the contrary, marine biodiversity surveillance was mostly 'scientific' and fragmented amongst academic institutions.

2. The Politics of Regulatory Surveillance

i. Making Regulatory Surveillance Policy-Relevant

As a regulatory science, fisheries science must produce instruments that translate and vehiculate its knowledge to fisheries managers. In that respect, stock assessments constitute "the cornerstone of the advice communicated by scientific committees to RFMOs [Regional Fisheries Management Organisations]" (Merino et al., 2020, p. 2). Despite their scientific limitations, they remain "as important, if not more important than 10 or 20 years ago", to the surprise of a fisheries scientist (IRD fisheries scientist K., Sète, 14.03.19). Inertia may occur and comfort the maintenance of 'imperfect' knowledge because of the need to bridge distinct communities.

The ambition to make stock assessments 'policy-relevant' shapes underlying scientific practices. For instance, stock assessments' spatial structure can be adjusted to jurisdictional boundaries rather than 'tuna boundaries' only. Modelling adjustments can also facilitate the spatial organisation of management procedures: "From a management point of view, you want your boxes [i.e. the regions used in MFCL] to line up because it makes things a lot easier. Right now, there's been an effort to try and get the main tunas and their boxes lined up. I think yellowfin and bigeye have the same structure." (SAM modeller N., Noumea, 15.11.19).

Before WCPFC's annual Scientific Committee, SPC convenes a Pre-Assessment Workshop to discuss its research with other tuna fisheries experts. The workshop is supposed to be "technically focused" (SAM chief scientist P., Noumea, 20.05.20) to build scientific objectivity claims and facilitate the assessments' validation by the Scientific Committee. Hence, it contributes to the unremitting demarcation work of regulatory scientists and boundary-organisations to establish their scientific legitimacy (Guston, 1999). The validation process is not independent from political influences, however. The composition of the workshop brings together (often historical) foreign and regional experts. Some of these experts come from national administrations also parties to WCPFC: "They have a stake as well" (SAM chief scientist P., Noumea, 20.05.20). This hybrid peer-review practice is presented as both a pragmatic solution against limited available expertise and a means to avoid scientific controversy:

It's targeting the key expertise in the region. We don't have this expertise in the island nations but Japan, the US, Australia, New Zealand, Taiwan, Korea, China do, so we pick up the main players that have scientific expertise that can advise us in the region, and the ones that will cause trouble in the Scientific Committee. [laughter] [...] They don't have a role in telling us what to do exactly, it's more for feedback and it provides a bit more confidence to the Scientific Committee that the way we've done the assessment this year has been reviewed. PAW [the pre-assessment workshop] is important to bypass that review phase [by the Scientific Committee]. (SAM chief scientist P., Noumea, 20.05.20)

The Pre-Assessment Workshop reviews MFCL's design and underlying assumptions. Following the meeting, SPC modellers input WCPFC member countries' fisheries data and assess stocks based on the model's results. The final report, officially presented to the Scientific Committee, is a lengthy Working Paper providing descriptions of the data, the model and its results compared to the previous stock assessments. SPC also analyses the fisheries to cross-analyse stock health with fishing impact. The reports can be almost two hundred pages long, making them relatively cumbersome management instruments even though they aim to establish some scientific transparency. To facilitate the circulation of scientific results, these reports are 'packaged' against a series of descriptive and prescriptive indicators that facilitate assessments' interpretation. Indicators like the Target Reference Point or the Limite Reference Point (cf. Chapter 6)²⁹⁴ have been developed to match managers' interests and objectives. Fish constitute a "biomass", which may be "a weird metric to use" but are a "more understandable" indicator for managers interested in resource exploitation and management: "That's how management wants it, in terms of describing." (FEMA fisheries biologist E., Noumea, 19.11.19).

SPC's work is eventually summarised in diagrams that provide influential visual knowledge tools (over)simplifying and objectifying wild tuna populations and heavy surveillance practices into resource

²⁹⁴ These reference points are instruments of the precautionary approach to fisheries management. The Target Reference Point sets the desired objective for the stock status and the Limit Reference Point sets a threshold to preserve fish stocks within safe biological limits

stocks safe or risky to exploit. The Kobe Plot,²⁹⁵ later supplemented by the Majuro Plot, represents fishing mortality (F) against stock abundance (SB), relative to management targets (see Figure 51). These plots indicate if a fish stock is considered as “not overfished and not undergoing overfishing” (green), “not overfished but undergoing overfishing” (orange), “overfished but not undergoing overfishing” (yellow) and “overfished and undergoing overfishing” (red). When a stock moves into the orange or red zone, the WCPFC must undertake management and conservation measures to combat overfishing and restore the stock. These visual instruments permit “to improve the *mutual understanding* of scientists and managers concerning stock status determination, management advice and the uncertainties inherent to both” (Merino et al., 2020, p. 7, my emphasis) by intertwining scientific descriptions of ‘nature’ and political prescriptions over the latter.

²⁹⁵ The Kobe Plot is a visualisation tool that was adopted from 2007 after a general meeting between RFMOs to harmonise their practices.

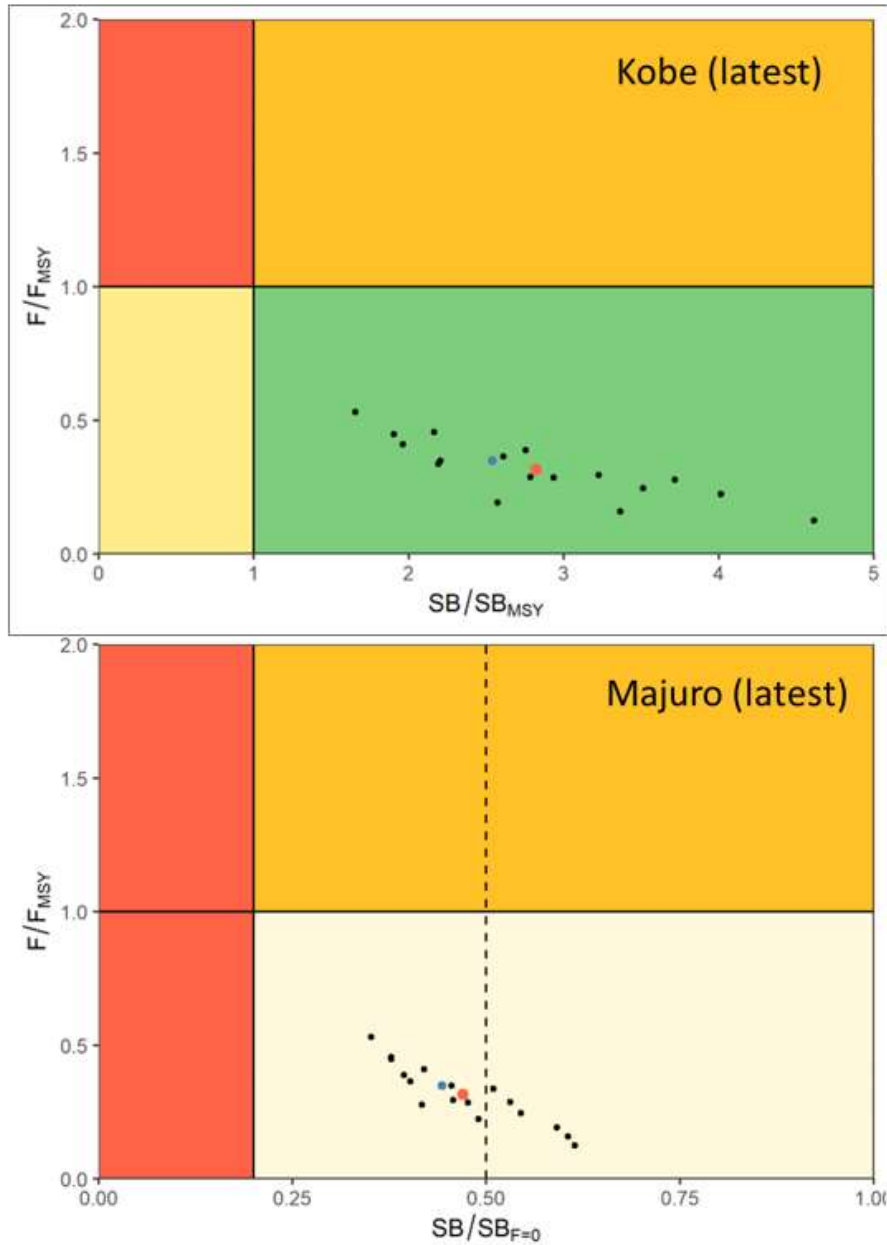


Figure SKJ-11. Kobe (top) and Majuro (bottom) plots summarising the results for each of the models in the structural uncertainty grid for the ‘latest’ (2021) period. The vertical dotted line on the Majuro plot is included to indicate the interim TRP of $0.50SB_{F=0}$ for the WCPFC-CA skipjack stock as specified in CMM 2021-01. The blue point is the diagnostic model, and the red point is the median.

Figure 51: Kobe and Majuro plot from the 2023 skipjack tuna stock status and management advice report of WCPFC Scientific Committee.

ii. Regulatory Surveillance: Fragile Science, Disguised Politics?

The scholarship on regulatory science has well evidenced the intrinsic fragility of this ‘intermediary’ science, which is more porous to political influences because of its very proximity with political actors and because it addresses ‘wicked problems’. If scientists can ‘bend’ science to make it policy-relevant,

certain actors have also been shown to bend scientific processes and uncertainties to advance their political interests (e.g. Finley & Oreskes, 2013; Oreskes et al., 2018).

Assessing tuna stocks is a vast and complex undertaking, as the previous sections of this chapter have evidenced. Considering the high stakes of this operation, presenting the end result of SPC's expertise to the Commission constitutes a "trial" (Latour, 2011): "That's the most unpleasant thing for my guys, defending their work in those forums, knowing that data are never perfect. There are uncertainties, there are estimations." (SAM chief scientist P., Noumea, 20.05.20). To maintain its objectivity claim and credibility, the SAM modelling team demarcates its work as scientific rather than political: "[Managers] just ask us for advice on options but we need to be conscious that we don't cross that line. [...] It's an important distinction, for the stock assessment group and more generally the research we do here. We are not political, we're not a management agency." (SAM chief scientist P., Noumea, 20.05.20).

Such demarcation and 'de-politicisation' of SPC's regulatory surveillance also occurs on the 'political' side of the boundary. An SPC scientist recounted that the Parties to Nauru forbid her to write any management recommendations following a study she performed on dFADs to retain their authority over SPC and tuna fisheries (Field notes, Ecosea Workshop, conversation with a SAM scientist, Noumea, Oct. 2019). Hence, the capacity of regulatory science to shape political decision is fragile. Governments' will to control their fisheries can result in overlooking scientific advice and environmental considerations:

The limit on dFADs. [...] The Spanish said that it would be a good idea for the EU to do something about dFADs. [...] Instead of thinking that it might be a good idea, that we could perhaps ask SPC, the scientific provider, to do a study, to find out how many, the number to choose for our ocean, all that, they just came up with 350, which is the limit of the Indian Ocean - so based on nothing in our ocean after all. And nobody said anything. If no country says anything, that means no one is at that level. Otherwise, there would have been complaints [...]. I tried to see how many FADs the boats were following at any given time [...] and in fact virtually no boat was at that level. Most of the boats are well below that, 250/200. Even after showing that, there was no adjustment. (SPC fisheries scientist L., Noumea, 18.11.19)

For another scientist, "every year, decisions are based less and less on science" (FEMA fisheries scientist J., Noumea, 11.11.19). However, many managers and regional officers simultaneously praise and pride the region's scientific capabilities, particularly compared to other regions. To many, WCPO fisheries are better regulated than other regions thanks to their extensive surveillance. This raises questions about the paradox of putting so much effort into 'regulatory' surveillance only for it to be ignored: "To put it really simply, it's window-dressing. They do the right thing with models, stock assessments, telling what limits should be [...] but they don't follow it. But they can still say they've got SPC doing their science" (Former SPC fisheries officer, Noumea, 07.05.21). In that case, surveillance legitimates management decisions more than the effective production of scientific knowledge.

Science can also be instrumentalised to defend political interests under its guise (Finley & Oreskes, 2013). The spatial demarcation between WCPFC and IATTC's jurisdictions was based on political rather than biological considerations, "on the basis of fishing boats, not fish" and fishing license allocation interests (FEMA fisheries scientist E., Noumea, 19.11.19). These divisions have become embedded and enforced through fisheries regulatory surveillance, which consider Eastern and Western Pacific tuna stocks as distinct. Despite growing empirical evidence that this stock structure is incorrect for Bigeye tuna, the topic remains unaddressed in stock assessment practices:

In the Pacific tuna fisheries, the problem is essentially political, with a Berlin Wall between IATTC and WCPFC. Discussing stock structures in the Pacific is virtually forbidden, despite all the data proving these movements. For example, I tried to raise the issue of the east-west movements of bigeye at the IATTC Scientific Council meeting in 2010 [...], but my question was ruled out of order. (IRD tuna fisheries scientist A., France, 11.07.19)

Additional organisational lock-ins consolidate this division and sustain ignorance of the Pacific-wide connections. Collaboration between IATTC and WCPFC fisheries scientists is limited by the use of different modelling tools (cf. Section II.2) and the enclosure of fisheries data under each Commission, which prevents information (and tuna)-sharing across the ocean (SAM modeller N., Noumea, 15.11.19).

Fisheries expertise is entrenched in multilateral politics. Certain countries, through their national fisheries experts, weigh more than others in stock assessment models' design, as mentioned in the case of the Pre-Assessment workshop. WCPFC members do not have the same capacity to influence, let alone mobilise, fisheries science and management negotiations. WCPFC's Scientific Committee is hardly composed of scientists only. If most Distant Water Fishing Nations (DWFNs)' delegations are "like what you would expect", most Pacific Islands, on the contrary, "do not have the capacities to provide delegations with scientists" (WWF representative, Suva, 05.07.19). While "Japan always comes with a super competent person, an expert who weighs greatly in the scientific committee." (SPC fisheries scientist J., Noumea, 11.11.19), SPC "found that most of the fisheries officers were lacking the understanding to interpret target reference points, what they mean in terms of management" (USP marine scientist, Suva, 24.06.19). As a result, SPC trains Pacific Islands fisheries officers to ensure they can at least understand stock assessments. A New Caledonian delegate shared: "It's so technical, I don't have a scientific background. My background is more in professional fisheries management. It's a highly specialised field, the world's highest level of fisheries management. It's great to see but often very complicated to follow." (New Caledonian fisheries officer, Noumea, 21.05.21). Tuna stock assessment science is a political instrument in itself. As a complex, modelling-intensive practice, it has coincidentally become a closed and elitist field, hardly accessible to the many, making uncertainties more subject to political manipulation: "The difficulty with the current models is that they are very complicated, nobody can accept them." (IRD tuna fisheries scientist, France, 11.07.19). Such regional

surveillance becomes a political instrument for certain countries rather than a common instrument of knowledge of tuna populations.

Doubts and criticisms still arise, especially when modelled results have immediate management implications. Bigeye status' sudden change after a parameter reappraisal (cf. Section II.2) prompted much reaction amongst scientists, managers and NGOs. Some actors questioned the lack of scientific pluralism underlying fish stock evaluations and WCPFC's centralised regulatory model:

SPC is the only provider of scientific information. [...] We know the outcome of the stock assessment is only food as an estimate; there's always uncertainty. [...] If only we had another independent provider to verify the outcome of SPC' stock assessment, that would be good. [...] I think we should have a second opinion, another independent stock assessment provider. (USP marine scientist, Suva, 24.06.19)

The capacity for other actors to produce alternative narratives is a matter of scientific skills *and* of access – to data and evaluation processes. WWF deplored that they could only “comment on the uncertainty [of stock assessments] because that's all they could deal with as they don't have any science unit and don't have access to the stock assessment process” (WWF representative, Suva, 05.07.19).

Criticisms of SPC's science are indexed to its political implications rather than accuracy: “I think there are disputes as soon as things aren't going well.” (New Caledonian fisheries officer, Noumea, 14.07.21). A SAM modeller expressed his surprise at the lack of reaction regarding changes he made to MFCL:

We added a bit more data, and it doesn't make much different, so they were pretty passive [...]. I was kind of surprised there wasn't a lot more discussions in terms of the skipjack model assessment. [...] I think a lot of it comes down to if it meets their desires. Like, if it's at the level that they want, they're not going to argue with that. (SAM modeller M., Noumea, 20.11.19).

The stock assessments adopted by WCPFC's scientific committee partly reflect the negotiated outcome of a *desired* reality rather than a scientific description of that reality.

iii. Anticipating Uncertain Futures and Making Scientific Uncertainty Political

Stock assessments are co-produced by tuna fisheries scientists and managers to surveil tuna resources. They are filled with informational and structural uncertainties, making them a relatively fragile knowledge product and attesting to the specific challenges of surveilling and controlling living non-humans (Fortané & Keck, 2015). Against the complex mutability of life and irreducible uncertainties preventing risk-based calculations, regulatory surveillance practices become more flexible and anticipatory, shaping information and management approaches to cope with uncertainty (Lakoff & Collier, 2008; Barker et al., 2013; Hinchliffe & Lavau, 2013). Coping with uncertainty results in making

it explicit to managers, turning it into a management object, and acknowledging that surveillance may not result in actionable knowledge and enhanced capacity of control.

SPC modellers used to submit the model they considered the most accurate to WCPFC's scientific committee. More recently, they have rather shared a set of models accounting for many likely variations:

We provide advice based on an *ensemble of models*, so we change a bunch of structural assumptions, things we don't have much certainty about. For instance, last year, in the shark assessment, we had really huge uncertainties in the catch, so the catch was at different levels and that was one of the structural uncertainties that was explored for managers. (SAM modeller N., Noumea, 15.11.19).

With this strategy, science becomes more transparent by transferring uncertainty to decision-makers and exploring a range of possible oceanic realities with them.

SPC modellers now produce an 'uncertainty grid' to explain and test MFCL's informational and structural uncertainties. The model is run many times with likely parameter values to observe the models' sensitivity to these variables' variations. The goal is no longer about selecting the most likely reality of tuna populations but about framing reality within a range of possible options to exclude improbable ones and envision less uncertain realities: "One of the key parameters in modelling is called steepness, which is affecting the growth rate of the stock. No one knows what it is, but you could put limits: it's not going to be less than that and more than that. So it gives you a constraint." (SAM modeller R., Noumea, 08.11.19). This attests to a more fluid epistemology, a new framing of science and management relations, and a greater *acceptance of uncertainty*:

If you're looking at the stock assessment that we produce here, even 5-10 y ago, the tendency was to run a lot of stock assessments [...] and then we'd agree this one was the correct one. [...] The difference this year for skipjack, or even the one we produced three years ago, is this idea that actually the 50 stock assessment models... it's not that one is correct and the others are incorrect. [...] None of them are really correct [...]. But there's an acceptance of uncertainty in what's going to happen. I think it's a very important step because it prevents from searching that one answer, and all of a sudden we magically know that solution. Now the case is that we don't really know where we are, but we've got a pretty good idea of the range of uncertainty. (SAM modeller F., Noumea, 08.11.19)

The uncertainty grid gives managers greater liberty to interpret SPC's stock assessments: "That's what the grid is, to capture what we think is the *potential range* of where that stock is. For the manager, they can look at the middle point of all that [...]. Some managers can look at the outliers rather. [...] So that's what uncertainty is: capturing the possibilities that we've made a judgment on [...]." (SAM chief scientist P., Noumea, 20.05.20). Hence, instead of seeking to contain and reduce uncertainty, this approach makes it visible. This restores the role of public decision-making in coping with uncertainty and managing despite, or rather with it (Granjou, 2003):

I think that this is one of the major improvements that I have seen in WCPFC and SPC's work. We've really improved the integration of this notion of uncertainty and therefore of risk calculation, and behind that we've improved the quality of the information transmitted to managers. [...] I greatly appreciated this, as a manager. Managers always take risks, and there are very few areas in which, as a manager, you can say that you're 100% sure of the basic data so that you can plan ahead and put the right measures in place. Putting this kind of process in place and quantifying the risk has been a real improvement. (Former New Caledonian fisheries officer, Noumea, 11.09.19)

The reconceptualisation of uncertainty permits fisheries stock assessment science to absorb and reorient its criticisms and intrinsic limitations *while* retaining its epistemic standards. It also acknowledges the porosity of science and management more frontally by relocating modelling debates in management arenas and discussing more publicly "on what areas of uncertainty we should spend your money to allow you to tighten a lot that uncertainty, and prioritise" (SAM modeller F., Noumea, 08.11.19). It widens stock assessment practice to fisheries managers, following a more hybrid model of scientific expertise co-construction (Joly, 2001). Hence, SPC now engages in a consultative process make modelling more collective: "You're never going to get away from this, from relying on expert opinion, even just in choosing scenarios. You rely on scientists saying this is important, or that, but it moves away from having a single body [...]" (SAM modeller R., Noumea, 08.11.19).

These considerations have led to a new approach and temporality in tuna fisheries surveillance and management with the development of Harvest Strategies. Stock assessments are criticised for providing outdated snapshots of stocks. Combined with the slow pace of intergovernmental negotiations to agree on and adopt conservation and management measures, fisheries management is seen as too slow and only *reactive* to stocks' degraded states. Harvest strategies promise to fasten and smoothen management responsiveness by adopting a future-oriented stance on fisheries management decisions: "It's a shift from running an assessment asking: 'where are we? Oh, we think we are here, what do we do now?' To: this is what we want to do and how do we get there? Which now is the question." (SAM modeller F., Noumea, 08.11.19).

Harvest strategies are developed in several stages. The first stage involves consulting stakeholders to determine management objectives (e.g. job creation, stock sustainability, etc.). Next, management procedures for achieving these objectives are identified. These procedures are based on fisheries data, stock assessment methods and Harvest Control Rules, which regulate fishing activities. Management Strategy Evaluations are then developed to assess these management procedures' relevance and probability of success and select the most appropriate ones. Finally, a "monitoring programme" tracking "performance indicators" is put in place to surveil the fishery against the management objectives and adjust actions accordingly: "You have to constantly monitor what's happening, to update and adapt accordingly." (SAM modeller F., Noumea, 08.11.19). Harvest strategies, therefore, define upstream

management measures against a range of plausible futures, and these measures are unlocked when and if the context they were planned for arises.

Harvest strategies embody a participatory, processual and anticipatory approach to fisheries management and a new way of adapting to uncertainty: they are “designed to achieve management objectives for a stock and a fishery despite uncertainties on data and knowledge”.²⁹⁶ Even though the future remains uncertain, harvest strategies build certainty regarding what will happen for each future scenario, thereby “reassuring NGOs, managers and the market alike” by guaranteeing stability in resource exploitation (Field notes, Ecosea workshop, Noumea, Oct. 2019).²⁹⁷ The idea is not to predict the future but to agree at a given time on how a possible future should be dealt with:

It's not quite the same as running a projection. The intention is different, it's not trying to predict exactly the future. We want to identify the best management procedure likely to meet the objectives across a range of plausible scenarios. [...] You rather say: “Oh, I don't know what the effect of climate change is going to be, it might do this or that, so we want a management system in place that can deal with either of those alternatives. [...] We're trying to develop robust [...] management systems that are able to perform well enough across a broad range of uncertainty.” (SAM modeller R., Noumea, 08.11.19)

Fisheries management policies do not so much seek to anticipate a possible crisis than to prepare for an upcoming and already emergent crisis (Fortané & Keck, 2015).

This turn to the future makes modelling activities even more central in tuna fisheries regulatory surveillance. Models proliferate to simulate a multiplicity of management procedures against a multiplicity of possible scenarios: “We use computer simulation models to predict how a certain management approach will perform under certain uncertainties and ranges of unknown variations. [...] If we manage fishing in a certain way, where will the stock be in 20, 30 years? Will it still meet our objectives? It's a forward-looking simulation approach.” (SAM chief scientist P., Noumea, 20.05.20).

That process accentuates the co-construction of scientific expertise. The recently recruited SPC modelling team in charge of the harvest strategies consults fisheries stakeholders to establish scenarios and define management objectives and harvest control rules. This approach acknowledges the existence of a distributed knowledge and expertise on fisheries and the necessity to incorporate them better:

You speak to different people, to the biology, to the ecosystem guys... and from that you try to generate scenarios that you think are going to be significant or important. [...] By the people running the Seapodum and Ecopath models, we are able to identify what we call plausible future scenarios. [...] So you have to speak to people from other

²⁹⁶ SPC website: <https://fame.spc.int/fisheries-management/tuna-harvest-strategies> (accessed: 23.07.24)

²⁹⁷ Noticeably, the harvest strategy procedure has also been fostered and driven by the MSC label, which has made harvest strategies a condition for the obtention of the certification. This confirms the market approach underlying this new management model.

disciplines to generate those different scenarios. (SAM modeller F., Noumea, 08.11.19)

This time, consultation exceeds the scientific sphere and the WCPFC Scientific Committee to incorporate “the industry and the Pacific Nations” and decompartmentalise fisheries surveillance and management (SAM modeller F., Noumea, 08.11.19). Consultation with the industry, for example, could help integrate uncertainties and concerns relating to the ‘social’ dimension of tuna fisheries:

The sources of uncertainties stakeholders tend to come up with are certainly different from population biologists. They work in a very modelling mindset, on steepness, things like that, very technical stuff. The things that the industry members or countries identify are things that affect how they sell licenses or something called hyperstability²⁹⁸ [...] (SAM modeller R., Noumea, 08.11.19).

Participation helps connect stakeholders and widen discussions around fisheries management *and* modelling: “I think one of the big advantages of this approach is that it provides the framework for negotiating discussions and decision processes. It takes people to the very objective of modelling [...]. It’s very much a process for reaching a negotiating outcome as it is guessing what might happen in the future.” (SAM modeller R., Noumea, 08.11.19).

The implementation of such endeavours, in their early stage, is particularly burdensome. By 2019, the SPC modelling team had engaged in the process for the skipjack purse seine fishery because it was assumed to be “an easier case study”: a healthy stock targeted by a single fishery (Field notes, Ecossea workshop, harvest strategy presentation, Noumea, Oct. 2019). Even in this supposedly straightforward case study, the procedure is extremely heavy. By 2019, the team had established “288 operating models with 4 replicates of each with recruitment variability producing 1,152 replicates (half day to a day to run each”, each one being a “combination of scenarios on stock-recruitment relationship, tag mixing period, tag overdispersion, movement, hyperstability, recruitment period, recruitment autocorrelation, catch and effort, tag recaptures, effort creep” to test harvest control rules capable of achieving WCPFC’s Target Reference Point established (Field notes, Ecossea workshop, Noumea, Oct. 2019).

These new approaches to managing scientific uncertainties bring ambivalent results. Although models proliferate, integrating stakeholders and possible futures remains partial – and may lead to even more simplistic modelling assumptions. Ecosystem considerations had not yet been incorporated, and consultation only focused on the fisheries sector. The operating model actually used a “slimmed down version of MFCL because the full assessment model for skipjack takes about 24 hours to run” (Field notes, Ecossea workshop, Noumea, Oct. 2019). Some management objectives could not be integrated due to a lack of indicators: “Objectives like employment: what indicator do we use to measure it?” (Field notes, Ecossea workshop, Noumea, Oct. 2019). Modelling skills remain entrenched in ‘conventional’

²⁹⁸ Hyperstability refers to stable catch permitted by increased fishing efficiency and therefore masking fish stock decline.

fisheries science. As a result, preliminary trials “generally [came] down to catches, stability and CPUE” (SAM modeller F., Noumea, 08.11.19), i.e. to the already dominant and longstanding indicators of fisheries science and management. Often criticised for being too mathematical and ‘out-of-sea’, fisheries science remains largely entrenched in this same framework. Beyond its technical limits, the exercise raises the question of its appropriation by the target users. Two SPC researchers talked about their trips to the Pacific Islands to consult stakeholders and shared their “concern that there is actually no stakeholder able to interact with the process as we would like”: “They’re just starting to understand the stock assessment work, and then suddenly...” (SAM modeller R., Noumea, 08.11.19). Fisheries managers must once again be trained to grasp a new management instrument within a timeframe constrained by the Commission and negotiations with other countries – some of which are better equipped, particularly the DWFNs.

Finally, although certain fisheries managers appreciate their enhanced capacity to manage uncertainty with this (partial) co-construction of modelling expertise, others are more reluctant to surrender to uncertainty and rather call for intensifying surveillance:

The difficulty is that some managers struggle to integrate this notion of risk. They see it as something that prevents them from making decisions. There’s a risk, so we’re not 100% sure, so we don’t do it. That’s a bit like what happened recently with the Tuna Commission. It’s been the same thing all the time: we need to do more studies, etc. (Former New Caledonian fisheries manager, Noumea, 11.09.19)

In that case, visibilising scientific uncertainties and surveillance’s fragility may delay decision-making and induce a “paralysis by analysis” (Demortain, 2019, p. 1064; see also Braverman, 2017).

3. A WCPFC ‘Civic Epistemology’ and the Production of Ignorances

i. The Exclusion of Non-Regulatory Knowledge

The WCPFC provides a strong framework for SPC’s surveillance and research work. Yearly, its Scientific Committee “decide[s] on the budget and timetable for all the scientific work, and if necessary, we prioritise the studies according to the possibilities of SPC” (New Caledonian fisheries officer, Noumea, 14.07.21). It simultaneously excludes and prevents other types of surveillance and knowledge from emerging. This selective process results in the institutional and systemic production of ignorance by leaving aside potential knowledge that could also guide political action (Dedieu & Jouzel, 2015).

WCPFC and its member countries control fisheries surveillance data. As the recipient of this information infrastructure, it shapes what knowledge can or cannot arise:

That’s the problem, unless they [scientists] are working with us under contract and it’s deemed WCPFC work, they need to go through a data request process, to outline the purpose of their request, that will then go to the executive directory of WCPFC, who then sends it to all member countries in broad. [...] The best approach is to go and get

approved by WCPFC as WCPFC work. (SPC chief data scientist P., Noumea, 20.05.20)

Hence, the study of tuna stocks is highly supervised, and compartmentalised by WCPFC, even *within* SPC:

Stock Assessment is going to make recommendations to the WCPFC, saying that they have parameterised this, that the little brick for the bigeye age curve is uncertain, and that it should be updated. WCPFC will contract CSIRO [an Australian research institute], who will contact us [FEMA] to get the samples, and they will make a report to WCPFC, who will provide the report to Stock Assessment. So they're upstairs, but it crosses the whole Pacific. (FEMA marine biologist D., Noumea, 02.10.19)

The confidentiality of fisheries surveillance information precludes alternative stock assessments from emerging and offshore ecosystem investigations to develop independently from WCPFC's supervision: "Stock assessment models are annoying because their data are sensitive, so if you wanted to ask someone else to do it, you'd have the whole problem of data confidentiality." (FEMA scientist J., Noumea 11.11.19).

Hindered access to the best available fisheries information may prevent potentially 'uncomfortable' questions and knowledge from emerging. As I asked whether topics like illegal, unreported and unregulated (IUU) fishing or MPAs were part of their research enquiries, a modeller replied:

If the Commission say they want to look at spatial protection and MPAs as a way to manage tunas, then we'll change our focus obviously. [...] Our priorities are aligned with what governing organisations and countries' prerogatives are. [...] So if they don't want spatial management, we won't spend their money looking into spatial management. It's not up to us to pre-empt the science needed for management, just to improve what's being done. It's an interesting question to see if pelagic MPAs benefit tunas, but we've not been asked this question by the Commission. (SAM chief scientist P., Noumea, 20.05.20).

Commission's approval requires member states to agree on the type of science and surveillance that matters and ought to be done – something far from consensual amongst countries with opposing interests and varied conceptions of offshore environments.

WCPFC also decides what expertise and instruments should inform fisheries management decisions in the WCPO. Scientists working for the Scientific Committee only come from fisheries science and population dynamics, while other disciplines also interested in offshore ecosystems and fisheries management are excluded: "Conservation ecology: we don't see them in the Commission. In fact, we've never seen them.", a fisheries scientist observed based on his experience in WCPFC and IATTC (IRD tuna fisheries scientist, France, 11.07.19). If "WCPFC accepts both MFCL and Stock Synthesis for management", it does not "really consider the ecosystem models all that much" (SAM modeller N., Noumea, 15.11.19). The Commission categorises ecosystem models as "only theoretical" academic

rather than governing instruments: “They are more maths games than management, there is no connection with management.” (IRD tuna fisheries scientist, France, 11.07.19). If Seapodym is now presented to the Commission, it has not led to any management advice or received any feedback from member countries (Field notes, Ecosea workshop, Seapodym presentation, Noumea, Oct. 2019).

The exclusion or dismissal of certain forms of surveillance and knowledge does not only result from active obfuscation strategies; it also partly derives from ‘involuntary’ mechanisms of ignorance production (Dedieu & Jouzel, 2015). Several reasons explain why ecosystem models have not penetrated the management arena despite their expansion within scientific communities. First, the field is too diverse. Models are numerous, complex, and relatively ‘untried’. The ecosystem approach definition is not consensual, and scientific communities have not yet provided easily manipulable indicators that could circulate between scientific and management arenas. Following a global meeting on ecosystem-based management implementation in tuna commissions, a FEMA scientist explained:

It’s still too complicated and focused on target species. This does not prevent scientific work from developing around these issues, but there’s no clear path to the management sphere. There is less agreement on these models than on single-species stock estimates. [...] On the question of indicators. Single-species estimates use biomass and targets as indices. They use 2/3 indices and a graph that everyone can read. In contrast, for EBM [ecosystem-based management], there are 300 different indices, with new ones emerging every day. Interpreting the index remains complicated, and it’s difficult to know whether changes in the index indicate positive changes for the ecosystem or not. (FEMA fisheries scientist V., Noumea, 04.10.19)

Additionally, current ecosystem models provide little insight for managers in translating long-term environmental considerations, e.g. regarding climate change, into the following year’s regulatory decisions (IRD physical oceanographer C., Noumea, 28.08.19).

Stock assessment models remain the foundational knowledge instrument mobilised for management not because of their accuracy but because of a lack of viable alternatives. At stake is managers’ acquaintance with and effective appropriation of these instruments – a point already difficult with stock assessment models (cf. Section III.2). Path dependency and the need for temporal stability and comparability – sometimes more influential than the need for enhanced knowledge of offshore ecosystems and fisheries – also account for stock assessment models’ persistence. What matters is establishing a *shared* surveillance and knowledge rather than an exhaustive and accurate one, and the capacity to appreciate stock variations against a *fixed* interpretative frame. In that moral regime, exactitude matters less than consistency and precision, i.e. concepts’ clarity and intelligibility (Telesca, 2017; Daston & Galison, 2021)

The problem is that if you use different modelling framework and the results come out differently... There has to be an acceptance not just from the scientific community, but also from the wider community. [...] We assess stocks annually, and have done it for

the last 50 years or so, and there's an expectation that next year, [...] the newest stock assessment is probably... the methodology and so on will not have changed so much. (SAM modeller R., Noumea, 08.11.19)

This induces a technological lock-in that also accounts for the non-use of alternative stock assessment models like Stock Synthesis: "If next year, we turn up with a new stock assessment using Stock Synthesis, they would be puzzled. *It would be hard to get consensus* because there would be a whole new round of people trying to understand what the model is doing." (SAM modeller R., Noumea, 08.11.19). To build political consensus, scientists seek to improve an imperfect but supposedly perfectible model. This strategy also permits fisheries scientists to conserve their epistemic authority and legitimacy by WCPFC: "Here, we're still in the process really of developing the assessments. [...] *It's easier to get that endorsement if what you do is the same as the year before but extra, rather than turning with an entirely different model.*" (SAM modelling scientist F., Noumea, 08.11.19, my emphasis). This requirement for retaining the same epistemic framework also appears within the MFCL:

I proposed another way of doing things. [...] I gave them a new tag database, and when they ran MFCL, it completely changed bigeye's biomass, by 20%. Not even because of the model, but because of a small auxiliary analysis. [...] They found a way of fiddling with the model so that it wouldn't be too affected by the change; they used my new correction factors but the biomass remains more or less the same, between 45 and 50%, because managers won't be happy with a figure outside that. (FEMA fisheries scientist J., Noumea, 01.04.21).

Against highly uncertain regulatory surveillance, these practices mitigate the risk of scientific controversy that could hinder decision-making processes. In that objective, it is easier to gather around one single and stable form of surveillance than to consider the multiplicity of offshore ecosystem epistemologies: "It's part of the advisory process", modeller F. observed tersely (Noumea, 08.11.19), i.e. an advisory process concerned with producing a form of surveillance supporting multilateral consensus and action rather than improving the understanding of 'nature' only.

ii. **The Contentious Governance of Regulatory Surveillance**

WCPFC's model of regulatory surveillance is enclosed, characterised by a narrow set of questions and legitimate knowledge, where scientific expertise is carefully framed and supervised. Regulatory science has largely been investigated in national frameworks through its relations with national administrations in the frame of national sovereignty. From this perspective, sociologist S. Jasanoff suggested the existence of "civic epistemologies" emerging from the situated intertwining of regulatory scientific practices with national regulations and institutions (Jasanoff, 2011). In my case study, however, SCP's regulatory science serves a regional institution, WCPFC, which attempts to articulate a regional management framework with national authorities (cf. Chapter 6). It reflects and supports the more recent internationalisation of regulatory science under international communities and organisations and international agreements (Joly, 2016). However, this regional approach struggles to

satisfy the sovereign interests of the many states involved in WCPFC's governance. These difficulties are only exacerbated by the fact that SPC was historically established to support the Pacific Island governments. The internationalisation of tuna fisheries expertise raises knowledge/power scalar issues.

The framing of tuna stock surveillance under WCPFC masks more local considerations pertaining, e.g. to local depletion issues and associated economic risks:

The Commissions don't really care because they think at a regional level. [...] All the models consider large areas, and the models are not capable of running on smaller areas. [...] There is no other method, apart from the fact that each country can carry out its own analysis and produce local analyses that can then be integrated into the global models. Some countries do this for information purposes, but the Tuna Commissions don't care. SPC has done it to some extent, but has been criticised for it. The Commissions don't want to hear about EEZs because it's incompatible with the idea of migratory tuna. (IRD fisheries scientist A., France, 11.07.19)

The territorial tensions regarding tuna resources remain alive and locked in by surveillance designs that do not support national territorialisation processes. SPC's role as the main scientific provider *of the Commission* rather than the Pacific Islands accentuated tuna regulatory surveillance's regional scale:

We've changed the scale: clearly, today, fisheries research is chiefly regional, I mean for scientific analysis [...], from a scientific perspective regarding the exploitation of the resources. [...] I'm sure SPC has very good scientists, I've always said to WCPFC we won't find any better for the Pacific to do our stock analyses, etc. [...] Then, they have over 20 territories to serve, they can't do it as well as if they were only intervening in one country. They can't have as good of a knowledge as local people [...]. (Former fisheries manager, Noumea, 11.09.19)

Even though SPC has fisheries scientists devoted to conducting national studies for the Pacific Islands' administrations, it only has limited resources to provide such assistance.

SPC is torn between WCPFC's regional interests and the Pacific Islands's national ones. Although there are methodological and epistemological reasons for tuna science to be regional, Pacific Island countries simultaneously demand studies that would serve their localised management interests: "Can we have the total allowable catch for Fiji or Tuvalu? It'd be nice to have that for national management purposes. [...] Countries have been asking for that, but they [SPC] only provide: 'This is for the entire region.'" (USP marine scientist, Suva, 24.06.19). SPC does not provide a regulatory science that permit the construction of state sovereignty over tuna resources within EEZs – a feature particularly distinctive to marine biodiversity research, which more clearly intends to map and build local index of biodiversity to attach marine organisms to specific habitats within a given territory (cf. Section II.3.vi).

This framing produces local ignorance, especially at the scale of individual EEZs. Such ignorance derives from SPC's limited capacities, epistemic considerations or tunas' behaviour and from political beliefs regarding how tuna fisheries should be managed. An SPC scientist conceded her reluctance to

frame tuna research at a local scale to resist individual countries' ambition to 'nationalise' these fish and weaken the reach of regional cooperation in management:

Tuna in Fiji is not Fiji's tuna. It's a species that moves around a lot, but not that much in the end. There is certainly a level of residence, but it remains difficult to establish. However, if we go back to the national level, we run the risk of having too much diversity in management policies and, therefore, losing the regional link. (SPC fisheries scientist V., Noumea 04.10.19)

This has led certain countries to try and develop their own national scientific and regulatory surveillance for those which could afford such efforts. Papua New Guinea, like Japan, launched its own tagging programme: "The aim of a national programme is often to have the hope of saying that we have our own population." (SPC fisheries scientist J., Noumea, 15.11.19). However, access to national fisheries data may be complex because those are precisely managed by SPC, which entails administrative and technical barriers. A fisheries scientist recounted that it took him six months to obtain national fisheries data from SPC despite having approval from the Tongan fisheries service to conduct a national research project on tuna fisheries (USP marine scientist, Suva, 17.06.19).

The enclosure of SPC's tuna fisheries scientific activities by WCPFC also evinces research that would interest other actors like the tuna fishing industry. SPC's science generally raised limited interest in Fiji's and New Caledonia's industries because it bore little spatial and temporal relevance for their operations – even though these actors are central to the functioning of the apparatuses underlying the production of WCPFC's regulatory surveillance (cf. Chapter 7). A fishing company manager found that SPC's work had become "very statistical" and had lost its "practical application" and technical assistance capacity (Manager of company N., Noumea, 21.10.19).

All of the information collected beyond the fringing reefs belongs to others. And the government is not good about corraling that information together to understand it. As soon as you go to the deep sea, you're very much at the mercy of those organisations that hold the data [...]. They hold the data, but Fiji is very poor at getting them together, so it doesn't know what's out there. [...] There is data but it has very limited ownership by the country [...]. (Marine consultant, Suva, 27.02.20)

Finally, the enclosure of tuna surveillance within the remit of fisheries management also constrains the mobilisation of tuna fisheries surveillance apparatuses for other management concerns and policy developments relating, for instance, to biodiversity conservation. In Fiji, the Ministry of Fisheries initially refused to provide fisheries data under the Marine Spatial Planning-oriented MACBIO project "because they thought IUCN would want to make MPAs" (MACBIO project officer, Suva, 19.07.19), suggesting the infrastructural influence of the fisheries sector in shaping offshore ecosystem surveillance and management policies.

Conclusion

This chapter evidenced scientists' central efforts and unremitting challenges in surveilling the more-than-human offshore environment. The surveillance of marine animals remains reliant on accessing a hardly accessible field. Surveillance technologies and practices only provide reticular and patchy visions of offshore ecosystems that are difficult to assemble and integrate because of distinct methods and because they sometimes produce contradictory narratives on the offshore world.

The diffusion of environmental concerns occurs amongst various scientific communities, following two processes of 'ecologisation' and 'globalisation' of conservation concerns, to echo S. Aykut *et al.*'s discussion on climate change (Aykut *et al.*, 2017). They define the "globalisation" of climate as its sectoral expansion to new jurisdictions. Comparatively, "climatisation" refers to the incorporation of climate considerations by various groups, which henceforth reinterpret their concerns *through* the climate lens. If both trends are intertwined, they are not equivalent as they may be led by distinct logics and actors, following that the climate arena moves to a particular topic or that a particular topic reaches the climate arena. Applying this framework to discuss the rise of ecosystem concerns at sea, this chapter suggested an 'ecologisation' of fisheries, whereby the fisheries sector takes the lead on offshore environmental issues. On the contrary, the capacity of the conservation sector to 'globalise' its ecosystem framing and significantly transform offshore governance appears more limited. If the 'ecosystem turn' to ocean management calls for more integration, epistemic divisions hinder such efforts.

Divided professional networks, research agendas, methods and instruments diversify more than they unite offshore ecosystem surveillance and study. Although surveillance data are mobilised and assembled in more diverse ways, information infrastructures remain scarce. Two epistemic communities provide (and control) the principal and most comprehensive surveillance infrastructures underlying scientific research on offshore ecosystems: physical oceanographers and tuna fisheries scientists. Data collection remains constraining, underpinned by limited infrastructures that are (invisibly and irreversibly) burrowed in most contemporary modelling practices regarding offshore environments. Their infrastructures – involving both their information systems and their models – weigh heavily on the type of knowledge and representations of offshore ecosystems that can emerge. In particular, they tend to shape offshore ecosystems at a regional or global scale, at odds with the interests of coastal countries in managing their offshore territories.

Finally, the chapter demonstrated that the 'regulatory' status of tuna surveillance encloses the surveillance of WCPO tunas from other forms of environmental surveillance and oceanic spaces. The advisory position of SPC for WCPFC tends to 'capture' tuna surveillance under the interests of a multilateral and regional fisheries management organisation at the expense of other actors and interests. The political role of fisheries science makes the relations between surveillance, knowledge and control

more complex. Although rooted in science, environmental surveillance does not merely seek to improve knowledge and inform political decisions. It can take on more convoluted routes, e.g. dismissing uncomfortable knowledge, delaying decision-making, or facilitating collective agreement at the expense of improved knowledge.

CHAPTER 9. Watching the Sea from Patrol Vessels

In this final chapter, I now focus on the last main offshore surveillance infrastructure that provides while constraining access to the offshore spaces: the military vessel. The latter first supports a ‘coercive’ form of surveillance, primarily concerned with *human* maritime activities, for the state to assert and exert its sovereignty, enforce its rules and order its marine territory. The chapter explains how and why the Navy is turned into a boundary surveillance and security apparatus to address the features of offshore worlds, and discusses the consequences of involving the military in policing activities expanding to environmental issues. In return, it interrogates the influence of these environmental issues in ‘ecologising’ the Navy and maritime security policies and practices.

The first section shows evidence of the pivotal role of the military in providing surveillance technologies and discusses some socio-technical dimensions of the latter. It analyses the remote surveillance perspectives brought up by emerging technologies, which, if they enable the collection of information from a distance, only provide patchy visions of the sea.

The following section focuses on the emergence of shore-based surveillance centres processing, integrating and analysing information deriving from these various sensors. It outlines the prominence of calculative, risk-based approaches in maritime surveillance to rationalise limited resources. It describes the challenges of building an integrated surveillance of the offshore world by pooling information scattered across various state agencies with distinct interests and ways of doing and knowing – and uncovers the fragmented, negotiated and processual emergence of the ‘state entity’. It further demonstrates the infrastructural role of the military in supporting maritime surveillance and its increased mobilisation in policing activities while retaining its more conventional military, defence and diplomatic mandate. It explains how the army subsequently problematises the offshore environment, notably by ‘militarising’ fisheries issues and interpreting them as a ‘hard’ security issue.

The last section outlines the limits of remote surveillance and the persistent reliance on patrol operations permitting in-field surveillance and intervention. It describes the practical challenges of patrolling the Pacific Ocean and the friction resulting from multiplying partly antagonistic missions. Finally, it discusses the difficult ecologisation of military sailors and the limits of dissociating political-legal authority from technical-practical surveillance for states to exert their control over their marine territory.

I. Sensing the Sea at a Distance: Remote and Proximal Surveillance Technologies

Maritime surveillance traditionally draws on patrols conducted by vessels or aircraft. Against the challenges of conducting such operations over vast and remote areas, technological innovations permitting to surveil from a distance play an increasingly important role in maritime surveillance practices, as stated by the French Biodiversity Agency when investigating surveillance options for New Caledonia's EEZ: "The resources available to the Overseas Countries and Territories to monitor human activities in the areas under their jurisdiction [...] often appear very limited [...], calling for the search for innovative technological solutions for their surveillance" (AFB, 2018, p. 5). Many technologies, often deriving from the military sector and suggesting its infrastructural role, have recently emerged and opened new prospects for offshore surveillance and control and led certain techno-optimists to advance that "there's nothing invisible on the surface of the ocean anymore" (World Wide Fund for Nature (WWF) representative, New Zealand, 24.06.19). In this section, I mitigate this affirmation by showing how surveillance sensors afford but also constrain the collection of offshore information while transforming how the sea and what of the sea can be known and by whom.

1. Vessels and Aircraft: Proximal Surveillance and Intervention Capacity

Patrolling from the air or the sea is a complex operation requiring specific navigation, surveillance and (physical) sanction technologies. In Fiji and New Caledonia, amongst the most equipped Pacific Islands, infrastructures meeting these requirements and accessible to the public authorities almost exclusively derive from the military.

In 2017, Fiji had four patrol vessels provided by Australia as part of its maritime security programme (cf. Chapter 6). Prior Australia supplied Fiji with offshore vessels, the country had limited offshore navigational assets. It relied on second-hand vessels from the US or Israel that were poorly adapted to local maritime conditions and could only conduct brief incursions in the EEZ (Brown, 1989; Natuva, 2021). Even with Australia's assistance, Fiji's resources remain limited. In 2017, the Navy indicated that only one of those vessels was operational. Besides these state-owned vessels, offshore assets patrolling Fiji's EEZ are foreign military assets of cooperating countries. The same year, the New Zealand Navy deployed one of its patrol vessels in the Fijian EEZ (Smith & Wesley-Smith, 2021). In 2018, Fiji signed a 'Shiprider' agreement with the US, allowing Fijian authorities to board US Navy and Coast Guard vessels to "observe, protect board and search vessels suspected of violating laws or regulations" (Ministry of Fisheries, Facebook post, 06.03.22). France also supports surveillance efforts in Fiji's EEZ (cf. Section III). These patrolling capacities are, therefore, subject to foreign interests rather than controlled by Fiji's government and are fairly opportunistic.

New Caledonia's Government only possesses *Amborella*, attached to its Fisheries and Coral Sea Natural Park Service (SPNMCP). Although multi-purpose, it mainly serves the 'scientific' surveillance of the Coral Sea Natural Park's environment (cf. Chapter 8). Patrols are conducted using the French Navy's military vessels, the only additional publicly-owned vessels capable of navigating offshore in the New Caledonian EEZ. The other state administrations vested with maritime capacities, such as the maritime affairs, customs, or the gendarmerie, only have inshore navigational devices.

In 2019, the French Navy had four offshore vessels positioned in New Caledonia. Their design is adapted to the geographical constraints of the South Pacific region: "The problem with overseas France is that we often have small islands with small quays, so you need adapted boats" (Naval officer J., Noumea, 14.10.19). Military vessels are costly and long-lived technologies, whose design reflects the French army's past, present and future strategic orientations.²⁹⁹ It takes up to 25 years for such a vessel, its equipment and crew to be ready, and today's decisions regarding the fleet commit the Army until the last quarter of the 21st century (Rousseau, 2013). Such infrastructural rigidity is at odds with the necessity of the military infrastructure to adapt and react to significant uncertainties (Alex & Estève, 2018). Hence, although military vessels are designed following privileged uses, they also aim to be multipotent – a strategy that can only imperfectly succeed.

Vendémiaire is the largest vessel (93m), accommodating a crew of 92 sailors capable of travelling great distances for long periods. It is typically used for far-flung "international relations" missions in Asia (Naval officer C., Noumea, 16.10.19). Patrol vessels, which are 55m long, "are fast and all-purpose" – which becomes handy to chase fishing vessels – but "they become a bit rustic as soon as the sea becomes rough" (*La Moqueuse* officer P., Noumea, 30.06.19). *D'Entrecasteaux*, 65 m long and with a crew of 23, was the latest to arrive in New Caledonia and reflects more recent orientations within the French Navy (see Figure 52). Initially called a "multi-mission ship", it has more recently been relabelled as a ship for "overseas support and assistance". Overall, the vessel is described as a 'Swiss knife' and embodies the multipotent strategy of offshore surveillance: "*D'Entrecasteaux* is capable of carrying out more missions [...], it was designed to carry out more missions precisely to *ensure the state's presence in all situations*" (Naval officer J., Noumea, 14.10.19). In particular, the vessel's design attests to the prominence of environmental missions for the Navy in overseas territories. Hence, its large storage capacity serves maritime pollution operations and humanitarian missions in the event of natural disasters in regions strongly affected by climate change. *D'Entrecasteaux*'s multipotent design raises criticisms: its chief officer deplored that it resulted in a "multi-mission boat not optimal for anything" (Field notes, patrol mission, Dec. 2019). Hence, although *D'Entrecasteaux* also partakes in fisheries policing

²⁹⁹ Following my departure from New Caledonia in 2019, it appears that part of its locally-based military fleet is being renewed. In 2023, *La Glorieuse* was replaced by *Auguste Bénébig*, a more modern and bigger patrol vessel. These adjustments evidence France's political and strategic interest in the region. For instance, patrol vessels like *August Bénébig* also contribute to consolidating France's extension request over the New Caledonian continental shelf.

operations, it cannot navigate fast enough to catch a tuna fishing vessel, unlike *La Moqueuse* and *La Glorieuse*.³⁰⁰



Figure 52: *D'Entrecasteaux*. Picture by the author.

Navy vessels grant offshore access to surveillance agents. As it navigates at sea, the Navy always has “an open eyes policy, if only for safety on the water: there’s always someone on the bridge to keep an eye on things” (Naval officer C., Noumea, 16.10.19). In that ‘open eye policy’ case, surveillance is open-ended and supports the general and opportunistic knowledge of the territory and its surroundings. These vessels simultaneously offer a surveillance platform, housing a range of additional sensors that extend surveillance and detection capabilities beyond human vision alone, although still to a limited extent. Automatic Identification System (AIS) receivers can pick up position and identity signals emitted *voluntarily* by other vessels over a radio range of around 20-30 nautical miles (nm). However, from a technical perspective, detection capacity depends on the height of the antenna and the sea conditions (Field notes, patrol mission, Dec. 2019). Radar sensors can theoretically detect a vessel over a distance of around 30 nm. Again, however, visibility is rarely as performant: interpreting radar signals is complex, and some vessels can escape, voluntarily or not, radar detection: “If you have a very small boat, it might be difficult to catch it with the radar. New warships are furtive and have a different radar signature, they have a tiny signature. [...] If you have a bit of sea, you can’t see it because you have sea returns...” (Naval officer C., Noumea, 16.10.19).

³⁰⁰ *D'Entrecasteaux* has a maximum speed of 12 knots - roughly equivalent to fishing boats. Patrol boats can reach 18 knots. However, the latter have a range of one week (compared with sixty days for the *D'Entrecasteaux*), which limits the areas they can monitor.

As suggested in this description, surveillance is entrenched in a technological race to see and/or be invisible – showing the ambivalent role of surveillance technologies in affording reciprocal surveillance between surveillance agents and subjects and evasion routes:

IUU is becoming more difficult to enforce and monitor now because not only we, as agencies, have technology that access it. Those on the other side of the bar also have access to this information. [...] And while we're trying to monitor them, they'll probably monitor us from the other end [...]. So it's getting to a situation where who's gonna put more money in the pan in terms of the cost of monitoring tools. (Naval officer C., Suva, 25.08.21)

Several *D'Entrecasteaux's* sailors deplored being under-equipped in comparison with fishers. As we passed a Chinese longliner in Vanuatu waters during a patrol mission, the watch officer pointed to the vessel's numerous antennae: "They have more antennae than the military boats" (Field notes, patrol mission, Dec. 2019). For this officer, these technologies enabled fishers to detect and escape military vessels' surveillance – and surveil other fishers at sea (cf. Chapter 7).

Military vessels endure extensive sailing in rough conditions. Maintenance is a significant challenge for and contributes to the rigidity of surveillance practices at sea. In 2017, two of Fiji's patrol vessels were undergoing maintenance "because we have had them for the last 40 years so they are quite old", the Navy reported (Standing Committee on Foreign Affairs and Defence, 2018, p. 33).³⁰¹ Against these ageing instruments, Australia was refitting one of the patrol vessels and planned to renew two of Fiji's patrol assets between 2020 and 2022.³⁰² Against the cost of one patrol vessel, incremental refitting of pre-existing infrastructures is preferred to postpone their renewal as much as possible. In New Caledonia, technical vessel maintenance is carried out abroad, too, in New Zealand, as necessary resources are not available locally. The operation takes several months and immobilises both the vessel and the crew. This dramatically affects the number of "days at sea" – the primary indicator for assessing maritime surveillance efforts (Field notes, boarding, Dec. 2019). Maintenance is also a daily preoccupation. On board *D'Entrecasteaux*, I was struck by the prevalence of maintenance activities, which accounted for most of the crew's working time. The navigation cabin would host at least two persons at all times, with one devoted to surveilling the vessel itself, to oversee its engines' proper and safe functioning. Every day, the crew would clean, paint, repair and look after the vessel.

Aeronautical technologies are the other major patrolling technology. However, Fiji does not own any patrol aircraft and relies on Australian or French support. New Caledonia-based French Navy owns two Falcon 200 Guardians to fly over the EEZ. Equipped with radars and AIS sensors, the aircraft is one of

³⁰¹ In interview, a Navy officer said that Fiji aimed for a daily presence at sea but that the actual number of days at sea was secret – suggesting that the target was far from being achieved (Naval officer, Suva, 25.08.21).

³⁰² The first patrol boat was commissioned by Australia in 2024 but ran aground on Fijian reefs a few months after and is, therefore, no longer operational.

the rare technologies capable of providing exhaustive and synoptic surveillance of the marine territory in a timeframe short enough to allow for policing intervention (i.e. inspection and control):

The aircraft criss-crosses the zone. It can say: after the maritime surveillance patrol, I covered 100% of the area, with a radar and AIS coverage, in four hours. [...] The aircraft's mission is to be watertight. [...] You know everything that happened in those four hours in that zone. It's not the same for the boat, which is travelling at 15 knots with its radar. It knows that, where it's going, it can see 30 nm around it with its radar. [...] But we can't certify with a boat that it is watertight in that area. (Naval operation centre's officer C., Noumea, 16.10.19)

Based on the observations, the Guardians and their crews of six persons can provide information to relevant authorities and contribute to orienting maritime patrols. Aircrafts' motility also enables swift responsiveness and the possibility for *in situ* verification "within the day" (Naval officer J., Noumea, 14.10.19) to "clear up any doubts" about what is happening at sea (CFIM, 2020). Despite their efficiency, aerial patrol assets are costly to acquire, operate (mainly because of fuel consumption) and maintain (*D'Entrecasteaux* officer O., Suva, 22.06.19). A one-hour Guardian flight costs around €15,000 (Maritime surveillance technology expert, Noumea, 14.11.19).

Patrol instruments are costly, and if they enable localised and up-close surveillance, they become 'blind' beyond their immediate vicinity. Patrol vessels, in particular, would patrol "haphazardly" (*D'Entrecasteaux* officer O., Suva, 22.06.19), hoping to "be in the right place at the right time" (Naval officer J., Noumea, 14.10.19), which is hardly efficient to cover offshore territories.

2. Seeing the Sea from Space: Satellite Surveillance Technologies

Satellite advances have provided new possibilities to see the ocean, and not only one's EEZ, from above. States have heavily invested in these tools to surveil the sea from land – even if the data collected through these satellite technologies is not obtained without friction (Edwards, 2010; Helmreich, 2019).

i. Tracking 'Cooperative' Vessels at Sea

As described in Chapter 7, Vessel Monitoring Systems (VMS) were a major innovation in making tuna fishing vessels visible from the shore: "With VMS, we could know the concentrations of boats. [...] Without the VMS you were blind, so it was a huge change." (Former FFA director, Australia, 03.06.21). However, in the South Pacific region, this apparatus, controlled by fisheries administrations, only covers *licensed* and *compliant* industrial tuna fishing vessels. Satellite-based AIS (in distinction to radio-based AIS as mentioned above) has become an increasingly influential satellite geolocation tool used for broader maritime surveillance than its initial (and persisting) purpose of safety at sea. Since the 2010s, satellite developments have allowed for the recovery of these signals at a greater distance and on a much larger scale than radio-based technologies. AIS publicly diffuse information on various types of vessels (not just fishing ones) and on a global scale (see Figure 53): "So it gives us gigantic databases on the

globe, on maritime traffic, which are a gold mine for information, for knowledge of your environment” (Representative of satellite surveillance company I., Noumea, 14.11.19).



Figure 53: Snapshot of the vessels emitting AIS signals in the South Pacific region, obtained by satellite and publicly available on the website marinetraffic.com on 16.08.24 at 4PM (UTC+1). Arrows indicate vessels' positions, coloured by vessel type (red: tanker, orange: fishing vessel, pink: pleasure craft, green: cargo vessel, blue: passenger vessel, grey: unspecified).

AIS information has become central in states' maritime surveillance practices, which retrieve and interpret more than they produce the information. The information serves not only to look at fishing vessels, but also for additional maritime security concerns regarding drug trafficking or MPA frequentation by leisure vessels, which become subject to increased coercive surveillance and cannot rely on VMS or fisheries observer and logsheet apparatuses.

Although public, AIS data is not directly usable and requires some expertise to be made legible. Private companies now make a profitable business of developing specific algorithms (e.g. clearing AIS signals in congested areas) and software permitting to visualise AIS data on maps and charging their customers, including states, to access these enhanced features.³⁰³ Hence, AIS has permitted new actors to enter the field of maritime surveillance. The now renowned non-governmental organisation (NGO) Global Fishing Watch set foot in maritime surveillance by offering advanced analysis of AIS data and producing maps that significantly contributed to making the 'maritimisation' of human societies visible – and problematic (see Figure 54). In particular, the NGO produced visual 'evidence' of fishing pressure

³⁰³ Only 'basic' layers are freely available on AIS maps such as the one presented in Figure 2.

in the South Pacific region and around the New Caledonian and Fijian EEZs, reserved to domestically-based fishing vessels.

These visuals are extensively mobilised in narratives portraying Illegal, Unreported and Unregulated (IUU) fishing as a primary threat weighing on these marine territories and anticipating its intensification against the growth of Chinese fishing fleets. In Fiji, a domestic fishing company owner showed me a similar map to demonstrate the “scary” arrival of the Chinese fleet “after devastating the Northern Pacific” (Owner of fishing company F., Suva, 17.07.19). In an e-mail addressed to French ambassadors, a frigate commander relayed a Global Fishing Watch map published in the ni-Vanuatu press to “warn of intensive Chinese fishing in the South Pacific” and outline the “inseparability of sovereignty challenges, on the one hand, and biodiversity/ecosystem equilibrium on the other (security + environment) [...]” (email transferred to the SOCPacific project team, 14.12.17). This interpretation connects the defence of the French state sovereignty with that of the environment, turning the latter into a national security issue and reinforcing the need for maritime surveillance: “You see it, the map. If we’re not there, our waters will be plundered.” (Naval officer C., Noumea, 16.10.19).



Figure 54: Map of fishing intensity using AIS information produced by Global Fishing Watch, used in an article in the Daily Post in Vanuatu and relayed by e-mail between the Navy and the network of French embassies (14.12.17).

However, AIS tracking bears many limitations. The information transmission lag can vary from a few minutes to six hours, and message reception is unpredictable, which results in random data gaps

(AFB, 2018). The technology is only mandatory for certain boats, allowing the others to remain invisible.³⁰⁴ It is less secure than the VMS technology: hence, it is possible to switch it off at will and alter the transmitted information, e.g. the vessel's name or type (EU fisheries delegate, Suva, 14.06.19). During a patrol mission, *D'Entrecasteaux's* crew spotted an AIS trace indicating a 56 m cargo ship. In contrast, that vessel's indication mark was recorded in the Western and Central Pacific Fisheries Commission (WCPFC) vessel register as a 34 m fishing vessel. Only direct observation could lift the uncertainty of which, if any, of the two surveillance pieces of information was correct. On another day, an AIS signal indicating a fishing vessel revealed, once *in situ*, a drifting fishing net. *D'Entrecasteaux's* captain interpreted this as a strategy by fishers to hide their actual position. Hence, AIS technology is frequently enrolled in evasion and obfuscation strategies:

Last year, we observed certain behaviours of sailing boats on their way to the MPA [Marine Protected Area of the Coral Sea Natural Park], which switched off their AIS three or four days beforehand. [...] This year we had spoofing alerts on drug trafficking and fishing boats, where two vessels emit the same signal in two places. We've identified this behaviour quite a lot in the area, particularly from Chinese vessels. (Naval officer J., Noumea, 14.10.19)

The technology, like VMS, is presented as a "cooperative" surveillance system, reliant on "vessels' willingness" to be visible (Satellite surveillance expert, Noumea, 14.11.19). AIS signal is not 'self-explanatory'. It can be its absence or inconsistency that 'speaks' rather than the signal itself. On the contrary, the mere transmission of AIS is often read as a token of compliance. As we encountered two longliners emitting AIS, a *D'Entrecasteaux* watchman assessed the risk of illegal activity as minimal: "If he were outlawed, he wouldn't be transmitting, that's the basis." (Field notes, boarding, Dec 2019).

ii. Detecting 'Dark' Vessels from Space

AIS and VMS technologies help monitor cooperative flows in space and time. Recent progress in satellite imaging, including optical and radar techniques, now provides continuous surface *images* of the oceans, permitting to visualise more than dots on a map, surveil areas and detect non-cooperative vessels (see Figure 55): "With optics, you can see the structure of the boat, whether there is a bridge, whether it is a container ship, etc." (Satellite surveillance expert, Noumea, 14.11.19). Again, however, these technologies are far from making the ocean's surface transparent and accessible to any. The technology is relatively rigid and exclusionary, with few countries capable of establishing and controlling satellite infrastructures. Their coverage, resolution and frequency depend on the technique and satellite used. A trade-off exists between an image's scale and its resolution: the coverage of a large area often entails a resolution too low to detect any vessel. Optical imagery only works during day-time and is very sensitive to environmental conditions, e.g. cloud cover, which tends to be particularly acute in the South Pacific

³⁰⁴ The use of AIS is governed by the Convention on the Safety of Life at Sea (SOLAS), which makes it compulsory for certain categories of boat only (depending on their size and use).

region. Optical satellites available to New Caledonia pass over the territory once a day and can only produce a daily image at a given time. For satellites that can be directed to focus on specific areas, the request must be made 12-20 hours in advance. The New Caledonian government does not own the associated images: “With satellite data, all we buy is a licence to use it. Sometimes there are surprises: we can keep the licence for ourselves or use it for this project, but we can’t put it on a public platform, for example.” (Head of Information Systems Department, Noumea, 13.09.19). Radar imaging, in comparison, is less sensitive to clouds and can operate at night. Vested with a better detection capability, the technology is yet more expensive, cryptic and prone to false detection (see Figure 55) (Satellite surveillance expert, Noumea, 14.11.19).

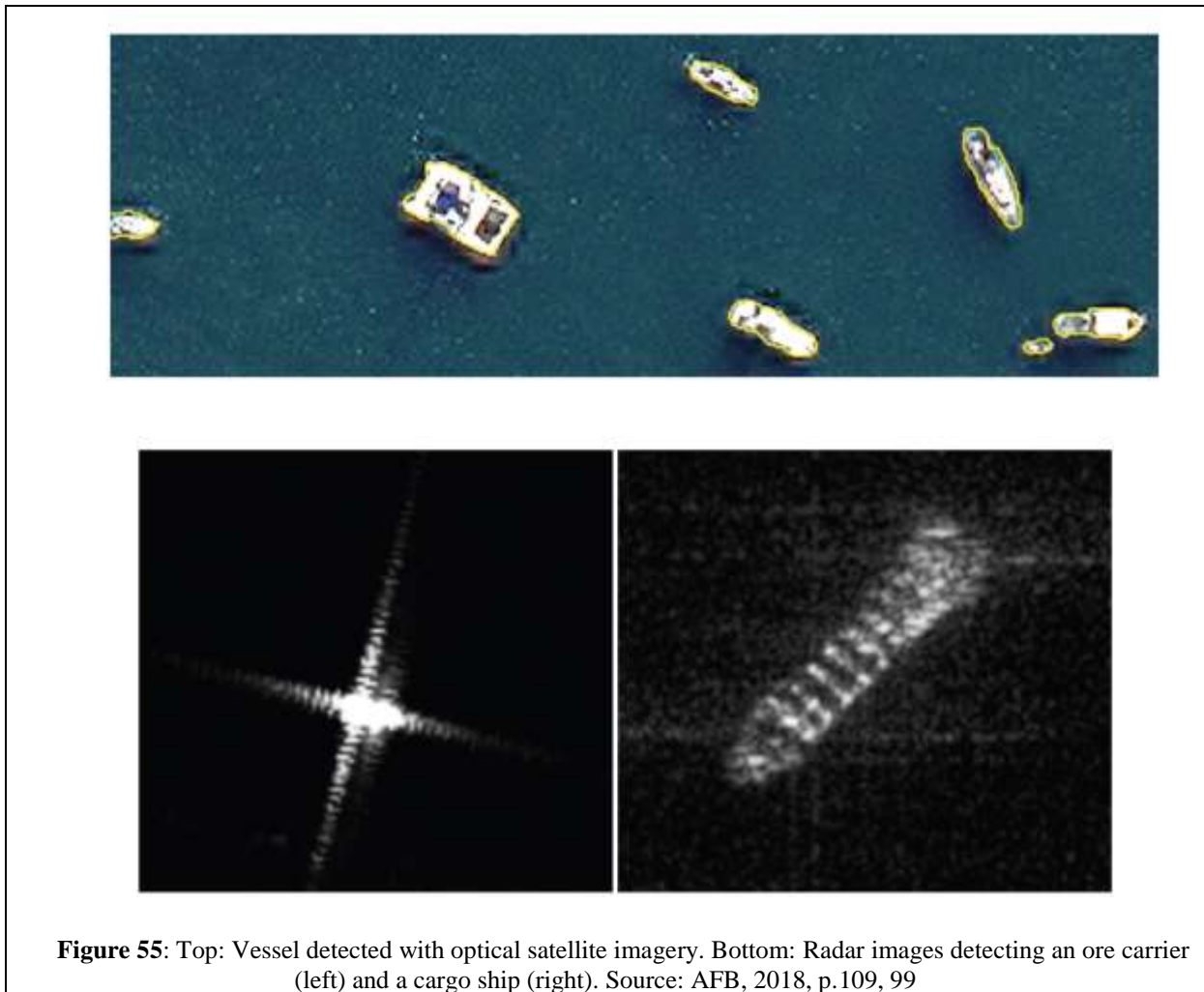


Figure 55: Top: Vessel detected with optical satellite imagery. Bottom: Radar images detecting an ore carrier (left) and a cargo ship (right). Source: AFB, 2018, p.109, 99

Satellite imaging does not provide photos; it produces measurements of solar energy or radar wave reflections, which must then be translated into visual images. This implies a burdensome interpretative process, further complexified by the fact that signals can be tainted by cloud cover, swell, sea mirror effects and other ‘false echoes’, particularly numerous in offshore environments. Observation is not direct and must sometimes rely on even more indirect traces of at-sea presences:

On reefs, it's easier because you know where vessels shelter. A moving boat is more complicated because the sea state plays. There's a lot of white foam to confuse the boat with, a lot of noise. There are other things you can consider, like the vessel's wake. [...] You're not looking for the vessel but for its wake. (Satellite surveillance expert, Noumea, 14.11.19)

Interpreting satellite information requires specific expertise. In New Caledonia, this tedious and “fairly unrewarding” task was delegated to private company I. because “it must not encroach on other [maritime surveillance] activities”, a maritime surveillance officer explained (Field notes, maritime surveillance centre, Noumea, 11.10.19). Obtaining a satellite image takes a few days up to a week, which reduces its operational value: “From an operational point of view, it is of very little interest because the vessels are already far away” (Satellite surveillance expert, Noumea, 14.11.19). This lag and lengthy translation chain complicate the judicial use of the image: “Because we have the problem of immediacy, we have to be able to certify that the information obtained in reverse has not been tampered with, biased or disguised. [...] It's *flagrante delicto* versus imaging” (Naval officer J., Noumea, 14.10.19).

The cost of satellite imaging also prohibits its continuous use to cover marine spaces. A single radar and optical image covering 100 km² costs €3,600 (Naval officer J., Noumea, 14.10.19). Most Pacific Islands cannot individually afford such technologies because of their costs and only benefit from them through their pooling under the Forum Fisheries Agency (FFA) regional surveillance centre (EU fisheries delegate, Suva, 14.06.19). More generally, “only the army can afford images at that price” (Satellite surveillance expert, Noumea, 14.11.19), partly thanks to economies of scale and preferential access rates to a technology it has historically contributed to developing. Hence, the army retains the most extensive access to maritime surveillance sensors.

Against these constraints, satellite imaging is more commonly used by the New Caledonian administration as a “tool for spatialising area usages” and developing a general knowledge of activities across the EEZ (Field notes, maritime surveillance centre, Noumea, 11.10.19). In that aim, the SPNMCP has ordered a weekly snapshot of the park from 2019 onwards, “so that it's not too expensive” but still permits to build a statistical understanding of mooring locations (Field notes, maritime surveillance centre, Noumea, 11.10.19). In that respect, satellite imaging supports a risk-based approach to better understand the EEZ and its usages, but does not become “predominant vector” of maritime surveillance (Naval officer C., Noumea, 16.10.19). This suggests that technological innovations do not necessarily substitute to each other to replace ‘old’ ones but rather assemble as part of an ever-complexifying surveillance assemblage (Potte-Bonneville, 2010).

3. Emerging Perspectives in Maritime Surveillance Sensors

More recent technological innovations, still originating from the military and deriving into civilian spheres, are increasingly under trial, mostly under aid projects or thanks to privileged relations with more extensive military powers. In the case of New Caledonia, most trials are first conducted in France

because the Territory “does not have the necessary industrial foundation” (Naval officer J., Noumea, 14.10.19). Just like for fishing, offshore surveillance is said to require industrial capacities that many Pacific Islands are short of.

In 2019, New Caledonia was installing hydrophones around its remote Chesterfields MPA.³⁰⁵ Instead of enabling to ‘see’ the ocean from space, hydrophones allow for listening to it under water and in fixed places, to detect vessel engines – and possibly, in the future, identify them thanks to their acoustic signature.³⁰⁶ Other tests involve drones in metropolitan France or as trialled in the Pitcairn Islands. This British territory has no aerial or maritime asset to patrol its EEZ-wide MPA created in 2015. The UK government, in partnership with the conservation NGO Pew, has experimented various remote surveillance technologies, including a Wave Glider surface drone equipped with various AIS, acoustic and photographic sensors to detect vessels and illegal fishing activities (AFB, 2018). For the time being, however, drone prices remain prohibitive for many Pacific Island countries (FFA chief officer, Honiara, 21.05.21). Radiofrequency technologies are also moving from the military and electronic warfare realm to the civilian one and permit to pick up and detect various satellite, radar and radio frequencies emitted by any vessel in a given area. As of now, like for the hydrophones, the technology only permits detection and not identification. Hence, it can only serve to raise alerts that still need to be cleared through other surveillance means:

These tracks will be suspect, and we’ll then have to see if we’re able to follow them. Eventually, we’ll still need to send an asset, a vessel, either to intervene or to report the signal. That’s the whole problem with surveillance [...]: we do monitoring and surveillance, but we’re never able to intervene. (Naval officer J., Noumea, 14.10.19)

Rather than listing every technological perspective, I shall highlight three salient points from this first section. Firstly, most surveillance sensors have some affiliation to the military, attesting to its central role regarding maritime surveillance. Secondly, these technologies all have limitations and are not even close to permitting a panoptic vision of the oceans. Finally, as suggested by the latter quotation, the main challenge regarding these surveillance technologies and ‘coercive’ surveillance is the effective capacity to *intervene* rather than merely know. Certain technologies, as I mentioned regarding satellite imaging and the statistical observation of mooring locations, serve the general production of knowledge on maritime activities but do not allow for effective policing, understood in its modern acceptance of law enforcement. This distinguishes, from the emic perspective of maritime surveillance agents, “monitoring” from “surveillance”. Monitoring, to them, refers to a ‘scientific’ form of surveillance that does not necessarily relate to action capacity. Surveillance, on the contrary, must permit the production of operational information, to support timely reaction, inspection and judicial sanction. As summed up

³⁰⁵ It takes three days of navigation to reach Chesterfield Reef from the main island of New Caledonia.

³⁰⁶ These methods are similar to those used by fishers and researchers to surveil fish, particularly under dFADs (cf. chapter 8).

by a naval officer, monitoring enables “practices to be identified” while surveillance enables “action to be taken” (Naval officer J., Noumea, 14.10.19). If emerging technologies greatly contribute to improving monitoring capacities and supporting a risk-based approach to maritime surveillance and security, they do not necessarily enhance surveillance capacities by themselves.

The following sections describe how these “monitoring” and “surveillance” articulate, with the former permitting the rationalisation of the latter’s limited resources, still mainly restricted to military vessels and aircraft.

II. Cross-Analysing Maritime Surveillance Data

Information produced by surveillance sensors is not self-telling and each type of sensor only produces patchy visions of maritime activities. Hence, maritime surveillance does not stop at collecting information. It also assembles information from a multi-modal sensing network (Klimburg-Witjes & Bowker, 2021), notably by implementing databases that permit the digitisation of marine areas (Le Goff, 2016) – and reminisce the scientific practices exposed in Chapter 8. In this section, I look at such attempts to produce a more comprehensive surveillance picture through the constitution of Maritime Information Fusion Centres, made all the more necessary against the diversification of surveillance imperatives – including environmental concerns. I suggest that these attempts mainly derive from an organisational rationalisation logic, which makes the boundary between the military and the police more porous and redefines the contours of maritime security’s concerns, practices and spatialities.

1. Integrating the Surveillance of New Caledonia’s Territorial ‘Mille-Feuille’

i. Action of the French State at Sea: A Boundary Apparatus Underpinned by the Navy

Understanding how the ‘coercive’ surveillance of maritime activities by public authorities works in New Caledonia first necessitates a detour through the legal and organisational framework of the French State regarding its – gigantic and fragmented – marine territory.³⁰⁷

To implement its capacity of control over its marine territory and flagged vessels,³⁰⁸ the French State established in 1995 a national organisational framework centred on the ‘Action of the State at Sea’ (AEM in French) concept. Although maritime matters are partitioned between several ministries, inter-ministry coordination is ensured through a General Secretariat for the Sea, responsible for developing

³⁰⁷ France’s total EEZ comprises over 11.57 million km² spread over several oceans.

³⁰⁸ States are responsible for their vessels in the high seas and must therefore combine areolar and reticular forms of control at sea.

and implementing public policies at sea. This secretariat is responsible for AEM, which, as its name suggests, covers all the government's actions at sea except for military defence operations that remain separated from civil dimensions. Reflecting the 'maritimisation' of human activities and the rise of environmental issues, AEM missions have expanded and diversified over 45 domains which cover interrelated and partially overlapping fields such as state sovereignty protection, maritime security (including terrorism and piracy), customs and economic police, illicit activities, human and material safety, protected areas and marine resource management, maritime pollution, and sanitary and labour controls.

The AEM concept emerged to avoid duplicating the French state's resources and efforts by bringing together and coordinating existing capabilities under a maritime prefect, representing the state over its marine domain (Rousseau, 2013). Hence, AEM is not associated with any devoted operational asset. Instead, it pools resources available across its agencies (Navy, police, maritime affairs, customs, gendarmerie) and, for maritime safety operations, provided by a civil association. These agencies participate in the 'coastguard function' and are assisted by the inter-agency Coastguard Operational Centre, which is responsible for the daily surveillance, analysis and diffusion of the 'maritime situation'. This analysis helps orient the AEM apparatus and its maritime interventions (Rousseau, 2013).

Although AEM relates to the state's civil realm, in practice, boundaries with the military are porous. AEM establishes a boundary organisation, articulating and demarcating the two spheres: "AEM is precisely the link between the military, between the Ministry of the Armed Forces and the other Ministries" (Naval officer C., Noumea, 16.10.19). Considering the Navy's infrastructural role in accessing and intervening in marine spaces, this link is necessary. Hence, the maritime prefect in charge of AEM is appointed within the Navy and is, himself, in a boundary position:

The maritime prefect wears two hats, one civil and one military. Why is he a military officer? He's a general officer in the Navy because, when the institution was created, it was the Navy that ruled the seas. In other words, it was the Navy that had the offshore resources. So, it was with this structure that we developed the concept of the maritime prefect, including the AEM. (Head of AEM office, Noumea, 14.10.19).

The Navy possesses most offshore capacities and the expertise to use them: indeed, the French Navy supplies 80% of AEM resources (Rousseau, 2016). Offshore interventions and any operation requiring a "high level of military commitment" or "sophisticated resources" invariably involve the Navy (Rousseau, 2013, online). This civil-military cooperation abides by a "state of necessity" ("état de nécessité") principle whereby the army provides assets when civil authorities lack the necessary resources to operate (Palle et al., 2022). Because the Navy controls much of the state's maritime infrastructures, it becomes involved in missions extending (while retaining) its original prerogatives of territorial defence against external threats and seapower projection. The AEM organisation, following a rationalising logic of resource optimisation, establishes a Foucauldian-like security apparatus in which

the military plays a policing role more than it exerts military might only, to enforce laws and, more generally, ensure order at sea (Foucault, 2004; see also Ryan, 2019).

ii. **New Caledonia's Fractured Governance and Multiple Surveillance**

The AEM structure has been partially adapted in France's overseas territories but retains the Navy's infrastructural and 'more-than-military' role. The maritime prefect's role is assigned to the territorial prefect, who becomes the government's AEM delegate. This delegate is assisted by the Maritime Zone Commander, a military officer with operational "control over the Navy's resources" (AEM chief officer J., Noumea, 14.10.19). This role grants the Commander a "civilian function" and links the two spheres so that state administrations may access military resources (AEM chief officer J., Noumea, 14.10.19). If French overseas territories have no coastguard structure, there are similar efforts to pool and coordinate informational and interventional resources. In French Polynesia, a Joint Maritime Centre was set up in 2016 and comprises a Maritime Information Fusion Centre and a Joint Rescue Coordination Centre. This shared, multipotent boundary apparatus merges maritime information from various public administrations and coordinates at-sea interventions relating to maritime safety, security, environmental pollution, and combatting illegal maritime activities.³⁰⁹

The French State ambioned a similar joint maritime centre for New Caledonia. However, the project turned out far more complicated because of the Territory's complex jurisdictional structure and conflicting political relations, particularly acute in the context of referendums on the Territory's independence.³¹⁰ Under the 1999 Organic Law, the French State gradually transferred certain powers to the Territory following a principle of shared sovereignty (Le Meur & Mawyer, 2022), resulting in a complex assemblage of governance practices, legal regimes and political ideals and a marine territorial 'mille-feuilles'. In the EEZ, the French State remains in charge of sovereignty protection, vessel security, terrorism, maritime circulation and fisheries police, search and rescue operations, maritime pollution and illicit traffic (mainly drug and illegal fishing activities). The New Caledonian Government became responsible for the exploration, exploitation, management, and conservation of natural resources – and, therefore, for tuna fisheries management, biodiversity, and MPA implementation. Hence, shared sovereignty with New Caledonia fragmented the EEZ's various dimensions and control, noticeably for environmental matters straddling the French State and the Territorial Government. For long, tuna fisheries and the Coral Sea Natural Park were managed under the Government's Fisheries and Environment Service, nested within the joint State-Government Maritime Affairs Directorate. In 2021, the Government created the fully independent SPNMCP in an emancipatory move from the French State. Fisheries police, however, stays the responsibility of the Maritime Affairs Directorate and AEM.

³⁰⁹ French Polynesia High Commission website: <https://www.polynesie-francaise.pref.gouv.fr/index.php/Services-de-l-Etat/Espace-maritime-et-aerien/AEM> (accessed: 17.08.24)

³¹⁰ Two referendums occurred in 2018 and 2021.

The fisheries police responsibility was not transferred mainly because it requires resources that New Caledonia did not have when the Organic Law passed and that the French State would not transfer: these resources belong to its Navy and are, therefore, sovereign and military instruments above all.

a. Maritime (Environmental) Surveillance by the New Caledonian Government

The joint intensification of maritime activities and regulations (environmental ones in particular) has enhanced and transformed the need for ‘coercive’ surveillance. The creation of marine reserves in the Coral Sea Natural Park has brought new enforcement requirements that rest on the Government and exceed the surveillance of the domestic tuna fishing fleet it already conducted. Now, the Government must also look at other sea users like leisure vessels: “Now, [the Government] has received responsibility for surveilling the Coral Sea Natural Park, so we have to look for tools other than just the VMS because before, we only monitored fishing pressure” (Surveillance expert, Noumea, 14.11.19).

The Government decided to hinge on the pre-existing Maritime Rescue Coordination Centre (MRCC) to build its environmental surveillance capacities. The structure already hosted a surveillance centre and was partly under its authority. Created in 2004, MRCC tracks AIS and radio information to support maritime safety and coordinate search and rescue operations for the French State *and* the Caledonian Government. In 2021, the centre had 11 employees, half from the Territory and half from the French Navy, and was housed in the French army’s facilities. The structure has gradually expanded since 2015, notably because of additional environmental responsibilities, starting with the surveillance of maritime pollution (MRCC director, Noumea, 04.10.19). In 2019, MRCC was chosen to assist with the surveillance of the Coral Sea Natural Park and its MPAs. Hence, an IUU fishing expert from the metropolitan National Fisheries Surveillance Centre had recently joined the centre to support this move. For the MRCC director, this evidenced a “natural movement towards environmental surveillance” (MRCC director, Noumea, 04.10.19), i.e. the ‘ecologisation’ of maritime surveillance. MRCC became the “eyes of the park” (Field notes, MRCC observation, Noumea, 11.10.19), serving as a ‘surveillance technician’ but lacking decision power and interventional capacity.

This new role reoriented MRCC’s activities. For the first time, it was tasked to daily track and report every vessel detected in the park (Field notes, MRCC, Noumea, 11.10.19). MRCC agents suddenly had to watch areas they would hardly look at when they were only preoccupied with maritime safety and circulation: the remote and little-frequented D’Entrecasteaux and Chesterfield integral reserves. Although I could only observe the early days of this process, I could already witness emerging frictions deriving from these new environmental prerogatives. MRCC agents only had access to *free* AIS data services and VMS information on the domestic tuna fishing fleet provided by the fisheries service: “They are not able to carry out a situation analysis because they don’t have the whole scheme, which requires crossing several interfaces” (AEM officer, Noumea, 14.10.19). Against that shortfall, SPNMCP later invested in satellite imaging and placed hydrophones around the Chesterfield reefs. MRCC agents

were not trained for the job either: one member had never heard of the Coral Sea Natural Park, showing limited knowledge of the EEZ, even among maritime actors. Agents bore conflicting opinions regarding their new mission. One feared environmental surveillance would only burden their workload, first oriented to maritime safety. Another agent contrarily appreciated “going to the end of surveillance” and contributing to the more exhaustive control of the New Caledonian marine territory (Field notes, MRCC, Noumea, 11.10.19).

Other difficulties outlined challenges more inherent to land-based maritime surveillance. One operator, spotting a vessel seemingly mooring in the Chesterfields reserve, found inconsistencies in AIS information: “It’s annoying because the positions are timed 10:57, and it’s actually 4 pm... So, I’m not going to send the email, it’s useless, it’s an old thing...”, the MRCC agent decided (Field notes, MRCC, Noumea, 11.10.19). A couple of hours later, a similar scene occurred with a domestic longliner’s VMS signal: “Now, either it’s [Company X] not updating or it’s our software that’s not working... I don’t know.” (Field notes, MRCC observation, Noumea, 11.10.19). Remote surveillance, relying on indirect and heavily mediated traces of maritime activities, blurs the distinction between ‘abnormal’ field observation and ‘abnormal’ technological functioning.

Compared with metropolitan France, the latest MRCC recruit noted the paucity of available surveillance resources, a feature shared by most Pacific Islands: “Here, it’s really system D” (MRCC chief officer, Noumea, 04.10.19). After several months of trial, MRCC stated: “Detecting abnormal situations is of prime importance. It has to be said that this function is still carried out imperfectly, in particular, because of the resources available [...] Offshore, detection is random, regardless of the source of information consulted.” (MRCC, 2019, p.34). Additionally, the capacity of the New Caledonian Government to effectively intervene and police environmental infractions remained virtually non-existent at the time due to a lack of both operational and judicial instruments.

This led the Government to adopt two main strategies: a risk-based approach and a delegation approach. The first one aims at rationalising the use of available resources by building a ‘scientific’ understanding of EEZ maritime activities. SPNMCP serviced a local company expert in satellite technologies and data analysis to draw a “statistical study of archived AIS data, in order to have an initial database of maritime traffic within the Park” (Representative of company I., Noumea, 14.11.19). The choice to work with a local but private entity shows the Territory’s willingness to build autonomy from the French State, while the local development of such companies illustrates the wide-spreading idea that surveillance becomes a sector of the Blue Economy (Voyer et al., 2018). This public-private collaboration also unveils the growing reliance on “calculative expertise” not necessarily detained by historical administrative actors (Demortain, 2019, p. 1063). With this initiative, the Government aimed to “characterise the risk” associated with maritime mobilities and orient policing efforts accordingly (AEM officer, Noumea, 14.10.19):

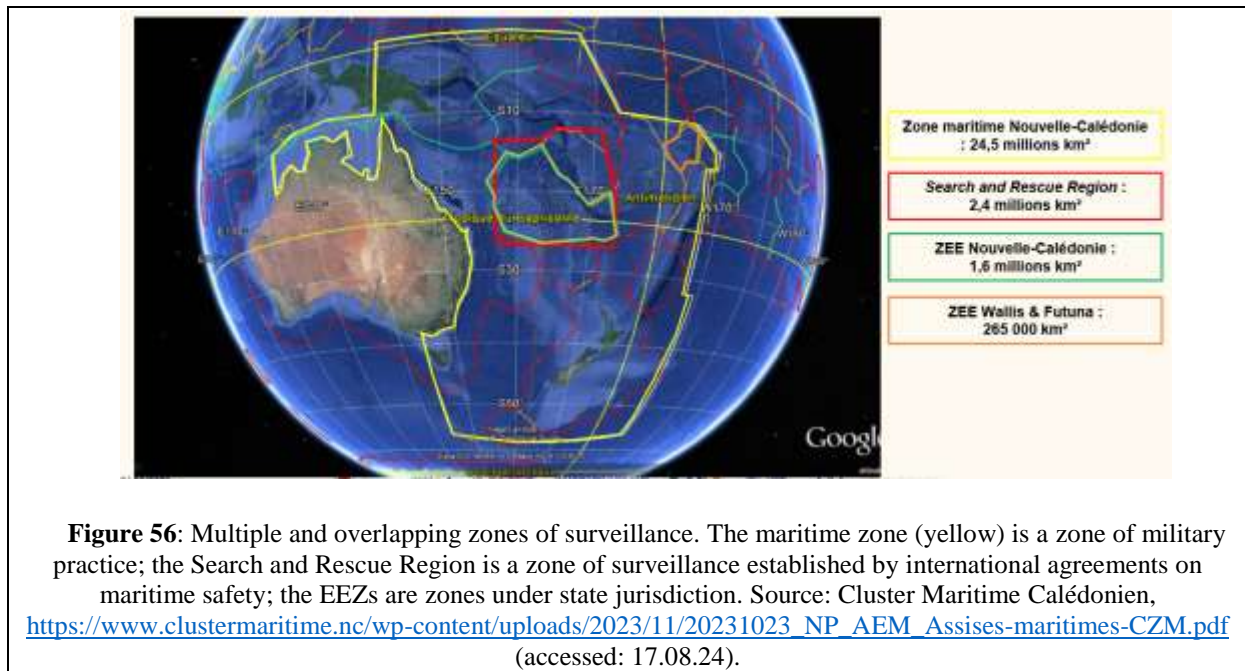
By studying AIS signals, you can identify a certain seasonality and look at the time of year when I have the most boats mooring in the MPAs. Depending on the weather conditions, there is probably a seasonal pattern [...]. But there are also preferential mooring areas. [...] By cross-referencing the seasonality, the mooring preferences, by taking information here and there, including AIS, you can orient the satellite and shoot intelligently. (Representative of company I., Noumea, 14.11.19)

This strategy acknowledges that crime is not randomly distributed. It underpins an intelligence-led form of policing which seeks to optimise (and prioritise) security in space and time (Benbouzid, 2018). This type of surveillance (or “monitoring”, following the emic perspective) does not so much aim to ‘see’ in real-time than anticipate: it establishes a form of ‘subveillance’ (“sousveillance”) focusing on (and concurrently defining) what is *statistically* normal for the sake of efficiency (Quessada, 2010).

The second delegation strategy consists of hinging on the French State’s AEM and, through it, the French army’s resources. Hence, MRCC operators may rely on the military to analyse information “because they have more resources” (Field notes, MRCC, Noumea, 11.10.19). Concomitantly, this environmental surveillance becomes dependent on and subjected to the Navy’s respective objectives and ways of doing and knowing.

b. Maritime Surveillance by the French Navy

While the French Navy assists AEM and the New Caledonian Government in their civil missions, it still retains its ‘traditional’ military preoccupations: “The main mission of the armed forces in New Caledonia is maritime surveillance. [...] You know, the strategic functions, knowledge and anticipation.” (Naval officer C., Noumea, 16.10.19). To that effect, the French army has an Operations Centre, neighbouring MRCC’s surveillance centre, which surveils the region-wide ‘Permanent Area of Responsibility’ and its associated Maritime Zone (see Figure 56). This military zone delineates a space of military practice over which the French armed forces based in New Caledonia may operate. It accommodates the army’s mandate of national territory defence, sea power projection and diplomatic role: “Knowledge and anticipation, we’re not going to confine ourselves to the EEZ, we’re going to go further. We’re also going to create links with other island countries [...], knowing that these links will enable us to intervene in our EEZ.” (Naval officer C., Noumea, 16.10.19, my emphasis). Hence, while New Caledonia’s Government is primarily concerned with affirming its internal sovereignty (Le Meur & Mawyer, 2022), the French Navy first contributes to asserting the French State’s external sovereignty against foreign nations: “The Navy’s vocation is above all oceanic, in other words, far away” (Field notes, *D’Entrecasteaux*’s chief of operations, patrol mission, Dec. 2019). Its surveillance efforts are consequently regional rather than exclusively national.



The military centre has access to surveillance sensors that partially overlap but also partially complete those of MRCC. In addition to AIS information, it has access to VMS information, including that of New Caledonia and that obtained through WCPFC and FFA (cf. Section III). It also benefits from enhanced satellite imaging tools and from its maritime and aerial patrolling assets' mission reports. These varied datasets are integrated into a spatialised database permitting the construction of a 'Recognised Maritime Picture' continuously analysed by two military officers (*La Moqueuse* officer, Suva, 30.06.19). This integrated analysis re-contextualises informational inputs and transforms them into *classified* 'intelligence': in that process, interpretation and interconnection are what grant information surveillance meaning and value (Bigo et al., 2019).

Contrary to the New Caledonian Government's choice to rely on private actors to conduct such analysis, the army prefers to maintain surveillance activities in-house: "Because of confidentiality issues, we'll take a military person" (Operations centre officer, Noumea, 16.10.19). This shows distinct value regimes and capacities between civil administrations and the army regarding informational sovereignty (Bigo et al., 2019), which may come at the expense of analytical expertise: "There are military data analysts, but they won't be here, a position like that is very expensive. [...] Here, the guys must be jacks-of-all-trades, know how to conduct maritime and aerial missions, do AIS surveillance, do the classic administrative work..." (Operations centre officer, Noumea, 16.10.19). Like other offshore surveillance apparatuses, versatility and flexibility are privileged to make limited human resources multipotent. The centre is, therefore, very closed. Information exchange mostly occurs with cooperating armies (e.g. the US) following geopolitical strategies: "We try to share information of maritime interest, it's all about international relations." (Operations centre officer, Noumea, 16.10.19).

In New Caledonia, AEM assistance represents most of the Navy's activities. Because "there is no military threat, here", the Navy converges toward policing missions "that are not normally the responsibility of the army": "We are doing this military mission and, in general, what we see in this zone are illegal fishing activities, drug trafficking to some extent... So we quickly enter into dialogue with AEM" (Operations centre officer C., Noumea, 16.10.19). This conjointly provides a new justification for having a strategic, yet particularly costly infrastructure facing weak signals (Doré & Barbier, 2015): "Obviously, it's France's interest to have a base here [in New Caledonia]. It's the only eyes it has on the South Pacific Islands." (Naval officer C., Noumea, 16.10.19). Hence, the army mainly focuses on criminal risks from outside, relating to illegal fishing activity by foreign fishers and drug trafficking, which extends its surveillance efforts beyond military enemies to civilian actors like leisure and fishing vessels.

The risk of illegal fishing became particularly acute around 2015-2017 after many Vietnamese 'Blue boats' illegally fishing in several Pacific Islands' EEZ, including New Caledonia's, were reported – and (only some) sanctioned: "In fact, this is *the* phenomenon that enabled us to say that we are not immune to the development of illegal fishing." (AEM officer, Noumea, 14.10.19). Out of the 95 reported, 20 Blue Boats were intercepted around the remote Chesterfield and D'Entrecasteaux reefs by fisheries police operations conducted under the French State's responsibility with the operational support of the French army, the New Caledonian fisheries service, FFA and the Australian fisheries authorities (AFB, 2018). This shows the extensive transnational and interagency cooperation required to police a risk that was itself transnational. Regarding drug trafficking, New Caledonia reported in 2020 that "of the four vessel interceptions made by Australia, two had a direct or indirect link with New Caledonia" (CFIM, 2020). This security issue may intersect with fisheries: that same year, Australia intercepted two tonnes of cocaine on a fishing vessel that "was transshipped by a presumed Chinese fishing vessel and boarded a month later by the Papua New Guinea Navy. The Chinese fishing vessel in question is the sistership of a vessel found stranded in 2019 in the Chesterfield Islands [of New Caledonia] without crew or identification marks." (CFIM, 2020).

The Navy also provides opportunistic surveillance assistance to the New Caledonian Government regarding the surveillance of the Coral Sea Natural Park:

Typically, you can see that you have ships moored [in one of the Park's MPAs]. That directs our resources. [...] My bosses see an AIS track, we've got the Guardian in the air for maritime surveillance, we'll orient it there to do a mission that doesn't mean anything to us, because it's not AEM, since the environment is a competence that's been transferred to the Government... [...] But we do it anyway. (Naval operation centre officer, Noumea, 16.10.19)

The French army assists both AEM and the Government because it detains the necessary surveillance instruments. The involvement of the Navy in environmental policing missions entails a dual

transformation. It contributes to ecologising the army, which, in return, inputs its ‘militarised’ problematisation of environmental coercive surveillance. Relying on the military infrastructure is not neutral. The army refuses to act as a simple ‘service provider’ or surveillance technician. There, it attempts to incorporate these missions within its own sectoral logic. Hence, its involvement in the internal surveillance of New Caledonia’s EEZ is legitimised through a mission of “Maritime Territory Defence”, aiming to protect the territory from any military while coincidentally assisting AEM and the Government:

The army wanted this, because we didn’t want AEM to... Well, we didn’t want to serve as coastguard and have AEM take over our resources without leaving us a say in the matter. So, we added this mission. [...] Typically, it’s open knowledge that there’s a Chinese warship sailing in these waters. Sending our boats into the EEZ to show that we’re present, etc., will be a matter of Maritime Territory Defence. [...] We’re in a zone that’s pretty well secured, where not much happens, so the points of attention we have, where the vessels go, the only AIS we see are in the MPAs. That’s how we can emphasise our job. Our job is to surveil the EEZ, among other things. And how to surveil this EEZ, well precisely by realising that there are vessels in that zone. Then you go a bit further, you ask if they have the right, etc. and then you get into pure environmental matter, which isn’t really our initial job... well, I couldn’t even say that... Yes, it’s not in the first missions I showed you, it’s not written down. Except that it’s knowledge of the area. (Operations centre officer, Noumea, 16.10.19)

As evidenced in this quotation, the justification of the Navy’s involvement in MPA surveillance is indirect. Convergence between the army, AEM and the Government is facilitated by resource nationalism (Le Meur & Mawyer, 2022). However, such convergence is only partial. For the army, environmental protection becomes a national security issue, legitimising its mobilisation (Palle et al., 2022). For the New Caledonian Government, environmental protection is a matter of ecological and economic security, implying a focus on ecosystem preservation and restoration and explaining its focus on the ‘scientific’ surveillance of marine ecosystems.

These aspects are even more visible in the case of fisheries, mainly problematised in connection to ‘hard’ security issues by the French Ministry of Defence – from a distance and at a much larger scale than the New Caledonian Territory. The former French Minister of Defence F. Parly incorporated environmental (including climatic) issues into the French Indo-Pacific axis narrative and against growing concerns for China’s presence in the Indian and Pacific Oceans.³¹¹ During a patrol mission, *D’Entrecasteaux*’s captain shared with me a confidential report of the International Relations Division of the Ministry of Defence linking climate issues to security and defence matters and referring to the rise of environmental (mainly fisheries-related) security issues, calling for increased surveillance by the French armies of maritime spaces (Field notes, patrol mission, Dec. 2019; see also Alex & Estève, 2018). He, himself, embraced this interpretation of environmental issues: he expressed his worries about inter-

³¹¹ See for instance her speech in Singapore in 2018: <https://www.vie-publique.fr/discours/206141-declaration-de-mme-florence-parly-ministre-des-armees-sur-les-defis-en> (accessed: 09.10.24)

state conflicts around the Spratly Islands, China's disregard of international law and rampant territorial expansion, and anticipated the South Pacific region to become the next stage of such territorial conflicts around fish resources (Field notes, patrol mission, Dec. 2019). Referring to scientific models projecting the relocation of tuna resources southward in the global warming context (cf. Chapter 8), an AEM representative claimed that it was "even more important for France to be present in its waters" (Field notes, patrol mission, Dec. 2019).

This observation attests to several transformations regarding the problematisation of maritime security and IUU fishing, and the role of the Navy at sea. The military retains (and performs) a realist analysis of international relations (Boşilcă et al., 2022) regarding the oceans and the South Pacific region, which it also applies to marine environments. Through that lens, it militarises and geopoliticises (Bueger & Mallin, 2022) illegal fishing issues. For the French State and its army, fisheries policing operations are about sovereignty protection and diplomacy more than resource management *per se*:

For the French state and its army, fishing in New Caledonia is an *issue of sovereignty rather than fisheries management*, which is the responsibility of the New Caledonian government. [...] Because the 'fait accompli' policy happened in the Spratly with the Chinese [...] We must have the means to assert our sovereignty, and these means are to control the actions of fishing vessels. (AEM officer, Noumea, 14.10.19, my emphasis)

This provides the army with a new rationale for engaging in fisheries policing missions in and out of the French EEZs (cf. Section III): hence, following the Blue Boats episode, the Navy redirected its patrols toward the remote D'Entrecasteaux reefs and Chesterfield reefs and consolidated its support to fisheries policing operations in the region (*La Moqueuse* officer P., Suva, 30.06.19; Field notes, Tenth Pacific Nature Conference, online, Nov. 2020). These operations simultaneously contribute to the army's mission of knowledge and anticipation:

So, we have the army's resources to go and police the fisheries in the northern and southern high seas pockets, and this contributes to the visibility of New Caledonia's action, or France's action, in the region. It also contributes to the knowledge of the zone in terms of fishing practices: knowing who fishes in these zones, who has a licence in the EEZs around, what fishing practices are observed... (AEM officer, Noumea, 14.10.19)

This geopolitical and militarised problematisation of fisheries reactivates France's strategic use of its overseas territories, much estranged from these territories' local interests (Le Meur & Muni Toke, 2024): "France doesn't want to abandon its strategic position via its Pacific territories", *D'Entrecasteaux's* captain confirmed (Field notes, patrol mission, Dec. 2019). This helps understand the French State's decision to renew the Navy's maritime assets in New Caledonia and French Caledonia and make them more versatile to partake in plural and non-conventional missions (Abensour, 2023).

iii. A (Partially) Integrated Approach to Maritime Surveillance and Security

Although maritime coercive surveillance in New Caledonia is partitioned across several jurisdictions and actors with distinct rationales, there are overlapping surveillance interests, sensors and areas. Compartmentalisation results in costly redundancies and prevents overcoming surveillance patchiness, hence the desire to integrate surveillance efforts in a Joint Maritime Centre akin to the French Polynesian one and pooling satellite, acoustic, nautical and aerial surveillance resources:

As it happens, the EEZ is the same thing as the Coral Sea Natural Park. So, if the DAM [Maritime Affairs Directorate], via MRCC, sets up surveillance systems, if they don't come to an agreement with the FANC [New Caledonian-based Armed Forces], they're going to have redundancies. The good news is that they are already working closely together and will be able to pool their resources. It's a big step forward, the fact that they're talking to each other, *it's good for our taxes*. (Satellite surveillance expert, Noumea, 14.11.10, my emphasis)

The project long stalled because of strained relations between the New Caledonian Government and the French State and their “very different visions” (AEM officer, Noumea, 14.10.19). For this interviewee, these sovereign tensions reflected an “old history, Navy vs. Maritime Affairs” and their distinctive visions and capacities to control the EEZ:

Maritime Affairs is looking to create a multi-mission centre with MRCC. They want to develop skills and make it both a State and Government centre. [...] But behind this, there is always the question of governance: who does the Joint Maritime Centre answer to? The State and New Caledonia have different interests because they don't have the same powers. [...] The State is more likely to focus on illegal activities than on environmental protection as such. In fact, it's not even so much the missions, because you can actually surveil the environment with the presence of vessels in the area. It's more a question of who's in charge, who's the boss (laughs). Which also involves the ability to pay. (AEM officer, Noumea, 14.10.19)

The Government would not fund the centre, and the French state refused to fund a centre that would be exclusively controlled by the former. Against this deadlock, the French State created a Maritime Information Fusion Centre of its own while “keep[ing] the door open for the participation of other entities: Government, Provinces, etc.” (AEM officer, Noumea, 14.10.19). Set up just a few weeks before my arrival in New Caledonia in 2019, the centre was looking for staff and computer equipment to build an integrated surveillance database. It struggled to lay a hand on the necessary calculative expertise while retaining its autonomy: “No one is capable of handling geographic information systems and analysing data like [company I.]. Government departments generally try to generate their own skills, at least for the armed forces. They call on framework contracts that meet several needs and are therefore not extremely well suited to the needs of New Caledonia.” (AEM officer, Noumea, 14.10.19).

Three years later, the centre had progressed. It reportedly had a database listing all fishing vessels' transits and operations near New Caledonia's and Wallis and Futuna's EEZs to “capitalise information on foreign fishers' practices and detect suspicious behaviour” (CFIM, 2023). It also sets up a “leisure

vessels database”, providing “a more complete view of maritime activity in the ZMNC [New Caledonia Maritime Zone]” (CFIM, 2023, p. 3). Although the centre remained under AEM, cooperation with the New Caledonian Government advanced under a Joint Maritime Commission and a partnership with SPNMCP to exchange information (CFIM, 2023). According to an SPNMCP representative, the ‘coercive’ environmental surveillance of the Coral Sea Natural Park propelled this rapprochement (SPNMCP officer L., Noumea, 07.07.21). The French State and the Government also agreed to co-fund an integrated tool of maritime traffic surveillance in the park, with 70% participation from the French State and 30% from the Caledonian Government (CFIM, 2023).

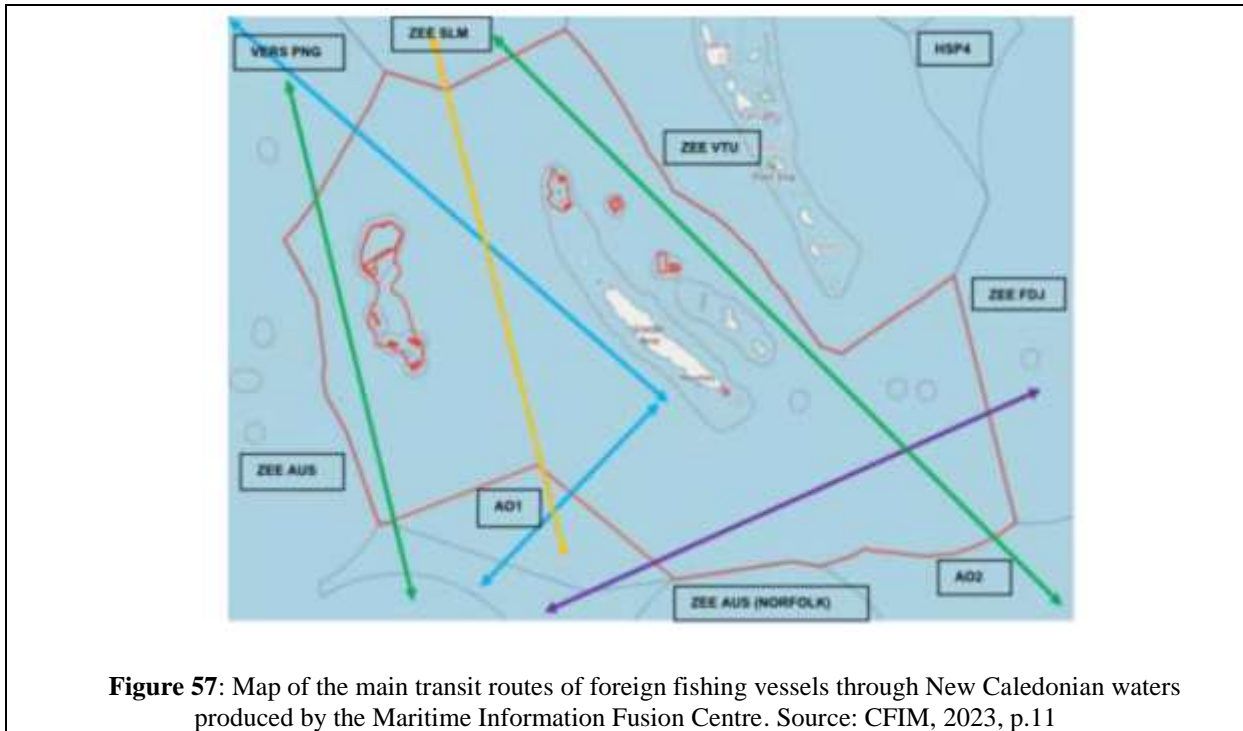
The Maritime Information Fusion Centre consolidates the risk-based approach permitting to rationalise policing resources already mentioned in the case of MRCC:

It’s actually quite simple, a very pragmatic way of managing. The EEZ is divided into zones. Within these squares is a statistical zone. [...] Then we’ll superimpose the VMS and AIS layers, and if necessary we’ll be able to use satellite captures to confirm the data. And from this matrix of statistics per zone, we can find out how often the zone is frequented, what the type is, what the threat may be in terms of protection, and then send nautical vectors into this zone more often [...]. (AEM officer, Noumea, 14.10.19)

The centre benefits from public and classified information provided by different institutions (AIS, VMS, maritime and aerial patrol reports, satellite imaging, leisure and fishing vessels’ declarations when they enter the EEZ, customs reports, declaration of arrival and departure from Noumea’s port, gendarmerie reports). It also intends to exploit the traces left by maritime actors at sea and on the Internet, e.g., by tracking maritime sports blogs, thereby opportunistically turning them into coercive surveillance data (Bigo et al., 2019). ‘Scientific’ environmental information, too, can endure the same transformation: a fisheries policing guide destined for the French Navy suggested using fishing recommendations software (cf. Chapter 7) to identify likely fishing zones and orient patrols (Field notes, patrol mission, Dec. 2019).³¹² The centre aims to define statistically normal ‘patterns of life’ at sea to detect ‘abnormal’ behaviour and “trigger a control operation” (AEM officer, Noumea, 14.10.19):

For example, we have many Chinese fishing vessels declaring transit [...]. Except that, for example, in September, there was a group of 3-4 Chinese vessels in the southwest of the EEZ, and based on AIS and VMS, it was strange because they had a low speed that looked like fishing speed. We sent a plane to check what they were doing [...]. When we analysed [all available] data, we found that the transit zone was more like this [see Figure 57]. [...] As a result, we are also focusing on this area. (AEM officer, Noumea, 14.10.19)

³¹² The capacity of scientific knowledge of the tuna fisheries to assist with ‘coercive’ surveillance is also identified by certain tuna fisheries scientists: a Seapodym developer (cf. Chapter 8) hence suggested that the model could also support maritime surveillance activities by identifying relevant ecosystem places at sea (Field notes, Ecosea workshop, Noumea, Oct. 2019).



This processing centre permits civilian-military intelligence gathering and underlies the development of maritime policing to secure the EEZ (Ryan, 2019). It concomitantly retains specific extraterritorial and geopolitical approaches characteristic of the military. Hence, the Maritime Information Fusion Centre focuses on New Caledonia’s EEZ and, more generally, on the region-wide Maritime Zone (cf. Figure 56). This results in projecting policing practices beyond the porous EEZ boundaries to address transnational flows and contributes to the emergence of a “global policing power” (Ryan, 2013). The centre exchanges information within transnational networks, including the US, FFA, or the Singapore Information Fusion Centre, in addition to the French Polynesian centre. Finally, the centre also constitutes a diplomatic instrument: “We want to cooperate with the various information fusion centres and then make offers of service to the Pacific Island Countries [...]” (AEM officer, Noumea, 14.10.19).

Completing these informational aspects, MRCC evolved into an Operational Surveillance and Rescue Centre in 2023, permitting State and Territorial administrations to pool and coordinate their operational capacities: “While its main mission remains rescue at sea, this change acknowledges the role of surveillance and information missions in improving maritime security and preserving the marine environment in New Caledonia’s bordering waters” (CFIM, 2023, p. 3). A “joint surveillance cooperation exercise for the park” was carried out to “implement the information processing chain from detection to the mobilisation of control resources” and test the effectiveness of the integrated

surveillance apparatus.³¹³ Such an exercise also consolidates inter-agency cooperation and publicly demonstrates the enhancement of maritime surveillance in the park. It is noteworthy that the Operational Surveillance Rescue Centre's environmental prerogatives extend to "monitoring reports of turtles, dugongs and marine mammals in distress" and "shark risk" (CFIM, 2023, p. 3). Surveillance, here, exceeds the control of human activities' impact on the environment to expand to the protection or sanctioning of individual animals (e.g. in the case of sharks' injuring humans, see Kon Kam King & Riera, 2022). Animal surveillance supports, in that case, a form of security expanding to other-than-human lives.

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The case of France and New Caledonia shows practical and instrumental (more than political) convergences and, therefore, porous boundaries between the civil and the military, external defence and internal policing practices. This suggests a fluid understanding and production of security at sea to establish national and regional order, notably propelled by the rise of environmental issues. This trend coincides with other research showing similar "war:police assemblages" of intervention (Bachmann et al., 2014) and the rise of an integrated and expanded maritime security framing (Boşilcă et al., 2022). This evolution of security doctrines, policies, and practices takes on various explanations, primarily dependent on the country under study. US-centred perspectives, which tend to dominate the international relations scholarship, point to the influence of the end of the Cold War and the 9/11 terrorist attacks as a breeding ground for these transformations, resulting in the identification of non-state enemies, the elevation of certain (in particular criminal) risks to high-level threats (e.g. Peoples & Vaughan-Williams, 2020; Bueger & Mallin, 2022). These aspects led the US to reformulate its homeland security policy and seek to establish a global intelligence network of policing agencies to build full (including maritime) 'domain awareness' (Boşilcă et al., 2022).

Looking at Great-Britain and drawing on C. Schmitt and M. Foucault's influences (Foucault, 2004; Schmitt, 2017), J. Ryan proposed another historiography of contemporary maritime security, anchored in this country's imperial economic interests. These led Great Britain to project its security practices at a global scale and turn its Navy into a policing force concerned with criminal risks and supporting a governmental power rather than protecting a sovereign power from external enemies at sea (Ryan, 2019). Without rejecting the influence of these historical events and political strategies, my case study suggests, in the case of France and Fiji (cf. below), that these features also result from the practical and material challenges of coercively surveilling the offshore world (see also Peters, 2014b). This argument resonates with that of G. Daho, focusing on French inter-ministerial cooperation in defence and security

³¹³ New Caledonian Government website: <https://www.nouvelle-caledonie.gouv.fr/Actualites/Espace-presse/Communiqués-de-presse/2021/Premier-exercice-conjoint-pour-la-surveillance-de-la-frequentation-du-parc-naturel-marin> (accessed: 12.08.24)

(Daho, 2019). Finding that social sciences too often separate the ‘internal’ study of public action from the ‘external’ study of the military through the prism of international relations, this scholar evidences the convergence of civilian and military actors, and the rise of integrative and risk-based approaches to surveillance derive from an organisational rationalisation logic. Hence, this rapprochement does not simply reflect an adaptation to a changing global context: instead, management imperatives significantly contribute to decompartmentalising administrations (Daho, 2019).

2. Integrating Maritime Surveillance: Fijian Perspectives

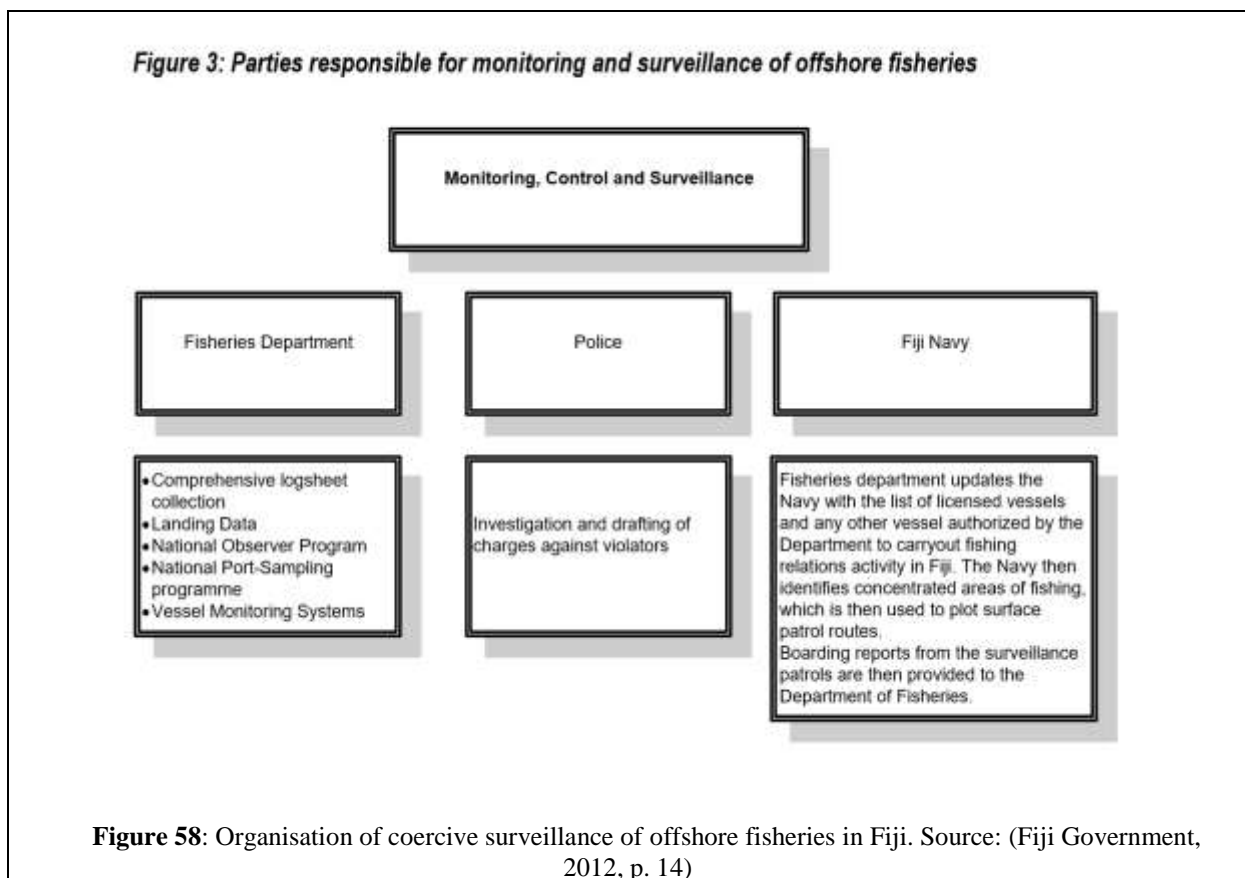
The development of maritime surveillance in Fiji puts New Caledonia’s case into perspective and highlights the same logic of centralising and sharing surveillance resources mainly supplied and operated by the Navy to the benefit of administrative authorities with no surveillance resources and the formalisation of a comprehensive Foucauldian-like approach to maritime security seeking general order at sea. Spelt out in its 2020-2030 National Ocean Policy, maritime security aims “to safeguard assets and ensure regulatory compliance for multidimensional maritime security of 100 per cent of Fiji’s ocean within national jurisdiction” and spans “traditional monitoring, compliance and enforcement components of boundaries and sovereignty, the safe use of shipping sea lanes and permitted marine activities” as well as “non-traditional maritime security issues” – including those pertaining to natural disaster, climate change, pollution events, unregulated exploitation of resources and transnational crimes (Republic of Fiji, 2020, p. 33). As outlined by Fijian Naval Commander T. Natuva, this ‘contemporary’ understanding of maritime security in relation to the Blue Economy is an “old paradigm” in Fiji, considering the country’s intimate tie with “the health of our oceans and to the marine plant and animal life that inhabit them” (Natuva, 2021, p. 4).

In Fiji, the Navy is the primary actor engaged in maritime surveillance and security for the EEZ. It assists the Ministry of Defence and also runs the Fijian Maritime Search and Rescue Coordination Centre (FMSRCC), which surveils and coordinates safety operations over Fiji but also Tuvalu’s, Kiribati’s, and Wallis and Futuna’s waters. Maritime safety is one of Fiji’s priority maritime surveillance activities (Standing Committee on Foreign Affairs and Defence, 2018). The other priority is offshore tuna fisheries, as for most Pacific Islands (Field notes, patrol mission, Suva, Dec. 2019). However, unlike New Caledonia, illegal fishing is not the only problem: most infringements come from licensed fishing vessels misreporting their catch.³¹⁴ A Fijian naval officer explained that fishers often have two catch reports to conceal, notably, the catch of certain fish species (Field notes, patrol mission, Suva, Dec. 2019). The administrative coercive surveillance of the fleet is the Ministry of Fisheries’ responsibility, which relies on VMS, observer and logsheet data weekly reports by vessels at sea, landing inspection reports and legal proceeding records (Ministry of Fisheries officers, Suva, 09.08.21).

³¹⁴ Also, unlike New Caledonia, Fiji has not yet established the offshore MPA it has committed to.

However, at-sea fisheries policing is carried out with the support of the Navy and its offshore vessels, which contributes to its ‘ecologisation’: “The unique thing about Fiji’s setup is that we have a Navy looking at the protection of our resources”, a naval officer praised (Naval surveillance officer, Suva, 25.08.21). Finally, judicial investigations are carried out by the Fijian police (see Figure 58).

Hence, coercive environmental surveillance straddles various agencies. However, until the early 2010s, inter-agency coordination was poorly formalised. A governmental audit noted that “there is no formal agreement between the two agencies [Fisheries and Naval Divisions] to define the responsibilities and obligations between the two agencies with regards to monitoring and surveillance” (Fiji Government, 2012, p. 15). Similarly, the report noted that “the Police Department is responsible for facilitating court action against those found to be contravening provisions of the Fisheries Act. However, there is no formal arrangement to outline the boundaries of responsibilities and obligations between the two agencies” (Fiji Government, 2012, p. 15). It concluded that “the lack of formal arrangements may result in the *duplication of resources* as the boundaries of monitoring work that has to be conducted by the two agencies are not clearly defined” and recommended strengthening inter-agency cooperation and coordination, especially between the Ministry of Fisheries and the Fijian Navy, to improve maritime surveillance and patrol operations especially (Fiji Government, 2012, p. 15).



Consequently, exchanges between the two institutions intensified: “We have officers that are based at the surveillance centre, at the Navy surveillance centre [...]. We are always in contact on a daily basis.” (Principal fisheries officer, Suva, 09.08.21). Patrol operations now involve a Ministry of Fisheries enforcement officer or Navy officers who have been appointed “honourable fish wardens” and “fisheries officers” entitled to enforce the Fisheries and Marine Spaces Acts’ regulations. Fisheries and naval officers undergo joint training courses in offshore inspection (Ministry of Fisheries, Facebook post, 11.07.20). In 2022, the Ministry of Fisheries and the Fijian Navy signed a Memorandum of Understanding to formalise this rapprochement (Ministry of Fisheries, Facebook post, 06.03.22), while ties with the customs administration were also strengthened to address drug trafficking after Fiji was identified as a transit point for drugs on their way to Australia (Natuva, 2021).

The gradual integration of Fiji’s agencies *within* the Navy Operation Centre seeks to enhance Fiji’s “Maritime Domain Awareness”, following a new concept spreading wider in international security communities advancing an integrated knowledge production on security at sea (Bueger, 2020a): “Embedding Fisheries officers and Customs officers onboard ships and at the Navy operation Centre will continue to strengthen the work of all three agencies and enhance our national MDA [Maritime Domain Awareness] capabilities.” (Ministry of Fisheries, Facebook post, 11.07.20). Fiji strategically imported the maritime domain awareness to *demonstrate* its security capacities and sovereign power in international fora, and consolidate its political capital:

In 2017, Fiji Navy Commander and a group of senior officers here at the naval base decided to bring in a concept that’s common in bigger countries, and it’s the new practice now in developed countries like the US, Australia, New Zealand and the likes. This concept came about after the 9/11 incident [...]. They changed the concept where each agency is working together in a particular space, sharing information in a closed network. This concept, we tried to establish it here at the naval base. One, because it hasn’t been done before in Fiji. Secondly, because of its pilot nature. We wanted to demonstrate that Fiji too has the capability to do the same as similar concepts done overseas. In 2017, we flipped the way the office looked like. (FMSRCC chief officer, Suva, 25.08.21)

In 2018-2019, Fiji formalised a “multi-agency operated” Maritime Fusions Centre associated with FMSRCC, involving an analyst from the Customs and Revenue Services and the Ministry of Fisheries, as well as the Police Force and the Immigration Department and underpinned by the Navy. These secondments permit these two administrations to “come in if they have issues with enforcement” and support intelligence-led patrolling by the Navy: “Instead of just deploying the vessels and keeping them out at sea, we now have targeted patrols and targeted areas of concern so that we maximize the use of asset and the information that are coming out from our stakeholders (FMSRCC chief officer, Suva,

25.08.21).³¹⁵ Fiji has also stepped up its regional action by partaking, for the first time, in *regional* fisheries policing operations (FFA chief officer, Honiara, 21.05.21).

Like in New Caledonia, this integrative process makes apparent divisions within the state and the existence of various authorities, strategies, knowledge and practice rather than a single coherent sovereign body: “It’s a centre or an institution where, if we’re not careful, there’s too many cooks for a particular dish [...] Agencies are always jumpy about sharing a particular piece of information.” (FMRSCC chief officer, Suva, 25.08.21). This officer referred to different surveillance requirements and inter-agency competition, firstly for financial resources: “Lately, because of the competitiveness of the key performance indicators for achieving our institutional targets, we’ve unconsciously set up that barrier.” (FMSRCC chief officer, Suva, 25.08.21).

3. The FFA Regional Surveillance Centre

i. A Fisheries Risk Assessment and Monitoring Centre IUU

Environmental ‘coercive’ surveillance in New Caledonia and even more so in Fiji must also be connected to the longstanding and pivotal role of FFA’s Regional Surveillance Centre regarding tuna fisheries surveillance in the South Pacific region, established to pool and coordinate fisheries policing resources (cf. Chapter 6). This surveillance centre, including nine FFA officers assisted by Australian and New Zealand military officers, comprises a data processing room where officers watch the Pacific Ocean for the Agency’s member countries, including Fiji but not New Caledonia (see Figure 59). Relations with the latter, however, appear to consolidate with the signing in 2024 of a Memorandum of Understanding.³¹⁶ The centre also coordinates regional fisheries policing operations mobilising patrolling capacities provided by the Pacific Quadrilateral Defense Coordinating Group (QUAD), including France, Australia, New Zealand and the US. Finally, it assists member countries with *ad hoc* surveillance requirements (e.g. helping Niue surveils its offshore MPA) and judicial investigations.

³¹⁵ The integration process continued with the announcement in 2024 of the creation of a Maritime Essential Services Centre, funded by Australia, and bringing together the French Navy, the Fiji Hydrographic Office, the Fiji Joint Rescue Coordination Centre, the Fiji Maritime Fusion Centre and the Suva Coastal Radio Station (Fiji government website: <https://www.pmooffice.gov.fj/prime-minister-hon-voreqe-bainimaramas-address-at-the-launch-ceremony-of-rfmf-rfn-maritime-essential-services-centre-mesc/>, accessed : 11.08.24).

³¹⁶ FFA website: https://www.ffa.int/2024/07/ffa-and-new-caledonia-sign-historic-agreement-for-enhanced-cooperation-in-fisheries/?_cf_chl_tk=6LG_Uf.P2dH09Zq8fdwBnpC2Z0oNDSZ5o1HfA_idFaE-1724018746-0.0.1.1-5524 (accessed: 19.08.24)



Figure 59: FFA Regional Fisheries Surveillance Centre Headquarters. Source:

https://www.youtube.com/watch?v=7a-2fjJbOPE&ab_channel=SustainPacFish (accessed: 09.08.24), snapshot by the author.

One of the centre’s primary functions is to pool surveillance information to produce and update a “regional surveillance picture”, primarily drawing on AIS and VMS data and shared with the member countries and the QUAD (FFA chief officer, Honiara, 21.05.21). To produce intelligence, it also analyses its members’ logsheets, fisheries workbooks, port and maritime inspection reports, prosecution reports, license registers, etc. The centre increasingly invests in complementary technologies to consolidate its remote detection of illegal fishing activities. In 2021, under a Canadian aid programme, it began a ‘Dark Vessel Detection Platform’ to pick up radio, light and satellite signals emitted by AIS and VMS-silent vessels.³¹⁷ In addition to this regional surveillance picture, the FFA centre also has access to fisheries observer data, inspection reports (at sea and in port), prosecution reports, etc. and regulatory information such as the register of licensed fishing vessels provided by its member countries.

By crossing and processing these datasets, the centre supports a risk-based approach to coercive surveillance, like at the national and territorial levels of Fiji and New Caledonia: “Vessels become green or red flagged on the surveillance picture, depending on the associated risk, and our members will be able to focus on those vessels. If it’s green, they will look into it if they have time, basically” (FFA chief officer, Honiara, 21.05.21). It has developed a “compliance index” based on vessels’ historical records to determine “which vessel is more likely to cheat than the others, and can thus target the analysis” (EU fisheries delegate involved in an IUU fishing regional programme, Suva, 14.06.19). The rationalisation of surveillance goes as far as to orienting onboard inspection practices, with the recent introduction of a “quality boarding” concept: “It’s not about doing checks on a vessel but doing *proper* checks. That

³¹⁷ Canadian government website: <https://www.canada.ca/en/fisheries-oceans/news/2021/02/government-of-canada-launches-international-program-to-track-illegal-fishing-using-satellite-technology.html> (accessed: 09.08.24)

includes undertaking intelligence before you actually get onboard the vessel [...] so that they can know exactly what to look for when they board the vessel.” (FFA chief officer, Honiara, 21.05.21).

ii. From Monitoring Illegal Fishing Boats to Monitoring Licensed Boats

FFA’s surveillance practices co-evolve with IUU fishing problematisation, which was historically main oriented to the detection of foreign non-licensed vessels illegally fishing in the Pacific Islands’ EEZs. However, a recent study requested by FFA established that over 90% of IUU fishing resulted from misreporting offences by licensed vessels, as mentioned for Fiji (MRAG Asia Pacific, 2021). This finding reoriented the centre’s surveillance strategies not to detect ‘dark’ vessels but to consolidate the logsheet and fisheries observer apparatuses and improve the verification and cross-checking of their associated information. This is why FFA extensively promoted e-reporting and e-monitoring developments and strengthened the coercive dimension of onboard observers – while simultaneously exacerbating the tensions running through these apparatuses (cf. Chapter 7): “There’s more reliance on observers now that we focus on UU fishing” (FFA chief officer, Honiara, 21.05.21). These developments aim to fasten the transmission and analysis of fisheries information³¹⁸ to identify reporting inconsistencies as quickly as possible, i.e. to smoothen the calculative dimension of surveillance rather than the collection of additional information (Field notes, Tenth Pacific Nature Conference, online, Nov. 2020): “Data analysis is one of our key area of work at the moment, to strengthen regional analytics. [...] We have lots of data, we need to make sure they’re analysed [...]. I would like to step up the Analysis team.” (FFA chief officer, Honiara, 21.05.21). To speed up burdensome calculative work, FFA recently invested in machine learning tools and started collaborations with calculative experts like Global Fishing Watch, the Australian Commonwealth Scientific and Industrial Research Organisation and SPC to improve its inconsistency detection capacities (FFA chief officer, Honiara, 21.05.21).

This new focus on licensed vessels has also transformed power exercise strategies beyond more conventional and costly ‘command and control’ approaches. FFA now promotes supposedly more cost-effective incentive-based approaches (FFC, 2010), emphasising compliance rather than enforcement from a Foucauldian disciplinary perspective (Foucault, 1975). This strategy attempts to delegate ‘coercive’ surveillance to the fishing industry by consolidating bounds with the industry and fishers’ employers so that it percolates down to the employed fishers:

We want the fishers to do the right thing by themselves. That they know something is illegal and just don’t do it. We increase our focus on voluntary compliance. We undertake quite a lot of stakeholder engagement with the industry to keep them informed on changes in measures. We encourage our members to undertake

³¹⁸ I showed in Chapter 7 that it can take several months to get observer data and logsheets from the boats to the databases. Moreover, because they do not follow the same transmission circuits, their reception by FFA is not necessarily synchronous.

consultations with the industry as well regarding new laws, conditions of the licence, etc. (FFA chief officer, Honiara, 21.05.21)

That framing, which necessitates negotiating surveillance and compliance with the surveillance subject, draws a new portrayal of the (licensed) fishing industry: “The fishing industry is our members’ partner. They contribute to the economy of the members, so they need to be part of the solution and not the problem.” (FFA chief officer, Honiara, 21.05.21). This delegation process also fosters new perspectives of enlisting compliant fishers in fisheries surveillance and creating new coalitions not so much opposing public authorities to their subjects than ‘obedient’ and ‘deviant’ fishers:

Fishing vessels are also reporting other vessels they don’t recognise and that may be stealing fish. We need to ensure that fishers, when they pay for the licence to access our waters, they get what they pay for, so that the fish is for them as well. Getting them is part of this process of compliance. We encourage them to ensure that any item they come across at sea is reported to us. (FFA chief officer, Honiara, 21.05.21)

Noticeably, the involvement of domestic offshore fishers and the acknowledgement of their sentinel role are also visible in New Caledonia and have even recently been formalised, especially after certain Vietnamese Blue Boats had been reported by fishers (*La Moqueuse* officer, Suva, 30.06.19) – outlining once again their infrastructural role in offshore surveillance, including for its coercive dimension. The French State and the Caledonian Government decided to equip tuna fishing vessels with radars to improve vessel detection in the Coral Sea Natural Park.³¹⁹ Public authorities conceive fishers as “territorial” actors eager to “defend their fishing grounds” (Field notes, naval officer, patrol mission, Dec. 2019). This framing reconciles public authorities and fishers’ territorial claims and permits to establish a distributed surveillance in partnership with non-state actors to exploit every existing offshore surveillance infrastructure. If this role of sentinel is well recognised by fishers, it is also nuanced:

Let’s just say that offshore fishing is the activity that occupies New Caledonia’s maritime zone the most. *We go everywhere and we’re the only ones.* [...] We’re well aware that there are illegal fishing boats in the EEZ and that we don’t know anything about it. [...] This was blatantly obvious in the last SPC report, which contained a lot of data on areas where we don’t fish. [...] Mainly at the edge, on Fiji and Solomon sides, where we don’t fish much because it’s so far away for us. [...] Let’s just say that our captains have all the instructions for that. If they see anything suspicious or hear or suspect anything, they tell us and of course we inform the army. (Manager of fishing company N., Noumea, 21.10.19)

Despite their extensive presence at sea, fishers do not cover the entire territory (and do not aim to do so, as they are first interested in catching fish) and, therefore, cannot ensure exhaustive surveillance.

³¹⁹ New Caledonian Government website: <https://gouv.nc/actualites/22-10-2021/optimiser-la-surveillance-du-parc-de-la-mer-de-corail> (accessed: 21.08.24)

iii. From Surveilling Vessels to Surveilling Humans: Connecting Fisheries and Maritime Security

As visible through this manuscript, tuna fisheries surveillance primarily focuses on the *fishing vessel* entity as its main subject rather than individuals. This perspective partly stems from how surveillance infrastructures were historically designed and, through them, the offshore world standardised at a time when surveillance was concerned with managing and securing the tuna resource and, therefore, only indirectly concerned with managing human conduct: “We started focusing on vessels because of the vessel register,³²⁰ which provides details of the vessels. That’s the way the register was structured. But it’s not the vessels doing wrong, it’s the people on it.” (FFA chief officer, Honiara, 21.05.21).

This new framing has consolidated after the fisheries sector has been affiliated with crimes not necessarily related to the environment, e.g. tax evasion, drug, people or weapon smuggling or corruption (e.g. UNODC, 2011), concerning more than “fisheries scientists, managers and conservationists” and also labour and human rights organisations, for instance (Christensen, 2016, p. 135). Tuna fisheries are reconceptualised not only as fish stocks and fishing vessels but as a more complex assemblage also involving crew members, captains, and corporations: “Now, we could have a green vessel with a red person onboard” (FFA chief officer, Honiara, 21.05.21). As a result, FFA is “slowly looking at pulling away from vessel-focus to person-focus” (FFA chief officer, Honiara, 21.05.21) and created a Persons of Interest database to complement the regional vessel register:

They [FFA] are trying to develop a database about the fishing crew, captains, and if they’re involved in a violation, they would be recorded on this list, so that if a particular person is on a boat fishing somewhere, the national authorities would be able to know. [...] Crew information is still hard to get, to know what crew is on what boat, etc., especially on the high seas because there’s no obligation to report on that data. All this, about slavery, forced labour... it’s happening but it’s a difficult challenge (Former FFA officer, Suva, 19.06.19)

Interest in fishing labour requires surveilling people at sea *and* on land to establish a “better understanding of the business chains behind these vessels” (Field notes, FFA, Tenth Pacific Conference, online, Nov. 2020): “The idea is to look as *who is in control of the vessel* because sometimes, the master is not in control, it’s someone from the corporate end” (FFA chief officer, Honiara, 21.05.21). This reticular approach sees IUU fishing as a doubly ‘offshore’ and liminal (Bueger et al., 2019) offence, taking place in offshore waters while also involving land-based, distant actors voluntarily ‘offshored’ from the South Pacific region.

³²⁰ See Chapter 6, which describes the creation of the FFA Regional Register listing the fishing vessels operating in the region and their characteristics.

These surveillance prerogatives raise new challenges and have led FFA to forge closer relations with agencies beyond fisheries administrations at the international³²¹ and national levels:

Crew standards are not in fisheries legislation. Most of the time, they lay in Ministries of Employment so there's a need for Fisheries and relevant ministries to work closely together. The other challenge is that it adds another layer of work for inspectors who need to interview crew as well. If there are instances of mistreatment, the question is who takes the lead in undertaking the investigation: Fisheries or Ministry of Labour? We also need to include it in our boarding inspection training [...]. To train to look for what doesn't look normal when they speak to crew, it's another challenge. (FFA chief officer, Honiara, 21.05.21)

Additionally, its regional fisheries policing operations now involve fisheries but also police, customs, and immigration representatives “so that we can focus on fisheries but also look from their perspective and through their channels [...]” (FFA chief officer, Honiara, 21.05.21). While maritime security actors progressively incorporate environmental issues, and fisheries matters in particular, FFA operates a converging movement. However, it retains its primary focus on fisheries – suggesting a securitisation of fisheries without resulting in the complete integration of fisheries and maritime security.

Hence, FFA's original mandate constrains its surveillance potential by bounding its missions to tuna fisheries: “The FFA analyses fishing, but does not produce an overall maritime knowledge”, a French officer observed (AEM officer, Noumea, 14.10.19), even though the agency ‘sees’ much more than it looks at and could inform other maritime surveillance dimensions. In Fiji, a Marine Spatial Planning project manager deplored what he saw as a loss of surveillance resources, with many surveillance information remaining unused:

They can also see cruise ships, even though they're not interested in them. But for me, it'd be interesting to see where they go, if they go close to the reefs, for instance, so that we can try to avoid accidents and oil spills. It'd be interesting for Marine Spatial Planning but FFA only cares about fishing. And because the data are sensitive, they can't share it, and I can't go into the room, it's too closed. [...] It's useless for the data to exist if you can't access them. (IUCN representative, Suva, 23.02.21)

Here, the issue derives not from a lack of information but access issues to the unshared processing centre. The confidential nature of tuna fisheries data spreads through other maritime data and restricts their use by contagion.

If there are new bridges between FFA and maritime security communities, the demarcation remains: “We share information with them [the Pacific Transnational Crime Centre] because they focus a lot on maritime security. We don't deal with any of maritime security issues so we share with the institutions that deal with those issues.” (FFA chief officer, Honiara, 21.05.21). Although the Pacific Islands

³²¹ e.g. the International Labour Organisation, the International Office of Migration, the International Maritime Organisation and Interpol

managed to develop transnational cooperation regarding fisheries, it appears that inter-sectoral cooperation is more challenging to establish because of different visions, know-hows and practices, suggesting the existence of distinct coercive surveillance communities (Bigo et al., 2019). Following the 2018 Boe Declaration in which the Pacific Islands Forum members explained their conception of maritime security and emphasised the importance of environmental and resource security, Australia proposed to create a Pacific Fusion Centre that would consist of a *regional* maritime information fusion centre. As a pre-existing and most-developed maritime surveillance infrastructure, the FFA surveillance centre was considered to host it (New Caledonian Government regional cooperation officer, Noumea, 07.06.21). However, the proposal was aborted, notably for fear that “having the Pacific Fusion Centre embedded in FFA would take away our primary focus on IUU” (FFA chief officer, Honiara, 21.05.21). If the FFA surveillance centre opportunistically assists other surveillance communities and becomes more multipotent, it remains under the predominant control of fisheries authorities.

As I have mentioned throughout this section, shore-based surveillance centres develop a risk-based approach to maritime surveillance to orient in-field patrols, which remain key to taking coercive action and effectively policing maritime offences – thereby showing the limits of a data-only form of surveillance. As of now, the legal framework does not permit to use AIS, satellite imaging or drones as sufficient proofs to characterise and sanction in a court of justice an offence. Only *flagrante delicto* reported by a sworn (human) agent can establish an infraction (AEM officer, Noumea, 14.10.19). Hence, the capacity to surveil at a distance and the digitalisation of surveillance remain limited by the non-digitalisation of the judicial framework. In that legal context, ‘fieldwork’ remains essential, and is the topic of the following section.

III. Patrolling the Offshore Terrain

In the middle of the sea, the only sensors... there are satellites, but we don't have them everywhere. Otherwise, it's the maritime surveillance vessels or aircraft.

(Naval operation centre officer, Noumea, 15.10.19)

1. Multipotent Patrols: Sharing Limited Resources

i. The General Organisation of Maritime Patrols

Patrol vessels play multiple roles at sea: transport, information gathering and physical intervention. *In situ* surveillance remains the only option to accurately characterise a maritime activity – instead of merely detecting a vessel's presence – at a spatiotemporal scale that permits public authorities to (re)act. With the expansion of maritime surveillance and security, the role of the Navy and its vessels has become more multi-faceted, combining several potentially antagonistic imperatives of surveillance and intervention, which transform patrol organisation.

In the case of France, patrols remain organised by army since, after all, “the vessels belong to the army” (AEM officer, Noumea, 14.10.19). The organisation is relatively rigid and follows a top-down and funnel-shaped approach established by the metropole-based Ministry of Defence before the New-Caledonia-based Joint Chiefs of Staff translates national strategies into a medium-term (4-24 months) plan. The operations centre then assumes the operational conduct of the missions in coordination with the patrol vessels’ captains in the field. Hence, the allocation of patrolling resources is scheduled up to 1-2 years ahead, considering these strategic requirements and the vessels’ infrastructural constraints: each vessel is allocated an annual number of days at sea based on maintenance constraints. In 2019, the combined vessel resources of New Caledonia, therefore, conducted 1,381 days at sea (CFIM, 2019).

‘Trident’ missions are the New Caledonia-based patrol vessels’ main missions. Their aim is the “watertight” coverage of the French EEZ, which requires the exhaustive, areal patrolling of the marine territory: “If we notice a significant practice at a given time, we will make an effort but we will still cover the entire EEZ to avoid detection gaps” (AEM officer, Noumea, 14.10.19). The EEZ is divided into ‘statistical travelling squares’ delineating patrolling zones and monitoring that no area is missed. Every month or so, a patrol alternatively targets one of these zones of surveillance. For the New Caledonia-based armed forces, the surveillance of the national EEZ also covers that of Wallis et Futuna, which lacks any locally-based offshore surveillance capacity. The reticular structure of the French EEZ considerably complexifies its patrolling and Wallis et Futuna’s EEZ remains, overall, at a distance from its surveillance efforts – evidencing the unequal repartition of security across the French territory under a cost-benefit logic (cf. Benbouzid, 2018): “I have to keep an eye on both [New Caledonia and Wallis and Futuna] but sending a vessel out there...” (Operations centre officer, Noumea, 16.10.19). A one-way journey to Wallis and Futuna from Noumea takes a vessel four days and a Guardian aircraft four hours. As a result, the Navy only goes there two or three times a year for four days: “To make the time there worthwhile, we’ll stay three days and do two maritime surveillance operations every day, but that consumes a lot of potential because the four hours spent going there [by plane] are four hours we could have spent monitoring our EEZ here [in New Caledonia]” (AEM officer, Noumea, 14.10.19). Aside from these punctual patrols, Wallis and Futuna’s EEZ is surveilled remotely using AIS and VMS. This caused discontent amongst Wallis and Futuna’s authorities, which have complained about illegal fishing activities in their zone:

There was one guy who said: “Our EEZ is being plundered. Every time you [the French army] come, you see nothing, but that’s because they know.” Now we’re going on another mission to Wallis and Futuna, even though we’ve already fulfilled the contract [...] because we can see that there’s a need there. And we’re going there more and more. (Operations centre officer C., Noumea, 16.10.19)

After the Trident mission quota is allocated, remaining operational capacities are used to patrol the extra-territorial Maritime Zone to “carry out international relations, fisheries policing missions within the framework of the FFA, WCPFC, etc.” or practice (Operations centre officer C., Noumea, 16.10.19):

If there are still days at sea for the boats, you say to yourself, well, next year, as far as international relations are concerned, the General said that we need to focus more on Fiji, so we’ll plan an extra stopover in Fiji. [...] You also have training periods: the boats do exercises. (Operations centre officer C., Noumea, 16.10.19)

In French Polynesia, where illegal fishing is more prominent and the EEZ even wider than New Caledonia’s, patrols spend more time in it. Conversely, in New Caledonia, whose EEZ is considered reasonably secure but is also closer to other Pacific Islands “with which to establish international relations”, patrols leave the EEZ more often – non-EEZ mobilities account for 54% of the vessels’ activities (CFIM, 2019). Outside the EEZ, the mission is co-defined in a back-and-forth exchange between the operations centre and the vessel’s captain according to diplomatic and military strategies and practical navigational constraints, which shapes surveillance spatiality:

I send instructions to the boat before it leaves on a mission, with objectives and tasks. [...] I’ve given him his stopover bases, I know he’ll be leaving Noumea on day A, he has to arrive in Suva on day B, so he has so many nautical miles in so much time. Then he tells me if he’ll have [...] 15 hours of leeway. If he has, I’ll say: well, you’d rather do this patrol here. Typically, he’d leave for Ouvéa [an island in New Caledonia], then he’d do a bit of training, then he’d go to Tuvalu, he’d have time to do an exercise with them. [...] Then he’d go via Vanuatu, and all that involves surveillance on his route. [...] After that, he’s on his own wherever he wants to go, unless I tell him to, because in fact my bosses and I [...] check VMS and AIS, we can also ask for satellite photos, and then we can direct them. That’s how it works on the daily basis. (Operation centre officer, Noumea, 16.10.19)

This joint organisation optimises patrol missions to ‘pull all the stops’ of days at sea. Organisation cannot be entirely top-down considering that, at sea, the vessel remains very isolated and the role of the captain, therefore, remains pivotal. Although *D’Entrecasteaux* was recently equipped with a satellite system to communicate with the operations centre, exchanges are limited to emails. The vessel would only receive satellite VMS and AIS information from the centre once a day and not in real-time (Field notes, patrol mission, Dec. 2019). Once offshore, the vessel can only rely on its radio and radar sensors to ‘see’ the sea around it.

The above description of a typical patrol operation demonstrates that one patrol simultaneously assumes several missions, which may require incompatible practices. For instance, the vessel must operate in and out of the national territory. Detecting illegal activities requires the military vessel to remain invisible, e.g. by turning off its AIS signal and adopting unpredictable, erratic and reticular patrolling mobilities, as alluded to regarding the Wallis et Futuna’s illegal fishing policing so that surveillance subjects cannot anticipate and escape its surveillance. MPA surveillance requires patrolling

internal boundaries while sovereign power manifestation and national territory protection privileges ostensible visibility along the EEZ external boundaries. In that case, it is the display of policing capacity rather than the effective collection of surveillance information and production of knowledge that matters the most. The “maritime surveillance mission” may be at odds with the “protection mission” (Operations Centre officer, Noumea, 16.10.19). Additionally, the vessel’s route is subjected to rigid organisational and navigational constraints (e.g. vessels’ speed, fuel and food capacities), favouring more linear trajectories and limited detours. During the mission I joined, the vessel only had two days to move from Noumea to Vanuatu: “We have no choice but to navigate in a straight line at maximum speed”, the captain declared (Field notes, patrol mission, Dec. 2019). Maritime surveillance, in that case, takes place willy-nilly: “It’s a mission of opportunity, really” (AEM officer, Noumea, 14.10.19). Maritime surveillance is a permanent mission but not always the priority of patrol vessels (Field notes, patrol mission, Dec. 2019). However, the sea materiality remains, first and foremost, what shapes patrol mobilities and surveillance possibilities:

Here, you have a lot of sea all the time, a lot of wind. [...] We have small boats, they get shaken up around a lot. [...] If the wind is north-easterly, they wanted to do a mission there, but they know that they won’t see anything with the radar when the sea’s rough. And no one will be fit [because of seasickness], so we may have to redirect them here. The sailor is dependent on the environment, [...] it’s the sea that controls you. (Operations centre officer, Noumea, 16.10.19)

In the following sections, I further analyse the functioning of maritime patrols as boundary apparatuses of maritime surveillance and security and the effects of their ‘ecologisation’, notably by drawing on my personal participation in such a patrol operation.

ii. Military Activities in the New Caledonian EEZ

Trident missions combine maritime surveillance and military protection in the New Caledonian EEZ (Field notes, patrol mission, Dec. 2019). As I joined a patrol involving such a mission, I could read in the Joint Chiefs of Staff’s Trident directive that it should contribute to fisheries and MPA surveillance, drug trafficking combat, deterrence and patterns of life identification: “Any presence in an MPA must be considered suspicious and automatically reported”, along with every foreign fishing vessel, whether fishing or in transit (Field notes, mission order, patrol mission, Dec. 2019).

During that same patrol, these considerations were subordinated to two other missions in the EEZ. The first consisted of transporting military personnel to a New Caledonian island as part of a humanitarian mission. The second was a ‘beach reconnaissance’ operation ahead of a joint ‘Southern Cross’ exercise scheduled for the following year³²² to simulate a natural disaster-related humanitarian

³²² The exercise finally took place in 2023, probably delayed by the Covid-19 epidemic: <https://www.defense.gouv.fr/operations/actualites/fanc-bilan-lexercice-croix-du-sud-2023> (accessed: 20.08.24)

operation. This exercise evidences the growing importance of non-conventional, environment-related activities for the Navy (Bachmann et al., 2014). It is also integral to France's international cooperation, contributes to inter-army³²³ knowledge and practical coordination and helps display and promote the military in the region. Finally, it contributes to the training and maintenance of military skills.

Beach reconnaissance prefigured the exercise to ensure that military vessels could dock on the islands and rescue their populations and, therefore, consisted of hydrographic work. Maritime surveillance and security require access and, therefore, hydrographic surveyance. The French hydrographic service is historically a military institute (see Locher, 2007), now holding a mixed civilian and military status. The army regularly communicates with hydrographic services or embarks hydrographers to “make national territory” (Operations centre officer, Noumea, 16.10.19), i.e. the effective *production* of the territory by improving maritime charts, which remain primarily blank or ‘grey’, i.e. inaccurate. A *D’Entrecasteaux* officer noted with dismay that they sometimes relied on 1893 charts while *Astrolabe* and *D’Entrecasteaux* reef areas remained relatively unknown (Field notes, patrol mission, Dec. 2019). The marine territory is also labile and requires regular updates to account for its continuous hydrographical evolutions.

Hydrographic knowledge conditions the material control of territory. The Navy detected fishers passing through the Chesterfield Reserve yet reported its inability to follow them because the areas had not been mapped. Military vessels would only surround the reserves and stay offshore (SHOM, 2019). In that case, offshore access permitted surveillance but also prevented the policing of fishing vessels escaping surveillance through scale and depth (Peters, 2014b). Following this observation, the hydrographic commission discussed the “need to produce more detailed charts of the Chesterfield islands and reefs” to enable military vessels and *Amborella* to navigate safely. It decided to keep these charts under “restricted distribution” so as “not to encourage navigation” amongst other sea users (SHOM, 2019, p. 3). Environmental, hydrographic knowledge would thus become an instrument of geographical sovereignty (Desbois, 2018), exclusively supporting the territorial ambitions of the French State and New Caledonian Government.

The role of the Navy in ‘making territory’ is also visible as we came closer to the edge of the New Caledonian EEZ and its contested boundary with Vanuatu. The issue, here, is not only one of cartography. Disputed sovereign authority over Matthew and Hunter Islands makes them particularly risky in terms of maritime security. They are, therefore, subject to emphatic surveillance by the French Navy because “we know that we are going to have porous fishing vessels that will voluntarily stray into our EEZ” (AEM officer, Noumea, 14.10.19). This concern is heightened by the growing presence of Chinese fishing vessels in Vanuatu, which “creates concerns for France regarding fishing issues on New

³²³ The associated armies come from Australia, Brunei, Canada, Fiji, France, Germany, Indonesia, Japan, Malaysia, Netherlands, New Zealand, Papua New Guinea, Peru, Philippines, Singapore, Tonga, Vanuatu, United Kingdom, United States.

Caledonia's borders" (Field notes, chief officer, patrol mission, Dec. 2019). The risk exceeds the New Caledonian EEZ, however. For the French State and its army, in-zone presence and surveillance is essential to the defence of its wider marine territory. A *D'Entrecasteaux* officer and an AEM representative explained to me that maintaining claims over Matthew and Hunter were essential to avoid setting a precedent that could lead other parts of the French EEZ to be contested, e.g. around Clipperton or Mayotte (Field notes, patrol mission, Dec. 2019). Hence, the dispute with Vanuatu is not only framed (and managed) as a local stake for New Caledonia but as a national stake involving the French State's broader and world-scattered marine territory. If surveillance is intensified, physical and judicial control is not, however – and may not be the primary objective, as I just suggested. Using the emic definition of "surveillance" as enabling controlling action, a naval officer explained: "There is a 20 nautical strip that is not surveilled around Matthew and Hunter [...]: we are present, but not controlling. In the disputed areas, fishers don't know that the New Caledonian armed forces don't carry out controls; presence alone is enough to deter" (Field notes, MRCC observation, AEM officer, Noumea, 11.10.19) This strategy uses surveillance as an indirect form of control by way of deterrence to bypass blurred regulatory power and the risk of activating inter-state conflicts with Vanuatu.

The increasing importance and diversification of the Navy's environmental missions in New Caledonia's EEZ is evident in other missions. *D'Entrecasteaux*, along with *Amborella* or *Vendémiaire* partake in maritime pollution clean-up, e.g. following the recent grounding of a fishing vessel against the Chesterfields reefs or that of the *Kea Trader* container vessel off the Loyalty Islands. In 2021, an exercise took place around the *D'Entrecasteaux* reefs to test the operational surveillance chain of the Coral Sea Natural Park's reserves.³²⁴ More recently, the army formalised a new mission of 'scientific' environmental surveillance. While the Navy opportunistically contributed to offshore scientific research by transporting researchers or reporting encounters with marine mammals at sea, the 'Bougainville' missions recently saw the day of light. In that frame, *D'Entrecasteaux* started welcoming 'biodiversity officers' sampling the oceanic microbiome during the vessel's patrols. These officers are academic students who undergo military training and, therefore, join the professional corps of the Navy while contributing to other missions at sea. This suggests, once again, the ecologisation of the army rather than the sectoral globalisation of biodiversity concerns (cf. Aykut et al., 2017), whereby the army retains its control and develops its own framing of environmental matters.

iii. Patrolling beyond the EEZ

If, because of New Caledonia's specific context, fisheries are ranked low amongst the many missions of the French Navy, they become much more central as soon as patrol vessels leave the EEZ. Outside

³²⁴ New Caledonian Government website: <https://www.nouvelle-caledonie.gouv.fr/Actualites/Espace-presse/Communiqués-de-presse/2021/Premier-exercice-conjoint-pour-la-surveillance-de-la-frequentation-du-parc-naturel-marin> (accessed: 21.08.24)

the EEZ, the French Navy becomes concerned with two primary missions: bilateral cooperation with the Pacific Islands and regional fisheries policing operations with WCPFC and FFA.

a. The Diplomatic Surveillance of Tuna Fisheries

The patrol mission I joined made us enter Vanuatu's EEZ before going to Fiji, with stopovers in these countries' capital cities. At the moment we crossed the (blurred) New Caledonia-Vanuatu maritime boundary, the mission turned into a 'ZRP [Permanent Responsibility Area] mission'. It aims to strengthen links with "friends", particularly Fiji: "It's more about geopolitical relations and diplomacy than POLPECHE [fisheries policing]", the *D'Entrecasteaux* captain explained (Field notes, patrol mission, Dec. 2019). Regardless, IUU fishing and other environmental issues are at the core of ZRP missions. As 'non-traditional' sectors of maritime security for the Navy, they demand new transnational and inter-agency connections with civil actors to be established:

Before, we only worked army to army, but now we also have to try and contact the Ministries of Environment and so on. It's not always easy to implement this political demand in the field, to reconcile what [French president] Macron wants, what the DGRIS [Directorate of International Relations and Strategy of the Ministry of Defence] recommends and what the EMIA [New Caledonia's Joint Chiefs of Staff] wants. (Field notes, captain, patrol mission, Dec. 2019)

If common professional knowledge and practices may support inter-army connections, connections are more complex to draw in the case of military-civil relations.

The role of the patrols in consolidating cooperation between France and the Pacific Islands is plural. One occurs ashore: "The port calls are also an opportunity to gather intelligence" (Field notes, patrol mission, captain, Dec. 2019). Once we arrived in Suva, the crew held a formal ceremony with the French ambassador, Fiji's authorities and military representatives on board *D'Entrecasteaux* to forge links. The ceremony, which involved civil society, simultaneously advertised the French army. Every time the vessel stops over, it offers free visits of the vessel to the public. During that same stopover, *D'Entrecasteaux*'s chief officers also visited the Fijian maritime surveillance centre to learn about their practices and, above all, poll their needs "to better identify what France could do to extend its sphere of influence" (Field notes, patrol mission, Dec. 2019). Following this visit, the *D'Entrecasteaux* captain confirmed how critical environmental matters (IUU fishing and natural disaster-related humanitarian aid) were to Fiji's government. Environmental security appeared as a strategic and niche political resource for France to stand out from the other nations aiding the Pacific Islands: "The US doesn't care [about the environment], Australia had recent political changes that go against the environmental issue, and China is not yet getting good press on the subject even though it's trying to initiate an environmental policy [...]. Many players are already involved in humanitarian aid, and France needs to identify where it fits in." (Field notes, patrol mission, Dec. 2019). Stopovers are also used to offer joint military exercises to build capacities in the Pacific Islands while simultaneously improving practice

harmonisation and inter-army coordination. In Fiji, the French Navy systematically offers to partake in fisheries policing exercises (Field notes, patrol mission, Dec. 2019).

Patrols also serve to assist the Pacific Islands with at-sea maritime surveillance. As they navigate through their EEZs, the French military vessels report what they see – especially the presence of fishing vessels – to the French Joint Chiefs of Staff, which then circulates this information to the concerned Pacific Island authorities. In effect, it was not until we left New Caledonia’s EEZ to enter Vanuatu’s waters that the *D’Entrecasteaux* crew and I directly saw vessels – longliners – for the first time. Given the immensity of the Pacific Ocean, it is unlikely to detect any vessel by chance (see Figure 60): “Here, when you go out to sea, you don’t come across anything. It’s so weird! When I went to sea, a lot in the Mediterranean Sea, ok, you have watches where you don’t come across anyone, but otherwise you do see boats. Here, you can spend days and days and see nothing.” (Marine officer C., Noumea, 16.10.19). Over the three weeks I was on the vessel across the three EEZs, we only spotted five longliners, in Vanuatu and Fiji. According to the head of operations, this experience is symptomatic of most patrols. It also reflects the predominance of tuna fisheries in offshore spaces, striated by distinct national fisheries policies and regulations: “In New Caledonia, we don’t see any vessel at sea. You see more in Vanuatu, a lot of Chinese fishers, especially in the east. You see more in Vanuatu than in Fiji. Most of the vessels you see in the region are more or less fishing boats. Even the cargo ships: in general, they carry frozen fish” (Field notes, patrol mission, Dec. 2019).



Figure 60: The main view from *D’Entrecasteaux* while patrolling across New Caledonia, Vanuatu and Fiji for three weeks. Picture by the author.

The surveillance of visually empty spaces is challenging. Hence, just like tuna tagging fishers tend to orient their surveillance activities where the presence of fish is certain (cf. Chapter 8), patrols follow

AIS and VMS information or common fishing grounds to at least see something, following a cost-benefit logic:

In fact, the zones are so big! It's not a stupid question, we could say that we go where we don't have AIS. [...] But you're right, SURMAR [maritime surveillance] also means going where there's no one to see if there really is no one. That's more a job for a plane, it's very easy to do in four hours. Using a boat, pfff... I think it also depends a bit on each person's sensitivity. (Operations centre officer, Noumea, 16.10.19)

De-routing the patrol vessel to obtain a direct visual of a radar or radio-detected vessel depends on its distance, the weather conditions and the vessel's identity. Direct surveillance is not systematic. Every evening, the *D'Entrecasteaux* captain updated neighbouring AIS signals before the crew, invariably commenting on fishing vessels' positions.

When sighting a fishing vessel, the crew collects basic information: registration number, flag presence, AIS signal, if the crew is fishing, etc. They cross-reference visual information with the WCPFC register and take pictures. This proximal surveillance remains distant (see Figure 61), and the Navy can only pick up partial information. The head of operations told me that filling in the sighting reports required by the operations centre for all the fishing vessels spotted at sea was difficult because of this unremitting distance (Field notes, patrol mission, Dec. 2019). In Vanuatu's waters, we encountered two longliners whose decks were covered with tents (see Figure 61): "That's new, maybe to hide things?" the watch officer noted before writing it down in the sighting report. Latent suspicion influences the French sailors to interpret every sign as an avoidance strategy. One officer interpreted that another fishing boat was "fleeing" as it resumed moving upon *D'Entrecasteaux*'s arrival. On the radio, we heard clicking sounds akin to Morse code. The watch leader interpreted this as an encrypted language for fishers to communicate with each other near a grey military surveillance boat (Field notes, patrol mission, Dec. 2019).



Figure 61: Photo of a Chinese longliner in Vanuatu waters, taken by the watch leader for the Sighting Report and anonymised by the author (10.12.19). The patrol vessel did not come any closer, and the green tents covered the vessel's bridge, limiting visual observation of the fishers and their doings on deck.

b. Regional Fisheries Police Operations

The Navy's other main mission outside New Caledonia's EEZ is to participate in regional fisheries' policing operations under the aegis of WCPFC or FFA. WCPFC-related policing operations (e.g. Operation Nasse) target the high seas pockets. Patrol vessels go to the high seas pockets to control compliance with the commission's Conservation and Management Measures. These policing operations involve France, Australia, New Zealand, the United States, and, since 2023, Fiji, under the coordination of a joint headquarters. For Operation Nasse 2023, such a Joint Command Centre was set up in Noumea for three weeks, bringing together the French military Operations Centre with AEM, two New Zealand intelligence analysts, two Australian fisheries officers and an American liaison officer.³²⁵ By combining surveillance resources provided by each partner, the patrols report fishing vessel sightings and check for infringements, which they transmit to the flag state and WCPFC. During these operations, the patrol assets fly the WCPFC flag to obtain associated policing authority. Hence, they can access WCPFC's VMS data and have the right to carry out 'compliant boarding' missions on fishing vessels to verify fishing licences, logsheets, VMS boxes, prohibited species, etc. FFA's regional fisheries operations work similarly. This time, however, they occur in FFA members' EEZs under the Kuru Kuru or Rai

³²⁵ French Ministry of Defence website: <https://www.defense.gouv.fr/operations/actualites/fanc-operation-nasse-2022-mettre-pression-peche-illegale> (accessed: 21.08.24)

Balang operations, under FFA's surveillance centre which coordinates the QUAD resources and expertise. These operations occur four times a year and target the areas with the highest fishing intensity while considering navigation conditions (FFA chief officer, Honiara, 21.05.21).

Compliance control operations at sea are challenging and are not systematic. They are only carried out when the weather conditions are good and regional operations are never organised during cyclonic periods, which are too dangerous for boarding as a small vessel must be launched for the military crew to transship from the patrol to the fishing vessel (*La Moqueuse* officer, Suva, 30.06.19). On board, the inspection procedure is lengthy: the whole procedure takes about half a day in general. Fishers do not appreciate what is also a loss of time and money, making relations tense. Hence, vessels over 2,000 tonnes are not boarded "because it would take too long to inspect" (Field notes, patrol missions, Dec. 2019). Exchanges are often complicated because fishers and Navy sailors generally do not speak the same language, which makes document checking all the more difficult (Naval officer O., Suva, 22.06.19). In that case, the boarding team must contact the shore-based operations centre with satellite communication technologies to ask for (delayed) translation: "It's a mess", officer O. concluded. Most checks are only "based on estimates" (*La Moqueuse* officer, Suva, 30.06.19).

France's contribution to the regional police operations permits it to obtain information in the region and, in particular, "free access to the [confidential] VMS" of other countries. This consolidates its extra-territorial surveillance: "We're really happy. It's these little connections, and by aiming very broadly, that enable us to fulfil our mission" (Operations centre officer, Noumea, 16.10.19). France's involvement, however, remains opportunistic, subjected to its Navy's contextual priorities: "It's not our job, we only take part in Kuru Kuru if we're available, it's not our priority" (Field notes, watch leader, patrol mission, Dec. 2019). Again, the French army seeks to retain the full control of its resources:

For Kuru Kuru, I have a guy over there, at the joint command centre. I send a vessel and two Guardian flights. So we offer areas, see if that suits the joint command centre. Once again, it's more a question of coordination *because we have the right to sail where we want*, but it's precisely to coordinate. (Operations centre officer, Noumea, 16.10.19)

Regional patrols are essential to police the South Pacific tuna fisheries but depend on the conditional availability of surveillance infrastructures devoted to other usages. Conversely, France receives partial reciprocal benefits as it is not an FFA member: "FFA refuses to communicate more details about the flows, the analyses they carry out... We have access to the information given before a fisheries control operation. It's an interesting global brief, but on a given area and just at the time of the mission" (AEM officer, Noumea, 14.10.19).

Cooperative struggles also show in France's decision to refuse shipriding agreements, unlike the US or Australia. These agreements involve 'lending' patrolling assets to the Pacific Islands to help them police fishing vessels: e.g., an Australian military vessel and its crew can welcome a foreign fisheries

inspector to inspect and verbalise fishing vessels in the latter's country. France refused to offer this service because its legal framework prohibits "any transfer of sovereignty to the authorities of another State" (Bachelier & Pajon, 2023). Hence, France refuses to have a foreign entity exerting any power on its territory, be it its EEZ or military vessels (Field notes, patrol mission, Dec. 2019). At stake are the specific status of military resources, France's desire to retain sovereign control over those, and the refusal to use the army as a mere technical infrastructure usable by another state authority. Several officers criticised what they saw as an outdated and inefficient approach to maritime security France's diplomatic interests:³²⁶

D'Entrecasteaux was there [in Samoa], they had lunch with the authorities there [...]. They said it was a shame, why doesn't France help us, we're having a hard time, the only people helping us are the Chinese. [...] It's obvious they're not going to come here [in New Caledonia], they don't even have the means to monitor their waters. It's a stupid question of principle. This has to change because it's a shame. It doesn't contribute to our surveillance of the EEZ, but as I was saying, everything is linked, good relations with our neighbours. Your maritime surveillance relations will enable you to better conduct your maritime protection towards actions of opportunity... (Operations centre officer C., Noumea, 16.10.19)

Instead of opposing traditional national policing and external military logics, this interviewee exposes their connection and the necessity to reconcile them by re-problematising the role of the military vessels.

2. 'Ecologising' the Navy's Sailors

The multiplication of the Navy's missions and their ecologisation creates tensions regarding the allocation of limited patrol resources, and it also affects the professional knowledge, practices and identities of its sailors – which, in turn, conditions the effective policing of environmental issues at sea. The ecologisation of the army occurs at several levels, leading the military personnel to reflect on the environmental impact of its practices and manifest their environmental engagement (Palle et al., 2022).

Regarding its environmental impact, Navy sailors must now be careful about onboard waste management. During the beach reconnaissance operation in New Caledonia, *D'Entracasteaux* crew members were particularly attentive not to damage the beaches they berthed. These precautions emerged after a joint military exercise with US and Japan damaged reefs in Guam's MPA, causing a mediatic scandal about the detrimental environmental impact of military activities (Field notes, patrol mission, Dec. 2019): "Before, the military didn't give a damn, but now environmental awareness is much more prevalent in the armed forces" (Naval officer C., Noumea, 14.10.19). Environmental awareness, however, appeared somewhat limited, e.g. despite its increased attention to waste management, the crew continued to dump munitions and bullet casings into the sea after firing drills. None of the

³²⁶ It seems that France recently changed its position on the subject, following the meeting of South Pacific defence ministers at the end of 2023 (<https://www.defense.gouv.fr/actualites/esprit-defense-ndeg10-pacifique-du-sud-changement-climatique-au-coeur-du-spdmm>, accessed: 21.08.24).

D'Entrecasteaux crew had joined the army for environmental reasons, and environmental sensibility was generally low. Most justified their enrolment in the Navy out of love for vessel technology, patriotism, or to have the opportunity to travel around the world (Field notes, patrol mission, Dec. 2019).

Hence, accepting the Navy's environmental mission is not unequivocal, especially considering that if missions multiply, resources do not. A *D'Entrecasteaux* officer declared that "they're not here to deal with the environment or biodiversity" (Officer O., Suva, 22.06.19). One officer shared that she was initially dubious about partaking in the environmental surveillance of the Coral Sea Natural Park's reserves: "At the beginning, I was like: this isn't our job at all, why are we spending money on this? [...] Whatever we use for the environment, that's what we won't use to surveil trafficking, for example" (Operations centre officer, Noumea, 16.10.19). Conceding that "here, you don't want to destroy", she related to the mission through a form of resource patriotism, like the *D'Entrecasteaux* captain proud to "protect our waters, to have such a well-protected lagoon" (Field notes, patrol mission, Dec. 2019). Biodiversity protection resonated with their traditional military interest in defending the national territory.

If humanitarian aid seemed commonly appreciated amongst the *D'Entrecasteaux* crew, fisheries policing missions were more conflicting. One sailor complained that regional fisheries policing operations were lengthy, tiring, with few stopovers – i.e. too 'offshore' and isolating (Field notes, patrol mission, Dec. 2019). A member of the boarding team inspecting fishing vessels was particularly jaded by these operations necessitating to "dress up like a warrior, with the battledress, a bulletproof vest and all the rest" (Field notes, patrol mission, Dec. 2019). Several sailors found that fisheries police was "not their core business" and expressed their reluctance to control and punish fishers who are not the army's traditional 'enemies' (Field notes, patrol mission, Dec. 2019). An officer involved in several Vietnamese Blue Boat arrests spoke about his ethical struggle in arresting "small-scale fishers" with no choice but to come to New Caledonia after being "chased out of their waters by China" to feed their families while another one similarly relucted to arrest enslaved foreign fishers (Field notes, patrol mission, Dec. 2019). As soldiers rather than policemen, they were uneasy to arrest fishers with whom they empathised – raising the question of whose life should ultimately be protected from foreign human lives or 'national' fish. Fisheries policing duties were better accepted by the *D'Entrecasteaux* crew when they targeted "the Chinese who are emptying the oceans", i.e. when they were interpreted through the (more familiar to the army) perspective of geopolitical and inter-state relations. This explains why automatic suspicion against Chinese fishing vessels was particularly palpable amongst the crew – with only the head of operations criticising this negative *a priori* against any Chinese fishing vessel sighted at sea and which may be licensed and legally fishing (Field notes, patrol mission, Dec. 2019).

Environmental missions require the Navy to acquire new skills and, therefore, training. Maritime pollution clean-up operations necessitate knowing how to use special chemicals or nets to catch

pollutants (Field notes, patrol mission, Dec. 2019). The army regularly partakes in maritime pollution, fisheries policing and, more recently, MPA policing exercises to acquire and maintain such skills. All of this (im)mobilises a patrol vessel and prevents it from fulfilling other missions: “We’re going to supplement that with SURMAR [maritime surveillance], but yes, that comes at a cost”, an officer conceded when referring to an upcoming maritime pollution exercise for *D’Entrecasteaux* in Wallis and Futuna. Fisheries policing is the most challenging skill for the Navy to develop contrary, e.g. to the surveillance of integral reserves, which only requires detecting (forbidden) presence (Field notes, patrol mission, captain, Dec. 2019). Training was largely *ad hoc* and self-made, suggesting the limited formal incorporation and prioritisation of these missions in the French Navy.³²⁷ *D’Entrecasteaux* members had a relatively unclear understanding of the region’s complex governance and management of tuna fisheries, involving several levels and many management institutions. One sailor did not know of WCPFC; another sailor explained that there was no fisheries expert on board and that they would struggle identifying fish when inspecting a fishing vessel.³²⁸ The head operations officer hoped that I could enlighten them on the sector and its regulations (Field notes, patrol mission, Dec. 2019). The acquisition of these skills is complicated by the fact that French sailors are first trained in metropolitan France, i.e. in an entirely different marine environment. Hence, sailors stumble against the eminently *place-based* characteristic of environmental issues like fisheries: they are not familiar with tuna fish and longline fishing which are “relatively unknown in metropolitan France”.³²⁹ Despite more than 20 years in the Navy including “policing fisheries”, an officer confirmed that he was “not a specialist” and shared his difficulties in learning local regulations and fish species identification with every posting change (*La Moqueuse* officer, Suva, 30.06.19). In an attempt to consolidate the French Navy’s skills (confirming the strategic importance now granted to the fisheries police), AEM and the army provided training to the sailors in partnership with the New Caledonian domestic fleet, again supporting the development of environmental coercive surveillance capacities: “We are working with the army to carry out trials, so we have put the boats on display [...]: they are also training to go on board (Manager of fishing company P., Noumea, 02.11.21).

Acquiring and *maintaining* these skills, in the long run, is challenged by the high professional mobility characterising naval professions and the high turnover of New Caledonia-based armed forces. Sailors remain in posts for 2-4 years only. This strategy enables the naval workforce to be versatile and

³²⁷ On the contrary, *D’Entrecasteaux* officers suggested that Australians were much better trained regarding fisheries policing, attesting to different national military strategies and showing the more external and distant position of the French (and mostly metropolitan) army compared to an Oceanian Navy.

³²⁸ The Fijian army reported the same problem. Consequently, WWF and SPC produced a marine species identification manual to support the Navy when inspecting fishing vessels (WWF, Facebook post, 24.02.21).

³²⁹ Coral Sea Natural Park website: <https://mer-de-corail.gouv.nc/fr/actualites/21-12-2021/la-collaboration-entre-le-parc-naturel-de-la-mer-de-corail-et-la-marine> (accessed: 21.08.24)

adaptable precisely by developing a rigid (human) infrastructure, i.e. by tightly framing professional practices to erase individualities and developing a quasi-machinic approach to labour:

It's quite formalised, particularly for the operational management of resources. [...] The advantage of having military resources is that it's very structured. [...] It's standardised, things are not called into question just because someone new is about to arrive. The principle is that no one is indispensable to be resilient [...]. The idea is to have a minimum level of knowledge to ensure continuity. (Naval officer J., Noumea, 14.10.19).

This infrastructure remains fragile, however. An officer explained that France struggled to recruit sailors and lowered its standards, therefore relying on “less and less passionate” people (Field notes, patrol mission, Dec. 2019). The high turnover prevents the development of skills more eminently localised, e.g. for fisheries: “Boats have short memories because there is a high turnover of staff” (AEM officer, Noumea, 14.10.19).

Another challenge for the New Caledonia-based naval forces is the maintenance of their skills and vigilance in a context where security issues remain scarce, and signals are weak and intermittent – i.e. the maintenance of their abilities when what they are meant to manage is absent, rare and uncertain. An officer reported visiting only six fishing vessels over the two years he had spent in New Caledonia. After six months in the territory, the *D'Entrasteaux* head operations officer, also head of the boarding and inspection team, had not yet partaken in any fisheries policing operation (Field notes, patrol mission, Dec. 2019). Remaining vigilant at sea with days spent without detecting any human trace is difficult, too, and requires tolerating to wait (Doré & Barbier, 2015). Over a night watch, I could witness the *D'Entrecasteaux* Chief Officer taking advantage of this time to complete his administrative work instead of watching outside, raising his head only when the radar emitted a signal (Field notes, patrol mission, Dec. 2019). This explains why sailors devote so much effort into maintenance work, not only of the vessel (cf. Section I.1) but also of their skills. On board *D'Entrecasteaux*, I could witness the daily efforts put into completing fire drills, emergency evacuation simulations, firing exercises, etc., in complement to the repeated missions devoted explicitly to training and exercises. Several sailors found these aspects somewhat dull. Observing a shooting drill, I noted that these skill maintenance activities only partially met their objective: many crew members were reluctant to shoot and missed the target. This contributed to – at least partly – consolidating the crew's interest in environmental missions and finding justification for their presence and work in the region. One officer declared that he found fisheries policing operations at least more valuable than this training. Reading IUU fishing through and incorporating the issue in geopolitical and ‘hard’ security issues regarding the Indo-Pacific axis can also be interpreted as a discursive strategy to maintain vigilance and alertness by the permanent anticipation of an imminent and looming military crisis (Doré & Barbier, 2015).

3. Distributed State ‘Coercive’ Surveillance: Surveilling Without Power

Besides the professional challenges of involving the Navy in environmental security missions, a main constraint deriving from the opportunistic reliance on the military infrastructure is the disjunction it entails between political-legal power and surveillance capacities, i.e. between regulatory and enforcement authorities, held by various agencies, and the technical-practical exercise of surveillance and action at sea delegated to the Navy. This limits the capacity of surveillance to effectively result into any action and reflects unremitting tensions within the coercive surveillance assemblage. Hence, while the French Navy supports the New Caledonian Government in surveilling the Coral Sea Natural Park’s marine reserves, it can only serve as an observer and report to SPNMCP as it has no enforcement power concerning these environmental regulations. Joint surveillance is limited by the remaining partitioning of regulatory authorities amongst jurisdictions: “There’s an ongoing dialogue with the AEM office because typically we can see that there’s an AIS track in a given place, but we don’t know whether it’s authorised or not. Hence the dialogue. Then AEM calls Maritime Affairs [and the Government’s fisheries service]. You know, it’s very particular here, *and it’s not practical at all*. (Operations centre officer, Noumea, 16.10.19). For that interviewee, it makes the approach: “It’s also a weakness because operational control is not taken over by the body that decides on mission strategy”.

Likewise, surveillance assistance provided by the French patrol vessels to the neighbouring Pacific Islands when they navigate across their waters does not necessarily result in control operations. Again, the French Navy lacks enforcement power and is not authorised to board fishing vessels outside the French EEZ. It can only question fishing vessels by radio; boarding depends on the national authorities’ approval. A *D’Entrecasteaux* officer reported that Pacific Islands were “often happy to receive such a proposal” from the French Navy (Field notes, patrol mission, Dec. 2019). However, the process implies a lengthy chain of command, complicated by the technical challenges of offshore communications, which burdens every party. This forces patrol and fishing vessels to remain immobile at sea for long hours, making the cost of an inspection prohibitive. As we spotted a fishing vessel in Vanuatu not emitting AIS, the *D’Entrecasteaux* watch commander pointed out that “it’s too late to consider a visit: by the time we get the authorisations, etc. it will be dark, and we don’t do visits at night” (Field notes, patrol mission, Dec. 2019). Even if the French Navy eventually obtains the authorisation to board a vessel in a Pacific Island’s EEZ, it is not allowed to sanction and can only ‘observe’ and report: “We won’t be able to take any action, make any seizures or do anything” (*D’Entrecasteaux*’s officer O., Suva, 22.06.19).³³⁰

This dissociation also poses a knowledge problem. If some countries provide France with the list of fishing vessels licensed to fish in their waters, permitting to identify illegal activities, this is not always

³³⁰ Conversely, in New Caledonia’s EEZ, the Navy has the power to seize catches, take control of the boat to bring it back to port, and detain the fishing crew in the *D’Entrecasteaux* retention room (Field notes, patrol mission, Dec. 2019).

the case. The *D'Entrecasteaux*'s head of operations showed me Tuvalu's national register: "It's really cool of them to give us this; Vanuatu would never give us their list, for example" (Field notes, boarding, Dec. 2019). Without such knowledge, the French Navy can only report the presence and identity of the fishing boat, without knowing whether it is illegal or not. This lack of transparency on the part of the fishing authorities is also criticised by other surveillance stakeholders, such as this representative of the NGO Global Fishing Watch, who sees it as a central limitation to the proper functioning of surveillance - which would also be distributed and delegated to the fishermen:

I think there should be more transparency in the management of the fisheries. Even now, you can't access the list of licenses that are allowed to fish in an EEZ. Sometimes when we see a boat, we don't know if they have a license to fish there or not. In terms of surveillance, if you have more transparency in the fishery, we can have more voluntary compliance by the industry as well. In that way, it's natural; like if I pay to fish here and then I see you fish here, I'll definitely report you to the authorities. (Global Fishing Watch representative, Suva, 05.10.21)

While some Pacific Islands are willing to receive support in terms of surveillance, they nevertheless want to retain their sovereignty – by keeping the regulatory dimensions of their fisheries secret.

The dissociation between surveillance and enforcement may lead to costly errors. A representative of the Fijian tuna industry recounted the interception of a Fijian fishing vessel by the French Navy in the high seas that was brought back to port because it detained non-tuna species onboard like swordfish when the French navy thought that its fishing license only authorised it to have tuna fish onboard:

This incident stems from poor communication between the Ministry of Fisheries and foreign patrols, because all fishers have these species on board, they never only have tuna. [...] Usually, Australian, New Zealand patrol boats, they know that, they would not have called on this vessel. [...] And when the boat did come back to port, the Ministry of Fisheries said that nothing was wrong. It was a mistake, but a huge cost... (Fiji Fishing Industry Association representative, Suva, 25.06.19)

Hence, the costs (including commercial ones) of policing operations on the surveillance subject also weigh on the Navy's propensity to conduct controls.

The Navy's capacity to use force to exert its authority is also highly constrained. Hence, the Navy is mostly reliant on the vessel agreeing to comply with inspection: "In the end, we don't have many means of arresting someone", *D'Entrecasteaux*'s captain concluded after detailing the lengthy chain of command to obtain the right to shoot at a vessel (Field notes, patrol mission, Dec. 2019). Finally, the judicial segment of 'coercion' and law enforcement also comprises many weaknesses. Fisheries policing operations do not always end in a court of justice, especially when the offence involves several countries and WCPFC – which eventually questions the relevance of focusing efforts mostly on offshore surveillance developments.

Conclusion

The Navy is one of the rare entities capable of *accessing* offshore spaces. This grants it an infrastructural role in coercive surveillance, whereby state actors delegate it multiple and diversifying missions expanding beyond its historical military mandate. The transformation of the Navy into a boundary apparatus attests to the diversification of security issues at sea – propelled, in particular, by environmental issues and regulations – but also derives from a logic of rational organisation, i.e. from a pragmatic answer to the financial, technical and practical challenges of surveilling, enforcing regulations and ordering the remote, vast and porous offshore spaces. Increasingly, military institutions integrate “policing modes of operations, through techniques such as patrolling, the production of liberalised space, the focus on enabling circulation, surveillance, monitoring and management of movement, the securing of order and the prevention of risk” (Bachmann et al., 2014, p. xix).

Relying on (sometimes distant or foreign) armies to police fisheries or MPAs or offer humanitarian aid to populations in the event of ‘natural’ catastrophes participates in their ecologisation and raises new organisational, cognitive and practical challenges for military professionals and the organisation of at-sea operations, increasingly hinging on risk-based approaches and intelligence-led policing interventions. The implication of the army in these ‘more-than-military’ missions remains, to a certain extent, more opportunistic and fragile, subject to its conventional military objectives of defending the national territory, projecting sea power and supporting diplomatic strategies. Hence, instead of ‘surrendering’ to these new civilian missions, the army rather inputs new ways of problematising environmental issues to incorporate them while retaining its oceanic vision and ways of doing: the ‘ecologisation’ of the Navy does not imply its ‘demilitarisation’. In particular, the protection of the environment becomes a matter of territory defence and a geopolitical instrument, while maritime surveillance and coercive intervention are projected beyond national boundaries. These rapprochements result in a transnational and cross-jurisdictional maritime understanding of security (Bueger et al., 2019). Against the rigidity of coercive surveillance infrastructures, maritime security framing and practices become fluid, making the boundaries between external and internal security, civilian and military actors, and sectors more porous. These rapprochements, however, remain limited and complicated by frictional claims over and framings regarding the offshore world. The ensuing decorrelation of political-legal power and technical-practical action at sea renders coercive capacities more uncertain.

Maritime surveillance and security involve an increasing number of actors, including non-state ones. However, the state, through its army –at least for those states which have one – remain central in these developments: this explains the contemporary resumption of military considerations around the Indo-Pacific narrative, whereby “maritime security is increasingly seen as an inter-state problem that needs to be addressed by military instrument and a naval build up, instead of a (civil) maritime law enforcement issue” (Bueger & Mallin, 2022, p. 4).

General Conclusion

In June 2025, France and Costa Rica will co-host the Third United Nations Conference on the Oceans to implement Sustainable Development Goal 14, aiming for the conservation and sustainable use of the oceans and their resources. The conference will address several fronts ranging from conserving high seas biodiversity to addressing plastic pollution or illegal fishing while enabling the development of a ‘Blue Economy’. Ahead of that event, French President E. Macron proclaimed the ‘Year of the Sea’, attesting to the prevalence of national and global oceans-related agendas. While he pushed forward climate and biodiversity matters, critics pointed to the continuation of French and European policies running counter to environmental preoccupations and supporting instead economic and geopolitical issues in a context where inter-state and military tensions intensify, especially in the South China Sea.³³¹

In parallel, socio-political and ethical considerations about the propagation of surveillance in contemporary societies remain omnipresent. The 2024 Olympic Games in Paris has significantly and invisibly accelerated the ‘algorithmic surveillance’ of the city’s public spaces, currently in trial – while it is already widespread in China.³³² The management of the Covid-19 pandemic has, more than ever, raised the question of the ‘right’ degree of surveillance to protect people from a sanitary risk and their individual liberties all at once.

At the intersection of these contemporary concerns, this thesis examined how surveillance affects the ocean and is affected by it in return to shed some light on each of these dimensions. This research examined the reasons for offshore surveillance deployment on tuna fisheries and its evolution. It explored the links between surveillance, state, territory and (human and animal) populations by interrogating how surveillance shapes the territorialisation of offshore spaces, increasingly reconceptualised as more-than-human environments and characterised by their vastness, distance, lability and poor accessibility. Through this lens, the thesis contributes to more general inquiries into surveillance as a social phenomenon, human-ocean relations and offshore spaces specificities.

Influenced by the environmental humanities, critical geography, science and technology studies and surveillance studies, this research displaced the study of surveillance to its political *and* practical dimensions and *beyond* any thematic compartmentalisation. I did not *a priori* narrow surveillance to a territorialisation instrument, a policing instrument of social control or an instrument of environmental monitoring. Instead, my goal was to unravel these rather ordinary classifications of surveillance. Hence, I conjointly examined similar data collection and uncertainty management practices developed by state administrations, but also by fisher individuals, companies, scientists, non-governmental organisations, search and rescue centres, etc. and targeting both the ‘social’ and ‘natural’ dimensions of offshore fisheries and environments. Overcoming these categories aimed to interrogate their boundaries and

³³¹ E.g. see this article in *Le Monde*: https://www.lemonde.fr/idees/article/2024/01/12/emmanuel-macron-et-l-avenir-des-oceans-entre-ambitions-et-realites_6210389_3232.html (accessed: 15.10.24)

³³² E.g. see this article by Amnesty International: <https://www.amnesty.fr/liberte-d-expression/actualites/pourquoi-la-videosurveillance-algorithmique-pose-probleme-cameras-technologies> (accessed: 15.10.24).

construction and discuss similarities and/or differences between these forms of surveillance. Going beyond a mere comparison, this research suggests their entanglement as a condition of their existence.

I. Surveillance as a Territorialisation Instrument

By historicising offshore surveillance deployment in relation to the Pacific Islands states' construction, this work resonates with anthropologist J. Scott's enquiry regarding governmental expansion into 'peripheral' and 'extra-state' spaces (Scott, 2009).³³³ As he described the resistance of Southeast Asia mountains and their people to be incorporated into nation-states, J. Scott suggested that some environments may facilitate the construction of political fugitiveness and evasion and make territorialisation particularly challenging. He hypothesised that a similar statement could be made for the sea – and I suggest that further comparisons with deserts, subsoils or extra-terrestrial spaces would be worth pursuing. While geographer B. Trouillet argued that contemporary practices of surveillance and marine spatial planning ultimately make the sea a banal geographical space (Trouillet, 2006), my investigation, looking further offshore, converges toward J. Scott's thesis and supports an emerging literature which contrarily emphasises the specificities of offshore spaces and suggest that they constitute worlds apart (e.g. Parrain, 2010; Anderson & Peters, 2014; Legroux, 2024).

When the Pacific Islands turned toward offshore spaces and fish to support their political and economic development, they laid territorial claims to appropriate those and projected surveillance practices to enforce these claims. As explained in chapters 5 and 6, surveillance resembled a state-making necessity more than a "high modernism" ideology (Scott, 1998, p.4). Surveillance progressed through apparatuses designed to measure available resources, administer their exploitation to guarantee optimised and sustained economic revenues while protecting them and the marine environment, control human mobilities and activities and, therefore, materialise new offshore maritime boundaries. Surveillance served different facets of territory-making to order it. It necessitated surveilling both humans and non-humans, as populations, to understand and measure the territory, regulate it and enforce those rules.

However, as described in the second part of this dissertation, territorialisation and the incorporation of offshore spaces in the coastal states stumbled against the legal oceanic framework, the political-economic structure of the tuna fishing industry and the material characteristics of offshore environments, making such endeavour eminently complex. The thesis provided extensive evidence of how other-than-humans' behaviour, including that of mobile water and fish, conditioned surveillance practices, spatialities and temporalities. It suggested that offshore fish like tunas largely continue to escape

³³³ Unlike J. Scott's case study, which critically portrays state expansion as a process of domination over 'anarchist' populations, my case study describes another process of power relation. For the Pacific Islands and their populations, asserting their state sovereignty and claiming territorial rights over their adjacent marine waters was instrumental not so much to subjectify local populations than to exclude former colonial powers from the offshore fishing grounds.

surveillance efforts, reminiscing the ‘furtives’, those characters escaping a Deleuzian society of control imagined by writer A. Damasio (Damasio, 2019).³³⁴

While surveillance is often attached to large bureaucracies (state or private ones) capable of conducting the extensive work it requires, offshore environmental surveillance appears too big of an undertaking for any single player, state or otherwise. The Pacific Islands’ surveillance ambitions far exceeded their capabilities and required them to “improvise” (Scott, 1998). This resulted in the adoption of *fluid* surveillance strategies and practices to adapt to offshore constraints. As suggested by philosopher M. Serres, drawing on his personal naval experience, the sea requires “you [to] learn to think fuzzily. The sea is not solid, it is fluid” (Serres, 2017, p.12). Fluid surveillance consisted of pooling limited resources, such as the very costly nautical technologies of access and surveillance, and *opportunistically* ‘pulling out all the stops’ to circumvent rigid infrastructural constraints and accommodate the marine environment’s own fluidity.

As a result, offshore environmental surveillance is *distributed* among several actors, *including its surveillance subjects*. It hinges on infrastructures over which the Pacific Island authorities have only partial control and which serve several functions – not only of surveillance but also of circulation and (e.g. fishing or military) action. Instead of simplifying surveillance to a dialectic between the imposition of power by surveillants and resistance or evasion by the surveillance subjects, the thesis emphasised surveillance as *co-produced*. This observation finds power relations to be more complex and less unbalanced, although it does not deny the existence of power imbalances. The co-production of surveillance suggests that resistance to surveillance can admittedly consist of escaping surveillance but also contributing to it. Partaking in surveillance activities permit surveillance subjects to influence what and how surveillance data are produced or the exactness of such data. These findings supplement research interested in showing how surveillance, quantification or mapping techniques can be re-routed: instead of being conceived as, roughly saying, ‘top-down’ instruments of control and domination, they can become ‘bottom-up’ instruments of evasion, contestation or emancipation – for better or for worse³³⁵ (e.g. Whitney & Kiechle, 2017; Noucher, 2017; Boullier & Henry, 2022). States’ dependence on surveillance subjects results in the further (vertical) propagation of surveillance with the development of what I have called ‘meta-surveillance’ mechanisms (e.g. chapters 5 and 7) to control the delegation of surveillance.

One dimension of fluid surveillance resided in blurring certain boundaries precisely to enable the establishment of the Exclusive Economic Zone maritime boundaries. Surveillance and EEZ bordering

³³⁴ In the novel, the furtives are some rare entities capable of escaping the omnipresent surveillance of large companies by hiding in their environment. Just like tunas can hardly be seen and studied alive, furtives ‘freeze’ when they are seen and reach a state preventing their study.

³³⁵ For instance, these techniques can be used to surveil state authorities and improve political transparency but they can also be used by companies to evade state regulation or tax policies.

became possible by making the boundaries between surveillance agent and subject, the military and the police, or science and fishing more porous – notably to capture the surveillance capacities of the few actors capable of accessing offshore spaces. Jurisdictional boundaries, too, are reworked to facilitate the coordination between the various administrations of a fragmented state entity and improve its action capacity at sea. Surveillance practices also diffused through national boundaries to encompass transnational and reticular flows of more-than-human entities, again to consolidate maritime boundaries.

As a territorialisation instrument, offshore surveillance did not allow the Pacific Islands to transpose modern state conceptions of territory from land to offshore spaces. Instead, territorialisation was *refracted* by its encounter with the offshore environment and its specific properties, resulting in an original configuration between the state, the territory, the (more-than-human) populations and instruments of surveillance and control, combining both area-based and reticular logics. The EEZ embodies a territory ‘diminished’ to certain functionalities, with more porous boundaries than on land. If states only have a limited ability to contain flows across the EEZs and depend on non-state and foreign players to exert their sovereign rights over these offshore spaces, their authority, surveillance and security practices may concomitantly overflow their jurisdictional boundaries. Although offshore environmental surveillance only imperfectly served marine territorialisation, it was nonetheless conditional. Hence, the creation of offshore Marine Protected Areas (MPAs) and conservation territories at sea is noticeably constrained by the lack of surveillance capacities and the dependence of these territorial endeavours on surveillance instruments mainly provided by the actors they seek to exclude, i.e. the fishing industry. This situation resonates with some of the dynamics observed during the EEZ creation, in which coastal states depended on surveillance capacities mainly provided by foreign fishing nations and fleets.

While this research confirms the need to move away from overly narrow and stabilised definitions of territory and sovereignty to understand them as emergent and produced, it also supports certain scholars’ arguments finding states to remain influential actors in ocean governance (e.g. Till, 2013). Hence, although state expansion capacity at sea is limited, offshore spaces significantly remain under the influence of state actors. Regional fisheries management organisations retain state authorities, especially in the Western and Central Pacific Ocean, where consensus is necessary to adopt a conservation and management measure. The regionalist strategies developed by several Pacific Island states consolidated their authority as sovereign states rather than attenuating it. Surveillance apparatuses may rely on non-state or foreign actors, but the information they produce is most often controlled by nation-states, which assert their control of the sea by attempting to control its associated data. Most visibly, military navies constitute one of the few infrastructures capable of surveilling and intervening at sea and, therefore, influencing ideas and practices regarding offshore worlds. States vested with navies continue to possess significant power in ocean governance.

II. The Coexistence of Multiple Surveillances as a Condition of Offshore Surveillance Existence

The Pacific Islands do not have the internal and autonomous offshore surveillance capacities they aspire to. A fluid approach to surveillance results in the development of *multipotent* surveillance apparatuses capable of serving several functions at once, following an organisational rationalisation logic. For the Pacific Islands, this meant designing apparatuses that could, for instance, fulfil both stock assessment and compliance control, as I have shown with the fisheries observer programmes and the logsheets. These apparatuses also serve other actors' interests, especially those whose work is necessary to the apparatuses' functioning – such as the fishing industry. Reusing the same example, logsheet data and, to a lesser extent, fisheries observer data can also serve the commercial interests of the fishing companies to rationalise their activities or certify their practices as environmentally sustainable.

The thesis showed that, more often than not, surveillance data were not always purposely designed to be multipotent. They could also opportunistically be made as such and be mobilised for purposes they were not initially planned for, as I have shown in Chapter 8 with the development of ecosystem models. Hence, I chose the term 'multipotent' to emphasise this potential. This multipotency can become an object of management in its own right: Chapter 5 evidenced the boundary work to demarcate the 'scientific' surveillance of tuna stocks from the 'regulatory' and 'coercive' surveillance of fishers because foreign fishing nations objected to this multipotency. This observation reflects some genericity between various forms of surveillance which can ultimately use similar information, although for distinct purposes. This confirms the relevance of approaching surveillance in practice and in an agnostic fashion rather than with pre-assigned ideas on its functions and effects. These findings resonate with sociologist F. Castagnino's refutation of any determinism between a form of surveillance and a form of power (Castagnino, 2017). Surveillance is relational: as he argued, what matters is its combination with specific interests. The development of surveillance is neither 'good' nor 'bad' in itself and should not be considered as a standalone phenomenon since it does not presage its use and, therefore, its effects.

This thesis pushes these considerations further. In my case study, offshore surveillance explicitly serves multiple ends – and can, therefore, only be understood by considering these various forms of surveillance altogether. The multipotent apparatuses it hinges on are *shared* between various actors to pursue several, sometimes overlapping and sometimes antagonist, objectives that I have loosely categorised as 'scientific', 'regulatory', 'coercive', 'commercial' or 'protective'. This configuration constitutes *boundary surveillance apparatuses and infrastructures* that bring together different collectives with specific visions and investments in the oceans and their surveillance. Hence, different forms of surveillance may co-exist within these apparatuses and infrastructures, which can also serve functions other than surveillance. Going one step further, my results suggest that *their coexistence is precisely what conditions the possibility of offshore surveillance*, which would otherwise remain too

complex for one actor alone. Hence, instead of witnessing the spread of uniform surveillance across multiplying apparatuses, as regularly suggested in the surveillance scholarship, my research provides evidence of multiplying forms of surveillance that tend to aggregate within common apparatuses to enable and consolidate their respective existence. Following F. Castagnino (2017), surveillance must be assessed against the interests it serves. In the rest of this conclusion, I reflect on what happens when, as in my case study, surveillance serves multiple interests simultaneously.

These boundary apparatuses articulate a broader, complex and relatively fragile *surveillance assemblage*, whose components must constantly be held and maintained together. What triggers these multiplying forms of surveillance and enables their (precarious) entanglement? In other words, what motivates and permits the deployment and convergence of surveillance efforts? In his joint study of safety-oriented and security-oriented railway surveillance, F. Castagnino hypothesised that surveillance may be more acceptable when it relates to safety considerations. The contribution of offshore surveillance to maritime safety and the expanded redefinition of maritime security evoked in Chapter 9 have been selling points in expanding the reach of offshore surveillance. More than a mere instrument of social control, offshore surveillance appears to progress to provide some form of insurance and protection, or even protectionism, in a particularly hazardous marine and globalised world. Still, surveillance is deployed to protect sea people and other-than-human lives from a dangerous/endangered environment, fishing companies from bankruptcy and foreign competition or states from disorder and criticism. In that context, surveillance emerges, although to varying degrees, as a solution to organisational challenges exacerbated by the specific features of offshore worlds and identified as sources of uncertainty and insecurity. However, as I have suggested regarding fisheries observers, surveillance expansion may also produce new insecurities – a phenomenon deserving further investigation and discussion on whose protection matters. Protection, thus, must be understood broadly; it encompasses but also exceeds risk-management and is subject to biases and power disputes.

Maintaining the heterogeneous surveillance assemblage is an unremitting challenge. Chapter 7, in particular, highlighted the problematic interestment and enrolment work this process requires and described how it would, at times, fail to establish ‘awkward’ coalitions between actors with divergent interests and needs of protection. If surveillance does not determine a specific type of power, it remains intertwined in disputes over *informational governance* (see Toonen, 2013), whereby information becomes a primary resource – a view also developed by the contemporary scholarship on platform capitalism. Surveillance apparatuses and the information they produce constitute a – rare and disputed – resource that different collectives attempt to dominate. These power struggles regularly call into question the possibility of shared and multipotent boundary apparatuses and demonstrate their fragility.

This thesis, therefore, departs from the idea of ‘liquid’ surveillance (Bauman & Lyon, 2013) and other discourses of surveillance scholars invoking, as a marker of contemporary societies, the arrival of surveillance spreading into the smallest spaces and interstices of life, with ever lesser efforts thanks to more robust and remote technologies. In contrast to the image of liquid surveillance knowing no boundary (an image metaphorically reinforced in a marine context), this thesis has described the many frictions offshore surveillance must overcome to exist: deploying offshore surveillance is, by no means, a smooth undertaking. Even more so, its development, at the crossroads of plural interests, permits its existence as much as it thwarts its reach. This is why I privileged the term ‘fluid’ to emphasise the adaptive and opportunistic more than the totalising nature of offshore surveillance against multiple constraints.

III. Revisiting Surveillance and Knowledge Relations: a Tool for Ignorance and Inaction?

Ensuring the coexistence of different forms of surveillance within shared boundary apparatuses is eminently *frictional*. Interests can be antagonistic and different approaches to surveillance may raise incompatible epistemic standards. Thus, tuna stock assessment scientists preferred ‘invisible’ surveillance practices that do not influence the phenomenon they wish to observe, in contrast to policing practices, which may sometimes opt for visibility as part of a (more cost-efficient) deterrence strategy. Scientists privileged synoptic visualisation strategies to cover the Pacific Ocean and obtain a representative view of offshore spaces and fisheries. Comparatively, fishing companies preferred to see less but in more detail. They privileged an oligoptic vision permitting the individual surveillance of fishing vessels, captains and fish to control their employees, improve their productivity or market ‘traceable’ products. In the case of onboard fisheries observers, it is precisely because they embody both a ‘scientific’ and ‘coercive’ form of surveillance that their surveillance capacity is undermined. Hence, although these intertwined surveillances allow each other to exist, they also impede each other. Relying on boundary surveillance apparatuses enables the development of surveillance while simultaneously leading to the *production of (in)voluntary and organisational ignorance*, as I have shown in Chapters 7 to 9. Surveillance limitations do not only derive from resistance or evasion strategies opposed by surveillance subjects. They also stem from the very organisation of surveillance, which, because it serves multiple functions, results in compromises that undermine its ability to fulfil them.

Throughout this research, I have approached surveillance as a data-collecting practice supporting knowledge production and uncertainty reduction and management. My empirical findings prompt a more critical discussion of the links between surveillance and knowledge. As I have suggested, surveillance may be deployed for its own sake, regardless of the knowledge it permits to produce. It can also prevent the development and stabilisation of knowledge of offshore worlds. One reason for developing offshore surveillance was the development of a *surveillance economy* as a new development

sector. Offshore surveillance is not only an instrument underpinning the sound development of a Blue Economy but is also identified as a fully-fledged player in this blue growth. For the Pacific Island authorities, fisheries observer programmes admittedly improved the surveillance of the tuna fisheries but also primarily helped raise employment. These aspects weigh heavily on surveillance developments, resulting in a curbed rather than linear trajectory. In the observer example, the labour dimension of surveillance hindered the adoption of surveillance cameras which, if they could improve data collection and surveillance efficiency, also imperilled local employment. In that case, surveillance does not necessarily seek to improve cognitive capacity. The framing of surveillance as an economic activity may clash with the framing of surveillance as an instrument to secure blue growth's environment.

In other cases, the *spectacularisation* of surveillance matters more than effectively collecting and utilising information to produce knowledge. Dissuasive strategies to deter 'misconducts' reverse the visibility regime: instead of making surveillance subjects visible, the spectacularisation of surveillance helps make surveillance agents visible to the former. Such strategy is more concerned with showing that knowing is possible than with effectively knowing. Displaying surveillance efforts may also serve reputational and strategic purposes. States have a stake in showing off their surveillance activities to the regional fisheries management organisations and the international community regardless of the accuracy and effective use of the information they collect. Hence, a country like Fiji built the reputation of having a solid surveillance system for its fishing fleet. However, there is little transparency (and much criticism) about this information and how it is used. Surveillance existence becomes a token for effective management. This is even more striking regarding environmental certifications. Chapter 7 demonstrated that the existence of surveillance was used as a guarantee of 'sustainable' management. Certifying actors controlled the existence of surveillance instead of proving the real sustainability of the fishing practices. Eventually, certification and its associated surveillance create additional economic value more than knowledge of the oceans and their fisheries.

In chapter 8, I have outlined other reasons for which surveillance may not necessarily aim to improve knowledge. I described that stock assessment models were retained despite their incapacity to be accurate. The surveillance of tuna stocks privileged time consistency and the construction of a common language enabling the collective organisation of different states and fisheries managers over knowledge exactitude – to the detriment of fish stock and offshore ecosystem conservation. My results also tie in with work showing how surveillance may impede political action (e.g. Mirer, 2003; Braverman, 2017). Instead of reducing uncertainty, surveillance may make it more visible and justify inaction under the pretext that not enough is known and, therefore, more surveillance is needed. Surveillance makes 'noise' in order to know less and control less.

IV. Surveillance Diversification, Exclusionary Infrastructures

Contrary to the claims of many techno-optimists, offshore surveillance falls short of reaching a panoptic ideal. Surveillance apparatuses remain largely patchy and lacunar, which results in proliferating surveillance apparatuses to provide complementary oceanic gazes. Rather than a surveillance progressively encompassing everything everywhere *à la* Big Brother, integrating these different visions into a more comprehensive one remains a hurdle.

To begin with, some of my results mitigate the technological ‘revolution’ which many surveillance scholars have identified as a cause of surveillance development. Although the ocean tends to be portrayed as a domain where progress in surveillance technologies is particularly pivotal, I have shown that surveillance efforts, extensive as they may be, remain relatively ‘low technology’. The use of drones, artificial intelligence, satellite imaging or even surveillance cameras remains embryonic despite supporting an economics of technoscientific promises. For many surveillance practitioners I interviewed, however, offshore surveillance underwent incremental improvements in a pre-existing frame more than a ‘revolution’. My research exhibits various hindrances to the adoption of technological innovations other than their cost or technological ‘immaturity’. I showed cases of techno-phobia or ‘techno-doubt’ amongst some fishers with other epistemic standards. As I have mentioned regarding fisheries observers, some feared that technologies could imperil their job or induce professional transformations that were not desired – e.g. becoming a ‘dry’, desk-based observer distant from ‘sea-work’. Because these technologies also require specific expertise, certain actors preferred to do without rather than become dependent on external experts. My empirical observations of fishing companies also suggest that the ‘culture of surveillance’ is not as widespread as frequently thought amongst industrial actors.

Against the patchiness of the various surveillance apparatuses, calculative practices intensify and are just as important to study as data collection practices. Calculations circumvent some data collection difficulties by *creating* data. They also interlink heterogeneous datasets in an attempt to provide a more comprehensive vision of the oceans. They are integral to making a growing and diversifying mass of data legible and to sharing them by circulating them through different arenas and formats. To a certain extent, these practices may open offshore surveillance to new actors and interests, as I have shown in Chapter 8 regarding ecosystem models, who mobilise existing data more than they collect new ones, and exploit or enhance their multipotency. These perspectives fuel emerging (yet frail) considerations regarding *informational justice*, with some non-governmental organisations pleading, for instance, for opening access to marine data and democratising access to bycatch, pollution or VMS data for conservation purposes. At stake here is not so much the lack of data than their accessibility and utilisation.

Calculative practices may diversify, but they invisibly and irreversibly burrow scarce informational infrastructures, providing most of the available offshore data. These infrastructures afford as much as they rigidly constrain what can be known and, more importantly, how it can be known. Hence, my attention to *informational infrastructures* mitigates the idea that data access suffices to open offshore surveillance. Throughout the dissertation, I described offshore worlds as *closed worlds*, only accessible to a few (mainly the industry and the military) and relatively hermetic from one another. Perhaps paradoxically, given the scale of the oceans and related stakes, offshore surveillance remains dependent on a few infrastructures. Although surveillance is shared and distributed, it is nonetheless hierarchical and unequal. Actors who control and operate the infrastructures underpinning most surveillance activities retain considerable influence over the problematisation of surveillance and, therefore, its possible uses.

Thus, while I mentioned that tunas remained furtive, their surveillance is captured in an infrastructure that mostly frames offshore environmental surveillance as the surveillance of exploitable resources. As I have shown in Chapter 8, the surveillance of offshore ecosystems is embedded in the surveillance of industrial tuna fisheries. Alternative surveillance practices, independent from these infrastructures, do exist, as illustrated by the surveillance efforts of marine ecologists and conservation organisations, but their scope remains limited. These observations suggest an *ecologisation* of maritime sectors like the tuna fisheries and the navies more than a *globalisation* of biodiversity concerns. Although these two movements are not exclusive, it seems that the first takes precedence over the second. The fishing industry or the military incorporate environmental concerns into their prerogatives and frame them *according to* their economic and sovereign protection(nist) prerogatives, more than they surrender to the visions, objectives and protection requirements of other sectors like the conservation sector. Against the question of how the reconceptualisation of offshore spaces as more-than-human environments affects their governance, I propose that it transforms the sectors that have historically dominated these spaces without, however, redefining ocean governance and management entirely. Parallel problematisations of the marine environment (by the fisheries, the conservation and the military sectors) seem to emerge and produce distinct marine worlds across relatively disconnected arenas. Converging with L. Riera's thesis, this remark calls into question the possibility of developing the integrated 'ecosystem approaches' put forward by an increasing number of actors (Riera, 2022).

Although calculative and integrative practices progress, my results mitigate the power of remote "dataveillance" and its capacity to overcome conventional surveillance techniques (e.g. Clarke, 1988). The third part of this thesis provided ample evidence of the irremediable dependence on field-based surveillance and access to the field. The Covid-19 containment measures made this dependence particularly acute. At the time, fisheries observers could no longer board fishing vessels and military patrols' activities were restricted. As direct connections to offshore spaces and fishing vessels were suspended, the Pacific Island authorities found that illegal activities at sea would soar. Against the

critical influence of surveillance infrastructures, I suggest that informational governance considerations cannot only focus on data management modalities and that infrastructural resources, too, weigh on ocean management. The unequal capacities of actors to access the ocean and collect information call for complementary reflections on *infrastructure governance* and more democratic discussions on the roles these infrastructures should fulfil and prioritise.

I started this dissertation by suggesting that oceanic and Oceanist perspectives could provide new insights into the social study of surveillance. It would be fruitful to enrich and consolidate the dialogue with more ‘common’ study sites of surveillance, such as in the European Union: there, too, multipotent sociotechnical apparatuses tend to emerge to address increasingly plural surveillance issues, intertwined and concerned with more-than-human reticular flows in voluminous spaces and across porous national boundaries, both maritime and terrestrial.

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Appendix 1: Summary and Chronological List of Interviews and Observations

I. Interviews

Certain interviews that provided general context but ended up too distant from the research topic have been removed from the list. Interviews lasted between 1-3.5h. Most have been recorded and transcribed.

	Institution	Function	date, loc., lang.	Interviewer
1	Institut de Recherche pour le Développement	Oceanographer and fishery scientist	06.02.19, Montpellier, French	Juliette Kon Kam King, Léa Riera
2	Institut de Recherche pour le Développement, MARBEC	Tuna fisheries scientist G.	30.03.19, Sète, French	Juliette Kon Kam King, Léa Riera
3	Institut de Recherche pour le Développement, MARBEC	Marine ecologist and fisheries scientist K.	14.03.19, Sète, French	Juliette Kon Kam King
4	University of South Pacific	Shark scientist	01.04.19, Suva (online), English	Léa Riera
5	French Embassy	French Diplomat	17.05.19, Suva, French	Juliette Kon Kam King, Léa Riera
6	University of South Pacific	Marine Spatial Planning scientist	17.05.19, Suva, English	Juliette Kon Kam King
7	European Union Delegation for the Pacific Region	European Union delegate – Programme manager involved in the Pacific European Union Marine Partnership Programme	27.05.19, Suva, English	Juliette Kon Kam King, Léa Riera, Annette Breckwoldt
8	University of the South Pacific, then Pacific Community	Tuna geneticist G.	06.07.19, Suva, English 12.02.21, Noumea, English (second interview)	Juliette Kon Kam King
9	Wildlife Conservation Society	Programme directors (two interviewees)	10.06.19, Suva, English	Juliette Kon Kam King, Léa Riera, Annette Breckwoldt
10	University of the South Pacific	Officer of the Pacific European Union Marine Partnership Programme	11.06.19, Suva, English	Juliette Kon Kam King, Léa Riera, Annette Breckwoldt
11	Fijian fishing company R.	Owner and general manager	13.06.19, New Zealand (online), English	Juliette Kon Kam King

12	European Union Delegation for the Pacific Region	European Union delegate, fisheries attaché involved in fishing agreement negotiations	14.06.19, English	Suva,	Juliette Kon Kam King
13	University of the South Pacific	Marine scientist working on tuna fisheries management and remote sensing	17.06.19, English	Suva,	Juliette Kon Kam King
14	Traceability and digital service company C.	Founder and general manager, former FFA officer	19.06.19, English	Suva,	Juliette Kon Kam King
15	Fijian fishing company	Owner of <i>Longline 1</i>	21.06.19, English	Suva,	Juliette Kon Kam King
16	French Navy, <i>D'Entrecasteaux</i> multi-mission ship	Officer	22.06.19, French (including a guided tour of the vessel)	Suva,	Juliette Kon Kam King
17	University of the South Pacific	Offshore Fisheries scientist and lecturer, formerly Tuvalu fisheries officer, SPC officer, and fishing company manager	24.06.19, English	Suva,	Juliette Kon Kam King
18	World Wide Fund for Nature	Senior Fisheries Programme Officer	24.06.19, Zealand, (online)	New English	Juliette Kon Kam King
19	Fiji Fishing Industry Association	Executive officer	25.06.19, English	Suva,	Juliette Kon Kam King
20	University of South Pacific, Traceability and digital service company C.	Marine scientist and project officer of service company C.	25.06.19, English	Suva,	Juliette Kon Kam King
21	Fijian fishing and processing company S.	Executive officer	26.06.19, English	Suva,	Juliette Kon Kam King
22	Fijian fishing company R.	Fishing operations manager	27.06.19, English	Suva,	Juliette Kon Kam King
23	French Navy, <i>La Moqueuse</i> patrol ship	Operations officer	30.06.19, French	Suva,	Juliette Kon Kam King
24	French Navy, <i>La Moqueuse</i> patrol ship	Cook and electrician	01.07.19, French	Suva,	Juliette Kon Kam King
25	University of the South Pacific and Pacific Dialogue NGO	Marine scientist and executive officer of Pacific Dialogue	04.07.19, English	Suva,	Juliette Kon Kam King
26	World Wide Fund for Nature	Programme officer	05.07.19, English	Suva,	Juliette Kon Kam King
27	Fijian fishing company S.	Longline captain R.	06.07.19, English	Suva,	Juliette Kon Kam King
28	Traceability and digital service company C.	Founder, former Samoan fisheries boarding and inspection officer	08.07.19, English	Suva,	Juliette Kon Kam King

29	Spanish digital service company K.	Manager and project officer	09.07.19, Suva, English (including a guided tour of the e-monitoring infrastructures onboard a fishing vessel in the harbour)	Juliette Kon Kam King
30	Fijian fishing company	Captain of <i>Longline 1</i>	10.07.19, Suva, English (including a participation to the navigational testing of the fishing vessel)	Juliette Kon Kam King
31	Institut de Recherche pour le Développement	Tuna fisheries scientist A.	11.07.19, France, French (online)	Juliette Kon Kam King
32	University of the South Pacific	Marine biologist and geneticist	16.07.19, Suva, French	Juliette Kon Kam King
33	Fijian fishing company F.	Owner	17.07.19, Suva, English	Juliette Kon Kam King
34	Deutsche Gesellschaft für Internationale Zusammenarbeit	Project manager of MACBIO (Marine Spatial Planning Project)	19.07.19, Suva, English	Juliette Kon Kam King
35	Digital service company V.	Founder	08.08.19, Noumea, French	Juliette Kon Kam King
36	Institut de Recherche pour le Développement	Physical oceanographer and climate scientist C.	28.08.19, Noumea, French	Juliette Kon Kam King
37	Institut de Recherche pour le Développement	Marine and sharks scientist	28.08.19, Noumea, French	Juliette Kon Kam King
38	Institut de Recherche pour le Développement	Marine scientist, remote sensing and marine spatial planning	02.09.19, Noumea, French	Juliette Kon Kam King
39	Institut de Recherche pour le Développement	Marine and bird scientist E.	03.09.19, Noumea, French	Juliette Kon Kam King
40	Institut de Recherche pour le Développement, Opération Cétacés	Marine and whale scientist	09.09.19, Noumea, French	Juliette Kon Kam King
41		Coastal fisher	09.09.19, Noumea, French	Juliette Kon Kam King
42	Direction des Affaires Maritimes de Nouvelle Calédonie, Service des Pêches	Former manager	11.09.19, Noumea, French	Juliette Kon Kam King
43	Direction Territoriale des Systèmes d'Information de Nouvelle-Calédonie	Chief officer, geomatician	13.09.19, Noumea, French	Juliette Kon Kam King
44	Institut de Recherche pour le Développement, Muséum National d'Histoire Naturelle	Former marine taxonomist and seamount scientist	17.09.19, Noumea, French	Juliette Kon Kam King

45	Pacific Community, Oceanic Fisheries Programme	Fisheries and micronekton scientist A.	18.09.19, Noumea, French	Juliette Kon Kam King
46	Pacific Community, Oceanic Fisheries Programme	Marine scientist D.	02.10.19 and 03.10.19, Noumea, French	Juliette Kon Kam King
47	Pacific Community, Oceanic Fisheries Programme	Marine scientist V., Fisheries and Ecosystems Monitoring and Analysis Division	04.10.19, Noumea, French	Juliette Kon Kam King
48	Centre Opérationnel de Surveillance et de Sauvetage de Nouvelle Calédonie	Director and vice-director	04.10.19, Noumea, French	Juliette Kon Kam King
49	ADECAL Technopole	Chief officer of the marine division, fisheries manager	07.10.19, Noumea, French	Juliette Kon Kam King
50	Institut Français de Recherche pour l'Exploitation de la Mer	Fisheries, marine management and marine spatial planning scientist	08.10.19, Noumea, French	Juliette Kon Kam King
51	Pacific Community	Director of the Fisheries, Aquaculture and Marine Ecosystems Division	09.10.19, Noumea, English	Juliette Kon Kam King, Léa Riera
52	Aquarium du Lagon	Director of the Aquarium, former Pacific Community fisheries officer and territorial fisheries officer in New Caledonia	09.10.19, Noumea, French	Juliette Kon Kam King
53	Direction des Affaires Maritimes de Nouvelle Calédonie et ADECAL Technopole	Tuna fisheries Observer Programme manager, onboard observer	14.10.19, Noumea, French; 21.05.21, Noumea, French (second interview)	Juliette Kon Kam King Antoine Wickel (second interview)
54	Action de l'Etat français en Mer	Chief officer	14.10.19, Noumea, French	Juliette Kon Kam King
55	Service Hydrographique et Océanographique de la Marine	Chief oceanographer	15.10.19, Noumea, French	Juliette Kon Kam King
56	Etat-Major Inter-Armées	Officer of the Operations Centre	16.10.19, Noumea, French	Juliette Kon Kam King
57	Section Espadon Game Fishing Club	Two game fishers	16.10.19, Noumea, French	Juliette Kon Kam King
58	New Caledonian Fishing Company N.	General manager	21.10.19, Noumea, French	Juliette Kon Kam King
59	Pacific Community, Oceanic Fisheries Programme	Tuna fisheries scientist, Tuna Tagging Programme manager	22.10.19, Noumea, French	Juliette Kon Kam King

60	Pacific Community, Fisheries Programme	Oceanic	Tuna fisheries scientist T.	08.11.19, Noumea, English	Juliette Kon Kam King
61	Pacific Community, Fisheries Programme	Oceanic	Tuna fisheries scientists F. and R. (2)	08.11.19, Noumea, English	Juliette Kon Kam King
62	Pacific Community, Fisheries Programme	Oceanic	Tuna fisheries scientist J.	11.11.19, Noumea, French/English; 15.11.19, Noumea, French/English; 01.04.21, Noumea (online), French	Juliette Kon Kam King
63	Pacific Community, Fisheries Programme	Oceanic	Database manager	13.11.19, Noumea, French	Juliette Kon Kam King
64	Insight SAS		Remote sensing and geographic information system project manager	14.11.19, Noumea, French	Juliette Kon Kam King
65	Pacific Community, Fisheries Programme	Oceanic	Tuna fisheries scientists N.	15.11.19, Noumea, English	Juliette Kon Kam King
66	Pacific Community, Fisheries Programme	Oceanic	Tuna fisheries scientist L.	18.11.19, Noumea, French	Juliette Kon Kam King
67	Pacific Community, Fisheries Programme	Oceanic	Fisheries biologist E.	19.11.19, Noumea, English	Juliette Kon Kam King
68	Pacific Community, Fisheries Programme	Oceanic	Tuna fisheries scientist M.	20.11.19, Noumea, English	Juliette Kon Kam King
69	Pacific Community, Fisheries Programme	Oceanic	Chief data scientist	22.11.19, Noumea, English	Juliette Kon Kam King
70	University of the South Pacific		Director of the Institute of Marine Resources, One Ocean Hub project manager, climate change and ocean consultant	27.02.20, Suva, English (online)	Juliette Kon Kam King
71	Fisheries Transparency Initiative		Executive director	12.05.20, Germany, English (online)	Juliette Kon Kam King
72	Pacific Community, Fisheries Programme	Oceanic	Chief fisheries scientist P.	20.05.20, Noumea, English (online)	Juliette Kon Kam King
73	Institut de Recherche pour le Développement		Tuna fisheries anthropologist	02.06.20, France, French (online)	Juliette Kon Kam King
74	Université de Montpellier		Marine ecologist	08.10.20, Montpellier, French	Juliette Kon Kam King
75	Fisheries consultancy firm		Fisheries consultant, former SPC fisheries officer and observer G.	16.02.21, USA, English (online)	Juliette Kon Kam King
76	Pacific Community, Fisheries Programme	Oceanic	e-reporting and e-monitoring officer	17.02.21, Noumea (online); 15.03.21, Noumea (online)	Juliette Kon Kam King
77	Pacific Community		Former fisheries officer Y. and	27.08.14, Noumea, English;	Paul Judd

		manager of the Skipjack Stock Assessment Programme	23.02.21, Australia, English (online)	Juliette Kon Kam King
78	International Union for the Conservation of Nature	Marine programme officer	23.02.21, Suva, English (online)	Juliette Kon Kam King
79	Hawaii Institute of Marine Biology	Marine biologist and tuna tagging cruise leader	25.02.21, Hawaii, English (online)	Juliette Kon Kam King
80	Pacific Community, Oceanic Fisheries Programme	Observer programme advisor	04.03.21, Noumea, English (online)	Juliette Kon Kam King
81	Food and Agriculture Organisation	Consultant, e-monitoring project manager	17.03.21, Roma, English (online)	Juliette Kon Kam King
82		Ni-Vanuatu onboard fisheries observer E.	18.03.21, Vanuatu, English (online)	Juliette Kon Kam King
83		Kiribati onboard fisheries observer T.	24.03.21, Kiribati, English (online chat)	Juliette Kon Kam King
84	Association for Professional Observers	President	25.03.21, USA, English (online)	Juliette Kon Kam King
85		Palauan onboard fisheries observer J.	25.04.21, Palau, English (online)	Juliette Kon Kam King
86	Hawaiian seafood company	Fish buyer, former fisheries development officer at the Pacific Community, former longline fishing captain	04.05.21, Noumea, English (online)	Juliette Kon Kam King
87		Fisheries consultant, former SPC fisheries officer, former Papua New Guinean fisheries manager	07.05.21, Noumea, English (online)	Juliette Kon Kam King
88		Kiribati onboard fisheries observer B.	14.04.21, Kiribati, English (online)	Juliette Kon Kam King
89	Forum Fisheries Agency	MCS – fisheries operations director	21.05.21, Honiara, English (online)	Juliette Kon Kam King
90	Australian Fisheries Management Authority	Fisheries manager, former Forum Fisheries Agency director	03.06.21, Australia, English (online)	Juliette Kon Kam King
91	Direction des Affaires Maritimes	Fisheries officer J.	06.05.21, Noumea, French	Antoine Wickel
92	Government of New Caledonia – International Cooperation Division	International relations government officer	07.06.21, Noumea, French (online)	Juliette Kon Kam King
93	Direction des Affaires Maritimes	Fisheries officer R.	07.06.21, Noumea, French	Antoine Wickel
94	Direction des Affaires Maritimes	Fisheries officer L.	07.07.21, Noumea, French	Antoine Wickel

95	Fiji Ministry of Fisheries, Offshore Fisheries Division	Group interview with four offshore fisheries managers and officers	09.08.21, English	Suva,	Apete Dabea, Sera Lewanuya
96	Direction des Affaires Maritimes	Fisheries officer M.	14.07.21, French	Noumea,	Antoine Wickel
97	Fijian processing company G.	Processing employee and former onboard fisheries observer A.	29.07.21, English (online)	Suva,	Sera Lewanuya
98	Fiji Maritime Surveillance Rescue Coordination Centre	Chief officer	25.08.21, English	Suva,	Sera Lewanuya
99		Fijian onboard fisheries observer J.	05.10.21, English	Suva,	Apete Dabea
100	Global Fishing Watch	Forced Labour Project officer, former crewing and shipping agent	05.10.21, English	Suva,	Sera Lewanuya
101	Fiji Ministry of Fisheries	Fijian onboard fisheries observer M.	08.10.21, English	Suva,	Sera Lewanuya
102	New Caledonian fishing company P.	General manager	02.11.21, French	Noumea,	Antoine Wickel
103	ADECAL Technopole	New Caledonian onboard fisheries observer C.	15.11.21, French	Noumea,	Antoine Wickel
104	Fishing company F.	Crewmate A.	09.12.21, English	Suva,	Sera Lewanuya
105	Fishing company F., Fishing company R.	Crewmate B.	15.12.21, English	Suva,	Sera Lewanuya
106	Fishing company R.	Longline captain S.	20.12.21, English	Suva,	Apete Dabea
107		Fijian onboard fisheries observer K.	20.12.21, English	Suva,	Apete Dabea
108	New Caledonian processing company	General manager	23.01.22, French	Noumea,	Antoine Wickel

II. Observations

	Type of Event	Institution	Date, Location	Description
1	Third Climate Action Pacific Partnership – Decarbonising and Building Resilience		13.05.19-14.05.19, Suva	International High-Level Conference with officials from the Pacific Islands on climate change
2	Workshop “MSC Standards and MSC Chain of Custody and Traceability in Fiji’s longline tuna fishery”	WWF, EU, Fiji Government, Fiji Tuna Industry	29.05.19-31.05.19, Suva	Workshop organised by WWF, involving the tuna fishing and processing industry, Fiji national agencies, FFA and MSC representatives on the topic of traceability and certification. Involved a one-day visit in the premises of a fishing and processing company in the port of Suva
3	Offloading and processing operations	Fishing and processing company S.	03.07.19, Suva	Day at the main port of Suva with the teams of company S., attending offloading, processing and traceability tests
4	Biopelagos Conference	Institut de Recherche pour le Développement, Pacific Community	August 2019, Noumea	Public restitution of the main results of a research project on the spatial repartition of marine species in the EEZ of New Caledonia
5	Visit of the oceanographic vessel <i>L’Atalante</i> and observation of the preparations before the scientific campaign	Museum National d’Histoire Naturelle, Institut de Recherche pour le Développement, Pacific Community	04.09.19, Noumea	Preparations of an upcoming oceanographic campaign in the EEZ of New Caledonia to study seamounts biodiversity
6	Sea Shepherd Public Meeting	Sea Shepherd	September 2019, Noumea	Meeting of Sea Shepherd’s local antenna for volunteers
7	Scientific seminar – Opération Cétacés	Institut de Recherche pour le Développement	September 2019, Noumea	Scientific seminar presenting current research and results on whales in New Caledonia’s EEZ
8	Workshop ‘Subsea Observatory in the South Pacific and its surrounding ocean: scientific frontiers and technical challenges’	Institut Français de Recherche pour l’Exploitation de la Mer, Pacific Community, Japan Agency for Marine Earth Science and Technology French State,	19.09.19-20.09.19, Noumea	International and multi-stakeholder workshop on the creation of a subsea observatory for biodiversity preservation, fisheries management and climate change

		New Caledonian government		
9	Scientific Conference Kanadeep	Museum National d'Histoire Naturelle	October 2019, Noumea	Public conference showing the results of the oceanographic campaign on seamounts and their biodiversity in the EEZ of New Caledonia
10	Section Espadon – Game fishing competition awards	Section Espadon	10.10.19, Noumea	Awards ceremony and celebratory dinner with the game fishing club Section Espadon
11	Daily operations at the Centre Opérationnel de Surveillance et de Sauvetage de Nouvelle Calédonie	Centre Opérationnel de Surveillance et de Sauvetage de Nouvelle Calédonie	11.10.19, Noumea	Observation of a typical day of work at the maritime surveillance and rescue centre
12	Ecosea Modelling Workshop	Pacific Community, Oceanic Fisheries Programme	28.10.19-01.11.19, Noumea	International scientific workshop on oceanic ecosystem modelling
13	Bathymetric operation	Service Hydrographique et Océanographique de la Marine		One day observation on board of an oceanographic ship to conduct bathymetric measures nearby Noumea
14	Fisheries, Aquaculture and Marine Ecosystems Division Results Workshop	Pacific Community, Fisheries, Aquaculture and Marine Ecosystems Division	12.11.19-13.11.19, Noumea	Internal annual workshop to reflect on recent results of the fisheries division
15	Visit of the <i>D'Entrecasteaux</i> military vessel	French Navy	05.11.19, Noumea	Visit and discussions with the crew of <i>D'Entrecasteaux</i>
16	<i>D'Entrecasteaux</i> patrol mission	French Navy	25.11.19-12.12.19, Noumea, Port-Vila, Suva, New Caledonia's, Vanuatu's and Fiji's EEZ	Participation in a patrol mission on board <i>D'Entrecasteaux</i> with the French Navy
17	Preparatory workshop for 2020 yellowfin and bigeye tuna assessments	Pacific Community, Oceanic Fisheries Programme	22.04.20-23.04.20, online	Annual workshop to prepare stock assessment and the scientific committee of the Western and Central Pacific Fisheries Commission
18	Fishing for Data Webinar		20.05.20, online	International and multi-stakeholder webinar on developments in fisheries data collection
19	Satellite data for ocean webinar	Campus de la Mer	17.06.20, online	Webinar and hackathon on satellite data and ocean surveillance

20	16 th Scientific Committee of the Western and Central Pacific Fisheries Commission	Western and Central Pacific Fisheries Commission	10.08.20-19.08.20	Annual meeting of the scientific committee of the Commission
21	Conference “Pourquoi renforcer la protection de nos océans ?”	Pew Bertarelli Ocean Legacy, International Union for the Conservation of Nature	15.09.20, online	Conference on ocean conservation
22	Journée Agence Française pour la Biodiversité sur les aires protégées	Agence Française pour la Biodiversité	03.11.20, online	Conference on marine protected areas
23	Conference “Protection forte des eaux françaises”	Pew Charitable Trust	17.11.20, online	Conference on ocean conservation
24	Conference “Our Fish, Our Future: Maximising benefits from our tuna fisheries”	Forum Fisheries Agency	23.11.20, online	Conference on tuna fisheries involving the Forum Fisheries Agency and its Pacific Island members
25	Tenth Pacific Nature Conference on Nature Conservation and Protected Areas	Secretariat of the Pacific Regional Environment Programme	24.11.20-27.11.20, online	Regional Multi-stakeholder conference on conservation and protected areas in the South Pacific
26	Pacific Tuna Tagging Programme Advisory Committee Virtual Meeting	Pacific Community	16.02.21, online	Meeting of the advisory committee to plan for the upcoming tuna tagging campaign
27	Preparatory Workshop for 2021 Southwest Pacific Swordfish Assessment	Pacific Community, Oceanic Fisheries Programme	30.03.21-01.04.21, online	Annual workshop to prepare tuna stock assessment and the scientific committee of the Western and Central Pacific Fisheries Commission
28	ScInObs project meeting	Institut Français de Recherche pour l’Exploitation de la Mer, Pacific Community, Japan Agency for Marine Earth Science and Technology	14.10.21, online	Follow-up project meeting on the establishment of a subsea observatory in the EEZ of New Caledonia
29	Vaka Moana Conference “A healthy and resilient Pacific Ocean – The success story of world-class tuna science work by SPC Fisheries Scientists”	Pacific Community	11.03.22, online	Public conference of fisheries scientists at SPC presenting the work and activities of the Oceanic Fisheries Programme

Appendix 2: Formal Request to Conduct Research sent to Fiji's Ministry of Fisheries

Object : Formal request to conduct research with the Ministry of Fisheries Offshore Division

To whom it may concern.

I, Juliette Kon Kam King, am a Ph.D. student in social sciences working with the University of the South Pacific (USP), the French National Research Institute for Development and the Leibniz Centre for Tropical Marine Research in the frame of the research project “A Sea of Connections: Contextualizing Fisheries in the South Pacific Region” or SOCPacific (<https://socpacific.net/>). Information about this project was sent in 2018 by the project's coordinators, Drs. Elodie Fache and Annette Breckwoldt, to Mr. Joela Cama from the Ministry of Fisheries, and a brief outline is provided below. This multidisciplinary project deals with issues related to both coastal and offshore fishing, fisheries management and marine conservation.

Within this frame, my research focuses on the evolution of the offshore fisheries sector and on the challenges of monitoring and managing this fisheries and its associated ecosystems. In that regard, I focus on several interrelated aspects:

- 1) The development of marine spatial planning and marine protected areas in offshore spaces;
- 2) The functioning and transformation of several fisheries monitoring schemes (e.g. capture and effort data; tuna tagging and biological sampling programmes; observers programmes; but also private certification schemes such as the MSC certification) in light of emerging technologies (e.g. e-monitoring or e-reporting) and concerns (e.g. labour conditions, gender aspects);
- 3) The (dis)articulations between regional and national organizations with regard to tuna fishery development and management;
- 4) The organization and evolution of surveillance schemes to implement marine protected areas and deter IUU fishing in offshore spaces in light of emerging technologies (e.g. VMS, satellite imagery) and integrated approaches to the monitoring and management of EEZs;
- 5) The impacts of Covid-19 on tuna fisheries activities, monitoring and management.

I spent most of 2019 in Fiji and New Caledonia conducting fieldwork for my research. I met with the fishing industry, scientists, and NGOs to draw on a comparative case study. Adopting a multi-scalar analysis at local, national and regional scales, I also used my time in New Caledonia to discuss with various representatives from the Pacific Community Oceanic Fisheries Programme (SPC-OFP).

Mr. Craig Strong, then Permanent Secretary of the Ministry of Fisheries, had given me permission to interview representatives from the Offshore Division. The Offshore Division is a prominent actor

regarding Fiji EEZ and Fiji tuna fisheries monitoring and management. However, because of a tight schedule, these meetings had to be postponed. The Covid-19 pandemics then prevented me from returning to Fiji. To overcome these difficulties, in 2021, I started working with two USP students, Apete Dabea and Sera Lewanuya. Under SOCPacific, they have been recruited to conduct interviews with the Offshore Division and collect complementary data in support of my research.

Before proceeding any further, I would like to make sure the approval I got in 2019 remains valid. Following the guidelines I had then received, you will find herein below:

- A brief outline of SOCPacific
- A brief description of my research project within this frame
- A presentation of the expected benefits of this research
- Its likely relevance with regard to the Ministry of Fisheries' activities
- My research questions for the Offshore Division
- Confirmation letters from supporting institutions.

I remain at your disposal should you have need any additional information about me and my research.

Yours faithfully,

Juliette Kon Kam King

SOCPACIFIC PROJECT SUMMARY:

The South Pacific region represents a unique context in which local communities and their political representatives are increasingly committed to integrated management of marine resources and spaces after a predicted dissolution of related community-based activities in the 1970s. This holds especially true for fisheries, the main field of activity in this oceanscape and a critical component of local livelihoods, national and regional economies, and global fish supplies. Fisheries remain one of the most important concerns on the national and regional policy agendas in the Pacific.

Recent studies have started to take into account the multi-faceted aspects of Pacific fisheries by articulating ecological and economic perspectives. Our project aims at broadening this endeavour by **re-embedding coastal and oceanic fisheries in their wider context** and by **exploring the large web of socio-cultural, geopolitical and policy connections within which fishing practices occur**.

For this, we will conduct an interdisciplinary and multi-level analysis across diverse scales and dimensions of fisheries, fisheries management and marine governance in the South Pacific region, including local perceptions and practices, global changes and drivers, and national and regional management frameworks and strategies. This analysis will focus on three study areas: **New Caledonia, Vanuatu and Fiji** where fieldwork periods will be conducted.

Three **thematic areas** will be at the core of the project's cross-sectional investigations:

- 1) An environmental anthropology assessment of social values of places and resources in connection with offshore and inshore fisheries;
- 2) A socio-political ecology perspective on interwoven fisheries and conservation issues within marine protected areas;
- 3) A policy analysis of the inclusion of fisheries in marine spatial planning.

The **project outcomes** will be five-fold:

- 1) The production of policy briefs to be disseminated to regional stakeholders on these three thematic areas, with a spot-light on the neglected 'sea of connections' in which fisheries are embedded.
- 2) The production of knowledge exchange pathways between local marine resource users, local students and other stakeholders of South Pacific fisheries via, for instance, local perceptions of fishing activities in a broader context of natural resource uses and values, conservation initiatives and issues, and conflicts related to boundaries.
- 3) The contribution to the advancement of cross-cutting knowledge in the multi-faceted field of fisheries management and marine governance.

4) The participation in the endeavour to build new forms of integrative governance of the sea including all stakeholders, and in which both Pacific countries and territories and the European Union are closely working together.

5) The strengthening of the existing working ties between the French and German partners, to complement respective national research landscapes.

STUDENT RESEARCH PROPOSAL

Context

My PhD proposal is part of a multidisciplinary research project involving the University of the South Pacific (USP), the French National Research Institute for Development (IRD) and the Leibniz Centre for Tropical Marine Research (ZMT): “A Sea of Connections: Contextualizing Fisheries in the South Pacific Region” or SOCPacific (<https://socpacific.net/>). Recent studies have started to take into account the multi-faceted aspects of Pacific fisheries by articulating ecological and economic perspectives. The SOCPacific project aims at broadening this endeavour by **exploring the large web of socio-cultural, geopolitical and policy connections within which fishing practices occur in the South Pacific region, with a main geographical focus on Fiji, Vanuatu and New Caledonia.**

Tuna fisheries represent an important resource for the Pacific region and its inhabitants but are under environmental, social and economic pressures due to climate change, biodiversity erosion, Illegal/Unreported/Unregulated (IUU) fishing, human right issues and, more recently, the Covid-19 pandemic. Efforts to sustainably manage the tuna fisheries and its associated ecosystems operate at both regional and local levels, to devise and implement conservation and management measures (CMMs). Complementary to these endeavors is the expansion of marine protected areas (MPAs) in offshore spaces and the development of integrated managed approaches through ecosystem-based management and marine spatial planning. These initiatives draw on monitoring practices and apparatuses to produce knowledge on the state and evolution of the ecosystems, assess the impacts of human activities and implement the management rules. However, offshore marine protected areas and fishing activities are located in remote spaces, difficult to access and therefore monitor. This raises specific issues and challenges for the understanding of offshore ecosystems and the effective implementation of CMMs and marine protected areas.

Aim of the research

The present research lies in human geography and science studies. It accounts for the transformation of tuna fisheries and offshore environment monitoring in connection with the governance and management of these fields. The aim is to unpack the various motives, strategies and practices that shape various monitoring schemes (e.g. tagging programme, observers programme, fisheries surveillance operations...) devised to support the knowledge and management of offshore ecosystems and fisheries.

The project will analyse the articulation of these schemes with various stakeholders (fishing industry, fisheries authorities, scientists, environmental NGOs..) and at different scales. More particularly, it will enquire into the transformation and adaptation of these schemes in light of emerging concerns (e.g. biodiversity conservation concerns, human rights concerns, economic sustainability of the fleet...) and of innovations related to emerging Monitoring, Control and Surveillance technologies and practices.

The research draws on a comparative study between Fiji and New Caledonia, while also looking into the potential (dis)connections between the local, national and regional levels. The research uses qualitative techniques (interviews and observation) to describe the practices and challenges associated to the monitoring offshore fisheries, offshore ecosystems and offshore marine protected areas and discuss the (potentially unforeseen) effects and reappropriations of such work for marine governance and management. The goal of the research is therefore not to access any sensitive fisheries data, but to better understand the social context within which these data are produced, circulated and used.

This project deals with several interrelated thematic areas:

- The status of offshore fisheries in Fiji;
- The process of implementing offshore marine protected areas in Fiji;
- The creation, functioning and evolution of fisheries and offshore marine protected areas monitoring schemes;
- The management of tuna fisheries in Fiji;
- The changes brought up by new reporting and monitoring requirements and tools.

BENEFITS OF THE RESEARCH

By putting into perspective the representations of various stakeholders (fishing companies, fishermen, private companies supporting the fishing industry, fisheries authorities, environmental administrations, environmental NGOs, the Navy, SPC, FFA and WCPFC representatives, scientists, etc.), the research will provide insights into potential (dis)connections between tuna fisheries stakeholders and at different levels. The comparison of the two case studies, Fiji and New Caledonia³³⁶, will also help identify common or distinct challenges, successes and concerns and bring out practical and grounded perspectives for each of the two countries. The research will also contribute to assessing the impacts of emerging technologies such as e-monitoring or e-reporting for monitoring, management and fishing activities.

The research results will be shared with the Ministry of Fisheries. They will have the potential to provide support to Fiji's efforts to develop comprehensive fisheries monitoring schemes. They will help

³³⁶ New Caledonia presents many commonalities with Fiji: its tuna fishing fleet is a longline domestic fleet, although with far less vessels and mostly targeting a domestic market. New Caledonia has also created a Natural Park encompassing all of its EEZ and is in the process of implementing MPAs across the EEZ.

identify potential gaps in knowledge production and diffusion and in the implementation of management measures. It will also help ensure the relevance of technological choices regarding different fisheries context to ensure proper adoption and use of these tools.

HOW THE STUDY CAN SUPPORT GOVERNMENT IMPLEMENTATION

This research could help pinpoint potential obstacles in the adoption of digital tools by fishers and institutions and in the collection and diffusion of the data to produce relevant knowledge regarding fisheries state and their management. It might provide support in identifying constraints (of a material, social, cultural, political nature) hindering the production and sharing of information. For instance, results may help identify areas where enhanced collaboration between different branches of the government is needed to improve and fasten the circulation of information required for licensing procedures.

The results of the research could also shed light on the different ways these information are appropriated by different stakeholders like fishing companies and fishers and how they influence their practices. This could help the government better understand how MCS requirements impact stakeholders in the field and the extent to which these changes achieve expected results for the Ministry of Fisheries in line with its Annual Corporate Plan goals. The research could thus provide new insight into the implementation of the Offshore Fisheries Monitoring System and the reviewing of the Fisheries Data Collecting System (relevance of the technological efforts adopted, of the information collected in line with the diverse commitments of the Ministry, etc.). It could also provide insight into the ongoing discussions and efforts with the industry regarding the determination of fishing effort or compliance with MSC standards.

RESEARCH QUESTIONS FOR THE MINISTRY OF FISHERIES OFFSHORE DIVISION

The Ministry of Fisheries Offshore Division is a key player in tuna fisheries monitoring and management as well as in the development of offshore MPAs. Better understanding its role, actions, rationales and aspirations over time is therefore of utmost important.

My questions for the Ministry of Fisheries Offshore Division therefore pertain to the history of the division, its general structuration, the evolution of its agendas over time and of its relations with others stakeholders (international/regional institutions, environmental organizations, the industry, other Ministries, etc.). I would also like to enquire about the specificities of the Fijian context in implementing national, regional and international fisheries-related commitments and about the changes, successes and challenges encountered by the Offshore Division. I would also be interested in enquiring about the MCS schemes and how these have evolved through time, along with the Ministry's regulatory and management roles. The research questions also pertain to the recent trials to implement e-reporting and

e-monitoring and their effects on former ways of reporting, monitoring and controlling, as well with the collaboration with Fiji Navy and regional organisations to deter IUU fishing.

Main questions:

- The structuration of the Offshore Division and the current projects and commitments of the Ministry for offshore management
- The evolution of the Ministry of Fisheries' concerns and policies over time regarding offshore fisheries, in relation with the evolution of the offshore fisheries sector in Fiji
- The Ministry and its offshore division's relations with the regional institutions (SPC, WCPFC, FFA, etc.), environmental and scientific organizations, the industry, the inshore division, etc.
- The different measures and tools used by the Ministry to monitor and manage Fiji's offshore fisheries
- The practicalities of collecting information on offshore fisheries
- The Monitoring, Control and Surveillance roles of the Ministry and the advantages and challenges of adopting new technologies and producing/accessing relevant data for MCS purposes.
- Lessons learnt from the recent trials to implement e-reporting and e-monitoring

15th July, 2019

TO WHOM IT MAY CONCERN

I, Joeli Veitayaki, Associate Professor at the School of Marine Studies at the University of the South Pacific (USP), am working as the local counterpart and supervisor for Ms Juliette Kon Kam King, who is seeking your assistance to conduct interviews with of the Ministry of Fisheries Offshore Division Officials in 2019.

Ms Juliette KON KAM KING has been granted a Ph.D scholarship under the SOCPacific project (www.socpacific.net) involving the French National Research Institute for Development (IRD), the Leibniz Centre for Tropical Marine Research (ZMT) and USP.

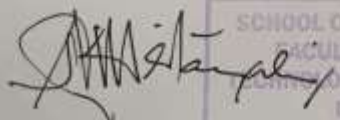
Ms KON KAM KING's research project is entitled: "A Sea Under Watch: Tracking Fish and Fishers in the South Pacific". This is an important research topic that will yield useful results to the country.

She is working under Dr Elodie FACHE and Dr Annette BRECKWODLT's supervision. These ladies are co-leading the Franco-German research project "A Sea of Connections: Contextualizing Fisheries in the South Pacific Region" (SOCPacific, 2018-2021), in which I am personally involved along with other members of the USP School of Marine Studies.

As part of this project, it is essential that Juliette KON KAM KING can spend some time interviewing and observing some of the work of the Ministry of Fisheries Offshore Division officers to (1) collect field data on the social dimensions of Fiji offshore fisheries, fisheries management and marine governance framework and better understand the articulation of the Ministry of Fisheries with other stakeholders, and (2) strengthen the links with the Ministry to better identify its needs and ensure the relevance of her research project.

Please do not hesitate to contact me if any further details are required. I do thank you in advance for helping Juliette KON KAM KING to carry out her research in Fiji.

Yours sincerely,



Joeli Veitayaki

SCHOOL OF MARINE STUDIES
FACULTY OF SCIENCE,
TECHNOLOGY & ENVIRONMENT
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Appendix 3: Informed consent form and transfer of copyright

N.B.: This form was only used during the first interviews I conducted before I privileged an oral approach to informing and discussing consent modalities with the persons I interviewed (cf. Chapter 3).

Contracting parties :

The researcher : Juliette KON KAM KING (Ph.D student – IRD-UPVM and ZMT-Uni Bremen)

The informant :

Preamble : Context and object of study

Juliette Kon Kam King is carrying out Ph.D research in geography within the project “A Sea of Connections: Contextualizing Fisheries in the South Pacific Region” (SOCPacific, <https://socpacific.net/>), coordinated jointly by Elodie Fache from the French National Research Institute for Development (IRD) and Annette Breckwoldt from the German Leibniz Centre for Tropical Marine Research (ZMT). The project team is international, with eight partners in the Pacific. Project funds are provided by the French National Agency for Research and the German Research Foundation.

Juliette Kon Kam King’s Ph.D aims to document and analyze the production and circulation of spatial data and of knowledge related to Fiji’s fisheries, in relation to the governance and management of marine spaces in the South Pacific. For this work she would like to conduct interviews with people involved in fisheries and marine conservation (fishers, boat captains, patrollers, scientists, institutions involved in fisheries managements, officials, NGO members, etc.), referred to herebelow as “the informant”.

Interview conditions

The interviews will be conducted by Juliette Kon Kam King, herebelow called “the researcher”. She may be occasionally accompanied by other SOCPacific team members, upon agreement by the informant.

If the informant consents to the specified terms (see below), the interview will be recorded and transcribed into a text file. The researcher may also take handwritten notes and/or photographs during the interview, upon agreement by the informant.

The interview notes, audio file and transcript will be deposited and stored in a securised database, made accessible for the SOCPacific’s team depending on the conditions specified hereinbelow.

This form will be stored in a separate database accessible to Juliette Kon Kam King only.

Recording conditions

The informant confirms he/she has been given knowledge of the context and the object of study and of the interview conditions.

He/She authorizes Juliette Kon Kam King to conduct and record the interview. He/She is free to interrupt the recording and/or note-taking at any time during the interview.

Conditions of use *(select the preferred options, several choices possible)*

The informant authorizes the free quotation of his/her transcribed words in diverse project-related media (conference papers, scientific publications, reports, policy briefs, online blogs, supports for teaching activities, etc.) aiming to disseminate the results of the research, as long as the following conditions are respected:

- Anonymization (deletion of any personal data that could make the informant recognizable)
- Use of a pseudonym (which the informant can choose)
- Anonymization and/or use of a pseudonym while indicating the status or position of the informant (e.g. member of ONG X; senior scientist at the research institute X; etc.)
- Disclosure of the informant's identity :
 - If the informant has been given knowledge of the respective quotation
 - Without having been given knowledge of the respective quotation
- The participant wants to receive an audio copy of the interview
- The participant wants to receive a transcript of the interview and has the possibility to edit his/her words within 2 months after reception of the transcript

Diffusion conditions *(select the preferred options, several choices possible)*

The informant authorizes the researcher to communicate an audio copy and/or the transcript of the interview joined to this anonymized contract to the following persons :

- Léa Riera, SOCPacific Ph.D. student
- Elodie Fache and Annette Breckwoldt, SOCPacific coordinators
- To other SOCPacific members requesting it
 - Immediately after the interview
 - A year after the interview
 - _____ years after the interview

The informant can freely edit his/her choices at any time during the interview and after.

Place and date: _____, on _____ in two copies

The researcher

The informant

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