



HAL
open science

Introduction: Pacific Islanders as ‘custodians of the ocean’ facing fisheries challenges

Elodie Fache, Simonne Pauwels, Joeli Veitayaki

► To cite this version:

Elodie Fache, Simonne Pauwels, Joeli Veitayaki. Introduction: Pacific Islanders as ‘custodians of the ocean’ facing fisheries challenges. Elodie Fache; Simonne Pauwels. Fisheries in the Pacific: The challenges of governance and sustainability, Pacific-Credo Publications, pp.7-18, 2016. halshs-01735399

HAL Id: halshs-01735399

<https://shs.hal.science/halshs-01735399>

Submitted on 21 May 2018

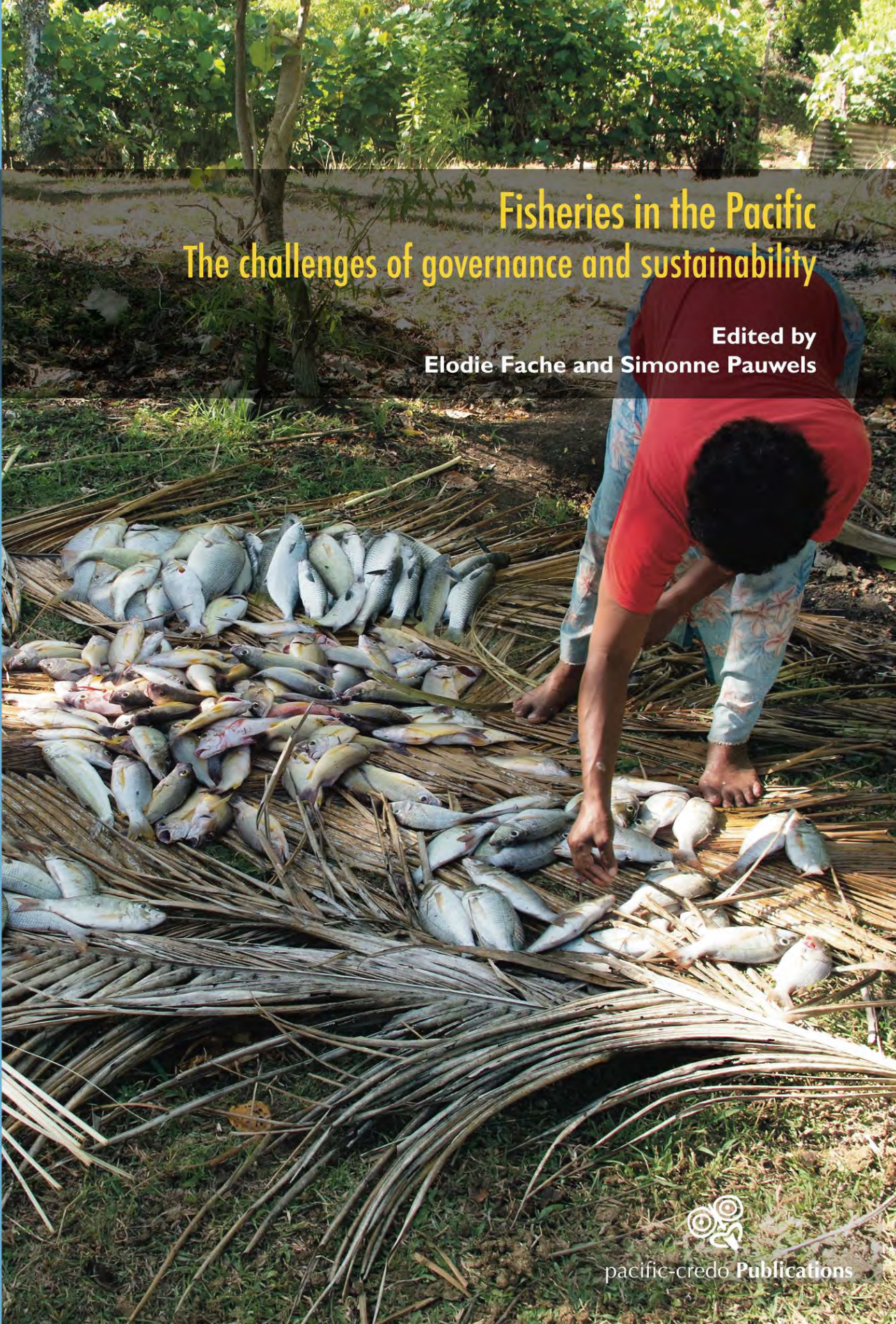
HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Fisheries in the Pacific

The challenges of governance and sustainability

Edited by
Elodie Fache and Simonne Pauwels



Fisheries in the Pacific

The Challenges of Governance and Sustainability

Edited by
Elodie Fache and Simonne Pauwels

All rights reserved.

No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying or otherwise, without the prior permission of the publisher.

© pacific-credo Publications, 2016

ISBN : 978-2-9537485-5-0

Aix-Marseille Université — CNRS — EHESS

Credo, UMR 7308, Marseille — France

Grafic design : Émilie Courel, CREDO

Cover photography : © Simonne Pauwels

Fisheries in the Pacific

The Challenges of Governance and Sustainability

**Edited by
Elodie Fache and Simonne Pauwels**



pacific-credo **Publications**

Acknowledgments

The book Fisheries in the Pacific: The Challenges of Governance and Sustainability grew out of a workshop on the topic “Resources, boundaries and governance: What future for fisheries in the Pacific?” held in October 2014. This workshop was co-organized in Marseilles by the Centre for Research and Documentation on Oceania (CREDO, Aix-Marseille University – CNRS – EHESS, France) and the Centre for Pacific Studies (CPS, University of St Andrews, United Kingdom) in the context of the European Consortium for Pacific Studies (ECOPAS, 2012–2015) funded by the European Union (FP7, Coordination & Support Action, Grant N°320298). This event was hosted by Aix-Marseille University and launched by Prof. Denis Bertin, then Vice President for Research, whom we are delighted to thank here.

This book owes much to the attentive reading and constructive comments of its anonymous reviewers, to Grace Delobel’s conscientious work of proofreading and translation, to Pascale Bonnemère institutional support and to Emilie Courel, our publishing assistant. We owe them our gratitude.

Last but not least, the realization of both the workshop and the book were greatly facilitated by the efficient assistance of the Protisvalor team. Thank you.

Table of contents

Introduction: Pacific Islanders, “custodians of the ocean” facing fisheries challenges <i>Elodie FACHE, Simonne PAUWELS and Joeli VEITAYAKI</i>	7
Overview of tuna fisheries, stock status and management framework in the Western and Central Pacific Ocean <i>Valérie ALLAIN, Graham Michael PILLING, Peter Gregory WILLIAMS, Shelton HARLEY, Simon NICOL and John HAMPTON</i>	19
Resources, boundaries and governance: what future for marine resources in Micronesia? <i>Manuel RAUCHHOLZ</i>	49
The other side of large-scale, no-take, marine protected areas in the Pacific Ocean <i>Yan GIRON</i>	77
Kanak coastal communities and fisheries meeting new governance challenges and marine issues in New Caledonia <i>Samuel CORNIER and Isabelle LEBLIC</i>	119
Socioeconomic significance of fisheries in the Small Island Developing States: natural heritage or commodity? <i>Nathalie HILMI, Tamatoa BAMBRIDGE, Alain SAFA, Bran QUINQUIS and Paul D'ARCY</i>	175
Green Turtle: an emblematic marine species at a crossroads in New Caledonia <i>Catherine SABINOT and Sarah BERNARD</i>	199
The challenge of sustainability for Pacific Island village fisheries, a historical perspective <i>Gilbert DAVID</i>	221
Policy options for coastal and tuna fisheries in the Pacific Islands: sustaining resources on the same side of the same coin <i>Joeli VEITAYAKI and Esaroma LEDUA</i>	255
The authors	283



Introduction: Pacific Islanders, “custodians of the ocean” facing fisheries challenges

Elodie FACHE, Simonne PAUWELS, Joeli VEITAYAKI

*[The] sea is our pathway to each other and to everyone else,
the sea is our endless saga, the sea is our most powerful metaphor,
the ocean is in us. (Hau’ofa 2000: 43)*

The Ocean is in us

In his much-acclaimed essay, *Our Sea of Islands*, Epeli Hau’ofa (1993) argued that Pacific Islanders are the most suitable people on earth to be the custodians of the ocean. He reasoned that since Pacific Islanders have been living in the Pacific Ocean for centuries, they have made this ocean their home using knowledge of seafaring, navigation, ship design and construction, and have developed social and cultural systems that can be used to manage the sea and its resources. The personal journey of Joeli Veitayaki, an author of this volume’s introduction and final chapter, and a native of Fiji, illustrates the importance of encounters with and experiences on the sea in the lives of Pacific Islanders. Although his story is not representative of all Pacific Islanders, it highlights the necessity of bringing their perspectives into the centre of global debates about the governance of marine territories and the sustainability of marine resources. Joeli’s view, one increasingly shared in Fiji and regionally, is that Pacific Islanders’ close association and special relationships with the ocean should be used in the drive to effectively manage the ocean.

Joeli’s first encounter with the sea was as a five-year-old boy accompanying his uncle (his mother’s brother) on an old cutter sailing from Suva, the capital of Fiji, to his village on Gau Island, about 80 km away to the east. Joeli was to be educated and raised by his uncle in the village, under a type of adoption that strengthens family ties. As Aseela Ravuvu (2005: 2) explained, “a man’s sister’s son (and to a different extent her daughter) had a particular claim on his counsel, loyalty, assistance and even property”.

The trip took over ten hours. The sea, though calm, looked immense, imposing and gave the impression that it must be respected because of the mysteries it hid. In the village, Joeli was immediately taught to swim so that he could be spared the watchful attention of the elders, who kept him under their radar until he earned his freedom by proving that he could swim and survive on the island.

Growing up, Joeli participated in reef gleaning, fish poisoning, fish drives, turtle fishing, gillnetting, handling of other types of nets, spear fishing on the surface and underwater, and a variety of night fishing activities. The multitude of traps, nets, spears, poisons and other ingenious fishing methods used by Pacific Islanders, in particular Fijians, demonstrate their deep understanding of their prey (see also Veitayaki 1990: 50-55). Joeli was taught to pole and navigate the family's small wooden punt along the adjacent shores. He was also taken by his family members to the gardens and was coached on his relations with other members of his group. This was all part of his induction into being an islander. His uncle told him that if he did not want to eat, he could be excused from these family chores, but if he loved food, as he did, then he had to work harder.

Food was cooked in saltwater, as there was no processed salt. Women had rocks that were occasionally picked from where they were placed at sea to boil in water and make soup whenever fishing was unsuccessful. Strict food restrictions were also observed within the village and on the island. In a communal feast for instance, members of the chiefly clan would have pork, freshwater fish and a few chiefly marine fish species such as trevally, while the *bati* or warrior and planter clan members would only eat reef fish.

Every year, the primary school community dived for branching coral, which was roasted overnight in wide shallow pits to produce white chalk powder. When mixed with water, this provided the paint that was used to turn all of the black stones in the school compound into a refreshing white. Sand, dead coral and gravel from the sea provided building and decorative materials. The sandy beaches were recreational spots where people drew, played or simply sat to observe the beauty and power of the sea. The villagers also used the sea as a rubbish dump and toilet because they believed it was capable of swallowing and accommodating these wastes.

Joeli also heard of shark gods, giant octopuses and stingrays which protected the fishing ground and people and punished those who acted inappropriately. He was told of the dual between a shark god and a giant octopus; a fight that was won by the octopus, a mere invertebrate.¹

Bravery and prowess at sea were acclaimed, revered and the common subject of folklore. Joeli's uncle, a self-taught seafarer, sailed as a young man and gradually learned to be a navigator. On one of his trips to the island, the steering chain connected to the rudder broke and the ship began to drift. He volunteered to dive under the ship and tie ropes around the rudder in order to set the ship back on course towards its original destination. He did so despite the fact that Joeli's mother's older sister was killed by a shark when diving for trochus just beside the reef passage. His grandfather and uncle were also lost at sea when the cargo sailboat transporting them capsized.

1. The surprising fact that an octopus can win over a shark has been captured on video in recent times.

Joeli was familiar with the joy and sensation of having a good fish catch and the disappointment, laments, excuses, long faces and jokes when the catch was not up to expectation. At the time, poor catches were interpreted to be the result of wrong timing, wrong decisions or customary misgivings. Overfishing was never considered to be an issue as people believed that nature would always provide for them as it had for their ancestors before them.

Years later, Joeli left the island and sailed to Suva to pursue his education. The journey took nearly a week as the cutter visited three other small islands to collect passengers and copra. By the time the cutter reached the final destination, the school was into its first week and it was hard to distinguish passengers from crew members as everyone had shared the same basic facilities, which had an overpowering oil stench. The cutter was dirty, small and powered by a loud but slow engine spurting dark black smoke, revealing the ship's arrival long before it was seen. The kitchen and toilets drained straight into the sea.

At school and later university, Joeli learned about how fish are adapted to live in the sea and of the importance of maintaining the beauty and integrity of coastal habitats so that they may continue to provide the services that they offer. He learned of coral reefs that protect the tiny islands and support a variety of organisms, some minute, some small and others big — each uniquely adapted to live on land, in water, or both. Similarly, some of these organisms live in fresh water, salt water, or both. He also learned of ocean explorations, naval battles and overseas territories and of new development options such as aquaculture, desalination and renewable energy.

On many Sunday afternoons, Joeli went to the local port in Suva because he was fascinated by its activities. There were cruise ships and large cargo vessels loading or offloading all types of products, oil and gas tankers, private pleasure boats and the occasional naval and research vessels from countries outside the Pacific Islands.

Joeli graduated in geography and English from the University of the South Pacific (USP) in the early 1980s oblivious to the environmental and political storms brewing in the Pacific Ocean. Overseas territories of colonial powers were being used for nuclear testing,² overfishing was taking place, and shipping and marine pollution threatened the security of life in the region. No course or programme on the proper use and management of the marine environment was available at the time. The Pacific Island region, countries and people were not prepared to deal with the issues relating to the protection of their ocean, although it was the dominating feature of the human environment in the USP's 12 nations.

2. Radioactive materials in Mururoa, Johnston and Kwajelein Atolls continue to pose danger to local communities and islands. In addition, nuclear powered ships and vessels carrying radioactive materials are still plying the ocean, while international business concerns are still looking for islands on which to dispose toxic industrial wastes.

For his postgraduate studies, W.C. Clarke and R.R. Thaman, two distinguished Pacific Island geographers with a keen interest in ocean resource management, advised Joeli to do his research in the area of marine resource use. He was easily convinced because of his childhood experience and his interest in the fishers of Qoma Island, a fishing village near to where he was teaching at the time. The relationships with the sea of these men and women, who invested the barest minimum in their fishing activities, regularly pursued fish in their realm with equipment that was an eclectic combination of old and new, and were not formally regarded as commercial fishers because they were villagers, intrigued him. He wanted to understand and publicise the plight of these fishers. Interestingly, his association with Qoma villagers marked the beginning of his involvement in marine resource management. He became familiar with more traditional knowledge, resource use methods and management practices, the importance of fisheries to the local economy, the depletion of resources and the increasing importance of the marine space. These lessons from Qoma Island became the foundation on which Joeli has based his research in Fiji and the Pacific Island region.

Fijians, like most Pacific Islanders, still practise intricate exchange arrangements with their relations, and these arrangements ensure that resources are used efficiently and that people look after each other in times of need. Hoarding is neither practical nor necessary because people's basic requirements are supplied through their kin-based networks (see also Narayan 1984: 13). An important feature of indigenous Fijians' social relations and culture is that people are related to one another because of where they are from. Social relations called *mataqali* (a respectful relation between people from the Kubuna Confederacy³), *tovata* (a respectful relation between people from the Tovata Confederacy), *tauvvu* (jovial but close relation between people who have common ancestral gods), *naita* (jovial but close relation between people from Kubuna and Burebasaga Confederacies), *takolavo* (relation between particular districts within Viti Levu), and *dreu* (jovial but close relation between people from Tovata Confederacy and those from some parts of Viti Levu), are examples of the social networks guaranteeing that people assist each other because they are related. In their villages and homes, people also tell stories about their fish, bird and plant totems, which demonstrate their common lineages. These relations are reinforced and publicised during social ceremonies and are strengthened by inter-marriages, regular visits and sharing. They are at the core of resource use practices, such as

3. Today, all of the chiefs of Fiji and their people belong to one of three confederacies: Kubuna, Burebasaga and Tovata. These confederacies are a result of geographical propinquity, kinship ties (often engineered by strategic marriages), and conquests and/or military alliances. Before colonization, the central highlands of the main island of Viti Levu, and the west and northwest areas of Fiji, were not part of these confederacies, but the colonial government found such socio-political entities far easier to both comprehend and administer, and these areas were therefore simply associated with Kubuna, and to a lesser extent Burebasaga.

kerekere or the borrowing of food, mats, *tabua* (whale teeth) and other artefacts from one's relations, which ensures that surpluses are shared and thus prevents the accumulation of wealth. Similarly, *kana veicurumaki*, or the sharing of subsistence resources, is a widely observed practice between groups that have resources or borders in common or who cannot eat the same food due to the nature of the relationship binding them — for example, people linked to the sea cannot eat fish in the presence of people linked to the land, but they will eat the land people's pork while the others eat their fish. This practice also allows access to food when prevailing conditions are abnormal, such as after a cyclone.

A person caught fishing illegally in an area will seek pardon from the village or district chief by presenting an offering of *yagona* (kava, *Piper methysticum*) or *tabua* (whale teeth) depending on the severity of the deed. More generally, presentations to seek forgiveness and atonement for any serious breach of protocols and norms committed against other people are referred to as *matanigasau* and *bulubulu*. In other instances, people who feel that their misfortunes or mishaps are due to something wrong they or one of their elders have done will make the same presentation to appease the spirits that they believe are punishing them. Turtle fishers of Qoma Island use this form of seeking forgiveness and atonement to ensure they succeed with a catch when they are out in the fishing ground (Veitayaki 1990, 1995). These turtle fishers believe that they go fishing with their ancestral spirits, who will punish them if they are offended, that is to say if the fishers conduct themselves inappropriately or deviate from acceptable practices. Failure to make a catch is interpreted as the sign that not all is well within the family unit.

Customary marine tenure, meaning the formal or informal ownership of sea space by a social unit (Calamia 2003), is common across the Pacific. In Fiji, the size and location of customary fishing grounds were formalized by the determination of boundaries between the 1890s and 1996, in the beginning by the colonial government and later by the Fijian government. These boundaries do not reflect the size of the population which depends on the marine resources, nor are they based on ecologically optimal management units (Muehlig-Hofmann et al. 2005). They are rather the result of a local history of migration, settlement, marriage and warfare, and reflect who wielded the most influence when government representatives came to put these boundaries into writing.

Joeli also learned of the United Nations Convention on the Law of the Sea,⁴ which favoured Pacific Island countries by making them Large Ocean Island States,

4. "The United Nations Convention on the Law of the Sea lays down a comprehensive regime of law and order in the world's oceans and seas establishing rules governing all uses of the oceans and their resources. It enshrines the notion that all problems of ocean space are closely interrelated and need to be addressed as a whole. The Convention was opened for signature on 10 December 1982 in Montego Bay, Jamaica. [...] The Convention entered into force in accordance with its article 308 on 16 November 1994 [...]. Today, it is the globally recognized regime dealing with all matters relating to the law of the sea."

or LOIS, and simultaneously burdened them with the responsibility of ensuring the sustainable and peaceful use of the Pacific Ocean. He became aware that these LOIS were collaborating increasingly with each other to protect and secure their respective self-interests in the face of global challenges such as environment management and commitment to global initiatives and arrangements.

In 1992, Joeli joined what is now the School of Marine Studies at USP, and then in 2001 completed a Ph.D. in environment management and development at the Australian National University in Canberra, Australia. Since the 1990s, his responsibilities at USP have included teaching, research and advice (to students and researchers, Pacific Island governments, and other people and institutions) on marine resource management. In that capacity, he helped to build the multidisciplinary Marine Studies programmes which are available today. For the first time, these programmes have allowed Pacific Island students to focus their academic pursuits on the sea, which is considered as a food basket, hunting ground, recreational arena, theatre, and art gallery, as well as an economic and cultural highway linking Pacific Islanders to each other and to the outside world.

Pacific peoples are observant, adaptive and resilient — traits honed by millennia of close association and intimacy with their ocean and island homes. These traits have allowed them to live with minute land resources and ever changing island environments for thousands of years. Now, however, contemporary changes such as global warming, ocean acidification, environmental degradation, alteration of natural habitats, loss of territories and boundaries, globalisation and rampant consumerism promise a tropical cyclone or tsunami of a magnitude greater than anything Pacific Islanders have ever faced.

What is the future for fisheries in the Pacific?

The Pacific Ocean has exceptional dimensions: it covers about half of the Earth's total ocean area and a third of its total surface. It also plays a major role in the global supply of fish and other marine resources (for example, crustaceans and echinoderms⁵). In 2011, according to statistics from the Food and Agriculture Organization (FAO) of the United Nations, the Northwest Pacific had the highest fishery production with 21.4 million tonnes (26% of the global marine catch), followed by the Southeast Pacific with 12.3 million tonnes (15% of the global marine catch) and the Western Central Pacific with 11.5 million tonnes (14% of the global marine catch) (FAO 2014: 37). Together, these three regions provide almost half of the global marine

(Website of the United Nations Division of Ocean Affairs and the Law of the Sea, http://www.un.org/depts/los/convention_agreements/convention_overview_convention.htm, Accessed on July 20, 2015).

5. Including holothurians, also called sea cucumbers or "bêches-de-mer".

catch. The current challenges "to produce more fish, to do so in a sustainable manner and to ensure that fish for food is also available where most needed" (FAO 2014: 199) are therefore of paramount importance in the Pacific Ocean.

In this context, the Pacific Small Island Developing States (Pacific SIDS) of Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Nauru, Niue, Palau, Papua New Guinea, Republic of the Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu see themselves as LOIS which are responsible for the sustainable management of the coastal and offshore resources available in "their" ocean. Although historically, geographically, socioculturally and politically diverse, all Pacific SIDS/LOIS are economically dependent on marine resources as they have very limited land territories but extensive economic exclusive zones (EEZs). For instance, Kiribati has a total land area of 800 km² and an EEZ of approximately 3.5 million km². Who would be surprised that such states aspire to control both the exploitation and the conservation of marine spaces and resources? These shared interests are increasingly giving rise to formalized regional and subregional alliances, such as the Western and Central Pacific Fisheries Commission (WCPFC), a regional fisheries management organization, the Pacific Islands Forum Fisheries Agency (FFA), which "strengthens national capacity and regional solidarity so its 17 members can manage, control and develop their tuna fisheries now and in the future",⁶ and the Parties to the Nauru Agreement (PNA), which controls the world's largest tuna purse seine fishery as well as around 50% of the global supply of skipjack tuna, the most commonly canned tuna.⁷ The role of these and other organizations with specific mandates to assist the Pacific SIDS/LOIS in meeting their obligations in accordance with the resource use and management agreements, treaties and conventions which they have signed and ratified, as well as their interrelationships, will be discussed throughout the book.

Pacific SIDS/LOIS gained their independence very recently,⁸ their total population (less than 10 million people) represents less than 0.2% of the world population, and their economies rely on funding granted by donors of development assistance to the region, mainly Australia, the United States of America (USA), New Zealand, Japan, China, France and the European Union (Borrevik et al. 2014: 25). Some of these donor states, such as Japan, China and the USA, are furthermore actively involved in fisheries in the Western and Central Pacific Ocean (see especially Allain et al., Rauchholz, and Giron in this volume). Therefore, the future of fisheries and marine

6. See "About FFA" on FFA's website, <https://www.ffa.int/about> (Accessed on July 19, 2015).

7. See "About us" on PNA's website, <http://www.pnatuna.com/About-Us> (Accessed on July 16, 2015).

8. Samoa became the first independent State in Oceania in 1962, then other independence proclamations followed each other until the 1990s with, for instance, Fiji and Tonga in 1970, Papua New Guinea in 1975, Vanuatu in 1980 and Palau in 1994.

resources in the Pacific is inseparable from the future of the relationships between Pacific SIDS/LOIS and the superpowers based within as well as outside the region.

This complex situation raises many questions. In particular, who are the stakeholders of coastal and offshore fisheries in the Pacific, what are their practices, and what are the associated management measures? How could the Pacific SIDS/LOIS benefit further and sustainably from the management of Pacific waters, which are critical for regional food security and also represent a reserve of food resources for the rest of the world? How do fisheries articulate with the domain of environmental conservation and the sector of current and future mining in the region? What power relations are involved in this context? How may relations between national governments at the regional level, as well as between these governments and extra-regional governments, non-governmental organizations, international development agencies and the private sector, be strengthened or redefined so that Pacific SIDS/LOIS secure, individually and collectively, the political, financial, technical and other resources and capacities needed to effectively implement fisheries management measures? How can Pacific SIDS/LOIS ensure that these measures support their own interests and decisions?

At first, these various questions were approached in the context of a workshop on the topic “Resources, Boundaries and Governance: What Future for Fisheries in the Pacific?” held at Aix-Marseille University in France on 13-14 October, 2014. This event was co-organized by the Centre for Research and Documentation on Oceania (CREDO, Aix-Marseille University - CNRS - EHESS, France) and the Centre for Pacific Studies (CPS, University of St Andrews, United Kingdom) in the context of the European Consortium for Pacific Studies (ECOPAS). With funding for 2012-2015 from the European Union’s Seventh Framework Programme (FP7) in response to its call “Climate Change Uncertainties: Policymaking for the Pacific Front”, this consortium was composed of six major centres for Pacific studies, four in Europe (Norway, France, the United Kingdom and the Netherlands) and two in the Pacific (Papua New Guinea and the 12-nations of the University of the South Pacific). Its work programme was designed to provide coordination and support to research and policy communities on issues connected to climate change and related processes in the Pacific region.

We thought that the sum of knowledge shared during the workshop deserved to be gathered together and diffused. This book examines various aspects of coastal and oceanic fisheries in the Pacific region. It highlights that both these fisheries sectors raise major economic and ecological issues while revealing significant social changes, political asymmetries and alliances, geostrategic rationales, developments in legislation, customary dynamics and conservation challenges. Understanding the current state of fisheries in the Pacific therefore requires one to simultaneously grasp their coastal and oceanic components as well as deeply entangled international, regional, sub-regional, national and local processes. We also hope that the compelling need to establish a constructive and ongoing dialogue on the matter between social scientists

and environmental scientists, based in Europe and in the Pacific Islands, and between these experts and the various stakeholders and policy-making institutions involved in the Pacific region, will become obvious over the course of the chapters.

Indeed, the authors of this book are scientists from quite diverse disciplines: anthropology, geography, history, economic sciences and international economics, marine biology and biological oceanology, agro-fisheries, marine studies, applied ecology, ethnoecology, environment management and development. They are based in various (academic or applied) research institutions, often multidisciplinary, in France, Monaco, Germany, New Caledonia, French Polynesia, Australia and Fiji. Together, they accepted the challenge to propose an overview of, and to highlight connections between, current data on fisheries in coastal and oceanic areas of the Pacific Ocean while offering a diachronic perspective on associated dynamics and issues. Complementary approaches and interpretations of the data respond to each other throughout the book, and even within certain chapters. This confrontation of views results from an extension of discussions between the scientists who participated in the workshop in October 2014, their colleagues who decided to take part in this publication project, and the editors of the book. We hope that the following chapters will contribute to a better understanding of the current situation of fisheries in the Pacific while demonstrating to the various stakeholders and policy-making institutions involved in the Pacific region how policies and projects relative to fisheries can benefit from the latest research outputs.

Summary of the book's content

The first chapter offers an overview of pelagic fisheries in the western and central Pacific Ocean, with a major focus on tuna fisheries, which provided 58% of the global tuna catch in 2013. Valérie Allain, Graham M. Pilling, Peter G. Williams, Shelton Harley, Simon Nicol and John Hampton present the most recent Pacific Community (SPC) catch estimates and stock assessments of the main tuna species targeted in the Western and Central Pacific Ocean: skipjack, yellowfin, bigeye and South Pacific albacore tuna. They also describe the tuna resource management framework implemented at different spatial scales in the region as well as new developments concerning the monitoring of tuna fisheries.

Through a focus on the Micronesian region, especially the Federated States of Micronesia, Manuel Rauchholz's chapter highlights how local, national and regional efforts to develop sustainable fisheries — and thus prevent the depletion of coastal, nearshore and offshore fish stocks and marine life — are confronted with the overwhelming forces of globally operating fishing corporations, which are particularly active in the commercial tuna industry. In their rush for quick profits, these corporations are relying on exploitative practices and ignoring the voice of science. Rauchholz shows how such a quest for relentless economic gain, associated with political

interests, was and remains a cause for serious ecological and human rights concern using the example, among others, of poaching and illegal fishing activities by foreign vessels, including by purse seine vessels under the PNA's Vessel Day Scheme, in the waters of the Micronesian islands. In parallel, he illustrates issues of self-regulation in local fishing practices through the study of blast fishing on and around Chuuk's coral reefs.

Yan Giron demonstrates that the exploitation of tuna resources in the Pacific is also intrinsically linked to the mining of offshore oil and gas resources, the mining potential of marine rare earths in deep sea areas, geostrategic issues of defence and leadership (involving especially the USA and China), and the establishment of marine protected areas (MPAs) categorized as large-scale (covering marine surfaces of over 100,000 km²) and "no-take" (meaning where fishing is prohibited). In so doing, Giron presents his concept of "maritime pivot", which allows him to analyse opportunist synergies between public and private plays for power as well as articulations between "hard power" and "soft power" in the Asia-Pacific region. He particularly points out some of the unexpected issues raised by the lobbying campaigns of American charitable trusts which promote the creation of a network of large-scale "no-take" MPAs in the Pacific.

Through a case study in New Caledonia, whose lagoons were inscribed on the World Heritage List in 2008, Samuel Cornier and Isabelle Leblie also address the question of the articulation between fisheries, environmental conservation and mining. They particularly illustrate that the impacts of the Hyabé/Lé-Jao MPA (Yambé), officially established in 2009 within the UNESCO serial site, diverge from those expected. The real-world implementation of this MPA reveals low local involvement in marine resource management, social frustrations and tensions, the abandonment of fishing areas or — to the contrary — "hidden" fishing and overfishing activities, and the loss of "traditional" fishing knowledge. The authors put their case study into perspective using the controversies associated with the Coral Sea Natural Park (Le Parc Naturel de la Mer de Corail), an MPA created in 2014 and encompassing all of New Caledonia's EEZ (about 1.3 million km²).

Nathalie Hilmi, Tamatoa Bambridge, Alain Safa, Bran Quinquis and Paul d'Arcy then explore the socioeconomic and cultural significance of fish and fisheries from the viewpoint of Pacific Islanders themselves, especially in French Polynesia which, like New Caledonia, is part of the Overseas Countries and Territories (OCTs) that have special links with France. Their analysis challenges the understanding of marine resources and fisheries in the Pacific through the prism of the still common opposition between the notion of "commodities" (marketable and interchangeable goods or services produced to satisfy wants or needs) and that of "natural heritage" (the biodiversity inherited from past generations, maintained in the present, and transmitted to future generations). They also argue that Pacific societies are re-conceptualizing fish and fisheries as "pluralistic objects" having entangled economic, environmental, social and cultural values.

Catherine Sabinot and Sarah Bernard propose a complementary perspective through their analysis of the evolution of the values, norms and management measures that have been associated with the green turtle (*Chelonia mydas*) in New Caledonia. They demonstrate that this marine species lies at a crossroads of local, tribal, provincial and international expectations. In so doing, they reveal that Kanak society confers on the green turtle a "symbolic" value and increasingly, in the context of growing environmentalist pressures and significant socioeconomic mutations, a "heritage" value. Their study of management measures and their implementation also shows that the green turtle is both the "subject" and "object" of conflicting views, territoriality issues and legitimacy issues.

Gilbert David raises the question of the sustainability of Pacific Island village fisheries in the context of a rising demand for fishery products generated in part by population growth. To do so, he offers a diachronic perspective of three types of village fisheries (outer slope artisanal fishery, artisanal fishery around fish aggregating devices, nearshore subsistence fishery), each considered as a system composed of a production subsystem, a management subsystem and a fisheries product chain and trade subsystem. A particular focus on Vanuatu illustrates this overview. David concludes that given the importance of village fisheries for the food security of Pacific Island coastal populations, ensuring their sustainability should be a priority of both government and village authorities in all Pacific Island countries and territories. According to this author, sustainability can only be achieved through a holistic approach, based on the fisheries system paradigm (rather than an ecosystem approach) and the building of a bridge between national and local levels (for instance through co-management agreements), and through the development of a network of effective locally managed marine areas associated with the setting up of deepwater MPAs, nearshore fish aggregating devices and artificial reefs.

Joeli Veitayaki and Esaroma Ledua close this book by emphasising that the sustainability of both coastal and tuna fisheries is an overwhelming challenge for Pacific SIDS/LOIS. These authors argue that years of increasing use and production with little concern for ecological well-being have resulted in overexploitation, resource depletion and environmental degradation that are threatening these two important and interrelated economic sectors, which therefore face sustainability issues that cannot be addressed separately. They also present several innovative fisheries management arrangements that should be built on, and suggest some policy changes to assure the integrity and health of fisheries resources while securing maximum and perennial returns for Pacific Islanders. In particular, they request all stakeholders (governments, regional and subregional organizations, private sector companies, local communities, etc.) to be involved and collaborate in fisheries management, and Pacific SIDS to reinforce their environmental commitment and their regional alliances.

References

- Borrevik, Camilla, Tony Crook, Edvard Hviding, and Craig Ling, with the contribution of Elodie Fache, Toon Van Meijl, Sue Farran, and Michael Goldsmith
2014 European Union Development Strategy in the Pacific (Study Requested by the European Parliament's Committee on Development). Brussels: European Union.
- Calamia, Mark A.
2003 Expressions of Customary Marine Tenure and Environmental Entitlements: A Case Study Involving Common Property Regimes in a Fijian Outer Island Group. Ph.D. Thesis. Boulder: University of Colorado.
- FAO
2014 The State of World Fisheries and Aquaculture. Opportunities and Challenges. Rome: Food and Agriculture Organization of the United Nations, <http://www.fao.org/3/a-i3720e.pdf> (Accessed on July 16, 2015).
- Hau'ofa, Epeli
1993 "Our Sea of Islands". In E. Waddell, V. Naidu and E. Hau'ofa (eds.), *A New Oceania: Rediscovering our Sea of Islands*. Suva: Beake House, p. 2-16.
2000 "The Ocean in Us". In A. Hooper (ed.), *Culture and Sustainable Development in the Pacific*. Canberra: ANU E Press and Asia Pacific Press, p. 32-43.
- Muehlig-Hofmann, Annette, Joeli Veitayaki, N.V.C. Polunin, S. Stead, and N.A.J. Graham
2005 Community-Based Marine Resource Management in Fiji – From Yesterday to Tomorrow. Paper Presented to the 10th International Coral Reef Symposium. Japan: Okinawa.
- Narayan, Jay
1984 *The Political Economy of Fiji*. Suva: South Pacific Review Press.
- Ravuvu, Asesela
2005 *Vaka i Taukei: The Fijian Way of Life*. Suva: Institute of Pacific Studies, University of the South Pacific.
- Veitayaki, Joeli
1990 *Village-Level Fishing in Fiji: A Case Study of Qoma Island*. MA Thesis. Suva: University of the South Pacific.
1995 *Fisheries Development in Fiji: The Quest for Sustainability*. Suva: Institute of Pacific Studies and the Ocean Resources Management Programme, University of the South Pacific.



Overview of tuna fisheries, stock status and management framework in the Western and Central Pacific Ocean

*Valérie ALLAIN, Graham Michael PILLING, Peter Gregory WILLIAMS,
Shelton HARLEY, Simon NICOL, John HAMPTON*

Introduction

The tuna fisheries in the Western and Central Pacific Ocean (WCPO), encompassed by the Convention Area of the Western and Central Pacific Fisheries Commission (WCP-CA)¹ (fig. 1), are diverse. They range from small-scale, artisanal operations in the coastal waters of Pacific states to large-scale, industrial purse seine, pole-and-line and longline operations in the exclusive economic zones (EEZs) of Pacific states and in international waters (high seas). The main species targeted by these fisheries are skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), bigeye tuna (*Thunnus obesus*) and albacore tuna (*Thunnus alalunga*). Tuna are highly migratory species travelling across the region. The catch supplies fresh and frozen tuna markets for local consumption and for export as well as canning industries based in the Pacific Islands and abroad.

The tuna fishery in the WCPO is the largest in the world with 2,627,696 tonnes (t) of tuna caught in 2013. This tonnage represented 82% of the total 2013 Pacific Ocean catch of 3,213,733 t and 58% of the global tuna catch (the provisional estimate for 2013 is 4,517,435 t) (Williams and Terawasi 2014).

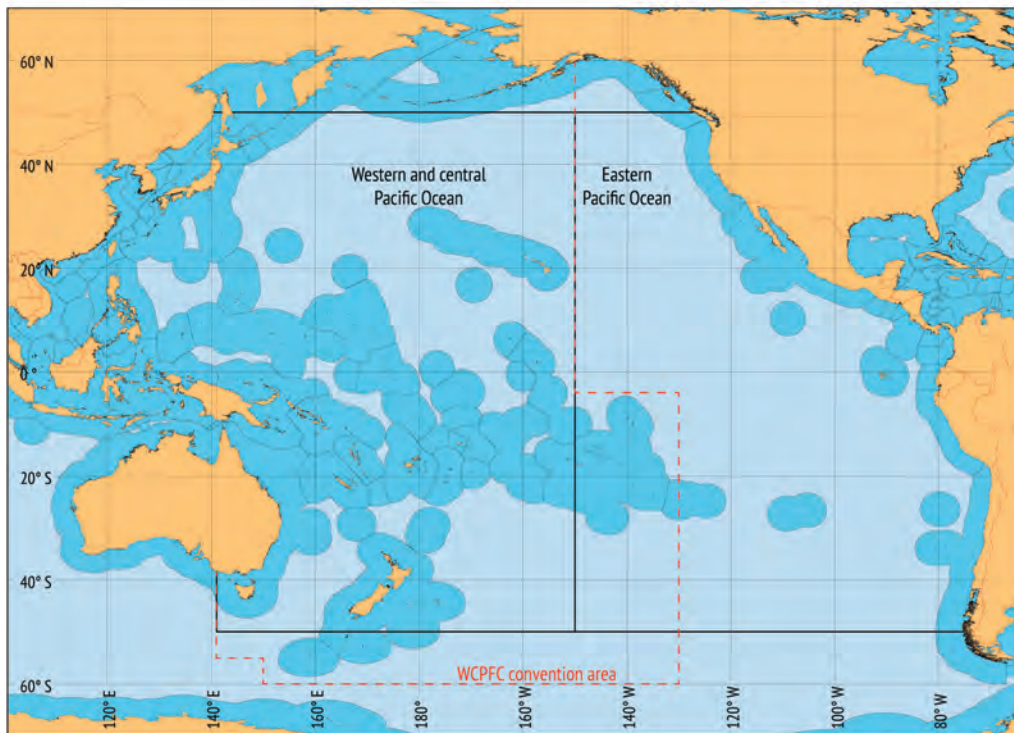
The exploitation of tuna delivers important economic benefits to Pacific Island Countries and Territories (PICTs) through the sale of fishing access rights and the profits and employment generated by the fishing and fish processing industries (Bell *et al.* 2015; Gillett *et al.* 2001). The value of the tuna catch in the WCPO was estimated at U.S.\$6.2 billion in 2013 (Williams and Terawasi 2014). In 2012, fishing access revenues represented between 11 and 63% of total government revenue in six PICTs (Kiribati, Tuvalu, Federated States of Micronesia, Nauru, Marshall Islands and Palau) (Bell *et al.* 2015), and given the increases in access fees since 2012 this share is likely to have increased. Tuna fishing and processing also provide employment for thousands of people mainly in Papua New Guinea, Solomon Islands, Fiji and American

1. The longitude 150°W delimits two geographic entities: the WCPO to the west and the Eastern Pacific Ocean (EPO) to the east. The WCP-CA has been defined for fisheries management; it includes the WCPO, but extends north and south of the WCPO and partially overlaps the EPO in the southern hemisphere. For simplification WCPO will be used as an approximation of the WCP-CA in the text.

Samoa (Gillett 2009). Total direct and indirect tuna-related employment is estimated to be between 5 and 8% of all wage employment in the region, and tuna canneries employ 5% of all formally employed women in the region (Gillett *et al.* 2001).

Given the importance of the tuna fisheries, their sustainability needs to be monitored through the collection of a broad range of biological, economic and fisheries information. This information is used in stock assessments to evaluate the status of the tuna stocks. However, uncertainties in this information have implications for stock assessment outputs, the evaluation of management options, and hence the advice provided to managers. Access to reliable historical data is not always guaranteed, and fishing companies and countries can be slow in providing data, which

Figure 1: The Western and Central Pacific Ocean (WCPO), the Eastern Pacific Ocean (EPO) and the Western and Central Pacific Fisheries Commission (WCPFC) Convention Area (WCP-CA) in dashed lines



This map is indicative only of agreed and potential maritime jurisdictional limits within the Pacific Islands. This map does not necessarily reflect coastal state claims and is without prejudice to negotiations that countries may enter into. Data related to EEZ areas were mostly extracted from Claus *et al.* 2014.
© Pacific Community, 2015.

limits the data available. Illegal, unreported and unregulated fishing (IUU) is moreover difficult to estimate (Agnew *et al.* 2009). In addition, knowledge of the basic biology of the species is incomplete. In stock assessments, some uncertainties in information and their potential impact on assessment results are tested; however these uncertainties in information increase the uncertainty in stock status advice and hence management decisions may be more precautionary than would otherwise be necessary.

The present review provides a broad description of the tuna fishing techniques, the tuna and other species exploited and the data collected for monitoring in the WCPO. It draws on the 2013 catch estimates compiled for the WCPO and the status of tuna stocks. It also includes sections covering the tuna resource management framework in the Western and Central Pacific Fisheries Commission (WCPFC). Lastly, the review presents issues and new developments concerning monitoring, which provides information to scientists and managing agencies for the development of conservation and management measures aiming to ensure the sustainability of tuna stocks, ecosystems and fisheries.

The pelagic fisheries² of the Western and Central Pacific Ocean

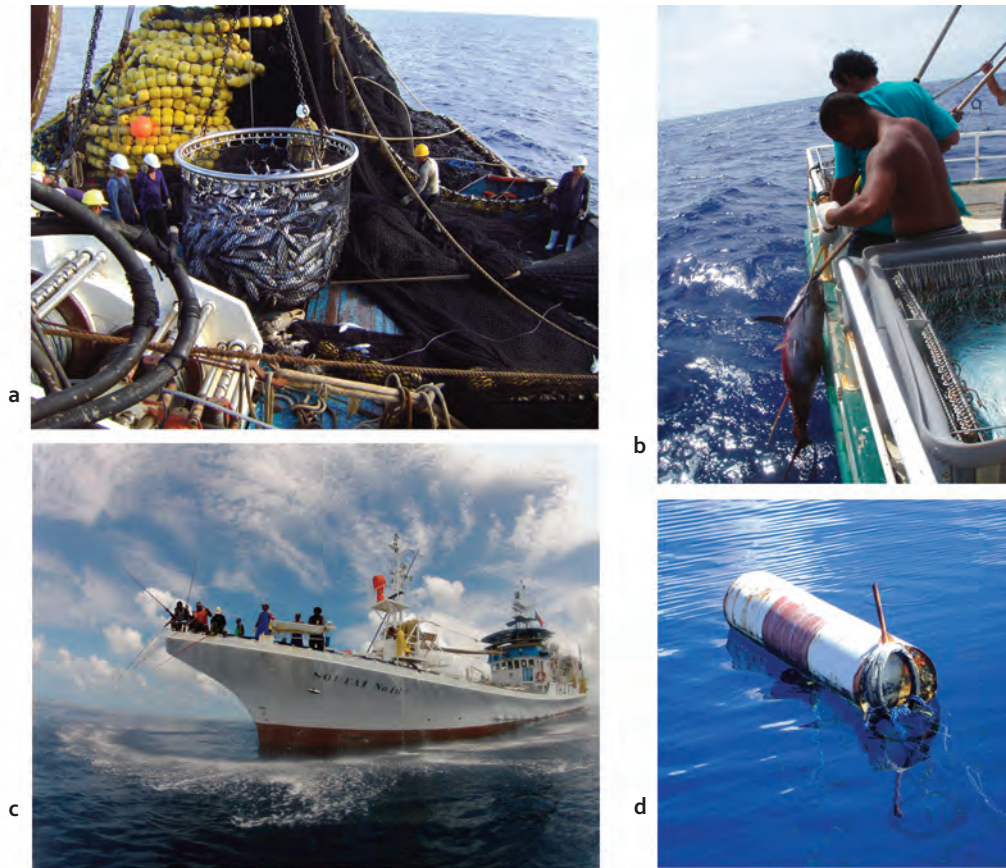
In the present paper a fishery is defined by one or several of the following elements: people involved, species caught, area of water, method of fishing and class of boats. A fishery can be composed of several fleets defined in terms of vessel nationality, fishing location, species caught, class of boats, duration of fishing trips, fish preservation method, and base port. Vessels of the same nationality are classified into a domestic fleet if they are fishing in their home waters, into a foreign fleet if they are based in a country different from their flag nationality, or into the distant-water fleet if they undertake voyages of several months over large areas of the region.

Purse seine fishery

Purse seine fishing consists of encircling tuna schools with a large net (1,500-2,000 m long and 150-250 m depth), which is closed at the bottom before being hauled on board (fig. 2a). The fishing operation, meaning the surrounding of the fish school, is called a set. The fish are scooped on board from the net and frozen in brine. This fishing technique targets free schools (visually spotted feeding at the surface of the water from the boat or using helicopters), and schools aggregated around floating objects, which can be large animals such as marine mammals or whale sharks, but which are primarily in the WCPO man-made drifting or anchored fish aggregating devices (FADs) (fig. 2d), or natural drifting logs. There is no purse seine

2. Pelagic fisheries are the fisheries occurring in the water column of the ocean away from the seafloor as opposed to benthic fisheries, which occur in contact with the seafloor such as bottom trawling.

Figure 2: The main tuna fishing gears: purse seine (a), longline (b), pole-and-line (c), and fish aggregating device (d)



© Pacific Community (William Sokimi for pictures a, b and d; Malo Hosken for picture c).

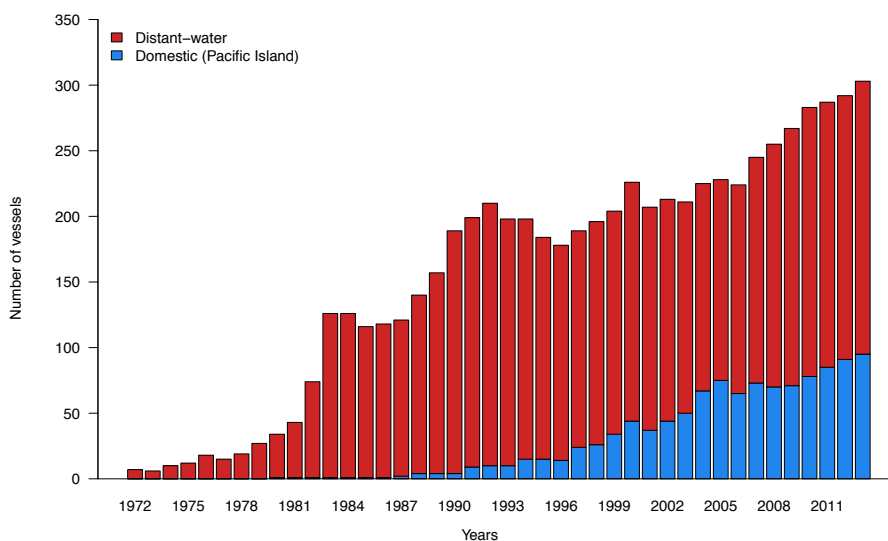
fishing around dolphins in the Western and Central Pacific. The fishing technique can result in catches of small and large fish; larger fish are generally caught when setting on free schools, and smaller fish when setting on schools associated around floating objects under which small fish aggregate. The resulting catch mainly supplies canneries.

In the WCPO region, the purse seine fishery is primarily a skipjack fishery, unlike in other ocean areas where purse seine fishing targets yellowfin and skipjack. Skipjack generally account for 65-77% of the purse seine catch within the WCPO, with yellowfin accounting for 20-30% and bigeye accounting for only a small proportion (Williams and Terawasi 2014). Small amounts of albacore tuna and Pacific bluefin

tuna are also taken in temperate water purse seine fisheries in the North Pacific. Overall, tuna species represents 99% of the catch. The main bycatch species caught are rainbow runner (*Elagatis bipinnulata*), silky sharks (*Carcharinus falciformis*), dolphinfish (*Coryphaena hippurus*), frigate (*Auxis thazard*) and bullet tuna (*Auxis rochei*), kawakawa (*Euthynnus affinis*), oceanic triggerfish (Balistidae), wahoo (*Acanthocybium solandri*) and marlins (Xiphoidei). There is limited interaction with protected species, such as whale sharks and manta rays. Historically, some vessels deliberately set around whale sharks associated with tuna schools, but this practice was banned by a WCPFC conservation and management measure that entered into force on 1 January 2014.³

The total number of purse seine vessels was relatively stable over the period 1990-2006 (in the range of 180-220 vessels), but over the last seven years, the number of vessels has gradually increased, attaining a record level of 297 vessels⁴ in 2013 (fig. 3) (Williams and Terawasi 2014).

Figure 3: Number of purse seine vessels operating in WCPO (Harley *et al.* 2015)



This does not include the Japanese Coastal purse seine fleet and the Indonesian, Philippine and Vietnamese domestic purse seine/ring net fleets which account for over 1,000 vessels (Williams and Terawasi 2014).

3. <http://www.wcpfc.int/doc/cmm-2012-04/conservation-and-management-measure-protection-whale-sharks-purse-seine-operations> (accessed on December 7, 2015).

4. There are a large number of ring net (see footnote 6) and small purse seine vessels in the Indonesian, Japanese coastal and Philippine domestic fisheries which are not included in this total.

The majority of the historic WCPO purse seine catch has come from the industrial fleets of the four main distant-water fishing nations (DWFNs) — Japan (41 vessels), Korea (27), Chinese Taipei (34) and USA (40) — which accounted for a total of 142 vessels in 2013⁵ (Williams and Terawasi 2014). The industrial purse seine fleets of Pacific Island countries has gradually increased in number over the past two decades to 95 vessels in 2013 (fig. 3). This fleet covers vessels fishing under multilateral and bilateral agreements and domestically-based vessels, and comprises vessels from the Federated States of Micronesia (FSM; 10 vessels), Kiribati (12 vessels), Marshall Islands (10 vessels), Papua New Guinea (PNG; 51 vessels including their chartered vessels), Solomon Islands (5 vessels), Tuvalu (1 vessel) and Vanuatu (6 vessels). The remainder of the industrial purse seine fishery includes several fleets which entered the WCPO tropical fishery in the 2000s (e.g., China, Ecuador, El Salvador, New Zealand and Spain) (Williams and Terawasi 2014).

In addition to the industrial purse seine fleets, a large number of smaller domestic Philippine purse seine and ring net⁶ vessels operate in the Philippines and northern Indonesian waters. Prior to 2010, they also operated in the high seas pocket between Palau, Indonesia, FSM and PNG. These fleets accounted for 190,000–250,000 t annually in the period 2004–2009. The closure of the high seas pocket⁷ (2010–2012) resulted in a considerable decline in the domestic Philippine purse seine catch, but also in increased activity by Philippine-flagged vessels fishing in PNG waters under bilateral arrangements. Following an exemption under recent tropical tuna conservation and management measures,⁸ the domestic-based Philippine fleet recommenced activities in the high seas pocket between Palau, Indonesia, FSM and PNG during 2013. Prior to 2013, the domestic Indonesian purse seine fleet accounted for a catch level similar to the Philippine domestic fishery but generally did not fish in high seas areas. During 2013, the Indonesian fleet catch estimate increased substantially (215,582 t) because of increased onshore processing facilities and more vessels entering the domestic fleet. The domestic fleets of Indonesia and the Philippines have usually accounted for about 13–20% of the total WCPO purse seine catch (Williams and Terawasi 2014).

5. In 2013, there were an additional 40 vessels in the category less than 200 gross register tonnage (GRT) which are a part of the Japanese purse seine fleet, but these are not included here.

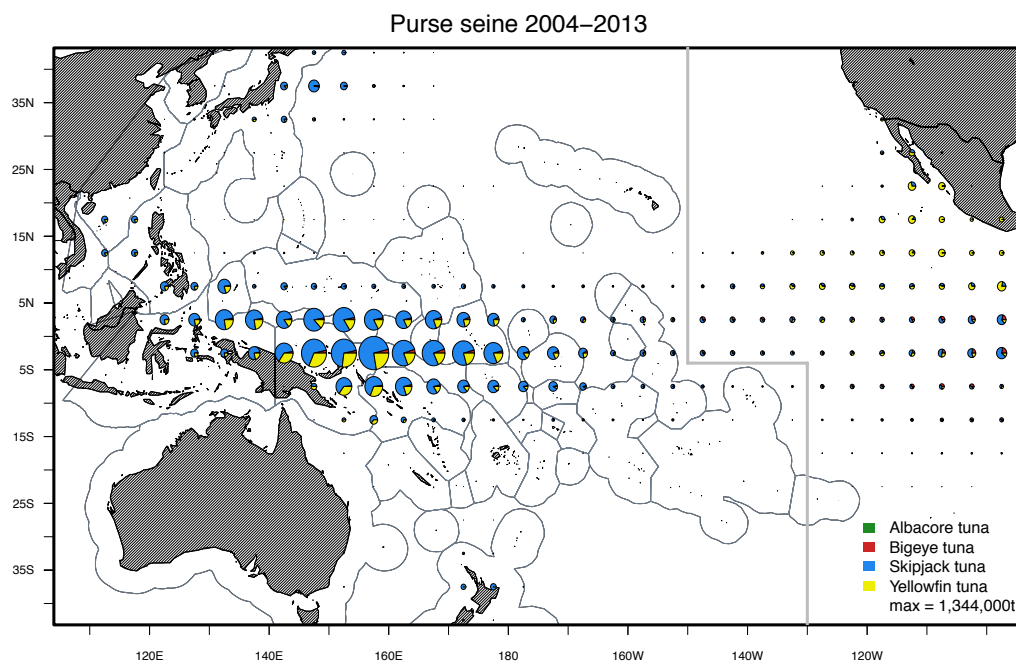
6. Ring net vessels are smaller than purse seine vessels and have a manual winch to haul the net on board while purse seiners are equipped with an electrical winch.

7. In 2010, conservation and management measures were adopted by the WCPFC to limit the catch of tropical tuna. One of the measures consisted in a closure of the high seas pockets, i.e., international waters wholly enclosed by EEZs, located between 10°N–10°S and 130°E–180° (<http://www.wcpfc.int/system/files/CMM%202008-01%20%5BBigeye%20and%20yellowfin%5D.pdf>). Accessed on December 7, 2015.

8. The westernmost high seas pocket was reopened to Philippine traditional fresh/ice chilled fishing vessels in 2012 (<http://www.wcpfc.int/system/files/CMM-2012-01-Conservation-and-Management-Measure-BET-YFT-and-SKJ.pdf>). Accessed on December 7, 2015.

The geographical distribution of the purse seine fishery is concentrated in the equatorial band where fish form dense schools,⁹ with the highest catches in the latitudinal zone 5°N - 10°S (fig. 4). The purse seine catch/effort distribution in tropical areas of the WCPO is strongly influenced by El Niño–Southern Oscillation Index (ENSO)¹⁰ events, with fishing effort typically expanding further to the east during El Niño years and contracting to western areas during La Niña periods (Williams and Terawasi 2014).

Figure 4: Spatial distribution of the purse seine catch by species in 2004–2013 (Harley *et al.* 2015)



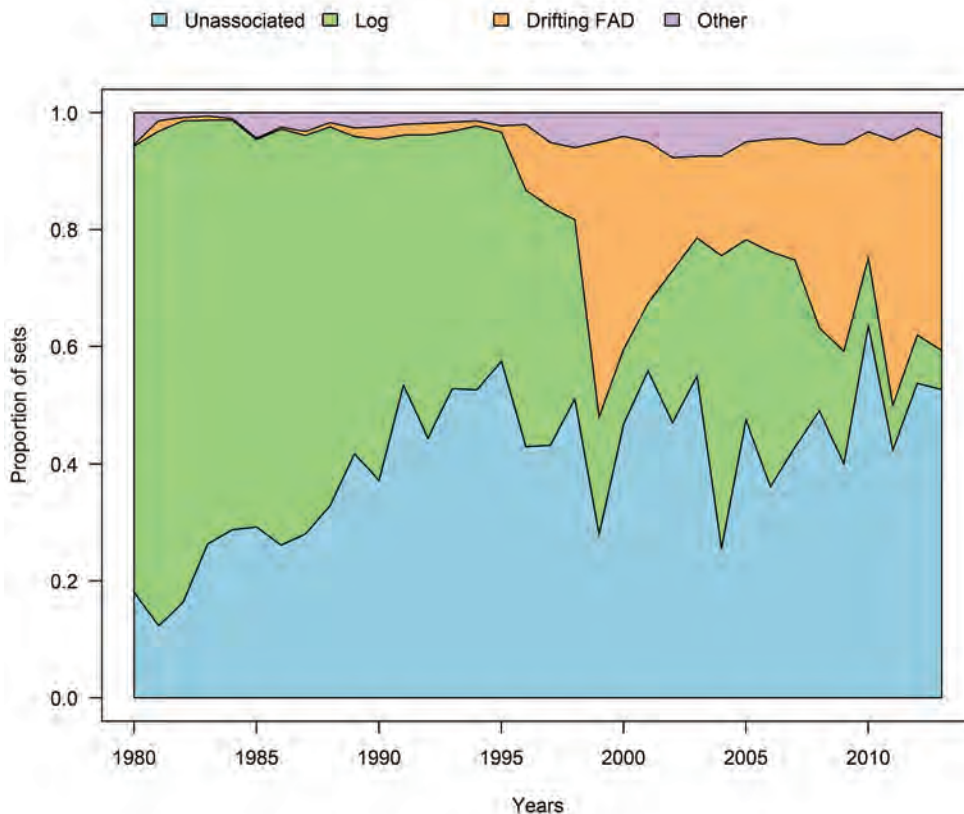
The size of the largest pie corresponds to the maximum value of 1,344,000 t.

9. Fish do not form dense schools in the subtropical and temperate areas.

10. ENSO refers to a climatic phenomenon occurring across the whole Pacific Ocean and characterised by two phases: a warming phase, El Niño, and a cooling phase, La Niña. During El Niño, a band of warm ocean water develops in the central and east-central equatorial Pacific, while during La Niña, the sea surface temperature is 3–5°C lower than normal. The atmosphere (temperature, rainfall and winds) and ocean (surface and vertical temperature and currents) are both impacted, and these impacts in turn affect living organisms, resulting, for example, in the displacement of tuna and tuna fisheries. The ENSO cycle has a global impact reaching beyond the Pacific Ocean.

Sets on free-swimming (unassociated) schools of tuna have dominated over recent years and represented 68% of all sets for all purse seine fleets in the WCPO in 2013 (fig. 5). The proportion of sets on drifting FADs in 2013 (22%) is consistent with recent years and remains amongst the highest over the past decade, but the number and proportion (5%) of sets on floating logs is now at the lowest level ever (Williams and Terawasi 2014).

Figure 5: Time series showing the percentage of total sets by school type for the major purse seine fleets operating in the WCPO



Longline fishery

Longline fishing consists of horizontally deploying a mainline, maintained on the surface with floats, and attaching to this mainline vertical branchlines ending with baited hooks. The mainline can be as long as 100 km and hold as many as 3,000 hooks located between the subsurface and 100 to 400 m depth. After letting

the line sit in the water ('soak') for several hours, it is slowly hauled on board and both empty hooks and fish caught are recovered one by one (fig. 2b), with the fish usually then stored fresh on ice, in brine, or frozen. Because of the size of the hooks used and the depth of fishing, this technique typically catches larger tuna. In contrast to purse seining, longline fishing does not require spotting fish schools. This technique supplies fresh and frozen markets (including sashimi) and canneries.

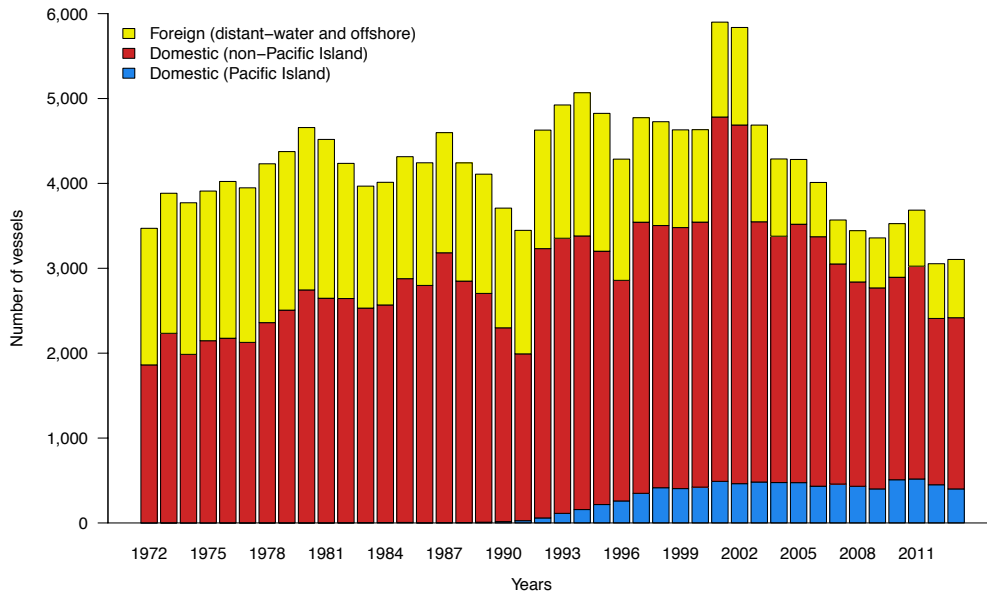
The composition of the longline catch has varied since the beginning of the fishery. While yellowfin tuna catches used to be dominant in the past, the catch composition has changed since 2005 and in recent years albacore has been the main target, accounting for 44% of catch, while yellowfin and bigeye each accounted for 28% (Williams and Terawasi 2014). Overall, tuna species account for 50% to 75% of the total catch (in weight) in the longline fisheries. Non-tuna species in the longline catch are principally shark and billfish species, dolphinfish, opah (moonfish – *Lampris guttatus*), wahoo, escolar (*Lepidocybium flavobrunneum*) and barracudas (Sphyraenidae). Interactions with seabirds and marine mammals are very low in the tropical WCPO; interactions with seabirds take place mainly in temperate areas. Catches of marine turtles (five different species) have been observed at a low encounter rate in the equatorial longline fisheries.

The total number of vessels involved in the longline fishery has generally fluctuated between 3,000 and 6,000 over the past 30 years (fig. 6), making longline vessels around 10 to 20 times more numerous than purse seiners.

The fishery involves two main types of operations (Williams and Terawasi 2014):

- large (typically > 250 gross register tonnage – GRT) distant-water freezer vessels which undertake long voyages (many months) and operate over large areas of the region. These vessels may target yellowfin and bigeye tuna for the frozen sashimi market, albacore tuna for canneries, or recently swordfish. This fleet comprises vessels from Japan, Korea, Chinese Taipei, mainland China, Vanuatu, Portugal and Spain. Distant-water longline fleet dynamics have continued to evolve in recent years, with the number of vessels dropping from 687 in 2004 to 349 vessels in 2013 for the Japanese, Chinese Taipei and Korean distant-water longline fleets and the Japanese foreign longline fleet.
- smaller (typically < 100 GRT) vessels which are usually domestically-based, undertaking trips of less than one month, with ice or chill capacity, serving fresh local or air-freight sashimi markets or albacore canneries. This category comprises Pacific Island domestic vessels from American Samoa, Cook Islands, Fiji, French Polynesia, Kiribati, New Caledonia, Samoa, Solomon Islands, Tonga, Micronesian countries, PNG and Vanuatu. The domestic fleets of Australia, Japan, New Zealand and Hawaii target different species depending on the market, season and/or area involved. There are also domestic fleets in Indonesia, the Philippines and Vietnam. Finally there are several foreign fleets based in Pacific Island countries, such as Chinese Taipei sashimi longliners based in Micronesia, Guam, and the Philippines. Mainland China also has vessels based in Micronesia.

Figure 6: Longline vessels operating in the WCPO (Harley *et al.* 2015)



Available data does not make the distinction between foreign “distant-water” and “offshore” fleets.

A significant change in the WCPO longline fisheries over the past 10 years (2003–2013) has been the growth of the Pacific Island domestic albacore fleets (involving American Samoa, Cook Islands, Fiji, French Polynesia, Kiribati, New Caledonia, Samoa, Solomon Islands, Tonga and Vanuatu). Taking just 33% of the total south Pacific albacore longline catch in 1998, these fleets accounted for around 50–60% of the catch in recent years (Williams and Terawasi 2014). The number of vessels in the national fleets (including chartered vessels) active in this fishery has risen to over 450 (mainly small vessels) and catches are now at a level similar to that of distant-water longline vessels active in the WCPO (Williams and Terawasi 2014).

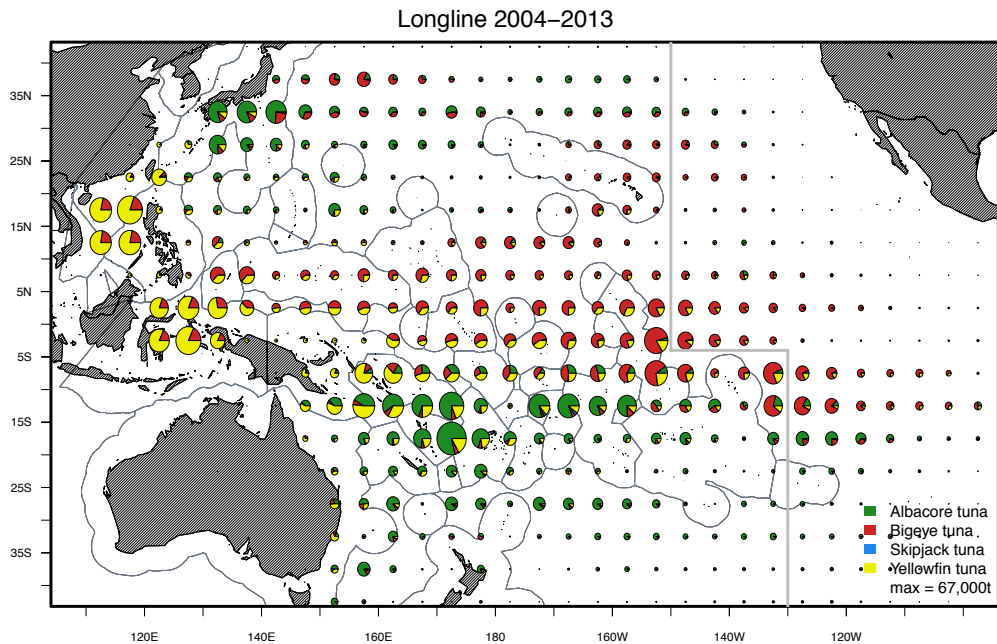
Small vessels in Indonesia, the Philippines and Vietnam also use handline and small vertical longline gears, usually fishing around the numerous arrays of anchored FADs in their home waters.¹¹

Large-vessel, distant-water fleets from Japan, Korea and Chinese Taipei account for most of the longline effort in the WCPO, which is spatially widespread (fig. 7). The activity of foreign fleets from Japan, mainland China and Chinese Taipei is

11. These types of vessels are not included in fig. 6.

restricted to tropical waters. The substantial effort in the west of the region is primarily carried out by Indonesian, Chinese Taipei and Vietnamese domestic fleets. The growth in domestic longline fleets in the South Pacific (5°S-25°S) over the past decade is notable; the most prominent fleets in this category are the Cook Islands, Samoan, Fijian, French Polynesian and Vanuatu fleets (Williams and Terawasi 2014).

Figure 7: Spatial distribution of WCPO longline catch by species in 2004-2013 (Harley *et al.* 2015)



Note that the data on the distant-water efforts of Chinese Taipei and other fleets targeting albacore in the North Pacific is poor. The size of the largest pie corresponds to the maximum value of 67,000 t.

Pole-and-line fishery

Pole-and-line fishing consists of baiting schools of tuna visually spotted at the surface of the water from the boat, and catching them at the surface, one by one, with poles (fig. 2c). The boat is equipped with tanks to maintain live bait (i.e., small fish caught in coastal areas). Each boat has a crew of 20-30 fishermen distributed at the bow and stern of the boat on special platforms, catching fish with 2-3 m long poles with a short line, at the extremity of which hangs a feathered jig mounted on a barbless

hook. Due to the size of the hooks used, the fishing at the surface and the manual hauling, this technique catches small to medium-size fish. Fish are frozen in brine to supply the cannery industry.

Skipjack tends to account for the majority of the catch (~70–83% in recent years, but typically more than 85% of the total catch in tropical areas), and albacore (8–20% in recent years) is taken by Japanese coastal and oceanic fleets in the temperate waters of the North Pacific (Williams and Terawasi 2014). The remainder of the catch consists of yellowfin tuna (5–16%) and a small component of rarer bigeye tuna (1–4%). Overall, tuna species represent 96% of the catch. The main bycatch species caught are rainbow runner, dolphinfish and small silky sharks.

The WCPO pole-and-line fishery has several components (Williams and Terawasi 2014):

- the year-round tropical skipjack fishery, mainly involving the domestic fleets of Indonesia, Solomon Islands and French Polynesia, and the distant-water fleet of Japan,
- seasonal subtropical skipjack fisheries in the domestic (home) waters of Japan, Australia, Hawaii and Fiji,
- a seasonal albacore/skipjack fishery east of the Japanese EEZ conducted by Japanese vessels.

Japanese distant-water and oceanic fleets and Indonesian fleets account for nearly all of the WCPO pole-and-line catch (99% in 2013) (Williams and Terawasi 2014).

Economic factors and technological advances in the purse seine fishery (primarily targeting the same species, skipjack) have prompted a gradual decline in the number of pole-and-line fishery vessels in all of the fleets (fig. 8) (Williams and Terawasi 2014). Pacific Island pole-and-line domestic fleets in particular have declined in recent years with fisheries formerly operating in Fiji, Palau and Papua New Guinea no longer active; only one vessel is now operating (occasionally) in Kiribati; and there has been a substantial reduction in the Solomon Islands pole-and-line fishery during the 2000s. Several vessels continue to fish in Hawaii, and the French Polynesian *bonitier* fleet¹² remains active (45 vessels in 2013), but an increasing number of vessels have turned to longline fishing. Provisional statistics suggest that the Indonesian pole-and-line fleet has also declined over recent years (Williams and Terawasi 2014).

Increased market demand for ecolabelled tuna is driving, on a global scale, audits of tuna fisheries against standards such as that of the Marine Stewardship Council.¹³ There has been increased interest in undertaking ecolabelling audits for pole-and-

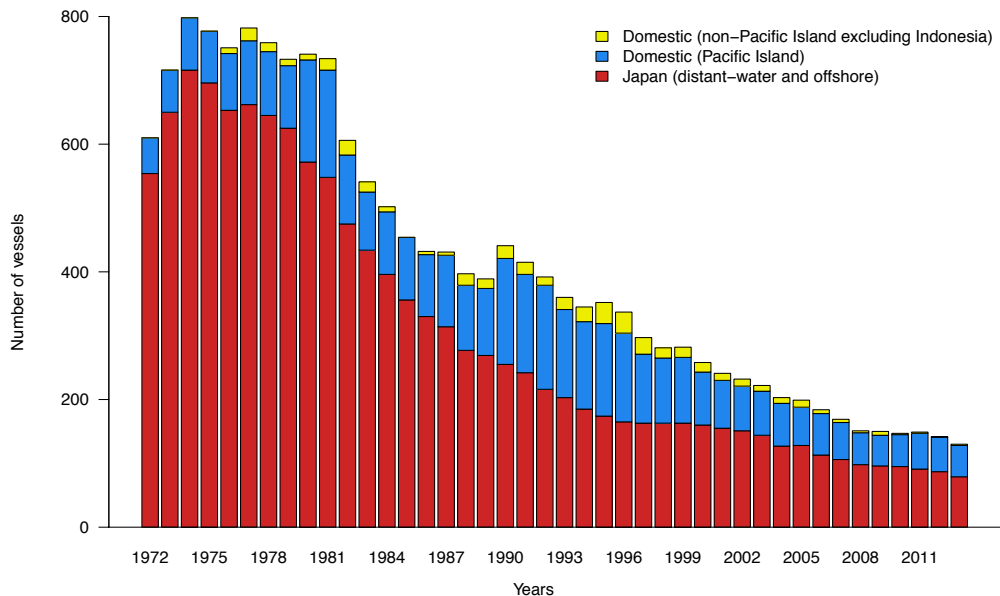
12. *Bonitiers* are 10 to 12 m long boats targeting skipjack using mainly pole-and-line and operating close to the shore in territorial waters.

13. <https://www.msc.org/> (Accessed on December 7, 2015).

line tuna, as the fishing approach is seen as a relatively ‘clean’ method of fishing, with minimal bycatch of non-target species. This provides an advantage for eco-labelling schemes where low bycatch levels are seen as an important asset, and there is at least one initiative underway, in Papua New Guinea, to revitalize the domestic pole-and-line fisheries in the Pacific Islands as a result. In regard to the eco-friendliness of the pole-and-line fishery, it is important to note that this fishery is dependent on live bait which is only available in limited areas and seasons; moreover this nearshore/lagoon bait fishery is complex both ecologically and socioeconomically (Gillett 2011).

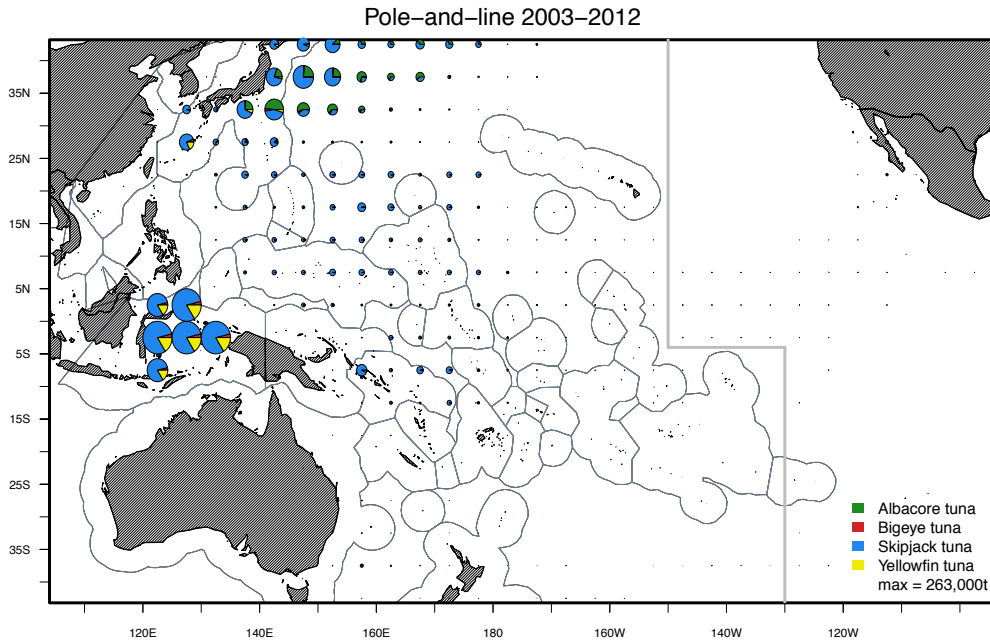
Effort and catch in tropical areas (fig. 9) is usually year round. The pole-and-line effort in the vicinity of Japan by both oceanic and distant-water fleets is seasonal (Williams and Terawasi 2014). There also was some seasonal effort by pole-and-line vessels in Fiji and Australia during the 1995-2013 period. The effort in French Polynesian waters is essentially represented by the *bonitier* fleet.

Figure 8: Pole-and-line vessels operating in the WCPO (Harley *et al.* 2015)



Pole-and-line vessels from the Japanese coastal and Indonesian domestic fisheries are not included in the figure.

Figure 9: Average distribution of WCPO pole-and-line catch (2003–2012)
(Harley *et al.* 2015).



Catches by the pole-and-line fleet based in Hawaii and the *bonitier* fleet in French Polynesia are not shown in this figure. The size of the largest pie corresponds to the maximum value of 263,000 t.

Tuna and other species caught in the pelagic fisheries

The four main tuna species in the tropical and subtropical waters of the WCPO¹⁴ are skipjack, yellowfin, bigeye and albacore tunas (fig. 10).

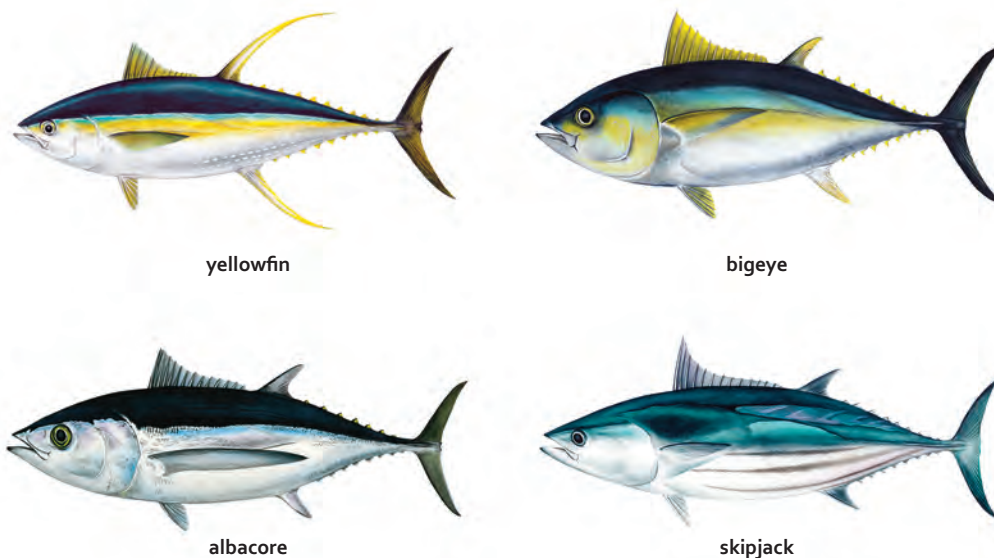
Skipjack tuna are found across the region, but the centre of abundance lies in the equatorial waters where they form large surface schools. Skipjack are relatively small, their typical capture size is between 40 and 70 cm, corresponding to fish between one and three years of age, with very few captured fish exceeding 80 cm. Skipjack tuna are fast growing (reaching 42–45 cm within their first year), relatively short-lived (few live longer than 3–4 years) and mature early (~1 year of age). Skipjack are highly fecund and can spawn year round over a wide area of the tropical and subtropical Pacific. These biological characteristics promote rapid turnover in skipjack populations.

¹⁴. Omitting stocks such as bluefin tuna caught in the northern Pacific.

Yellowfin and bigeye tunas are also widespread over the region, with a centre of abundance for juveniles in the tropical waters. Adult yellowfin tuna are usually found within the upper 250 m, while adult bigeye tuna are found at deeper depths (300-500 m).

Yellowfin are a relatively large tuna species; their capture size in the WCPO varies depending on the fishing techniques used (see section “The pelagic fisheries of the Western and Central Pacific Ocean”). Specimens measuring 20 to 70 cm in length are fish between 3 months and 1.5 years of age caught by purse seine and pole-and-line; those 90 to 160 cm are fish between 1.5 and 6-7 years of age caught by purse seine and longline. Very few captured fish exceed 180 cm. Yellowfin tuna are fast growing (reaching > 45 cm within their first year), have a life span of up to ~7 years of age and mature around 2-3 years of age. Yellowfin are highly fecund and can spawn year round over a wide area of the tropical and subtropical Pacific, providing environmental conditions (such as water temperature) are suitable. These biological characteristics promote moderate turnover in yellowfin populations.

Figure 10: The four main tuna species in the tropical and subtropical waters of the WCPO: yellowfin (*Thunnus albacares*), bigeye (*Thunnus obesus*), albacore (*Thunnus alalunga*), and skipjack (*Katsuwonus pelamis*) tunas



Bigeye tuna are among the largest tuna species. Like yellowfin tuna, their capture size in the WCPO shows two distinct modes related to differences in fishing techniques (see section “The pelagic fisheries of the Western and Central Pacific Ocean”). Specimens measuring 20 to 75 cm in length are fish between 3 months and 1.7 years of age caught by mainly purse seine and pole-and-line; those measuring 100 to 180 cm are fish between 2 and 10 years of age caught by longline. Very few captured fish exceed 200 cm. Bigeye tuna grow more slowly than either yellowfin or skipjack, reaching around 40 cm after one year, have a longer lifespan (at least 12 years) and mature later (around 3-4 years of age). They are highly fecund and can spawn year round over a wide area of the tropical and subtropical Pacific, providing environmental conditions (such as water temperature) are suitable. These biological characteristics promote only moderate turnover in bigeye populations. This feature, combined with their susceptibility to multiple gear types throughout their lifespan, render bigeye tuna less resilient to exploitation than more productive species like skipjack.

Albacore tuna is a subtropical/temperate species. There are two separate stocks of Pacific albacore tuna located respectively in the northern and southern hemispheres. In the present document, the North Pacific albacore stock is not considered.¹⁵ The centre of abundance for adult South Pacific albacore tuna is located at latitudes 10°-30°S, where they are caught by longline, the only fishing gear capable of targeting depths of 100-400 m. Albacore tuna of all age classes are rarely caught in equatorial waters or in the Central Pacific. In these areas, the level of dissolved oxygen absorbed by the fish through their gills is too low for their survival (Bard *et al.* 1999). Subadult albacore tuna (50-90 cm) are found in temperate surface waters (30-40°S). Albacore tuna are relatively large tuna. Again, their capture size in the WCPO shows two distinct modes related to differences in fishing techniques (see section “The pelagic fisheries of the Western and Central Pacific Ocean”). Specimens measuring 50 to 70 cm in length are fish approximately 1.5 and 2.5 years of age caught by trolling, those measuring 80 to 110 cm are fish mostly between 3 and 10 years of age caught by longline. Very few captured fish exceed 130 cm. Albacore are relatively slow growing (reaching > 45 cm within their first year), have a life span of up to ~10 years of age and mature around 4-5 years of age. Mature albacore spawn in tropical and subtropical waters between latitudes 10 and 25°S, with individual fish becoming available to surface fishing at about latitude 40°S approximately one to two years later, at a size of 45-50 cm. From this area, albacore appear to gradually disperse towards the tropics, but may make seasonal migrations between tropical and subtropical waters. These biological characteristics promote moderate turnover in albacore populations.

15. The North Pacific albacore tuna stock is not fished by the PICTs; it is mainly exploited by Japan, USA, Canada and Chinese Taipei. Fisheries statistics for this stock are managed and analysed by the International Scientific Committee for Tuna and Tuna-like Species that reports to the Northern Committee of the WCPFC.

Different fishing fleets may target different species but the species targeted is mainly determined by the fishing location in relation to the abundance of the species (e.g., albacore tuna is targeted in temperate waters while skipjack is targeted in equatorial waters) and by the fishing technique.

The fisheries targeting tuna also catch a range of other associated species, and more than 200 bycatch species have been observed in catches. Some of the associated species are of commercial value (by-products), while many others are discarded (tab. 1). There are also incidents of the capture of species of ecological and/or social significance ('protected species'), including marine mammals, sea turtles and some species of shark (e.g., whale sharks). Information concerning the catch composition of the main tuna fisheries in the WCPO comes largely from the various observer programmes operating in the region.

Table 1: List of the main bycatch species caught by tuna fisheries

Common name	Scientific name	Fisheries	Status
<i>Billfishes</i>			
Black marlin	<i>Istiompax indica</i>	LL, PS	Commercial
Blue marlin	<i>Makaira nigricans</i>	LL, PS	Commercial
Sailfish	<i>Istiophorus platypterus</i>	LL, PS	Commercial
Striped marlin	<i>Kajikia audax</i>	LL, PS	Commercial
Swordfish	<i>Xiphias gladius</i>	LL	Commercial
<i>Sharks and rays</i>			
Blue shark	<i>Prionace glauca</i>	LL	Discard
Mako sharks	<i>Isurus sp.</i>	LL	Commercial
Oceanic whitetip shark	<i>Carcharhinus longimanus</i>	LL, PS	Discard
Silky shark	<i>Carcharhinus falciformis</i>	LL, PS, PL	Discard
Thresher sharks	<i>Alopias sp.</i>	LL	Discard
Hammerhead sharks	<i>Sphyrna sp.</i>	LL	Discard
Manta rays	<i>Manta sp. and Mobula sp.</i>	PS	Discard
Pelagic stingray	<i>Dasyatis violacea</i>	LL	Discard
<i>Other species</i>			
Barracudas	<i>Sphyraena spp.</i>	LL, PS	Commercial
Dolphinfish	<i>Coryphaena hippurus</i>	LL, PS, PL	Commercial
Rainbow runner	<i>Elagatis bipinnulata</i>	LL, PS, PL	Commercial
Wahoo	<i>Acanthocybium solandri</i>	LL, PS	Commercial
Opah (moonfish)	<i>Lampris guttatus</i>	LL	Commercial
Lancetfish	<i>Alepisaurus sp.</i>	LL	Discard
Pomfrets	<i>Bramidae</i>	LL	Commercial
Snake mackerel	<i>Gempylus serpens</i>	LL	Discard
Escolar	<i>Lepidocybium flavobrunneum</i>	LL	Discard
Oilfish	<i>Ruvettus pretiosus</i>	LL	Discard

LL = longline, PS = purse seine, PL = pole-and-line

Fisheries data and monitoring

Data on fisheries are crucial to monitor the status of tuna stocks and for countries to take informed management decisions. Countries that have ratified the WCPFC Convention have obligations in terms of the provision of data to the Commission. They have to provide annual catch estimates by species and fishing gear, catch and fishing effort data by geographic area and time period, and fish size composition. To comply with these obligations, the countries have access to several sources of information that are submitted to the WCPFC:

- logsheets recording catch of the main species and fishing effort are provided by fishing vessels to the national fisheries authorities of the PICTs in whose waters they were fishing and to their flag state. For example, a Japanese vessel fishing in the Marshall Islands and Kiribati will provide the logsheets of the fishing operations conducted in each EEZ to the national fisheries authorities of the Marshall Islands and Kiribati, and to Japanese fisheries authorities. Detailed information on vessels is also provided, including vessel nationality. In general only tuna and the main commercial species are recorded on logsheets; however with management measures implemented on sharks, it is required that specific shark catches are recorded. Exact locations are not always provided. Provision of logsheets is compulsory for all industrial fleets.
- in-port information on unloaded catch, catch composition and size-frequency of the catch are recorded by port samplers of the national fisheries authorities of the PICTs where fish are unloaded. Only commercial species are seen at port. The exact location of the catch is not always known as the catch from different sets and areas are mixed in vessel wells.
- on-board vessel observers from the national fisheries authorities of the PICTs record catch, effort, catch composition and size-frequency of all the species caught. On-board observers can record very detailed information; this is notably the only way to obtain information on fish discarded at sea and better catch species composition. With a target to achieve 100% observer coverage on purse seiners, and provisional coverage of ~80% in tuna catches in 2013-2014, activities of those vessels are much better covered than longliners, for which the coverage was ~2% in tuna catches in 2014 with a 5% target (Williams 2015).
- satellite Vessel Monitoring Systems (VMS) on purse seine and longline vessels, which provide information on location at regular intervals. A WCPFC conservation and management measure has made these systems mandatory on all vessels fishing for highly migratory fish stocks on the high seas, and national regulations require these systems on vessels fishing within EEZs. While primarily a monitoring, control and surveillance tool, VMS data also provide opportunities for scientific data and research. It provides vessel position information at hourly intervals, allowing an analysis of fleet behaviour and dynamics which could not be easily performed using daily logsheet information.

Another critical source of information for monitoring fisheries impact and the status of stocks are tagging programmes, which provides information on the growth, movement, natural mortality and fishing mortality of tuna. In the WCPFC, tagging programmes have been implemented for the last 30 years (Leroy *et al.* 2015). The most recent one, the Pacific Tuna Tagging Programme (PTTP),¹⁶ started in 2006 and is still active in 2016. The PTTP concentrates its activities over the entire equatorial WCPO. It tags skipjack, yellowfin and bigeye tuna with both conventional and electronic tags.¹⁷ This is the largest tagging programme ever undertaken to monitor tuna stocks. As of May 2015, more than 400,000 tuna had been tagged by scientists on chartered pole-and-line and trolling fishing vessels since the beginning of the PTTP and 73,000 tags had been recaptured (return rate = 18%) by fishing vessels, at unloading ports, and in canneries.

Scientific research conducted by research institutions in the Pacific also focuses on obtaining information on reproduction pattern and fecundity, age and growth, trophic structure and ecosystem functioning. Such information contributes to determine the status of the tuna stocks and associated ecosystems.

Economic data is becoming increasingly important for fishery management; however there are no major agreements concerning their provision and management.

Catch estimates

Annual total catches of the four main tuna species (skipjack, yellowfin, bigeye and albacore) in the WCPO increased steadily during the 1980s as the purse seine fleet expanded, and remained relatively stable during most of the 1990s until a sharp increase in catch in 1998. The 1998 increase in catch is due to a combination of increased use of FADs and a shifting of the fleets towards the east on better fishing grounds during the strong 1997-1998 El Niño event (see section “Purse seine fishery”). Over the past seven years (2007-2013) there has been an upward trend in

16. The PTTP, endorsed by the WCPFC, was designed and implemented by the Pacific Community (SPC) in collaboration with Papua New Guinea, Solomon Islands, University of Hawaii and the Inter-American Tropical Tuna Commission (IATTC). <http://www.spc.int/tagging/webtagging> (Accessed on December 8, 2015).

17. Tags are implanted on fish caught during tagging cruises and the fish are released immediately. Each tag carries a unique number that identifies the fish tagged. Conventional tags are 10 cm long and 2 mm wide plastic tubes equipped with a barbed head placed in the flesh on the back of the fish. The tag protrudes externally and is easily spotted when the fish is recaptured. Electronic tags, in contrast, are miniature computerised data recorders measuring a range of parameters (depth, temperature, light intensity). Measuring 2 to 12 cm long, these small devices can be implanted surgically in the body cavity, while larger devices can be attached to the back of the fish. Fish implanted with an internal electronic tag also carry a visible external conventional tag. External electronic tags or satellite tags will detach automatically from the fish and will transmit their data via satellite once at the surface. Conventional and electronic internal tags need to be recovered by fishermen after they catch the released fish.

total tuna catch (fig. 11). The total WCPO tuna catch for 2013 was estimated at 2,627,696 t, the second-highest catch on record after 2012. This tonnage represented 82% of the total 2013 Pacific Ocean catch of 3,213,733 t and 58% of the global tuna catch (the provisional estimate for 2013 is 4,517,435 t) (Williams and Terawasi 2014).

In 2013, purse seine fishery accounted for an estimated 1,899,015 t (72% of the total catch in the WCPO, and the highest-ever catch for this fishery) (fig. 11) for an estimated delivered value of US\$3,947 million. During the 1980s the purse seine catch increased steadily, and during the 1990s it fluctuated between 800,000 and 1,200,000 t. Since 2002, when a significant increase in catch was observed in relation to increased fishing effort, the purse seine catch and effort have been continuously increasing.

In 2013, longline fishery accounted for an estimated 230,137 t (9% of the total catch in the WCPO). Although this was the lowest catch since 1999, with an estimated value of US\$ 1,276 million, it rivals the much larger purse seine catch in terms of landed value. This is due to the high value of longline fish sold on the sashimi market in comparison to the low value of purse seine fish sold to canneries. The WCPO longline tuna catch steadily increased from the early years of the fishery (i.e., the early 1950s) to 1980 (226,229 t), but declined to 155,402 t in 1984. Catches steadily increased between 1984 and the late 1990s, when catch levels were again similar to those observed in 1980. Annual catches in the longline fishery since 2000 have been maintained at a high level (> 200,000 t) despite a decrease in the number of fishing vessels. This high catch is due to a change in the dynamic of the longline fleets. While longline vessels mainly targeted tropical yellowfin tuna in the 1970s and 1980s, in recent decades the fleets have been targeting subtropical albacore tuna, which have been more exploited and show higher catch rates than in the past.

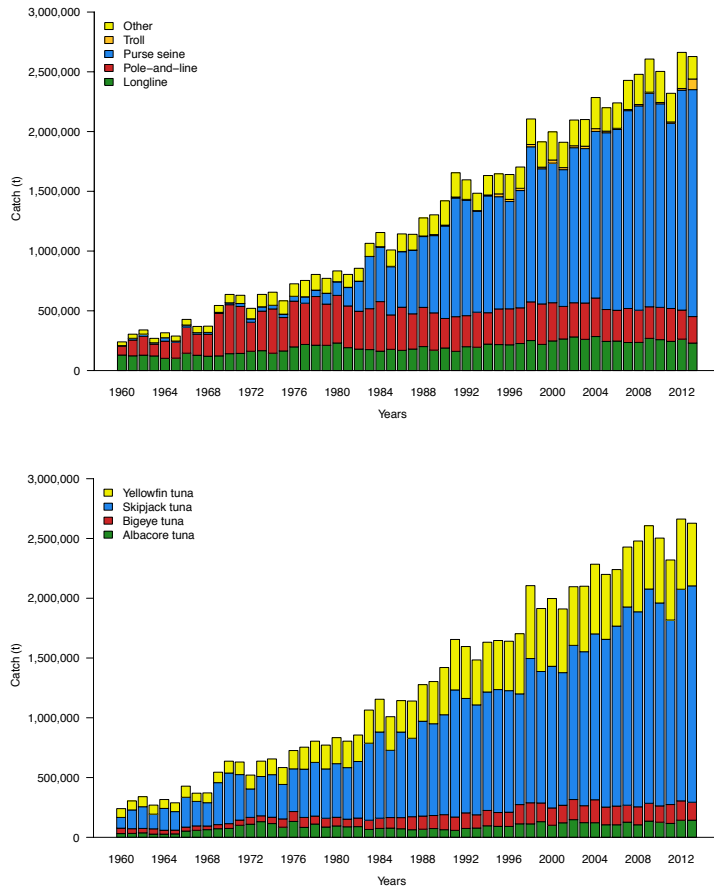
In 2013, the pole-and-line catch was estimated at 221,715 t (8% of the total catch in the WCPO — the lowest since the late 1960s), for an estimated delivered value of US\$506 million. Pole-and-line catches have continuously declined for three decades.

The remainder of the 2013 catch (~260,000 t — 10%) was taken by troll gear and a variety of artisanal gear, mostly in eastern Indonesia, the Philippines, and Vietnam.

The 2013 WCPO skipjack catch (1,810,166 t — 69% of the total catch) was the highest recorded catch (fig. 11). Skipjack catches have increased steadily since 1970, more than doubling during the 1980s due to growth in the international purse seine fleet combined with increased catches by domestic fleets from the Philippines and Indonesia, and the catches continued to increase in subsequent years. The 2013 WCPO yellowfin catch (524,022 t — 20%) was slightly below the average of the past 10 years. Yellowfin catch had been slowly increasing over time but since 1998, it jumped to a new level with annual catches regularly exceeding 500,000 t, mainly due to increased catches in the purse seine fishery. The 2013 WCPO bigeye catch (150,281 t — 6%) is around the average of the preceding nine years, with a 7% decrease from the 2012 catch, driven by a reduction in longline catches. The 2013

WCPO albacore catch (143,227 t — 5%) was the second highest on record. Prior to 2001, south Pacific albacore catches were generally in the range of 25,000-50,000 t, with a significant peak in 1989 (49,076 t) when driftnet¹⁸ fishing was still in existence. Since 2001, catches have greatly exceeded this range, primarily as a result of the growth in several Pacific Island domestic longline fisheries.

Figure 11: Catch (in tonnes) by gear (top) and species (bottom) for the Western and Central Pacific region, 1960–2013 (Harley et al. 2015)



Note that data for 2013 are preliminary.

18. Driftnets are nets that can reach up to 50 km long and are set vertically in the water, maintained by floats at the surface or near the surface. They drift with the current, and fish striking the net become entangled in the mesh. Driftnet fishing ceased in 1991.

Status of stocks

In the WCPFC, the status of tuna stocks is based on single-species stock assessments, which are performed separately for each of the tuna stocks discussed in the section “Tuna and other species caught in the pelagic fisheries”. The main assessment approach is MULTIFAN-CL, a computer program that implements a statistical, length-based, age and spatially-structured¹⁹ model for fisheries stock assessment (Hampton and Fournier 2001). The main data sets to which the model is fitted are time series of catch and effort data (i.e., the level of removals from the stock, and the amount of fishing effort required to achieve these removals), tuna length frequencies (which supplies information on, for example, the way different fishing gears impact the stock, e.g., catching larger or smaller individuals), and tagging information (which provides an idea of movement between areas of the WCPO). Biological information such as estimates of the rate at which tuna grow, the age at which individuals become sexually mature, the rate at which young are produced, and the rate at which tuna die from natural causes (natural mortality, by age), are also used. The model estimates tuna abundance per age class, quarter and area.²⁰

The assessments are reviewed by the WCPFC Scientific Committee (and occasionally by independent experts) and are used to provide advice on the status of tuna stocks to regional organisations and national fisheries authorities in charge of the management of these stocks. This advice is based upon outputs from the assessment model, including estimates of the quantity of fish of each species in the WCPO and the level of fishing mortality (the rate at which fish are removed from the stock through fishing). These are compared to ‘reference points’²¹ which indicate specific levels of these values that are of interest to managers. Related to reference points, the concept of maximum sustainable yield (MSY) is central to fisheries management. MSY is the largest average catch (yield) that can — in theory — continuously be taken from a stock under average environmental conditions without affecting stock health. Related indices frequently used as reference points within the WCPFC are:

- F/F_{MSY} , the level of current fishing mortality (F) compared to the fishing mortality which will support the maximum sustainable yield (F_{MSY});²²

19. Five to nine regions defined in the WCPO area according to the tuna species.

20. The assessment model is fitted to the data to best mimic the patterns and values observed in terms of relative abundance indices (catch per unit of effort), tagging information, and tuna size frequencies.

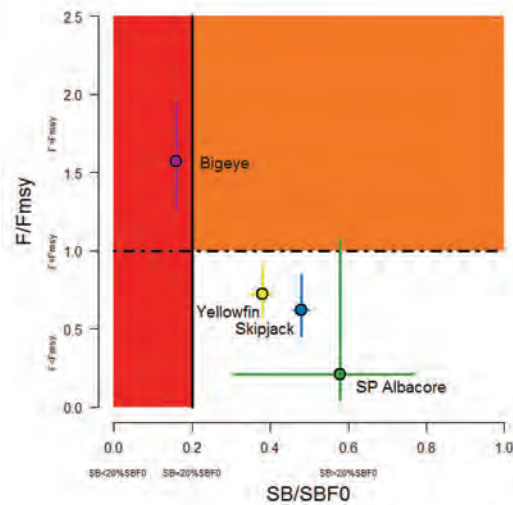
21. There are two key reference point types. Limit reference points (LRPs) represent stock or fishing levels that are to be avoided as they result in a biological danger to stock sustainability. Target reference points (TRPs) represent stock or fishing levels that would achieve the objectives of fishery managers (e.g., sustainability, good fishery catch rates, profitability). For example, if the stock assessment indicates that the stock is beyond the limit reference point, or the fishing mortality is too high, management action would be needed to reduce fishing levels to allow the stock to recover.

22. When F is greater than F_{MSY} or F/F_{MSY} is greater than 1, it is considered that overfishing of the

- $SB/SB_{F=0}$, the current amount of spawning biomass (or adult tuna quantity) (SB) compared to the estimated amount of adult fish that would be present within the stock if it had not been fished ($SB_{F=0}$).²³

These indices are used to draw a plot which provides a visual display of the estimated status of the four tuna stocks relative to reference points (fig. 12).

Figure 12: The modified Kobe plot (“Majuro plot”) identifying the status of the stocks according to reference points on fishing mortality (F/F_{msy}) and spawning biomass (SB/SB_{F0})



The plot describes the 2012 stock status for skipjack (Rice *et al.* 2014), bigeye (Harley *et al.* 2014) and yellowfin (Davies *et al.* 2014) and the 2010 stock status for South Pacific albacore (SP Albacore) (Hoyle *et al.* 2012). Stocks located in the white area are estimated healthy, overfishing is occurring for stocks in the orange area (catches are too high for sustainability) and stocks in the red area are overfished (the level of the spawning biomass is too low to sustain the stock). Many stock assessment runs are performed for each stock, using different combinations of input parameters (e.g., different estimates of growth rate, rates at which fish die due to natural causes, etc.). These lead to slightly different estimates of current stock status. Hence the stock assessment run selected as the 'reference case' for management advice is shown as the main 'point' (plain circle), and the range of estimated status from key uncertainty runs with these different input parameters are shown as lines radiating out from that point.

stock is occurring, meaning that the rate at which fish are being caught is not sustainable in the long term.
 23. Within the WCPFC, a limit reference point of $20\%SB_{F=0}$ has been adopted for key tuna stocks as it is considered a level below which the health of tuna stocks will be affected. It means that when the current adult biomass represents less than 20% of the amount that would theoretically have been present if no fishing had occurred, the stock is considered overfished, meaning that the level of the stock is too low. At present, the Commission has not adopted target reference points. However, at the time of writing (May 2015), discussions on options for $SB/SB_{F=0}$ target reference points for skipjack within the range of 40-60% of unfished spawning biomass were ongoing.

Skipjack tuna

The 2014 stock assessment results suggested that the skipjack stock is not overfished.²⁴ Despite recent catches slightly above the estimated MSY of 1,532,000 t, the assessment continues to show that the stock is currently only moderately exploited and fishing mortality levels are sustainable. However, there is concern that high catches in the equatorial region could result in a reduction in the latitudinal range of the stock toward the tropical area ('range contraction'), thus reducing skipjack availability to high latitude fisheries (Harley *et al.* 2015).

Yellowfin tuna

The 2014 stock assessment found highly likely that the yellowfin tuna stock is not experiencing overfishing and is not in an overfished state.²⁵ Despite increases in recent years, fishing mortality appears to be below the level of fishing mortality associated with maximum sustainable yield (F_{MSY}). However, recent catches were close to or exceeded the MSY of 586,400 t by up to 13%, indicating that this level of catch will not be sustainable in the long term. It is considered that yellowfin tuna is at least fully exploited. It was noted that levels of fishing mortality differed between regions, and that fishery impact was highest in the tropical region (Harley *et al.* 2015).

Bigeye tuna

It is considered that overfishing is occurring on an overfished bigeye tuna stock,²⁶ and urgent measures are necessary to rebuild the stock and decrease the fishing mortality, particularly of juveniles. Like for yellowfin tuna, the 2014 stock assessment

24. While estimates of fishing mortality for skipjack have increased over time, 2012 fishing mortality rates for skipjack tuna were estimated to be about 0.62 times the level of fishing mortality associated with maximum sustainable yield (F_{MSY}). Therefore, overfishing was not occurring (i.e., F was less than F_{MSY}). Estimated recruitment shows an upward trend over time, but estimated biomass declined over time to 52% of the level predicted in the absence of fishing, so still above the limit reference point of 20%, and within the region of the target reference point levels being discussed (40-60%).

25. 2012 fishing mortality rates for yellowfin tuna were estimated to be about 0.72 times the level of fishing mortality associated with maximum sustainable yield (F_{MSY}), which indicated that overfishing was not occurring (i.e., F was less than F_{MSY}). Both biomass and recruitment had declined gradually over the duration of the fishery, with current spawning biomass estimated to be about 38% of the level predicted in the absence of fishing, so still above the limit reference point of 20%.

26. Fishing mortality is estimated to have increased over time, particularly in recent years, and 2014 fishing mortality levels were 1.57 times the F_{MSY} level (F was greater than F_{MSY}). The biomass of spawners was estimated to have declined over the duration of the fishery, with current spawning biomass estimated to be about 16% of the level predicted in the absence of fishing, so below the limit reference point of 20%.

noted that levels of fishing mortality differed between regions, and that fishery impact was highest in the tropical region (Harley *et al.* 2015).

*South Pacific albacore tuna*²⁷

The 2012 stock assessment found that the South Pacific albacore tuna stock is not experiencing overfishing and is not in an overfished state.²⁸ Nevertheless, it is estimated that the current level of longline catch is having a considerably higher impact than in previous years on this stock, which is vulnerable to longline fishery. Despite the apparent biological health of the stock, it is estimated that fisheries in many PICTs could see declines in individual vessel's daily catches and fishery profitability (Harley *et al.* 2015).

Management framework

As tuna are considered highly migratory, management interventions are more effective at the regional scale. Yet management interventions are discussed and implemented at three different levels within the WCPO.

At the regional level, the annual Commission meeting of the WCPFC develops 'Conservation and Management Measures' (CMMs) for fisheries and stocks on the basis of advice from its Committees,²⁹ including the Scientific Committee advice on stock status (see section "Status of stocks"). These CMMs are often specific to fishing gear types, primarily because, as noted earlier, different gear types target different species. For example, recent CMMs aiming to limit fishing impacts on tropical tuna, in particular bigeye, focus on reducing longline catches and limiting fishing effort by purse seiners on FADs, because these fishing approaches have a strong negative impact on that stock. CMMs have also been developed for non-target species, such as mitigation methods³⁰ to reduce shark and bird bycatch.

27. The North Pacific albacore tuna stock is not exploited by PICTs and is not considered in the present document.

28. The last assessment at the time of writing (May 2015)(performed in 2012 by SPC) indicated that fishing mortality on adult fish had increased considerably over the past decade, but that overall estimates of 2011 fishing mortality were well below F_{MSY} . Spawning biomass levels remained well above SB_{MSY} .

29. Four subsidiary bodies support the work of the WCPFC. The Scientific Committee (SC) provides the best available scientific advice. The Technical and Compliance Committee (TCC) is in charge of evaluating the enforcement of WCPFC decisions. The Northern Committee (NC) makes recommendations on species mostly found north of 20°N. The Finance and Administration Committee (FAC) deliberates on the WCPFC's budget. All WCPFC members are part of the SC, the TCC and the FAC. Participation in the NC is limited to those members located north of 20°N or fishing for "northern stocks" (stocks which occur mainly north of 20°N).

30. Mitigation methods are fishing techniques or practices implemented to avoid the capture, minimise the mortality, and reduce the catch of unwanted species.

At the subregional level, two key organisations develop management measures:

- The Pacific Islands Forum Fisheries Agency (FFA) is an organization composed of 17 PICT members³¹ with a common fisheries interest in the Pacific Ocean region. FFA strengthens national capacity and regional solidarity through technical assistance and other support to its members. The member countries make sovereign decisions about their tuna resources and participate in regional decision making on tuna management through agencies such as the WCPFC, the Parties to the Nauru Agreement (PNA) and the new Tokelau Arrangement. FFA not only helps its members implement WCPFC and subregional management measures, it also helps them draft management measures for wider adoption within that Commission, including requiring action compatible with national measures to be taken on the high seas. FFA provides advice on options for fisheries development, including facilitating investment in onshore facilities such as processing plants. FFA also facilitates bilateral and multilateral negotiations between its members and foreign fleets, particularly regarding the US purse seine fleet.
- The PNA is comprised of eight tropical countries, a subset of the FFA membership: the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu. The territory of Tokelau is also an active member of the PNA Vessel Day Scheme (VDS), and conforms with the implementing arrangements of the Nauru Agreement. Around 75% of the WCPO skipjack catch is caught in the waters of these countries. As a group, the PNA aims to sustainably manage the purse seine fishery, primarily using the VDS. The VDS sets the total number of purse seine fishing days³² per year within PNA waters, covering the PNA members' combined EEZs. The total number of days is determined based on scientific advice from the Scientific Committee of the WCPFC about the status of the tuna stocks and management objectives. The number of days is allocated amongst the Parties for 12-month periods based on the proportion of tuna and the number of vessel days fished in the waters of each of the Parties. Each country can then sell these days to fishing companies/nations at a minimum benchmark price or higher. In this way, Pacific Islanders gain direct economic benefits and contribute to the sustainable management of the tuna resource. Examples of management measures taken by the PNA, and subsequently incorporated into WCPFC CMMs, include bans on FAD sets by purse seiners during specific months of the year, and full tuna catch retention. The PNA has also led work on developing a target reference point for WCPO skipjack tuna. A PNA vessel day scheme for longline vessels has recently been agreed and is in the process of being implemented.

31. 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, Vanuatu.

32. In 2015, the PNA total allowable effort was 44,623 days for purse seine fishing within their EEZs. One purse vessel fishing during a day represents one day and two vessels fishing during the same day represent two days.

Other subregional organisations involved in the tuna fisheries and their management are:

- the Pacific Community (SPC) which provides technical assistance, training and scientific support to 22 member countries and territories³³ and to other subregional and regional organisations, including the WCPFC. The SPC's main activities on oceanic fisheries³⁴ are training, support for oceanic fishery monitoring (observers and port samplers), fisheries catch and effort data management, scientific information on biology and ecology of tuna and large pelagic fish, ecosystem modelling, information on impacts of climate change, stock assessments of tuna, billfish and key shark species, and the provision of scientific advice to inform management decisions.
- the Te Vaka Moana (TVM), established in 2010, is a group of six fisheries administrations of countries located in the southern part of the region: Cook Islands, New Zealand, Niue, Samoa, Tokelau and Tonga. The TVM's goal is to secure and enhance long-term economic benefits derived from fisheries and protect the important contribution fisheries make to the food security of Pacific communities. It has interest in the implementation of fisheries management frameworks, including through monitoring, control, surveillance and enforcement systems, processes and activities.
- the Melanesian Spearhead Group (MSG), established in 2007, is a group of four independent countries — Papua New Guinea, Solomon Islands, Vanuatu and Fiji — and the Kanak socialist national liberation front (FLNKS) advocating for political independence in New Caledonia. The MSG's goal is to facilitate cooperation, promote stability and implement policies to achieve sustained improvements in livelihoods in Melanesian countries.

Finally, CMMs and subregional decisions are implemented in national fisheries legislation within EEZs and by the nations of vessels fishing in high seas. Individual countries do not rely on decisions taken within the Commission or other groups to drive national management, and make decisions for their own EEZs. Examples are the Palau 'shark haven', declared in 2009, and the New Caledonia shark sanctuary, declared in 2013, which banned commercial fishing for sharks within the two countries' respective EEZs. Most Pacific Island states, particularly those which are members of the FFA, have national tuna management plans that detail the national objectives and management mechanisms for the fishery defined by governments, and contain rules applying to tuna fishing within their EEZs, consistent with wider management decisions.

33. Northern Mariana Islands, Guam, Palau, Federated States of Micronesia, Marshall Islands, Papua New Guinea, Nauru, Kiribati, Solomon Islands, Tuvalu, Tokelau, Cook Islands, French Polynesia, Vanuatu, Fiji, Wallis and Futuna, Samoa, American Samoa, New Caledonia, Tonga, Niue, Pitcairn Islands.

34. SPC is composed of seven divisions: geoscience, economic development, social development, fisheries including oceanic and coastal, land resources, public health, and statistics for development.

Representatives of these national, subregional and regional organisations meet throughout the year, and annually during the Commission meeting of the WCPFC.

Some issues and developments to provide reliable scientific information to managers

In addition to tuna single-species stock status assessments, the ecosystem approach to fisheries management (EAFM)³⁵ (promoted by several international initiatives since 1995, see Garcia and Cochrane 2005) needs information on bycatch species and on the ecosystem. Despite the scarcity of data, the development of observer programmes in the WCPO (see section “Fisheries data and monitoring”) has enabled the recent development of single-species assessments for billfish and shark species (swordfish, blue marlin, oceanic whitetip shark, silky shark and blue shark), as well as detailed studies on bycatch. Moreover, ecosystem single-species and multi-species models are under development to provide managers with ecosystem indicators and detailed information on the impact of fisheries and climate variation on the whole ecosystem.

Uncertainties in the information used within stock assessments highlight the need to continue to improve fisheries monitoring to obtain the data required to produce more reliable estimates and management decisions. The increased coverage rate of observation on-board fishing vessels is a valuable source of detailed information on both the target species and bycatches. Moreover, new techniques are being developed to speed up the processing and receipt of fisheries data using electronic reporting and monitoring (e-reporting and e-monitoring). E-reporting is the electronic recording of catch and effort data by vessel officers. These data in electronic format are directly sent to national fisheries authorities and information is immediately accessible for analysis without having to await the return of paper logsheets. E-monitoring is the use of electronic equipment such as video cameras as an alternative or adjunct to on-board observers to record information on fishing activities. These new approaches have the potential to improve data collection and data quality, enhance assessments, and support alternative management approaches to improve the management of WCPO tuna stocks.

35. EAFM is an approach ensuring that benefits from living resources are high while the direct and indirect impacts of fishing on marine ecosystems are low and not detrimental to the future functioning, diversity and integrity of those ecosystems.

References

- Agnew, David J., John Pearce, Ganapathiraju Pramod, Tom Peatman, Reg Watson, John R. Beddington, and Tony J. Pitcher
2009 "Estimating the Worldwide Extent of Illegal Fishing". *PLoS ONE*, 4(2): e4570.
- Bard, Francois-Xavier, S. Yen, and A. Stein
1999 "Habitat of Deep Swimming Tuna (*Thunnus obesus*, *T. albacares*, *T. alalunga*) in Central South Pacific". *ICCAT*, 49(3): 309-317.
- Bell, Johann D., Valérie Allain, Edward H. Allison, Serge Andréfouët, Neil L. Andrew, Michael J. Batty, Michel Blanc, *et al.*
2015 "Diversifying the Use of Tuna to Improve Food Security and Public Health in Pacific Island Countries and Territories". *Marine Policy*, 51: 584-591.
- Claus, Simon, Nathalie De Hauwere, Bart Vanhoorne, Pieter Deckers, Francisco Souza Dias, Francisco Hernandez, and Jan Mees
2014 "Marine Regions: Towards a Global Standard for Georeferenced Marine Names and Boundaries". *Marine Geodesy*, 37(2): 99-125.
- Davies, Nick, Shelton Harley, John Hampton, and Sam McKechnie
2014 Stock Assessment of Yellowfin Tuna in the Western and Central Pacific Ocean. 10th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Majuro, Republic of the Marshall Islands, 6-14 August 2014 (WCPFC-SC10-2014, SA-WP-04, Rev.1).
- Garcia, Serge M., and Kevern L. Cochrane
2005 "Ecosystem Approach to Fisheries: A Review of Implementation Guidelines". *ICES Journal of Marine Science*, 62: 311-318.
- Gillett, Robert
2009 Fisheries in the Economies of the Pacific Island Countries and Territories. Mandaluyong City: Asian Development Bank.
2011 "Replacing Purse Seining with Pole-and-Line Fishing in the Central and Western Pacific: Some Aspects of the Baitfish Requirements". *Marine Policy*, 35: 148-154.
- Gillett, Robert, Mike McCoy, Len Rodwell, and Josie Tamate
2001 Tuna: A Key Economic Resource in the Pacific Islands. Manila Philippines: Asian Development Bank, Pacific Studies Series, <http://www.adb.org/sites/default/files/publication/28823/tuna.pdf>. (Accessed on December 8, 2015).
- Hampton, John, and David A. Fournier
2001 "A Spatially Disaggregated, Length-Based, Age-Structured Population Model of Yellowfin Tuna (*Thunnus albacares*) in the Western and Central Pacific Ocean". *Marine and Freshwater Research*, 52: 937-963.
- Harley, Shelton, Nick Davies, John Hampton, and Sam McKechnie
2014 Stock Assessment of Bigeye Tuna in the Western and Central Pacific Ocean. 10th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Majuro, Republic of the Marshall Islands, 6-14 August 2014 (WCPFC-SC10-2014, SA-WP-01, Rev.1).

- Harley, Shelton, Peter G. Williams, Simon Nicol, and John Hampton
2015 The Western and Central Pacific Tuna Fishery: 2013 Overview and Status of Stocks (Tuna Fisheries Assessment Report N°14). Noumea, New Caledonia: Secretariat of the Pacific Community, Oceanic Fisheries Programme.
- Hoyle, Simon, John Hampton and Nick Davies
2012 Stock Assessment of Albacore Tuna in the South Pacific Ocean. 8th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Busan, Republic of Korea, 7-15 August 2012 (WCPFC-SC8-2012, SA-WP-04, Rev.1).
- Leroy, Bruno, Simon Nicol, Antony Lewis, John Hampton, Dale Kolody, Sylvain Caillot, and Simon Hoyle
2015 "Lessons Learned from Implementing Three, Large-Scale Tuna Tagging Programmes in the Western and Central Pacific Ocean". *Fisheries Research*, 163: 23-33.
- Rice, Joel, Shelton Harley, Nick Davies, and John Hampton
2014 Stock Assessment of Skipjack Tuna in the Western and Central Pacific Ocean. 10th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Majuro, Republic of the Marshall Islands, 6-14 August 2014 (WCPFC-SC10-2014, SA-WP-05, Rev.1).
- Williams, Peter G.
2015 Scientific Data Available to the Western and Central Pacific Fisheries Commission. 11th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Pohnpei, Federated States of Micronesia, 5-13 August 2015 (WCPFC-SC11-2015, ST-WP-01, Rev.1).
- Williams, Peter G., and Peter Terawasi
2014 Overview of Tuna Fisheries in the Western and Central Pacific Ocean, Including Economic Conditions - 2013. 10th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Majuro, Marshall Islands, 6-14 August 2014 (WCPFC-SC10-2014, GN-WP-01).



Resources, boundaries and governance: what future for marine resources in Micronesia?

Manuel RAUCHHOLZ

Introduction

Being a cultural anthropologist and not a marine scientist, my primary method of data collection is to participate in the lives of the people I am living with, observing all aspects of their social and economic interactions and communication, interviewing individuals and groups of persons on aspects of their culture and language, enquiring into motivations and key values that might lie behind and drive observed behaviour and practices. In this research process, understanding the place of the diverse marine life forms we refer to as “marine resources” in our materialist world is central to understanding key aspects of Micronesian and most Pacific island cultures. As valued and revered life-sustaining substance, marine life forms are more than “marine resources” or a simple “source of protein”. They convey deep meaning, with emotional value central to people’s identity and sense of self. Pacific Islanders’ oral histories, cultural reasoning, moral tales, legends, myths, jokes, proverbs, war and political strategies, fighting techniques and even sorcery and healing methods involve and have evolved around local knowledge and highly specialized observations and associations regarding the surrounding environment with its forms of marine life.¹ To this day, much of this cultural and emotional heritage and knowledge is encoded in language, reflected in material culture, and is the kind of data historically collected and documented by cultural anthropologists like myself. Questions related to the current governance of marine resources therefore came to my attention in various contexts, but they never assumed centre stage in my overall research activities because they were subsumed under the larger cultural questions summarized above. However, since 2004, I have been able to accumulate considerable material on the Micronesian island region.²

1. I will not elaborate on this as it would lead us beyond the scope of this paper. For more material on the subject I refer to Fischer 1957; Goodenough 2002; Hanlon 1988; Mauricio 1987; Rauchholz forthcoming 2016. It is worth mentioning though that Pohnpeians revered the eel, and therefore refrained from eating it. In Chuuk, people who associated themselves with a specific species of fish or marine life also would not eat this particular species. All across Micronesia, specific species of fish were reserved for specific people of name and rank.

2. Fieldwork for this publication was done in the Western Pacific or Micronesian island region, especially in the States of Pohnpei, Yap and Chuuk in the Federated States of Micronesia in 2004-2007, 2009-2010, 2012, 2014 and 2015. I especially want to thank Maurice Brownjohn from the PNA office in Majuro for his valuable comments on the final draft of the paper.

Micronesia, an intermediary region between four continents, and global political and economic interests

The region of Micronesia under analysis here comprises among others three island nations, the Republic of Palau (RP), the Federated States of Micronesia (FSM) with the four States of Yap, Chuuk, Pohnpei and Kosrae, and finally to the east, the Republic of the Marshall Islands (RMI). Aside from Guam, which became a permanent US possession in 1899 after the Spanish-American War of 1898, the recent history of these islands has been shaped to varying degrees by the colonial powers of Spain, Germany, Japan and, since World War II, the United States of America (USA). When the US Trusteeship ended — for the FSM and RMI in 1986 and for RP in 1994 — these newly formed island nations entered into a Compact of Free Association (COFA) with the USA allowing COFA citizens to travel, study and work in the USA. US citizens in return are free to reside and work in the COFA states. Since independence, a large number of COFA citizens have moved to Guam, Hawaii and the continental USA in search of employment, education and health care and many have decided to reside there permanently. Today, an estimated 40,000 FSM citizens reside in the USA and its territories while about 110,000 remain at home (Rauchholz 2012).

In recent years, additional alliances and bilateral partnerships have been formed between the Micronesian island nations and their neighbours. From its beginnings in 1994, RP has maintained close ties with Taiwan while the FSM have maintained and developed their bilateral relations with the People's Republic of China. RMI initially cooperated closely with China but then turned to Taiwan in 1998, resulting in multiple aid and infrastructure projects being developed and supported by Taiwan.³

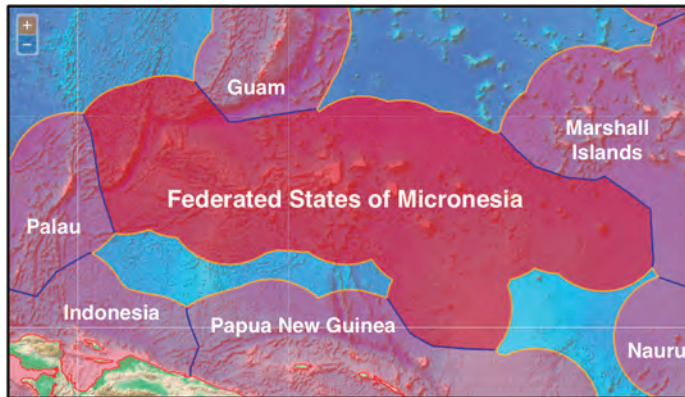
With the economic success of Asian countries such as Japan, Taiwan and South Korea in the 1980s and 1990s, and more recently the People's Republic of China, these Micronesian islands have seen a surge in tourism and imported labour from Asia with Palau leading the way.⁴ In the 1990s a Micronesian tuna fishing industry emerged. The attempts of the newly independent governments to boost their economies eventually failed due to ill-advised government investments and poor management by government contractors.⁵ Today, fleets of Asian, American and a few European fishing vessels sail the seas and exclusive economic zones (EEZs) of this region in search of prized tuna supporting a US\$7 billion industry (see fig. 1).

3. <http://www.nationsencyclopedia.com/World-Leaders-2003/Marshall-Islands-FOREIGN-POLICY.html> (Accessed on July 20, 2015).

4. According to Billy Kuartei, the current Minister of State, Palau received about 117,000 visitors in 2011. In 2014 the numbers have well surpassed the 140,000 mark.

5. Micronesian governments were ill-advised and often coerced into purchasing vessels (i.e. purse seiners) that had been proven to be uneconomical. Poor management of the vessels only increased the dilemma leading to annual losses in the FSM in the 1990s of nearly US\$13 million (Jacobs 2002: 8; Wilson 2007).

Figure 1: FSM and bordering countries' EEZs



© Flanders Marine Institute (VLIZ) 2015.

With an ocean area spanning around 7.2 million sq km, it is obvious that these small island nations cannot control, let alone monitor (illegal) activities within their borders. The following figure (see fig. 2) shows a manned fish aggregating device used by Indonesian fishermen to fish illegally in FSM waters.⁶

Figure 2: Manned Indonesian fish aggregating device (FAD) washed ashore on Mwooch Island, Chuuk State, after a storm



© Manuel Rauchholz, 2015.

6. This device was manned by an Indonesian fisherman. The structure was tied to a series of full-grown

Over the course of my work, two main foci have emerged with regard to questions of marine resource governance in Micronesia: local coastal fisheries management and the global commercial fishing industry.

Coastal and fisheries management in Micronesia

The most extensive summary on nearshore fisheries management in Micronesia was published in 2011 by The Nature Conservancy. This interdisciplinary report gives an excellent overview of the relationship between market forces and nearshore fisheries “in transition from subsistence to a market-economy” (Rhodes et al. 2011: 11). The overall findings indicate that “[d]espite obvious and ongoing overharvest and degradation, reef fisheries in Micronesia remain relatively unconstrained by legislative or management action” and in some cases government “*is even actively working against management measures to improve and sustain resources*” (*ibid.*; italics in the original). As an example, the article cites the illegal fishing activities of a former governor of Pohnpei State who was caught fishing in a marine protected area (MPA) in 2006 and the resulting measures taken to weaken the monitoring and enforcement of illegal fishing activities (Rhodes et al. 2011: 101-102).

Kevin L. Rhodes et al. report that “*Pohnpei is now extracting nearly 1.5 times (150%) its sustainable productive capacity*” (2011: 99-100; italics in the original; Rhodes et al. 2014). Thus, there is an immediate need to reduce catch volume and restore productivity in Pohnpei as in other Micronesian jurisdictions (Cuetos-Bueno and Houk 2014; Houk et al. 2012). The Republic of Palau has probably taken the strongest actions to introduce and enforce new legislation and protective measures of nearshore marine resource extraction backed by taxation providing funds to support monitoring and enforcement activities (Rhodes et al. 2011: 86). Currently, Palau collects a US\$30 green fee from every non-citizen departing the country and the State of Koror charges an additional US\$50 to every tourist visiting the Rock Islands and another US\$50 for a visit to Jellyfish Lake (*Ongeim'l Tketau*).⁷ In 2010, when the fee was still US\$25, this earned an estimated revenue of US\$3.1 million (*ibid.*). With tourism numbers increasing by around 25,000 in 2014 compared to 2011, this would amount to an estimated US\$7 million or more in revenue for

bamboo poles (ca. 5 m and longer) for stability in the ocean waves and to attract schools of tuna. The lone man had a communication system on board with which he would call in his colleagues from outside the FSM's EEZ once enough fish had aggregated around his FAD. The unregistered, illegal fishing vessels waiting outside the FSM's EEZ could then come in, make their sets around the FAD, haul in the catch and disappear immediately outside the FSM's EEZ. The FAD was further equipped with a kerosene cooker, a large jug of fresh water, some rice, fishing gear and canned food.

7. The lake is one of approximately 70 marine lakes in Palau and home to millions of jellyfish, which are the prime attraction for tourists who can swim and snorkel among these golden invertebrates.

conservation activities. However, the downside to this increase in funding is that the growing tourism industry also has an appetite for local reef fish, including some species not usually harvested, such as the Humphead Wrasse/Napoleon-Lippfish (*Cheilinus undulatus*) (Rhodes et al. 2011: 37, 76). Thus although Palau may serve as a model in conservatory stewardship in the Micronesian island region, “reef fish demand has not necessarily declined” (Rhodes et al. 2011: 87). Recent examinations of Palau’s fisheries suggest that the country is fully exploited (Newton et al. 2007) and there is no evidence to suggest that current levels of fishing are sustainable (Rhodes et al. 2011: 99-100). As in all parts of Micronesia, islanders are exporting large quantities of fish to Guam, Hawaii and the mainland USA for subsistence and family exchange or market sales.⁸ Shipping fish overseas to Guam, Hawaii or the USA is popular because it can increase the revenue and income of fishers, but it reduces the supplies available on local fishing markets and puts additional pressure on the marine ecosystems. In Chuuk, Guam is a primary destination for reef fish destined to support the demand of over 1 million tourists — most of whom are from Japan — who visit the island annually.⁹ A plane flies from Chuuk to Guam every other day and on flight days, catch numbers are higher than average. There are also times and days when reef fish are not available or lacking in quantity on the local markets on Wééné (Chuuk’s capital island) because of shipments to Guam and Hawaii.

However, one of the largest challenges in some jurisdictions is the use of harmful and illegal fishing methods such as blast fishing in Chuuk, the fishing of octopus by women in reef shallows using chlorine, and systematic poaching by foreign fishing vessels, mostly Southeast Asian (Thai, Indonesian, Vietnamese) or Chinese, within the EEZs of the Micronesian island nations.¹⁰

Blast fishing in Chuuk

When I began my fieldwork in Chuuk in 2004, I often saw dynamited fish being sold illegally off the back of pick-up trucks or even at the local fish markets on Wééné and in the two villages in the western part of the Chuuk Lagoon where I resided. Seeing my interest, local friends taught me how to identify blasted fish.

8. In a survey of 72 passengers exporting reef fish from Pohnpei in 2006, 45% indicated their fish was being taken to the mainland USA, 38% to Hawaii and about 12% to Guam (Rhodes et al. 2011: 37).

9. According to environmental scientist Javier Cuetos-Bueno (2014, personal communication), who has been doing research on nearshore fisheries and the marine environment in Chuuk.

10. In July 2015, 111 illegal fishermen from Vietnam who had been caught poaching on FSM reefs were repatriated from the FSM to their home country. See Kaselehlie Press August 3-16, 2015 and Kaselehlie Press online (especially June 13, 2015, <http://www.kpress.info/index.php/site-map/1386-pna-leaders-set-fisheries-agenda-for-2016-and-beyond>, Accessed on July 27, 2015) for more details.

People in the community and at the markets told me that there had been a recent surge in dynamite fishing in Chuuk after external funding had expired for a programme during the second term of Governor Dr. Ansito Walter (2001-2005). This programme had been helping the local government in its efforts to enforce legislation outlawing dynamite fishing. It also supported the daily monitoring of the reefs and ocean for possible blasts and fish sold at the local fish markets, and included the arrest and incarceration of persons who were caught fishing with dynamite, or got caught with dynamite in their possession.¹¹

On subsequent fishing tours along sections of the south-western barrier reef of the Chuuk Lagoon, I was personally shocked at the visible devastation of the reefs that one could even see when looking down at the sea bottom in calm waters off a small skiff: corals scattered in concentric circles everywhere I looked along a stretch of reef over a mile long. This area was regularly hard hit with blasting during the spawning time of groupers that congregated by the thousands on these reef sections each year. In 2007, I witnessed such a disaster when boatloads of groupers were brought to our village for sale and there were too many fish for the island community to consume, so that much of the fish ended up spoiling. Korean marine scientists confirmed these observations, saying they could not enter the water with diving gear in the western part of the Chuuk Lagoon without driving sharks into a feeding frenzy, forcing them out of the water on a number of occasions.¹² A few times, they returned to marine life testing grounds in this region only to find the reef had been blasted and their sea cultures destroyed. I often discussed the culture of blast fishing with community members and especially with religious leaders in our village community.

On a few occasions, we were sitting together talking in the village centre with me taking notes when young men came by our village from the neighbouring island of Pwééné to sell dynamited fish. On such occasions, I would use the opportunity to openly talk about and discuss the damaging effects of blast fishing for generations to come, and over time our religious community decided not to purchase the fish. Consequently, on later occasions, we all walked away from the dock empty handed after discovering that the catch for sale had been blasted. Our reasoning was that if the community and in particular the religious community¹³ in Chuukiyénú refrained

11. One of my neighbours was in fact caught with a homemade dynamite cocktail in his backpack on Wééné as he was buying fuel for a trip out to "fish". He was incarcerated for a few months. During this time the police force used jet skis to catch violators of the law.

12. The Korea South Pacific Ocean Research Center (KSORC) has a research station on Wééné in the village of Sópwuuk. It was established there in 2000 and is the base for numerous researchers and research projects from the Korea Institute of Ocean Science and Technology (KIOST). See the KIOST website for further details at https://eng.kiost.ac/kordi_eng/?sub_num=322 (Accessed on July 26, 2015).

13. I make a distinction here between the religious community and the village community. Even though most everyone is represented as a person by both (more than three fourths of the population) they also

from buying blasted fish collectively, this would discourage blast fishers from coming to sell their catch in our village and reduce the base of potential customers, while at the same time increasing the awareness of the harmful nature of this fishing method. If these measures led to a decline in blast fishers avoiding our dock I cannot say, but we did see some success on following occasions when only one or two families sent out their young to fetch some blasted fish when they were for sale at the village dock. This was in 2007.¹⁴

The history of blast fishing goes back to colonial times and it seems to have been introduced to Chuuk by Japanese traders. The earliest accounts of dynamite fishing I have found date back to reports from American and later German missionaries from around 1900 and onward. Japanese traders used this method to increase their catch and revenue. Later on, especially during World War II, the Japanese armed forces were cut off from their supply lines due to US control of the surrounding waters in early 1944. Food supplies became limited for the estimated 20,000 Japanese troops stationed in the Chuuk Lagoon and its surrounding atolls. For the next year and a half, the Japanese military personnel sent out blast squads in between the daily US bombing raids that usually struck in the mornings at around 10.00 a.m. and in the late afternoons at around 3.00-4.00 p.m. One old man I interviewed in 2005 in the village of Bokochow, Paata, in the western part of Chuuk Lagoon, had been assigned to one of these blast squads that systematically blasted along sections of Chuuk Lagoon's barrier reef. Often at gunpoint, he and his fellow islanders, which included Nauruans who were interned in Chuuk during World War II, were forced into the water after the blasts to collect the fish amidst the sharks who had gotten used to the practice and swam in between the islanders in a feeding frenzy as they were busy bagging as many fish as possible. To my knowledge, the impact of this wartime practice has never been assessed in Chuuk.

represent two organisational entities by which society is structured, civil society maintained and morality enforced. For about eight years, before, during, and after the time of my fieldwork, there was no functioning municipal government on the island of Tol after an election dispute. Secondly, religious groups in Chuuk are well organised with very active women's, men's and youth groups and the regional assemblies of ministers or clergy. These groups all have their own elected or appointed set of leaders (i.e., president, secretary, treasurer, etc.), who organise community events, run schools, raise funds for activities and organise regular community or sporting events and also try to solve disputes and other problems within their community beyond what the government has been able to accomplish. Integrating these groups into development efforts could lead to a serious improvement of activities such as marine resource management.

14. A year earlier, a series of incidents were also noteworthy. On one occasion, all but one of the elders and religious leaders of our community were off island for about a week to attend some meetings overseas. Over the course of two or three days large groups of young men, youth and children gathered together daily during school time, all in party mode, sitting around on the edges of their boats waiting and watching for their peers to blast a school of fish in our bay.

After World War II, tonnes of explosives were left behind in the hulls of the sunken Japanese support ships now lying at the bottom of the Chuuk Lagoon.¹⁵ For many years after the war, some islanders extracted these explosives, mostly ship mines, and used them as a source for TNT to make their own explosive devices for blast fishing. Some families have collected their own arsenals of ship mines over the years and have hidden them on the ocean floor in marked areas off their reefs. These arsenals provide them with free and regular access to explosive materials. During my fieldwork between 2004 and 2007, an accident involving a ship mine on the island of Wutéét left three men dead and one seriously injured. As they were trying to extract the TNT, one of the four had jokingly struck the backside of the opened mine, triggering the unintended blast. A year after the incident I met the lone survivor in his village. In multiple incidents, men have lost arms, hands and legs in failed blast attempts while many more have been killed.

Over the years, explosive material has also been obtained from companies involved with road construction and rock crushing on Wééné. Before and during the last road construction period, which started in 2006, explosives were reported to have disappeared from storage and increased incidents of blast fishing followed. The same was reported during the late 1970s and early 1980s when the airport runway was being paved and roads developed. Large amounts of explosives were needed to blast away basaltic rock, and some of this material wandered off for use in blast fishing activities.

Though awareness has increased over the years regarding the long-term harm of blast fishing to the marine environment, it may still be considered an occasional problem in Chuuk.

Future developments in nearshore fisheries

Though conservation efforts are slow, a combination of cultural marine tenure (CMT) with insights from marine science and external governmental support implemented through local governments and foremost NGOs and private channels seems to hold the most promise for future success in sustaining and developing nearshore marine resources.¹⁶ Over the past five years, for example, a programme funded by the EU and the German government (GIZ) on climate change adaptation (implemented in cooperation with the Pacific Community in Pohnpei) has provided invaluable support for marine resource management and development in the Micronesian region.

15. Close to 60 Japanese ships (and two submarines) were sunk during the US military operation "Hailstone" on February 17-18, 1944. Most of these ships were supply ships, their hulls filled with weaponry and other supplies. Some ships went down without their explosive cargo being harmed.

16. Unfortunately, some key government departments and agencies fail to deliver their programming

Figure 3: Women fishing together with hand nets on Tol Island, 1970s



© Roland Rauchholz.

Most communities in Micronesia have had conservation measures in place, usually enforced by reef owners who often limited access to the marine areas and resources, which they owned and controlled. These measures mostly included the closing off of reef sections for fisheries, normally after the death of a reef owner (*pwaarw* or *mechen* in Chuuk). Religious beliefs, which include ideas about the nature of things, spirit beings, ancestors and human beings that share the same universe, have had a history of being a driving force in CMT. People would and today still will mostly avoid the entrance to closed-off reef sections out of fear of negative repercussions from community leadership, but above all from the spirit world for possible violations against the established moral code. One source I interviewed mentioned how on her island a larger reef section, adjacent to the island, was closed for fishing by the

content despite sufficient funding and subsequent potential for follow up funding. One island community complained that they were only visited once for 2-3 hours by department specialists in a community project designed to educate and guide them through a process of establishing and maintaining their own marine protected area. A private person knowledgeable in environmental science who spent a few days in the community was able to achieve more without any funding because the community was willing to learn, but had been left alone by government authorities who did not bother to deliver the work they were being funded to do. In later reporting though, this community was highlighted as a case for the government's success.

chief for over 25 years. Nobody dared to violate this restriction.¹⁷ Everyone remembers the day, time and what they were doing when the taboo (*pwaaw*) was lifted and the markers (*mechen*) on the reef removed, thus allowing everyone to enter the formerly restricted area and begin feasting on the plentiful amounts of large and tame fish.

Figure 4: Young women cleaning reef fish (parrot), Chuuk Lagoon



© Manuel Rauchholz, 2006.

A weakness in conservation and other development efforts has been the exclusion or lack of integration of key religious organisations and communities such as the Catholic and Protestant churches. Religion in Micronesia does carry strong positive moral incentives for people to comply with what can be established as being in line with religious beliefs such as respect for creation and good stewardship over marine and natural resources. Today, churches in Micronesia are the largest and most successful independent social organisations able to raise funds, implement projects and mobilise people.

17. Many community leaders (traditional and Christian) I have talked to in Chuuk stated that the most common belief was that the consequences of violating a closed reef section after the death of a former owner or chief was the death of a person in the family of those who violated the reef closure.

Efforts are being undertaken by all local governments in Micronesia (including Guam and the Northern Mariana Islands not otherwise discussed here), supported by numerous organizations active at local and global levels,¹⁸ “to effectively conserve at least 30% of the nearshore marine resources and 20% of the terrestrial resources across Micronesia by 2020” through what has become known worldwide as the “Micronesia Challenge”.¹⁹

**Figure 5: Traditional fish trap, Mwooch Island, Chuuk State.
Such traps may support conservation measures**



© Manuel Rauchholz, 2005.

18. To this day there are at least 50 organisations, institutions and governments that have provided monetary and other kinds of support to the Micronesia Challenge. Support has come from countries such as Turkey, Germany, Japan, the USA, and Australia, as well as from the European Union and the United Nations and from many of their related institutions such as the US Environmental Protection Agency, the US Department of Interior – Office of Insular Affairs, and the European Union Conservation and Environmental Protection Programme to name just a few. Key partners are the Micronesia Conservation Trust and The Nature Conservancy. Next to the supporting governments in the region, they have been crucial in providing professional support and guidance to the efforts of the Micronesia Challenge. More information on the Micronesia Challenge can be accessed at <http://www.micronesiachallenge.org> (Accessed on July 25, 2015).

19. <http://www.micronesiachallenge.org> (Accessed on July 22, 2015). Other similar initiatives have sprung up, influenced by the Micronesia Challenge, such as the Coral Triangle Initiative (CTI) in the Southeast Asian region.

At present, precise research data on reef fish stocks is still rather limited, but promising research initiatives are underway. A long-term case study from the Chuuk Lagoon on the types, sizes, and quantities of reef fish caught and brought to the Wééné fish market was conducted over the course of a year (2013-2014) by environmental scientist Javier Cuetos-Bueno. Once the findings are published, they will provide the largest and most reliable quantity of data available for any jurisdiction in Micronesia on the state of reef fish populations and their habitats. Over many years, Kevin L. Rhodes, Kimberley Warren-Rhodes and Peter Houk, among others, have been doing similar work in Pohnpei. In Palau, numerous marine research projects are underway through the Palau International Coral Reef Center in cooperation with major overseas research institutions. One example is the ongoing cooperation between the University of Hawaii, Stanford University and Palau Community College in joint research, student exchanges and teaching efforts focusing on coral reef ecology and management options.²⁰ Another is the long-time work of the Coral Reef Research Foundation headed by Patrick Colin, who has been making long-term contributions to coral reef research in the Micronesian region.²¹ What is still lacking is a regional institutional research platform that could bring together the plentiful initiatives and activities of researchers, institutions, governments and NGOs in the region. Such a platform could provide better cooperation and coordination of research efforts and offer research-based advice for domestic, national and regional policy makers, environmental and development specialists, communities and potential funders of research in the Micronesian region.²²

Poaching and illegal fishing activities by foreign fishing nations²³

Poaching and illegal fishing activities of foreign fishing vessels in the coastal waters on and around the reefs of Micronesian islands has increased considerably over the past years and 2015 marked a climax in these illegal and exploitative activities. In the first half of 2015, over 120 Chinese and Vietnamese men were imprisoned on Pohnpei

20. See Palau International Coral Reef Center's website for more information at <http://www.PICRC.org> (Accessed on July 22, 2015).

21. For more information see the organisation's website at <http://www.coralreefresearchfoundation.org> (Accessed on July 22, 2015).

22. The Pacific Community (SPC) has been very active in research and development initiatives, but has not been involved in activities aiming to facilitate cooperative research with established institutions of higher learning. Though a lot of similar activities are going on through SPC, I do not see SPC providing the platform for domestic and international researchers and universities active in the region.

23. For this section, people in government and cooperating support agencies have been interviewed and wish not to be cited as investigations are still ongoing. The *Kaselehlie Press* in Pohnpei and the *Pacific Daily News* on Guam also provided accounts of the incidents. See also D'Arcy (2014, 299-301) for a brief overview of the problem in the Pacific.

and about 35 in Yap after they were caught conducting illegal fishing and poaching activities on the reefs of Ngulu, Nukuoro and Kapingamarangi Atolls.

A group of 10 vessels was sighted gathering sea cucumbers and reef fish at Ngulu Atoll in Yap, and islanders there reported them to the national and state governments. When Yap State's request for help from the national coastguard²⁴ was not met, local officials put together a small armada of skiffs and outboard motor boats, armed them with police officers and able citizens, and sailed around 120 km across the open ocean to Ngulu. There, they were able to successfully catch around 35 illegal fishermen and confiscate some of their vessels.

Larger groups of illegal fishermen, mostly from Vietnam and some from China, were caught on the atolls of Nukuoro and Kapingamarangi, south of Pohnpei. The sailors were mostly from Vietnam while the ship owners were identified as being either Chinese or Vietnamese. Many sailors in particular have claimed that they were trafficked to work on the vessels, others submitted claims of being smuggled and wanting to seek asylum. Figuring out the circumstances and the extent of illegal activities by these poachers has been a challenge for local authorities due to language barriers and the varying accounts of the persons interviewed. One confiscated vessel with its crew under house arrest was able to escape from Pohnpei Harbor during a typhoon in April 2015 under life threatening circumstances. After the typhoon they were caught a second time for illegal fishing activities exactly where they had been arrested the first time. There has therefore been talk of organised crime and trafficking through investors or ship owners pressuring crews and captains not to return home empty-handed lest they or their families back home experience further exploitation or aggression by their employers. While local governments and the International Organization for Migration (IOM) are trying to assist as best they can, it is difficult to identify or connect these activities with incidents of human trafficking or human smuggling.

In Palau, a Chinese poacher was accidentally shot and killed in March 2015 in an attempt to arrest him and a group of 25 poaching fishermen and confiscate their vessels. Rather than receiving apologies from China for the illegal breaching of its boundaries and theft of its marine resources by some of its citizens, the Palauan government received threats. Accusations of the maltreatment of its citizens and human rights violations were made in what was clearly an accident that took place when the Chinese citizens resisted arrest and fled the crime scene (unnamed

24. As mentioned earlier, Yap State is one of four states that make up the Federated States of Micronesia. It is the western most state while Pohnpei, where the FSM's three coastguard ships are usually stationed, is 3 hours away by air plane, equivalent to the distance between Frankfurt, Germany and Moscow, Russia. It would have probably taken a FSM coastguard vessel up to three days to get to Ngulu Atoll on the western edge of Yap State, by which time the poachers would have easily escaped.

government officials, 2015, personal communication). What is becoming ever more evident in the current illegal doings is that these are not the activities of single persons or vessels, but that these poaching activities are being well coordinated and systematically organised. In some of the cases involving illegal fishing activities, there have been smaller vessels including skiffs with Chinese fishing illegally in coastal waters and on the reefs of Palau. When the government made an attempt to contain the fishermen, the boats dispersed in multiple directions out to sea. Those who were caught had no supplies or fuel on board that could have suggested they came a long way, such as from the Philippines or China. In addition, the vessels did not have the capacity to preserve and transport their catch back to the Asian markets where the fishermen came from. The same is also true for poaching activities encountered regularly and systematically on the southern islands of Palau as well as on Helen Reef. Many of the poachers are operating small skiffs with supply and transport ships hiding further out at sea. The ability to monitor these distant reefs and atolls is hardly possible and poachers pose a serious threat to the sustainability of Micronesian island marine resources.

In another case, crew members of one larger but still small vessel claimed to have fallen off course and drifted for many days in their attempt to seek asylum overseas. When GPS and navigational instruments were inspected, it was found that they had taken direct course for Yap from their place of origin in Asia and their food supplies had recently been fully replenished. Therefore, there was little doubt that one or more larger vessels had launched them or supported them from a greater distance to avoid detection.

Some people I have talked to in Micronesian governments see a growing need to clearly redefine the security policies outlined in the respective Compacts of Free Association²⁵ between their independent Micronesian island states (Palau, the FSM and the RMI) and the USA. They claim that the USA must be more involved and held accountable to protect against intrusion from any person or entity in violation of their borders and EEZs, just as it is responsible for deterring a hostile foreign nation. With no more than a handful of coastguard vessels, these island states cannot protect their maritime borders from constant intrusion and illegal extraction of marine resources.

Another difficulty in preventing or even reducing illegal, unregulated and unreported marine resource exploitation (IUU) is the fact that most rural island communities are not serviced on a regular basis by their own governments. Many have therefore come to rely on foreign fishing vessels passing through their waters

25. Palau, the FSM, and the Marshall islands were part of the former United Nations US Trust Territory of the Pacific Islands. Under the Compacts of Free Association with these countries, the USA retains the right to military access and guarantees the protection of the islands should they be threatened by intruding nations.

for foodstuffs, supplies and cash. On the southern atolls of Palau, the small island population recurrently engages in trade relations with poachers, often only reporting those who may have disappointed local actors or caused a community to feel threatened by their presence. On the outer islands between Chuuk and Yap, there is a vibrant shark fin trade and in 2010 I saw some canoe houses draped with shark fins caught and dried by local fishermen for trade with the next available fishing vessel or trading partner.²⁶ This trade is in fact illegal, as foreign fishing vessels are not permitted to approach islands within the 12-mile zone, let alone get off their vessels to fish or trade with local populations. Often enough though, these illegal poachers provide resources for some remote island communities where government support is lacking. Many reefs, shoals and islands in this region are far removed from inhabited islands, so there is no secure monitoring of vessels' activities while passing through these waters. Other marine resources such as sea cucumbers and sea turtles, prized delicacies in Asia and Southeast Asia, are also at risk of increased exploitation through poaching by foreign fishing vessels.²⁷

In response to global shark finning and the reduction of shark stocks worldwide, the Republic of Palau has created "the first shark sanctuary in the world" (in 2001) and the RMI "the largest shark sanctuary in the world" (in 2011). The latter was established in response, among other reasons, to harmful poaching activities in some of the RMI's most attractive shark diving spots in recent years.²⁸ If illegal shark poaching activities cannot be contained, shark populations in Micronesia risk declining to levels harmful to the ecosystem. Over recent years I have been interviewing "observers"²⁹ monitoring fishing activities on board foreign fishing vessels legally fishing in the Micronesian island region and beyond. Some of their reports are very alarming with

26. The FSM states outlawed shark fishing between 2012 and 2014 within their islands' 12-mile zones. Chuuk was the last to do so in 2014, following Kosrae (2012), Yap and Pohnpei (2013). (<http://www.mpatlas.org/category/shark-sanctuary/>, Accessed on July 25, 2015). Whether this new legislation has had an effect on my observations in 2010, I cannot say at this time.

27. Even some historical sites such as the Japanese Lighthouse on the island of Alei, Pwolowot, a sight registered with the US national register of historical places, has seen all of its copper guardrails cut off and sold to Chinese and Taiwanese fishing vessels. Just this June 2015, one pastor in the Mortlock islands of Chuuk was said to have been negotiating the sale of a church bell donated to his church prior to World War II by a church in Germany.

28. For more information on shark sanctuaries in the Pacific and worldwide, consult the Marine Conservation Institute MPAtlas online at <http://www.mpatlas.org/category/shark-sanctuary/> (Accessed on July 25, 2015).

29. Foreign fishing vessels (FFVs) that are legally registered to fish in the EEZs of Pacific Island nations all carry one so-called "observer" on board the vessel. The observers are employed by Pacific Island nations, mostly by the Parties to the Nauru Agreement (PNA) member countries. They are tasked with monitoring, documenting and reporting all activities on board a FFV to ensure compliance with fishing regulations, environmental protection, human rights concerns, etc. Their job is therefore not easy, as I will explain when I reference their work further below.

regards to certain shark populations, such as the silky shark. According to one observer, in about 2010 he could count and document up to 70-80 full-grown silky sharks as part of the tuna bycatch on a successful fishing tour in Micronesian and Papua New Guinean waters. However, in 2014 and 2015, he only counted around 12 specimens in the bycatch of two multi-month fishing trips in the same waters, and all were junior sharks under 1 m long. This evolution in the number of sharks over barely more than five years was in his opinion alarming. This leads us to our next and final section, an outlook on the global commercial tuna industry.

Micronesia and the global commercial tuna industry

The global commercial tuna industry is a very complex industry with its own dynamics, challenges and risks. Sharp fluctuations in global market values of tuna render it difficult at times to assess or predict proceeds from the industry. The price of tuna has varied in recent years between US\$700 per metric tonne of skipjack, the most common Micronesian tuna caught and sold, in 2004 (Wilson 2007: 9), to around US\$2,150 per metric tonne in the fall of 2012. Currently, it has settled at around US\$1,150-1,250 per metric tonne on the global market.³⁰ Over the past years, revenue from the sale of tuna fishing rights has developed into the main or a key source of independent income for tuna resource nations such as the FSM, the Marshall Islands and a few other small island nations such as Nauru, Kiribati and Tuvalu. Along with numerous foreign fishing nations such as the USA, Japan, China, Taiwan, South Korea and the European Union, these resource nations are members of the Western and Central Pacific Fisheries Commission (WCPFC), currently headquartered in the FSM in downtown Kolonia on the island of Pohnpei.

In 1982, eight tuna resource nations formed their own interest group known as the Parties to the Nauru Agreement (PNA). The member states of the PNA are Nauru, Papua New Guinea, the Solomon Islands, Palau, FSM, the Marshall Islands, Kiribati and Tuvalu. They have pursued three main goals: the rational development and utilisation of the living resources within the EEZs, in particular the common stocks of fish; the exploitation of common stocks of fish, both within the EEZs and adjacent waters, by distant water fishing nations (DWFNs); and cooperation in the management of the eight EEZs to achieve maximum benefits from the fisheries resources. In his article “A Tuna Industry in Micronesia?” published in the *Micronesian Counselor*, Peter Wilson (2007), a former Director of Fisheries in Papua New Guinea and advisor to the government, suggested that Pacific Island nations strengthen their cooperation with the goal of improving regulations and the implementation of measures

30. <http://www.globefish.org/tuna-october-2012.html> (Accessed on July 22, 2015). More information can be accessed through the website of the Food and Agriculture Organization of the United Nations (FAO at <http://www.fao.org/fishery/en>, Accessed on July 22, 2015). For an overview of newer developments, including the socioeconomic aspects of the tuna trade, processing, and marketing, see Miyake et al. 2010.

Figure 6: Trolling for tuna outside the Chuuk Lagoon



© Manuel Rauchholz, 2006.

to increase local revenue from the tuna industry in the island states. In 2010 this goal was finally achieved when the PNA staffed an executive branch to manage and promote their interests *vis-à-vis* foreign fishing nations. The office was established on Majuro Atoll in the Marshall Islands and is headed by Transform Aqorau from the Solomon Islands, who has a PhD in maritime law. The so-called Vessel Day Scheme (VDS, see also Allain et al. in this volume) was strongly promoted and developed to allow foreign vessels to purchase active fishing days and pay auctioned or negotiated fees per day of fishing in PNA waters. Before the establishment of the PNA office in 2010, the VDS brought in only US\$1,100 per fishing day to the FSM.³¹ Two years later, the amount had risen to US\$3,000 per fishing day, the following year to US\$5,000

31. The PNA nations were receiving a total of US\$60 million per year in 2010, with only about US\$500 per fishing day for Tuvalu, while Papua New Guinea and Kiribati were receiving US\$2,500 per day.

per day, and by 2013 it was US\$6,000.³² That rate increased once again in 2014 to US\$8,000. According to Maurice Brownjohn, commercial manager of the PNA office in Majuro, fishing days were being traded for up to US\$10,000 per fishing day in 2015, and in Papua New Guinea even up to US\$12,000 with the amount expected to move towards the vicinity of US\$15,000 per fishing day in the years to come (Brownjohn 2015, personal communication). In sum, the establishment of the PNA executive office in 2010 to represent PNA interests in the global tuna fishing industry has resulted in an increase in revenues for the eight-member group of PNA nations in five years from US\$60 million in 2011 to US\$360 million in 2015. That is an increase of five to six times the amount received in 2011 (Brownjohn 2015, personal communication).³³ The industry is able and willing to pay these fees and some fishing companies and fish processors would like to see a hike in the price of tuna per metric tonne to about twice the amount of today's going rate for skipjack, which is a little over US\$1,000 per metric tonne, to around US\$2,000 or more (Brownjohn 2015, personal communication).

If one takes the development of these numbers into account and calculates them against the operating costs and profits of the purse seine tuna industry, one will be surprised at how high the profits of the purse seine and global tuna industry has been over the years.

The following table (tab. 1) represents self-reported data on operating costs and income presented by purse seiners to the FSM National Fisheries Corporation (NFC).³⁴ The two data sets in the table have been put into parallel columns by NFC for easier comparison. The first represents the average self-reported figures of a Japanese purse seine operator, while the second corresponds to the figures reported by the average Chinese or Taiwanese operator, according to Peter Sitan (2014, personal communication). One can see that the total revenue reported matches the tuna price for skipjack in 2012 of about US\$2,000 per metric tonne (see below).

32. During the same year the FSM sold 6,000 fishing days and could therefore account for US\$36,000,000 in revenue for that year alone (Sitan 2014, personal communication). With the price now at US\$8,000 per fishing day the FSM can expect a revenue increase up to US\$48,000,000 for 2014 and 2015.

33. From the creation of the EEZs in 1979 until 2001, the FSM by comparison received US\$170 million for the first 22 years of licensing or an average of annual fishing fees amounting to US\$7.7 million.

34. I want to thank Peter Sitan, Director of the FSM NFC for providing me with this data set. It must be mentioned here that these numbers do not coincide with figures shared with me by some observers and vessel operators who admitted to targeting up to 16,000 tonnes of tuna per vessel and year under the VDS, especially since the price of tuna has come down to little over US\$1,000 per metric tonne. One Taiwanese fish-master kept shaking his head in astonished disbelief at the rate he and the other 300 purse seiners in PNA waters were depleting fish stocks. According to his estimation in 2012, tuna stocks could hardly last at a sustainable level for another 10 years. The data of some observers regarding the average size of skipjack tuna landed in 2015 compared to 2009 in FSM and surrounding waters confirms these assumptions. Average fish size has fallen from 60-70 cm (reproductive size and age) to only 30-40 cm in 2015 (juveniles).

Table 1: Self-reported data on operating costs and income presented by purse seiners to the FSM National Fisheries Corporation (NFC)

	Japanese Purse Seiner	Chinese Purse Seiner
Catch (MT)	5,816	6,000
Export Income	12,904,081.00 USD	12,000,000.00 USD
Material Costs	3,937,816.83 USD	2,325,124.00 USD
Operating Expenses	4,283,834.20 USD	2,086,968.00 USD
Administrative Expenses	243,372 USD	93,000 USD
Total Crew Costs	3,101,896.83 USD	1,049,600.00 USD
Allowance	275,280.93 USD	?
Catch Bonus	1,842,882.02 USD	?
Food	221,494.36 USD	92,160.00 USD
Other Sailor Costs	7,240.84 USD	?
Salaries	478,392.77 USD	?
Social Insurance	241,685.94 USD	?
Welfare	34,919.97 USD	?
Net Income	1,259,449.84 USD	5,772,398 USD

© Manuel Rauchholz, 2015.

A number of things are noteworthy: (1) the Japanese reporting is exact, even behind the decimals, while the Chinese and Taiwanese reporting is approximate with round figures emerging; (2) material costs differ by US\$1.6 million; (3) operating expenses differ by US\$2.2 million; and (4) crew costs are over US\$2.0 million lower per annum on the Chinese vessels.

In sum, the Japanese purse seiner averaged a profit of US\$1.3 million in 2012 compared to a self-reported net profit of US\$5.8 million by the Chinese. Not only do labour costs differ greatly, but so do material costs and operating expenses, though it is unclear what is subsumed under operating expenses, as it could mean salary, fuel costs or multiple other possibilities. Unfortunately, I do not have a more detailed breakdown of the costs and profits of operating a purse seine vessel in Micronesia, but it is clear that a lot of money can be made, as indicated by the Chinese vessels. In any industry, a net profit of close to 50% of the total revenue would be considered exceptionally high. In the automobile industry for example, Porsche leads the way with about 18%-19% net profit, or about €16,820, per vehicle sold in 2013, while competitors such as Mercedes-Benz only made about €3,620 per vehicle sold before taxes, and yet others like Volkswagen (€966) and Toyota (€845) made even less per vehicle during the same time period.³⁵ These developments

35. <http://www.auto-motor-und-sport.de/news/studie-zum-neuwagenverkauf-porsche-mit-hoechstem-gewinn-pro-auto-5524692.html> (Accessed on April 29, 2014). See also Kruschke 2013 for more details on the University of Duisburg "CAR" study.

only give a glimpse of how economically and ecologically exploitative the industry was towards the small island nations before monitoring was improved with the introduction of the VDS and 100% observer coverage, among other measures.

Human rights issues

The question which arises is how can two vessels operate on such different terms, and who is bearing the hidden costs? From my interviews with ship captains, crew members and observers working in the industry, combined with the experiences of Indonesian fishermen who have worked in the Pacific tuna business in the past and were interviewed by my colleague in Heidelberg, Katharina Schneider, this profit margin can be clearly traced to labour violations and wide-scale incidents of human trafficking. One reliable source which does not wish to be identified, but has been working in the industry for more than 30 years, said that on many Chinese and Taiwanese vessels he has encountered, violations of labour rights are standard. On many vessels, crew members from Vietnam, Myanmar, Indonesia or Bangladesh only receive US\$25 of their monthly salary of US\$80-120. The rest of the pay cheque is withheld, and it is only after they have proven to be good workers that they might receive the remaining US\$55-95 at the end of six months.³⁶ They work in shifts of up to 18 hours and longer per day, eat canned tuna with oil, white rice and water three times a day, share their bed with other crew members, and if they are too tired to continue working, might be offered drugs to keep them awake and increase productivity. Some vessels employ a diverse population of sailors so that communication and the possibility of mutiny are decreased. The larger purse seine vessels often only employ smaller numbers of slave labourers, making it harder for the untrained eye to discover these injustices. Fear for their lives also exists among crew members of these vessels, as some are threatened to be thrown overboard at sea for noncompliance with expectations. For those crew members who are victims of human trafficking and working as slave labourers, these are valid fears as their presence on the vessels may not be known and they have no means of communication with the outside world while at sea.

36. For comparison: A captain on a Japanese or Korean purse seiner may receive between US\$200,000-400,000 per year while the first officer or fish-master might receive 50% or two-thirds that amount. Lower level crew members on some of the vessels I gathered information on said they received salaries of around US\$5,000, while the lowest level crew members were still receiving over US\$1,000 a month. The average crew on a 1,000 metric tonne capacity purse seine vessel may be between 25-35 individuals. The more crew members to be found on board, the more likely the possibility that slave labour may be present. On some Korean or Japanese vessels a few crew members from Myanmar, Bangladesh, or Vietnam – just to name a few countries of origin – may be on board for the lowest levels of tasks, while Chinese vessels are more likely to have more labourers working for almost no pay on board.

One captain said that in his view, further regulation would not help to alleviate this problem as long as the countries of origin were not taking any measures to counter these common and known practices in the industry. More regulation would only hurt those already working hard to comply with the law and decrease their ability to compete. There are measures being undertaken to prevent these types of labour violations, but detection and monitoring of these grievances will require better training of the observers on the vessels and the inclusion of human rights issues into the reporting procedures of observers and other persons involved in the monitoring of fishing activities and working conditions for sailors on board the vessels. The rate of exploitation is also expected to be higher on vessels fishing illegally. Reports by the BBC, CNN and the Associated Press have uncovered and documented these inhumane and illegal activities.³⁷ Given the profit margins and the hard labour involved, abusive labour practices are conduct that the industry can clearly do without. The PNA has been doing all it can to prevent these kinds of activities in their waters, including 100% vessel coverage with observers, but as the above case shows, it is very difficult to achieve that goal given the size of the ocean and the number of vessels fishing there.³⁸

Purse seining under the Vessel Day Scheme (VDS)

The VDS has come under criticism by organisations such as Greenpeace and the European Union as it is seen by them to promote overfishing.³⁹ Since the industry is not charged by the tonnage they land, but for the active fishing days, these must

37. I make reference here to one recent report sent to me by Simonne Pauwels where the Associated Press was able to trace and track slave boats to Papua New Guinean waters (McDowell et al. 2015).

38. According to the PNA, there are about 300 vessels registered in 2015 with purchased fishing days in PNA waters. Together, these vessels can purchase up to 45,881 fishing days in 2016 compared to 46,610 fishing days in 2015. <http://www.kpress.info/index.php/site-map/1386-pna-leaders-set-fisheries-agenda-for-2016-and-beyond> (Accessed on July 27, 2015).

39. Greenpeace has been a great supporter of the VDS according to Brownjohn. The PNA and environmentalists have criticised the hidden policy regarding the tonnage of purse seine vessels allowed to fish. Older vessels with a ship length of 60 meters and a cargo tonnage of 800 tonnes are replaced by vessels with the same length but a cargo tonnage of 2,000 tonnes. For instance, the Taiwan Fishery Agency has been accused of subterfuge, putting 22 new vessels into operation between 2007 and 2012, and sailing them under a US flag (Wikileaks id #76123 from August 25, 2006; Asia Sentinel October 18, 2012; <http://www.asiasentinel.com/econ-business/taiwans-oversize-tuna-fleet/>, accessed on November 26, 2015). Personal communication with sources in the industry that wish to remain unnamed have confirmed these observations, and one Taiwanese fish-master interviewed at length could not stop to shake his head in awe and disbelief at the rate these vessels were extracting the tuna. The EU it seems, is promoting its own agenda of bilateral fishing agreements with Pacific Island nations. It is driven primarily by the Spanish fishing industry, which is faced with depleted stocks in waters it has historically fished.

be maximised and the more one can catch, the higher the profits to be earned for the fishing days paid. “Conversely”, Brownjohn states, “VDS gives no incentive to mis-report catches which was rampant pre VDS. Further, the number of days reflects the catch, so whilst it is argued VDS gives incentive to catch more per day, the number of days issued [is] balancing this” (2015, personal communication).

The most fish caught under this scheme are through purse seine vessels, though plans are being made to apply the scheme to the longline industry as well. The average purse seine vessel has a cargo hold of 1,000 metric tonnes, and larger boats can hold up to 1,500-2,000 tonnes. Vessels with a capacity of below 1,000 metric tonnes have proven to be unprofitable. Smaller vessels are considered to be unsuitable for the Central and Western Pacific purse seining business according to some persons active in the industry due to the larger distances involved in fishing. Nevertheless, according to my sources in the industry that wished to remain unidentified, these “useless and unprofitable vessels” (head of a purse seine company, 2014, personal communication) were what the Micronesian governments purchased en masse in the 1990s based on the recommendations of their advisors (see also Jacobs 2002).

The purse seine fishing method is able to catch large amounts of fish in a relatively short amount of time, but it is also responsible for large numbers of bycatch and usually 1-2 tonnes or more of damaged tuna in the handling and transshipment process, especially when using FADs.⁴⁰ Observers on board foreign fishing vessels are responsible for monitoring fishing activities in PNA waters. They are tasked with monitoring fishing vessels’ compliance with proper documentation and the reporting of bycatch, tonnage of landed fish types, respect of FAD closures from July through September, etc.

The Japanese government, among others, has been instrumental in assisting some PNA nations (i.e. FSM) with the technology to better monitor fishing activities of legally registered and monitored vessels within PNA waters. Being fined for violations of activities under a system one has helped set up is therefore understandably an embarrassing situation. This was the case in October and November 2014, when four Japanese vessels were fined for violation of fishing during the FAD closure.⁴¹

40. According to the observers interviewed, this tuna is usually discarded within the 12-mile zones of Pacific Island nations after the ships leave port even though it is prohibited by law and is harmful to island maritime ecosystems. Majuro Atoll is probably the hardest hit as 500,000-600,000 tonnes of tuna are transshipped there annually. This could easily amount to over 1,000 tonnes of tuna being dumped off of Majuro Atoll each year according to observers interviewed on the matter.

41. In October and November 2014, four Japanese vessels were reported in violation of fishing during FAD closure in FSM waters (also rightfully described as illegal fishing activities in the press). Surprisingly, the Japanese government was seriously offended that four of its ships were exposed and fined appropriately and accordingly for this violation in such a short time period. Japan felt singled out by the FSM government and did not think that partners should treat each other in this way. Again, an ethically responsible reaction between partners should have been an apology for violating the friendship and

For the observers, taking note of violations is a difficult task when one also depends on the ship and its crew for one's livelihood and shares a confined living space over months at sea. The captains and their crew as well as the observers know the role that each plays and are constantly trying to navigate this difficult world in which they work. If they report incidents which the ship captain does not want to see recorded and reported, the observers might be at risk and threatened or alternatively attempted to be bribed. Attempts of being bribed have been reported by Pohnpeian observers in the past while at the same time others have been seen driving with cars beyond their pay scale. On the other hand, observers are only tasked with observing and documenting what they see while on tour with fishing vessels. Their superiors on land who read and analyse their reports must identify areas in need of prosecution or fining for violation of existing laws and regulations. At this operational level, corruption may further enter into the reporting system as an observer's superior willing to enquire about violations may contact ship captains. In return, the ship captain and his senior staff may respond by offering to pay a bribe in lieu of being reported or fined. For a company operating 50 vessels in the region, paying such "fees" is nothing. According to my own enquiries with persons in the industry, these and other violations abound and, for many, are considered normal.

Let us consider China, for example, which has close to 20 purse seine vessels operating in PNA waters. If each vessel made a net profit of close to US\$6 million, we are looking at a net profit for one nation of close to US\$120 million per year. Some of this money can easily be used to bribe government and other regulatory officials. One source familiar with these practices from personal experience and who spoke to me under the condition of anonymity told me it was "standard procedure" in the industry. In addition, many Chinese and Taiwanese captains and officers are poorly paid and thus feel forced to make some additional money on the side by not reporting their total tonnage of catch or by reporting different species caught so as to make a profit off the sales. These activities are reflected in the reports of observers who can report these illicit activities for most foreign fishing nations in the region, foremost though for the Chinese and Taiwanese active in Micronesian or Papua New Guinean waters.⁴²

taking advantage of the goodwill of the FSM as a junior trading partner. The companies did resist the high fines, yet two decided to pay their dues, while one vessel is still battling its case in the FSM Supreme Court. Often attempts are made by the ship captains to bribe the observers or do them special favors for not reporting incidences. Being an observer is a tricky and challenging task as one is confined to the space of a ship with a crew of 25 to 35 members and is seen as a thorn in the flesh for the operators, as it is known that observers must document all activities observed on board the vessels to monitor compliance and report irregular dealings and illegal activities.

42. These nations pride themselves in their strong partnership with Micronesian island nations, but when enquiring into the business practices of their industries one wonders whether, more than anything else, they are taking advantage of this trust for their own benefit. Larger corporations have also "divided" up certain numbers of their vessels to sail under PNA nations' flags too and therefore maintain access to

In 2006, for example, Japan landed 80% of its overall tuna from PNA waters (Wilson 2007), and depending on the price of tuna and the types of tuna landed, might have made earnings from the raw tuna of between US\$450 million to over US\$1 billion for that year (at skipjack tuna pricing a little over US\$1,000 per metric tonne). Over past years, the FSM has accounted for about 20% of total PNA tuna landings (Wilson 2007). Theoretically, this can mean that US\$80 to 160 million worth of raw tuna could be coming to Japan from FSM waters each year. The processed value of this fish (skipjack frozen and cooked) is three times that value (FAO 2012), or between US\$240 to 480 million in market value. In light of these numbers, US\$13 million in annual “aid” from Japan to the FSM seem reasonably small. Standing alone, the amount is respectable.

By comparison, according to Ron Crocombe’s investigations (1995), the USA paid US\$10 million⁴³ in fishing fees to 13 Pacific Island nations between 1987 and 1991 while annually landing tuna worth US\$150 million. Interestingly, the money was not paid directly to the resource nations, but was dispersed through USAID, which in turn received its funding from the US Department of Defense. During the same time period, the FSM received combined annual funding from the USA through its Compact of Free Association of about US\$60 million annually, of which 15% was used for service management costs directly in the USA, leaving the FSM with US\$51 million each year for the first five years of the Compact of Free Association. During this time period, the FSM accounted for 20–28% of the total catch of tuna in the Western and Central Pacific or roughly for about US\$36 million in total annual value of tuna landed by the USA in the region. If the value of the tuna landed by the USA from FSM waters during the first five years of the Compact of Free Association were to be included in our macroeconomic reasoning, the money spent by the USA in Micronesia is put into a different perspective as it then shrinks from US\$60 million to roughly 13–14 million per year, the amount Japan currently provides the FSM.

Even though these calculations might seem obscure to some policy makers, they do put into perspective the one-sided image usually presented in the USA, Japan, and to Micronesians of the lopsided relationship Micronesians have with their US and Japanese partners, as if their relationship was seemingly one of willful, one-dimensional dependence on foreign (US, Japanese, Chinese, etc.) “aid”. These numbers help us to gain a more balanced perspective that more accurately reflects the reciprocal nature of relations between small Micronesian island states and their larger neighbours

fishing grounds during FAD closure, as domestic boats are excluded from paying a minimum benchmark per fishing day and can fish in national waters during FAD closure. The ecological harm on tuna stocks remains high due to this commonplace practice.

43. Brownjohn (2015, personal communication) comments that it would have been 18 million a year in subsidies, which was later increased to 21 million.

on the Pacific Rim. It brings into plain view that Micronesians have something of value they have been sharing (too) freely with their neighbours who have a tradition of exploitation and domination under the guise of “aid”.⁴⁴

Conclusion

In the end, these observations and findings raise a number of questions. How can the two industries, the subsistence driven coastal fisheries of local island populations and the global tuna industry, practice self-control and self-regulation to the point of collectively and jointly preventing the depletion of coastal marine life and offshore tuna fish stocks? How are some of their current practices leading to the rapid depletion of marine resources and the marine environment to the point of seeing fish stocks collapse in the near future? What role can the governments of domestic and foreign fishing nations play in preservation and conservation efforts? The PNA has been able to make decisions on conservation and management during the past five years and thereby maintain healthy tuna stocks in its member’s EEZs. In the nearshore fishing industry, foreign nations must still demonstrate visible efforts to discourage their citizens’ illegal activities in Pacific Islands’ coastal and open waters. Besides, the high seas still suffer the “tragedy of the commons”, where conservation is always someone else’s issue (D’Arcy 2014).

Micronesian island nations’ governance and management arrangements are constantly confronted with their own limitations and boundaries, struggling to properly oversee foreign nations’ fishing activities and enforce the fishing industry’s self-imposed regulations, which are continuously and actively transgressed for the sake of maximising financial profit. This situation has been met over the years by complacency on the part of the Micronesian governments, which are both satisfied with the financial returns from the global fishing industry and technologically unable to confront and crack down more passionately on illegal activities of marine resource exploitation. These illegal activities are thus pursued on a scale that is harmful to the security of long-term sustainable extraction of these renewable resources. Self-control and self-regulation/research-based regulation to work within accepted and set boundaries of the fishing industry remains a question to be answered if the future of fisheries in Micronesia is to be secured. The suggestions of one ship captain seem to make sense: limiting tuna landings per vessel (purse seine) at a fixed amount of annual tonnage, around 7,000 tonnes per year, in order to improve the tracking of

44. This observation does by no means wish to undermine the great sacrifices and achievements of foreign civilian and political actors working hard from within and outside Micronesian societies to improve education, health and development of human wellbeing in Micronesia. Instead it wishes to expose exploitative political and economic practices (and reasoning) at top levels of international governance between the powerful and the less powerful countries.

the amount of caught tuna; predictions over the stability and development of tuna stocks; and the pricing of tuna products. Currently, the PNA is further promoting the VDS programme which has so far proven to best serve small island nations' interests against the exploitative practices of foreign fishing nations. Nevertheless, other avenues might be thought of and introduced to maintain and increase the income for PNA and other tuna resource nations while at the same time keeping fish stocks at self-sustaining levels. Here, the PNA needs to get away from "selling cheap licenses" and move "towards vertical integration" to participate in "fishing, processing and trading" of tuna (Brownjohn 2015, personal communication).

References

- Crocombe, Ron
1995 *The Pacific Islands and the USA*. Suva: University of the South Pacific.
- Cuetos-Bueno, Javier, and Peter Houk
2014 "Re-estimation and Synthesis of Coral-Reef Fishery Landings in the Commonwealth of the Northern Mariana Islands since the 1950s Suggests the Decline of a Common Resource". *Reviews in Fish Biology and Fisheries*, 25(1): 179-194.
- D'Arcy, Paul
2014 "The Lawless Sea? Policy Options for Voluntary Compliance Regimes in Offshore Resource Zones in the Pacific". *Asia & the Pacific Policy Studies*, 1(2): 297-311.
- Fischer, J. L.
1957 "Totemism on Truk and Ponape". *American Anthropologist*, 59(2): 250-265.
- Flanders Marine Institute (VLIZ)
2015 Website [Marineregions.org](http://www.marineregions.org), Map "Micronesia – MRGID 8316", http://www.marineregions.org/eezdetails.php?eez_id=9 (Accessed on October 2, 2015).
- Food and Agriculture Organization of the United Nations (FAO)
2012 Tuna – October 2012. *Globefish*, <http://www.globefish.org/tuna-october-2012.html> (Accessed on July 25, 2015).
- Goodenough, Ward Hunt
2002 *Under Heaven's Brow: Pre-Christian Religious Tradition in Chuuk*. Philadelphia, Penn.: The American Philosophical Society.
- Hanlon, David L.
1988 *Upon a Stone Altar: A History of the Island of Pohnpei to 1890*. Honolulu: University of Hawaii Press.
- Houk, Peter, Kevin L. Rhodes, Javier Cuetos-Bueno, Steve Lindfield, V. Fread, and Jennifer Louise McIlwain
2012 "Commercial Coral-Reef Fisheries across Micronesia: A Need for Improving Management". *Coral Reefs*, 31(1):13-26.

- Jacobs, Matthew
2002 "Spoiled Tuna: A Fishing Industry Gone Bad". *Micronesian Counselor*, 40: 1-15.
- Kruschke, Guido
2013 "Porsche ist der Profitabelste Autobauer der Welt". *Automobil Produktion* (April 2013), <http://www.automobil-produktion.de/2013/04/porsche-ist-der-profitabelste-autobauer-weltweit/> (Accessed on December 1, 2015).
- Mauricio, Rufino
1987 "Peopling of Pohnpei Island: Migration, Dispersal and Settlement Themes in Clan Narratives". *Man and Culture in Oceania*, 3: 47-72.
- McDowell, Robin, Martha Mendoza, and Margie Mason
2015 "AP Exclusive: AP Tracks Slave Boats to Papua New Guinea". *The Associated Press* (July 27, 2015), <http://bigstory.ap.org/urn:publicid:ap.org:c2fe8406ff7145a8b484deae3f748aa5> (Accessed on July 28, 2015).
- Miyake, Makoto Peter, Patrice Guillotreau, Chin-Hwa Sun, Gakushi Ishimura
2010 Recent Developments in the Tuna Industry: Stocks, Fisheries, Management, Processing, Trade and Markets. FAO Fisheries and Aquaculture Technical Paper N°543. Rome: FAO.
- Newton, Katie, Isabelle M. Côté, Graham M. Pilling, Simon Jennings, and Nicholas K. Dulvy
2007 "Current and Future Sustainability of Island Coral Reef Fisheries." *Current Biology*, 17(7): 655-658.
- Rauchholz, Manuel
2012 "Discourses on Chuukese Customary Adoption, Migration, and the Laws of State(s)". *Pacific Studies*, 35(1-2): 119-143.
forthcoming (2016). "Micronesian Cosmologies and Environmental Practices". In E. Dürr and A. Pascht (eds.), *Environmental Transformations and Cultural Responses: Ontologies, Discourses and Practices in Oceania*. Palgrave Publishing.
- Rhodes, Kevin, Kimberley Warren-Rhodes, Peter Houk, Javier Cuetos-Bueno, and Quentin Fong
2011 An Interdisciplinary Study of Market Forces and Reef Fishery Management in Micronesia. A Report to The Nature Conservancy, Asia Pacific Marine Program, Report N°6/11.
- Rhodes, Kevin, Kimberly Warren-Rhodes, Scott Sweet, Mike Helgenberger, Eugene Joseph, Linda Boyle, and Kevin Hopkins
2014 "Marine Ecological Footprint Indicates Unsustainability of the Pohnpei (Micronesia) Coral Reef Fishery". *Environmental Conservation*, 41(2): 182-190.
- Sitan, Peter S.
2014 The Development of the Tuna Fisheries in the Federated States of Micronesia. Paper presented at the Symposium "Micronesia in Focus," at the Australian National University from April 28-29 in Canberra, Australia. [Information cited in this article are based on notes taken by the author during the unpublished talk.]
- Wilson, Peter
2007 "A Tuna Industry in Micronesia?" *Micronesian Counselor*, 66: 1-18.



The other side of large-scale, no-take, marine protected areas in the Pacific Ocean

Yan GIRON

Introduction

Marine protected areas (MPAs), legal tools with multiple purposes

Since the 2002 World Summit on Sustainable Development in Johannesburg, States around the world have strengthened their commitment to marine protection. They have pledged to protect 20% of the marine areas under their jurisdiction, with at least 10% under strict no-take protection. The legal tool identified to secure this protection is the marine protected area (MPA).

Under the classification system of the International Union for Conservation of Nature (IUCN), MPAs can have different levels of protection, ranging from a simple supervision of extractive activities to complete protection of areas from human activities. A certain number of scientific publications¹ furthermore encourage the constitution of MPA networks. They do so both to enable the conservation of sensitive biotopes and biodiversity reservoirs and in the hope that the beneficial effects of this protection will spread to unprotected adjacent areas (spill-over effect).

This question of the spill-over effect requires scientific monitoring over time, both in protected and unprotected areas. It is also politically the most sensitive point when used extensively *a priori* by charitable trusts to sway public opinion in favour of full protection MPA networks. These trusts consider that the beneficial effects of spatial bans on fishing and spill-over to adjacent areas are systematically valid certainties when, in fact, there are uncertainties with regard to these points. Spill-over effects are in fact highly dependent on local conditions, both biological and environmental. A categorical approach to the subject is inadvisable, particularly in relation to the size of MPAs with complete protection from fishing and the intensity of grids linking MPAs. The risk is that a dogmatic approach to MPAs will be adopted.

The importance of the governance dimension of maritime territories associated with MPAs, in addition to that of their protection, has gradually come to the fore. MPAs are seen now as a tool allowing a degree of collaborative management of

1. Some bibliographic references are available in Leenhardt et al. 2013.

these territories, linking stakeholders who previously were not necessarily involved in the governance of their use (economic operators, coastal communities, local governments, States) (Gascuel and Hénichart 2011). MPAs also can be used in coastal areas to support the management of extractive activities such as fishing. This is notably when conventional fishing management approaches are insufficient, or when the resources required for these approaches are lacking. The question of governance may then be used to mobilize different stakeholders on a maritime territory to set up collective learning processes to manage the natural environment. It also can be advanced to regulate access to MPAs.

Since the mid-2000s, a new dimension has emerged: the political, and even geopolitical dimension. Setting up protection through an MPA can thus be presented to States by the different supporters of this tool as a means to strengthen their control of coastal and maritime space, notably in the Pacific but also elsewhere.

Marine environmental conservation in the Pacific

In order not to downplay the importance of environmental and marine biodiversity issues in the Pacific, we shall briefly review them here.

Islands are intrinsic havens of both land and marine biodiversity. Island ecosystems are indeed isolated ecological ensembles characterized by varying degrees of endemism. Shallow water tropical marine ecosystems, notably reef ecosystems, are furthermore characterized by a high concentration of biodiversity. This endemism and biodiversity also are found in the deep sea (not exploited by pelagic fisheries activities), notably in hydrothermal areas and seamounts. Human exploitation activities threaten these ecosystems when they are carried out in an unsustainable manner outside the framework of traditional or government management systems. The desire to create coastal MPAs on islands to protect reef ecosystems leads to the creation of MPA networks because island States predominate in the Pacific and consequently form a network. Certain species, notably birds, link these island spaces. In deep sea areas, connections are made through local physical and chemical conditions and marine currents.

Ocean acidification due to a higher concentration of carbon dioxide also is a major challenge, in particular in the Western Pacific. This acidification in turn impacts carbonate marine ecosystems, notably reef ecosystems. Changes in the populations appear, with the selection of coral resistant to acidification and the disappearance of more sensitive species.

Sand extraction (Gay 2014) and the use of coral reefs as raw material for construction (Seidel and Lal 2010) were one cause of the weakening of low-lying islands. When such activities are undertaken outside a sensibly planned framework, the natural defences of islands against rising sea levels are enfeebled and limited, exposing them to the flood risks associated with global warming.

The overfishing of some highly migratory species (tuna, sharks) affects the sustainability of their exploitation. It should be noted that the conservation of these species does not involve the same fisheries management conditions as reef or benthic or demersal species. The benefit of full protection (no-take) for highly migratory species via the establishment of strictly protected MPAs covering entire exclusive economic zones (EEZs) has yet to be determined because the geographic range of these species is wider than the boundaries of these EEZs. We do not know to what degree the shift of fishing activities outside the prohibited areas reduces the impact on these species of the full protection enforced inside MPAs. Moreover, the absence of proven scientific justification for protection through the strict prohibition of fishing activities over vast areas the size of an EEZ was recently highlighted in a scientific publication (Leenhardt et al. 2013).

The question of managing total fishing capacity and intensity also is not addressed by full protection approaches which do not cover the full geographic repartition of the fishing stocks targeted by this management measure. As these species are migratory, the benefits of large-scale² fishing bans are lower than those of a balanced management of fishing intensity over the entire spatial and temporal life cycle of these species. However, smaller protection areas, on certain stages in the life cycles of these species, can offer occasional benefits.

The total spatial ban approach also reveals some implicit assumptions: the first is that States cannot ensure standard fisheries management because they are subject to economic constraints; the second is that economic operators (in this context, diverse fisheries stakeholders) are incapable of following management rules. A total ban removes the need to manage as there is no longer an exploitation activity to be managed. States are normally responsible for fisheries management, collaborating and arbitrating within regional fisheries management organizations (RFMO), in this case the Western and Central Pacific Fisheries Commission (WCPFC).³ The promotion of the large-scale, no-take MPA option thus could be seen as an action rivalling the standard management provided under the WCPFC.

When flaws in fisheries management emerge, in the eyes of international law the WCPFC remains the only legitimate legal tool to bring about improvements at the geographic scale of the distribution of the species covered by this management. This is not the case of MPAs, even very large ones, which are promoted by the charitable trusts.

2. The expressions "large", "wide ranging" and "large-scale" associated with MPAs in this work are equivalents. They refer to MPAs which cover marine surface areas of over 100,000 km² (see Leenhardt et al. 2013).

3. In conformance with the 4 August 1995 adoption of the United Nations agreement on the conservation and management of straddling fish stocks (fish stocks moving within and outside of EEZs) and highly migratory fish stocks (came into force 11 December 2001).

Island States, by their very nature a concentration of issues

Due to their very insular nature, island States are faced with questions regarding the protection and management of maritime areas and the economic potentials associated with the exploitation of natural resources, as well as other challenges related to their strategic position.

In the first part of this chapter, issues related to the exploitation of pelagic tuna will be examined.

This will be complemented by a study of other issues such as those associated with deep sea mineral and offshore oil and gas resources, as well as those involving strategic questions of defence and leadership.

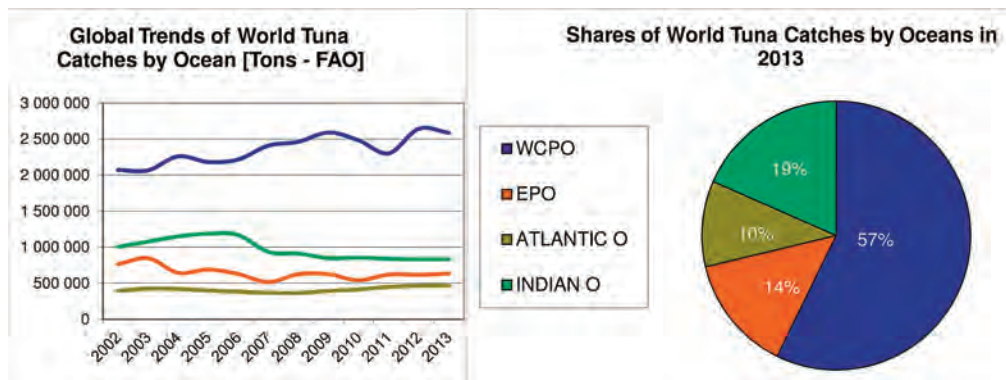
Lastly, we will discuss the extent to which the process of creating large-scale, no-take MPAs was able to benefit from the intentional or opportune alignment of these issues. This concordance facilitates their establishment by States subject to lobbying campaigns by American charitable trusts. The latter support an approach organized around networks of large-scale, strictly no-take MPAs, particularly in the Pacific.

Tropical tuna fishing in the Pacific

The global issue of Pacific tuna

Pacific tuna accounts for nearly three quarters of the world's tuna supplies. Production is stagnating after a period of strong growth which lasted over ten years. Tuna catches in the Western and Central Pacific represent nearly two-thirds of global supplies (fig. 1), which confers a particularly strategic status on this region.

Figure 1: Trends in world tuna catches



WCPO: Western and Central Pacific Ocean; EPO: Eastern Pacific Ocean.

Source: WCPFC 2014b

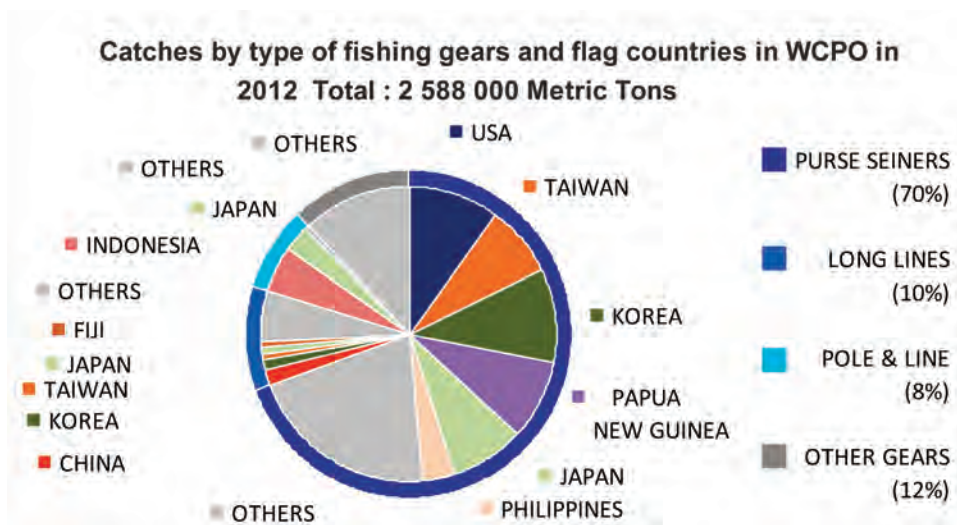
Most tuna canning and processing plants supplied by these landings are located in the Pacific and along the Pacific Rim. In 2010, they represented 75% of global processing capacity (note: Thai canning plants were supplied by both Pacific and Indian Ocean catches).

Pacific tuna thus represents a twofold issue, involving both catch and processing. These two sectors involve quite different economic benefits for the Pacific States: tax revenues from fishing permits and port landing charges, jobs and local taxes from canning and processing units. In many countries (even those with mining activities), the tuna sector is one of the leading economic resources alongside tourism.

The exploitation of tropical tuna in the Pacific

Overall, Western and Central Pacific tuna are taken mainly by purse seine vessels (more than two-thirds of the catch) (fig. 2). Longline vessels account for 10% of the catch. The main fishing nations are the USA, Taiwan, South Korea, Japan, the Philippines, and Papua New Guinea (PNG), with individual catches varying from 200 to 376,000 tonnes per year. Most of the catch is taken by long-distance fishing fleets (for more on this topic, see Allain et al. in this volume).

Figure 2: Main tuna fishing activities



Source: WCPFC 2013

Table 1: Estimation of net fishing capacity per Pacific Small Island Developing State (PSIDS) in 2015

	A		B		C		D = A-B+C		Percentage of net fishing capacity (D) estimated as foreign-owned* FVs	
	FVs registered in official national registers		Registered FVs (among A) chartered by other countries in 2015		Foreign FVs chartered by national companies in 2015		Net fishing capacity per PSIDS in 2015			
Country of flag	PS	LL	PS	LL	PS	LL	PS	LL	PS	LL
Cook Islands		11					0	11		45%
Federated States of Micronesia	12	16		12		35	12	39	75%	100%
Fiji		75		19		9	0	65		60%
Kiribati	13	1				2	13	3	100%	67%
Republic of the Marshall Islands	10					12	10	12	100%	100%
Papua New Guinea	37	21				6	37	27	62%	85%
Palau						1	0	1		100%
Solomon Islands	8	1				130	8	131	100%	99%
Tonga		1					0	1		
Tuvalu	1	4					1	4		
Vanuatu	5	96		9			5	87	100%	93%
TOTAL	86	226					86	381	79%	87%

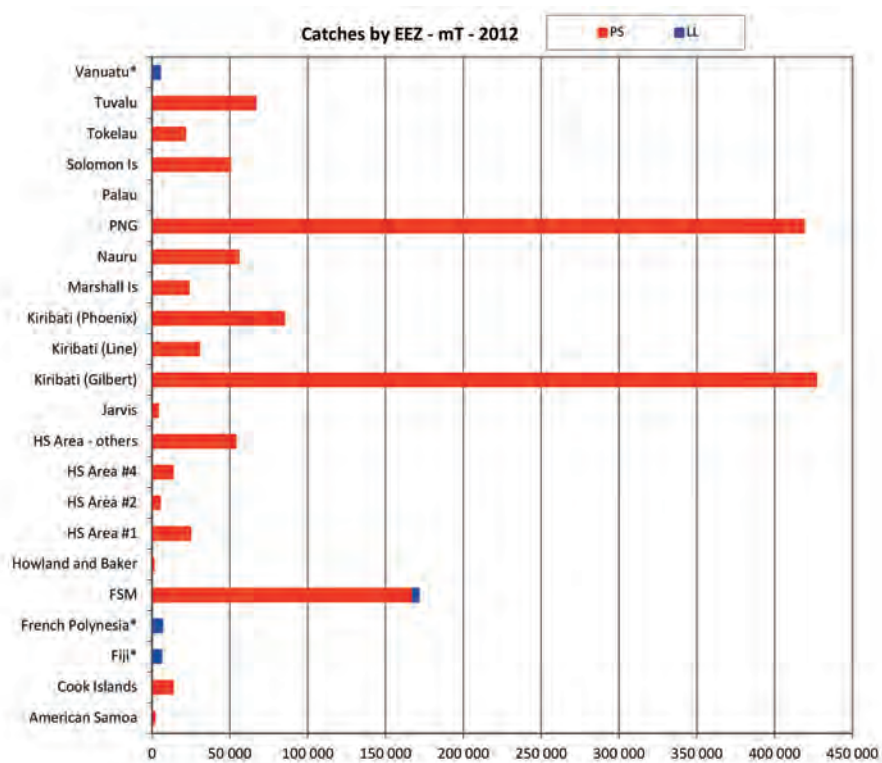
PS: Purse Seiners; LL: Long Liners; FVs: Fishing Vessels.

* "foreign-owned" = the assets of the company that owns these FVs are held by foreign (especially Chinese and Taiwanese) interests, whatever the flag of these FVs.

Source: WCPFC Record of Fishing Vessels database, <https://www.wcpfc.int/record-fishing-vessel-database> (Accessed on December 12, 2015).

One should note that while China, with a catch of about 120,000 tonnes in 2012/2013, does not appear as a major fishing nation, it has reflagged vessels in several Pacific Island States or operates them under charter. The reflagged vessels (the flag indicates the nationality of the vessel) no longer belong to the country of origin, but retain its economic interests. The countries which list these vessels in their national registers are attributed the catches and bear the associated responsibilities of these fleets in terms of declaring catch and respecting international conventions. Reflagged fleets can fish under the fishing authorisations of the new flag country. Fleets from the People's Republic of China and the Republic of China (Taiwan) are the main operators of this reflagging and chartering. The catch data of island States listing Chinese and Taiwanese fleets on their registers therefore include the catches made by these foreign economic operators (tab. 1). Some island States tie this reflagging to commitments to land and supply the processing units set up on their territories. Finally, it should be

Figure 3: Catches by EEZ (in metric tonnes - mT) in 2012 — mainly purse seine estimates (Indonesia and Philippines not included)



*Data extracted from national report; LL: Long Liners; PS: Purse Seiners; HS: High Seas.

Sources: Data summaries in support of discussion of the Conservation and Management Measures on tropical tunas for the 10th Meeting of the Scientific Committee of the WCPFC.

noted that this reflagging has allowed the national fleets of island States to grow since the end of the 1990s, which can be seen for example in the statistics on the number of longliner and purse seine vessels belonging to the countries concerned.

Fig. 3 above presents WCPFC estimations of purse seine fleet catches per EEZ, and some estimations for national longliners. Data on the activity of foreign longliner vessels per EEZ is unavailable. Indonesian and Philippine purse seiner data are not presented because they cover small-scale activities which are monitored less at the statistical level. The combined data in fig. 3 represents 1.48 metric tonnes, or 60% of WCPFC tuna catches.

This figure provides an indirect view of the economic impacts associated with fishing permits and port taxes, and thereby an estimation of the States' strategic dependence on fishing activities. Royalties have increased by nearly 200% over the past five years. This economic revival takes place in the context of the renewal of a multilateral fishing

agreement with the USA and an overall increase in fees negotiated under the framework of private accords. It is difficult to estimate the actual economic returns due to the confidentiality covering private agreements. Parties to the Nauru Agreement (PNA) saw a rise in annual revenue from US\$60 million to US\$350 million uniquely on the basis of the renegotiation of the American fishing agreement.⁴

**Table 2: Location of main tuna processing units
in the Western and Central Pacific Ocean**

Country	Number of processing units	Yearly production estimates (mT of final processed products)
Ecuador	19	<i>225,000 mT</i> (450,000 mT ^{**})
Fiji	1	1,000 mT
Kiribati	1	n/a
Philippines	8	<i>100,000 mT*</i>
Papua New Guinea	6	15,600 mT canned + 55,000 mT Frozen
Republic of Marshall Islands	1	n/a
American Samoa	2	130,000 mT ? *,**
Samoa	(1)	n/a
Solomon Islands.	2	n/a
Thailand	n/a	<i>400,000 mT</i> (785,175 mT ^{**})

*FFA 2010 estimates (Hamilton et al. 2011); **Data given as equivalent of final product production; Italics: estimation according to supply of raw materials data.

Sources: Various national reports to the 10th Meeting of the Scientific Committee of the WCPFC (see the "Annual reports – Part 1" tab on the web page <https://www.wcpfc.int/meetings/10th-regular-session-scientific-committee> (Accessed on October 26, 2015); Hamilton et al. 2011

Tab. 2 presents the current distribution of tuna processing sites in the Pacific in terms of number of enterprises (with the absence of precise information for Thailand, which is the leading producer country). The processing capabilities of each country are estimated but this information remains uncertain. We should remember that Thailand is the main hub of these activities, followed by Ecuador, American Samoa and the Philippines. PNG is currently experiencing rapid growth and has developed port areas to attract investors (mainly Asian). Initiatives to create processing units are on the rise in the Pacific. This phenomenon brings States into competition. The limits on this development remain the total production capacity of the area, to avoid the creation of surplus processing capacities which would compete too strongly, and the absorption capacity of different markets recently impacted by economic crises.

4. See <http://www.pnatuna.com/node/278> (Accessed on October 1, 2015).

We have witnessed a recomposition and a concentration of economic decision making centres steering the processing and production sectors. Although there are a large number of tuna processing companies on the global level, they are owned by less than five holding companies. The control of processing activities is an important factor in the control of tuna production. Today, the main global processing operators are Dongwon, a Korean corporation, Thai Union, a Thai group, and Bolton, an international group. Trimarine, an Italian-American group, remains the global leader in the wholesale tuna trade while operating a set of activities ranging from fishing to processing, particularly in the Pacific. Fifteen years ago, the decision making centres were mainly Italian and American groups. They now are shared with Asia.

The status of fishing stocks

The status of the exploitation of fishing stocks was described in detail by Allain et al. in this book. We provide a synthesis below (tab. 3).

Table 3: Status of main tuna fishing stocks exploited in the Pacific Ocean

Species	Pacific Ocean Areas	Status	2013 – catches (mT)
Skipjack Tuna	E	Moderately exploited	280,077
	WC	Moderately exploited	1,797,897
Yellowfin Tuna	E	Fully exploited	228,112
	WC	Moderately exploited	517,803
Albacore Tuna	N	Moderately exploited	92,870
	S	Moderately exploited	84,835
Bigeye Tuna	E	Overfished	80,834
	WC	Overfished	137,502
Bluefin Tuna	NE / SE	Overfished	15,000

E: Eastern; WC: Western and Central; N: Northern; S: Southern

Sources: WCPFC 2014b and 2014c; www.atuna.com (Accessed on July 10, 2015)

The lobbying campaigns by American charitable trusts consist in informing the general public about themes such as fish exploitation via the press, through petitions, and by distributing publications and reports which they have funded. These campaigns today convey messages about widespread overexploitation and irresponsible fishing practices.⁵ The trusts also present finning activities (fishing to retain shark fins, with or without the rest of the carcass) as a dominant practice of Asian longliners, known for a large number of shark bycatch. They use the emotional impact of this practice

5. See various NGOs position papers from 2010 to 2014 issued prior to the meetings of the Scientific Committee of the WCPFC.

to drive the media message. The trusts also raise doubts about the use of fish aggregating devices (FADs), which in their view have an unduly high impact on the environment.

Scientific opinion regarding tuna stocks differs slightly from the image projected by these lobbying campaigns. Overexploitation is indeed noted for bigeye tuna and bluefin tuna, mainly targeted by Asian longliners and destined for the profitable sashimi market. PNA is also concerned about the situation of these stocks. However, the stocks which support most of the processing units are actually between a moderate and a full state of exploitation (skipjack, yellowfin, albacore tuna) (see also Allain et al. in this book), which is the sustainable management objective that is the most productive over the long term. There effectively is an increase in fishing pressure on juveniles due to an excessive use of FADs, notably with regard to over-exploited bigeye, but these activities are also beginning to be subject to rules and regulations.

With regard to sharks, the situation is mixed depending on the species (Patterson et al. 2014). Statistical coverage remains to be improved, but the data which are available nonetheless allow the status of five stocks to be identified (tab. 4).

Table 4: Status of main shark stocks in the Pacific Ocean

Species	Status	2012 – catches (mT) in WCPO	% of finning in 2009*
Blue Shark	Fully exploited	29,864	≈ 40%
Silky Shark	Overfished	1,565	≈ 10%
Oceanic Whitetip Shark	Overfished	801	≈ 30%
Mako Shark	Overfished	4,016	≈ 50%

*Clarke et al. 2014.

Sources: WCPFC 2014b and 2014c; Clarke et al. 2014

The blue shark (WCPFC 2014a) shows a full exploitation rate in line with the Maximum Sustainable Yield (MSY) management target. This species is mainly exploited in the WCPFC by diverse Asian fleets. The other shark stocks monitored are overfished. Depending on the shark species, finning remained an important activity in 2009 despite regulatory prohibitions. However, monitoring of shark bycatch does not find levels as high as those proclaimed by the American charitable trusts. These trusts also point to uncertainty about scientific advice, notably regarding blue sharks, even though the WCPFC (2014a) integrates these levels of uncertainty into its scientific advice about this species. The bycatch theme, notably shark bycatch, remains nonetheless a topic of concern with regard to the sustainable fishing

of tuna stocks, whether by longline or purse seine vessels. Mitigation measures were identified under the WCPFC framework.

Lastly, over and above the question of shark and tuna exploitation levels, certain charitable trusts (not necessarily American) take a dogmatic position with regard to the exploitation of skipjack tuna, notably singling out its industrial character. Its mode of exploitation is seen as essentially harmful (due to this industrial nature), although stock management opinion does not confirm this feeling, and this species plays a major role in fishing and processing activities.

The current issues at stake in fisheries management within the WCPFC concern the management of fishing intensity, which involves the definition of fishing intensity levels (in fishing days per year, see the Vessel Day Scheme discussed by Allain et al. in this volume) and the setting of target reference points. This notably involves defining precise management objectives⁶ and ensuring the effective implementation of corresponding management measures.

The current issues of Pacific tuna economic exploitation

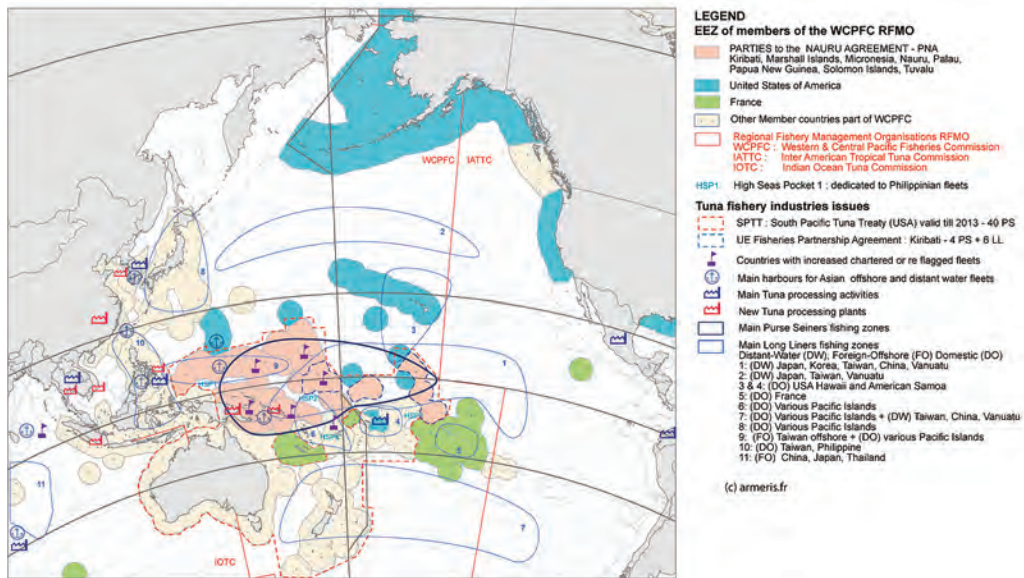
The Pacific States with high stakes in tuna are PNG, Kiribati, and the Federated States of Micronesia (FSM), which concentrate the bulk of purse seine vessel activity (fig. 4). One may add Nauru, the Marshall Islands, the Salomon Islands, Tuvalu and Tokelau, which are also located in the geographic heart of tuna territory but have smaller EEZ surface areas, reducing the space which can be exploited and catch opportunities. PNG has stakes in both fishing and fishing product processing. Other States carry less weight in absolute terms, such as Palau, the Cook Islands, and Fiji, but tuna remains an important source of income for the countries' economies next to tourism.

Asian fleets are very active in the EEZs of Pacific States, whether under their own flags, or under charter or reflagging arrangements. They also represent a major stake for the Pacific States hosting them, allowing these States to expand the activity of their national fleets, notably in PNG, Kiribati, the Marshall Islands, the Salomon Islands, and Fiji. Listing these fleets in their national registers through reflagging also allows the States involved to strengthen their political hands, notably when a coastal State is negotiating returns on fishing with long-distance foreign fishing fleets.⁷ For these States, what is at stake is the affirmation of their sovereignty over their maritime space, as was seen in the 1970s with the first wave of nationalisation of maritime space through the establishment of EEZs. For an island nation, another means to assert its sovereignty is to increase the size of its national fleet because this

6. See various propositions of management issued prior to the meetings of the Scientific Committee of the WCPFC.

7. The reflagging strategy is also of interest to the fleets' countries of origin, which must reduce the size of the fleets under their flags and thereby control their own overfishing capacity.

Figure 4: Locations and issues of tropical tuna activities in Western and Central Pacific Ocean



enables the country to permanently maintain more national vessels at sea, thereby rendering the economic interests linked to fishing activities more visible, and thus strengthen the legitimacy of the nationalisation of maritime spaces. This sovereignty strategy based on the growth of national fleets confers benefits as well as duties on the host countries, notably in terms of respecting their commitments to the United Nations Convention on the Law of the Sea (UNCLOS), which they have signed. The duties of these host countries notably include ensuring that all vessels flying their flag within the WCPFC respect the rules for the sustainable management of fisheries and the establishment of a system to control the maritime activities of their national fleets. The growth of national fleets also has a major geopolitical dimension for the small island States involved, which seek to affirm their maritime strength and which need to develop their economies. We also note that the small island States' negotiating power in relation to long-distance foreign fishing fleets has increased, as testified by the increase in revenues from permits sold to these foreign fleets to access Pacific EEZs.

The activities of foreign and reflagged fleets can be associated with harbour operations, facilitated by the implantation of communities from the vessels' home countries in the ports of landing. This situation also constitutes a form of cultural diplomacy which provides other economic and diplomatic benefits between a vessel's

country of origin and the host island State. Through these maritime and harbour components, Asian fishing activities in the Western and Central Pacific hold a real geopolitical dimension for the countries of origin.

Position of charitable trusts with regard to these fisheries issues

American charitable trusts respond to the issues facing tuna-exploiting countries, whether island States or operators of distant-water fleets, with three types of pressure strategies. First, they are observers within the WCPFC and produce position papers for annual negotiations.⁸ This participation is normal, and results from the 1996 reform of the Economic and Social Council of the United Nations (ECOSOC —resolution 1996/31) aiming to increase concertation with NGOs. Second, they conduct lobbying campaigns to sway public opinion (see above). Third, they promote large-scale no-take MPAs and sweeping bans on shark fishing, topics which are also covered by their public opinion and government lobbying campaigns.

The charitable trusts legitimize their pressure campaigns on fishing activities by highlighting (real) overfishing, caused mainly by longliners which target bigeye and bluefin tuna and take shark bycatch. As can be seen in fig. 4, these longliner fleets are also those with the greatest spatial range. The campaigns conducted by American charitable trusts in annual WCPFC negotiations regarding these species (bigeye and bluefin tuna) aim to incite member WCPFC States to make regulatory decisions to reconstitute overfished stocks. They are thus part of the standard governance process of RFMOs, in this case the WCPFC.

In contrast, the charitable trusts' calls to halt the exploitation of stocks that are not subject to scientifically proven overfishing are much less legitimate. Such calls undermine the counterweight role played by trusts, particularly when conveyed in pressure campaigns. These campaigns rely on simplifications along the lines of "tuna fishing is unsustainable fishing", an excessively negative picture of FADs (although it is necessary to regulate the use of freely drifting FADs), and a highly publicised divide between supposedly immoral industrial fishing and supposedly virtuous small-scale fishing. Furthermore, this less nuanced position of the trusts indirectly suggests that Pacific States would prioritise economic development over environmental conservation objectives and the control of illegal fishing. In that case, promoting large-scale, no-take MPAs (in other words, where there are no fisheries management decisions to make as everything is banned) would appear to be a strategic response to the fact that the States balance conservation decisions against other economic and social criteria.

8. See documents in the folder "NGO Papers" available for each meeting of the Scientific Committee of the WCPFC, <http://www.wcpfc.int/meeting-folders/scientific-committee> (Accessed on July 10, 2015).

However, many of these Pacific States — involved in the fisheries sector — are themselves asking for measures to supervise fishing activities, associated with an economic re-evaluation of fishing permits as testified by the positions of PNA member States in the various position papers produced during the annual WCPFC meetings. My analysis indicates that, rather than investing in large-scale no-take MPAs, sustained efforts to improve inter-State collaboration on regional fisheries management should be maintained as this collaboration is quite recent compared to the long collaborative management seen in other RFMOs. Launching an RFMO is a long process in which each State acts according to its own geopolitical objectives, beyond alliances and agreements. RFMOs involve common rules and duties based on international law. It is thus important to strengthen this management tool, which operates at the level of all life cycles of the species concerned.

Other geopolitical issues in the Pacific

The presentation of tuna activities demonstrated the economic, environmental, and geopolitical importance of fishing activities. In terms of maritime activities, other issues may be highlighted, amongst which we will explore deep sea mineral resources and issues of defence and leadership.

Energy and non-energy deep sea mining issues

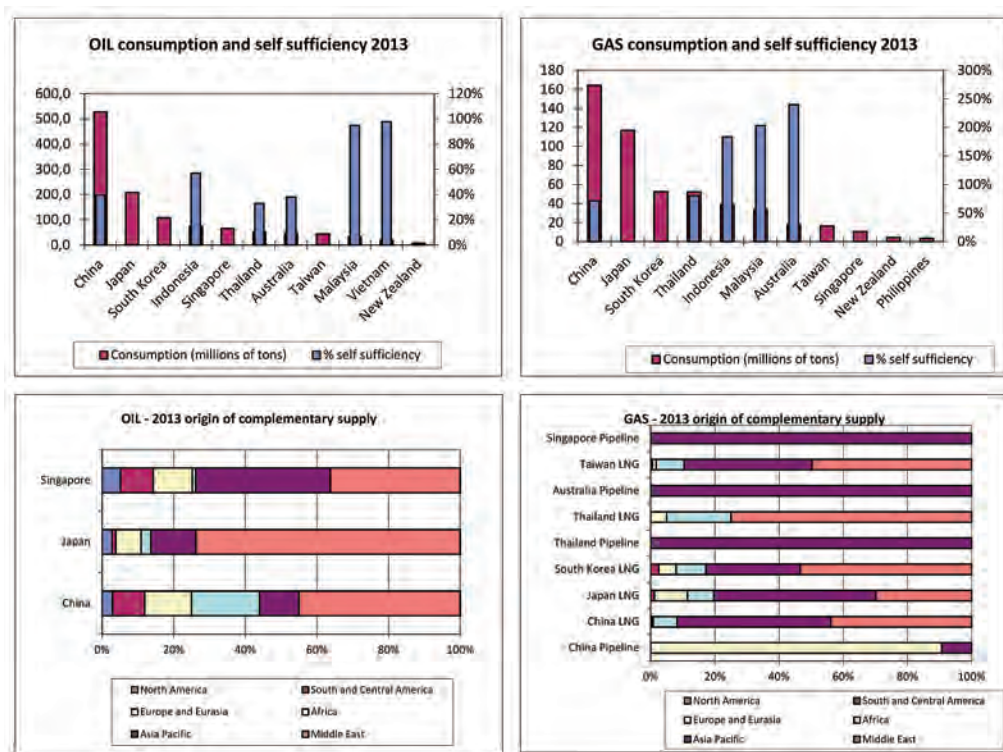
With regard to deep sea mining issues, it is necessary to distinguish between energy and non-energy questions. Energy mining resources involve marine offshore oil and gas. Non-energy mining issues are essentially related to rare strategic minerals that have not been exploited yet.

Deep sea energy mining resources

The issues related to the exploitation of offshore oil and gas resources are well-known and relatively well understood. These resources are concentrated in the western part of the Pacific (fig. 8) which has extensive continental shelves. The proved and probable reserves of the South China Sea have given rise to numerous geostrategic tensions, presented in the media as a clash between China and other coastal States, essentially Vietnam and the Philippines, related to maritime territorial claims.⁹

9. See for instance the conflict between Vietnamese fishermen and a Chinese exploration platform in April 2014 in *The Diplomat* magazine. Many articles can be found, see for example the last one which summarizes all the international sequence: <http://thediplomat.com/2014/07/chinas-rig-departure-proves-nothing/>. See also section 10, entitled "Actualités en relation avec le conflit Chine Vietnam de juin 2014 + Chine/ Philippines avril 2015 (Scarborough Shoal)" in the article "Le pivot maritime Asie Pacifique", <http://atlas.bluelobby.eu/2014/06/le-pivot-maritime-asie-pacifique.html> (Accessed on July 9, 2015).

Figure 5: 2013 consumption, self-sufficiency and origins of complementary supply of oil and gas in the Asia-Pacific area



Self-sufficiency in production/consumption.

Source: BP 2014

In terms of global geostrategic weight, the energy resources of the Asia-Pacific area (South Asia included) have only an average importance (fig. 5). According to British Petroleum statistics (BP 2014), they represent 2.5% of world oil reserves in 2013 and 8% of world gas reserves, but 9.5% of world oil production and 14.5% of world gas production. China is the leading producer in the region with 208 million tonnes of oil per year (5% of world production) and 117 billion cubic metres of gas (3.5% of world production). China alone accounts for more than half of oil production in the region. China, Indonesia and Malaysia together represent half of the gas production in the region.

While the production of the Asia-Pacific region is not important on the world scale, it nonetheless plays an important role at the regional scale. Gas and oil produced in the region — with the exception of South Asia — is mainly consumed

by countries in the region. Only 20 million tonnes of oil were exported to other regions of the world in 2013 (or less than 1% of world trade in oil), of which 7.2 million tonnes went to the USA (or less than 1.5% of their supplies). If one considers the oil and gas self-sufficiency rates of the main consumer countries in the region (fig. 5), one notes that:

- China, the principal consumer of oil and gas in the region, meets 39% of its demand for oil and 71% of its demand for gas through its own production. The remainder of its supplies comes mainly from the Middle East (45%) for oil, and from Turkmenistan via pipeline (50%) for gas. The portion of its supplies coming from other countries in the Asia-Pacific region is 11% for oil and 26% for gas.
- Japan, which does not produce energy resources, meets 73% of its demand for oil and 30% of its demand for gas with supplies from the Middle East. The share of its supplies from other countries in the Asia-Pacific region is 13% for oil and 51% for gas.
- South Korea, Singapore and Taiwan, nonproducer countries, also mainly supply themselves from the Middle East and the Asia-Pacific region.
- The other main consumer countries (Australia, Thailand, New Zealand) supply themselves mostly from the Asia-Pacific region.

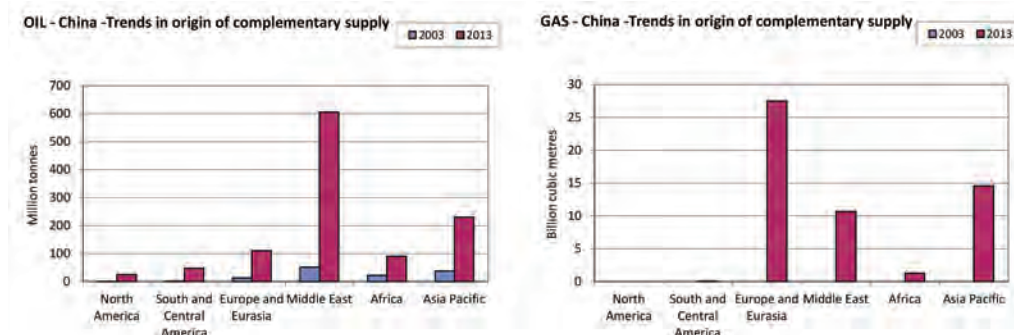
At the regional scale, production ensures a significant share of internal supplies, complementing the imports from the Middle East. It reflects the geostrategic issues of this area, notably in relation to conflicts in the South China Sea. However, dependence on the Middle East remains high in all of the countries of the area (fig. 5). It has increased over the past decade with regard to both oil and gas, in particular for China. The corresponding flows transit through the Strait of Malacca and the South China Sea, and thus depend on the freedom of passage of merchant vessels through this straight (see the notion of the “Malacca dilemma” further down).

Elsewhere, Chinese investment projects aim to diversify supply routes (fig. 6). We may briefly cite the Sino-Russian gas and oil pipelines which will serve eastern China; the Sino-Pakistani pipeline starting from the port of Gwadar to serve western China; the Sino-Burmese oil and gas pipelines; and lastly the Iran-Sino-Pakistani gas pipeline. China is the only nation to invest in such alternative routes to marine traffic. While the evolution of the Chinese energy demand is uncertain,¹⁰ its needs are such that its dependence on maritime flows of energy is likely to remain high, even if this is attenuated by alternative routes.

A final point must be highlighted. New technologies are being developed that could allow the use of alternative energies (such as ocean thermal energy for the

10. Even if its economic growth slows, many factors can influence its consumption profile, such as gas/oil and oil/gas/coal substitutions.

Figure 6: Trends 2003-2013 in the origins of the supply of oil and gas for China



Sources: BP 2004; BP 2014.

small island States) or nontraditional marine hydrocarbons. For the latter, methane hydrates trapped in marine sediments are being sought, in particular by Japan. The first successful extraction took place in April 2013. Japanese researchers have since estimated that the methane hydrates reserves available in their EEZ could cover up to one hundred years of their needs at current levels.¹¹ Marine deuterium (deuterium oxide) could also have energy uses. Important reserves were identified on the frontier of the marine EEZs of Palau and the Philippines and on the South China Sea side of the Philippines' EEZ.

Deep sea non-energy mining resources

Although it was discussed in the mid-1970s, strictly speaking there is still no deep sea marine mining. The sector is still in a stage of quantifying potentials, estimating impacts, and exploration. On the other hand, offshore deep sea technologies are making the development of exploitation possible. The most advanced Pacific nation in this regard is PNG, with the exploitation in its EEZ of hydrothermal sulphides by the Nautilus Minerals company.¹²

This same company is exploring the possibility of mining polymetallic nodules in its concession in the Clarion Clipperton international zone.¹³

11. <http://www.japantimes.co.jp/news/2014/12/25/business/economy-business/methane-hydrate-extracted-sea-japan/> (Accessed on July 9, 2015).

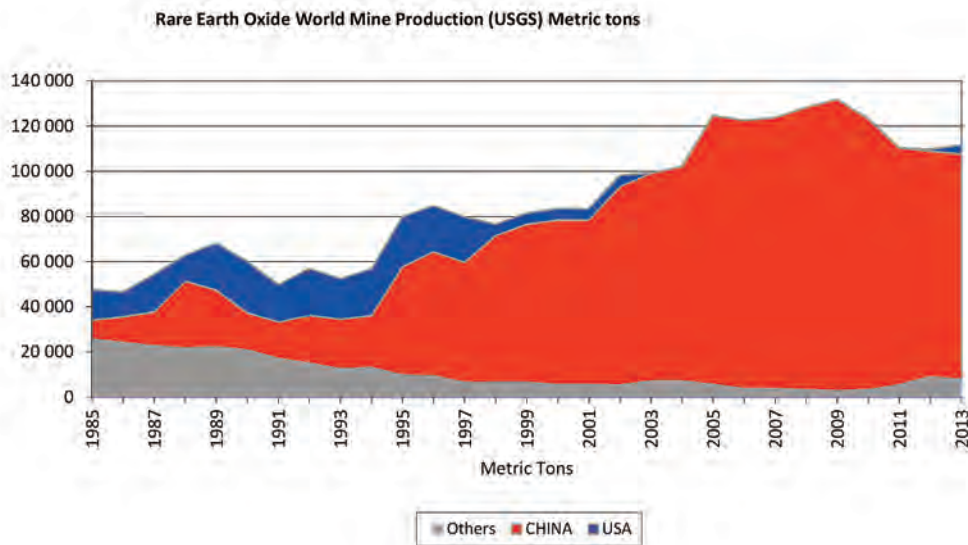
12. Nautilus Minerals' press release on April 24, 2014: "Nautilus Minerals and State of PNG Resolve Issues and Sign Agreement", http://www.nautilusminerals.com/s/Media-NewsReleases.asp?ReportID=649293&_Type=News-Releases&_Title=Nautilus-Minerals-and-State-of-PNG-Resolve-Issues-and-Sign-Agreement (Accessed on July 9, 2015).

13. See numerous press releases on the website of the company Nautilus Minerals, <http://www.nautilusminerals.com/s/Media-NewsReleases.asp> (Accessed on July 9, 2015).

The most likely driver of the development of these operations will be the demand for certain strategic minerals which are becoming less available on land. The main strategic minerals in the Pacific identified at present are marine rare earths. The metals known as rare earths are essential components of new information and communication technologies (screens, telephones, computer hardware) and renewable energies (for example, magnets of wind turbines, batteries of electric cars, super conductors).

The global land production of rare earths is today the quasi monopoly of China (fig. 7). The low cost of their production suggests that it is undertaken under conditions that have a high environmental impact. Over the 1985-1990 period, China and the USA were the principal world producers. In 1998, China accounted for over 85% of global production and it has maintained this dominant position. In 2011, China placed heavy restrictions on exports to international markets (which represent over 30% of its production) to supply its own domestic market on a preferential basis.

Figure 7: Trends in world rare earth oxide production



Source: U.S. Geological Survey, <http://www.usgs.gov/> (Accessed on July 9, 2015)

In the marine environment, rare earths are present and concentrated in four forms (for their exact distribution, see the online International Seabed Authority (ISA) atlas¹⁴):

14. <http://mapserver.isa.org.jm/GIS/> (Accessed on July 9, 2015).

- Hydrothermal sources (hydrothermal sulphides). These sources are present over all oceanic ridges and at volcanic sites. They are very widespread in the Pacific and are not featured on the summary overview map (fig. 8).
- Cobalt-rich ferromanganese crusts. These are situated at the level of seamounts. They are mainly located in the EEZs of island States, in international waters and in the EEZ of Eastern Pacific coastal States.
- Polymetallic nodules. According to the latest information, the richest areas are in the Central Pacific and in the Clarion Clipperton international zone.
- Marine seabed sediment rich in rare earths. Following Japanese explorations in the 2000s, the distribution of the richest sediments is estimated mainly in the Eastern Pacific Ocean.

The legal regimes for the exploitation of these resources are distinct depending on whether they are located in EEZs or in the international high seas zone (referred to hereafter as “the Zone”). In the EEZs, exploitation falls under the legal regime of the State involved, which manages all of it following the rules of United Nations Convention on the Law of the Sea (UNCLOS). In the Zone, exploitation is also regulated by UNCLOS, which created the International Seabed Authority (ISA) for this end, and the resources have the status of global public goods. The USA has not ratified UNCLOS but applies its principles within its EEZ. In contrast, in the Zone the USA cannot participate in the ISA mechanism.

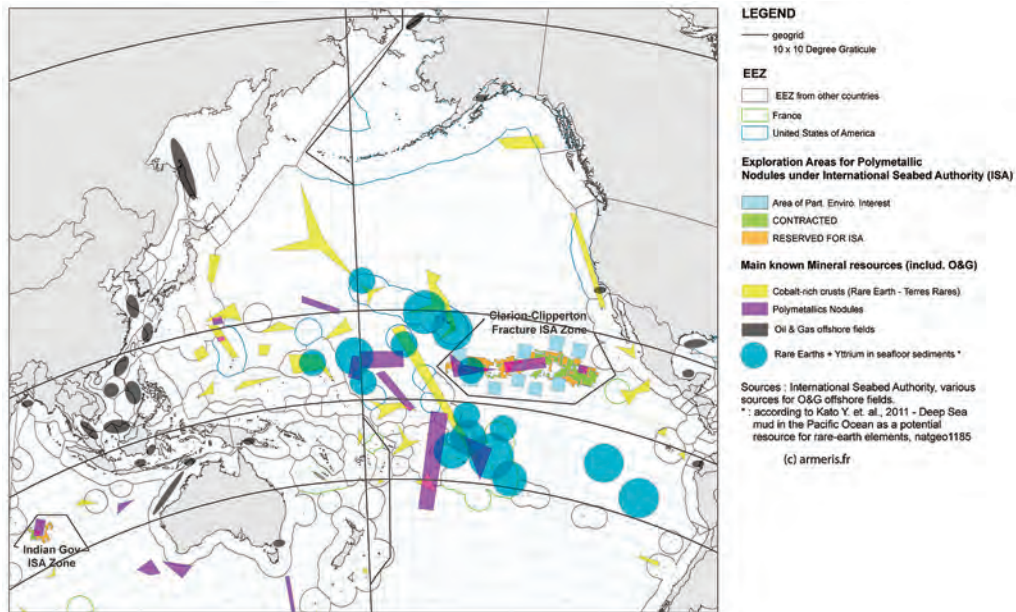
The maritime exploitation of rare earths has not begun yet (in either the EEZs or in the Zone) but there is deep scientific concern about environmental impacts. Scientific evidence regarding the quantification and forecasting of these impacts is incomplete, particularly as no reference exploitation exists yet. Nonetheless, there is a sense that these impacts will be very different depending on the type exploited (hydrothermal sources, ferromanganese crusts, polymetallic nodules, marine sediments) and the exploitation area considered (Dyment et al. 2014). Acquiring the knowledge needed on this subject is today a major objective.

Given global demand for these minerals, paradoxically amplified by green growth strategies which need a lot of this type of material, the strategic issues at stake are high for private enterprises and States. For the Pacific States, it is a major opportunity for economic diversification and growth, as well as the development of new macro-economic rents.

Like for the economic resources derived from fishing, deep sea mining issues lie at the heart of the Pacific States’ claims over marine space. If these States wish to fully benefit from the economic opportunities associated with these activities, they must implement a full blown strategy of maritime power, at their respective levels, which assumes a strong assertion of maritime sovereignty.

The map below (fig. 8) superimposes all of the deep sea mineral resources described in this chapter, which allows one to estimate their distribution and locate the associated geostrategic issues (note: the hydrothermal sulphide concentrations are not represented).

Figure 8: Location of marine minerals in the Western and Central Pacific Ocean



Strategy and leadership issues

The Pacific has been an arena of strategic confrontation for many years. To strengthen their hands in these power games, States in the region are developing today strategies which combine “hard power” (strategic, military) with “soft power” (influence and maintaining leadership) actions. The following paragraphs will briefly present these strategies.¹⁵

The notion of a maritime pivot

First, it would be worthwhile to point at a methodological and analytic tool applied to the case of the Pacific: the maritime pivot. It is a tool which I developed for maritime analyses and named by extrapolating from the term used by American

15. Most of the updated bibliographic references of the strategy and leadership section can be consulted on the following website: <http://atlas.bluelobby.eu/2014/06/le-pivot-maritime-asie-pacifique.html> (Accessed on July 9, 2015).

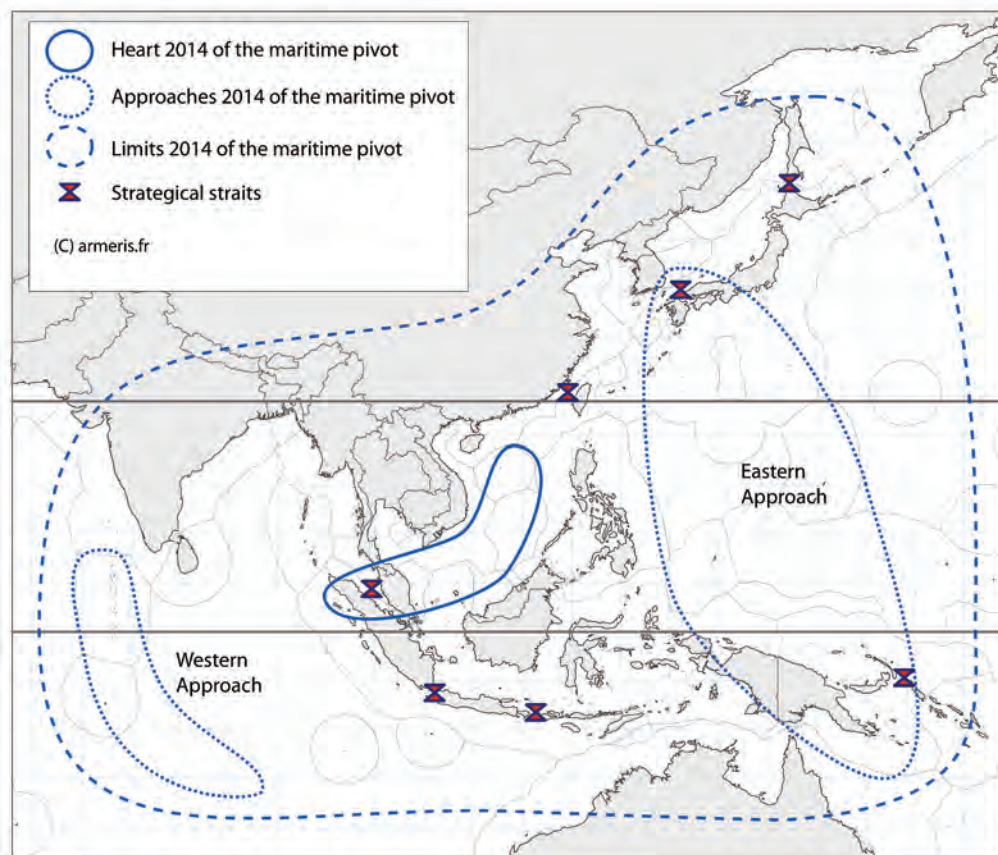
diplomacy in the field of international relations (the “Asia-Pacific Pivot”). At present, I can identify some fifteen maritime pivots in the world.

I define a maritime pivot as a coherent functional set associating public and private actors, issues, maritime territories and control points which shape the implementation of priority power strategies for the States involved.

In the Asia-Pacific region, this pivot consists of the following elements (fig. 9):

- A core in which the most significant activities and issues are concentrated. Hard power is dominant in this area. It consists of the entire “Malacca Straits” and its eastern outlet, the South China Sea. All of the States interacting on the maritime issues of the pivot are particularly concerned by the free and peaceful flow of commercial traffic through this core. Also found in the core are strategic possibilities and sources of economic development (here, the supply and procurement of energy, but also fishing and freedom of navigation) for countries dependent

Figure 9: Brief presentation of the main components of the Asia-Pacific maritime pivot



on the pivot. This in particular is translated into claims over maritime territories. The boundaries of the core have evolved greatly over time, successively including or not including the East China Sea and Taiwan. At the end of 2014/beginning 2015, pressure was most focused on the South China Sea. However, given the geopolitical tensions which are currently building, it is possible that by the end of 2015, the core of the pivot will again include the East China Sea, Taiwan and Japan.

- Two maritime approaches (in the geographic and maritime sense of the word): a western approach which includes the Chagos Archipelago, and an eastern approach which includes South Korea and Japan in the northeast, and the Mariana Islands, Palau, FSM and northern Australia in the southeast. At the level of the approaches, hard power and soft power underpin the strategies deployed in the core.
- The boundaries of the pivot encompass all of the States which are either directly concerned by shared pivot concerns, or indirectly concerned through diplomatic gamesmanship. Geographically, the eastern side of the Indian Ocean, the western side of the Pacific Ocean, and the East China Sea are thus included. Although the latter has its own strategic issues, it is notably connected to the pivot through Chinese and American maritime strategies which do not distinguish questions regarding the South China Sea from those of the East China Sea.

Finally, we note that this notion of a maritime pivot applies equally to the two main protagonists, China and the USA, which determine the main movements and manoeuvres within this pivot.

The main American strategies on the maritime pivot

These principles are above all dictated by the relationship between the USA and China¹⁶ and the perception of the Asia-Pacific area as the driver of the global economy and diplomacy. China is seen at once as a challenger of American diplomacy, a rising diplomatic partner in what has become a multipolar world where the USA can no longer act alone as the global policeman, and lastly as a both profitable and competitive trading partner. Concerns also include questions of internal stability in China, notably regarding expectations of democracy entertained by an emerging middle class and the stability of Chinese stock markets.

This vision is reflected in a number of strategic government positions, notably under the two Obama administrations. First and foremost, from a diplomatic and defence angle, Hillary Clinton initiated, to the benefit of the pivot, a strategy to

16. See in particular Global Trends 2030, <http://www.dni.gov/index.php/about/organization/global-trends-2030> (Accessed on July 9, 2015), and the coming Global Trends 2035, <http://www.dni.gov/index.php/about/organization/national-intelligence-council-global-trends> (Accessed on July 9, 2015), released by the National Intelligence Council, US Office of the Director of National Intelligence.

rebalance American commitments between the Middle East and the Asia-Pacific pivot (Clinton 2011). This is notably reflected in the orientation of American diplomacy, but above all in their maritime military strategy (last updated in March 2015¹⁷). These strategies interact with negotiations to conclude the Trans Pacific Partnership (TPP) free trade agreement.

The main Chinese strategies on the maritime pivot

Since opening up to the market economy under Deng Xiaoping in 1979, China has had to reconsider its geostrategic positions in the light of its economic growth and the need to secure its vital interests. From a maritime perspective, this resulted in the mid-1980s with the formulation of the “lines” doctrine by the strategist Admiral Liu Huaqing. This doctrine assigned three spatial and temporal objectives to the People’s Liberation Army Navy (PLAN) for the control of its coastal and offshore waters (Cole 2014): (1) by 2000, PLAN should be able to exert control over the first line of islands, extending from the Kouriles to the Indonesian archipelago, including Japan, Taiwan and the Philippines (in other words, the South and East China Seas); (2) by 2020, PLAN should be able to exert power over a second belt of islands, from the Kouriles to the Indonesian archipelago including the Mariana Islands and Palau; (3) by 2050, PLAN should be able to act on the global level with a carrier battle group. Starting from this time, there have been three geopolitical considerations: military, political (in particular with regard to the question of Taiwan) and economic (securing the maritime trade routes sustaining China’s development). We also note that the second line is considered to be less of a military objective and more of an expression of strong Chinese influence.

In November 2003, Hun Jintao pronounced a discourse taken up later in the guise of the “Malacca Dilemma” (Amelot 2010). This speech echoed themes of the 1990s, a period rich in Sino-American conflicts, and focused on the Taiwan question. It implied that PLAN’s capabilities would not allow it to simultaneously engage in an armed conflict with Taiwan while ensuring the free passage of strategic supplies through the Malacca Straits (Amelot 2010).

Over the past 15 years, China has undertaken cooperation and investment activities enabling it to advance on four fronts detailed below, both in a westerly direction to secure maritime routes, and in an eastern direction in accordance with the strategic lines defined by Liu Huaqing:

- First, the modernisation of its navy and nearby naval bases, notably in the South China Sea on contested islands (the Spratleys and Paracels¹⁸);

17. US Department of the Navy, March 2015, “A Cooperative Strategy for XXIst Century Seapower”, <http://www.navy.mil/local/maritime/150227-CS21R-Final.pdf> (Accessed on July 9, 2015).

18. Spratleys: Johnson South Reef, Mischief Reef. Paracels: Woody Island, Duncan Islands.

- Second, the creation of a network of port cooperation arrangements (known as the “String of Pearls”) meant to act as both logistical relays for PLAN (ensuring it a capacity to stay outside areas under its authority and to support its sea-trade routes) and as departure points for oil and gas pipelines;
- Third, moves in a game of influence and cooperation as well as naval actions to ensure China’s effective maritime might;
- And lastly, for the record, the development of a rail link with Europe and gas and oil pipelines allowing it to bypass the Malacca maritime route with a Eurasian land route and thereby ensure the creation of energy corridors supporting Chinese interests (Iran, Pakistan, Myanmar).

These strategic principles were reaffirmed by Xi Jinping in 2013 with the “One Belt, One Road” slogan (the concept of a modern Silk Road). The “belt” represents here neighbouring Eurasian States sharing a “common destiny” with China, and the “road” refers both to the maritime and land routes. This strategy is articulated in economic and diplomatic terms, and PLAN must ensure the maritime safety dimension. PLAN now even includes an objective to protect China’s “vital economic interests” in its white papers.¹⁹

The formulation of routes in an easterly direction towards the Pacific is less explicit in the official discourse. However, this process draws from Liu Huaqing’s strategic lines. This is shown in the route linking the Mariana Islands, PNG and New Caledonia which corresponds to the second belt of archipelagos defined by Liu Huaqin. Chinese economic and diplomatic activity along this axis increased over the past few years through the economic features of fishing and onshore mining projects (nickel), support provided following natural catastrophes (PLAN thus serves as a tool of diplomacy and influence through its disaster relief work) and diplomatic pressure regarding the recognition or not of Taiwan.

The resulting lines of defence

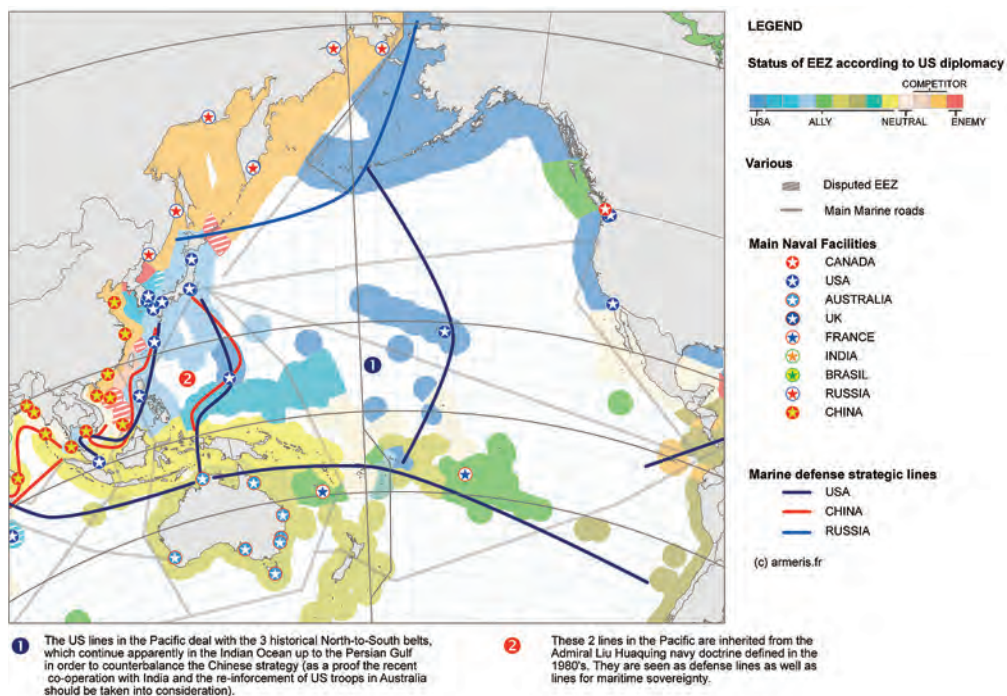
For the USA, the rebalancing of forces towards the Asia-Pacific pivot is leading to an increase and modernization of their naval capabilities deployed on this pivot and the reinforcement of strategic alliances with Japan, the Philippines, Australia and Vietnam.

For China, as already mentioned, the rebalancing of forces towards the Asia-Pacific pivot is reflected in an increase in strength of both the coastal and high sea naval forces²⁰ supported by the “String of Pearls”, the creation of port facilities with potential air and maritime military uses in the Paracel and Spratley Islands (April 2015), and lastly a gradual operationalization of the first carrier battle group.

19. 16 April 2014, “Xinhuanet. Chinese Navy safeguards security of int’l sea lines of communication: white paper”, http://news.xinhuanet.com/english/china/2013-04/16/c_132312715.htm (Accessed on July 9, 2015).

20. 16 April 2014, “Xinhuanet. Chinese navy intensifies blue water training: white paper”, http://news.xinhuanet.com/english/china/2013-04/16/c_132312785.htm (Accessed on July 9, 2015).

Figure 10: Chinese, US and Russian strategic defence maritime lines on the Asia-Pacific pivot and in the Pacific Ocean



These moves, combined with Chinese claims over the entire South China Sea, is promoting intense remilitarisation activity in the largest countries of the Asia-Pacific region and the modernisation of their capabilities.

Certain American strategists refuse to think in terms of strategic lines, asserting a capability to intervene anywhere “outside the lines” in accordance with modern naval strategic principles (Cole 2011). However, these moves and the pre-positioning of corresponding capabilities can today be represented in the form of strategic maritime lines, whether with regard to the USA or China (fig. 10). In the West Pacific, the American and Chinese lines overlap. In a very simplified manner, one may grasp that the issues facing China in the Pacific are extension towards the east, control over the South and East China Seas, and access to international waters. The first line of islands is strongly affected by all of the conflicts directly involving “hard power” springing from the claims of diverse States over the South China Sea.²¹ The second line of

21. This issue of South China Sea conflicts is not the main goal of this article. Readers can refer to the updated web page on this subject (in French with various links to English papers at the bottom of the article): <http://atlas.bluelobby.eu/2014/06/le-pivot-maritime-asie-pacifique.html> (Accessed on July 9, 2015).

Pacific Island States, with on the front row Palau, FSM and PNG, is directly concerned by “soft power”, meaning diplomatic-economic influence actions.

On the Indian Ocean side, we should simply recall the importance of Chagos (US naval air station) which operates as a mirror of Asia-Pacific movements. Its interest must be viewed in conjunction with the influence actions of the USA in India and India’s own strategy concerning the Malacca Straits (the *Looking East Policy*).

American leadership

We shall not review here all of the many American strategies to strengthen its alliances and leadership in the Pacific. They hold a historic dimension which has been well described. Let us simply recall that these strategies combine American alliances with western governments holding territorial possessions in the Pacific (France, Australia, New Zealand, United Kingdom) and historical American partnerships based on fundamental defence aspects with Japan, South Korea, the Philippines, Thailand, and Singapore. However, let us emphasize that these historical alliances evolve over time (see the USA-Philippines relationship) and are shaped by economic issues (Thailand thus may move closer to China). Recent tensions linked to the China Sea (2014 and 2015) are also leading to the conclusion of indirect partnership agreements with the USA, just as a new partnership between Vietnam and the Philippines seems to be forming, more in reaction to Chinese maritime policy than from a real tropism for America.

Two elements should be specified here: the intergovernmental partnerships between the USA and three Pacific countries, and the mobilisation of public-private partnerships to facilitate the expression of American government leadership.

The Compact of Free Association associates the USA with Palau, FSM, and the Marshall Islands through three separate agreements. They include numerous components, of which one is economic support and another defence. On the economic front, the USA has endowed each of these three countries with a trust fund. The interest earned by these trust funds, invested on international markets, constitutes a public fiscal resource. These trust funds supplement revenue from fishing permits under the framework of the multilateral US fisheries treaty.²² The defence component stipulates that the signatory countries delegate their defence functions, whether these maritime, air, or land, to the USA. The USA exercises this military cooperation directly from its base in Guam, which ensures it a level of potential control similar to that of their own EEZ over a significant section of the West Pacific (located on the second line of islands defined by Liu Huaqing).

22. See <http://www.state.gov/e/oes/ocns/fish/bilateral/c33153.htm> (Accessed on July 9, 2015).

With regard to the mobilisation of public-private partnerships, on 22nd September, the USA presented the U.S. Global Development Policy.²³ It notably mentions that to facilitate the implementation of American policies and diplomacy, strong partnership approaches need to be developed with private actors, non-governmental organisations and philanthropies, and various American immigrant communities. This principle is applied heavily in the Pacific to strengthen American leadership there, notably in the negotiation process of the Trans Pacific Partnership (TPP) free trade agreement. One may assume that it was also applied to other maritime questions.

Chinese leadership

As seen above, Chinese leadership is expressed by combining an assertion of a will for power and the provision of economic support for sympathetic countries (for example, Pacific nations involved in reflagging processes). This economic support, particularly in the area of infrastructure, is financed by Chinese public investment banks and implemented by Chinese enterprises or Chinese joint-venture companies. Chinese-owned enterprises²⁴ then establish themselves in the countries in question and can take an equity interest in or buy national companies. These leadership actions concern the Indian Ocean as well as the Pacific region.

With regard to tensions in the South China Sea, China is not seeking a resolution through the International Court of Justice (ICJ) based on UNCLOS. It prefers a resolution through a dual mechanism: the establishment of a Code of Conduct in the South China Sea under the auspices of the Association of Southeast Asian Nations (ASEAN) at the initiative of Indonesia; and the instauration of mutually beneficial joint development partnerships.²⁵ Within ASEAN, China hopes notably for the support of Cambodia, Myanmar, and Thailand (the latter country could benefit from Chinese investments under the framework of strategies to bypass the pivot) and even Malaysia. As for the USA, what is involved is the promotion of interdependent economic ties to favour the peaceful resolution to military conflict risks. It is likely that China is seeking to encourage this path by occasionally demonstrating its military might elsewhere. The Philippines and Vietnam are considered to be local tactical rivals.

23. See <https://www.whitehouse.gov/the-press-office/2010/09/22/fact-sheet-us-global-development-policy> (Accessed on July 9, 2015).

24. The expressions "Chinese enterprises", "Chinese joint venture companies", and "Chinese-owned companies" refer to three different forms of private economic participation in China. The most generic is "Chinese-owned companies": these can either be Chinese enterprises, companies owned jointly by China and a friendly country, or foreign companies with some Chinese shareholders.

25. See <http://thediplomat.com/2013/10/china-asean-joint-development-overshadowed-by-south-china-sea/> (Accessed on July 9, 2015).

The shipping fleets (Chinese, Vietnamese, American, etc.) are they leadership tools?

One cannot help but be struck by the number of violent incidents in the Asia-Pacific area (armed boardings, destruction of vessels, imprisonment of crews, summary executions, etc.), including in the island States, which involve fishing vessels inside potential areas of bitter geostrategic conflicts (both on the first and second belt of islands, meaning the centre of the pivot and its eastern approach). These misdeeds are carried out on the pretext of illegal fishing as much with respect to specific bans (sharks in Palau, for example) as to fishing practices in areas simultaneously claimed and contested over by several countries.

Should one deduce that the shipping fleets are knowingly being used by China, Vietnam, the Philippines, Japan, Russia, North and South Korea, Malaysia and Indonesia to provoke conflicts and legitimize interventions aiming to protect their nationals? And, in so doing, are they demonstrating their maritime power and influence?

The geostrategic dimension of fishing activities is not new; it was already significant in the 1970s to 1990s. Its return to centre stage is fuelled by the sovereignty claims over maritime areas by various coastal States, notably in the Pacific, and by the necessity of developing a regional framework for sustainable fisheries management, notably with regard to large pelagic migratory species.

The Asian countries also are subject to international requirements to reduce their excess fishing capacities. They do so by the actual destruction of part of their capacities, but also by the exportation of capacities through reflagging, as described earlier. The international community doubts the effective capacities of host States to enforce sustainable fishing principles regarding illegal, unregulated and unreported (IUU) fishing on the reflagged fleets. At the regional level, pelagic activities are nonetheless subject to reinforced fisheries regulations thanks to the gradual operationalization of the WCPFC since 2001, associated with national decisions to create large-scale, no-take MPAs or equivalent prohibitions such as shark sanctuaries.

Returning to the case of China, its position is nuanced according to the location involved — within the maritime areas claimed by several States, including China, in the first belt of islands (core of the pivot), or within the area of the second line of islands (eastern approach of the pivot).

In the first belt, the actions against an ensemble of fishing fleets are highly publicised through “nationalist” press campaigns, with armed boardings most often justified by questions of sovereignty.²⁶ Mirroring this, other nations also reproduce sovereignty mechanisms by mobilizing their own fishing fleets and invoking both

26. A State considers that it has the right to board foreign vessels fishing within maritime space which is under its sovereignty. By defending these spaces, its sovereign rights and associated duties, the State exercises and further strengthens its sovereignty. (See also the section, “The current issues of Pacific tuna economic exploitation”.)

the historical character of traditional fishing zones and the legitimate and sovereign nature of their presence. The conflict in April 2014 between Vietnam and China was emblematic of this: China authorized one of its companies to conduct an offshore oil and gas exploration campaign in a contested area; Vietnamese fishing vessels put up opposition to the effort; and both sides were supported by their fisheries control and coast guard vessels. The conflict went so far as to ramming attempts and Chinese merchant communities in Vietnam suffered abuse.

Even in this type of situation, it is difficult to believe that the Vietnamese fishing vessels had received government orders to deliberately oppose the Chinese offshore oil and gas operation. The fishermen are effectively able to anticipate the economic consequence for themselves if they are denied access to fishing zones. They are not necessarily working in partnership with their State or its government administration.²⁷ At most, State authorities guarantee them a form of protection at sea or monitor their movements.

The geostrategic interests of States in the core of the Asia-Pacific maritime pivot overlap with the private geostrategic interest of fishing fleets. Both public and private actors use “hard power” types of open conflict actions.

In the second belt of Western Pacific islands, the positions of the Chinese government are more moderate concerning armed boardings resulting from IUU activities of their vessels, for example in the territorial waters of Palau. China in contrast relies on diplomatic efforts to obtain peaceful resolutions to conflict, compatible with its joint economic development interests. IUU activities of fishers there disrupt Chinese diplomatic efforts.

At the level of the approaches to the pivot, the Chinese government encourages the economic development of fishing activities through investments in infrastructure. It also encourages private Chinese investment in the fishing sector of sympathetic countries located in these areas.

In response to these Chinese government efforts, there has been significant activity on the part of private American charitable trusts to encourage the creation of large-scale MPAs and of no-take shark sanctuaries. Historically, the lobbying campaigns of these trusts initially targeted two areas, the Chagos Islands on the Indian Ocean side, and the Mariana Islands and Palau on the Pacific side, resulting in the effective creation of no-take areas. These actions were part of “soft power”, or more precisely, “smart power”,²⁸ mixing State diplomatic influence (here the USA against China) with the influence of nongovernmental actors (here, the American charitable trusts) in line with the American Global Development Policy doctrine of 2010.

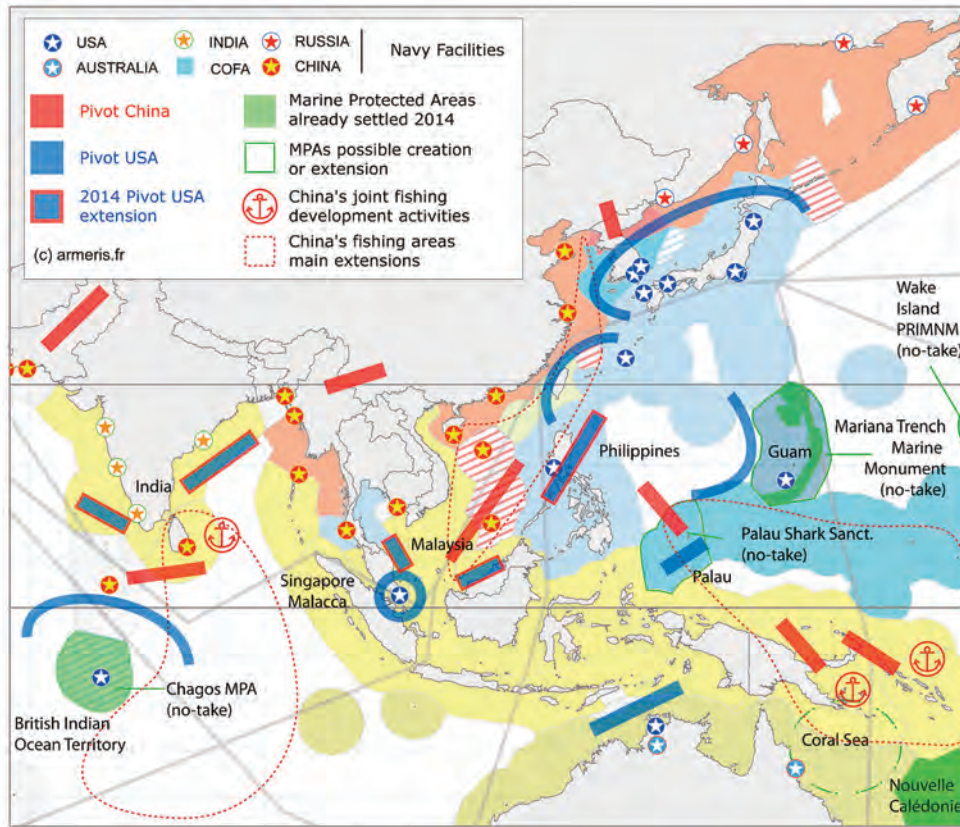
From the perspective of the Asia-Pacific maritime pivot, for both China and America there is a dichotomy between the core and the approaches of the pivot for

27. See for example the news article entitled, “Chinese Fishermen in Troubled Waters” published in October 2014 in *The Diplomat*, <http://thediplomat.com/2014/10/chinese-fishermen-in-troubled-waters/> (Accessed on July 9, 2015).

28. “Smart power” consists of a combination of “soft power” and “hard power” strategies.

both fishing activities and strategic and leadership activities. Yet it would be wrong to see this as evidence of intentional coordination. Each activity, public and private, follows its own logic. This does not hinder opportunistic rapprochements and public/private synergies when private and public objectives resonate with each other.

Figure 11: Synthesis of current trends underlying the strengthening of the Asia-Pacific marine pivot, both on Chinese and US sides



The Asia-Pacific maritime pivot, a combination of States (public) and private actors jockeying for power

In conclusion, strategic (in the sense of defence) and leadership issues in the Pacific are essentially oriented around the Asia-Pacific pivot, which currently corresponds to the American and Chinese strategic reading of this area. In the Pacific, one discovers interactions between States based on strategic lines which are shared by both China and the USA (fig. 11). Since 2010, and notably in 2014, the USA has been reinforcing

its lines around both the core and the approaches to the pivot. China is pushing these lines, both in the direction of the Indian Ocean and in the direction of the Pacific Ocean towards the tuna heartland, through joint economic development initiatives associated with fishing activities. For China, private sector fishing activities can indirectly serve to support the government's intentions, but they can also undermine these through IUU fishing activities. On the American side, the ocean conservation activity of charitable trusts does not seem to be coordinated with government aims, but they nonetheless coincide with them, and the government uses the conservation arguments put forward by these trusts as a supplementary tool of influence. In practice, these trusts' activities oppose the geographic inroads of private Asian fishing interests into the Pacific's tuna heartland.

The development of large-scale, no-take MPAs

Panorama

Since the mid-2000s, the creation of large-scale (over 100,000 km²), no-take MPAs and shark sanctuaries has accelerated. The first large-scale, no-take MPAs and shark sanctuaries created after 2006 are mainly positioned on areas with high geostrategic stakes, notably in relation to the Asia-Pacific maritime pivot and tuna.

The designation of these areas is the responsibility of the States concerned, but quite often the creation of these protected areas are the result of heavy lobbying by charitable trusts, particularly American, through dedicated campaigns (see Leenhardt et al. 2013). The following table (tab. 5) shows the emergence of this trend over time. Three North American charitable foundations are preeminent: PEW Charitable Trusts (PEW),²⁹ Conservation International,³⁰ and Mission Blue (initiated by the

29. On PEW's website (<http://www.pewtrusts.org/en/about/mission-and-values>, Accessed on July 10, 2015), the foundation is described in these terms: "The Pew Charitable Trusts is driven by the power of knowledge to solve today's most challenging problems. We are an independent non-profit organization – the sole beneficiary of seven individual trusts established between 1948 and 1979 by two sons and two daughters of Sun Oil Company founder Joseph N. Pew and his wife, Mary Anderson Pew. [...] Today, Pew is a global research and public policy organization, still operated as a non-partisan, nongovernmental organization dedicated to serving the public. Informed by the founders' interest in research, practical knowledge and a robust democracy, our portfolio has grown over time to include public opinion research; arts and culture; and environmental, health, state and consumer policy initiatives."

30. On its website (<http://www.conservation.org/about/Pages/default.aspx#mission>, Accessed on July 10, 2015), Conservation International's mission is described in these terms:

"For more than 25 years, Conservation International has been protecting nature for the benefit of everyone on Earth. But we're not a run-of-the-mill environmental organization. We're more like a human organization. We know that human beings are totally dependent on nature — and that when we work to save nature, we're really working to save ourselves. CI is 900 people in 30 + countries helping to build a healthier, more prosperous and more productive planet, for you and for everyone."

American oceanographer Sylvia Earle and focussed on the protection of oceans). These actors themselves work in synergy. Sylvia Earle worked for about fifteen years in former subsidiaries and partner companies³¹ of SUNOCO, an oil company which was owned by the PEW family up to October 2012. She applies to oceans the concept, first put forward by Conservation International, of biodiversity “hot spots” (which becomes “hope spots”). Sylvia Earle is herself linked to diverse PEW initiatives such as the High Seas Alliance and the Global Ocean Commission,³² as well as the Global Ocean Legacy programme which specifically aims to create large-scale, no-take MPAs.³³ Conservation International is behind initiatives in Kiribati and the Seychelles for which it has requested funding from the OCEANS 5 group,³⁴ which is itself supported by PEW and partner charitable trusts. The head of PEW’s environmental division was himself, prior to 1990, vice-president of Conservation International and a congressional aid to the U.S. House of Representatives sub-committee on Foreign Affairs. Since the 1990s, PEW has assumed the role of coordinator and initiator on marine environment issues among charitable trusts and environmental NGOs.³⁵ It is building de facto partnerships with other charitable trusts such as the Oak Foundation³⁶ and the Moore (Intel) and Packard family foundations. It also intervenes in the creation of alliances between international environmental NGOs on various questions by ensuring secretariat and communication functions. It is estimated that one third of its 2012 operating budget was dedicated to questions of influence over the oceans, or about US\$100 million/year; this “ocean orientation” has been in place since 1990. Lastly, PEW intervenes through the Lenfest Ocean Program,³⁷ which it manages, to fund scientific research which it then puts to use in science-based lobbying. The Moore and Packard foundations also provide funding for this type of research.

However, it is not because PEW, Mission Blue or Conservation International include the protection of maritime areas in their campaigns that they alone should receive credit for the creation of no-take MPAs and shark sanctuaries. States can also

31. See <http://www.hartheresearchinstitute.org/hri-s-panel-of-oil-spill-experts#searle> (Accessed on July 10, 2015).

32. See these two organisations’ websites for further information, respectively <http://highseasalliance.org/> and <http://www.globaloceancommission.org/> (Accessed on July 10, 2015).

33. See <http://www.pewtrusts.org/en/projects/global-ocean-legacy> (Accessed on July 10, 2015).

34. See this organisation’s website for further information, <http://oceans5.org/> (Accessed on July 10, 2015).

35. See the blog “How U.S. nonprofits came to care about fish” by Denis Devine, <https://denisdevine.wordpress.com/my-portfolio/environmental-reporting-commentary/how-us-nonprofits-came-to-care-about-fish/> (Accessed on July 10, 2015).

36. See this organisation’s website for further information, <http://www.oakfnd.org/> (Accessed on July 10, 2015).

37. See this organisation’s website for further information, <http://www.lenfestocean.org/> (Accessed on July 10, 2015).

Table 5: Large-scale Marine Protected Areas and shark sanctuaries in the Indian Ocean and the Pacific Ocean

Year	Area (km ²)	No-take area (%)	Type & (IUCN category) * in negotiation	Site	Campaigners	Manager
2004	333,619	33	MPA (VI)	Great Barrier Reef Marine Park (AUS)	?	GBRMP Authority
2006	362,074	100	MPA (VI)	Papahānaumokuākea Marine National Monument PMNH (USA) – Hawaii	PEW + Marine Conservation Institute + The Ocean Conservancy	NOAA
2007	469,276	?	MPA (VI)	Kermadec Benthic Protection Area (New Zealand)	PEW + WWF	NZ gov.
2015	620,000	100				
2008	408,224	12	MPA (?)	Phoenix Islands Protected Area (PIPA) – Kiribati	Conservation International – New England Aquarium	PIPA Manag. Committee – PIPA Trust
2014		37				
2015 ?		100				
2009	215,000	100	MPA (-)	Pacific Remote Islands Marine National Monument (PRIMNM) – USA	US gov. + PEW + Friends of the Monument (local)	NOAA (US gov.)
2014	1,271,525	100				
2009	246,608	100	MPA (III)	Mariana Trench Marine National Monument (USA)	US gov. + PEW	NOAA (US gov.)
2009	604,289	100	Shark Sanctuary	EEZ size – Palau National Marine Sanctuary	PEW (mainly) + Mission Blue + The Nature Conservancy (through Micronesia Challenge initiative)	Palau Sh. Sanct
2015 ?		100	MPA (?)			
2010	150,000	100	MPA (Ia)	Motu Motiro Hiva Marine Park (Chile – Easter Island)	OCEANA + PEW	Chilean gov.
2010	636,600	100	MPA (?)	Chagos Islands (UK BIOT)	PEW + Zoological Society of London + UK gov.	UK gov.
2010	923,322	100	Shark Sanctuary	EEZ Maldives	PEW, WWF, Mission Blue	Maldivian gov.
2011	1,990,530	100	Shark Sanctuary	EEZ Marshall Islands	PEW + Mission Blue + The Nature Conservancy (through Micronesia Challenge initiative)	Marshall gov.
2012	989,842	51	MPA (II)	Coral Sea Commonwealth Marine Reserve (Australia)	PEW & Mission Blue	Australian gov.
2012	4,767,242	-	Shark Sanctuary	French Polynesia EEZ	Mainly French gov. than PEW	French Pol. Gv
2012	1,997,000	-	Shark Sanctuary	Cook Islands EEZ	Gov.	Gov.
2013	1,291,000	<0.3	Shark Sanctuary MPA (VI)	Parc Naturel Marin de la mer de Corail French Nouvelle-Calédonie EEZ	Mainly gov. + Conservation International + PEW	French Caledonian Gov
2014						
?	?		*MPA (VI)	Marquises French Polynesia	French gov. mainly + PEW	French gov.
?	?		*MPA	Australes French Polynesia	PEW	
2015 ?	836,064	100	*MPA	Pitcairn	PEW+ Zoological Society of London + UK gov.	
?	?	33	*MPA	Seychelles	Conservation International / OCEANSS5 (with PEW's support)	

Sources: <http://mpAtlas.org/explore/> (Accessed on July 10, 2015) and various sources including charitable trusts' documentation

have an interest in creating large-scale MPAs (see notably Leenhardt et al. 2013), for diverse reasons: coherence with geostrategic interests, to comply with their international commitments with regard to protecting ocean areas, to seek international recognition through environmental issues, or to increase control over their EEZ with regard to illegal fishing pressure. In this case, the creation of large-scale MPAs is a direct or indirect realization of State objectives. As already mentioned (see the section, “Strategy and leadership issues”), the charitable trusts, which have their own objectives, then find themselves in agreement with the objectives of the States concerned, and establish supposedly win-win partnerships with these States, or present a communications partnership to reap benefits from the dynamics initiated by these States. The fact, noted above, that the first large-scale, no-take MPAs and shark sanctuaries established after 2006 are positioned principally on areas with high geostrategic stakes, notably with regard to the Asia-Pacific maritime pivot and tuna, is likely due to this concordance of objectives and the charitable trusts’ resulting strategies.

We should note the application of the classification proposed by the IUCN, which classes protected areas according to their management objectives, is not always strict with regard to human activities within large-scale MPAs. The classification is based on categories which range from the most demanding management objectives (the statuses Ia — Strict Nature Reserve, Ib — Wilderness Area and II — National Park) to more flexible objectives (status V — Protected Landscape/Seascape and VI — Protected area with sustainable use of natural resources).³⁸ Yet the choice to ban fishing is predominant in large-scale MPAs, which confers a very particular status on fishing compared to other human activities. In MPA creation processes, one also may observe that a total ban on fishing can subsequently be relaxed by an authorisation of so-called “traditional” fishing activities. The no-take feature of MPAs mainly consists of prohibiting large pelagic fisheries and/or banning long-distance fleet activity. In the following paragraphs, these observations will be illustrated by a brief study of several case studies.

*The case of Palau*³⁹

The large-scale marine conservation area in Palau’s EEZ originally was the work of several shark protection actors. In the early 2000s, the Palau government banned shark finning inside its EEZ. This State then was the subject of a case study on illegal fishing involving Chinese fishers. In 2008/2009, PEW funded a study undertaken by an Australian university with assistance from a local NGO (in fact backed by a foreign-owned company specialized in diving tourism, notably to observe sharks) (Vianna et al. 2010).

38. See http://www.iucn.org/about/work/programmes/gpap_home/gpap_quality/gpap_pacategories/ (Accessed on July 10, 2015).

39. Let us recall that Palau is located in an area with high geostrategic stakes (but low tuna stakes) and

Based on an estimation of the number of divers coming to Palau specifically to observe sharks, this study sought to assess the economic weight in 2009 of this shark-observation activity, which was very likely overestimated.⁴⁰ The results were taken up by public opinion under the slogan, “a live shark earns more than a dead (fished) one”. The successive presidents of Palau (Toribiong and Remengesau) used the results of this study to justify the establishment of a strict shark sanctuary in Palau’s EEZ. Following difficulties in controlling illegal shark fishing, a total ban on fishing within the EEZ, in the form of a large-scale, no-take MPA, was announced in 2014-2015. Only local fishing activities, which cannot export catch, are allowed. Beyond long term environmental benefits hoped for by the government, the policy intends to compensate for the financial loss resulting from the end of fishing permits by developing shark-related ecotourism.

This strategy nonetheless raises questions regarding the real capacity of shark observation to financially compensate the State, meaning in fiscal resources, for both the loss of fishing permits and the cost of controlling the large-scale, no-take MPA.

From PEW’s perspective, Palau was not initially an area identified in their no-take MPA programme (Global Ocean Legacy); they only added it in 2015. Palau was listed instead in the Global Shark programme. PEW thus facilitated the emergence of a shark protection dynamic that grew larger than initially foreseen, passing from only sharks to all pelagic fish in accordance with the will of the government of Palau.

The case of Kiribati — Phoenix Islands Protected Area (PIPA)

In 2012, the government of Kiribati announced the creation of a strictly no-take MPA, named the Phoenix Islands Protected Area (PIPA), within its EEZ. This decision followed lobbying by Conservation International and the New England Aquarium,⁴¹ long-standing PEW partners,⁴² and an initial commitment by the government of Kiribati in 2008.

that the country signed a COFA (Compact of Free Association) with the USA, thereby delegating to the USA the effective control of their EEZ. Nevertheless, to date American naval forces have not carried out significant fisheries control actions in Palau’s territorial waters. Meanwhile, the government of Palau is seeking low-cost solutions for the control of fisheries, such as the use of drones. PEW also announced a new project with Catapult, a British company, based on a satellite-linked vessel monitoring system to ensure surveillance of EEZs where no-take MPAs have been set up on its initiative.

40. See <http://wiki.bluelobby.eu/analyses/shark-studies-pew> (Accessed on July 9, 2015).

41. See this organisation’s website for further information, <http://www.neaq.org/index.php> (Accessed on July 10, 2015).

42. New England Aquarium carried on the PEW marine fellowship program, thus US\$11.07 million between 1996 and 2002. The PEW director of the conservation unit, Joshua S. Reichert, is a former vice-president of Conservation International which received financial and technical support from PEW between 1990 and 2000. Conservation International received a strong support from the Walton family foundation and the Gordon and Betty Moore foundation for marine conservation and MPAs in Indonesia, thus US\$84 million between 2005 and 2012. Gordon Moore is a member of the board of trustees of Conservation International, and Conservation International operates the Moore Center for Ocean Science.

The PIPA Conservation Trust associates the two afore-mentioned American charitable trusts (Conservation International and New England Aquarium) with the government of Kiribati and manages this no-take MPA, which is rich in tuna (85,000 tonnes of catch in 2013). The establishment of an MPA led to a drop in fishing permits and the loss of the resources derived from these permits. The absence of compensation for this loss hindered the effective ban on catches as early as 2012. This difficulty was partially resolved with the creation of the PIPA Conservation Trust's "endowment fund", a private entity endowed with public and private funds. The long term goal of the trust fund is to reach US\$25 million and its dividends will be given to the government of Kiribati under the framework of a "conservation contract", in other words, only if the government enforces the "no-take" character of the MPA.⁴³ The final agreement is still to be implemented. The government of Kiribati will thus give up its fishing permits on PIPA, a direct budgetary resource it manages with full sovereignty. It must put in place and finance very specific fishing surveillance and it will, in compensation, earn income whose attribution it cannot fully control, and which is provided by public and especially private funds.

The first officially identified private donor was the "Clinton Global Initiative" in September 2013, which funded the PIPA Conservation Trust's "endowment fund" through Conservation International in the amount of US\$2.5 million, and which called on the government of Kiribati to co-finance, also to the tune of US\$2.5 million. This first injection of US\$5 million can at best yield US\$500,000 in dividends per year, which will not cover the estimated operating costs of the no-take MPA backed by the PIPA Conservation Trust, which will likely be the only beneficiary.

In 2015, the Waitt Foundation and OCEANS 5 (initiated by PEW) also pledged US\$5 million, with a payment schedule of US\$1 million/year, and the Global Environment Fund of the World Bank intervened for the definition of an MPA management plan, which improved the financial situation of PIPA Conservation Trust's "endowment fund".⁴⁴ Ecotourism could be seen as a complementary financial resource like stock market products (through the Global Conservation Fund of Conservation International) or write-offs of public debt for environmental improvements (debt-for-nature swap).

Conservation International justifies PIPA's complete no-take nature through the following argument: "CI [Conservation International] firmly believes that large-scale MPAs have a role to play in ecosystem-based management of pelagic fisheries such as tuna".⁴⁵ Within PIPA, tuna catches are essentially taken by purse seiners,

43. See <http://www.phoenixislands.org/trust.php> (Accessed on July 10, 2015).

44. See the report entitled, "The state of conservation of the Phoenix Islands Protected Area (Kiribati) (N 1325)" dated January 2015, <http://whc.unesco.org/document/134952> (Accessed on July 10, 2015).

45. See <http://depts.washington.edu/mpanews/MPA133.htm#PIPA> (Accessed on July 10, 2015).

with 78% of the 2012 catch consisting of skipjack tuna (moderately exploited), 18% yellowfin tuna (moderately exploited), and less than 4% bluefin tuna (overexploited). They represent 15% of the purse seiner catch in Kiribati's EEZ.

In 2014, President Obama also considered the possibility of establishing operational partnerships with PIPA and American no-take MPAs, notably the Pacific Remote Islands Marine National Monument.

Is it sheer chance that Kiribati is situated along the American geostrategic line linking Hawaii to the American Samoa Islands and framing the eastern limits of the tuna heartland? Or that Kiribati is the sole Pacific country with which the European Union has a fisheries agreement (currently being renewed)? Or that the maritime area corresponding to PIPA has an abundance of cobalt-rich marine crusts? Lastly, is it still just an accident that Kiribati hosts a substantial number of reflagged vessels and offers fishing licenses to South Korean fleets (as part of its Vessel Day Scheme, see Allain et al. in this volume)?

The case of the Chagos Archipelago

The creation of a no-take MPA covering the entire EEZ of the British Indian Ocean Territory (Chagos) is particularly well documented and instructive regarding the opportunist synergies between public and private plays for power.⁴⁶ The Chagos Archipelago is a highly geostrategic area in relation to the Indian Ocean and the control of Eurasia, but also in relation to the Asia-Pacific pivot, for which it constitutes the western Approach. This area was disputed over by the United Kingdom and Mauritius when the latter became independent in 1968. Since the 1960s, the Chagos Islands have been leased to the USA, which set up a naval air station on the Diego Garcia atoll, and the local inhabitants were expelled from the entire archipelago.

Diplomatic cables from 2009 (see footnote 46) mention the statements of diplomats regarding the Chagos Archipelago and the following points are interesting:

- The proposal to create a no-take MPA in the territorial waters of the Chagos Archipelago was made at PEW's initiative: "*The Pew Charitable trust, which has proposed a BIOT [British Indian Ocean Territory] marine reserve, is funding a public relations campaign in support of the idea*" (in this regard, PEW worked in partnership with a private foundation, the Zoological Society of London (ZSL), notably to produce scientific arguments, and participated in the creation of the Marine Reserves Coalition associating PEW, ZSL, Greenpeace, Marine Conservation Society and Blue Marine Foundation).

46. Diplomatic cable #1156/01 1350700 of the 15th May 2009, from American Embassy of London to Secretary of State in Washington, "HMG floats proposal for marine reserve covering the Chagos Archipelago (British Indian Ocean Territory)", http://wikileaks.org/plusd/cables/09LONDON1156_a.html (Accessed on July 10, 2015).

- This creation was timely in the framework of the conflict between the UK government and the Chagossians over the return of the expelled inhabitants, “[Colin] Roberts, (director of the Foreign and Commonwealth Office at the time) *opined that the UK’s environmental lobby is far more powerful than the Chagossians’ advocates*”.
- And lastly, no-take conservation was an interesting excuse to prevent this return: “*Establishing a marine reserve might, indeed, as the FCO’s Roberts stated, be the most effective long-term way to prevent any of the Chagos Islands’ former inhabitants or their descendants from resettling in the BIOT [British Indian Ocean Territory].*”

The decision on 18th March 2015⁴⁷ by the Permanent Court of Arbitration condemned the British government for having created this no-take MPA with the view of using it as an indirect tool to manage the conflict between it and Mauritius, Chagossians, and their descendants.

This case illustrates the level of lobbying a charitable trust can deploy. One may note that PEW knew perfectly well how to identify and institute a win-win partnership with the United Kingdom and the American government to promote the solution which met its own goals, all the while satisfying other governmental interests (notably those of the United Kingdom).

This type of win-win partnership with the British government is also at work in the creation of the Pitcairn no-take MPA, as well as in the South Atlantic near the Falkland Islands (the South Georgia and Sandwich Islands), the Tristan Da Cunha archipelago, Ascension Island and the Bermudas off the east coast of the USA. In each of these cases, one can identify potential stakes for the British government, whether geostrategic, in agreement with an allied American strategy, or in conformance with spatial and quantitative oceans protection objectives.

Should one inquire whether such opportunistic public/private mechanisms also exist for the other large-scale, no-take MPAs promoted by PEW in the Pacific? One point which is certain is that public interests are not always in accord with the private interests of charitable trusts. For the American government, the creation of no-take MPAs can contradict the interests of the long-distance American tuna fleet — some forty purse seiners. This interplay between public and private actors is thus probably very “fluid”, including over time.

Analysis-Conclusion

The issues at stake in the Pacific revolve around its natural resources and their exploitation, as well as assertions of maritime sovereignty and geostrategic dynamics. The interactions of public actors are strongly influenced and affected by the leadership

47. International Court of Justice, 2015. In the matter of the Chagos Marine Protected Area Arbitration,

strategies deployed by the USA and China, whether through official channels or by independent private actors.

Public powers (the USA and China, but not only them) act and use leadership strategies. Private powers act and use comparable strategies, whether they are economic operators (energy operators, future mining operators, tuna operators, and even tourism operators) or charitable trusts.

Large-scale MPAs are consequently a tool with strategic and sovereignty dimensions. There are, in addition, the “no-take” dimension, which should be understood as “no-take of highly-migratory pelagic fish” (which includes tuna and sharks), a dimension of spatial control of resources and fleets, and, with the prospect of the growth and extension of Asian activities in the Pacific, a regulatory control and supplementary standards dimension. Environmental conservation action is thus one of the arguments and tools that can be used to assert sovereignty within a much larger set of diplomatic and legal instruments. One can also wonder how much benefit such large-scale no-take MPAs really bring up in comparison with the fishery management through an RFMO.

The creation of an MPA remains a State process, or, in other words, results from the decision of a government. However, the influence of charitable trusts, and indeed their tactical use of governmental decisions and associated issues to serve their own objectives, should not be ignored. Furthermore, when the interests of a State and the private interests of trusts coincide, *de facto* public/private partnerships can emerge or even be developed intentionally.

However, beyond regulatory and financial commitments, what is the actual effectiveness of these partnerships? Has the American government used the pretext of the existence of no-take MPAs to practice armed boardings in the EEZs belonging to States which have delegated their defence to the USA through a Compact of Free Association? To date, the American government has not undertaken any support action. Palau must currently feel quite alone in enforcing the fishing ban within its MPA, which covers its entire EEZ. Environmental conservation may not be an adequate means for a “hard power” style expression of sovereignty. However, American charitable trusts are beginning to promote the effective implementation of fishing bans with high profile campaigns to control IUU activities and the development of monitoring tools for fishing activities. In the approaches to the pivot, the United States government has not decided yet to exercise hard power under the pretext of conservation, but there is room to manoeuvre if it decides to do so in the future. Furthermore, the United States government could in the future extend fishing-related concerns for environmental conservation to other activities, for example,

before an arbitral tribunal constituted under annex VII of the UNCLOS between the Republic of Mauritius and the UK of Great Britain and Northern Ireland, 18 March 2015, http://www.pca-cpa.org/showfile.asp?fil_id=2899 (Accessed on July 10, 2015).

mining. Should the creation of large-scale MPAs in the Pacific be considered as a move to assume a strategic pre-position and indirect control of maritime areas, which will evolve in parallel with diverse issues involving the Pacific?

The maritime pivot is also a combination of subtle and evolving interplays between hard and soft power and private and public power.

References

Amelot, Laurent

2010 « Le dilemme de Malacca », *Outre-Terre*, 25-26(2): 249-271.

British Petroleum (BP)

2004 BP Statistical Review of World Energy – June 2004.

2014 BP Statistical Review of World Energy – June 2014, <http://www.bp.com/content/dam/bp/pdf/Energy-economics/statistical-review-2014/BP-statistical-review-of-world-energy-2014-full-report.pdf> (Accessed on July 9, 2015).

Clarke, Shelley, Mayumi Sato, Cleo Small, Ben Sullivan, Yukiko Inoue, and Daisuke Ochi

2014 Bycatch in Longline Fisheries for Tuna and Tuna-Like Species: a Global Review of Status and Mitigation Measures. 10th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Majuro, Marshall Islands, 6-14 August 2014 (WCPFC-SC10-2014, EB-IP-04).

Clinton, Hillary

2011 "America's Pacific Century", *Foreign Policy*, 11 October 2011, <http://foreignpolicy.com/2011/10/11/americas-pacific-century/> (Accessed on October 9, 2015).

Cole, Bernard D.

2011 "Drawing Lines at Sea". *U.S. Naval Institute's Proceedings Magazine*, 137/11/1,305, <http://www.usni.org/magazines/proceedings/2011-11/drawing-lines-sea> (Accessed on October 9, 2015).

2014 Reflections on China's Maritime Strategy: Island Chains and the Classics. Working Paper in EMC Chair Symposium "Maritime Security, Seapower, and Trade", 24-26 March 2014, <https://www.usnwc.edu/Academics/Faculty/Derek-Reveron/Workshops/Maritime-Security,-Seapower,-Trade/Maritime-Working-Papers/cole-island-chains.aspx> (Accessed on October 9, 2015).

Dyment, Jérôme, François Lallier, Nadine Le Bris, Olivier Rouxel, Pierre-Marie Sarradin, Sylvain

Lamare, Coralie Coumert, Marie Morineaux, and Julie Tourole

2014 Les impacts environnementaux de l'exploitation des ressources minérales marines profondes. Expertise scientifique collective, Rapport. Paris: CNRS-Ifremer.

Gascuel, Didier, and Laura-Mars Hénichart

2011 Étude sur l'état de l'art du rôle des AMPs dans la gestion des pêches. Rapport technique « volet bio-écologie ». Dakar: Commission Sous Régionale des Pêches (CSRP).

- Gay, Jean-Christophe
2014 « Réchauffement climatique: L'instrumentalisation des îles ». *L'Espace Géographique*, 43(1): 81-89.
- Hamilton, Amanda, Anthony Lewis, Mike McCoy, Elizabeth Havice, and Liam Campling
2011 Market and Industry Dynamics in the Global Tuna Supply Chain. Honiara: Pacific Islands Forum Fisheries Agency (FFA), <http://www.ffa.int/node/567> (Accessed on October 10, 2015).
- Leenhardt, Pierre, Bertrand Cazalet, Bernard Salvat, Joachim Claudet, and François Feral
2013 "The rise of large-scale marine protected areas: Conservation or geopolitics?" *Ocean & Coastal Management*, 85: 112-118.
- Patterson, Heather, Scott Hansen, and James Larcombe
2014 A Review of Shark Bycatch Mitigation in Tuna Longline Fisheries. 10th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Majuro, Marshall Islands, 6-14 August 2014 (WCPFC-SC10-2014, EB-WP-05).
- Seidel, Henrike, and Padma N. Lal
2010 Economic Value of the Pacific Ocean to the Pacific Island Countries and Territories. Gland, Switzerland: IUCN, https://cmsdata.iucn.org/downloads/economic_value_of_the_pacific_ocean_to_the_pacific_island_countries_and_territories_p.pdf (Accessed on October 26, 2015).
- Vianna, Gabriel M.S., Mark G. Meekan, David Pannell, Sally Marsh, and Jessica Meeuwig
2010 Wanted Dead or Alive? The Relative Value of Reef Sharks as a Fishery and an Ecotourism Asset in Palau. Perth: Australian Institute of Marine Science and University of Western Australia.
- Western and Central Pacific Fisheries Commission (WCPFC)
2013 Tuna Fishery Yearbook 2012. Noumea, New Caledonia: Pacific Community, Oceanic Fisheries Programme.
2014a Stock Assessment and Future Projections of Blue Shark in the North Pacific Ocean. Report of the Shark Working Group. 10th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Majuro, Marshall Islands, 6-14 August 2014 (WCPFC-SC10-2014, SA-WP-14, Rev.1).
2014b Tuna Fishery Yearbook 2013. Noumea, New Caledonia: Pacific Community, Oceanic Fisheries Programme.
2014c Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean — Summary Report. 10th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Majuro, Marshall Islands, 6-14 August 2014. Majuro: WCPFC, https://www.wcpfc.int/system/files/SC10%20-%20final_posted_rev.pdf (Accessed on October 26, 2015).



Kanak coastal communities and fisheries meeting new governance challenges and marine issues in New Caledonia

Samuel CORNIER, Isabelle LEBLIC

Contextualization

As one of the most biodiversity rich regions of the world, Oceania plays a key role in contemporary ecological, conservation and sustainable development strategies (Dahl and Carew-Reids 1985; Trichet and Leblic 2008; Kingsford et al. 2009). Throughout history, the Pacific environment has shaped Oceanian islander societies, and today it holds natural resources of international interest (D'Arcy 2006). The small Pacific states and overseas territories with few sources of income have mainly focused their cultural and economic strategies on the valuation of these resources and, more recently, on sustainable development. They therefore must deal with the growing constraints of global orientations related to environmental governance and protection, pressure from world powers, and the “soft-power” of conservation organizations (NGOs) targeting their natural heritage (see Giron in this volume; IUCN 2013). Meanwhile, these Pacific small states and overseas territories must also deal with indigenous communities for which coastal and marine territories have always been part of their sociocultural organizations and livelihoods (Malinowski 1935; Kent 1980; Johannes 1981; Hviding and Bains 1992). In Oceania, “community-based” and “participatory” approaches, through the integration of “traditional”¹ knowledge and marine tenure, have become very popular means to reconcile marine conservation, fisheries management² and the development of coastal communities (Ruddle and Johannes 1989; Akimichi 1995; Pomeroy 1995; Veitayaki 2004).

Over the past few decades, marine protected areas (MPAs) have progressively imposed themselves in the region, as elsewhere in the world, as the tool to be used to conserve coastal zones and provide social benefits with the implication of local

1. According to Marcel Mauss' approach (1934), the adjective “traditional” refers to uses and practices inherited from the past even if various transformations have affected the sociotechnical systems. Given the framework of this article, we use this term and “customary” interchangeably (Wagner and Evans 2007). For a definition of “tradition” in Kanak society, see notably Leblic (1993: 19-21).

2. For a collection of studies about traditional fisheries and marine management in Oceania see the Pacific Community Information Bulletin (*Traditional Marine Resource Management and Knowledge* 1992-2015).

stakeholders (Beaumont 1997). However, no uniform definition³ of this notion, which covers diverse realities depending on the region of the world considered, has been offered to date (Salvat et al. 2008). The international Convention on Biological Diversity (Rio de Janeiro, 1992), a founding treaty, recognized the importance of MPAs and established international targets to create a representative network that should cover 20 to 30% of the world's marine habitats (Day et al. 2015). MPAs have become instruments of state legitimization around which complex issues are tending to crystallize (Boncoeur et al. 2004; Dahou et al. 2004; Gaspar and Bambridge 2008) and elicit the “know-how” of a corpus of specialized experts at the impetus of international conservation lobbying groups (Claudet 2011; Féral 2011; Day et al. 2015). Recognition of this know-how has become a determining factor within the “management culture” taking root at the global level, and in which France wishes to impose itself as a leader⁴ for a “Pacific vision” of MPA governance (Salvat et al. 2008).

For decades, New Caledonia, a French overseas territory located in the southwest part of the Pacific Ocean near Australia and New Zealand (see fig. 1), has played an important role in improving regional and national environmental, marine governance and sustainable development strategies (Cornier 2009: 107-117). The New Caledonian archipelago, which includes a main island (named *Grande Terre* in French) and various smaller surrounding islands (fig. 2), is widely known for its outstanding biodiversity. It is identified by the scientific community as the second hotspot of the planet after Madagascar, and the third country for vegetal endemism, after Hawaii and New Zealand (Richer de Forges and Pascal 2008).

Given that the archipelago is estimated to hold 20 to 40% of world resources⁵ in nickel ore, it is also one of the leading countries in this mining industry. At the same time, New Caledonia is facing a crucial moment in its history, and between 2014 and 2018 must decide on its political future through a consultation process on “self-determination”.

3. The reference framework is set by the definition given by the World Conservation Union: “A MPA is a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.” (Dudley ed. 2008, Day et al. 2012). This definition is based on six levels of protection, ranging from “strict nature reserve” (Ia) set aside for scientific research only and off limits to the public, to “sustainable resource management areas” (VI). Despite the recent revision of the classification, the contents and scope of this definition remain debatable with regard to the contemporary development of MPAs (Féral 2011; Roth and Thompson 2012).

4. France equipped itself with a new institutional tool in 2007, the Marine Protected Areas Agency (*Agence des Aires Marines Protégées* in French), which has become “France’s strike force to realize its conservation and marine conservation policy”, although its activities and role are still being debated (Féral 2011). In 2013, it organized the 3rd International Marine Protected Areas Congress (IMPAC3) in Marseille (France).

5. The term “resources” designates the ensemble of nickel volumes identified to date (25% in 2014). It must be distinguished from “reserves”, which correspond to the share of resources whose economic viability is ensured under precise market conditions (15% in 2014). The share of the latter can evolve depending on sale prices and new extraction and handling procedures (CEROM 2015).

Figure 1: New Caledonia in the landscape of Oceania

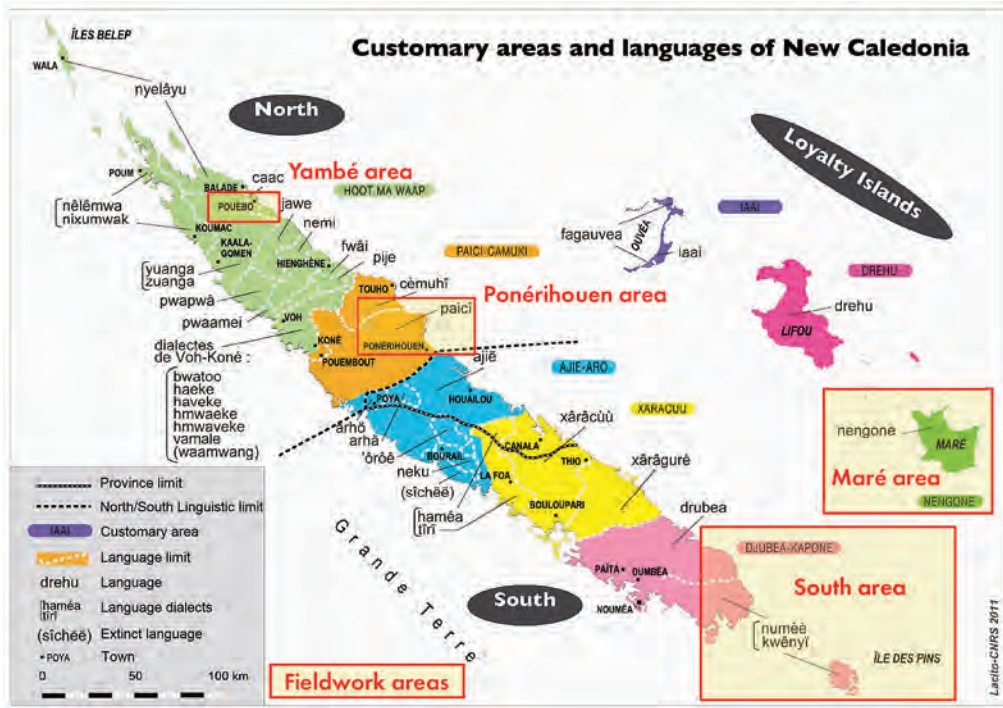


Sources: Adaptation by S. Cornier and I. Leblic of the "Oceania UN Geoscheme - Map with Zones", licensed under CC BY-SA 3.0 via Wikimedia Commons, URL: https://commons.wikimedia.org/wiki/File:Oceania_UN_Geoscheme_-_Map_with_Zones.svg#/media/File:Oceania_UN_Geoscheme_-_Map_with_Zones.svg

Being a world nickel leader while at the same time a sanctuary for biodiversity represents huge challenges and issues for such a small archipelago, and political institutions must reconcile these to plan for development (Leblic 1993; Faugère and Merle 2010; Demmer and Salomon 2015). Various economic interests and socio-cultural and political strategies are at stake and give momentum to opposing views about the choices to be made concerning New Caledonia's governance and self-determination. The Kanak indigenous people are heavily invested in all of these issues on which they have built part of their cultural identity recognition (Leblic 1993; Winslow 1995; Horowitz 2004). In this context, Kanak coastal communities and fisheries are facing new marine governance policies, sustainable governance challenges and mining governance schemes. This paper aims to bring together and examine these issues from a contemporary perspective.

The present paper is based on field research (see fig. 2) conducted by Isabelle Leblic (1983-1989) in the south of New Caledonia (Isle of Pines, Yaté, Goro), on Maré Island, and on the East Coast (Ponérihouen), and by Samuel Cornier (2009-2013) on the North East Coast (Yambé). It focuses on Kanak traditional knowledge, marine customary management and fisheries, MPAs and the Coral Sea National Park around New Caledonia.

Figure 2: Map of linguistic and customary areas and location of the fieldwork areas on which this case study is based



Sources: Adaptation and translation from French to English by S. Cornier and I. Leblic of the map *Aires coutumières et langues de Nouvelle-Calédonie*, Lacito-CNRS, 2011.

Historic and contemporary context of New Caledonia

The archipelago has been inhabited since at least the Lapita period, dating back roughly 3,000 years (Sand 1995). It later hosted a civilization based on yam culture common to this part of Oceania, known as Melanesia (Haudricourt 1964). Cosmopolitical⁶ systems, referred to as “custom” in Melanesia, were structured around the triad “land - myths - social organization” (Missotte 1985; Leblic 1993). Social organization

6. According to the Political Ecology theory, the adjective “cosmopolitical” refers to sociopolitical organizations and systems of beliefs at the foundation of “humans and non-humans” management. Cosmopolitical also distinguishes between the Western “modern” approach of political ecology, relying on the dichotomy “nature/culture”, and “non-modern” approaches on which most non-Western societies rely (Descola 2005; Latour 2004; and for Kanak societies Leblic 1993, 2005).

relied on related patrilineal lineages occupying complementary functions and forming “customary groups” (Leblic 1989a, 1993: 90-106). Land was the pillar of these groups’ existence. Their social identity was built in interaction with the territory where they were settled. The myths rooted in this territory recounted the origins of lineages and customary groups as well as their histories and migrations on which their statuses and functions in the society were based. The social hierarchy was organized around the “Elder son” (*Grand fils* in French), who descended from the “founding ancestor” and had particular “land-owner” rights over the territory because of his autochthony and status as “first occupant” (i.e., Leblic 1993: 75-116, 2000c, 2008). The rhythm of life was organized around the yam calendar with specific ritual ceremonies during which exchanges and alliances between lineages reinforced the customary groups’ identity and complementary functions (Leblic 1989a, 1993: 90-106, 2008). These groups were scattered across each island within more or less expanded sociopolitical wholes depending on their kinship links and alliances. When New Caledonia was discovered⁷ in the XVIIIth century, the archipelago was divided into distinct geographical “customary areas”⁸ within which groups shared genealogical, political and linguistic ties (see fig. 2). These customary areas were further subdivided into “customary districts” then “countries”⁹ at smaller social, territorial, and linguistic scales. Each country relied on a specific and more or less developed system of functions depending on the demography and level of cohesion and organization of the customary groups and territories. Nowadays, these pre-colonial cosmopolitical systems are referred to as “clans” (a set of lineages sharing the same name), “chiefdoms” (land-owner clan at the level of the country), “tribes” (customary group depending on the chiefdom), and “supra-chiefdoms” (land-owner clan at the level of a customary district) according to the Western classification introduced through colonization and history (i.e., Leblic 1989a, 1993: 90-106).

After an initial period of contact with missionaries and marine traders, New Caledonia was occupied by France in 1853 and rapidly became a penal and settlement colony (Leblic 1993: 24-30). Indigenous people were given the name, “Kanak”,¹⁰ and underwent a colonization process based on their confinement in reserves, the

7. Cruising for the first time near *Grande Terre* in 1774, James Cook named the island “New Caledonia” because it resembled the coasts of his Scottish homeland (*Caledonia* in Latin).

8. This pre-colonial administrative breakdown was recognized in the 1988 Matignon-Oudinot Accords with the creation of “customary areas” ratified by the institutional law n° 99-209 which defined the institutional functioning of New Caledonia.

9. The term “country” refers to Kanak cosmopolitical organization over a specific territory.

10. The name “Kanak” comes from the Hawaiian term *Kanaka*, meaning “human being”, which was generally given in the 19th century by European navigators to indigenous people from Melanesia. It progressively became a pejorative name for indigenous people from New Caledonia during the early colonization period (most of the time written “Canaque”) before being reclaimed in the 1970s under the process of indigenous cultural recognition.

spoliation of their lands, their evangelization and the denial of their traditional organizations and beliefs (Leblic 1993: 10-74; Merle 1998; Faugère and Merle 2010). This colonial situation had major incidences on the pre-colonial cosmopolitical systems and the identity of the customary groups, and led to the rise of Kanak cultural and independence claims in the 1970s (Leblic 1993; Chappell 2003). These claims culminated in a rough period of conflicts called “The Events” (*Les Événements* in French) at the end of the 1980s. To end these conflicts, a so-called “negotiated decolonization” process based on the Matignon-Oudinot Accords (1988) was initiated. The objectives were to end the violence, create local institutions and organize New Caledonia’s self-determination within 10 years (Barbançon 2015). These agreements were followed by the Noumea Accord (1998), in which the preamble recognized the Kanak people as the indigenous people of the archipelago and acknowledged the trauma they suffered from colonization (Leblic 1993; Mokaddem 2012). A strategic document also defined, amongst many other institutional, economic and social considerations, a framework aiming to increase the autonomy of New Caledonia and extend by a further 20 years the preparation period for a consultation process to define its future political status.

New Caledonia consequently fell into a specific *sui generis* territory status adapted to the French Constitution and structured around three pillars: local autonomous institutions (New Caledonia government, three Provinces — see fig. 2, and some transferred competencies, with some sovereign responsibilities retained by France¹¹); the recognition of Kanak customary cosmopolitical organization; and the planning of a consultation of the population about the future of the archipelago.

The Noumea Accord also stated that this consultation process¹² was to take place between 2014 and 2018¹³ under the initiative of the New Caledonia Congress so that everyone holding citizenship¹⁴ could vote on the territory’s future legal status, the remaining sovereign competencies, and citizenship matters. Part of the self-

11. Since the Noumea Accord, the French government has progressively been transferring, or sharing, institutional competencies to New Caledonia, such as education, environmental management, political organization and some foreign policies, while keeping sovereign powers in the domains of foreign affairs, justice, defence, public order and currency policies.

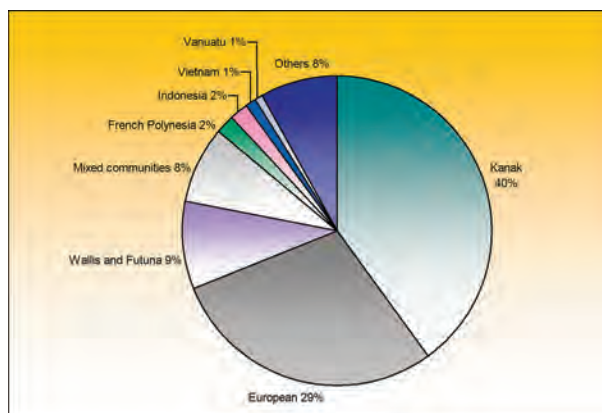
12. In New Caledonia, it is common to allude to this process as the “self-determination referendum” which could be one of the possible modalities although there is no explicit reference to this consultation mode in the Noumea Accord.

13. If by 2019 this deadline has not been respected, the task of organizing the consultation will fall to the French government.

14. Under the Noumea Accord, New Caledonian citizenship is attributed according to specific criteria, in particular residence, around which the electoral rights of people living in New Caledonia are defined. This citizenship leads notably to particular electoral restrictions depending on the type of election (provincial, territorial, self-determination, or national) which are today at the heart of the local political debate and the cause of high tension between parties present (Graff 2012).

determination process also aims to create a socioeconomic balance¹⁵ between the north of the island (with a Kanak majority) and the south (mostly Westernized around the main city of Noumea). Another objective is to build symbols¹⁶ that could be shared by all of the inhabitants of New Caledonia and therefore induce a sense of “common destiny” among them (Leblic 2007; Faugère and Merle 2010). Some of these symbols were widely accepted (slogan, anthem) but there continues to be sharp controversy over the future flag of New Caledonia, which is subject to social and political tensions (*Les Nouvelles calédoniennes* 2015).

Figure 3: Distribution of communities in New Caledonia in 2009



Sources: S. Cornier and I. Leblic, using “Répartition de la population par communauté en 2009”, ISEE, URL: <http://www.isee.nc/population/recensement/communautes>

New Caledonia cultural and marine biological diversity

Due to the French government’s settlement and development policies, people from various countries and other islands of the Pacific region started to occupy the archipelago from the 19th century onward. Initially, metropolitan French were deported to New Caledonia, then, starting in the 20th century, others were attracted by economic and employment opportunities, and were encouraged by the French government (Leblic 1993). The history of the colonization, settlement and development of the territory, combined with Oceanian migration processes, thus contributed to the formation of a multi-ethnic society (see fig. 3). Complex claims based on community, identity and language are being voiced in the New Caledonian society

15. See also Leblic (1993) for a previous socioeconomic north-south rebalancing project in the 1980s.

16. Among which a flag, the future name of New Caledonia, a slogan, an anthem and currency graphics.

today (Leblic 1993; Sand et al. 2003; Demmer and Salomon 2015). Huge inequities still exist between the three Provinces: the Kanak people represent the majority of the population in North Province and the Loyalties, while they are a minority in South Province, which hosts almost 70% of the total population¹⁷ of the archipelago, with more than 50% living in the main city, Noumea. Nevertheless, the majority¹⁸ of Kanak people now live in Noumea as well (ISEE 2014).

New Caledonia hosts some of the richest marine biodiversity in the world, with approximately over twenty thousand species, 5% of which are endemic, inhabiting what is the longest continuous coral barrier reef of the world and the second largest after the Great Barrier Reef of Australia (Comité local Ifreco 2006a; Richer de Forges and Pascal 2008). Marine scientists and environmental NGOs (such as Conservation International and the World Wild Fund) also consider the archipelago to be a sanctuary for many emblematic species such as whales, sea turtles, dugongs and birds. At the national level, New Caledonia's exclusive economic zone (EEZ) represents the second largest maritime territory after French Polynesia, with a surface area of nearly 1.4 million square km. The archipelago alone holds 75% of the coral reefs and lagoons under French jurisdiction (Comité local Ifreco 2006a; Richer de Forges et Pascal 2008).

This national and international recognition, combined with contemporary socioeconomic issues,¹⁹ were among the reasons that six marine clusters in the lagoons of New Caledonia, forming a serial site, were inscribed on the World Heritage List in 2008 (see fig. 4 and Comité local Ifreco 2006a). The total area covers 16 million hectares, which represents almost 60% of New Caledonia's marine coastal territories. An innovative framework was designed for the conservation of this area based on the concept of "integrated and participatory co-management". Integrated coastal zones management consists of linking these marine clusters, which are deemed representatives of the marine biodiversity and ecosystems of the archipelago, to several upstream terrestrial buffer zones (Cicin-Sain and Belfiore 2005). The co-management of this area relies on the participation of international stakeholders (French MPA Agency, NGOs such as the World Wild Fund and Conservation International, UNESCO, scientific institutions such as the Research and Development Institute and Ifremer), the implementation of an "MPA network",²⁰ and multiple institutional scales of competencies. The legislative organization of

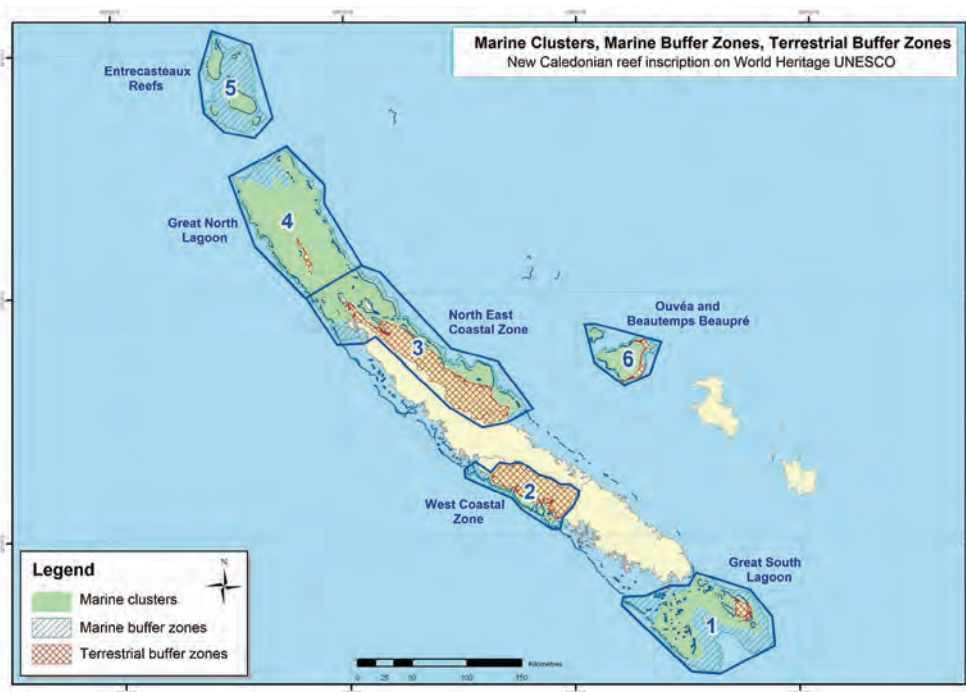
17. The total population of New Caledonia was estimated to be 268,767 inhabitants in the last census conducted in 2014 (ISEE 2014).

18. The same census counted 42,065 Kanak residents in Greater Noumea (*Grand Nouméa* in French) for a total of 104,958 representatives of this community (ISEE 2014).

19. This project was initiated by local NGOs campaigning for sustainable development alternatives to the mining industry (Corail Vivant, Action Biosphère) and was supported by Kanak authorities via the customary Senate (Cornier 2009: 122-123).

20. The World Conservation Union defines an MPA network as: "a collection of individual marine protected areas or reserves operating co-operatively and synergistically, at various spatial scales and with a range of

Figure 4: New Caledonia coastal zones and terrestrial buffer zones inscribed on the World Heritage List in 2008



Sources: Translation from French to English by S. Cornier and I. Leblac of Map 1.a. in Comité local Ifreco 2006a, Annexes Cartographiques, p. 4

New Caledonia leads in particular to a specific sharing of responsibilities. The Provinces, which have authority over the waters within their respective maritime public domains, as well as questions regarding the environment, are responsible for managing classified areas and the development of MPAs under their jurisdiction. The New Caledonia government, which has authority over the EEZ's territorial waters, is responsible for the overall management of the UNESCO heritage site. The French government, which has sovereign power over New Caledonia's EEZ, supports the local authorities in their management efforts, providing technical support for MPAs and ensuring coordination with regional and national actions²¹ and international conventions relative to the marine environment. Since 2012, the

protection levels that are designed to meet objectives that a single reserve cannot achieve" (Dudley ed. 2008).

21. For the main ones: *Programme régional océanien pour l'environnement* (PROE), Coral reef initiatives for the Pacific (CRISP), *Initiative française pour les récifs coralliens* (Ifreco), *Grenelle de la Mer*, RAMSAR Convention, Convention on Biological Diversity.

Conservatory for Natural Spaces²² was given the task of coordinating the management of the heritage site and works as a mediator between all of the stakeholders. Last but not least, the framework of the UNESCO area aims to closely integrate local stakeholders in a participatory process. Following global recommendations, Kanak indigenous communities living in the specified coastal zones were targeted by community-based approaches (Pomeroy 1995; Roe et al. 2000; Pollnac et al. 2001). In this perspective, traditional knowledge and customary management²³ were identified as a means to promote sustainable development (Comité local Ifrecor 2006a).

Traditional marine management systems in Kanak society

The concepts of “naturalist knowledge and know-how”²⁴ were introduced in the 1950s as part of the methodological approach on which the ethnosciences are based (Barrau 1985; Friedberg 1987; Sheps 1993). This approach relies on the Western scientific idea that relationships between human beings and nature can be described by collecting and inventorying quantitative data related to local uses and perceptions of the environment. From the 1980s, it became very popular in the fields of environment management, biodiversity conservation and sustainable development, with a growing interest in the term “traditional ecological knowledge” (TEK)²⁵ (Johannes 1989; Inglis 1993; Berkes et al. 2000). However, there is considerable controversy over this term, mainly because it relies on a Western academic perspective and does not properly reflect, from most indigenous viewpoints, their holistic systems of knowledge which are part of larger cosmopolitical systems (McGregor 2008). TEK nonetheless remains widely popular. Interest in traditional knowledge initiated new maritime

22. The Conservatory for Natural Spaces (French acronym, CEN, for *Conservatoire des Espaces Naturels*) of New Caledonia is a public interest group dedicated to supporting environmental management and actions at the level of the archipelago. It is part of the French CEN network. URL: <http://www.reseau-cen.org/fr> (Accessed on October 10, 2015). See Decree n° HC/DIRAG n° 08 of 28 February 2011 concerning its constituting convention for more information on the organization and mission of the CEN (*Journal officiel de la Nouvelle-Calédonie – JONC* of 22 March 2011: 2460-2470).

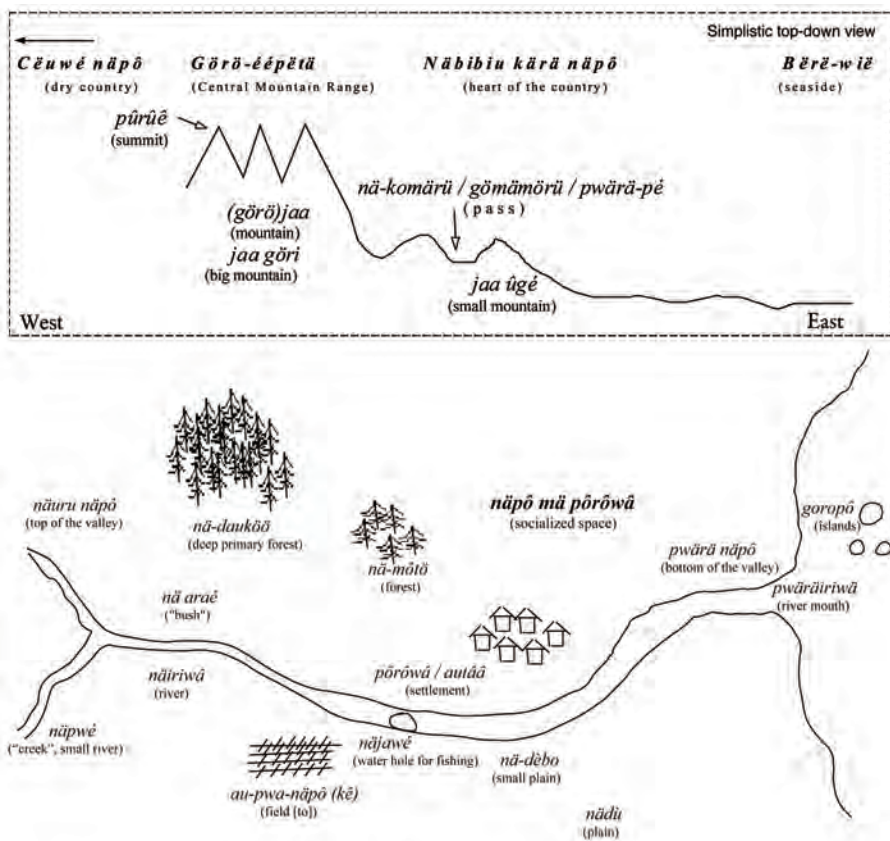
23. Under Article 3 of national law n° 2001-017 of 11 January 2002 transferring the management of the maritime public domain to the Provinces, recognition is given to the existence of “customary uses” of the marine environment requiring special provisions. This recognition of specific rights based on custom does not imply a private appropriation of coastal waters but allows the provinces to take them into account if they so wish.

24. These concepts have been particularly studied in French anthropology (see chronologically Lévi-Strauss 1962; Chamoux 1981; Sperber 1982; and for the Kanak context, Leblic 2008).

25. For a review of the diversity of definitions and ideologies surrounding TEK and some other similar terms (indigenous or aboriginal knowledge), see for example the online compilation from the National Aboriginal Forestry Association. URL: http://nafeforestry.org/forest_home/documents/TKdefs-FH-19deco6.pdf (Accessed on September 23, 2015).

anthropology epistemological discussions to deepen understanding of the technical processes and occupation, exploitation, and appropriation modes of fishers and coastal communities and their representations of marine spaces (Breton 1981). Oceania played a major role in this renewal and consolidation of marine ethnobiology. Research conducted in this region revealed that indigenous Pacific populations had developed a corpus of highly specialized traditional knowledge linked to the marine species and coastal ecosystems that they exploited, and diversified traditional marine tenure systems or customary management systems aiming to regulate the uses of, and access to, marine resources and territories (Johannes 1981; Ruddle and Akimichi 1984; Ruddle and Johannes 1989).

Figure 5: An example of mapping a Kanak “country”: simplistic top-down view of the east coast of the paicî country and simplification of a lived space in this country, referred to as *nāpō mā pōrōwā* in the paicî language (meaning “country and settlement”) (valley of Gōiëta, Ponérihouen).



© I. Leblac, translated from French to English from Leblac 2005: 97-99

In this context, between the 1980s and the mid-1990s, studies were initiated by Isabelle Leblic²⁶ in New Caledonia to gain a better understanding of Kanak fisheries and were progressively extended to traditional knowledge, customary marine tenure and development issues (Dahl 1985, 1989; Leblic and Teulières 1985, 1987; Leblic 1990, 1991, 1993, 1999, 2001a, 2008). It has been revealed that despite colonization and its impacts on customary livelihoods, traditional knowledge and marine tenure systems are still operating in diverse ways in Kanak coastal communities. One point which must be kept in mind is that, as in most non-Western societies, the idea of “nature” does not exist in Kanak cosmogony. What makes sense is the country, defined as a territory where humans (sharing the same habits, languages and kinship links) and non-humans (animals, plants and spirits) are interconnected with each other (see fig. 5 and Leblic 2005: 97-100). At the level of the country, the concept of “land” extends from the mountain range to the barrier reef, including the lagoon, and thus reveals continuity between land and sea. Marine territories are therefore subject to the “customary law” of each country and fall under the responsibility of landowner clans just like any other type of territory. The main design principles of traditional marine management in Kanak society are the spatial and social boundaries determining the authority, system of rights²⁷ and rules within the fishing community and cosmopolitical organization specificities of each country.

Pictures 1-3: Ancient fishing artefacts in the Museum of New Caledonia (Noumea)



1. Dam filter on a raft, 2. Traditional fishing nets, and 3. Octopus fishing lure.

Sources: Leblic 2008: 59, 53 and 66, courtesy of the Museum of New Caledonia in Noumea, pictures by I. Leblic.

In her summary work of the ways Kanak societies live with the sea, Isabelle Leblic (2008) nevertheless suggests that, despite the diversity and singularities of countries, a

26. Jacques Barrau invited Isabelle Leblic to respond to a 1982 CORDET call for tenders on fishing in the Dom-Tom and she proposed a response on New Caledonia which lies at the origin of Kanak maritime anthropological research (Leblic 2002a: 116).

27. Marie-Hélène Teulières-Preston (1992, 2000) introduced the term “customary maritime law” to define specific rights of use claimed by a clan resulting from its historical relationship with a specific marine territory.

Pictures 4-5: Daily fishing practices



4. Women collecting shells along the coast of Yambé and 5. A fisherman with his net on the shore.
© S. Cornier, 2010 and 2012.

general framework of customary marine management can be identified. Kanak fishing practices generally rely on specific traditional knowledge of marine biodiversity and ecosystems. Using a cultural technology methodology (see Creswell and his team, in the years 1970-1980; Haudricourt 1988) and ethnoscience, Leblic introduced a categorization of Kanak naturalist knowledge which includes the marine territory (toponymy; topography), species (biotope and life cycle; vernacular nomination and classification systems), annual ecological rhythms (moon and tides; seasons; winds; variations of weather), and associated technical skills (lure fishing; dam filters; various nests; harpoons; see pic. 1-3). Moreover, fishing practices are organized by gender. Men generally fish in the lagoon (for bait and/or daily supply), while women fish mostly from the shore and on the reef (collecting shells) (see pic. 4-5). An important distinction is also made between individual practices (for household and everyday supplies) and collective practices (dedicated to customary events such as annual celebrations, weddings, and burials) targeting specific species²⁸ and relying on specific skills, rights and rules (see pic. 6-7).

From a technical perspective, the Kanak make a clear distinction between knowledge which is locally qualified as indigenous, having mythic origins and “stolen” from the spirits (Leblic 1988, 2000b, 2001b), and exogenous knowledge and/or fishing gears which have been introduced since colonization. Indigenous knowledge includes magical and propitiatory skills and practices (magical stones, places of cult) dedicated to favour fishing through requests to the ancestors (see pic. 8a-b). “Totems”²⁹ and

28. These species (such as sea turtles and dugongs) generally are described as “customary” due to their symbolic and ritual dimensions. See the next paragraph on this topic and Leblic (2008).

29. In New Caledonia, on the basis of Maurice Leenhardt’s research (1930, 1946), “totem” refers to one form of the ancestors of the clan, or the lineage, and is presented in oral tradition as being at the origin of the paternal clan. For marine totems considerations see Leblic (2000a, 2002b and 2008: 200-205).

Pictures 6-7: Return from collective fishing



6. Return from sea turtle fishing in Goro (February 1986) and 7. Return from milkfish or *mijkwa* (*Chanos chanos* [Forsskål 1775]) fishing (October 1983) in the Isle of Pines.
© I. Leblic, 1986 and 1983

Pictures 8a-b



a. Old fishing magic stones and b. Mââgenin Rock, bay of Oro, an old place of cult for votive practices on the Isle of Pines.

Sources: Leblic 2008: 197-198, 8a: courtesy of the Museum of New Caledonia in Noumea, picture by E. Dell'Erba, 8b: © I. Leblic

ancestors play a major role in Kanak fisheries; as in every other human activity, their support is critical for success. In particular, some marine species are recognized as “customary species”³⁰ (Leblic 2008). The criteria for this designation can vary like the “authenticity value” in relation to the indigenoussness and status of different clans. Thus across New Caledonia, numerous clans have totems of marine species

30. Among these, sharks and banded sea kraits (*Laticauda colubrina* [Schneider 1799]) are among the most remarkable and widespread, but numerous other species such as the bluespine unicornfish (*Naso unicornis* [Forsskål 1775]), milkfish (*Chanos chanos* [Forsskål 1775]), dugong (*Dugong dugon* [Müller 1776]), sea turtles, and crabs can be encountered in different regions of the archipelago.

which have symbolic and ritual functions due to their links with the ancestors and mythic origins of some lineages (Leblic 1989b). For this reason, their capture, like their consumption, obeys very strict rules and involves the rights and specific competencies of certain clans to which they are sometimes exclusively dedicated. These customary species can play a symbolic role in the management of the marine world in order, for example, to guide fish into the nets or protect sailors during fishing expeditions. They can also act as guardians of marine territories. Totems and ancestors ensure the respect of customary maritime law and prohibitions, protecting in particular “taboo”³¹ sites, and can severely punish offenders (Leblic 2008).

Finally, to guarantee respect of customary maritime law, as well as the success of collective practices, some clans hold a high degree of naturalist knowledge and sociotechnical and magical skills; they are often recognized as “fishing clans”³² within the system of complementary functions operating in the country. In the past, their function used to be mainly identifying and effective during customary ceremonies and ritual exchanges between the chiefdom and its partners.

To conclude this section, it is critical to keep in mind that in Kanak coastal communities, the whole marine environment is socialized. As part of larger cosmopolitical systems, traditional marine management and fisheries rely on singular social organizations, countries, vernacular languages, naturalist knowledge and technical and magical skills. For these reasons, from a Kanak perspective, protecting the environment through the management of marine resources and territories is above all a way to preserve their livelihoods, technocultural systems, identity and heritage. Past research has demonstrated the existence of traditional marine conservation measures in some Kanak coastal communities, including “customary reserves” (Leblic 1989a-b, 2001b, 2008; Teulières-Preston 2000; Horowitz 2004, 2008). Léa Horowitz (2008: 263) provides some explanation about Kanak customary reserves: “Areas of land or sea may be set aside by customary authorities as ‘reserves’ for the exclusive use of certain groups or as a food source to be harvested during customary ceremonies (Teulières-Preston 2000). People may involve kin relationships to gain permission to fish or hunt in some types of reserve areas. In contrast, outsiders, usually townspeople of European origins, are often kept out of these reserves with road blocks or even chased away at gunpoint. While usually tolerated by local gendarmes, Kanak reserves are illegitimate under the French (now Provinces) legal systems which stipulates that the lagoon and state-owned lands are open to all”.³³

31. “Taboo” refers to a social, magical, religious or ritual prohibition, and to the object or the place targeted by the prohibition (Leblic 1989b, 2002b, 2005).

32. Isabelle Leblic (1988, 1989ab, 1991, 1993, 2001a, 2008) introduced the term, “fishing clans”, to define the clans which are the depository of rights and/or functions over parts of marine spaces according to their historical relationships with these territories.

33. See also Leblic (1989a, 2008).

This perception refers to a “substantive rationality”³⁴ which differs drastically from “formal rationality” inherent in Western perceptions of the environment and modern conservation, and in which the protection of biodiversity remains the primary goal and achieved through the regulation of human activities. The confrontation between these two rationalities has deep consequences for environmental and conservation projects implemented today in New Caledonia in the context of marine protected areas (MPAs).

Case study: the Hyabé/Lé-Jao Marine Protected Area (Yambé)

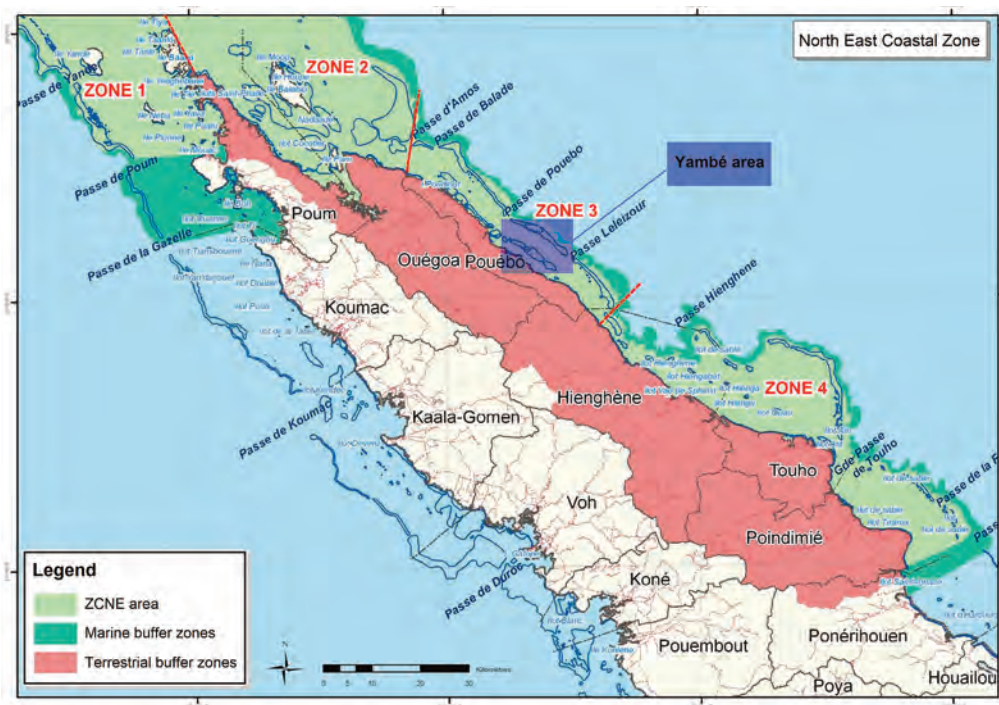
Indigenous people from all of the Pacific Islands have developed traditional marine conservation methods targeting specific areas (Johannes 1978; Ruddle and Akimichi 1984; Ruddle et al. 1992). The management of these “customary reserves” operates through a system of area-specific restrictions such as fishing closures and openings, prohibitions of particular fishing gears or targeted species fishing regulations discussed at the level of the local communities. Meanwhile, indigenous communities often expected recognition of their cultural identity and heritage in the conservation project in which they were supposed to be involved (Horowitz 2008). Improvements in the implementation of MPAs thus progressively led to new schemes to better integrate traditional knowledge and customary management into Western marine conservation and fisheries management policies (Johannes 1982; Fiske 1992; Veitayaki 2004; Cinner and Aswani 2007).

In New Caledonia, researchers have shown an increasing interest in these topics since 2008 with a focus on the UNESCO World Heritage sites and associated MPAs (Horowitz 2008; Cornier 2009, 2010; Bodmer 2010; Faurie 2011a-b). Among the classified areas, the Northeast Coastal Zone (henceforth referred to using the French acronym, ZCNE, see fig. 6) can be distinguished by a number of singular features. Possession of the archipelago took place in this region,³⁵ which was deeply marked by the colonial period. It remained for a long time marginalized due to its distance from the main economic centre, as well as its historic opposition to the regime imposed by France (Saussol 1979: 145-153; Rougeyron 1995). The contemporary situation is characterized by socioeconomic constraints related to infrastructure, local employment, and development projects (Leblic 1991, 1993; Freyss

34. Donna Winslow (1995) suggested that the Kanak approach of managing the environment and natural resources can be called “substantive rationality”, characterized by the intrinsic values of an object or an act. In opposition, she suggested that the Western approach can be called “formal rationality”, characterized by the intellectualization of “nature” and increasingly efficient means of managing the environment and natural resources.

35. The official act was signed 24 September 1853 in Balade, some 20 kilometres north of the Yambé tribe, by Admiral Auguste Febvrier-Despointes. Sometime later, the captain of the ship Tardy de Montravel had the great chief of the region sign a declaration recognizing the sovereignty of Emperor Napoléon III over New Caledonia (Leblic 1993; Rougeyron 1995).

Figure 6: New Caledonia Northeast Coastal Zone and terrestrial buffer zones listed on the World Heritage in 2008 and the Yambé tribe's area



Sources: adaptation and translation from French to English by S. Cornier of Map 1.d. in Comité local Ifreco 2006a, Annexes Cartographiques, p. 7

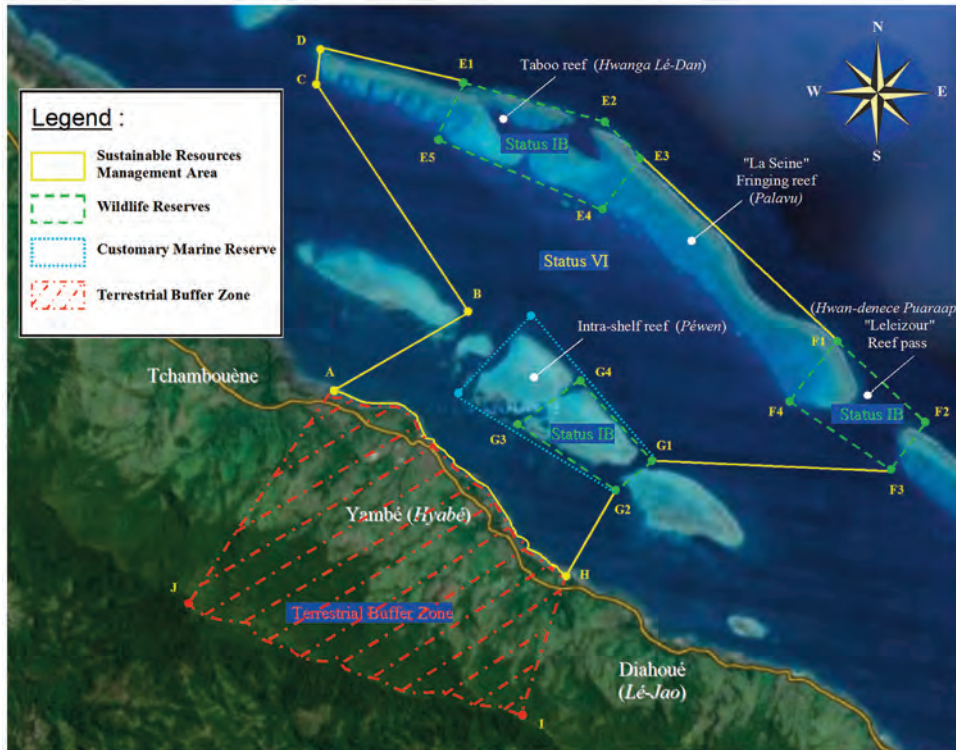
1995: 401–413; Cornier 2010: 38–41). However, this isolation has also helped maintain ways of life, traditional knowledge and customary management, particularly in relation to maritime territories. It would thus be relevant to examine the expectations of local communities with regard to these MPAs, the ways traditional knowledge and customary management operating in this area are taken into account, and the contribution of these local development projects, notably involving fisheries.

The Yambe tribe's area was selected as one of the two³⁶ pilot MPA projects of the ZCNE (see fig. 6). Samuel Cornier (2010) established the correlation between this choice and the prior identification, based on scientific inventories,³⁷ of “customary

36. The second site is further south in the district of Hienghène, where the two Yeega and Doïmen MPAs were established at the same time (see fig. 9; Faninoz 2009).

37. Rapid marine assessment programme coordinated by Conservation International (Mc Kenna et al. 2006); Marine ecoregional analysis coordinated by WWF (Gabrié et al. 2005); Interim report for the north-east MPA projects coordinated by WWF (Baudat-Franceschi 2007).

Figure 7: Mapping of the official boundaries of the Hyabé/Lé-Jao multi-use MPA and the previous Yambé tribe's customary reserve



Sources: S. Cornier using Google map; Cornier 2010; Faninoz 2009

conservation measures set up by the tribe” (existence of a customary marine reserve,³⁸ a reef considered taboo,³⁹ regulation of dugong fishing) and a “local will to preserve” in response to fishing pressures from neighbouring tribes. Furthermore, the sub-dossier corresponding to the ZCNE had already fixed specific objectives: “identify indigenous knowledge, uses, and organization of the customary management of the marine environment”; “create one or several MPAs”; and favour “participatory management” (Comité local Ifrecor 2006b: 37-38). The World Wild Fund (WWF),

38. Operating on the intra-shelf reef named *Péwen*, which means “manta ray” in the local vernacular language in reference to the shape of the reef.

39. Underwater canyon within the La Seine fringing reef named *Hwanga Lé-dan*, which means “subsea tribe” in the local vernacular language. People from Yambé consider that a tribe lives in this part of the reef, which explains why it is targeted by a social taboo and specific behaviours (customary request and gestures necessary to enter, injunction not to talk loudly, laugh or shout) must be respected in this place.

in partnership with North Province, which is responsible for managing the ZCNE, was given the task of implementing this MPA through a participatory process involving the local Yambé tribe. The Hyabé/Lé-Jao MPA was officially established⁴⁰ on 28 August 2009 and inaugurated on 12 March 2010 (WWF 2010). It is a “multiple-use”⁴¹ MPA, meaning designed around three types of management areas,⁴² where conservation objectives and North Province’s normative framework are expected to meet local traditional marine tenure (see fig. 7 and tab. 1).

Table 1: Customary marine management meeting the framework of marine conservation through the implementation of the Hyabé-Lé Jao MPA

Customary marine management			Hyabé/Lé-Jao Multi-use MPA	Marine conservation tool-kit		
Customary regulation	Customary stakes	Customary zoning	North Province Referential zoning	Conservation stakes	Methodological concepts	MPA regulation
Fishing prohibited except for Yambé clans with respect to customary behaviours	Symbolic value Enforcement of the customary prohibition	Taboo reef : <i>Hwango Lé-Dan</i>	Wildlife reserve E ₍₁₋₅₎	Rare geomorphologic unity : deep lagoon in barrier reef Exceptional live coral cover	North Province - IUCN referential (IB) : Wildlife reserve Ecosystemic approach Ecological corridors	“Permanent no-take” area : fishing strictly prohibited at any time
Marine boundary with the Diaboué chiefdom	Respect of customary alliances and kin relationships	Reef pass “Lelazour” : <i>Hwam-demece Puaroop</i>	Wildlife reserve F ₍₁₋₄₎	Intersystemic exchanges: lagoon/deep-sea interface	Ecotourism Scientific prospection Emblematic species Ecological anchors	
Fishing prohibited except for customary events Customary partnerships with the Diaboué and Tchambouéne tribes	Seafood supply for customary ceremonies and exchanges Enforcement of the customary regulation	Customary marine reserve : Intra-shelf reef <i>Péwen</i>	Wildlife reserve G ₍₁₋₃₎	Rare geomorphologic unity : double barrier reef Two species in overfishing : trochus (<i>Trochus niloticus</i>) and giant clams (<i>Hippopus hippopus</i>)		“Partial no-take” area : fishing prohibited excepted for customary events “Permanent no-take” area for giant clams and trochus
Yambé chiefdom’s customary maritime law Marine boundary with the Tchambouéne chiefdom : northern part of “La Seine” reef	Marine customary rights recognition Continuity between land and sea of land-owner rights Respect of customary alliances and kin relationships between tribes	Yambé clans customary fishing area for everyday supply Customary fishing area shared with the neighbouring tribes	Sustainable resources management area (A-D-F2-H)	Targeted at/or endangered species : Humphead wrasse (<i>Chelinus undulatus</i>), Loggerhead sea turtle (<i>Caretta caretta</i>), Green sea turtle (<i>Chelonia mydas</i>), Hawksbill sea turtle (<i>Eretmochelys imbricata</i>), Whale shark (<i>Rhincodon typus</i>), Dugong (<i>Dugong dugon</i>)	North Province - IUCN referential (VI) : Sustainable resource management area Ecosystemic approach Emblematic species Fisheries sustainable management IUCN Red List	Public maritime domain North Province “Permanent no-take” area for dugong “Partial no-take” area for sea turtles : fishing prohibited excepted for customary events with provincial derogation
Yambé chiefdom’s customary land law		Yambé chiefdom’s customary land	Terrestrial buffer zone (A,H,I,J)	Regulation of inland activities and pollution within MPA coastal zones	Integrated coastal zone management	Customary lands North Province

© S. Cornier, 2015

In the “sustainable resource management area”, fishing is allowed as long as it respects provincial law (which establishes periods of fishing for regulated species,

40. Provincial law n° 2009-342/APN of 28 August 2009 (modified by law n° 2012-88/APN of 29 February 2012) involving the creation of a marine protected area named the “Hyabé-Lé Jao sustainable resource management area” (JONC of 20 October 2009: 8967).

41. According to IUCN: “multiple-use MPAs may have a spectrum of zones within them, each zone type having different objectives with some allowing greater use and removal of resources than others (e.g., no-take zones are commonly designated as one of the zones of a multiple-use MPA)” (Dudley ed. 2008).

42. The categorization is based on the IUCN referential which was adapted to the North Province’s code of environment which defines the main management principles of natural protected areas. Provincial law n° 2014-322/APN of 24 October 2014 modifying law n° 2008-306/APN of 24 October 2008 relative to North Province’s environment code (JONC of 11 December 2014: 11365-11371).

quotas and catch size, prohibited species). This area refers to the customary marine territory, which is placed under the authority of the chiefdom of Yambé and the landowner clan of the tribe (i.e., the customary clan having land rights on this territory). The area was expanded to include territory to the north and south of the reef to respect customary kin relationships between the Yambé tribe and two neighbouring tribes, Tchambouène and Diahoué. These tribes were also invited to participate in the MPA project. The MPA also includes three “wildlife reserves”. Zone E₍₁₋₅₎, which refers to the customary taboo area (*Hwanga Lé-Dan*), and Zone F₍₁₋₄₎, covering the marine border with the customary district of Lé-Jao, are under a “permanent no-take” regulation. Zone G₍₁₋₄₎, which refers to the pre-existing customary marine reserve (*Péwen*), and which was not previously recognized under provincial law, is under a “partial no-take” regulation. Finally, the MPA’s terrestrial buffer zone, aims to integrate sustainable inland activities with respect to marine environment preservation objectives. This area refers to the main customary land under the responsibility of the chiefdom of Yambé.

Having described the context, we will focus now on some issues regarding fisheries, traditional knowledge and customary marine management which have emerged from our field research. First, due to the MPA’s legal framework, some community members are frustrated because they feel that provincial law seems to be overriding their customary practices and rules more than it had in the past.

“Now, with the MPA, it is not like before. We are no longer really the ones who decide. It is the (North) Province which decides when one can fish and for which fish. There are places we can no longer go, but before, we worked with customary request and gestures enabling us to fish in these places, and we used to decide everything together as a tribe, the periods of opening and closing of fishing. But we stay at home and so it is we who are the most affected” (extract from an interview with a 42-year-old man).

Their opposition to the project and Western fishing prohibitions has had three main consequences. One is the emergence of overfishing, especially in the context of customary events when people have to ask for official permission to fish specific protected species. Permission must be asked beforehand from the police department of the council of Pouébo with authority over the territory of the tribe. The case of sea turtles (*Chelonia mydas* [Linnaeus 1758] in this case) that used to be collectively caught for customary events is significant (see Leblic 2008: 161-167; Sabinot in this volume). Because permission is now only attributed for the “Yam ceremony”, which is a central event in the customary calendar of northern Kanak communities, while the capture of sea turtles is prohibited during the rest of the year, people are tempted to capture more turtles than allowed or needed for the event. During fieldwork conducted in 2013, we observed that while a permit is usually attributed for one or two turtles, four turtles were captured (see pic. 9a-b-c).

One may also witness hidden fishing practices involving protected and regulated species. People capture such species whenever possible, but keep their capture secret because they could be faced with penal and financial punishment (see pic. 10).

Pictures 9a-b-c: Sea turtles caught and cooked in their shells for the Yam ceremony in Yambé



© S. Cornier, 2013

Picture 10: Head and guts of a sea turtle barely concealed along the coast



© S. Cornier, 2013

“Now, if people catch one (sea turtle) in the nets, or see one passing right next to them and they snag it, they then only cook the turtle in their house with their family. To avoid problems, we no longer share it the way we use to. But sometimes others can smell it and the next day they lecture us, but it stays between us, it is only to laugh” (extract of an interview with a 60-year-old man).

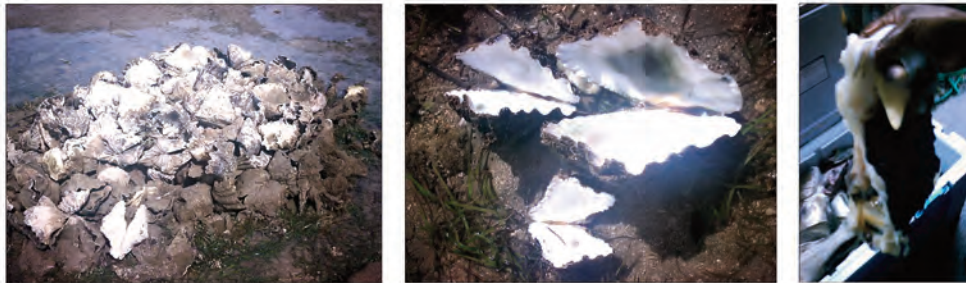
In addition, some ancestral fishing areas have been abandoned. Some people show their opposition to the MPA and the associated new legislation by simply giving up fishing zones in which they used to go before the implementation of the project. This seems to be particularly the case with the reef where the multizone system appears to be the most confusing, with some people mistaking no-take areas for sustainable management areas under provincial law.

“Me, before I had my spots on the reef where I placed my nets and threw out a line. But now with the MPA no one knows anymore what is prohibited or not. So I no longer go out. But it also is to show that I do not agree with all this. Their story is not clear and it is not the (North) Province or WWF which should tell us what to do in our own home (extract of an interview with a 55-year-old man).

Other impacts of the MPA affect traditional fishing practices and traditional knowledge more directly. This is well illustrated by the case of the giant clam.⁴³ Like in other parts of Melanesia (Hviding 1993), in the past people grew these shellfish along the shore in “coastal gardens”, mainly for home consumption (see pic. 11a-b-c). However, this practice was regulated due to the categorization of giant clams as an endangered species in North Province’s environment code. One potential consequence is the loss of traditional naturalist and technical knowledge linked to this species, partly because most people still think this practise is prohibited rather than regulated. Another is an increase in hidden behaviour, as people who want to perpetuate the practice of growing giant clams will do so secretly in order not to become outcasts.

“Today with the MPA you can no longer fish (for giant clams) like that. In addition, they (the scientists, WWF) do not even know that people here in Yambé rear giant clams on the seashore. We have always done that to avoid having to go on the reef to fish. Giant clams also reproduce very quickly and you quickly see mounds growing. We, in the tribe, do not really pay attention to the regulations on giant clam fishing” (extract of an interview with a 40-year-old man).

Pictures 11a-b-c: “Coastal gardens” and giant clams



a. Examples of “coastal gardens” along the near shore. © S. Cornier, 2013
 b. Freshly collected giant clams.
 c. The flesh of the giant clam is much appreciated by local people. Fearful that this could lead to overfishing, government authorities introduced the targeted regulation of this species within the MPA.
 © S. Cornier, 2010

Following international recommendations, MPA management is now based on a “multidisciplinary research-action” approach organized around preliminary evaluation, implementation and monitoring processes which are increasingly becoming more normative to fit institutional frameworks (Claudet 2011). This recent methodology aims to combine and optimally reconcile objectives of biological conservation with cultural, socioeconomic, and political considerations through scientific research.

43. The species considered in this case is the bear paw clam (*Hippopus hippopus* [Linnaeus 1758]), also known as the horse’s hoof clam or strawberry clam.

However, particular attention must be paid to how the Yambé indigenous people perceive Western “scientific ecological knowledge” (SEK)⁴⁴ and how it may impact their perception of the MPA in comparison to customary management.

Firstly, we observe that some local fishermen doubt scientific knowledge when it does not coincide with their own traditional knowledge.

“The scientists say that the reef takes a long time to recover. But we know it is fast. In 4-5 years in some places. We do not agree with them about many things, but we do not dare tell them for fear of offending them. So we let them believe what they like, after all, they are paid for their little business, but I am no longer interested in their stories” (extract of an interview with a 50-year-old man).

“It is like what they say about cyclones. They say cyclones damage things. But the elders have always said that cyclones are needed to clean the beds, to renew the lagoons and eliminate pollution” (extract of an interview with a 65-year-old man”).

“These guys study turtles but when we go with them for a count they cannot even see them. We see them right away but we do not always tell them. So their counts are really not very exact” (extract of an interview with a 65-year-old man).

Their perception of the vulnerability of marine resources, the diversity or the interest of some marine species, and the impact of their practices often sharply diverges from the scientific point of view.

“They (the scientists) came to study a small yellow fish with a blue spot (*Pomacanthus xanthometopon* [Bleeker 1853]). I don’t remember what they call it. It was important for them, but we do not even have a name for that fish. It is quite small so we do not fish for it or eat it, we do not pay it any attention. What we want protected are the turtles, bluespine unicornfish and golden-lined spinefoot (*Siganus lineatus* [Valenciennes 1935] locally named “picots”) because they are important to us” (extract of an interview with a 45-year-old man).

“They have a giant clam reseeded project too. We know where the clams are. They are no longer on the reef, you have to know the spots, but we do not tell everyone. They made a count and found that the population was low. They are the ones who insisted on reseeded from the Golone farm” (extract of an interview with a 40-year-old man).

They particularly do not understand the need for the fishing prohibitions and regulations recommended by scientists as they feel the pressures on their marine territory are very low.

“What I do not understand is why they came to make a MPA here when there already was a customary reserve. Instead of creating one themselves with other people in other places. They should have gone to Pouébo because the reef and sea are much more damaged and there are no longer as many fish as before” (extract of an interview with a 60-year-old man).

44. For a review of previous results of SEK regarding coral reefs protection, management and valorisation in the Pacific region and for specific results related to the Hyabé-Lé Jao MPA, see Gabrié (2011).

“The problem with the ban on fishing (turtles here) is that the population can no longer be regulated. The count results are not representative; we see that there are too many now. It would be better to adapt the laws to the actual context rather than deciding once and for all not to touch” (extract of an interview with a 35-year-old man).

However, other fishermen downplay the efficiency of their traditional knowledge and feel ignorant faced with the purportedly omnipotence of “Western science”. Such feelings spring from the colonization process, during which the Kanak people’s knowledge was ignored and considered “primitive”, progressively giving some of them the sense that Western knowledge was more efficient than their own.

Secondly, the scientific investigation processes used to study the marine environment are perceived as disturbing because they are based on a Western biological perception of nature while for the Kanak people their marine territory remains part of their country where non-humans — especially the dead,⁴⁵ ancestors and totems — reside. For example, in this case study, there was strong local opposition to the research conducted in the taboo area (Zone E₍₁₋₅₎ in fig. 7) where according to local customary systems specific behaviours must be observed and no one is supposed to dive or cause any disturbance.

“They (the scientists and the WWF marine coordinator) had to go under (dive in the taboo area of *Hwanga Lé-Dan*) to see and people here were not happy. They even filmed and took photographs. These guys don’t respect anything, they want to see everything, know everything, while for us, it was always forbidden. Just imagine if we went poking around the forbidden places in their homes. We would see then what they would say” (extract of an interview with a 45-year-old man).

More generally, scientific activities are often considered very intrusive and opposed to the community’s efforts to maintain the tranquillity of marine species and spirits. The lack of limits in scientific investigation combined with misunderstandings about scientific knowledge and processes explain why some people are bothered by or show little interest in the activities of scientists working in the MPA.

“Me, I do not really agree. They (the scientists) always need to go out to sea to take samples, count or dive. But from our point of view, when we want to protect, we just leave the fish alone” (extract of an interview with a 35-year-old man).

“They (the scientists) came again today. I saw their boat leave and then on the reef. But we do not even know what they have come to do, we are not kept informed. In the beginning, people were interested, but no one pays attention anymore. When they need us, we are here, but that is all” (extract of an interview with a 30-year-old man).

We thus witness a situation where provincial law, fisheries regulations, scientific ecological knowledge and MPA legislation either are not always understood or are

45. In Kanak cosmogony, marine subsea territories are often considered as sanctuaries for the dead (the submarine space is called “the country of the dead”).

deliberately ignored by local stakeholders. In Yambé, people seem to consider that they can still do whatever they want on their country, including within the MPA. At the same time, customary maritime law is not operating as efficiently as it used to due to changes induced by the project. The confusion in people's minds about which law is now effective in their marine territory leads them to engage in new fishing behaviours, locally called "outlaw" behaviour, which do not respect either provincial law or customary rules.

"With laws characteristic of the rule of law there is a new risk of transgression. The law is made to be broken. It is different from the implicit which is attached to culture, which is anchored profoundly in the mentality of people. Implicit rules are made up of their lives and they know that they must be respected for the equilibrium of the community, the cohesion of the group — they are much stronger" (extract of an interview with a 60-year-old man).

"It is difficult now to explain to young people or to fishers from other tribes. There is the MPA and the laws of the (North) Province, but they also see that people are less involved than before when there were old fashioned manners. So it is no longer like before when they knew there would be trouble if they did not respect prohibitions" (extract of an interview with a 46-year-old woman).

"For old people, when something was forbidden, it was forbidden. Everyone knew what was what and respected the ban. But now there are people who act tough, who go fish anyway. They go on the reef to fish" (extract of an interview with a 50-year-old man).

Earlier, we highlighted the impacts of the MPA on local knowledge and some fishing practices; we will now deal with some of the project's impacts on customary management. International recommendations regarding the community-based MPA approach have focused on the importance of creating a "co-management committee" in which all stakeholders are represented and traditional marine tenure is incorporated in the participatory process involving local communities (Pollnac et al. 2001). With this in mind, a co-management committee was created for the Hyabé/Lé-Jao MPA. This committee includes local representatives of the Yambé tribe and representatives of the neighbouring Tchambouène and Diahoué tribes, representatives of North Province and of the council of Pouébo. The WWF keeps a coordinating role to assume the management of the MPA in partnership with the committee, North Province and scientists. However, while this committee was built on paper as a "metaphor" of customary systems, in concrete terms it remains disconnected from local sociopolitical organization. Indeed, the committee works at the rhythm imposed by the representatives of the Province, scientists and WWF; meetings and interventions are often planned during the week when most people are working or are occupied with their daily customary tasks. Moreover, the committee relies on Western administrative tools (meeting reports, financial planning, and project management methods) whereas people are used to and would have expected traditional protocols such as palavers and elders' meetings.

“Their business is too long. We have other things to do than sit in their meetings, we don’t have time to waste and while we are stuck in the meetings there is no one to take care of the fields or do the other work. They arrive full of words but they do not make real progress. In the beginning, everyone was motivated, young people too, but now we are fed up with their meetings in which nothing gets done, nothing is ever finished” (extract of an interview with a 32-year-old man).

“Old people in Colnett and Diahoué (neighbouring tribes of the Lé-Jao district) have also told us that the old ways were easier. They asked us why we did not go back to the old ways? Oh yes, it was better before all this blah blah blah and all these papers” (extract of an interview with a 60-year-old man).

Finally, the committee mostly substitutes for, rather than integrates, previously existing habits and customary management. However, one of the main concerns is the progressive loss and erosion of these customary systems and marine heritage as people had deep expectations about the MPA in this regard. The local population appears unlikely to become very involved in the project due to the gap between the way it is being implemented and their expectations.

“For us, the objective of the MPA is to preserve resources and by doing so, preserve our culture and our old ways. Because all of these species and marine sites, like the taboo reef, are valuable to us. The turtles are also related to very important customs, like for hunting” (extract of an interview with a 46-year-old woman).

“The idea was to continue with modern tools what our elders had started before with the customary reserve. It is so that the young can benefit from and continue the ways of the tribe. Otherwise, it serves no purpose” (extract of an interview with a 50-year-old man).

The participatory approach also has other effects. Part of the methodology consists of defining which components of the traditional marine tenure are able to meet the conservation objectives and fit the framework of the MPA. Thus a selection process discriminates between these components and others (Brennan Jacot 2010). This process builds a kind of reductive perspective of “customs and traditions” because only a very few components of traditional management are targeted by the MPA (the taboo area, the customary marine reserve and emblematic species in this case study). In addition, the cosmopolitical values and customary rights and rules that previously regulated these components are only partly recognized in the MPA through fishing regulation considerations. This process can also be described as “set in stone” because the components selected in the MPA will now be submitted to prescriptions by law although the main characteristic of traditions is their capacity to adapt to changing sociocultural circumstances at the local level. Customs must be understood as being in continuous motion whereas the framework of the MPA implies new restrictions on adaptation and innovation. Again, this selection process meets with little local support because people feel as if they are hostages of the MPA and its normative framework which differs from their perception of managing the sea.

“I remain guarded about the MPA because there are still questions about the results of this approach, notably about the consequences of having the rule of law take the place of customary precedent. From the beginning, I preferred to distance myself from their (scientists, WWF, North Province) discourses. We do not want to be hostage to this rule of law, this MPA should be above all else a sanctuary, notably for different customary events. Here, culture, custom, our way of thinking about things does not always correlate with this rule of law” (extract of an interview with a 60-year-old man).

Global reflections about the economic value of MPAs have also focused on “ecotourism” as a means for sustainable development (Agardy 1993). In the view of the WWF, and in order to answer the expectations of North Province, ecotourism was believed to further both marine conservation objectives and provide socioeconomic benefits for the community participating in the management of the MPAs. In this case study, a snorkelling “subsea discovery trail” and an “ecolodge” were considered for the Hyabé/Lé-Jao MPA, but they were never implemented. The two projects were aborted due to the local community’s minimal interest in such activities, which did not fit their idea of the MPA.

“However, for the reef (*Péwen*), I am not in favour of letting people dive on the protected reef. We want to continue the old ways and it is different to bring tourists in all the time to go diving and continually disturb the fish. We protect them so that they can be left in peace” (extract of an interview with a 40-year-old man).

“After, everyone must discuss together about it (the ecolodge) to see what they think. We have to talk about it but it is their (North Province and WWF) idea. Our priority is conservation, protecting resources and the old ways” (extract of an interview with a 65-year-old man).

Indeed, these projects were based on a “simplistic vision” of the community (Le Meur 2008). Due to the value accorded to the marine environment, the latter is assumed to be interested in sustainable development projects. However, most local actors have diverse job prospects and responsibilities, are invested in a good number of tribes’ organizations and also harbour other expectations regarding the development of their region.

“The heritage (UNESCO project) stipulates a wish to take into account human activities. But at the council level (Pouébo), we are not sufficiently equipped; we do not even have correct sanitation networks. No funds are available, there is no suitable tax system, and legal texts are nonexistent. One should favour the determination of local people land by land, unlike the big words of politicians. The politicians waste millions on bad development” (extract of an interview with a 60-year-old man).

“Sustainable development is just a question of money for the (North) Province. Here, people still do not have internet (high speed), there is no infrastructure for young people, there are problems with the roads and one has to go all the way to Koumac (on the west coast) to find stores. We also have tribal projects but there is

never any follow up or response. It is always the same with politicians” (extract of an interview with a 55-year-old man).

The WWF and political representatives mostly operate within an “ethnic and folkloric” conceptualization of the Yambé community and the participatory approach represents precisely one important process to build “imagined communities” (Le Meur 2008). However, the economic valorisation of the MPA through ecotourism did not take into account local expectations and prevented the achievement of primary objectives, especially of local initiatives and fisheries development. With the recent reshuffling of the WWF and North Province marine coordinators, the recruiting of a coordinator and local animators for the ZNCE, as well as projects such as INTEGRE,⁴⁶ it appears that new directions to better respond to local expectations are being followed in Yambé,⁴⁷ and at the larger scale of the ZCNE, but they still need to be analysed in the field (see Bodmer and Marty 2014).

To conclude, the Hyabé/Lé-Jao MPA case study is one more example of the opposition between Western and Kanak ecological rationalities (Leblic 1993; Winslow 1995; Horowitz 2008). Therefore, despite the participatory approach adopted and some primary observations (Bodmer 2010), long term fieldwork revealed that the tools and objectives of the project’s coordinators (North Province, WWF) do not effectively meet the Yambé community’s expectations or give real recognition to customary management. In particular, the MPA poses more constraints for fishers through increased provincial and scientific influence, its normative framework and complex management schemes, while affecting fishing practices and regulations, traditional knowledge and marine tenure. Like all development projects, the MPA establishes a new “local arena” within which complex issues crystallize (Leblic 1993; Le Meur 2008). From the viewpoint of the Yambé tribe, the MPA is a means to have its authority over the territory and marine resources recognized and perpetuate traditional knowledge and customary management, which is part of a marine heritage to be passed down to future generations. From the viewpoint of North Province, the MPA is part of territorial legitimization and socioeconomic rebalancing processes at the heart of the self-determination of New Caledonia, which it has historically led. Lastly, from the viewpoint of the new “development brokers” (WWF, scientific

46. INTEGRE (French acronym for *Initiative des territoires du Pacifique Sud pour la gestion régionale de l’environnement*) is a sustainable development project supported by the Pacific Community and coordinated by French Polynesia with financial support from the FED (French acronym for *Fonds européen de développement*). Its objectives are to sustain local initiatives, favour communities’ participation and integrated coastal zones management, and reinforce regional cooperation between four European overseas countries and territories (New Caledonia, Wallis and Futuna, French Polynesia and Pitcairn). For further details, see INTEGRE website. URL: <http://integre.spc.int/> (Accessed on October 07, 2015).

47. A nursery project initiated in 2012 formulated by the tribe had enabled an abandoned quarry on the MPA watershed to be rehabilitated with a first phase of revegetation in 2013.

institutions), the MPA contributes to the legitimization, refinement, and vulgarization⁴⁸ of their specialized know-how in marine and coastal area conservation, of which they are the ideological spokesmen. However, under the guise of these environmental issues, this development arena accords only partial attention to traditional knowledge, customary management and local fisheries issues, to the detriment of political and ideological questions that go far beyond the expectations of the local community. This situation could result in less and less interest and involvement of the people over the long term, and would not properly benefit local fisheries. A last question raised is whether this MPA could be effective and locally managed without the support and financial subsidies of the North Province's marine services and development brokers.

Linking Kanak fisheries and New Caledonia governance challenges

Looking at past Kanak fisheries development initiatives, Leblic (1990, 1993, 1999, 2001a) found rather disappointing results. The main reason that these initiatives fell short is that they already failed to take into account traditional Kanak cosmopolitical organizations, customary management and the existence of fishing clans (Leblic 1999: 133-137). Leblic's studies evidenced that these initiatives were based instead on a "simplistic vision" of Kanak communities, a supposed "primitive communism" (Leblic 1990, 1991, 1993). They consequently suffered from strong "ethnocentrism" and simply transposed the Western concept of fishing cooperatives⁴⁹ to New Caledonia even though it did not coincide with the Kanak perception of collective organization. In the case of the "FADIL" boat project,⁵⁰ Leblic also highlighted a lack of planning, professionalism and qualifications on the part of project holders, and the absence of a commercial network to sell fishers' catches. As a result, these projects were aborted and the boats often abandoned on the coast. More generally, Leblic also found two factors restricting their success: Western administrative constraints and a deep dependency on financial subsidies. The recommendations that she made in her successive works were never taken into account to improve these projects. One may

48. See notably the North-East coast MPAs Information Bulletin (*Le Journal des Aires Marines Protégées de la Côte Nord-Est* in French, 2009-2015) and the New Caledonia WWF's web blog (URL: <http://nouvelle-caledonie.wwf.fr/>, accessed on October 30, 2015) for a vulgarisation of the conservation ideology, scientific and technical protocols, and local participatory actions and micro-projects related to the Hyabé-Lé-Jao MPA as well as the Doïmen and Yeega MPAs in Hienghène.

49. See Leblic (1993: 260-278, 1999: 131-133, 2001a: 146-148) for details about Kanak fishing cooperatives in New Caledonia.

50. The "FADIL" boat project aimed to promote commercial fishing in Kanak communities by giving fishers the opportunity to buy a motorboat through an investment protocol supported by subsidies. See Leblic (1993: 162-167 and 256-260, 1999: 129-131, 2001a: 143-145) for further details.

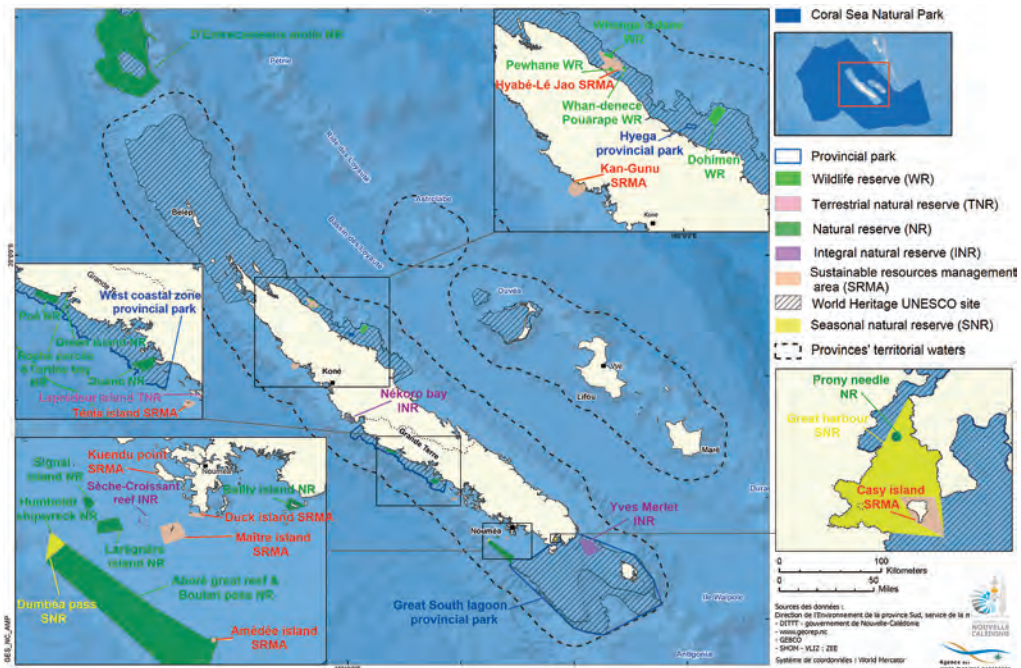
note that most of the issues Leblic identified with regard to Kanak fisheries in the 1990s are still encountered in contemporary projects, as was shown in the case study of the Hyabé/Lé-Jao MPA.

Today, the situation of Kanak fisheries is not very encouraging. Indeed, this sector is facing strong competition from more popular and lucrative sectors such as mining and biodiversity conservation (Léopold et al. 2013). No real strategies are being implemented to improve fisheries commercial networks over the archipelago or the professional qualifications of fishers. Competition with “recreational fisheries” is another factor limiting the development of coastal commercial fisheries in New Caledonia (Leblic 1990, 1991, 1993, 1999; Léopold et al. 2009, 2013). In addition, in Kanak coastal communities, most fishers are not considered by government authorities to be professional fishers despite the size of their catch or their membership in fishing clans which give them particular rights and/or functions over marine territories and fishing activities (Leblic 1989ab, 1993; Léopold et al. 2013). In consequence, the Provinces still often consider fisheries to be a secondary objective in coastal zone development plans, placing a priority instead on sustainable governance, MPAs and ecotourism, which they believe provide better “ecological services” (Léopold et al. 2013).

Nevertheless, at a global scale, MPAs have become key topics in the field of fisheries management and many research studies describe potential benefits to marine ecosystems if targeted areas, species and habitats are combined with appropriate planning, zoning and regulation schemes (for a complete review see Ward et al. 2001; Boecker 2012). However, a wide range of studies have shown that there are also costs that may impact local fisheries, such as conflicts between fishers, local disagreements involving MPAs, increased fishing pressures near no-take areas, and ecosystem perturbations ensuing from a lack of fishing effort (Claudet 2011; Le Sann 2013a). Recommendations about MPAs highlight that the involvement of local communities, and more particularly the integration of fishers, are key for management success (Boecker 2012). The recognition of fishers would be a first step so that they could share their knowledge and expectations, and build positive relationships with scientists, NGOs and political representatives to accurately implement, manage, and monitor MPAs.

In New Caledonia, such an approach within the MPA network implemented today could effectively benefit fisheries (see fig. 8). However, research still needs to be improved to better understand the impacts of this process on Kanak fisheries around the archipelago. In the Hyabé/Lé-Jao MPA, even though local fishers are expecting recognition of their territories, traditional knowledge and practices, marine customary management and functions, these are not taken properly into account in the project. A quick look at a larger scale shows that the historical and sociopolitical specificities of each Kanak country have specific consequences for each MPA project. Research conducted in other regions of the archipelago have highlighted that MPAs can be used as tools for empowerment and recognition in diverse sociocultural,

Figure 8: New Caledonia MPA network in 2015



Sources: Translation from French to English by S. Cornier and I. Leblac of the map "Nouvelle-Calédonie: Aires marines protégées", French MPA Agency, URL: http://cartographie.aires-marines.fr/sites/all/modules/cartopdf/GES_NC_AMP.pdf

political and economic strategies (such as land conflicts between clans, political claims and strategies regarding small-scale economic projects or even claims against the mining industry) developed at the local community level (Horowitz 2008; Lasseigne 2008; Poncet 2010; Sauboua 2010; Toussaint 2010; Faurie 2011a; Le Meur et al. 2012; Léopold et al. 2013). Since 2008, a growing trend of conferring a heritage value to marine spaces outside the UNESCO serial site can also be observed in these studies. The Provinces as well as some coastal communities looking for recognition and benefits from their marine territories seems to be riding the wave of interest in marine co-management. In this context, one needs to pay particular attention to each MPA's arena and stakeholders' expectations, to local cosmopolitical systems and history, as well as Kanak traditional knowledge and symbolic representations of the marine environment in order to favour "co-construction of knowledge" during the whole process, from the preliminary evaluation up to the management of the MPA. The multidisciplinary research-action approach proposed in scientific literature could contribute to this by taking into account the variability of the issues at stake and actors concerned by the governance of MPAs (Chaboud et al. 2008; Claudet

2011). Today, some projects, such as the COGERON,⁵¹ are trying to adopt this methodology in New Caledonia (Léopold et al. 2009, 2013; Poncet 2010; Toussaint 2010; Le Meur et al. 2012). However, these efforts remain isolated and also reveal some difficulties encountered by anthropologists in discussing and making their viewpoints known to other scientific disciplines and project policy coordinators.

It was precisely regarding this point that the recent conclusions made at workshops⁵² dedicated to marine ethnobiology and the management of MPAs emphasized the importance of more effectively involving marine ethnobiology and anthropology in the planning of MPAs. Indeed, the relationship established between local stakeholders and ethnologists during their long-term fieldwork offers consistent data that allow a better understanding of communities' expectations, traditional marine tenure and sociopolitical constraints, and might therefore positively influence the development and management of MPA projects with other stakeholders. However, the recommendations made during these workshops have stressed that marine ethnobiology and ethnographic research will really benefit MPAs if the multidisciplinary approach builds a clear framework for "transversality" (Narchi et al. 2014) rather than remaining at a conceptual stage. A space of dialogue should be created in order to build a new vision of MPAs, define common tools, language and partnerships between MPAs' political actors, conservation NGOs and scientists, foster local stakeholders' empowerment and expectations and switch the focus from the "bottom-up" approach that is still dissimulated behind the integrated and participatory process towards a "co-learning" or "co-existence"⁵³ process.

Marine conservation is just one of the challenges facing Kanak fisheries in New Caledonia. Nickel mining is another very important one. It is impossible to avoid "King Nick".⁵⁴ The industry has been part of New Caledonia's history and development since the beginning of the colonial period and today dominates the economy (Bencivengo 1999), representing almost 10% of the Gross Domestic Product and

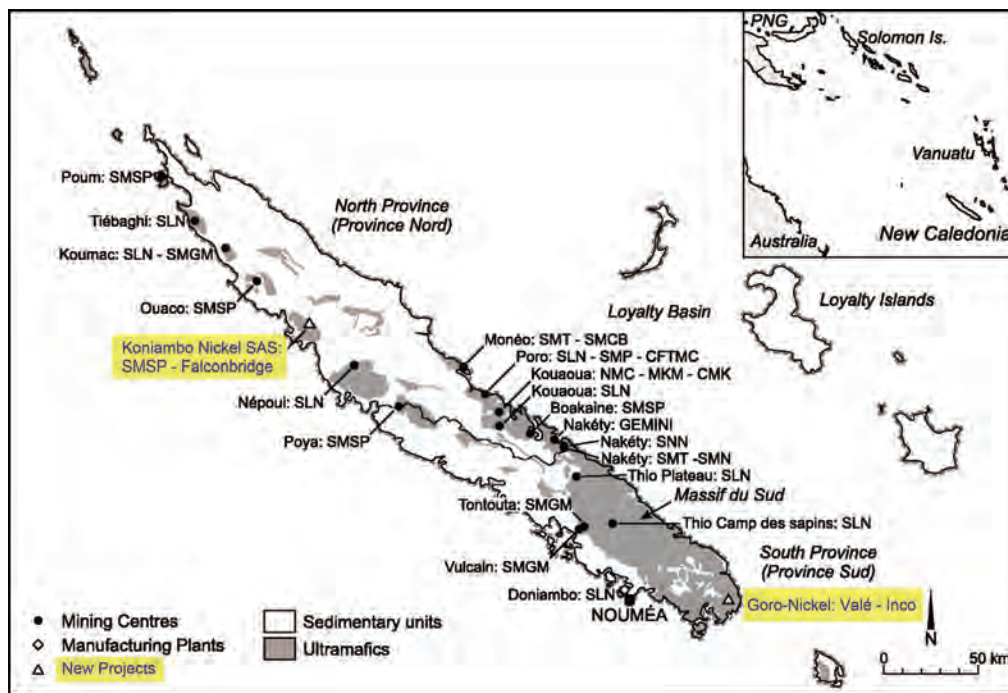
51. COGERON (French acronym for *Organiser la cogestion des ressources à forte valeur patrimoniale en Nouvelle-Calédonie*) was a multidisciplinary project developed in order to respond to fisheries and coastal management issues in North Province.

52. Workshop (S40): De Wit R., Narchi N. E., Camoui L. E. and Cornier S. (co-chairs) – "Ethnothassic interactions", 13th Congress of the International Society of Ethnobiology (CISE), Montpellier, 20-25 May 2012; and Workshop (WS2H2): McDonnald A. and Cornier S. (co-chairs) – "The role of culture and tradition in MPA management: Case studies", 3rd International Marine Protected Areas Congress (IMPAC3), Marseilles, 21-27 October 2013.

53. For more details on "co-learning" and "co-construction of knowledge" concepts and on the ethical questions of collaborating with indigenous communities, see among others the website and scientific project of the International Society of Ethnobiology (ISE). URL: <http://www.ethnobiology.net/> (Accessed on September 10, 2015). For the "co-existence" model introduced during the State of the Lakes Ecosystem Conference (SOLEC), see McGregor (2008).

54. Local nickname given to nickel ore, which highlights its patrimonial dimension in New Caledonia (see Horowitz 2004: 299).

Figure 9: Nickel mining centres and companies in New Caledonia



Source: Adaptation by S. Cornier and I. Leblíc of Figure 1 in Wells et al. 2009

more than 90% of commercial exports (IEOM 2014). Accounting for 7% of global nickel production, New Caledonia was the sixth largest producer in the world in 2014 (CEROM 2015). This percentage is expected to reach 15% in the near future due to the recent establishment of two factories which are globally competitive in terms of capacities and technologies. One is located in the northwest of the main island, the Koniambo Nickel SAS (KNS) project, and the other in the south, the Goro-Nickel project (see fig. 9), and both are linked in complex ways to self-determination issues and the socioeconomic balance process related to the Matignon-Oudinot Accords (Leblíc 1993) and then the Noumea Accord (Horowitz 2004; Demmer 2007). This contemporary development of the mining industry relies on strong partnerships between New Caledonia and various countries (France, Canada, Japan, Australia, Korea) looking for rare ores while China has also entered the game and became the territory's first client in 2014 (IEOM 2014).

Despite its economic benefits, such an industry nonetheless has major consequences. First, nickel ore remains a “non-sustainable” resource and its long-term financial profitability is highly dependent on market rates and international competition. Basing New Caledonian development and self-determination on such a resource

implies making appropriate choices (Lagadec and Sudrie 2013). Moreover, nickel ore requires ever more powerful mining and processing methods and its exploitation impacts the environment through direct and indirect pollution. Its impacts on coastal zones and marine biodiversity are denounced by local organizations and scientists (Richer de Forges and Pascal 2008). However, the mining operators and local authorities still largely deny these environmental impacts, even when faced with evidence of pollution incidents.⁵⁵ This phenomenon is progressively creating a new divide between protected coastal zones and other zones that seem to be deliberately sacrificed to high impact activities such as mining (Faurie 2011b).

Nevertheless, mining has real sociocultural repercussions in New Caledonia. In Kanak society, it is becoming increasingly attractive because it offers great opportunities for jobs and training. People, and in particular young people, have now experienced Western wages and living standards, which are very different from their customary habits and traditional exchanges, and are often leaving their tribes and countries to reach mining centres. Under the impact of this industry and diverse other socioeconomic factors springing from New Caledonia's development model (centralised administration, education system, cultural centres), one can observe that the tribes are progressively becoming "vacation" sites for young people, where they return to spend their weekends or holidays when not going to Noumea. Related impacts on customary systems can already be observed and will probably be accentuated in the future. Their daily involvement in customary ways of life and the local development of their country appears to be less and less important. History already has shown that when the mining industry is flourishing and hiring en masse, fishing activities in particular often tend to decrease in Kanak communities. Consequently, the marine environment and fishing practices now hold more of a "recreational" interest for Kanak youth, which could partly explain their low involvement in the sectors of fisheries and MPAs (Léopold et al. 2013). For example, in the case of the Hyabé/Lé-Jao MPA, no youth from Yambé showed any real interest in applying for the job as the local animator of the project, although many of them are working or training in the mining sector, which they consider offers better professional and lifestyle perspectives.

To conclude this section, the New Caledonia political context also is posing some constraints. One consequence of the self-determination process with respect to Kanak fisheries is the static behaviour of local institutions. Few decisions and initiatives are effectively taken or given continuity locally when political realignments are regularly at work and their outcomes are awaited. In this context, politicians are paying little attention to small-scale fisheries as they focus on more strategic sectors such as

55. The last two major incidents occurred in 2009 and 2014 in the Goro-Nickel mine area with respectively 2,800 litres and 96,000 litres of acid solution ejected into "la Baie du Nord" river, "toasting" almost all the aquatic fauna from the river and the near shore area (EPLP 2014a; Lebigre 2014).

conservation and mining (Léopold et al. 2013). Aquaculture⁵⁶ is one marine economic sector in which the Provinces have also shown interest in their development strategies. The sector remains nonetheless small (1% of exports), and is undergoing a crisis in niche markets, but it offers interesting perspective in terms of the economic re-balancing between the Provinces (IEOM 2014). While the majority of activity is concentrated in South Province (with 72% of farm surface areas), North Province is quite interested in it, and has coastal areas suitable for the development of breeding basins. However, local organizations, such as EPLP (French acronym for *Ensemble pour la Planète*), are denouncing some of aquaculture's impacts⁵⁷ on coastal zones and mangroves, such as silting due to discharge from farms, or pollution due to the use of antibiotics and food supplements to optimize the health of shrimp, which are the main species grown in New Caledonia. These impacts are suspected to have direct consequences on some fishing activities and areas (the collection of crabs by Kanak women's organizations for example), as well as on consumers' health (EPLP 2014b, 2015a). According to EPLP,⁵⁸ local authorities and aquaculture stakeholders deny that these perverse effects exist, and scientists specialized in this sector generally support this denial.

In addition, in the context of the Koniambo Nickel SAS (KNS) mining project launched in North Province, the brand new town of Voh-Koné-Pouembout is currently emerging from the ground. From the Province's perspective, this town is expected to become a real city which aims to counterbalance, as part of the self-determination process, the monopoly of Noumea, and it already has led to deep landscape and sociocultural changes all over the Northwest coast of New Caledonia (Kowasch 2012; Grochain 2015). The consequences of the KNS mining project and of the development of Voh-Koné-Pouembout on the lagoons and adjacent coastal areas remain difficult to predict given the potential socioeconomic and ecological changes (direct and indirect pollution, maritime flows, marine recreation activities, mining vessels traffic). At the same time, fisheries could benefit from this development with an expected increase of local demand (Léopold et al. 2009, 2013). In order to anticipate such changes, North Province created in this precise area the Kan-Gunu MPA,⁵⁹ which is the result of COGERON project recommendations. However, the creation of the Kan-Gunu MPA once again reflects the development dichotomy

56. In 2014, 18 mollusc farming areas were operating in New Caledonia (IEOM 2014).

57. See Virly et al. (2005) for a report about aquaculture impacts on coastal mangroves in New Caledonia.

58. Interview with Martine Cornaille (President, EPLP) after a heated debate on this subject in which she argued against the specialized scientific community and sector administrative representatives at the conference organized in North Province by AGORA-SHS – "Sustainable development in Oceania: towards a new ethic?", April 24-26, 2013.

59. This MPA is located on the west coast of North Province at the level of the communes of Voh and Kaala-Gomen (see fig. 9). According to the Province's referential, it is a sustainable resource management area created by law n° 2014-316/APN of 24 October 2014 (*JONC* of 11 December 2014: 11361-11363).

in North Province, and more generally New Caledonia, which is generating ever closer and coercive links between the two emblematic resources of the archipelago, the lagoon and nickel ore.

The marine heritage (UNESCO serial site) and the mining development scheme represent in a sense two symbols for a future common destiny in which Kanak people have put great expectations for self-determination and cultural recognition. However, while the nickel industry is providing fast and substantial revenues, the value of marine ecosystem services is less evident. In this context, sustainability appears to be a popular element in election campaigns and mainly provides an important source of funds (subsidies from the South Pacific Community, France, Europe, conservation NGOs) and international recognition for the New Caledonian government and the Provinces, but it seems to be an “empty shell”. Behind the conservation and sustainable development ideology, the privatization of natural resources and territories seems to remain at the crux of the matter.

The “dark side” of conservation

The conclusion of this chapter will focus on the case of the Coral Sea Natural Park (*Le Parc Naturel de la Mer de Corail* in French, see fig. 10), which symbolizes some of the key contemporary challenges and controversies in New Caledonia and at the regional Pacific scale. The case brings together conservation ideology, marine protected areas, fisheries regulations and mining issues.

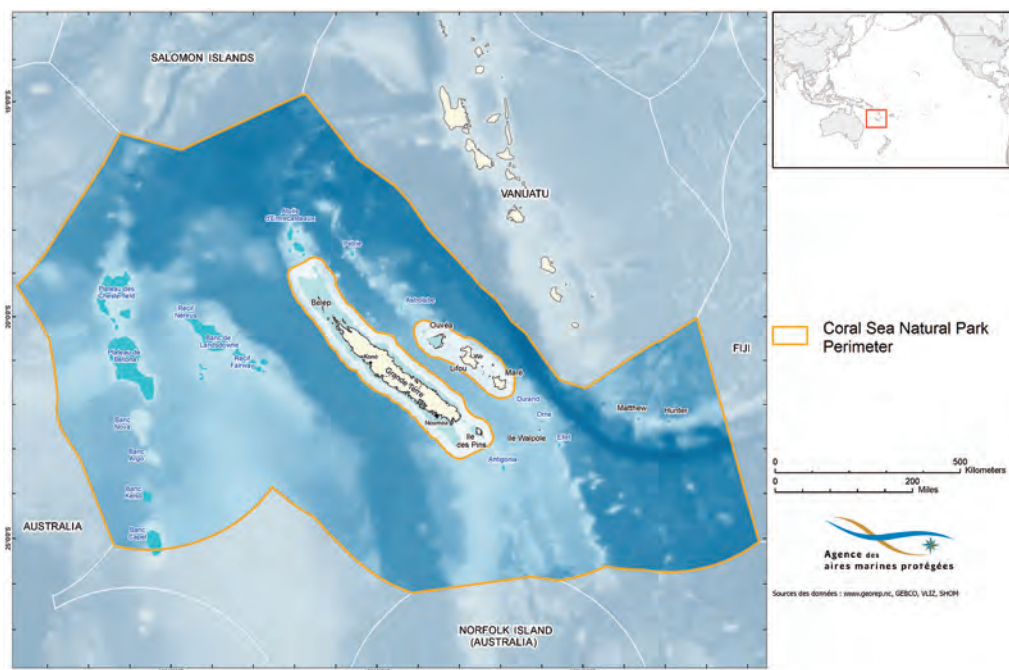
This Park was created⁶⁰ in April 2014 and is the biggest MPA in the world; it covers 1.3 million square km and 95% of New Caledonia’s exclusive economic zone (EEZ). Once again, this project (which began in 2012) was built through a so-called “concerted” process based on a strategic analysis and a multi-institutional committee. Three main objectives⁶¹ were identified: protection of marine biodiversity; sustainable development introducing the concept of a “Blue economy”; and regional integration and international visibility. However, the project rapidly faced strong opposition from local actors and environmental organizations, calling into question the concerted approach on which the management process of the future Coral Sea Natural Park was supposed to be based. Indeed, even though “consultation” was officially claimed to be at the heart of the project, it appears that very little attention has been paid to its effective implementation.

Firstly, local organizations have pointed out the gap existing between French and New Caledonian legislation about Natural Parks and public consultation (see

60. New Caledonia government decree n° 2014-1063/GNC of 23 April 2014 creating the Coral Sea Natural Park (*JONC* of 01 May 2014: 4245).

61. See the booklet dedicated to the Coral Sea Natural Park (2014) published under the coordination of the Maritime Affairs of New Caledonia and the French MPA Agency.

Figure 10: Official perimeter of the Coral Sea Natural Park



Source: Translation from French to English by S. Cornier and I. Leblac of the map "Parc naturel de la mer de Corail - Périmètre", French MPA Agency, URL: http://cartographie.aires-marines.fr/sites/all/modules/cartographie/pdf/_GES_NC_Perimetre_PN_a3pa.pdf

Action Biosphere 2014). The local organization “Action Biosphere” pointed to the fact that in France, the Environment Charter adjoining the Constitution as well as the Environment Code stipulates that marine natural park projects must be subjected to public inquiry, based on the idea that people have to be part of decisions concerning their common environment. In New Caledonia, however, no public inquiry was implemented to initiate a dialogue about the Coral Sea Natural Park project with the people living in the archipelago. According to Action Biosphere, this is because the EEZ became the responsibility of the New Caledonian government in 1998 and thus does not fall under the Environment Code of the three Provinces. In addition, this organization denounces that in its integrated marine territory management strategy, the government makes a clear distinction between two different publics: one is “restricted, co-opted and docile”, and is allowed to participate in the project and likely to share its future benefits; the other, called “the general public”, is only supposed to be informed about the project (*ibid.*). Furthermore, the creation of the Coral Sea Natural Park was based on a prior deliberation of the New Caledonia government which did not involve any obligation to consult the public

with regard to MPAs developed in this zone (*ibid.*). According to Action Biosphere, these special features of New Caledonian law explain why most people, local environment organizations and fishers' organizations were not given the opportunity to participate in the debate.

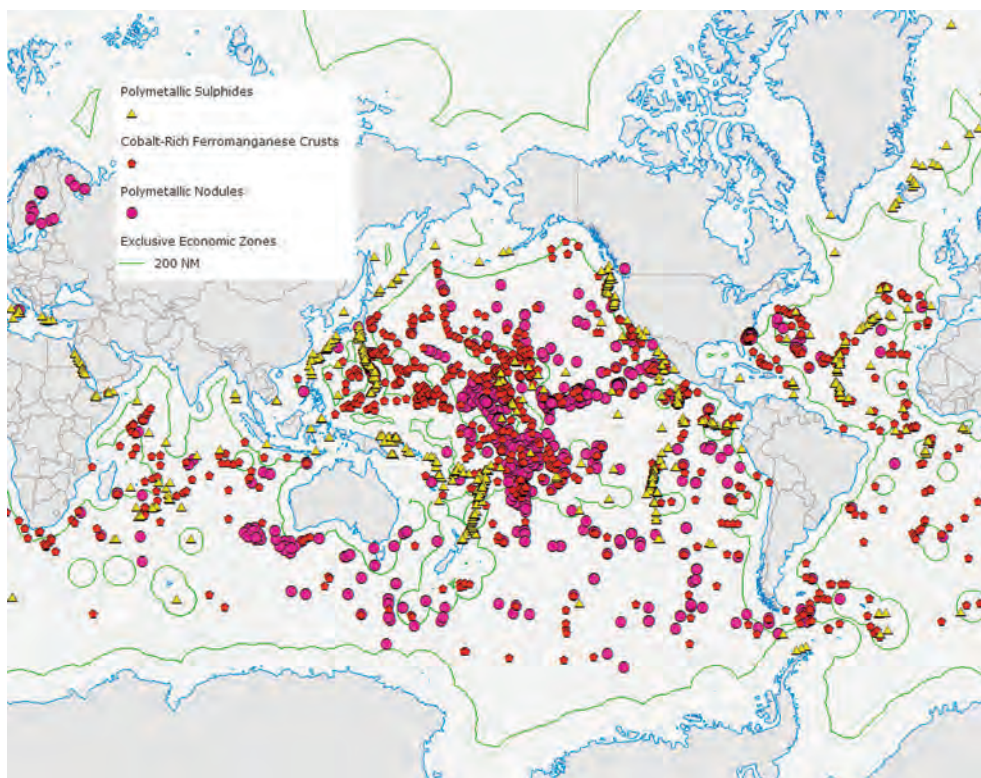
Secondly, according to another local organization, EPLP, the decree allowing the creation of the Coral Sea Natural Park should have been discussed within the Environment Consultative Committee (French acronym, CCE, for *Comité consultatif de l'environnement*) of New Caledonia (Cornaille 2014). However, the organization noted that on two occasions, the CCE was not able to sit and no dialogue was engaged in this advisory body. Both organizations, Action Biosphere and EPLP, denounce this "carelessness or deliberate intent" (*ibid.*) on the part of the authorities and the fact that their elected representatives favour electoral strategies to the detriment of environmental issues. As a consequence, neither local organizations nor the New Caledonian population were able to raise their concerns and requests about the Coral Sea Natural Park or voice opposition to the project.

In fact, the main concerns of Action Biosphere and EPLP about the Coral Sea Natural Park seem to involve suspicions about hidden economic stakes within the project. Such concerns reflect recent global controversies about large-scale MPAs: the possible links with deep-sea exploitation of marine resources, especially minerals. Richard Mahapatra and Anupan Chakravartty (2014) discussed the contemporary context of deep-sea mining activity focussing on the extraction of polymetallic nodules, polymetallic sulphides or ferromanganese crusts. These ores are essential for modern high technologies and therefore are the focus of much interest. However, they are unequally distributed on earth and generally found in low concentrations among other minerals; hence a high degree of technology is required for their localization, extraction and exploitation. At the same time, global stocks are dwindling due to increasing demand, which keeps pushing up prices. As a result, since the 1980s mining industries have been seeking new deposits in the deep ocean where "rare minerals"⁶² are found in high concentrations. The International Seabed Authority (ISA)⁶³ is in charge of delivering licences to mining companies and scientific research institutes which wish to explore subsea floors. It has had to respond to a growing number of requests over the past few years. Indeed, the economic perspectives of seabed mining justify its qualification as a new "gold rush" (Donges 1985; Goldenberg 2014). The quest is already on-going and the Pacific Ocean is perceived as a new

62. Polymetallic nodules, polymetallic sulphides and ferromanganese crusts are particularly rich in precious cobalt, zinc, manganese, copper, gold and silver among other earth minerals.

63. The ISA was created in 1994 by the United Nations' Law of the Sea Convention to control the exploration and exploitation of seabed mineral resources in international waters, which have been declared "common heritage of mankind". See the ISA's website of for further information about its competencies, ongoing projects and technical reports about seabed mineral resources. URL: <https://www.isa.org.jm/> (Accessed on July 21, 2015).

Figure 11: Global distribution of three major types of deep-sea mineral resources



Source: Figure 1 in UNEP-GEAS 2014, "Wealth in the Oceans: Deep-sea mining on the horizon?", URL: http://na.unep.net/geas/getUNEPPageWithArticleIDScript.php?article_id=112

Eldorado⁶⁴ for deep-sea exploration and mining (see fig. 11). In this context, Pacific states started to target this "Green and Blue economy" (Baker and Beaudoin 2013; Loubersac 2015). In New Caledonia, one SGNC (French acronym for *Service Géologique de la Nouvelle-Calédonie*) program precisely consists in "evaluating and promoting subsea mineral resources"⁶⁵ in partnership with scientific institutions

64. In their report, Mahapatra and Chakravarty estimate that the global annual turnover of deep-sea mining would reach US\$13 billion by 2030, starting from virtually zero today. Indeed, metals extracted from one ton of polymetallic nodules can fetch US\$1000 at current market rates. This gives an idea of the potential revenue that could be earned through, for example, extractions from the Pacific Clarion-Clipperton zone, estimated by ISA to hold almost 62 billion tons of poly metallic nodules.

65. For further details about the missions of the SGNC, see the DIMENC website (French acronym for *Direction de l'Industrie des Mines et de l'Energie de la Nouvelle-Calédonie*). URL: <https://dimenc.gouv.nc/geologie/presentation-et-missions> (Accessed on July 21, 2015). For the stakes related to the Green and Blue economy and subsea minerals in New Caledonia, see Loubersac et al. (2013).

(Research and Development Institute — IRD; Ifremer; University of New Caledonia — UNC) and the New Caledonia EEZ research program (ZoNéCo).

Mahapatra and Chakravartty also remind us, however, that some marine scientists and environmental organizations already are arguing that the extraction of rare minerals from the deep sea will possibly have massive consequences for marine biodiversity and unknown impacts on entire marine ecosystems, from the sea surface to the subsea ground floor (Drew 2009; D’Arcy 2013; Dymont et al. 2014). Most of these studies voice concerns about the lack of scientific knowledge about deep-sea ecosystems and the lack of transparency about the extractive processes to be used. Although mining actors claim that scientific studies have been and are being undertaken, controversies remain about the inadequacy and partiality of such studies, a lack of access to the data collected, and the gap between conservation strategies and project proposals. The most recent example of such controversy is the case of the Bismarck-Solomon Sea area where Nautilus Minerals Inc. was in charge of implementing the seabed-mining project Solwara 1 (Roche and Bice 2013). Apart from environmental issues, this project also faced strong local opposition⁶⁶ under the leadership of the Bismarck-Solomon Sea Indigenous Peoples Council (BSSIPC), which revealed social impacts induced by the project because of a lack of consultation and a divergence between government and community stakeholders’ expectations. In fact, the increase of Pacific licences to explore subsea floors, regardless of their potential environmental and/or social consequences, seems to conflict with the objectives of conserving seabed resources as a “common heritage”, of the Declaration on the Rights of Indigenous Peoples and of Principle 10 of the Rio Declaration providing for public participation and the establishment of independent “Citizens’ Advisory Councils” in such environmental issues (SPC 2012), and of the large-scale MPAs that are now established in the same areas. ISA currently has to face growing pressure from scientists and environmental and civil⁶⁷ organizations calling for a precautionary approach and a freeze on contracts until independent research on seabed ecosystems has been conducted and the regulatory framework⁶⁸ of deep-sea mining has been improved (Halfar and Fujita 2002; Wedding et al. 2015).

Moreover, Action Biosphere and EPLP are also denouncing the ambivalent role of the international NGO, Pew Charitable Trusts (henceforth referred to as “Pew”),

66. See also EPLP (2015b) for a case of customary representatives’ opposition in the French overseas territory of Wallis and Futuna.

67. See the petition on Avaaz.org which is entitled “ISA: Protect our oceans” and will be addressed to “the ISA Secretary General Nii Allotey Odunton, members of the ISA Assembly, Council and Committees, and relevant ministers”. URL: https://secure.avaaz.org/en/deep_sea_mining_en_dn1/?bswWfdb&v=62024 (Accessed on July 21, 2015).

68. The first draft framework for regulation of global seabed mining activities was issued in March 2015 (see ISA 2015). For a complete report on the Pacific regional framework for deep-sea minerals exploration and exploitation, see also SPC (2012).

which supported New Caledonia and the French MPA Agency in the implementation of the Coral Sea Natural Park, and now has one representative on the management committee. Pew is one of the major promoters of large-scale MPAs in the Pacific Ocean (see also Giron in this volume), but is also known for its conservative values, liberal policies and economic “lobbying”⁶⁹ methods in relation to marine scientists and small insular states looking for income from their natural resources and this new “Ocean Business” (see Giron et al. 2012 and in this volume; Le Sann 2012, 2013b). A particular question raised is whether large-scale MPAs and fisheries prohibitions could be the first steps towards the privatization of oceans to be followed by the deep-sea exploitation of rare minerals (see Giron et al. 2012 and in this volume)? The loss of income from fishing licences ensuing from the establishment of MPAs obliges small insular states to find new sources of revenue. Pew’s environmental lobbying combined with its affinity for multinational mining and petrol companies, the so-called “mineral hunters”, nourish the suspicions of Action Biosphere and EPLP. Pew’s ambivalence is reflected in part in its internal organization: the Pew Centre on Global Climate Change, in charge of studies on the implementation of MPAs, has recently been transferred to the Centre for Climate and Energy Solution (C2ES),⁷⁰ in charge of studies aiming to develop innovative processes for energy supply, which reinforces the suspicions of Pew’s detractors.

At another level, the French government’s interests in the Coral Sea Natural Park and the support of the French MPA Agency reflect national maritime strategic issues and illustrate the “regulatory state administration” (Féral 2011). Indeed, the Coral Sea Natural Park constitutes almost 12% of French marine territories and is helping to expand the coverage of the French MPA network from 4 to 16% of these territories (French MPA Agency 2014). If the marine territories of the Austral archipelago (French Polynesia) are also declared an MPA, in partnership with Pew (Salvat et al. 2015), by the end of 2015 or the beginning of 2016, 20% of France’s marine surface will be protected. This nation will thereby meet the objectives defined in the Convention on Biological Diversity and the “Grenelle de la Mer” agreement, reinforcing its international leadership in the field of marine conservation and MPAs. Without French overseas territories, which represent almost 90% of France’s marine spaces, and the support⁷¹ of Pew as a mediator for the creation of large-scale MPAs, the task would have been difficult to achieve.

69. The Pew Charitable Trust’s funds are estimated to generate US\$300 million in dividends per year, resulting from investments valued at US\$6 billion. Almost US\$100 million per year are dedicated to ocean conservation and a large part to its ocean science division (See Giron et al. 2012 and Giron in this volume).

70. See the website of C2ES for further information on the subject. URL: <http://www.c2es.org> (Accessed on July 20, 2015).

71. Estimations about a global network of MPAs protecting 20 to 30% of the world’s marine ecosystems may cost between US\$5 and 19 billion and create more than one million jobs. It gives an idea of the

Therefore, the Coral Sea Natural Park can be analysed in terms of international geostrategic stakes, where superpowers are fighting for the control of mineral resources and marine territories in the Pacific Ocean, using the soft-power of NGOs like Pew (see Giron⁷² in this volume). Yet it can also be interpreted through the prism of “neo-colonialism”. Superpowers, mainly France in this case, are accused of using environmental pretexts to strengthen their geopolitical positions and investments in small countries and territories in the Pacific within a context of larger regional, national and international stakes. Meanwhile, behind official discourses related to fisheries management and marine conservation, large-scale MPAs, through fishing prohibitions and regulations of vessel traffic, tend to inhibit the development of the fisheries sector while providing new opportunities for the Green and Blue economy⁷³ (Giron et al. 2012; Le Sann 2012, 2013b).

Last but not least, the Coral Sea Natural Park appears to fall under the scope of what we could call an “ecological corporatism tradition” that was established in New Caledonia a long time ago. Indeed, due to the richness of its environmental resources, scientific institutions (such as the Research and Development Institute — IRD, New Caledonia Agronomic Institute — IAC, and Ifremer) and international conservation NGOs (such as Conservation International and WWF) have for decades targeted the archipelago as a strategic laboratory in which to improve their intervention, management tools and scientific protocols (Cornier 2009). This phenomenon can be described in terms of the “institutionalization” of nature and has two major effects (Latour 2004). First, it allows the international recognition of these actors’ know-how, their ideology and their research projects implemented in what we can call an “Eldorado of biodiversity”. Second, at the level of Oceania, very narrow partnerships have been formalized between scientific institutions, international conservation NGOs, and economic sectors and authorities which could result in conflicts of interests (Richer de Forges 2007; Agniel 2008). Consequently, in New Caledonia, local organizations such as Action Biosphere and EPLP often denounce the lack of independence of scientific research in environmental projects and their ambiguous role because of their simultaneous involvement in private research sponsored by mining operators and investors.

The Coral Sea Natural Park gathers together a large scientific community and international conservation NGOs while linking large-scale MPAs, fisheries regulations, subsea mining, and economic and geostrategic stakes. It therefore crystallizes

“worldwide costs” to manage these MPAs and the key challenges for states to find private financial and technical support (Balmford et al. 2004).

72. For further information about Yan Giron’s approach of geostrategic stakes in the Pacific Ocean, his theory about the “Pivot” and the “Blue Charity Business”, see also his personal very well documented web blog “Bluelobby”. URL: <http://blog.bluelobby.eu/> (Accessed on July 19, 2015).

73. For further information about French strategy on the Green and Blue economy, see the website of the “Trame verte et bleue” network which is one of the emblematic measures adopted in the “Grenelle de l’Environnement”. URL: <http://www.trameverteetbleue.fr/> (Accessed on October 10, 2015).

the deep complexity of some of the challenges facing New Caledonia today. Given its mining history and high degree of technological and scientific specialisation, the archipelago may be able to effectively shift to subsea mining in the event that Action Biosphere and EPLP's suspicions become reality. This conclusion aims to invite the scientific community to take a real interest in the Coral Sea Natural Park, to be aware of the controversies surrounding this project and more generally large-scale MPAs in the Pacific, and to engage in discussions and independent research on the Green and Blue economy.

References

Action Biosphere

2014 Le Parc naturel de la Mer de Corail: 'Une coquille vide' ou une manipulation néocoloniale? News release [Online]. URL: <http://www.actionbiosphere.com/?p=738> (Accessed on May 20, 2015).

Agardy, M. Tundy

1993 "Accommodating Ecotourism in Multiple Use Planning of Coastal and Marine Protected Areas". *Ocean & Coastal Management*, 20(3): 219-239.

Agniel, Guy

2008 « La gestion de l'environnement dans le Pacifique. Moyens et objectifs ». *Journal de la Société des Océanistes*, 126-127 (Special issue « Environnement dans le Pacifique Sud »): 145-151 (<https://jso.revues.org/3952>).

Akimichi, Tomoya

1995 "Indigenous Resource Management and Sustainable Development: Case Studies from Papua New Guinea and Indonesia". *Anthropological Science*, 103(4): 321-327.

Baker, Maria, and Yannick Beaudoin (eds.)

2013 *Deep Sea Minerals: Deep Sea Minerals and the Green Economy*, Volume 2. Noumea: Secretariat of the Pacific Community.

Balmford, Andrew, Pippa Gravestock, Neal Hockley, Colin J. McClean, and Callum M. Roberts

2004 "The Worldwide Costs of Marine Protected Areas". *Proceedings of the National Academy of Sciences of the United States of America*, 101(26): 9694-9697.

Barbançon, Louis-José

2015 « Des accords de Matignon à l'accord de Nouméa (1988-1998) ». *Ethnies*, 37-38 (Special issue « Emancipations Kanak »): 46-59.

Barrau, Jacques

1985 « À propos du concept d'ethnoscience ». In *Les savoirs naturalistes populaires: Actes du séminaire de Sommières, 12-13 décembre 1983*. Paris: Maison des sciences de l'homme, p. 5-12.

Baudat-Franceschi, Julien

2007 Rapport intermédiaire du projet d'Aire Marine Protégée du Nord-est. Noumea: WWF.

- Beaumont, J.
1997 "Community Participation in the Establishment and Management of Marine Protected Areas: A Review of Selected International Experience". *South African Journal of Marine Science*, 18(1): 333-340.
- Bencivengo, Yann (ed.)
1999 *La mine en Nouvelle-Calédonie*. Noumea: Île de Lumière, coll. 101 mots pour comprendre.
- Berkes, Fikret, Johan Colding, and Carl Folke
2000 "Rediscovery of Traditional Ecological Knowledge as Adaptive Management". *Ecological Applications*, 10(5): 1251-1262.
- Bodmer, Dolorès
2010 « Entre préservation et/ou mise en valeur de la ressource, quel avenir pour les Aires Marines Protégées en Province Nord de la Nouvelle-Calédonie? ». *Études caribéennes* [Online], 15: <http://etudescaribeennes.revues.org/4513> (Accessed on September 17, 2015).
- Bodmer, Dolorès, and Claire Marty
2014 Renforcement de la gestion participative et intégrée du bien inscrit au patrimoine mondial. Fiche Activités n° 1 et 2 – Projet INTEGRE. Noumea: Secretariat of the Pacific Community.
- Boecker, Christine
2012 Marine Protected Areas in the 21st Century – Breakthrough or Static? Capstone Project – Graduate Certificate in Fisheries Management. Corvallis: Oregon State University.
- Boncœur, Jean, Jean-François Noël, Agnès Sabourin, and Jessy Tsang king sang
2004 « La gouvernance des aires marines protégées: Le projet de parc marin en Iroise, un exemple de processus participatif? ». *Mondes en développement*, 138: 77-92.
- Brennan Jacot, Maya
2010 *Les aires marines protégées comme outils de conservation de la biodiversité marine: Application de critères de sélection et considération de la pertinence des critères adoptés dans le cadre de la Convention sur la diversité biologique*. Québec: Université de Sherbrooke.
- Breton, Yvan
1981 « L'anthropologie sociale et les sociétés de pêcheurs: Réflexions sur la naissance d'un sous-champ disciplinaire ». *Anthropologie et Sociétés*, 5(1): 7-27.
- CEROM
2015 Impact du nickel en Nouvelle-Calédonie. Étude Comptes Économiques Rapides de l'Outre-Mer. Noumea: ISEE.
- Chamoux, Marie-Noëlle
1981 « Les savoir-faire techniques et leur appropriation: Le cas des Nahua du Mexique ». *L'Homme*, 3: 71-94.
- Chappell, David
2003 "The Kanak Awakening of 1969-1976: Radicalizing Anti-Colonialism in New Caledonia". *Journal de la Société des Océanistes*, 117 [Special Issue « Nouvelle-Calédonie 150 ans après la prise de possession »]: 187-202 (<https://jsso.revues.org/1280>).

Cicin-Sain, Biliiana, and Stefano Belfiore

2005 "Linking Marine Protected Areas to Integrated Coastal and Ocean Management: A Review of Theory and Practice". *Ocean & Coastal Management*, 48: 847-868.

Cinner, Josh E., and Shankar Aswani

2007 "Integrating Customary Management into Marine Conservation". *Biological Conservation*, 140: 201-216.

Claudet, Joachim (ed.)

2011 *Marine Protected Areas: A Multidisciplinary Approach*. Cambridge, New York: Cambridge University Press.

Comité local Ifreco (coord.)

2006a Les lagons calédoniens: Diversité récifale et écosystèmes associés. Dossier de présentation en vue de l'inscription sur la liste du Patrimoine Mondial de l'Unesco au titre de bien naturel. Noumea: Comité local Ifreco.

2006b Site 3: Zone côtière Nord-Est. Sub-dossier Unesco. Noumea: Comit. local Ifreco.

Coral Sea Natural Park

2014 Presentation booklet "Le Parc Naturel de la Mer de Corail". Noumea: Maritime Affairs of New Caledonia and French MPA Agency [Online], <http://www.aires-marines.fr/Documentation/Livret-Parc-naturel-de-la-mer-de-Corail/Livret-de-presentation-du-Parc-naturel-de-la-mer-de-Corail> (Accessed on September 19, 2015).

Cornaille, Martine

2014 « Parc naturel de la mer de Corail: Il y a tromperie sur la marchandise ». *L'Éveil Calédonien* [Online], <https://leveilhebdo.wordpress.com/tag/martine-cornaille/> (Accessed on August 02, 2015).

Cornier, Samuel

2009 Systèmes techniques de gestion du milieu marin au sein des clans pêcheurs kanak de Nouvelle-Calédonie. Masters dissertation in social and cultural anthropology. Aix-en-Provence: Aix-Marseille University.

2010 Écologie, politique et clans pêcheurs kanak: Anthropologie des enjeux et de leurs modalités d'articulation dans le cadre du projet d'aire marine protégée Pweevo/Hyabé/Lé-Jao, district coutumier de Pouébo, province Nord de la Nouvelle-Calédonie. Master dissertation in social and cultural anthropology. Aix-en-Provence: Aix-Marseille University.

Dahl, Arthur L., and Jeremy Carew-Reid (eds.)

1985 *Environment and Resources in the Pacific: A Regional Approach*. UNEP Regional Seas Reports and Studies, 69. Geneva: United Nations Environment Programme.

Dahl, Arthur L.

1989 "Traditional Environmental Knowledge and Resource Management in New Caledonia". In R.E. Johannes (ed.), *Traditional Ecological Knowledge: A Collection of Essays*. Gland and Cambridge: IUCN.

Dahou, Tarik, Jean-Yves Weigel, Abdelkader Mohamed Ould Saleck, Alfredo Simao Da Silva, Moustapha Mbaye, and Jean-François Noël

2004 « La gouvernance des aires marines protégées: Leçons ouest-africaines ». *Vertigo, la*

revue électronique en sciences de l'environnement [Online], 5(3):
<http://vertigo.revues.org/3327> (Accessed on September 20, 2015).

D'Arcy, Paul

2006 *The People of the Sea: Environment, Identity and History in Oceania*. Honolulu: University of Hawai'i Press.

2013 "Seabed Mining and Oceania: Imminent Resource Bonanza or Resource Curse Writ Large?". In C. Berger and J.-L. Roques (eds.), *L'eau dans le Pacifique Sud: Entre mythe et réalités*. Paris: L'Harmattan, p. 205-219.

Day, Jon C., N. Dudley, M. Hockings, G. Holmes, D. Laffoley, S. Stolton, and S. Wells.

2012 *Guidelines for applying the IUCN Protected Area Management Categories to Marine Protected Areas*. Gland, Switzerland: IUCN.

Day, Jon C., D. Laffoley, and K. Zischka

2015 "Marine Protected Area Management". In G. L. Worboys, M. Lockwood, A. Kothari, S. Feary and I. Pulsford (eds.), *Protected Area Governance and Management*. Canberra: ANU Press, p. 609-650.

Demmer, Christine, and Christine Salomon (eds.)

2015 « Emancipations Kanak ». *Ethnies*, 37-38. Paris: Survival International.

Demmer, Christine

2007 « Autochtonie, nickel et environnement: Une nouvelle stratégie kanak ». *Vacarme*, 39: 43-48.

Descola, Philippe

2005 *Par-delà nature et culture*. Paris: Gallimard.

Donges, Juergen B.

1985 [2012]. *The Economics of Deep-Sea Mining*. Berlin: Springer.

Drew, Lisa W.

2009 "The Promise and Perils of Seafloor Mining: Can Minerals be Extracted from the Seafloor without Environmental Impacts?". *Oceanus magazine* [Online], 47(3):
<http://www.whoi.edu/oceanus/feature/the-promise-and-perils-of-seafloor-mining>
 (Accessed on July 19, 2015).

Dudley, Nigel (ed.).

2008 *Guidelines for Applying Protected Area Management Categories*. Gland, Switzerland: IUCN.

Dyment, Jérôme, François Lallier, Nadine Le Bris, Olivier Rouxel, Pierre-Marie Sarradin, Sylvain Lamare, Coralie Coumert, Marie Morineaux, and Julie Tourolle

2014 *Les impacts environnementaux de l'exploitation des ressources marines profondes. Expertise scientifique collective, Rapport*. Paris: CNRS-Ifremer.

EPLP (Association Ensemble Pour La Planète)

2014a *VALE minimise scandaleusement*. EPLP Press release, 20 May 2014 [Online]. URL:
<http://www.eplp.asso.nc/?p=4755> (Accessed on May 20, 2015).

2014b « L'aquaculture, oui, mais en milieu naturel ». *Les Nouvelles Calédoniennes*, 07 January 2014 [Online]. URL: <http://www.inc.nc/article/kone/l-aquaculture-oui-mais-en-milieu->

- naturel (Accessed on September 15, 2015).
- 2015a Plan de contrôle des denrées animales DAVAR 2014. Faire pour faire, ce n'est pas bien faire... EPLP Press release, 18 June 2015 [Online]. URL: <http://www.eplp.asso.nc/?p=5028> (Accessed on September 15, 2015).
- 2015b Gros dérapage de Mme Pau-Langevin, Ministre des Outre-Mer... EPLP Press release, 10 September 2015 [Online]. URL: <http://www.eplp.asso.nc/?p=5089> (Accessed on 30 October, 2015).
- Faninoz, Sébastien
- 2009 Aires marines protégées nord-est Nouvelle-Calédonie. Planche synoptique composante 1A, projet 1A2, programme CRISP. Noumea: WWF, ADECAL, Province Nord.
- Faugère, Elsa, and Merle Isabelle (eds.)
- 2010 *La Nouvelle-Calédonie: Vers un destin commun*. Paris: Karthala.
- Faurie, Mathias
- 2011a « Impacts et limites de la patrimonialisation à Ouvéa (Nouvelle-Calédonie) ». *Journal de la Société des Océanistes*, 132: 109-122.
- 2011b Ouvéa: Le sanctuaire Kanak. Dynamiques patrimoniales et recompositions territoriales en Nouvelle-Calédonie. PhD Thesis in geography. Paris: Université Paris IV-Sorbonne, École doctorale de géographie de Paris.
- Féral, François
- 2011 « L'extension récente de la taille des aires marines protégées: Une progression des surfaces inversement proportionnelle à leur normativité ». *Vertigo, la revue électronique en sciences de l'environnement* [Online], Hors-série 9: <http://vertigo.revues.org/10998> (Accessed on September 16, 2015).
- Fiske, Shirley J.
- 1992 "Sociocultural Aspects of Establishing Marine Protected Areas". *Ocean & Coastal Management*, 17(1): 25-46.
- French MPA Agency
- 2014 Creation of the Coral Sea Natural Park: The World's Largest Marine Protected Area in French New Caledonia. Noumea: French MPA Agency and New Caledonia Government [Online]. URL: <http://www.aires-marines.com/News/Creation-of-the-Coral-Sea-natural-park> (Accessed on October 03, 2015).
- Freyss, Jean
- 1995 *Économie assistée et changement social en Nouvelle-Calédonie*. Paris: PUF, coll. Tiers monde/IEDES.
- Friedberg, Claudine
- 1987 « Les études d'ethnoscience ». *Le Courrier du CNRS*, suppl. au n° 67: 19-24.
- Gabrié, Catherine with M. Duflo, C. Dupré, A. Chenet; E. Clua (coord.)
- 2011 Six années pour la protection, la gestion, et la valorisation des récifs coralliens du Pacifique. Capitalisation des résultats. Nouméa: Secretariat of the Pacific Community.

- Gabrié, Catherine, Annick Cros, Christophe Chevillon, and Ahab Downer (coord.)
 2005 Analyse écorégionale marine de Nouvelle-Calédonie: Atelier d'identification des aires de conservation prioritaires (final report). Noumea: WWF.
- Gaspar, Cécile, and Tamatoa Bambridge
 2008 « Territorialités et aires marines protégées à Moorea (Polynésie française) ». *Journal de la Société des Océanistes*, 126-127 (Special issue « Environnement dans le Pacifique Sud »): 231-245 (<https://jso.revues.org/2462>).
- Giron, Yan, Alain Le Sann, and Philippe Favrelière
 2012 Blue Charity Business: La réforme de la Politique européenne Commune des Pêches – Premier panorama – 2000 à 2011. Rapport réalisé pour le Collectif Pêche & Développement.
- Goldenberg, Suzanne
 2014 "Marine Mining: Underwater Gold Rush Sparks Fears of Ocean Catastrophe". *The Guardian* [Online]. URL: <http://www.theguardian.com/environment/2014/mar/02/underwater-gold-rush-marine-mining-fears-ocean-threat> (Accessed on July 21, 2015).
- Graff, Stéphanie
 2012 « Quand combat et revendication kanak ou politique de l'État français manient indépendance, décolonisation, autodétermination et autochtonie en Nouvelle-Calédonie ». *Journal de la Société des Océanistes*, 134: 61-83 (<https://jso.revues.org/6647>).
- Grochain, Sonia
 2015 « La constitution d'une identité sociale et spatiale VKP ». *Ethnies*, 37-38 (Special issue « Émancipations Kanak »): 186-193.
- Halfar, Jochen, and Rodney M. Fujita
 2002 "Precautionary Management of Deep-Sea Mining". *Marine Policy*, 26(2): 103-106.
- Haudricourt, André-Georges
 1964 « Nature et culture dans la civilisation de l'igname: L'origine des clones et des clans ». *L'Homme*, 4: 93-104.
 1988 *La technologie, science humaine: Recherches d'histoire et d'ethnologie des techniques*. Paris: Maison des sciences de l'homme.
- Horowitz, Léa S.
 2004 « Réserver sa place: Définition kanak du concept de 'réserve' des ressources naturelles vivantes ». In J.M. Lebigre and P.M. Decoudras (eds.), *Les aires protégées insulaires et littorales tropicales*, 32. Bordeaux: Université de Bordeaux 3, CRET, Coll. Îles et archipels, p. 141-148.
 2008 "It's up to the Clan to Protect: Cultural Heritage and the Micropolitical Ecology of Conservation in New Caledonia". *The Social Science Journal*, 45: 258-278.
- Hviding, Edvard
 1993 *The Rural Context of Giant Clam Mariculture in Solomon Islands: An Anthropological Study*. Bergen: ICLARM Technical Report, 39.
- Hviding, Edvard, and Graham B. K. Baines
 1992 *Fisheries Management in the Pacific: Tradition and the Challenges of Development in*

Marovo, Solomon Islands. UNRISD Discussion Paper (32). Geneva: United Nations Research Institute for Social Development.

IEOM (Institut d'Emission d'Outre-Mer)

2014 Rapport annuel 2014 de l'Institut d'Emission d'Outre-Mer, Nouvelle-Calédonie. Paris: IEOM.

Inglis, Julian T. (ed.)

1993 *Traditional Ecological Knowledge: Concepts and Cases*. Ottawa: IDRC.

ISA (International Seabed Authority)

2015 Developing a Regulatory Framework for Mineral Exploitation in the Area. Report to Members of the Authority and all Stakeholders. Kingston, Jamaica: International Seabed Authority.

ISEE (Institut de la statistique et des études économiques Nouvelle-Calédonie)

2014 Recensement de la Nouvelle-Calédonie [Online]. URL: <http://www.isee.nc/population/recensement> (Accessed on September 16, 2015).

IUCN (International Union for the Conservation of Nature)

2013 Oceania 2013-2016: Charting a Sustainable Future in Oceania. IUCN: Oceania Regional Program.

Johannes, Robert E.

1978 "Traditional Marine Conservation Methods in Oceania and their Demise". *Annual Review of Ecology and Systematics*, 9: 349-364.

1981 *Words of the Lagoon: Fishing and Marine Law in the Palau District of Micronesia*. Berkeley: University of California Press.

1989 *Traditional Ecological Knowledge: A Collection of Essays*. Gland, Switzerland and Cambridge, UK: IUCN.

Kent, Georges

1980 *The Politics of Pacific Islands Fisheries*. Boulder, Colorado: Westview Press.

Kingsford, Richard T., J. E. M. Watson, C. J. Lundquist, O. Venter, L. Hughes, E. L. Johnston, J. Atherton, M. Gawel, D.A. Keith, B.G. Mackey, C. Morley, H.P. Possingham, B. Raynor, H.F. Recher, and K. A. Wilson

2009 "Major Conservation Policy Issues for Biodiversity in Oceania". *Conservation Biology*, 23(4): 834-840.

Kowasch, Matthias

2012 « Le développement de l'industrie du nickel et la transformation de la valeur de l'environnement en Nouvelle Calédonie ». *Journal of Political Ecology*, 19: 202-220.

Lagadec, Gaël, and Olivier Sudrie

2013 « Du court au long terme: Un scénario 'norvégien' pour pérenniser la rente nickel en Nouvelle-Calédonie ». *Développement durable et territoires* [Online], 4(3) (Special issue « Les conditions de production d'un transport durable »): <http://developpementdurable.revues.org/9884> (Accessed on October 31, 2015).

Latour, Bruno

2004 *Politiques de la nature: Comment faire entrer les sciences en démocratie?* Paris: La Découverte.

Lasseigne, Laetitia

2008 La formalisation des enjeux de gestion sur la zone côtière à partir des usages liés à la pêche locale. Le cas de la zone récifo-lagonaire Voh-Koné-Pouembout. Masters dissertation. Pouembout-Lorient: IAC-CRN éditions, COGERON, Université de Bretagne Sud.

Lebigre, Jean-Michel

2014 Catastrophes écologiques à répétition à Goro Nickel. Post on the blog « Paesaggio, Paysages », 08 May 2014 [Online]. URL: <http://paesaggio.over-blog.com/article-30036590.html> (Accessed on October 07, 2015).

Leblic, Isabelle

1988 « L'évolution des techniques de pêche en Nouvelle-Calédonie ». *Techniques & culture*, 12: 81-119.

1989a « Les clans pêcheurs en Nouvelle-Calédonie. Le cas de l'île des Pins ». *Cahiers des sciences humaines*, 25 (1-2): 109-123.

1989b « Notes sur les fonctions symboliques et rituelles de quelques animaux marins pour certains clans de Nouvelle-Calédonie ». *Anthropozoologica* (Special issue « Animal et pratiques religieuses: Les manifestations matérielles »): 187-196.

1990 "Traditional Kanak Fishing Communities and Fisheries Development in New Caledonia". In H. Frost and P. Andersen (eds.), *Seafood Trade, Fishing Industry Structure and Fish Stocks. The Economic Interaction*. Esbjerg: IIFET/University of South Jutland, p. 1267-1293.

1991 "Fishing, Fishing Clans and Development in New Caledonia". In J.-R. Durand, J. Lemoalle and J. Weber (eds.), *La recherche face à la pêche artisanale*, 2. Paris: ORSTOM, p. 747-756.

1993 *Les Kanak face au développement. La voie étroite*. Grenoble: PUG.

1999 « Pêcheurs kanak et politiques de développement de la pêche en Nouvelle-Calédonie ». In G. Blanchet (ed.), *Les petites activités de pêche dans le Pacifique Sud*. Paris: IRD éditions, p. 119-141.

2000a « Diables et 'choses d'ailleurs' à Ponérihouen (Nouvelle-Calédonie) ». *Cahiers de Littérature orale*, 48 (Special issue « Diable(s) »): 203-230.

2000b « Marmites rituelles et autochtonie à Ponérihouen (Nouvelle-Calédonie) ». *Techniques et culture*, 33 (Special issue « Entre histoire et tradition): 53-87.

2000c « Le dualisme matrimonial paicî en question (Ponérihouen, Nouvelle-Calédonie) ». *L'Homme*, 154-155 (Special issue « Questions de parenté »): 183-203 (<https://lhomme.revues.org/29>).

2001a « Efficacité technique et rituelle face aux changements techniques et sociaux: Le cas des pêcheurs kanak (Nouvelle-Calédonie) ». In G. Danic, A. Geistdoerfer, G. Le Bouëdec and F. Théret (eds.), *Mutations techniques des pêches maritimes: Agir ou subir?* Plouzané: Ifremer éditions, p. 135-163.

2001b « Une pirogue pontée à l'île des Pins ». *Techniques et culture*, 35-36 (Special issue « Traversées. Construction navale, expressions symboliques Asie-Pacifique »): 301-326 (<https://tc.revues.org/296>).

2002a « Igname, interdits et ancêtres en Nouvelle-Calédonie ». *Journal de la Société des Océanistes*, 114-115 (Special issue « En hommage à Jacques Barrau »): 115-127 (<https://jsoc.revues.org/1439>).

- 2002b « Polymorphismes des animaux marins bénéfiques et maléfiques en Nouvelle-Calédonie ». In A. Geistdoerfer, J. Ivanoff and I. Leblic (eds.), *Imagi-Mer. Créations fantastiques, créations mythiques*. Paris: CETMA, Anthropologie maritime « kétéos » 1, p. 229-242.
- 2005 « Pays, 'surnature' et sites 'sacrés' paicî à Ponérihouen (Nouvelle-Calédonie) ». *Journal de la Société des Océanistes*, 120-121 (Special issue « Ethnoécologie en Océanie »): 95-111 (<https://jso.revues.org/410>).
- 2007 "Kanak Identity, New Citizenship Building and Reconciliation". *Journal de la Société des Océanistes*, 125: 271-282 (<https://jso.revues.org/1004>).
- 2008 *Vivre de la mer, vivre avec la terre... en pays kanak: Savoirs et techniques des pêcheurs kanak du sud de la Nouvelle-Calédonie*. Paris: Société des Océanistes, coll. Travaux et documents océanistes 1.
- Leblic, Isabelle, and Marie-Hélène Teulière
- 1985 « Transformations dans l'exploitation du littoral de deux sociétés de pêcheurs kanak: à l'île des Pins et à Poum ». *Anthropologie maritime*, 2: 269-278.
- 1987 *Systèmes techniques et sociaux d'exploitation traditionnelle des ressources marines des pêcheurs du Nord et du Sud de la Calédonie*. Paris: Mission du patrimoine ethnologique, Ministère de la Culture.
- Leenhardt, Maurice
- 1930 [1980]. *Notes d'ethnologie néo-calédonienne*. Paris: Institut d'ethnologie, Musée de l'Homme.
- 1946 *Langues et dialectes de l'Austro-Mélanésie*. Paris: Institut d'ethnologie, Musée de l'Homme.
- Le Meur, Pierre-Yves
- 2008 « Communautés imaginées et politique des ressources naturelles ». In P. Méral, C. Castellanet and R. Lapeyre (eds.), *La gestion concertée des ressources naturelles*. L'épreuve du temps. Paris: Karthala, p. 289-301.
- Le Meur, Pierre-Yves, Paul Sauboua, Estelle Poncet, and Marie Toussaint
- 2012 « Les enjeux de la gouvernance locale des ressources marines en Nouvelle-Calédonie. Contribution à la réflexion sur le 'foncier maritime' à partir de deux études de cas ». In C. David and N. Meyer (eds.), *L'intégration de la coutume dans l'élaboration de la norme environnementale*. Bruxelles: Bruylant, p. 235-252.
- Léopold, Marc, Nathaniel Cornuet, Zacharie Moenteapo, Pierre-Yves Le Meur, Nicolas Guillemot, Jean-Michel Sourisseau, Arnaud Bonmarchand, Carine David, and Benoît Beliaeff
- 2009 *Projet COGERON, rapport de synthèse: Quel avenir pour la pêche dans le lagon de Vook-Khoonê-Pwëëbuu?* Noumea: Service information et communication scientifique IRD.
- Léopold, Marc, Jean-Michel Sourisseau, Nathaniel Cornuet, Carine David, Arnaud Bonmarchand, Pierre-Yves Le Meur, Laetitia Lasseigne, Estelle Poncet, Marie Toussaint, Guy Fontenelle, Jean-Eudes Beuret, and Nicolas Guillemot
- 2013 « La gestion d'un lagon en mutation: Acteurs, enjeux et recherche-action en Nouvelle-Calédonie (Pacifique sud) ». *Vertigo, la revue électronique en sciences de l'environnement* [Online], 13(1): <http://vertigo.revues.org/13297> (Accessed on September 15, 2015).
- Le Sann, Alain
- 2012 « Ocean Business, multinationales, fondations et ONGE: Les pêcheurs sous tutelle ». *Pêche et Développement* [Online], 98-99: 6-14, http://www.peche-dev.org/IMG/pdf/p_d_98-99_web.pdf (Accessed on September 24, 2015).

- 2013a « Réserves marines: Une autre forme d'apartheid? ». *L'Encre de Mer* [Online]. URL: <http://www.l-encre-de-mer.fr/2013-01-20-reserves-marines-accaparement-des-oceans-depossession-des-pecheurs/> (Accessed on May 21, 2015).
- 2013b « Blue Charity Business, suite 2 », *L'Encre de Mer* [Online]. URL: <http://www.l-encre-de-mer.fr/2013-01-06-blue-charity-business-suite-2/> (Accessed on July 20, 2015).
- 2014 « Les terres rares d'un immense océan: La nouvelle bataille du Pacifique ». *Ritimo* [Online]. URL: <http://www.ritimo.org/Les-terres-rares-d-un-immense-ocean-la-nouvelle-bataille-du-Pacifique> (Accessed on July 20, 2015).

Les Nouvelles calédoniennes

- 2015 « Le rappel du drapeau » (published on 6 August 2015).

Lévi-Strauss, Claude

- 1962 *La pensée sauvage*. Paris: Gallimard.

Loubersac, Lionel, Denis Lacroix, and Yves Henocque

- 2013 « Croissance et Sociétés Bleues: Quels intérêts et perspectives pour la Nouvelle-Calédonie ». *TaiKona* [Online], 5: 12-35, <http://archimer.ifremer.fr/doc/00174/28505/26854.pdf> (Accessed on October 30, 2015).

Loubersac, Lionel

- 2015 « L'océan porteur d'enjeux de croissance et de défis majeurs dans l'outre-mer français du Pacifique Sud ». *TaiKona* [Online], 12: 24-36, <http://archimer.ifremer.fr/doc/00255/36615/35184.pdf> (Accessed on September 25, 2015).

Mahapatra, Richard, and Anupan Chakravartti

- 2014 "Mining at Deep-Sea". *Down To Earth*, 15 September 2014 [Online]. URL: <http://www.downtoearth.org.in/coverage/mining-at-deep-sea-46049> (Accessed on May 09, 2015).

Malinowski, Bronislaw

- 1935 *Coral Gardens and their Magic*. London: George Allen and Unwin.

Mauss, Marcel

- 1934 « Les techniques du corps », Extrait du *Journal de Psychologie*, 32 (3-4), 15 mars - 15 avril 1936. In M. Mauss 1985 [1950], *Sociologie et anthropologie*. Paris : PUF, p. 365-386.

McGregor, Deborah

- 2008 "Linking Traditional Ecological Knowledge and Western Science: Aboriginal Perspective from the 2000 State Of The Lakes Ecosystem Conference". *The Canadian Journal of Native Studies*, 28: 139-158.

Mc Kenna, Sheila A., Nathalie Baillon, Henri Blaffart, and Giacomo Abrusci (eds.)

- 2006 Une évaluation rapide de la biodiversité marine des récifs coralliens du Mont Panié, Province Nord, Nouvelle-Calédonie. Bulletin PER d'évaluation biologique, RAP n°42. Washington: Conservation International.

Merle, Isabelle

- 1998 « La construction d'un droit foncier colonial. De la propriété collective à la constitution des réserves en Nouvelle-Calédonie ». *Enquête*, 7: 97-126.

Missotte, Philippe

- 1985 Endogène et exogène en développement mélanésien de Nouvelle-Calédonie. Une

décennie 1970-1980. PhD Thesis in anthropology. Paris: EHESS.

Mokaddem, Hamid

2012 *L'accord de Nouméa pour tous*. Noumea: IFMNC (Institut de formation des maîtres de Nouvelle-Calédonie).

Narchi Nemer E., Samuel Cornier, Donata Melaku Canu, Luis E. Aguilar-Rosas, Mariana G. Bender, Christian Jacquelin, Marion Thiba, Gustavo G.M. Moura, and Rutger de Wit

2014 "Marine Ethnobiology a rather Neglected Area, which Can Provide an Important Contribution to Ocean and Coastal Management". *Ocean & Coastal Management*, 89: 117-126.

North-East Coast MPAs Information Bulletin

2009-2015. *Le Journal des Aires Marines Protégées de la côte Nord-Est*. Noumea: WWF, ADECAL Agence de Développement économique de Nouvelle-Calédonie, North Province.

Pollnac, Richard B., B. R. Crawford, and M. L. Gorospe

2001 "Discovering Factors that Influence the Success of Community-Based Marine Protected Areas in the Visayas, Philippines". *Ocean & Coastal Management*, 44: 683-710.

Pomeroy, Robert S.

1995 "Community-Based and Co-Management Institutions for Sustainable Coastal Fisheries Management in Southeast Asia". *Ocean & Coastal Management*, 27(3): 143-162.

Poncet, Émilie

2010 Modes d'usage et de gouvernance des ressources marines dans la zone d'Oundjo et Gatope, région de Voh-Koné-Pouembout (Nouvelle-Calédonie). Master dissertation. Aix-en-Provence: Aix-Marseille University.

Richer de Forges, Bertrand

2007 Lettre ouverte au directeur du Centre IRD de Nouméa [Online]. URL: <http://www.corail vivant.org/en/archives/IRDRdFletteouverte22marso7.pdf> (Accessed on May 05, 2015).

Richer de Forges, Bertrand, and Michel Pascal

2008 « La Nouvelle-Calédonie, un 'point chaud' de la biodiversité menacé par l'exploitation minière ». *Journal de la Société des Océanistes*, 126-127 (Special issue « Environnement dans le Pacifique sud »): 95-112.

Roce, Charles, and Sara Bice

2013 "Anticipating Social and Community Impacts of Deep Sea Mining". In E. Baker and Y. Beaudoin (eds.), *Deep Sea Minerals: Deep Sea Minerals and the Green Economy*, Volume 2. Fiji: Secretariat of the Pacific Community, p. 59-80.

Roe, Dylis, James Mayers, Maryanne Grieg-Gran, Ashish Kothari, Cristo Fabricius, and Ross Hughes

2000 *Evaluating Eden: Exploring the Myths and Realities of Community-Based Wildlife Management*. Series overview, 8. London: International Institute for Environment and Development (IIED).

Roth, Maggie, and Brian Thomson

2012 "Vers une définition correcte des aires marines protégées". IUCN International news release [Online]. URL: <http://www.iucn.org/?10904/2/Vers-une-definition-correcte-des-aires-marines-protegees> (Accessed on September 16, 2015).

- Rougeyron (Le père)
 1995 *Abrégé de la vie d'Hippolyte Bonou, chef de la tribu de Pouébo en Nouvelle-Calédonie*. Noumea: Grain de sable.
- Ruddle, Kenneth, and Tomoya Akimichi (eds.)
 1984 *Maritime Institutions in the Western Pacific*. Senri Ethnological Studies, 17. Osaka: National Museum of Ethnology.
- Ruddle, Kenneth, and Robert E. Johannes
 1989 *Traditional Marine Resource Management in the Pacific Basin: An Anthology*. Contending with global change, Study N° 2. Jakarta, Indonesia: Unesco/ROSTSEA.
- Ruddle, Kenneth, Edvard Hviding, and Robert E. Johannes
 1992 "Marine Resources Management in the Context of Customary Tenure". *Marine Resource Economics*, 7: 249-273.
- Salvat Bernard, Bertrand Cazalet, and François Féral
 2008 « La représentation internationale des aires marines protégées françaises: Définition et affichage des surfaces protégées. Réflexions sur les aires marines protégées ultramarines ». *Le Courrier de la Nature*, 239: 34-41.
- Salvat, Bernard, Tamatoa Bambridge, Donatien Tanret, and Jérôme Petit
 2015 *Environnement marin des îles Australes, Polynésie Française*. Tahiti: Institut Récifs Coralliens Pacifique, CRIOBE and The Pew Charitable Trusts Polynésie Française.
- Sand, Christophe
 1995 *'Le temps d'avant': Préhistoire de la Nouvelle-Calédonie. Contribution à l'étude des modalités d'adaptation et d'évolution des sociétés océaniques dans un archipel du Sud de la Mélanésie*. Paris: L'Harmattan.
- Sand, Christophe, Jacques Bolé, and André John Ouetcho
 2003 « Les aléas de la construction identitaire multi-ethnique en Nouvelle-Calédonie: Quel passé pour un avenir commun? ». *Journal de la Société des Océanistes*, 117 (Special issue « Nouvelle-Calédonie 150 ans après la prise de possession »): 147-169 (<http://jso.revues.org/1252>).
- Sauboua, Paul
 2009 La mise en place des Aires Marines Protégées du district de Borendy (Thio, Nouvelle-Calédonie). Acteurs, enjeux et gouvernance. Masters dissertation. Montpellier: IRC.
- Saussol, Alain
 1979 *L'Héritage. Essai sur le problème foncier mélanésien en Nouvelle-Calédonie*. Paris: Société des Océanistes.
- Sheps, Ruth (dir.)
 1993 *La science sauvage: Des savoirs populaires aux ethnosciences*. Paris: Seuil.
- SPC (Secretariat of the Pacific Community)
 2012 Pacific-ACP States Regional Legislative and Regulatory Framework for Deep Sea Minerals Exploration and Exploitation. SPC SOPAC Division published report 111 on the Deep Sea Minerals Project. Suva, Fiji: Secretariat of the Pacific Community – EU EDF 10.

- Sperber, Dan
1982 *Le savoir des anthropologues*. Paris: Hermann, coll. Savoirs.
- Traditional Marine Resource Management and Knowledge*. Secretariat of the Pacific Community Information Bulletin, Coastal Fisheries Program, 1992 (1) – 2015 (35). Noumea: Secretariat of the Pacific Community, Fisheries Information Section.
- Teulières-Preston, Marie-Hélène
1992 "Traditional Marine Resource Management in the North of New Caledonia". *Ressources marines et traditions*, 1: 8-11.
2000 « Le droit maritime kanak et ses transformations ». In A. Bensa et I. Leblic (eds.). *En pays kanak. Ethnologie, archéologie, linguistique, histoire de la Nouvelle-Calédonie*. Paris: Maison des Sciences de l'Homme, p. 129-146.
- Toussaint, Marie
2010 Pratiques et enjeux de la cogestion des ressources lagonaires en Nouvelle-Calédonie: L'exemple du programme COGERON dans la région de Voh-Koné-Pouembout (Nouvelle-Calédonie). Masters dissertation. Aix-en-Provence: Aix-Marseille University.
- Trichet, Jean and Isabelle Leblic (eds.)
2008 *Journal de la Société des Océanistes*, 126-127 Special issue « Environnement dans le Pacifique Sud ». Paris: Société des Océanistes (<https://jsoc.revues.org/1804>).
- Veitayaki, Joeli
2004 "Building Bridges: The Contribution of Traditional Knowledge to Ecosystem Management and Practices in Fiji". Reporting of the Millennium Ecosystem Assessment Conference "Bridging Scales and Epistemologies: Linking Local Knowledge and Global Science in Multi-Scale Assessments", Alexandria, Egypt (2004).
- Virly, Sabrina, Damien Buisson, Barry Clough, Hugues Lemmonier, and Bertrand Richer de Forges
2005 Évaluation de l'impact de l'aquaculture de crevettes sur les mangroves de Nouvelle-Calédonie (Final report). Noumea: ZoNéCo Program.
- Wagner, John, and Mike Evans (eds.)
2007 "Customs, Commons, Property, and Ecology: Case Studies from Oceania". Special issue of *Human Organization*, 66(1).
- Ward, Trevor J., Denis Heinemann, and Nathan Evans
2001 *The Role of Marine Reserves as Fisheries Management Tools: A Review of Concepts, Evidence and International Experience*. Canberra: Bureau of Rural Sciences, Australia.
- Wedding, Lisa M., S. M. Reiter, C.R. Smith, K. M. Gjerde, J. N. Kittinger, A.M. Friedlander, S. D. Gaines, M.R. Clark, A.M. Thurnherr, S. M. Hardy, and L.B. Crowder
2015 "Managing Mining of the Deep Seabed". *Science*, 349: 144-145.
- Wells, Martin A., Erick R. Ramanaidou, Michael Verrall, and Christian Tessarolo
2009 "Mineralogy and Crystal Chemistry of 'Garnierites' in the Goro Lateritic Nickel Deposit, New Caledonia". *European Journal of Mineralogy* 21(2): 467-483.
- Winslow, Donna
1995 « Indépendance, savoir aborigène et environnement en Nouvelle-Calédonie ». *Journal of Political Ecology*, 2: 1-19.

WWF (World Wildlife Fund for Nature)

2010 "Création des 3 aires marines protégées de la côte Nord-est (inauguration officielle) ». Le Caillou Vert – WWF New Caledonia Press release, 20 December 2010 [Online]. URL: <http://nouvelle-caledonie.wwf.fr/2010/12/20/creation-des-3-premieres-aires-marines-protgees-de-la-cote-nord-est-inauguration-officielle/> (Accessed on May 15, 2015).



Socioeconomic significance of fisheries in the Small Island Developing States: natural heritage or commodity?

Nathalie HILMI, Tamatoa BAMBRIDGE, Alain SAFA, Bran QUINQUIS and Paul D'ARCY

Introduction

Commodities are defined in economics as marketable and interchangeable goods or services produced to satisfy wants or needs; they can also be inputs in the production of other goods and services with commodity prices determined by supply and demand. This chapter questions if fisheries should be considered as just economic commodities or something broader which we refer to as “natural heritage”. “Natural heritage” refers to the biodiversity inherited from past generations, maintained in the present, and transmitted to future generations. In local daily life, communities in the Pacific do not really make a distinction between natural and cultural heritage. For many Pacific Islanders, land and sea marks are inherited through ancestral transmission and the relation between nature and culture is embedded in their cultural visions and practices (Descola 1986; Hviding 1996). Universal environmental features such as reef passages are therefore also given, in some places, local meaning by specific references to historical events and cultural views on how the world is formed and maintained (Kirch et al. 2010; Morrison 1966; Verin 1965). Thus, for example, the northernmost point of Aotearoa/New Zealand is known as Cape Reinga to European New Zealanders, but “TeRerenga Wairua” to Māori, the leaping place of spirits of the dead on their journey to the spirit world of the ancestors. In Tahitian oral history, Tahiti is conceptualized as a fish, with the head located in Tairapu (the small peninsula of southwest Tahiti), the stomach in Mataeia (the western part of Tahiti) and the tail in Faaa (the northern part of Tahiti). The locality of Hotopua in Teahupoo, Tairapu, combines sea and land spaces, and is known throughout the Polynesian triangle (the cultural-geographical area bound by Hawai'i, Aotearoa/New Zealand and Rapanui/Easter Island) as the primary portal of the gods Taaroa and Tane, and of the spirits of the dead, when they come to visit the visible world of humans. At the other end of Tahiti, Tata'a located in Faaa (the tail of the fish) is where the spirits of the dead and gods leave the visible world for the invisible world of the gods and ancestors. The first modern version of the Tahitian *rahui* (a restriction on resources), established in 2014, encompasses Hotopua as a sacred place that needs to be protected for the benefit of local communities (Bambridge 2013).

Moreover, specific species (for example the green turtle in the central Tuamotu, Archipelago of French Polynesia) in many cultures of Oceania are considered as gifts from the ancestors, as a *taura'a* or a sort of totem that personalizes the extended family today, or as kin (Bambridge 2009; Firth 1964). Other marine species or individuals within a species might be seen as *waka* (vessels) of ancestors or gods, for example tiger sharks whose body marks make every individual easily identifiable. In Hawaii, their appearance soon after the death of a relative created a bond between the deceased's family and the particular shark involved from then onwards (Beckwith 1970: 128).

Indigenous history across the Pacific Islands region also reveals clans associated with the sea shore and others associated with mountains and valleys. For example, the linguistic distinction between *tai* (the side of the sea) and *uta* (valley) in French Polynesia (Bambridge 2015) reflects both the indigenous and the local representation of island territory. Fish, yam and taro also served as commodities for exchanging objects and food between clans (Bambridge 2015). Even on small atolls where no location was more than a few hundred meters from the ocean, exchanges occurred between land and sea products, identified and socially constructed as exchanges between males/sea and females/land (Alkire 1968). In the earlier period of Pacific history when indigenous priorities dominated, the modern dichotomy noted above between fish as a commodity and fish as a cultural exchange item and natural heritage was not present (Caillot 1909; Hanson 1973; Kirch 2000). For example, Katherine Luomala (1984) demonstrated how certain sea creatures could be viewed as both food and ancestors in different contexts in Kiribati. This characteristic is not isolated to Pacific Island societies. Many other societies (e.g., in Japan, Mediterranean countries, etc.) also exchange objects, food and fish for economic, ritual, political and cultural purposes. However, Pacific Islanders are unique in the extent to which utilitarian, economic values assigned to objects exchanged were of secondary importance to the social and political interactions prompting these "economic" exchanges. Goods were a means to an end rather than the end itself. Even in exchanges between resource-poor atolls and better endowed high islands, social and political alliances were constructed and maintained, and the respective *mana* (prestige and authority) recognized and acknowledged. These exchanges of sea and other products were more valued than these goods. They also provided more substantial benefits in terms of refuges from natural disasters and networks of support (Alkire 1965; Davidson 1978; Lessa 1950; Lewthwaite 1966).

What is also specific to Pacific Island societies is the fact that they live in a territory incorporating the largest inhabited section of the world's oceans (Banks 1962). The Pacific Ocean is the biggest ocean in the world and many Pacific Islanders maintain a special link with the ocean (see also the introduction of this volume). It is considered, for example, by the Polynesians as the very first *marae* (open place where ritual ceremonies are performed). Furthermore, it was common in ancient

Polynesia that those *marae* were the place where “guardian animals” would meet with their mentors (Barry 2002). This was for instance the case for Upaupai Fenuaura Marae where a famous ancestral figure, the guardian shark, would appear at very specific seasons.

The Pacific Ocean is also the richest ocean in terms of commercial fisheries. For example, the Western and Central Pacific tuna fishery is the largest and most intact tuna fishery in the world, supplying more than half of the world’s tuna supplies (Bardach and Riding 1985; Allain et al. in this volume). This economic role at times conflicts with cultural roles that fisheries play in Pacific societies.

Another issue that concerns Pacific peoples is that many emblematic species protected by international conventions (whales, dolphins, turtles, rays) are localized in the Pacific Ocean and are often small populations or in the early stages of recovery from overfishing. The Central and the South Pacific for example accommodate the smallest specific populations of humpback whales and many other species of dolphins such as the rough-toothed dolphin and spinner dolphin (Poole 2015).

The first part of this chapter will highlight the cultural and socioeconomic importance of fisheries in Pacific Small Island Developing States (PSIDS). The second part will discuss the importance of fisheries for Pacific Islanders in terms of environmental issues and viewing fisheries as natural heritage rather than as commodities. This chapter reveals a contemporary trend of some Pacific Islanders reconstructing their relations with various marine organisms and acting as guardians, not only of their marine resources (Teiwaki 1988; Willis et al. 2003), but also of oceanic spaces (near and off-shore) which are imbued in some localities with long and deep cultural histories and meanings, central to Pacific identities (D’Arcy 2006a: Chapter 2; Hviding 1996). The involvement of Pacific Islanders in fisheries as well as in near and off-shore conservation forms a complex dynamic that needs to be taken into account in any form of contemporary and future sustainable management regimes (D’Arcy 2013).

Socioeconomic and cultural importance of fisheries

The status of fish in indigenous Polynesia

Mythologies of eastern and southern Polynesia relating to fish and the ocean are numerous and convergent despite linguistic diversity (Arbousset 1867). According to Henry (1928: 389), in ancient Tahiti, the whale was the “Shadow of Ta’aroa” (the preeminent god associated with the ocean in Polynesian cosmogony). Other fishes, including dolphins, personified the spirits of those lost at sea and drowned. In the latter case, the changing colour of a dolphin-fish (*mahimahi*) was allocated from these spirits after the death of people (Henry 1928: 390; Williamson 1933). An interpretation of Rongorongo petroglyphs (a written language of Rapa Nui or Easter Island) locates the whale in the song of creation of this island as born from the union of the god

Tinirau and the goddess Hina. It thus establishes a relationship between the whale and the supreme god Makemake (Metraux 1941: 321; Rjabchikov 2000, 2001: 219, 2002; Whimp 2008).

In the Austral Islands and Cook Islands, just as in the Tuamotus, there were experts (*Tobunga, arai'a*) who specifically regulated relations between large marine mammals and island societies. For instance, stranded whales in Pukapuka (Cook Islands) came within the jurisdiction of Te Mangamanga, the guardian of the trees. This guardian priest oversaw the division and distribution of whale meat, whose consumption was forbidden to children (Beaglehole and Beaglehole 1938: 311). In Rurutu and Rimatara in the Austral Islands, the consumption of turtle meat was reserved for *ari'i* (chiefs), within the chiefdom. Because of the removal of the privilege of eating turtle meat in these last two islands during the French annexation in 1900, the guardian experts (*arai'a*) criticized the terms of the annexation (Bambridge 2009). To the west of the Austral Islands, Vatea, the father of the gods in Rarotonga (Cook Islands), appeared as half man, half fish and was recognized as an ally of the dolphin (Williamson 1933: 12).¹

In some Pacific Islands, the universe of the Great Ocean, Moana, permeated all human relations regarding mythology, gods, classification and taxonomy systems, ontology, power relations and statutory alliances between chiefdoms, tenureship arrangements, protection of the invisible world of spirits and ancestors, and the capture and consumption of fish and other animals (Kirch and Khan 2007; Lucett 1851; Moerenhout 1837; Whimp 2008). In the oral traditions of Rurutu and Raivavae (Austral Islands), porpoises and some species of sharks acted as protectors of specific extended families and as the equivalent to land toponyms in helping people find their way to their village (for similar observations in Kiribati, see Grimble R. 1972; Grimble A.F. 1989). In the case of the Austral Islands, the beautiful "Ire" shark is saved by the gods Ta'aroa and Tu. The former gave Ire to another god, Tane. Tane had a little red bird companion that guided this shark and a large red bird who was also his messenger in the realm of Moana ("*mono eia Taneirotoitemoana o teieaonei*"). This large red bird guided travellers, but travellers risked perishing by storm if the sailors abused him (Henry 1928: 369).

Fish and other marine animals are not only aspects of many Oceanian mythologies, they are also objects of exchange between clans from the sea and the land for ceremonial purposes (Bonnemaison 1996 for Melanesia and Lewthwaite 1966 for Polynesia).

1. We do not know precisely if the term "dolphin" used by Williamson refers to the dolphin mammal or the dolphin-fish. In Tahitian the word is "*tohora*" for the dolphin mammal and "*mahimahi*" for the dolphin-fish, which is called "*masimasi*" in Samoan. According to Poole (personal communication), there is no uncertainty whatsoever – "*masimasi*" applies only to the dolphin-fish and never to the dolphin mammal in Samoa.

Whether it is considered as a commodity or as a natural or cultural heritage, during the last decade, fish and ocean in the Pacific have gained tremendous importance for many actors inside and outside Oceania for two main reasons: food security and environmental protection in the context of globalization (D'Arcy 2012). They have also been assigned significant economic importance that is not only concerned with fisheries but also with protection/valorization of the marine environment.

Food security, trade and income

Food security

The Small Island Developing States appeared in the 1992 Earth Summit as a group of nations sharing similar and unique concerns. In particular, the PSIDS form an organized group of developing countries of the Pacific region advocating their views of the Pacific Ocean and its resources.² Fisheries and living marine resources are essential for the lives, cultures and economies of the PSIDS' inhabitants, especially in the context of the limits on land-based development. These people are dependent on ocean-related economic activities, such as fisheries and coastal tourism, for food, employment and national income.

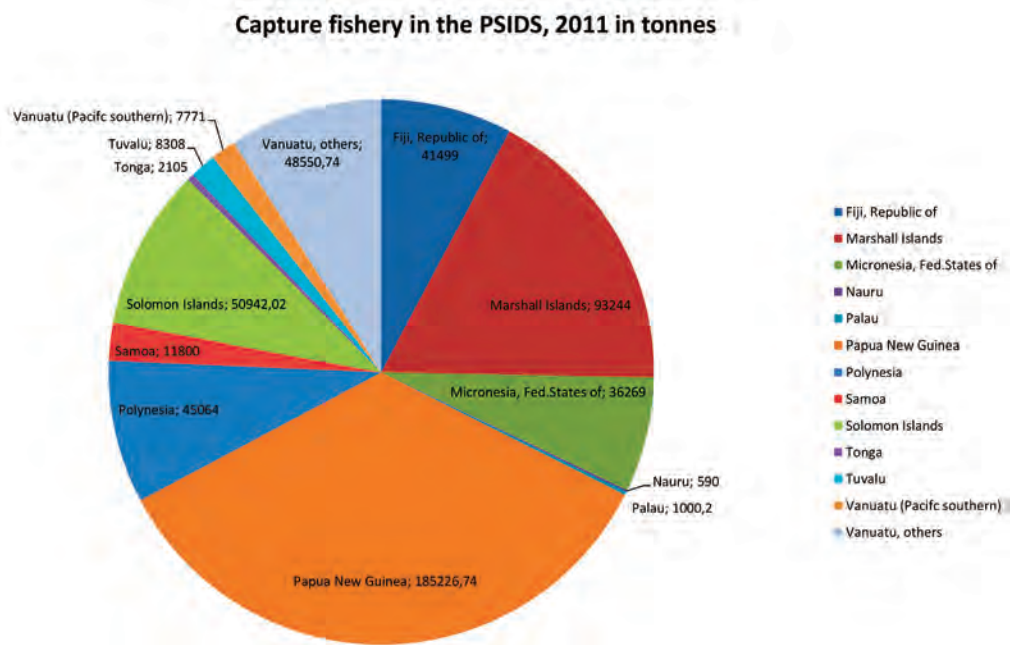
Access to fish, as their basic source of animal protein, is crucial for the PSIDS. They are very dependent on their offshore resources and very vulnerable to food insecurity (ADB 2007; Gillett 2009). Subsistence fisheries (fish caught for local consumption rather than market sale) provide 50% to 90% of the animal protein diet of the PSIDS' populations living in rural settings and in remote islands.³ But this resource is threatened by the loss of coral reefs, which provide nutrients to fish and other seafood, and by climate change effects such as ocean acidification and rising water temperatures. It is also threatened by legal and illegal fishing within the exclusive economic zones (EEZs) of the Pacific nation states. In the last decade, the Pacific Community has declared bluefin, bigeye and yellowfin tuna to all be overfished beyond sustainable levels (Allain et al. 2008; FFA 2008; Gillett 2008).⁴ The total harvest of tuna has increased by an average of 5% per year over the past 50 years.

2. According to the United Nations Conference on Trade and Development (UNCTAD), PSIDS are Fiji, Marshall Islands, Federated States of Micronesia, Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu. Biodiversity issues are crucial for these PSIDS because they have special connections with the ocean and sea.

3. For example, in French Polynesia, 58% of households consume their own catches in Tahiti and 85% outside Tahiti (ISPF 2002).

4. In this volume, Allain et al. confirm that, according to the 2014 stock assessment, overfishing is occurring on an overfished bigeye tuna stock. They also state that it is highly likely that the yellowfin tuna stock is not experiencing overfishing and is not in an overfished state, even if yellowfin tuna is at least fully exploited.

Figure 1: Capture fishery in the PSIDS in 2011 by tonnes



Sources: FAO Fishstat

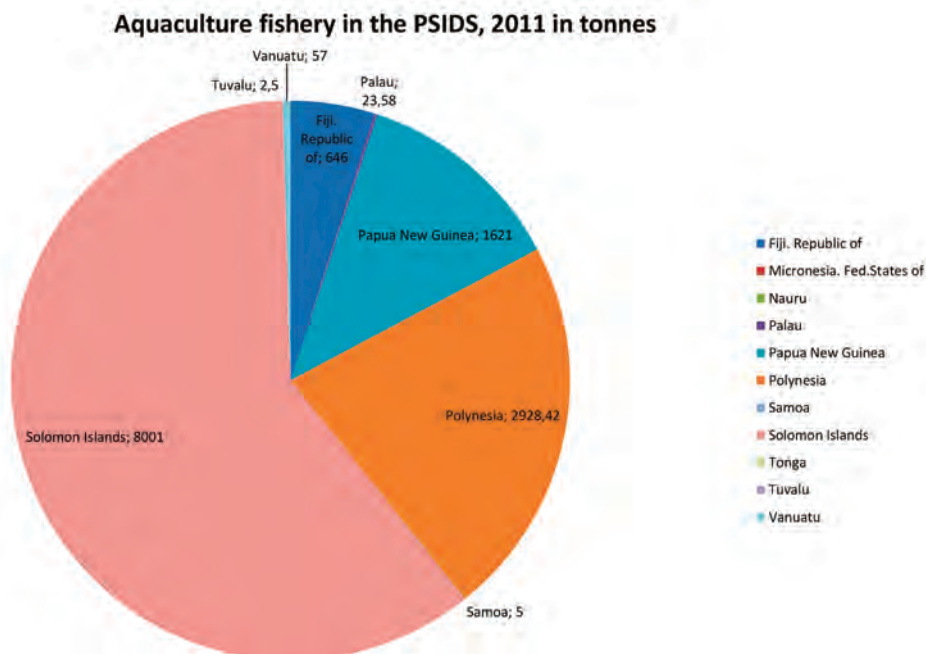
This average understates the escalating pressure on fisheries given that the number of boat-days has risen about 10% per year over the period 1970–2000. Boat-days are the fishing access license standard measure of one day's fishing by one boat (Kompas, Grafton and Che 2010: 1–2).

Fig. 1 demonstrates that the PSIDS that are the most reliant on capture fishery are the Melanesian countries of Papua New Guinea, Solomon Islands, Vanuatu, and Fiji, with Marshall Islands and French Polynesia also being heavily dependent. Most of their catch is for their own consumption, but part of it is traded.

Overfishing and climate change have depleted natural resources and increased pressures on subsistence-level livelihoods in the Solomon Islands. Fig. 2 shows that the Solomon Islands have thus developed a large aquaculture sector, which mainly consists of small-scale inland aquaculture ventures. Farming of seaweed (*Kappaphycus*) and fish (such as *Macrobrachium* or tilapia) is promoted as an alternative means of supplying food and livelihoods in rural areas, in accordance with aquaculture development plans.⁵ Environmentally sustainable forms of aquaculture are developed to

5. See, for instance, Solomon Islands and the Pacific Community's Joint Country Strategy 2009–2012, approved by the Solomon Islands Government in November 2008,

Figure 2: Aquaculture fishery in the PSIDS in 2011 by tonnes



Sources: FAO Fishstat

build economic growth through exports of Penaeid prawn, hatchery-reared giant clams (*Tridacna derasa*), and marine ornamentals such as corals, juvenile lobsters and other crustaceans for aquarium exporters, or blacklip and goldlip pearl oysters. Kiribati has also invested significantly in aquaculture, in this case coastal and near-shore because of its atoll environments (Thomas 2003).

Fisheries contribute to employment and income, poverty alleviation and social inclusion. It is a crucial sector for the PSIDS' economies, and one where women play a substantial role. Although it varies between geographic regions, women account on average for 56% of annual small-scale catches, resulting in an economic impact of US\$363 million in the Pacific region (Harper et al. 2013). Livelihoods of coastal communities are focused on fishing and fish farming, even though other income generating or subsistence activities are important too, e.g., tourism or homestead farming.

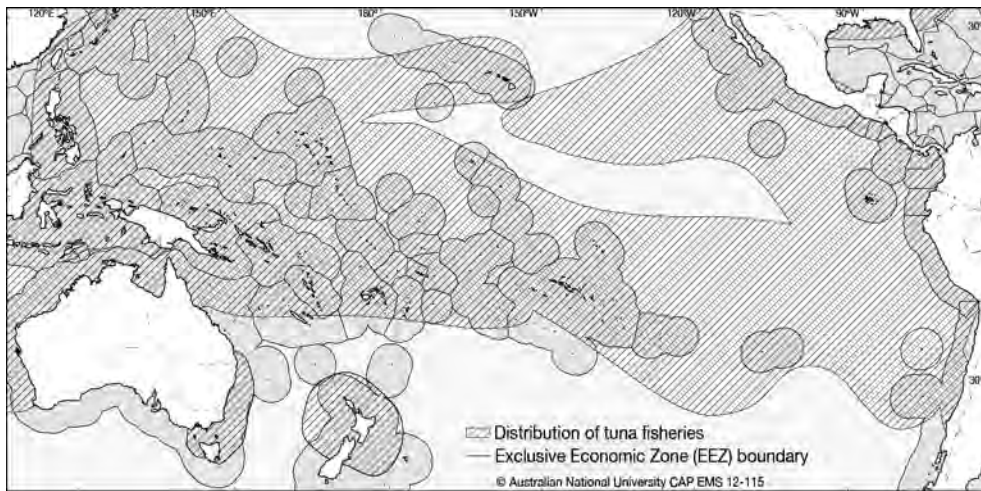
In the PSIDS, fisheries provide revenue and employment to small-scale fishers and fish farmers who sell their catch in urban centres and tourist resorts. Some are

<http://www.spc.int/sppu/images/stories/microsoft%20word%20-%20solomon%20islands%20jcs%20revised%20final%20edited%20for%20print.pdf> (Accessed on October 16, 2015).

also employed on vessels for industrial fisheries. Women often market their catches, creating new job opportunities. Sport fishing has potential for development as a small-scale ecotourism activity for many communities. An important percentage of the active population is employed in fisheries and associated activities, such as processing and trading. It is important to note that in some island states, capture fishery can contribute as much as 10% of Gross Domestic Product (GDP) and fish consumption accounts for 50 to 90% of the diet of coastal communities, 3 to 4 times the world average (FAO 2014). If the fisheries sector declines, fishers have to find work outside the country and send back remittances to support relatives because there are few alternative employment options in their country. In small-scale artisanal fisheries, most catches are for human consumption. In industrial fisheries, bycatch and discards are unregulated practices that increase pressure on the resources. Only high-value species are retained because of a lack of storage space on vessels. This is the practice of high-grading, which increases the pressure on oceans when the industrial fishers have high volume export objectives.

Trade and income

Figure 3: Distribution of the Pacific tuna fisheries relative to EEZ



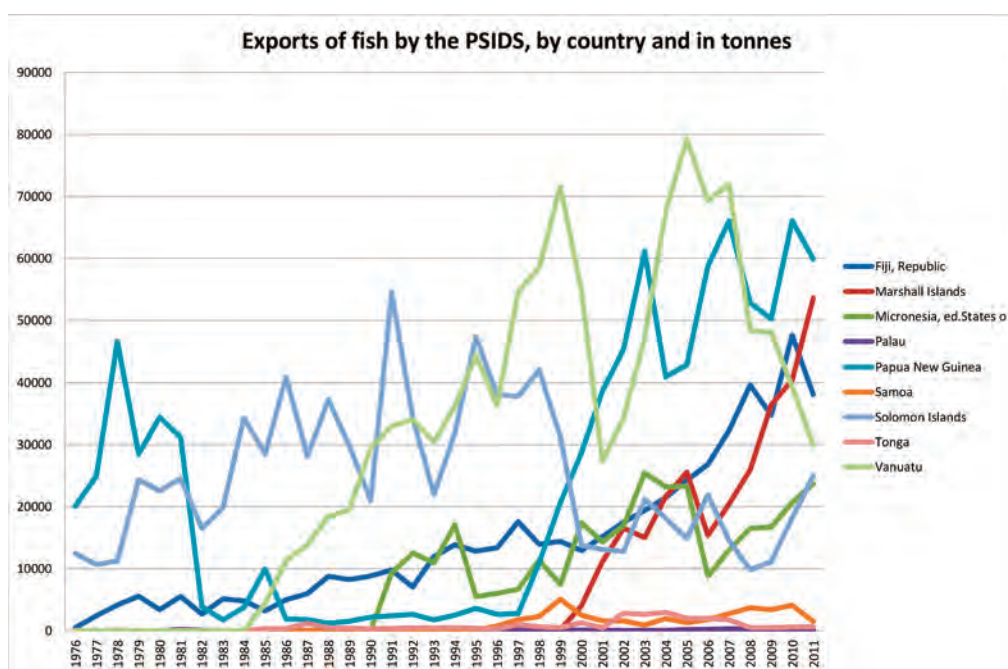
Sources: Bambridge and D'Arcy (2014: 119)

According to the latest report from the South Pacific Commission (Gillett 2014), tuna fisheries account for just over 2.5 million tonnes in the Pacific (fig. 3). In this volume's first chapter, Allain et al. note that the tuna fishery in the Western and Central Pacific Ocean (WCPO) is the largest in the world with 2,627,696 tonnes

(t) of tuna caught in 2013. This tonnage represented 82% of the total 2013 Pacific Ocean catch of 3,213,733 t and 58% of the global tuna catch (see also Williams and Terawasi 2014).

For the last 20 years, the artisanal catch has represented less than 10% of the total catch in tuna fisheries (Chand, Grafton and Petersen 2003: 331-332; Cordonner 2005: 724; D'Arcy 2006a and 2006b; Gillett 2014; Gillett et al. 2001; Williams and Reid 2006). Fig. 4 shows that tuna fisheries make a minor contribution to Pacific nations' GDP, even though they represent a source of foreign exchange through exports of fish and fishery products. Fish caught in the Pacific contribute to the world food supply, for human consumption (protein intake) or feed for livestock and aquaculture (Borgese and Ginsburg 1985).

Figure 4: Exports of fish by the PSIDS, by country and in tonnes



Sources: FAO Fishstat

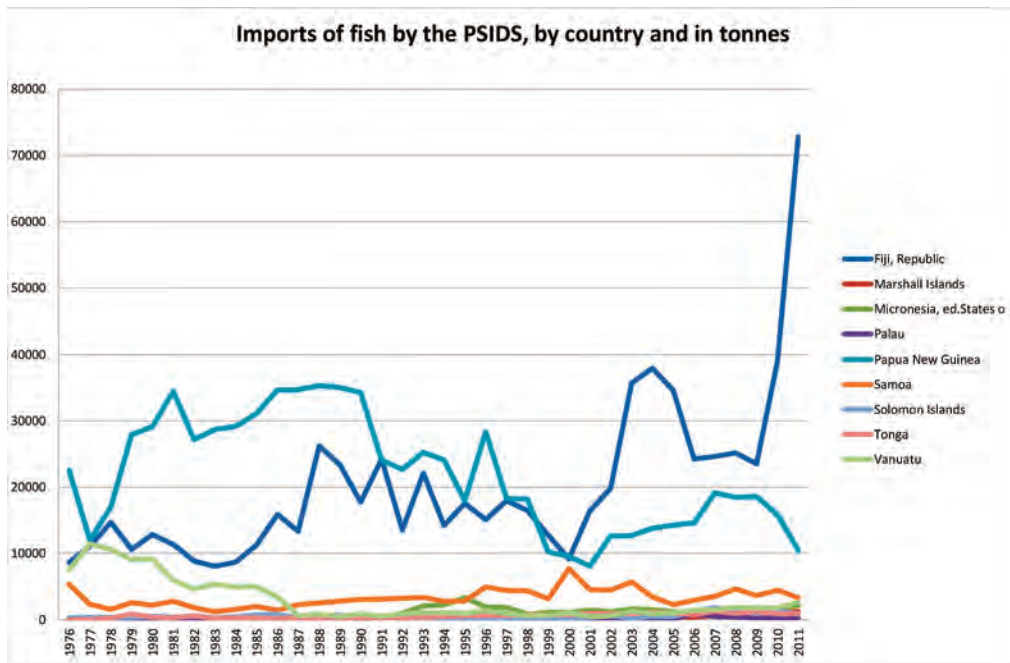
Distant-water fishing nations (DWFNs) are important users of tuna resources in the Pacific Islands region. It is estimated that they account for 86% of the catch from the Pacific and sold at market, especially in Japan, Taiwan, South Korea and the United States. Despite all major stakeholders signing a Multilateral High Level Convention (MHLIC) on the Conservation and Management of Highly Migratory

Fish Stocks in the Western and Central Pacific Ocean in Honolulu in 2000 (MHLC 2000), DWFNs continue to prefer bilateral relations to multilateral ones when dealing with Pacific Island nations because of the greater strength of Pacific collective bargaining stances (Cordonnery 2005: 725; MHLC 2000; Tarte 1998 and 1999). The exception has been the United States whose multilateral agreement with members of the Pacific Islands Forum Fisheries Agency (FFA) produced terms more favourable to Pacific Island nations than most bilateral ones between these nations and DWFNs (Van Dyke and Nicol 1987). Bilateral agreements tend to be less restrictive on DWFNs' operations than the protocols collectively defined by FFA members. These protocols also potentially compromise bilateral aid, which is seen by DWFNs that are also aid donors as a potential tool for gaining the fishing access rights they desire.

Pacific nations not only derive little benefit from selling fishing access rights to their EEZs to DWFNs, but contrary to prevailing beliefs, many PSIDS are net importers of fish for their own consumption and for their tourist industry (fig. 5).

The case of the Republic of Fiji is unique because of their important re-export figures (fig. 6), meaning that they export a part of their fish imports. Fish

Figure 5: Imports of fish by the PSIDS, by country and in tonnes

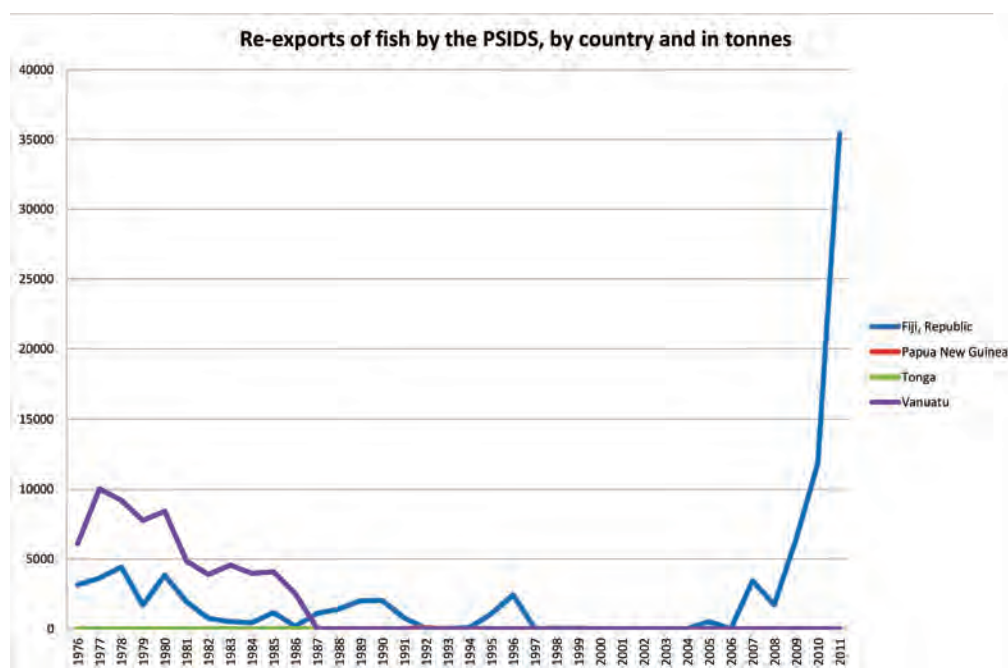


Sources: FAO Fishstat

is an important natural resource sector in Fiji, second only to sugar. In 2005, the Asian Development Bank (ADB 2005) estimated that fishing represented 1.7% of Fiji's GDP, exports of fishery products were about 9.1% of all Fijian exports, and jobs directly related to fisheries represented about 3.8% of the total number of jobs in Fiji (salaried or self-employed). Fish make an important contribution to the diet of local residents and tourists. Fisheries are either offshore (mainly tuna long-lining) or coastal (for subsistence, local markets or exports) and about 50% of all rural households are involved in subsistence fishing (reef gleaning, hook-and-line fishing, and spear-fishing). The main ocean-based exports are tuna and bycatch, mostly to supply the sashimi market in Japan (Ministry of Finance and National Planning 2006) but also in the USA and Europe, as well as aquarium items, *bêche-de-mer* and trochus. They import fresh chilled quality fish from the Pacific area and re-export it as frozen fish or processed fish products to other countries.

When these ocean-based resources are less abundant or their price increases, the PSIDS' food security becomes at risk. The level of their populations' vulnerability depends on their capacity of adaptation to hazard risks. Boats are easily lost in

Figure 6: Re-exports of fish by the PSIDS, by country and in tonnes



Sources: FAO Fishstat

storms and aquaculture infrastructure is often exposed to climate hazards. Fish is a highly perishable good that needs to be sold or consumed rapidly when freezing is not possible. Small-scale fishers are price-takers on the markets, so in a weak marketing position. They tend to take life-threatening risks to increase their capture. Small-scale fisheries are increasingly dedicated to commercial goals and exports rather than subsistence, and therefore compete with industrial fisheries, but they have limited access to insurance and financial credit. In brief, artisanal fisheries remain a risky sector with low profitability.

Maximizing fish commodity through environmental protection

Pacific nations' engagement in world negotiation forums

The fishing industry (whether coastal or offshore) is not the sole resource of Pacific nations. Fisheries conservation and management also play key social and economic roles, both in coastal areas near urban centres and in the EEZs of Pacific nations.

The international ocean governance framework for the management of oceans is provided by the 1982 United Nations Convention on the Law of the Sea (UNCLOS), which defines the extent of jurisdictional zones and sets the rights and obligations of each country. The UNCLOS governs activities both at sea and on land. Other global and regional agreements supplement the UNCLOS, like the United Nations Fish Stocks Agreement, the Convention on Biological Diversity, Chapter 17 of Agenda 21, and the United Nations Environment Programme that includes the Regional Seas Programme, complemented by regional fisheries management organisations such as the Western and Central Pacific Fisheries Commission. Multilateral agreements (Brownlie 1995) have also been adopted under the auspices of the International Maritime Organisation with regard to shipping, and of the International Whaling Commission that aims to ensure sustainable whale populations. In the Doha round of the World Trade Organization, the SIDS participated in the negotiations because of the impact on their trade of marine goods and services (especially commodities through preferential trade regimes).

Besides, a series of local regimes and interest groups operate under a broad umbrella of national and international principles, such as conservation of endangered ecosystems and species being paramount over sector or community interests, and open but differentiated access to the foreshore on the basis of historical and cultural factors (D'Arcy 2006b; Govan 2009; Hviding and Baines 1994; Johannes and Macfarlane 1990; Laffoley 2008; Veitayaki et al. 2011).

It is in this context that, for the last 10 years, we have been observing a rapid and profound trend towards the guardianship of resources and marine territories near and off-shore in and around many Pacific Islands (Bambridge and D'Arcy 2014; D'Arcy 2013; Lee et al. 2007; Toonen et al. 2013).

Pacific population and environmental issues

As mentioned earlier, fisheries are not only important as a commodity for Pacific peoples, but also as a natural and cultural heritage managed by local populations (SPC 2012). In 2011, Govan et al. (2011) recorded 420 sites across 8 countries in Oceania practicing “Community-Based Adaptive Management” (CBAM) over 12,000 km² of coastal marine areas. But the number of sites and the area covered is actually much larger than that if one takes into account the full range of legal, ecological and cultural instruments used for marine protected areas (MPAs), which are only rarely classified as CBAM by marine scientists.

Some approaches in the Pacific do insist that fisheries are both a commodity and a natural and cultural heritage. Examples include the Cook Islands where a legal framework has been established that combines traditional management of *ra’ui* (Cook Islands’ term for *rahui*, meaning a restriction on resources) by local chiefs with a legal state framework and ecological surveys implemented by the National Environment Service.⁶ There are, for example, six locally-managed MPAs on the island of Rarotonga (Cook Islands), whose ecological connectivity (the ease with which species can move between them) helps to develop the fish biomass for the whole lagoon. In Moorea (Society Islands, French Polynesia), 8 MPAs are managed by an island committee to protect the entire lagoon. As far as clam shells are concerned, significant positive spillover effects have already been recorded by the biologists of a marine research center based on the island.⁷

As argued by Bambridge and D’Arcy (2014: 115): “The recent trend in local MPA has involved the simultaneous development of cultural and ecological connectivity to enhance reef resilience. In a context of isolated islands and atolls in the Pacific (which does not, however, mean the isolation of their people), the development of many small MPA at the scale of an island, not to say, at the scale of interconnected islands of a same archipelago, the multiplication of separated but interconnected MPA is fostering the fish biomass and the resilience of the reef. In this latter case, the protection of parrotfish and similar herbivores helps to preserve the good health of the reef (ICRI 2013). Almany et al. (2013) demonstrated that the protection of

6. See Cook Islands International Waters Project in Takuvaive Community, http://www.environment.gov.ck/index.php?option=com_content&view=article&id=70&Itemid=110 (Accessed on October 9, 2015); Cook Islands’ Environment (Atiu and Takutea) Regulations 2008, <http://www.ecolex.org/ecolex/lodge/view/RecordDetails?index=documents&id=LEX-FAOC098952> (Accessed on October 9, 2015); Cook Islands’ Environment (Mitiaro) Regulations 2008, http://www.bagheera.com/wp-content/uploads/es_laws/Cook_Islands_Environment_Mitiaro_Regulations_2008_No._5_of_2008 (Accessed on October 9, 2015).

7. CRIIBE, Centre de Recherches Insulaires et Observatoire de l’Environnement, <http://www.criobe.pf/> (Accessed on October 9, 2015).

specific fish in Papua New Guinea at the scale of their territory of reproduction (which encompasses multiple MPA), appears to be more efficient than the mere protection of a unique MPA.”

In recent years, several Pacific Island nations have been prominent in declaring species-specific protected areas, most notably for sharks and whales. In 2009 Palau declared the world's first shark sanctuary. It was followed in 2011 by the Marshall Islands which created a 1.9 million km² shark sanctuary in which commercial shark fishing is banned. The Federated States of Micronesia, Guam and the Commonwealth of the Northern Marianas joined to create a 5 million km² shark sanctuary in the Western Pacific. Stretching without interruption from Palau to the Marshall Islands, this sanctuary is located right beside the main East Asian market for shark fins and other shark products, and in so doing it forgoes potentially significant income derived from shark products. French Polynesia declared its entire EEZ a shark sanctuary in 2006, and in addition a whale sanctuary in 2008. Tokelau declared its entire EEZ a shark sanctuary in 2011, with Cook Islands also doing so in 2012. Similarly, whale sanctuaries exist throughout the entire South Pacific, including the EEZs of New Zealand and Australia, thus forming a continuous sanctuary across the breadth of the Pacific.⁸

Furthermore, many Pacific Island nations and coastal nations of the Pacific Rim (for example the USA and Chile) have legislated large-scale marine protected areas (LSMPAs) in their EEZs (fig. 7; about LSMPAs, see also in this volume Giron, and Cornier and Leblic). Among them, we should especially note certain clusters of highly beneficial practices. The Great Barrier Reef Marine Park established in Australia in 1975 is now run by a public authority, the Great Barrier Reef Marine Park Authority. On 14 June 2012, the Australian Federal Government announced a major extension of its MPA network to encompass much of its EEZ. The package included AU\$100 million for commercial fishers who would lose their fishing access to new MPAs.

The second especially noteworthy example is the Papahānaumokuākea Marine National Monument,⁹ created on 15 June 2006, measuring 362,074 km², located in the uninhabited Northwestern Hawaiian Islands. This MPA contains 7000 species of wildlife and is administered by the U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration,¹⁰ in close coordination

8. Secretariat of the Memorandum of Understanding on the Conservation of Migratory Sharks, “Shark Sanctuaries”, <http://sharksmou.org/shark-sanctuaries> (Accessed on October 9, 2015).

Department of Conservation/Te Papa Atawhai, New Zealand Government. The conservation of whales in the 21st century – Whale sanctuaries, <http://www.doc.govt.nz/publications/conservation/native-animals/marine-mammals/conservation-of-whales-in-the-21st-century/conserving-whales-a-challenge-for-the-21st-century/whale-sanctuaries/> (Accessed on October 9, 2015).

9. Papahānaumokuākea Marine National Monument Management Plan, <http://www.papahānaumokuākea.gov/management/mp.html> (Accessed on October 9, 2015).

10. National Oceanic and Atmospheric Administration (NOAA) Fisheries, Pacific Islands Regional Office:

with the State Government of Hawai'i. The latter party ensures that a significant indigenous voice is represented and empowered in the context of the management of the Monument.

In 2012 the Cook Islands Government announced the creation of a LSMPA encompassing the southern half of its entire EEZ, or about 1.1 million km². This MPA will be zoned for multiple uses — tourism, fishing, and possibly seabed mining, but only if these activities can be carried out sustainably and adhere to the precautionary principle wherein a new potentially damaging activity must be proven not to cause harm before it can proceed. The process of creation of this LSMPA was characterized by wide consultation and the search for consensus between government, traditional leaders and local communities (Cook Islands Government 2011; Kanwal 2013; Lynch 2011).

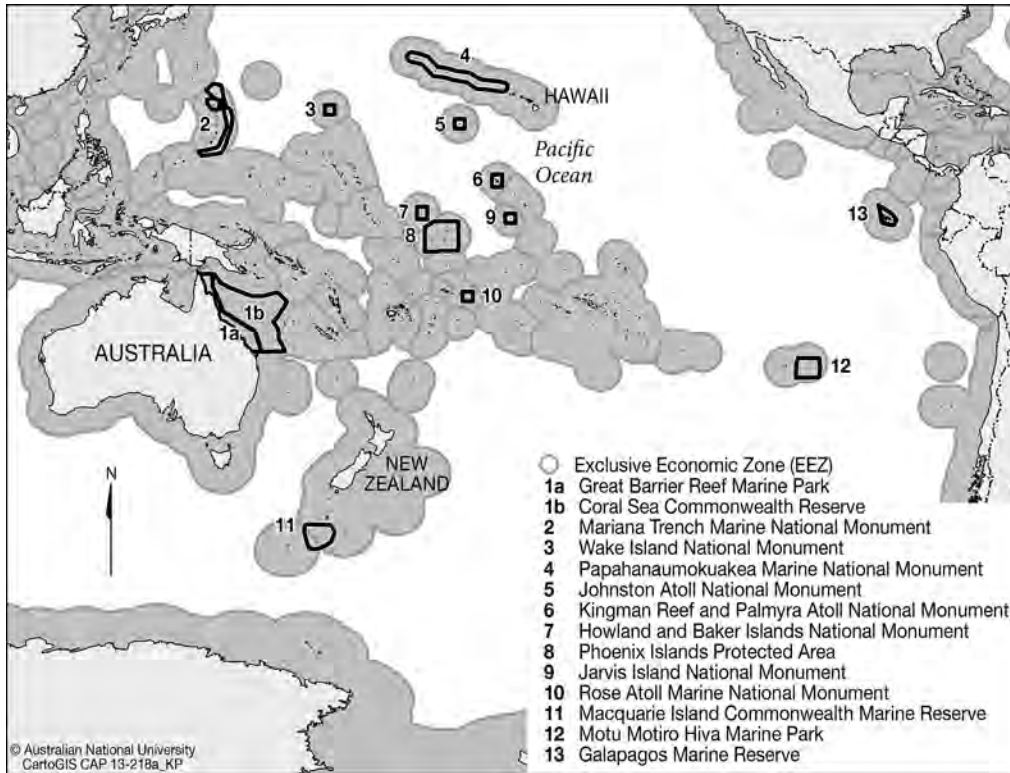
Under these strategies many Pacific Island countries and territories (such as Palau, Cook Islands, French Polynesia, Hawaii)¹¹ have sought to diversify their income while at the same time protecting their resources. Their view of fish and the marine environment is changing while the commodity status of fish and the marine environment is transforming. Compensation measures, sometimes subsidized by international NGOs and governments, are regularly discussed in order to find other incomes and benefits for protecting huge areas of fish stocks. In this regard, viewing fish solely as a commodity becomes unsustainable because food security constraints may run counter to other paths such as the tourism industry, the international conservation NGOs' attention and the "science industry". Fish have, and will continue to always occupy, multiple roles in society. The recent words of T. 'Aulani Wilhelm, Superintendent of the Papahānaumokuākea Marine National Monument, also suggests that, more generally, marine biodiversity is a pluralistic objective:

"The 2010 inscription of Papahānaumokuākea as a World Heritage site by the United Nations' Educational, Scientific and Cultural Organization (Unesco) redefines the value of oceans to the collective heritage of humankind. The designation also recognizes the multifaceted relationship that indigenous people of Hawai'i still have with this ocean expanse today. As with prior national designations, first as a Coral Reef Ecosystem Reserve then a Marine National Monument, these distinctions honoring both nature and culture were not by chance. They were the result of direct engagement by Native Hawaiians, in partnership with many others, in the design, advocacy and implementation of the management regime put in place to protect ¾ of the Hawaiian Archipelago." (T. 'Aulani Wilhelm and Randall Kosaki, personal communication to Tamatoa Bambridge).

Marine National Monument Program, http://www.fpir.noaa.gov/MNM/mnm_index.html, and Marianas Trench Marine National Monument, http://www.fpir.noaa.gov/MNM/mnm_marianas-trench.html (Accessed on October 9, 2015).

11. Many of these initiatives are presented in Bambridge and D'Arcy 2014.

Figure 7: Pacific large-scale MPAs



Sources: Bambridge and D'Arcy (2014)

Conclusion

This chapter offers an alternative mechanism and way of thinking to the standard regional institutional frameworks within which most fisheries scientists operate, but it does not seek to challenge or overturn these frameworks. Rather, it aims to show that the approach they reflect is partial and not necessarily appropriate for integrating coastal communities' expertise and concerns within fisheries management and conservation plans. Indeed, fisheries science cannot be separated from community expertise as fishers have been part of the ecosystem for millennia and the diverse relations they have with fish also affect their identity and social structures. These factors complicate fisheries management, but cannot be ignored and, as T. 'Aulani Wilhelm and others show, are a powerful force for conservation when integrated and allowed a voice. Our use of T. 'Aulani Wilhelm's quote not only reflects her own opinion, but that of a pan-Pacific coalition of indigenous communities involved in MPAs and LSMPAs,

which includes one of the this chapter's authors, Tamatoa Bambridge. Our point was that, while coastal communities' concerns and fisheries scientists' concerns are not necessarily incompatible, the former are sidelined in international debates and fora despite these communities' long history of sustainable fisheries management and their current interest in being active in the implementation of fisheries management and conservation, rather than just in consultation processes.

Finally, in Oceanian tradition, there has never been a contradiction between fish as a commodity (defined as an object of exchange) and fish as a cultural and natural heritage. What changed in the 20th century was that Pacific fish gained an economic importance far beyond the Pacific world, which changed their global economic relevance both in scale and intensity. This challenged the local pluralistic value assigned to fish in the Pacific Islands. The decimation of the Atlantic fishery to the point of non-sustainability has changed global perceptions of the need to control fisheries exploitation. Such control requires the cooperation of all parties in a system essentially based on voluntary compliance in the absence of effective monitoring and policing of the vast offshore expanses of the Pacific Ocean (Grafton et al. 2006). Pacific societies are now taking the lead in reconceptualising fisheries as pluralistic objects with environmental, economic, social, and cultural issues to be considered in any management regime at local, national, regional and global levels. The already mentioned effective use of traditional means of fishery regulation and conservation known as a *rahui* at Hotopua in Teahupoo (French Polynesia), a culturally sacred site for all Eastern Polynesians, has much wider application. The vital importance of emphasizing the economic, social, cultural and environmental value of fish in combination goes far beyond the Oceanian world.

References

- Alkire, William H.
1965 *Lamotrek Atoll and Inter-Island Socioeconomic Ties*. Urbana: The University of Illinois Press.
1968 "Porpoises and Taro". *Ethnology*, 7(3): 280-289.
- Allain, Valérie, Julie-Anne Kerandel, Serge Andréfouët, Franck Magron, Malcolm Clark, David Kirby, and Frank Muller-Karger
2008 "Enhanced Seamount Location Database for the Western and Central Pacific Ocean: Screening and Cross-Checking of 20 Existing Datasets". *Deep-Sea Research Part I: Oceanographic Research Papers*, 55(8): 1035-1047.
- Almany, Glenn, Richard Hamilton, Michael Bode, Manuai Matawai, Tapas Potuku, Pablo Saenz-Agudelo, Serge Planes, Michael Berumen, Kevin Rhodes, Simon Thorrold, Garry Russ, and Geoffrey Jones
2013 "Dispersal of Grouper Larvae Drives Local Resource Sharing in a Coral Reef Fishery". *Current Biology*, 23(7): 626-630.

Asian Development Bank (ADB)

- 2005 Republic of the Fiji Islands: Fisheries Sector Review. Manila: ADB.
2007 Annual Report 2007, Volumes 1 (Main Report) and 2 (Financial Report). Manila: ADB,
<http://www.adb.org/documents/adb-annual-report-2007> (Accessed on October 22, 2015).

Arbousset, Thomas

- 1867 *Tahiti et les îles adjacentes. Voyages et séjour dans ces îles, de 1862 à 1865*. Paris: Grassart.

Bambridge, Tamatoa

- 2009 *La terre dans l'archipel des Australes (Pacifique Sud). Étude du pluralisme juridique et culturel en matière foncière*. Tahiti: IRD Éditions/Au vent des îles.
2013 "Le foncier terrestre et marin en Polynésie française. L'étude de cas de Teahupoo". *Land Tenure Journal*, 2(12): 118-143.
2015 *Rahui in Polynesia. Legal Pluralism in Environmental Management*. Canberra: ANU Press.

Bambridge, Tamatoa, and Paul D'Arcy

- 2014 "Large-Scale Marine Protected Areas in the Pacific: Cultural and Social Perspectives". In F. Féral and B. Salvat (eds.), *Gouvernance, enjeux et mondialisation des grandes aires marines protégées. Recherche sur les politiques environnementales de zonage maritime: le challenge maritime de la France de Méditerranée et d'Outre-mer*. Paris: Harmattan, p. 113-132.

Banks, Joseph

- 1962 *The Endeavour Journal of Joseph Banks, 1768-1771* (Edited by J.C. Beaglehole, 2 volumes). Sydney: Angus and Robertson.

Bardach, John, and Penelope Ridings

- 1985 "Pacific Tuna: Biology, Economics, and Politics". In E. Mann Borgese and Norton Ginsburg (eds.), *Ocean Yearbook 5*. Chicago: University of Chicago Press, p. 27-59.

Barry, Rolett

- 2002 "Voyaging and Interaction in Ancient East Polynesia". *Asian Perspectives*, 41(2): 183-194.

Beaglehole, Ernest, and Pearl Beaglehole

- 1938 *Ethnology of Pukapuka*. Honolulu: Bernice P. Bishop Museum (Bernice P. Bishop Museum Bulletin N°150).

Beckwith, Martha

- 1970 *Hawaiian Mythology*. Honolulu: UH Press.

Bonnemaison, Joël

- 1996 *Les Fondements géographiques d'une identité. L'archipel du Vanuatu. Essai de géographie culturelle. I- Gens de pirogue et gens de la terre*, Paris: Orstom éditions.

Borgese, Elisabeth Mann, and Norton Ginsburg

- 1985 *Ocean Yearbook 5*. Chicago: University of Chicago Press.

Brownlie, Ian

- 1995 *Basic Documents in International Law (4th Edition)*. Oxford: Oxford University Press.

Caillot, Eugène

- 1909 *Les Polynésiens orientaux au contact de la civilisation*. Paris: Ernest Leroux.

- Chand, Satish, Quentin Grafton, and Elizabeth Petersen
2003 "Multilateral Governance of Fisheries: Management and Cooperation in the Western and Central Pacific Tuna Fisheries". *Marine Resource Economics*, 18(4): 329-344.
- Cook Islands Government
2011 Press release "Talking Points for Prime Minister Henry Puna Pacific Oceanscape Event".
- Cordonnery, Laurence
2005 "Implementing the Pacific Islands Regional Ocean Policy: How Difficult is it Going to Be?" *Victoria University of Wellington Law Review*, 36(4): 723-731.
- D'Arcy, Paul
2006a *The People of the Sea: Environment, Identity, and History in Oceania*. Honolulu: University of Hawaii Press.
2006b "The Role of the Tuna Fishery in the Economy of Federated States of Micronesia". *Pacific Economic Bulletin*, 21(3): 75-87.
2012 "Oceania: The Environmental History of One-Third of the Globe". In J.R. McNeill and E.C. Stewart (eds.), *A Companion to Global Environmental History*. Oxford: Wiley Blackwell, p. 196-221.
2013 "The Nourishing Sea: Partnered Guardianship of Fishery and Seabed Mineral Resources for the Economic Viability of Small Pacific Island Nations". *Sustainability*, 5: 3346-3367.
- Davidson, Janet
1978 "Western Polynesia and Fiji: The Archaeological Evidence". *Mankind*, 11(3): 383-390.
- Descola, Philippe
1986 *La nature domestique*. Paris: Éditions de la MSH.
- Firth, Raymond
1964 *Essays on Social Organization and Values*. London: University of London (Monograph on Social Anthropology N°28).
- Food and Agriculture Organization of the United Nations (FAO)
Fishstat database, available online: <http://www.fao.org/fishery/statistics/en> (Accessed on October 10, 2014).
2014 *The State of World Fisheries and Aquaculture, Opportunities and Challenges*. Rome: FAO.
- Forum Fisheries Agency (FFA)
2008 Proposed Outline of Regional MCS Strategy Projects and Strategy: Development of an Integrated Regional MCS Strategy. Honiara: FFA.
- Gillett, Robert, Mike McCoy, Len Rodwell, and Josie Tamate
2001 *Tuna: A Key Economic Resource in the Pacific Islands. A Report Prepared for the Asian Development Bank and Forum Fisheries Agency*. Manila: Asian Development Bank.
- Gillett, Robert
2008 *A study of Tuna Industry Development Aspirations of FFA Member Countries*. Honiara: FFA.
2009 *Fisheries in the Economies of Pacific Island Countries and Territories*. Mandaluyong City, Philippines: Asian Development Bank.

- 2014 Hot Issues in Pacific Islands Coastal Fisheries. [Pêche côtière en Océanie: Les sujets brûlants]. SPC Fisheries Newsletter #144 (May-August 2014). Noumea: Secretariat of Pacific Community.
- Govan, Hugh
- 2009 Status and Potential of Locally-Managed Marine Areas in the Pacific Island Region: Meeting Nature Conservation and Sustainable Livelihood Targets through Wide-Spread Implementation of LMMAs. SPREP / WWF / WorldFish-Reefbase / CRISP, https://www.sprep.org/att/publication/000646_LMMA_Report.pdf (Accessed on October 22, 2015).
- Govan, Hugh, James Comley, Wendy Tan, Michael Guilbeaux, and Ron Vave
- 2011 Recommendations from Ten Years of Monitoring under the LMMA Network's Learning Framework. SPREP.
- Grafton, Quentin, Ragnar Arnason, Trond Bjørndal, David Campbell, Harry Campbell, Colin Clark, Robin Connor, Diane Dupont, Rögnvaldur Hannesson, Ray Hilborn, James Kirkley, Tom Kompas, Daniel Lane, Gordon Munro, Sean Pascoe, Dale Squires, Stein Ivar Steinshamn, Bruce Turris, and Quinn Weninger
- 2006 "Incentive-Based Approaches to Sustainable Fisheries". *Canadian Journal of Fisheries and Aquatic Sciences*, 63(3): 699-710.
- Grimble, Rosemary
- 1972 *Migrations, Myth and Magic from the Gilbert Islands: Early Writings of Sir Arthur Grimble*. London and Boston: Routledge and Kegan Paul.
- Grimble, Arthur Francis
- 1989 *Tungaru Traditions: Writings on the Atoll Culture of the Gilbert Islands* (Edited by H.E. Maude). Honolulu: University of Hawai'i Press.
- Harper, Sarah, Dirk Zeller, Melissa Hauzer, Daniel Pauly, and Ussif Rashid Sumaila
- 2013 "Women and Fisheries: Contribution to Food Security and Local Economies". *Marine Policy*, 39: 56-63.
- Hanson, Allan
- 1973 *Rapa, une île polynésienne hier et aujourd'hui*. Paris: Société des Océanistes.
- Henry, Teuira
- 1928 *Ancient Tahiti*. Honolulu: Bernice P. Bishop Museum (Bernice P. Bishop Museum Bulletin N°48).
- Hviding, Edvard
- 1996 *Guardians of Marovo Lagoon: Practice, Place, and Politics in Maritime Melanesia*. Honolulu: University of Hawaii Press.
- Hviding, Edvard, and Graham Baines
- 1994 "Community-Based Fisheries Management: Tradition and the Challenges of Development in Marovo, Solomon Islands". *Development and Change*, 25(1): 13-39.
- ICRI
- 2013 Framework for Action. A Call by the Membership of the International Coral Reef Initiative (ICRI) – October 2013.

- ISPF
2002 Autoconsommation: Une économie de 21 milliards. *Points Forts de la Polynésie Française* [Online], 3: http://www.ispf.pf/docs/default-source/publi-pf-bilans-et-etudes/PF_2002_no3_Autoconsommation_une_%C3%A9conomie_de_21_milliards.pdf?sfvrsn=0 (Accessed on October 22, 2015).
- Johannes, Robert, and Wallace MacFarlane
1990 "Torres Strait Traditional Fisheries Studies: Some Implications for Sustainable Development". In D. Lawrence and T. Cansfield-Smith (eds.), *Sustainable Development for Traditional Inhabitants of the Torres Strait Region*. Cairns: University of Queensland Medical School.
- Kanwal, Sahiban
2013 Speaking out on the Marine Park. *Cook Island News*, 13 August 2013, <http://www.cookislandsnews.com/item/15605-speaking-out-on-the-marine-park/15605-speaking-out-on-the-marine-park> (Accessed on October 22, 2015).
- Kirch, Patrick Vinton
2000 *On the Road of the Winds: An Archaeological History of the Pacific Islands before European Contact*. Berkeley: University of California Press.
- Kirch, Patrick Vinton, and Jennifer Khan
2007 "Advances in Polynesian Prehistory: A Review and Assessment of the Past Decade (1993–2004)". *Journal of Archaeological Research*, 15: 191-238.
- Kirch, Patrick Vinton, Eric Conte, Warren Sharp, and Cordelia Nickelsen
2010 "The Onemea Site (Taravai Island, Mangareva) and the Human Colonization of Southeastern Polynesia". *Archaeology in Oceania*, 45(2): 66-79.
- Kompas, Tom, Quentin Grafton, and Tuong Nhu Che
2010 "Bioeconomic losses from overharvesting tuna". *Conservation Letters*, 3(3): 177-183.
- Laffoley, Dan
2008 *Towards Networks of Marine Protected Areas. The MPA Plan of Action for IUCN's World Commission on Protected Areas*. Gland, Switzerland: IUCN WCPA.
- Lee, Taehwan, John Burch, Trevor Coote, Benoît Fontaine, Olivier Gargominy, Paul Pearce-Kelly, and Diarmaid O'Foighil
2007 "Prehistoric Inter-Archipelago Trading of Polynesian Tree Snails Leaves a Conservation Legacy". *Proceedings of the Royal Society*, 274(1627): 2907-2914.
- Lessa, William
1950 "The Place of Ulithi in the Yap Empire". *Human Organization*, 9(1): 16-18.
- Lewthwaite, Gordon
1966 "Man and the Sea in Early Tahiti: A Maritime Economy through European Eyes". *Pacific Viewpoint*, 7(1): 28-53.
- Lucett, Edward
1851 *Rovings in the Pacific, from 1837 to 1849; with a glance at California* (2 volumes). London: Longman, Brown, Green and Longmans.

Luomala, Katharine

- 1984 "Sharks and Sharkfishing in the Culture of Gilbert Islands, Micronesia". In B. Gunda (ed.), *The Fishing Culture of the World: Studies in Ethnology, Cultural Ecology and Folklore* (2 volumes). Budapest: Akademiai Kiado, p. 1203-1250.

Lynch, Abigail

- 2011 "Forging New Perspectives of Fisheries Science and Management". *Fisheries*, 36(7): 353-354.

Métraux, Alfred

- 1941 *L'île de Pâques*. Paris: Gallimard.

Ministry of Finance and National Planning (Fiji)

- 2006 Strategic Development Plan 2007-2011. Suva: Fiji Government.

Moerenhout, Jacques Antoine

- 1837 *Voyages aux îles du Grand Océan* (2 volumes). Paris: Adrien Maisonneuve.

Morrison, James

- 1966 *Le Journal de James Morrison, second maître à bord de la Bounty* (Translated by B. Jaunez). Paris: Musée de l'Homme.

Multilateral High Level Convention (MHLC)

- 2000 Report of the Eleventh and Final Session of the Multilateral High Level Conference on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific. Honolulu: MHLC.

Pacific Community (SPC)

- 2012 Pacific Oceanscape and the Ocean Commissioner: A New Way of Looking at the Pacific Ocean, <http://www.spc.int/en/library/991-pacific-oceanscape-and-the-ocean-commissioner-a-new-way-of-looking-at-the-pacific-ocean.html> (Accessed on October 22, 2015).

Poole, Michael

- 2015 "Les cétacés des îles Australes et l'emblématique baleine à bosse". In B. Salvat, T. Bambridge, D. Tanret and J. Petit, *Environnement marin des îles Australes*. Polynésie Française: Institut Récifs Coralliens Pacifique / CRIOBE / The Pew Charitable Trusts: 102-111.

Rjabchikov, Sergei

- 2000 On one Rapanui and two Marquesan rock pictures, http://www.oocities.org/script_rongorongono/art16.htm (Accessed on October 22, 2015).

- 2001 "Rongorongo Glyphs Clarify Easter Island Rock Drawings". *Journal de la Société des Océanistes*, 113: 215-220.

- 2002 Easter Island Petroglyphs Denote a Sentence of the Creation Chant, <http://rongorongono.chat.ru/artrr13.htm> (Accessed on October 22, 2015).

Tarte, Sandra

- 1998 *Japan's Aid Diplomacy and the Pacific Islands*. Canberra: Australian National University; Suva: University of the South Pacific.

- 1999 "Negotiating a Tuna Management Regime for the Western and Central Pacific: The MHLC Process 1994-1999". *Journal of Pacific History*, 34(3): 273-280.

- Teiwaki, Roniti
1988 *The management of Marine Resources in Kiribati*. Suva: Atoll Research Unit, Institute of Pacific Studies, University of the South Pacific.
- Thomas, Frank
2003 "Fisheries Development in Kiribati: Sustainability Issues in a 'MIRAB' economy". *Pacific Studies*, 26(1-2): 1-36.
- Toonen, Robert, Wilhelm Aulani, Sara Maxwell, Daniel Wagner, Brian Bowen, Charles Sheppard, Sue Tai, Tukabu Teroroko, Russell Moffitt, Carlos Gaymer, Lance Morgan, Nai'a Lewis, Anne Sheppard, John Parks, and Alan Friedlander
2013 "One Size does not Fit All: The Emerging Frontier in Large-Scale Marine Conservation". *Marine Pollution Bulletin*, 77(1-2): 7-10.
- Van Dyke, Jon, and Carolyn Nicol
1987 "U.S. Tuna Policy: A Reluctant Acceptance of the International Norm". In D.J. Douman (ed.), *Tuna Issues and Perspectives in the Pacific Islands Region*. Honolulu: East-West Center, p. 105-132.
- Veitayaki, Joeli, Akosita Nakoro, Tareguci Sigarua, and Nanise Bulai
2011 "On Cultural Factors and Marine Managed Areas in Fiji". In J. Liston, G.R. Clark and D. Alexander (eds.), *Pacific Island Heritage: Archaeology, Identity and Community*. Canberra: ANU E-Press, p. 37-49.
- Verin, Pierre
1965 *L'ancienne civilisation de Rurutu*. Paris: Orstom éditions.
- Whimp, Graeme
2008 "Cetaceans and Citations: A Survey of the English Literature on the Role of Cetaceans in South Pacific Island Cultures". *Tuhinga*, 19: 169-184.
- Williams, Peter, and Chris Reid
2006 Overview of Tuna Fisheries in the Western and Central Pacific Ocean, including Economic Conditions – 2005. 2nd Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Manila, Philippines, 7-18 August 2006 (WCPFC-SC2-2006, GN WP-1).
- Williams, Peter G., and Peter Terawasi
2014 Overview of Tuna Fisheries in the Western and Central Pacific Ocean, Including Economic Conditions – 2013. 10th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Majuro, Marshall Islands, 6-14 August 2014 (WCPFC-SC10-2014, GN-WP-01).
- Williamson, Robert Wood
1933 *Religious and Cosmic Beliefs of Central Polynesia* (2 volumes). Cambridge: Cambridge University Press.
- Willis, Trevor, Russell Millar, Russell Babcock, and Nick Tolimieri
2003 "Burdens of Evidence and the Benefits of Marine Reserves: Putting Descartes before des Horse?". *Environmental Conservation*, 30(2): 97-103.



Green Turtle: an emblematic marine species at a crossroads in New Caledonia

Catherine SABINOT and Sarah BERNARD

Introduction

In New Caledonia,¹ the green turtle, *Chelonia mydas*, is an emblematic and protected species. Today, it lies at a crossroads in administrative, political and customary terms. Knowledge and representations relative to this animal, and most of all provincial and tribal² as well as collective and individual legitimacies that emerge around the turtle and its management, are interconnected and often confronted with one another. In this paper, this animal will be studied not only as a “natural” or “social object” but also as a “political object”. This approach will allow greater depth to be employed in the comprehension of the relationships between societies and their marine environment and also between individuals regarding their environment.

As Faugère (2008) noted, sociologists such as Callon, Law and Latour drew attention to the absence of non-human objects in most social science studies (Latour 1997). Non-human objects are yet considered by some anthropologists, particularly in the realm of ethnosciences. However, Faugère (2008) emphasizes that most studies focus exclusively on a particular form of human-nature relationship — exploitation; studies of other forms are quite recent. Faugère first distinguishes between anthropology of natural resources and anthropology of “heritage-nature”, and then argues that these two realms should be considered together as in environmental anthropology.

1. New Caledonia is a *sui generis* French territory; its institutional status is unique in the French context. This status results from political agreements (Matignon-Oudinot Agreements in 1988 and Noumea Agreement in 1998) that laid the basis for a “negotiated decolonization” process, which should lead to a referendum on self-determination in the territory before 2018. In 1989, three Provinces were created in New Caledonia and environmental issues fell under the competence of these provinces.

2. In New Caledonia, the word “tribe” has a special meaning/connotation that differs from the classic use in social anthropology. Tribes do not correspond to any pre-existing “formation”, but are based on a “projection en milieu mélanésien de l’image européenne d’une sorte de conseil des Sages ou d’un Sénat – a projection in a Melanesian environment of the European image of a sort of council of Elders or of a Senate” (Leblic 1993). Tribe refers to a “historically produced administrative unit created in 1867 by colonization which was subsequently modified by the Indigénat regime (1887), the administrative chieftaincy (1897), and the demarcation of indigenous land reservations” (Le Meur 2013). Since the 1970s, the word has lost its colonial meaning and has been appropriated by everyone, in particular by Kanak people who are the indigenous inhabitants of New Caledonia. Today, as Le Meur (2013) underlined in his paper exploring the transformation of the notion of tribe in New Caledonia, ‘*Vivre à la tribu*’ is a French expression used by Kanak people to “express a strong feeling of locality and belonging”.

Following the constitution of these three co-existing anthropological sectors, in the introduction of the latest issue (n°6) of the *Revue d'ethnoécologie*, entitled “*Conservation of nature: What role for human sciences? Towards an anthropology of conservation*”, Dumez, Roué and Bahuchet (2014) describe the progressive setting up of an anthropology of conservation based on both ethnoecology and environmental anthropology. They argue that debates about biodiversity conservation strategies are acute and that they concern both their efficiency and questions of equity and social justice. Four questions are identified by these authors: Preserve for whom (see also Bahuchet et al. 2000)? Which uses of nature are “legitimate” and which are not? What are the links between biodiversity and cultural diversity (see also Roué 2006)? How may one analyse the sustainability of practices which are transforming the environment while at the same time managing this environment (see also Dumez 2010)?

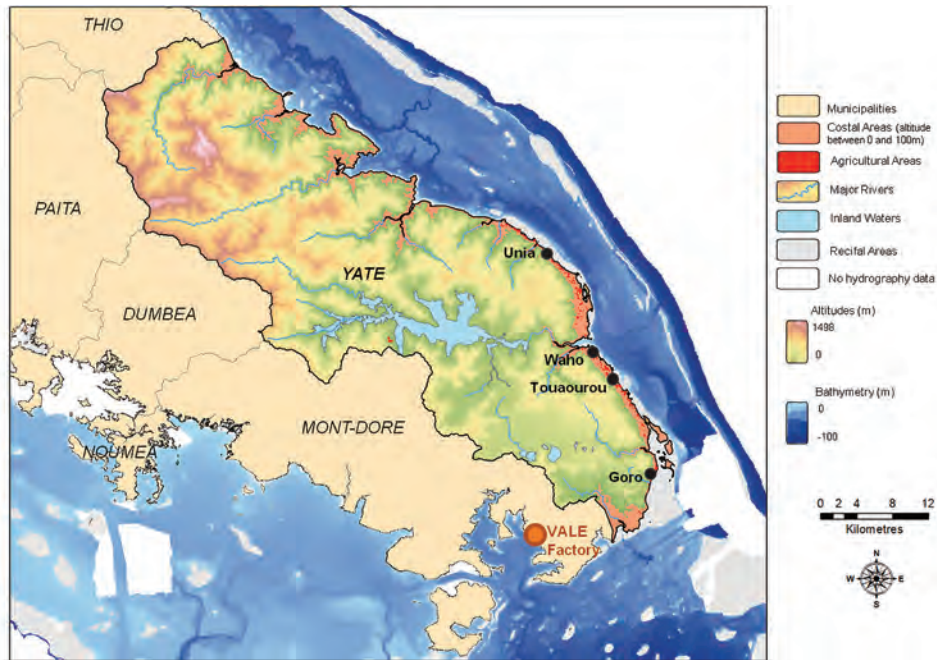
Studying the socio-environmental changes caused by the implementation of a protected area through anthropological and political ecological approaches has been done by several authors within and outside the Pacific region (Aswani and Hamilton 2004; Biersack and Greenberg 2006; Brosius 2004; Doyon and Sabinot 2014; Doyon and Sabinot 2015; Escobar 2001; West 2006; West et al. 2006). Studying the socio-environmental changes caused by the confrontations of diverse types of management of one migratory species, such as the green turtle, is less common.

This paper analyses the new legitimacy and social issues that are emerging in New Caledonia out of the production of new norms and values for the “management” of the green turtle, which lies at a crossroads of local, tribal, provincial and international expectations. It aims to provide a few insights into the four questions raised above. In many parts of the world, marine species are symbolic and emblematic species that spark specific debates, negotiations, and sometimes conflicts (Artaud 2014; Collomb 2009; Cormier-Salem 2000; David et al. 2003; Rosillon 2014). In New Caledonia, in a context of “negotiated decolonization” and mining industry development (see also Cornier and Leblic in this volume), the construction of environmental codes and regulations in the three Provinces involves confrontations of values, norms and knowledge systems. These confrontations are original and very enlightening for the understanding of socio-environmental dynamics that are currently occurring inside Kanak tribes and between Kanak tribes and other groups (Provinces, government, mining operators, etc.).

The argument put forward in this paper is based on anthropological fieldwork carried out over 18 months in 2014 and 2015 among three tribes in Yaté in the southeast of New Caledonia (fig. 1) and inside the offices of the Direction of the Environment of South Province.³ First, we will describe Yaté municipality, its

3. In addition to regular short periods of fieldwork conducted in Yaté and regular interviews with representatives and Kanak fieldworkers from the South Province done by the author in 2013, 2014 and 2015, a Masters student, Sarah Bernard, spent four months living with a family from the Touaourou

Figure 1: Map of Yaté municipality



© Despinoy and Sabinot

inhabitants and the marine and terrestrial management of this territory. We then will analyse the international status of the green turtle and compare this with its local status in Yaté tribes. On one hand, we will specify the place held by the green turtle within the Kanak environment and the role it plays in structuring Kanak society. We will also analyse the discourses and practices of various actors (inhabitants as well as employees from South Province) relative to this species. On the other hand, we will examine the intricacies of the individual and collective social logics and strategies that rely on and are revealed by the green turtle. By describing the evolution of customary, cultural, scientific and administrative knowledge and norms associated with this animal, as well as the customary and provincial ways of managing this resource, we will show in what sense the turtle is an indicator of social change

tribe and conducting fieldwork full time (see Bernard 2014). Moreover Sarah Bernard and I conducted 3 drawing workshops in Waho School in 2014. The main data used here were collected within the framework of the LIVE "Littoral Vivrier et Environnement" (Food-producing coast and environment) programme directed by Jean-Brice Herrens Schmidt and myself and funded by the Environmental Customary Consultative Committee. This programme aims to describe and analyse the dynamics of habits, practices and knowledge related to the use and management of the coast and the sea in the context of industrial pressure on the environment as well as of social change (Bernard et al. 2014).

in the Yaté area, and in what sense it can be used in negotiations with institutional and industrial actors. In addition, we will demonstrate the complexity of the relationships between the various actors present in the area.

Yaté municipality, its inhabitants and the marine and terrestrial management of its territory

Location, municipality, tribes, chiefdoms, and customary territories

Yaté is part of the Djubéa-Kaponé area. It is New Caledonia's most extensive municipality, but with a population of less than 2,000 inhabitants (95% Kanak people), it has the lowest population density (1.4 inhab./km²). The population is mainly constituted by four tribes, Unia, Waho, Touaourou and Goro, inhabiting a narrow strip of coast extending over 80 kilometres. This population comes from several areas in New Caledonia, including the Isle of Pines, Païta, Thio, Mont Dore, the Loyalty Islands, etc. (Mapou 1999). Migrations mostly date back to the 1840s and seem to have stabilised during the colonial period and the arrival of Catholicism in the Far South. In the settled areas of Yaté municipality, land is customary, meaning incommutable, unseizable and inalienable.

Understanding customary relations and the recent evolutions⁴ of the actual functioning of chiefdoms and clans in Yaté is essential to understanding the tensions emerging around the green turtle within clans and tribes and between tribes and the provincial authorities. Each tribe consists of several clans and is associated with a chiefdom that holds political power ensuring cohesion within the tribe and manages relations with those outside the tribe.⁵ In Yaté, there are three chiefdoms: Unia chiefdom (held by the Adjamé clan), Touaourou chiefdom (held by the Ouetcho clan) and Goro chiefdom (previously held by the Attiti clan). The Waho tribe is closely linked to the Touaourou chiefdom. In Yaté, each chiefdom is supposed to have a chief and each clan has a clan chief. In Goro, however, the chief's position has lain vacant since the death of the great chief (Charles Attiti) in 2004 due to internal discords in the Goro tribe, both between clans and within some clans. Goro clan chiefs cannot agree on who should hold the great chief's position. Such disagreements can mainly be explained by divergences in the understanding of the criteria of legitimacy to access this position, a legitimacy that is built and discussed with

4. For the development of customary relations before 2000, see Mapou 1999 and Leblic 1989; 2008.

5. As noted before, this situation is the result of a colonial reconfiguration that has gathered groups on administrative units (tribes) and "created an administrative chieftaincy, without clearly defining its duties and responsibilities" (Le Meur 2013). In 1897 and 1898, Kanak administrative chiefs were designated at the district and tribe levels, respectively a paramount chief or great chief (*grand chef*) and a headman (*petit chef*).

reference to the clans' history (particularly their establishment in the area) and the alliances between clans (especially through marriages). As political and socioeconomic stakes are high in the area, personal interests also play a role in strategies to access the position. When an issue related to a great chief's enthronement arises, due to legitimacy or to age-related problems, the chiefdom's powers can be provisionally entrusted to another clan, or can stay vacant for years (as it is happening for Goro) until an agreement between clans is reached.

As it will be shown, such ongoing reorganisations and negotiations within the tribes are superimposed on other significant governance mutations at the scale of New Caledonia. The political framework and ongoing transfers of competences from the French government to the Caledonian Provinces are giving rise to dynamic and heterogeneous organisational innovations. In Yaté particularly, due to its history, the strong development of the mining sector and the nearness of Noumea, the social and political context is constantly changing due to competition and negotiations between actors and unstable, changing alliances. These transformations are revealed in the study of tensions and negotiations inherent in the place occupied by the green turtle within the realms of conservation, custom and politics.

Management of marine territories: statutory law and customary law

Management of maritime territories depends on both statutory law and customary law.⁶ The set of customary rules governing Kanak society form the customary law, which now co-exists alongside the statutory law. The customary law covers all of the statutory law and is not always put into writing. "Custom" in New Caledonia refers to a way of being, or of considering oneself, and hence the social and legal standards ensuing from this. It is expressed particularly through exchange, donation and speech, which will be discussed several times in this paper. Today, "customary gestures" always consist of codified gifts of fabrics (named *manous*) and variable amounts of money that support speeches.⁷ According to the nature and significance of events, these gifts may be complemented by yams, tobacco and imported goods (rice, sugar, alcohol, etc.). In the Far South, for various major events such as the yam celebration,⁸ important weddings or recently for the Charter proclamation,⁹ one or more green turtles are also expected.

6. Papers relative to land issues are numerous but those analysing marine issues are rare (Leblic 1989; Le Meur et al. 2012; Léopold et al. 2013; Teulières-Preston 2000).

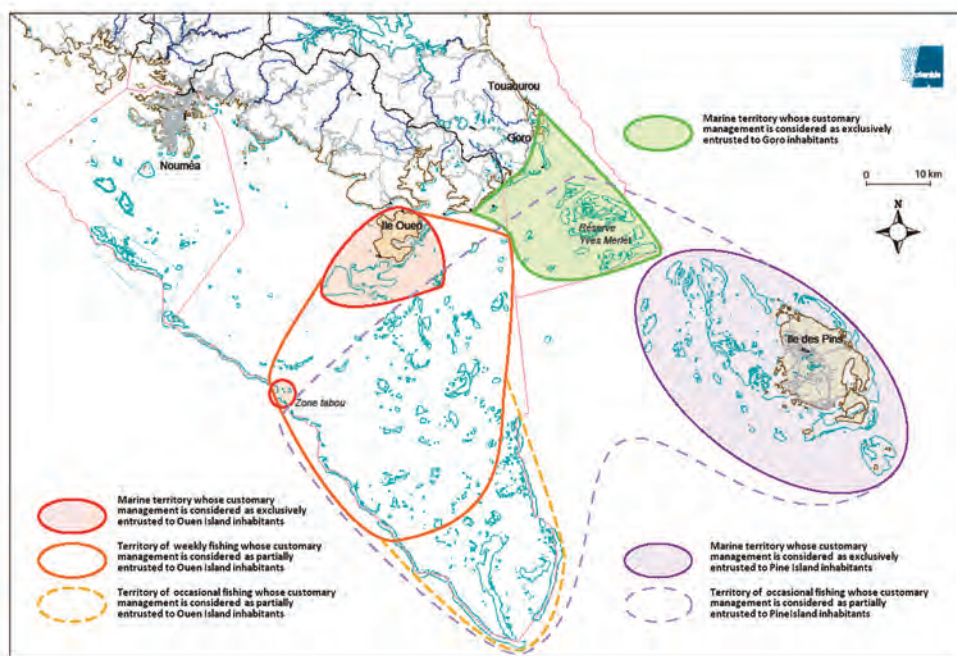
7. Speeches are accompanied by the material elements composing the 'gesture', but the speech, and the message shared, remains the most important feature.

8. The cropping cycle of yams determines the course of life in Kanak society and the Yam Celebration celebrating the beginning of the year (in February or March) is the most important annual event for Kanak people.

9. The Charter of the Kanak people, carried by the Customary Senate, was proclaimed on 2014. Also

These turtles live in marine territories that have a dual status in New Caledonia: the customary and cultural status that is recognized by Kanak clans and tribes, and the official one that is recognized by the New Caledonian government and the French nation-state (similar situations exist in the region: it is the case in Australia, the “other country” of New-Caledonian turtles). While land has a customary status officially recognised since 1998 by the Noumea Agreement, the marine environment pertains to the public maritime domain in administrative terms. Within the framework of the transfer of competences, the management of the lagoon was entrusted to the Provinces. However, within Kanak society, there is no land-sea discontinuity: land extends into the sea and the governance of the lagoon thus customarily pertains to the chiefdoms (fig. 2).

Figure 2: Map of chiefdoms’ influential areas in the Southern Great Lagoon



© Herrenschmidt et al. 2007

The contemporary customary marine territories are an expression of Kanak history, which is marked by their experience under colonial rule, during which clans were

known as “Common base of fundamental values and principles of Kanak civilization”, it has been validated and signed by the authorities of the eight customary areas of New Caledonia.

compelled to often migrate and regroup. Nowadays, the coastline is interspersed with limits that can be described as tribal, yet that seems to actually tally with the limits of influence between former customary regions (Herrenschmidt et al. 2007). The marine heritage constitutes the base for customary identities as well as for the close cultural and food-producing relationships between individuals and their ecological environments, including specific species. Such identity links to marine areas and species, as well as the territorial dimension of the lagoon, are found in most Kanak populations of New Caledonia.

In 2008, the lagoon was declared a Unesco World Heritage serial site comprising six marine clusters and including the Great Southern Lagoon marine park, “Parc du Grand Lagon Sud” or PGLS (see also Cornier and Leblic in this volume). In Yaté, the feasibility study for the development of participative management of coral reefs and associated ecosystems in the PGLS indicated that the marine environment, complementing the land environment, constituted “a vital territory cementing the pacified development of the community” (Herrenschmidt et al. 2007). The green turtle is one of the major stakes of this space: it is one of the internal structuring elements of the tribes of Yaté and a significant object of legitimacy and negotiation between these tribes, South Province and even the industrial sector.

Green turtle, its national and local status

International status translated in the environmental code of South Province and in the management plan of the Great Southern Lagoon marine park

The green turtle is classified as a vulnerable species on the international red list of threatened species (IUCN). Since 1977, the green turtle has appeared in texts concerned with environmental management in New Caledonia. In the environmental code of South Province established in 2008, it is specified that green turtles are fully protected in the context of the prohibition of the capture, collection, intentional disturbance, mutilation, stuffing, destruction, transport, peddling, use, possession or consumption of sea turtles of all species, whether living or dead. However, the president of South Province Assembly can grant authorisations for green turtle collection in the context of customary celebrations.

In the Far South, within the framework of the management plan for the Great Southern Lagoon marine park approved in July 2013, a number of actions were voted. One of them consists of bridging gaps between customary governance and statutory law, especially regarding green turtles, and hence requires acquiring knowledge related to the green turtle’s place within society, especially Kanak society. The inclusion of this kind of action in the management plan shows that a lack of knowledge on these topics could lead to failures in the management of this space.

Local status explored through the eyes of Kanak children

Adults in Yaté are particularly concerned by these administrative methods and frameworks. However, an analysis of children's perceptions reflected in their discourses and drawings (Pagezy et al. 2010; Sabinot and Carrière 2015) offers a larger view of the relationships between society and the green turtle. In 2014, we conducted two types of drawing workshops at the Waho School to understand how children perceive their environment, the place they allocate the marine environment, and the species they pay attention to. During the first workshop, children in CM1 and CM2 classes (about 10-12 years old) were asked to draw their environment, without being given further details. No comprehensive study of the drawings has yet been done but it should be noted that only 4 out of 26 children drew the lagoon, the reef or the beach. Surprisingly, while all of the children live near the sea and regularly play and fish on the reef, most of them drew the terrestrial environment: mountains, rivers, lakes, etc. At the second workshop conducted only with the CM2 class, children were asked to draw the sea and the lagoon: 5 out of 13 students drew one or more turtles. The drawings then became a support for interviews conducted with the children, who often knew several turtle species. They told us that the green turtle has a good taste and that it is eaten for the yam celebration. Children have a special relationship with this turtle, in particular in relation to this celebration during which they have the privilege of eating its cooked blood, which they love. Many children know the stories and legends associated with this animal, and in 2013 some 3 to 6 year-old children even participated in creating a tale "*Taa Nii Ngüü, La Petite Tortue Verte*"¹⁰ in *numee* language with the help of their Kanak teacher (École maternelle de Tchivi 2013).

This dynamic of creating storytelling with children is interesting because it reveals the place people want to give to the green turtle, which is both a symbolic and emblematic species — symbolic by the place the turtle holds inside tribes and clans, emblematic by the flagship role that is given to the animal at local, provincial and international levels. The interviews conducted with the socio-cultural officers who work for the mayor and intervene in schools also suggest this relationship. The socio-cultural officers' approach is definitely educational: they develop activities in schools to fight against the loss of traditional knowledge and skills, to fill the lack of knowledge of children relative to food and food crop practices, but also using their mother tongue. The green turtle seems to be less affected than other animals by this loss of knowledge and skills but it is deliberately and consciously emphasized in the tribes and at school, which is helping to convey messages beyond the tribe. The fact that the book relating the tale "*Taa Nii Ngüü, La Petite Tortue Verte*" is sold in Noumea attests to this dynamic. Moreover, people living in Noumea are now invited to join the yam ceremony.

10. "*Taa Nii Ngüü, The Little Green Turtle*"

Turtles and yams, inserted in normative and cognitive chains of local translations

Before dealing with the intersection of customary and administrative ways of proceeding, it is essential to describe the meshing/interlinkages between the yam and the green turtle, two highly structuring elements of Kanak society in Yaté. It should be noted that dualist logic is present in each “thinking process” (pine/coconut, man/woman, yam/taro, dry/wet...) characterizing the manner that Melanesian people understand unity and totality. Totemic operators (such as green turtles) invoked in myths for example are the “hyphen” between nature and culture and there is no opposition or dichotomy between these two intricate realms. As Herrenschmidt wrote, “instead of placing them in opposition, their presence and complicity show how this is not the rejection of nature that is fundamentally at stake, but the affirmation of duality as a civilizing vector and cultural basis” (Herrenschmidt 2004, my translation).

“One cannot talk about turtle without talking about yam. One cannot talk about yam without talking about whale. All of this is periodical.” (Old Man, Touaourou, 2014)

As suggested by this man from Touaourou, before defining and analysing the place held by the green turtle in Kanak society in Yaté, it is important to mention what the yam represents to Kanak society. The yam, which the green turtle accompanies during the yam celebrations, “is Man”: it lies at the heart of Kanak society; it structures society and forms its pattern. Thus, the yam cropping cycle determines the course of life in Kanak society, and particularly the date of significant events (yam celebrations, marriages, etc.).¹¹ It is also at the centre of customary gestures, which for a long time mainly included this tuber. In addition to its symbolic value, yam has a substantial nutritional value and was formerly consumed on a daily basis.

Today yam is no longer eaten daily and everyone no longer has his own yam field in Yaté: its use value has lowered. Nonetheless, its symbolic value remains very strong and it is unacceptable to fulfil a customary gesture without yams, ideally those called “true yams”, especially dedicated to important customary gestures (we will see below that the green turtle has the same status of “true turtle”). A few individuals, although this is slightly “shameful”, even buy some in shops for this purpose. Many customary gestures nowadays present only small loads of yams in proportion to the rest of the gesture (*manous*, rice, cans, money, etc.) and this creates real concern among the population. Such concern shows the importance of the yam and the population’s fear of losing their culture and their fundamental values.

While some values, knowledge or know-how, such as agricultural practices, fishing techniques, language skills, etc. are tending to disappear in the area, symbols such as the yam and green turtle remind everybody that Kanak culture is still alive and contribute

11. Haudricourt is one of the first major authors who dedicated an important part of his work to the comprehension of the “yam civilization” (Haudricourt 1964).

to keep it alive. These symbols are sometimes overvalued in speeches, especially when the availability of, or access to, the animals and tubers are threatened (by regulations, lack of time, loss of knowledge). As for the green turtle, named “true turtle”, unlike all other marine turtles (just like yams favoured for customs are called “true yams”), it is still always caught and consumed during the important ceremonies in Yaté.

Green turtle as food, symbol and flagship for Kanaks from Yaté

The analysis of interviews done in Yaté shows that the green turtle has played (and for some people continues to play) a dual role, as a food and as a symbolic animal, and therefore people distinguish between “food turtles” and “ritual turtles”.

The category “food turtle” is used when the green turtle is considered to be “a fish among other fish”,¹² that is regularly caught to provide meat in a meal. Since the imposition of the provincial bans, Yaté inhabitants can no longer eat turtle on a regular basis. However, this was not the case previously, and young and old agree on this point: “before people caught turtle to eat it at home” (25-year-old man); “before we killed turtles like fish. Now it’s forbidden” (80-year-old man).

The category “ritual turtle” is used when the green turtle is considered to be an emblematic and symbolic species. “Ritual turtles” are always consumed with yams during specific customary events. We shall thus talk of a symbolic species when the green turtle is used as a tool within the Kanak society in order to legitimate a place, function, role, etc. within a tribe. When it is used to assert rights and legitimate the place of an individual or a group from within the tribe with regard to authorities outside the tribe, we shall speak of an emblematic species.

Differences involving “food turtles” and “ritual turtles” are the customary paths¹³ followed to hunt them, capture modalities, and ways of cooking them. In each case, the persons authorized to carry out a particular task/function are specific, as are knowledge transmission modalities (fig. 3).

The study of the task of cooking green turtles highlights the two discourse registers that we have identified. In the customary register, green turtles are cooked in a specific way, by women only, and require a particular organisation. In the basic “food” register, green turtles are roasted, stewed, cooked with coconut milk or oil, etc. according to what the person in charge of cooking feels like eating and the preparation requires no particular organisation.

12. A work on local categorizations is still in progress.

13. Customary paths can be here defined as sociopolitical and familial networks that express alliance networks and family relationships. In other words, a customary path metaphorically links individuals with customary status to each other and facilitate understanding of the role that each clan and individual has *vis-à-vis* others. Concerning fishing and the use of marine territories, one frequently must follow a particular path (both metaphorically and physically), and one must request permission to someone or several persons to do some activities in some places.

Figure 3: Legitimate persons identified by the majority of inhabitants from Touaourou, Goro and Waho tribes for carrying out tasks relative to the turtle as a food or symbolic animal

Who may legitimately...	<i>Turtle as food</i>	<i>Turtle as symbol</i>
...capture turtle?	Everyone	Sea clan
...share turtle?	Everyone	Land clan
...cook turtle?	Everyone	Only women

© Sabinot and Bernard

The study of capturing green turtles also reveals both these registers. Prior to the provincial bans, fishing for family consumption was practised individually or in a group (family, friends, etc.); all clans could devote themselves to it.¹⁴ Yaté inhabitants generally did not only target green turtle during such outings. They went out fishing to bring back fish and were delighted when they also brought back a turtle should the opportunity arise.¹⁵ In contrast, fishing for a particular event, such as yam celebrations, was and is only practised by the sea clans. It can be described as customary fishing: sea products are consumed at yam celebration meals and sometimes even integrated into the customary gesture. Customary fishing was previously described as simultaneous fishing by several sea clans sharing their nets. Nowadays, with the evolution of fishing gear, each sea clan of the four Yaté tribes sometimes practises fishing individually. Whatever the clan going out fishing, a customary path must be respected in order to fish. Such paths vary according to individuals and clans, and also according to the ceremony for which they are followed.

When the date of the yam celebrations is officially announced, nowadays after a church service or gathering, “each clan knows its work”, “each clan knows what it should do”. Each clan’s function and individual statuses within the clan determine the role it will have to fulfil in the capture, killing, preparation and sharing of green turtle, and associated customary paths.

Today, for yam celebrations, the chiefdom provides a customary gesture for the sea clan and for its fishermen to go and catch green turtles. The land clans are in charge of bringing the yams to the chiefdom, including the fishermen’s share that

14. See Leblic’s excellent description of the activities, legitimacies and customary relations to the sea and to other clans and tribes (1989; 2008).

15. According to a few informants this practice still exists.

mainly comprises *manous* (fabrics) and beverages. The presence of beverage in this customary gesture expresses the gratitude toward the fishermen who will be “dried out” during fishing and will need to rehydrate upon their return. On the day of the yam celebrations, the chiefdom will redistribute to the sea clan the share intended for them (*manous* and beverages) to thank them for their catch. Only the sea clan receives a customary gesture: its task is renowned for being the most difficult due to the challenges of bad weather. Each clan (sea or land) at the yam ceremony offers a yam to the chief to thank him for the reception.

If the sea clan has to go out of “its lagoon territory” in order to catch green turtles, it must respect a particular “customary path”, asking permission from the tribe customarily known as the owner/manager of the concerned lagoon territory prior to fishing. When the fishing activity does not aim to capture green turtles or other meaningful species (such as the fish *darwa*, *Naso unicornis*), the fishermen do not need to “do the custom”, yet they must warn one of the empowered persons from the owner/manager tribe that they are going to the lagoon. In Yaté municipality, the Touaourou and Waho tribes catch green turtles opposite the Goro tribe and must therefore follow a customary path that leads them to the Goro tribe. The interviews reveal various discourses regarding this visit to Goro, and different ways of perceiving and living this customary path.

Many people say they have to go through Goro to access the marine territories that belong to the Goro tribe. However, while there was originally only one referent clan, some men say that they have to see a specific clan, others another clan. Everything depends on the relationships and conflicts that people have (or do not have) with the clans and their members. Some even claim they have to go through Goro to give legitimacy to the members of the sea clan of Goro, “to allow them to exist”. Finally, some now refuse to go through Goro and rely on the fact that only the consent of the provincial authority is now required.

Discordances in the discourses and actions reveal that important changes are taking place and that customary paths are becoming blurred and confused, revealing that legitimacies relative to status, territories and resources are nowadays being discussed extensively within the tribes.

From customary paths to the paths of provincial regulations

As noted above, a customary path links individuals having customary status with each other. According to their status, individuals can be in direct or indirect connection with other individuals. In the first case, individuals can go and directly meet other people; in the second case, intermediaries are needed to go from one person to the other. The Kanak society forms a network that provides several possible paths to reach an individual and reveals alliance strategies. Some paths have to be followed for activities related to the green turtle.

Progressive construction of provincial regulations

Because of the status of endangered species given to the green turtle, official, administrative paths are now added to — or even superimposed on — these customary paths. Among them are the provincial environmental regulations. A brief overview of how these regulations were implemented will enable us to analyse how they are understood and in what ways they shake up and disrupt Kanak habits while also being subject to “instrumentalisation”.

In 1977, the government passed the first ban on turtle fishing between November and March and on collecting turtle eggs all year,¹⁶ but exemptions were possible for scientific and customary purposes.¹⁷ In 1985, the rules were strengthened and specified, especially in terms of sanctions. With the creation of the three Provinces in New Caledonia in 1989, environmental issues became a provincial competence. In 2002 in South Province, the former article (ban with possibility of exemptions for green turtle) was abrogated and a limitation of capture in terms of quantity was voted (only one turtle per boat and per fishing trip is permitted).¹⁸ However, in 2006 the use of marine turtles and their products was totally banned: “are prohibited the capture, collection, intentional disturbance, mutilation, stuffing, destruction, transport, peddling, use, possession or consumption of sea turtles of all species, whether living or dead”.¹⁹ Additionally, modifications were made regarding the competent authorities responsible for the implementation of the regulations. Articles about these bans were completely rewritten in 2008 in the Environmental Code of South Province and they still include the possibility to obtain exemptions for the capture of green turtles for customary purposes.

Step-by-step integration in local minds and practices of the administrative approach to green turtle management

Nowadays, South Province agents are particularly active during the yam celebrations. At the beginning of the year, they send a formal letter to all of the tribes to remind them

16. « La capture des tortues de toutes espèces, quel qu'en soit le procédé, est interdite pendant les mois de Novembre, Décembre, Janvier, Février et Mars de chaque année » (The capture of all species of turtle, regardless of the method, is banned during the months of November, December, January, February and March of each year) (Délibération n° 220, art n°1, Journal Officiel de la Nouvelle-Calédonie du 19 août 1977).

17. « À l'occasion des fêtes traditionnelles et coutumières ou à fins scientifiques des dérogations [...] pourront être délivrées, sur demande justifiée, par le Service de marine Marchande » (On the occasion of traditional and customary celebrations, or for scientific research purposes, derogations [...] may be delivered, based on justified requests, by the Merchant Marine Service) (Délibération n° 220, art n° 3, Journal Officiel de la Nouvelle-Calédonie du 19 août 1977).

18. Délibération n° 12-2002 du 7 mai 2002, art n° 1, Journal Officiel de la Nouvelle-Calédonie du 28 mai 2002.

19. Délibération n° 20-2006/APS du 13 juin 2006, art n° 1, Journal Officiel de la Nouvelle-Calédonie du 27 juin 2006.

to submit their request for derogations to the Direction of the Environment of South Province. In such requests, the number of green turtles claimed (usually between 2 and 6), the date and name of the customary ceremony, fishing dates and locations, the port of discharge and the phone number of the person in charge of the fishing activity must be mentioned. If the authorisation is granted, the fishermen get organised and alert the “rangers” (“*garde-nature*”), some of the Provincial field agents, who will go to the “port of discharge” to control the catches. Provincial field agents have told us they aim to raise awareness about green turtle conservation rather than to penalize its fishing. Since 2006, only one person was penalised following a denunciation (a fine of 250,000 FCFP was imposed, less than the one million FCFP fine usually required by law).

The follow-up of tribes’ requests for derogation in South Province began in 2004. In archival requests reviewed, all authors mention the specific article of the law relative to the modalities of green turtle capture, the number of animals requested, the date and name of the customary ceremony, fishing dates and locations, and the port of discharge. Some add the name of a person in charge of fishing activities.

With the exception of 2009, when the request was submitted by the mayor of Yaté for the four tribes of the municipality, the person submitting the requests on behalf of the tribe — that is, the person whose name appears on the official documents — usually had a customary status: great chief, little chief (see note 5) or a representative of the sea clan of the tribe. For Touaourou, it has always been the great chief of the tribe. For Waho, the requests were made by the great chief of Touaourou, except in 2005 and 2011 when it was the little chief of Waho. In Goro, the person who submitted the requests changed every year except for the past two years (2013 and 2014), which is a direct reflection of the internal conflicts related to the chiefdom of Goro.

This absence of continuity/permanence in the “choice” of the persons entitled to submit a request reveals the confusion that exists in the minds of local actors, communication difficulties, and even a strategic use of the rules to express tensions between groups. Most of all, it reveals the dissonance between the representations of local and provincial actors.

Long and confused apprehension of intertwined local and customary legitimacies

Whatever the tribe, South Province agents experience difficulties in knowing who has legitimacy in customary terms to submit dispensation requests. Among the Yaté tribes, this role pertains to the great chief in Touaourou and the little chief in Waho. Goro is a special tribe as it has no great or little chief and comprises, according to some informants, two sea clans. This adds a layer of difficulty for the Province with regard to the application of the regulations.

When South Province receives two dispensation requests for the same event, such as the yam celebrations, which are submitted by the same tribe but by two different individuals who ask for different amounts of green turtles, which request

does it approve? Which of these two individuals should be considered the most legitimate to submit the requests? When actually faced with this situation in 2012, South Province selected the one requesting the lowest number of turtles, as the ecological consideration took precedent. This decision caused discontent within the tribe.

The division of the Touaourou sea clan into two sub-clans, “Little” and “Great”, also causes trouble, mainly when each sub-clan brings back from their fishing trip the total amount of green turtles granted to the entire tribe, or, in other words, twice the number of turtles allowed. Which turtles should be chosen? Which sub-clan may legitimately go catch the turtles? Moreover, for several years the “Great” sub-clan has no longer been taking part in the tribe’s yam celebrations, yet it organises its own internal yam celebrations. Each sub-clan considers its group as the fishermen and the other group as the intermediaries between the chiefdom and the fishermen. According to one of the Province agents, when faced with this situation, the agents requested the sub-clans to release half the turtles and let the two customary authorities who had originally submitted the requests to decide which turtles should be kept or released. According to the inhabitants we talked to, the Province requested the release of the smallest turtles (although we learned from Province agents that they in fact aim to preserve turtles old enough to breed).²⁰

There are thus misunderstandings between the different actors involved. The system of dispensations granted at the tribe level seems very difficult to apply without establishing strong relationships between South Province, members of the tribes and customary authorities, and without considering the legitimacy conflicts occurring internally in the chiefdoms but overlooked by the administration. Will the division of the tribe, reflected in the holding of two separate yam celebrations in Touaourou, make the Province consider requests for dispensation differently? Will the two sub-clans accept to submit a joint request? Will they request a larger number of turtles for this reason? These questions will be examined in further research.

According to South Province agents, while everyone agrees on the customary importance of the green turtle’s presence in yam celebrations, there is no consensus for other events such as weddings or funerals. Who is truly legitimate to receive a green turtle for a funeral or wedding? What requirements/criteria should be retained when nothing is codified, formalised or written?

South Province agents are sometimes in a delicate situation and usually combine political and customary figures to avoid controversy. Indeed, an individual holding a position with high responsibilities in the political world at a municipal, provincial or governmental level does not necessarily hold an important place within his/her tribe or his/her clan. The Province’s representatives sometimes granted derogations

20. See also the work of Colin Limpus and the PhD research of Tyffen Read.

for events related to politically important individuals, without knowing their actual customary value and status in the Kanak society, and this has been criticised by some people.

Another problem arises when requests are submitted for religious, i.e. Christian, events. Many requests were submitted in relation to religious events, such as building new chapels, the arrival of the Evangel, an end to mourning announced by a priest, etc. Nowadays, there are fewer religious requests (but not necessarily captures), as the population knows the representatives of South Province systematically refuse them. According to one of its agents, the distinction between customary and religious ceremonies is becoming less and less clear, and Kanak people are requesting more turtles, while only customary events should give the right to catch turtles, knowing that custom is imbued with Christianity.

In a context of strong cultural syncretism, agents have trouble distinguishing between the two types of events, and most agents consider that these requests do not have a customary character: religious and customary ceremonies are totally intertwined and customary rites apply for anything religious. Weddings in particular cause problems as the nature of the event is both customary and religious, but agents doubt their “customary” character and the obligation to have green turtles present. The logic underlying the conservation of the species leads the Province to be as restrictive as possible: its agents only tolerate rituals considered to be faithful to the “theoretical traditional canons” (such as yam celebrations). The stakes of conserving the species are assimilated with the stakes related to the cultural conservation of traditions, which is contrary to the logic and processes of syncretic identity and cultural transformation.

Finally, more recently, within the framework of the Charter proclamation, which gathered the customary authorities of the eight customary areas of New Caledonia, the permission to capture ten green turtles was requested. Such a request sparked controversy among South Province agents: after long debates, they decided the event was a political one rather than a customary one. They therefore initially proposed to grant only two turtles. However, we were given two different versions of the final decision. The first is that under pressure from politicians, the executive of the Province decided to accept the catch of ten turtles; the second version is that no catch was authorized. What is certain is that at the Charter proclamation event, a few green turtles were included in the customary gesture and were cooked. This event shows employees working within the Province’s administration face difficulties in recognizing legitimacy.

Progressive construction of an internal and external political object

Following inclusion as a Unesco World Heritage site in 2008, South Province worked with several clans from Goro whose members wanted to make the Merlet

area a “total” sanctuary. This area was first a “customary reserve” before becoming the “Merlet reserve” in 1970, a marine protected area that allowed customary fishing for special collective and customary events. To be a “total” sanctuary, rules for complete protection are required, namely the prohibition of all access to and use of this area, even if some dispensations remain possible. Such a project also reveals that some clans decided to no longer allow the capture of green turtles in the Merlet reserve, even though other clans wanted to continue the practice. This kind of decision is frequently challenged and renegotiated, notably in the context of new events or tensions between the Province and a few individuals of the Goro tribe. In February 2015, when the Province authorized a lesser number of green turtles than requested, it received a letter asking for the decision to be reconsidered. Respect for the administrative procedure relative to the green turtle, and the fact that Kanak tribes entrusted the management of Merlet Reserve to the Province a few years previously, were both called into question.²¹ This event shows that when an agreement is not co-constructed by the tribes and the administration, and when it is not considered for a “reasonable” period in order to include temporal changes and the fact that one or several individuals from one side or the other can have an impact on the shared regulations, the population may stop respecting or following the agreement, and it can become a strategic tool used in a context of conflict and claim. Understanding the evolution, and sometimes the mutations, of the relations between humans and the environment via the “green turtle” offers us a more integrated comprehension of the processes that are occurring in the southern part of New Caledonia, where both local and provincial regulations are in place, especially on the marine part of the country.

In a context of negotiation over independence and autonomy, several Kanak actors have highlighted the conservation of the environment and resources using the term, “heritage”. For instance, the green turtle has been widely used by the Rhéébù Nùù association, whose discourse is both indigenous and conservationist, in their negotiations with the mining industry. Members of Rhéébù Nùù demonstrated a will to preserve the environment by transforming a customary reserve into a provincial reserve and have shown a certain skill at negotiating with the polluting factory, the mining industrial VALE. The green turtle was one of the emblematic species invoked in these arguments.

Today in Yaté, in the context of both exogenous development politics and environmental conservation politics alike, a close link is observed between professionalization in mining industry-related trades and diversion away from traditional activities, and between increased financial resources and rapid changes in food consumption. The use value of the environment and food-producing goods seems to have considerably

21. More fieldwork is needed to well understand the recent and current history of the Merlet area and this is one of the objectives that our team is pursuing this year.

decreased, as the population no longer relies on them to meet basic food requirements. The deep social and identity mutations that accompany these changes are often perceived as a new breach by inhabitants, and particularly by customary authorities. The important moments of customary social life are a strong expression of the community's social cohesion and an identity assertion of belonging to a territory (Bernard et al. 2014, Sabinot et Lacombe 2015). The “heritage” value of the environment and of food-producing goods derived from it, that is, their social, cultural and symbolic value expressed at weddings, funerals and yam celebrations in particular, seems to increase all the more as their daily use value has decreased.

The green turtle is definitively both a symbolic and emblematic species. Although this animal is an endangered species and an emblem used in negotiations, it continues to swing between being considered a heritage and being considered a commodity. Nowadays, in becoming a political object as well as a natural and a social object, the green turtle lies at a crossroads in administrative, political and customary terms.

Conclusion

To conclude, the green turtle is both the “subject” and “object” of conflicting representations, territoriality issues and legitimacy issues. The fact that actors who are not members of Yaté tribes also use this animal as an iconic species, on which new, externally driven modes of relationships are superimposed, seems to reactivate or overactivate tensions around the animal. This study is particularly concerned about the stakes involved in South Province by this emblematic sea species. As both an animal with a strong cultural and customary value in Kanak society and an emblem for provincial and international institutions, the green turtle *de facto* ends up at a crossroads of knowledge systems, expectations, representations and regulations pertaining to these different actors.

The green turtle and the specific chains of translation in which it is inserted are currently challenged by environmentalist apparatuses and the socioeconomic mutations occurring in the country. In this context of quick and strong transformation, the social value of certain elements such as the green turtle is becoming more important and an increased “heritage” value is also conferred on them. Keeping the social practices related to the environment as well as cultural knowledge and references attached to environmental elements alive is, according to many, a fundamental issue for the Kanak community because it helps to maintain the links between people and their land and sea and the relationships between groups. It also explains why some “objects” like the green turtle are the subject of such negotiation between administrative, local and customary actors.

Moreover, as Artaud described in 2011 in Mauritania, the institutional regulations relative to green turtles (a complete ban on fishing, without possibilities of dispensation for the Imrâgen people, the local indigenous inhabitants — a much more

drastic regulation than in New Caledonia) can extend and renew the range of meanings that are “supported” by the green turtle. “Fishing and consumption [of the green turtle], instead of conveying the values of sacredness and the blessings thought to be received from the turtle’s flesh, suddenly became for some players, claimants and activists, emblems of resistance against this authoritarian policy of the Park [National Park that previously enclosed them]” (Artaud 2014, my translation). Instead of seeing in this coincidence of prohibitions the convergence of local and institutional interests, Imrâgen “communities have felt an additional encroachment on their “traditional” area, an arbitration too much on the scope of their practices and their representations” (*ibid.*, my translation). Although the law is not as restrictive and permits dispensations for a few customary events organized by Kanak people, fishing and eating the green turtle in New Caledonia could become for some inhabitants, as it has elsewhere, an act of militancy against the protagonists of economic development policies and environmentalist apparatuses. This holds even truer if the regulations are not well understood and accepted. Claims in Yaté do not seem to be as acute or shared as in Mauritania, notably because the regulation permits dispensations. The history is different but the processes that are occurring present some similarities. In a context of a growing cultural syncretism that blurs the distinction between customary, ritual, religious and political dimensions of the requests for everybody and particularly for the employees of the Province, the system of dispensations granted at the tribe level is difficult to apply without organizing new discussions with all of the actors concerned by the management of the green turtle. Even if the internal legitimacy conflicts occurring within the chiefdoms will probably be globally overlooked by the administration, recognizing that these conflicts exist is essential. Provincial agents have recognized that the rules and criteria of dispensation had to be revised in collaboration with the people to take into account both cultural and customary expectations and environmental concerns. Shared reflexions for adapting provincial regulations to the sociocultural, economic and identity dynamics experienced by the population have just begun in 2015.

References

- Artaud, H el ene
2014 « De l’efficacit e symbolique des interdits   leur fonctionnalit e  cologique ». *Revue d’ethno cologie* [Online], 6: DOI 10.4000/ethnoecologie.2055.
- Aswani, Shankar, and Richard J. Hamilton
2004 “Integrating Indigenous Ecological Knowledge and Customary Sea Tenure with Marine and Social Science for Conservation of Bumphead Parrotfish (*Bolbometopon Muricatum*) in the Roviana Lagoon, Solomon Islands”. *Environmental Conservation*, 31(1): 69-83.

- Bahuchet, Serge, Françoise Grenand, Pierre Grenand, and Pierre de Maret
 2000 *Forêts Des Tropiques, Forêts Anthropiques. Sociodiversité, biodiversité: Un guide pratique* [Volume I de *Les peuples des forêts tropicales aujourd'hui, rapport du programme Avenir des Peuples des Forêts Tropicales* (APFT)]. Bruxelles: AFPT-ULB.
- Bernard, Sarah
 2014 La tortue verte: Un indicateur des changements sociaux dans la commune de Yaté en Nouvelle-Calédonie ? Mémoire de fin d'étude de l'ISTOM. Nouméa: IRD-Océanide-CCCE.
- Bernard, Sarah, Shani Lacombe, Loeiza Lancelot, Jean-Brice Herrens Schmidt, and Catherine Sabinot
 2014 Dynamiques des habitudes, des pratiques et des savoirs relatifs à l'usage et à la gestion du littoral et de la mer dans un contexte de pression industrielle sur le milieu et de changements sociaux. Programme LIVE (Littoral Vivrier et Environnement). Nouméa: IRD-Océanide-CCCE.
- Biersack, Aletta, and James B. Greenberg
 2006 *Reimagining Political Ecology*. Durham, London: Duke University Press.
- Brosius, J. Peter
 2004 "Indigenous Peoples and Protected Areas at the World Parks Congress". *Conservation Biology*, 18(3): 609-612.
- Collomb, Gérard
 2009 « Sous les tortues, la plage ? » *Ethnologie française*, 39(1): 11-21.
- Cormier-Salem, Marie-Christine
 2000 « Appropriation des ressources, enjeu foncier et espace halieutique sur le littoral ouest-africain. » In J-P. Chauveau, E. Jul-Larsen and C. Chaboud (eds), *Les pêches piroguières en Afrique de l'Ouest*. Paris: Éditions Karthala, CMI and IRD, p. 205–229.
- David, Gilbert, Christine Henon, Christian Chaboud et Raphaël Plante
 2003 "World and Local Heritage, the Relationships between Conservation and Development: The Example of the Coelacanth". *International Journal of Environment and Sustainable Development*, 2(2): 122-138.
- Doyon, Sabrina, and Catherine Sabinot
 2014 "A New 'Conservation Space'? Protected Areas, Environmental Economic Activities and Discourses in Two Yucatán Biosphere Reserves in Mexico". *Conservation and Society*, 12(2): 133-146.
- 2015 *Anthropologie des espaces côtiers et de la conservation environnementale. Pêche, sel et flamands roses dans les Réserves de biosphère yucatèques au Mexique*. Québec: Presses de l'Université Laval.
- Dumez, Richard
 2010 *Le feu, savoirs et pratiques en Cévennes*. Versailles: Quae.
- Dumez, Richard, Marie Roué, and Serge Bahuchet
 2014 « Conservation de la nature : Quel rôle pour les sciences sociales ? ». *Revue d'ethnoécologie* [Online], 6: DOI 10.4000/ethnoecologie.2089.

- École maternelle de Tchivi
 2013 *Taa Nii Ngüü, la petite tortue verte*. Nouméa: Fondation VALE.
- Escobar, Arturo
 2001 "Culture Sits in Places: Reflections in Globalism and Subaltern Strategies of Localization". *Political Geography*, 20: 139-174.
- Faugère, Elsa
 2008 « Mettre en mots, en nombres et en politique la nature néo-calédonienne ». *Le Journal de la Société des Océanistes*, 126-127: 153-166.
- Haudricourt, André G.
 1964 « Nature et culture dans la civilisation de l'igname : L'origine ces clones et ces clans ». *L'Homme*, 4(1): 93-104.
- Herrenschmidt, Jean-Brice
 2004 Territoires coutumiers et projets de développement en Mélanésie du Sud (Îles Loyauté, Vanuatu, Fidji). Thèse de doctorat. Paris: Université Paris IV.
- Herrenschmidt, Jean-Brice, Sven Menu, and Pascal Hébert
 2007 Étude de faisabilité pour le développement de la gestion participative des récifs et des écosystèmes associés du grand lagon sud. Nouvelle-Calédonie: Direction de l'Environnement - Province Sud.
- Latour, Bruno
 1997 *Nous n'avons jamais été modernes. Essai d'anthropologie symétrique*. Paris: Éditions La Découverte.
- Leblic, Isabelle
 1989 « Les clans pêcheurs en Nouvelle-Calédonie. Le cas de l'île des Pins ». *Cahiers des sciences humaines*, 25(1-2): 109-123.
 1993 *Les Kanak face au développement : La voie étroite*. Nouméa, Grenoble: Presses Universitaires de Grenoble.
 2008 *Vivre de la mer, vivre avec la terre... en pays kanak : Savoirs et techniques des pêcheurs kanak du sud de la Nouvelle-Calédonie*. Paris: Société des Océanistes.
- Le Meur, Pierre-Yves
 2013 "Locality, Mobility and Governmentality in Colonial/Postcolonial New Caledonia: The Case of the Kouare Tribe (xûâ Xârâgwii), Thio (Cöö)". *Oceania*, 83(2): 130-146.
- Le Meur, Pierre-Yves, Paul Sauboua, Estelle Poncet, and Marie Toussaint
 2012 « Les enjeux de la gouvernance locale des ressources marines en Nouvelle-Calédonie. Contribution à la réflexion sur le 'foncier maritime' à partir de deux études de cas ». In N. Meyer and C. David (eds), *L'intégration de la coutume dans l'élaboration de la norme environnementale*. Bruxelles: Bruylant, p. 235-252.
- Léopold, Marc, Jean-Michel Sourisseau, Nathaniel Cornuet, Carine David, Arnaud Bonmarchand, Pierre-Yves Le Meur, Laetitia Lasseigne, et al.
 2013 « La gestion d'un lagon en mutation : Acteurs, enjeux et recherche-action en Nouvelle-Calédonie (Pacifique sud) ». *Vertigo – la revue électronique en sciences de l'environnement* [Online], 13(1): DOI 10.4000/vertigo.13297.

Mapou, Louis

1999 « Représentations et pratiques de l'espace foncier chez les Kanak de Yaté ». In G. David, D. Guillaud and P. Pillon, *La Nouvelle-Calédonie à la croisée des chemins : 1989-1997*. Paris: Société des Océanistes / Institut de recherche pour le développement, p. 103–111.

Pagezy, Hélène, Stéphanie Carrière, and Catherine Sabinot

2010 *Nature du monde, dessins d'enfants*. Paris: CTHS.

Rosillon, Caroline

2014 « La gouvernance environnementale au Sud: Regard sur un projet de conservation des tortues au Sri Lanka ». *Ethnographiques.org* [Online], 27: <http://www.ethnographiques.org/2013/Rosillon>.

Roué, Marie

2006 « Le désert, le wilderness et la forêt : éthique protestante et naissance de l'écologisme ». In C. Beck, Y. Luginbühl and T. Muxart (eds), *Temps et espaces des crises de l'environnement*. Versailles: Quae.

Sabinot, Catherine, and Stéphanie Carrière

2015 « Le dessin d'enfant: De l'outil aux médias pour la diffusion des savoirs scientifiques ». In L. Vidal (dir.), *Les savoirs des sciences sociales. Débats, controverses, partages*. Marseille: Editions IRD, p. 51-72.

Sabinot, Catherine, and Shani Lacombe

2015 « La pêche en tribu face à l'industrie minière dans le Sud-Est de la Nouvelle-Calédonie ». *Revue de la Société Internationale d'Ethnographie*, 5, La mer et les Hommes: 120-137.

Teulières-Preston, Marie-Hélène

2000 « Le droit maritime kanak et ses transformations ». In A. Bensa and I. Leblic (eds), *En pays kanak. Ethnologie, linguistique, histoire, archéologie en Nouvelle-Calédonie*. Paris: Maison des sciences de l'homme, p. 129–146.

West, Paige

2006 *Conservation Is Our Government Now: The Politics of Ecology in Papua New Guinea*. Durham, London: Duke University Press.

West, Paige, James Igoe, and Dan Brockington

2006 "Parks and People: The Social Impacts of Protected Areas". *Annual Review of Anthropology*, 35: 14-27.



The challenge of sustainability for Pacific Island village fisheries, a historical perspective

Gilbert DAVID

Introduction

The World Wide Fund (WWF) paints an extremely alarming picture of the state of marine populations exploited by fisheries in the most recent Living Blue Planet report (Tanzer et al. 2015). Fish stocks have fallen by 50% between 1970 and 2012. This information is consistent with a 2006 Science paper written by a group of biologists and economists announcing that 29% of fish and shellfish species were nearing extinction, their catches having decreased by 90% between 1950 and 2000. If this trend continues, Boris Worm et al. (2006) conclude that it is highly probable that all of the world's fish and shellfish stocks will disappear. This catastrophic view is not shared by all (Hilborn 2007). The Food and Agriculture Organization of the United Nations (FAO 2010) emphasizes that the maximum annual catch that fishers have taken from the ocean (74.7 million tonnes in 1996) is below the potential catch, estimated at between 80 and 100 million tonnes (Gulland 1971). The fact remains that many stocks are overexploited, and with the human population continuing to grow, demand for marine protein will rise accordingly, putting increased pressure on fish stocks.

Within this bleak picture of global fisheries, the Pacific Islands are relatively better off than other regions in the world because the development of their fisheries took place comparatively later, both with regard to commercial tuna fisheries (Cillaurren 1991) and artisanal fishing (David 1991). However, the situation is evolving rapidly and there is a strong risk that the status of stocks will deteriorate in the near future if the governance of fisheries is not improved. With the widespread adoption of the ecosystem approach to fisheries (Garcia 1996; Garcia et al. 2003), marine protected areas (MPAs) have become a fisheries management tool in their own right (FAO 2011; Lauck et al. 1998) and environmental NGOs now present them as being the principle means to save endangered fish stocks (Tanzer et al. 2015).

Over the past few years, large MPAs in particular have been created in the Pacific Islands: the Phoenix Islands protected area (408,250 km²) in 2008; the Coral Sea Marine Park (1,292,967 km²) and the Coral Sea Commonwealth Marine Reserve (989,842 km²) in 2012; the extension of the Pacific Remote Islands Marine National Monument, which was created in 2009 and extended in 2014 to cover 1,271,500 km². The British government plans to establish a 834,000 km² MPA around Pitcairn in the near future, while the Chilean government has decided to extend the MPA around Rapa Nui (Eastern Island) to 631,368 km² (see the chapters by Giron and by

Cornier and Leblic in this volume). Will these MPAs resolve the growing problem of overfishing in the Pacific Island region? There is reason to doubt. As Tundi Agardy et al. (2003) already demonstrated over 10 years ago, an increase in the number of MPAs often increases the risk that these MPAs will be ineffective if the required human and financial resources are unavailable.

This chapter argues that setting up MPAs in no way constitutes a panacea for fisheries management in the Pacific Islands, and that a holistic approach is needed to break from the ecosystem approach to fisheries and return to a fisheries system paradigm (Chaboud and Fontana 1992; Charles 1995; Quensière 1993; Rey et al. 1997) in order to establish responsible fisheries at the level of each state and territory.

Rationale and methodology

This chapter discusses Pacific Island village fisheries. Although generally less well known than the industrial fisheries exploiting tuna stocks in the region's exclusive economic zones, village fisheries play a vital role in island coastal economies in terms of both employment and food security. This fishery also is characteristic of Pacific fisheries because throughout the islands of Melanesia, Micronesia and Polynesia, the village is the geographic unit on which fish production, fisheries management — referred to as community-based fisheries management (SPC 2010) — and a good part of the distribution and consumption of fishery products is organized. Coastal communities have a land territory, which provides villagers with a large portion of their carbohydrates and fats, and a maritime territory, which provides the majority of their protein intake (Bell et al. 2009).

Until quite recently, this village maritime territory was composed exclusively of the *nearshore*, which comprises shallow areas such as mangroves, beaches, seagrass beds,¹ coral reefs,² and surface water inhabited by small pelagic species (see below). This space holds a wide range of fisheries resources: fish, shellfish, crustaceans, holothurians (sea cucumbers).³ Four thousand species of reef fish have been recorded

1. The seagrass beds are composed of marine phanerogams. Specific to sandy and sandy-muddy zones, these herbaceous plants with roots are unique in marine ecosystems. They are clearly distinguished from algae which, equipped with clamps but no roots, attach to rocky substrates.

2. Coral reefs are bioconstructions created by colonies of scleractinar corals, micro-animals belonging to the phylum Cnidaria (like sea anemones and jellyfish) known as "polyps", which use carbonates and calcium in seawater to construct a coral skeleton in which they take refuge. Polyps live in symbiosis with dinoflagellates, single-celled micro-algae belonging to the genus *Symbiodinium*, which provide 70 to 80% of their food through photosynthesis. Scleractinar coral therefore need light to survive and are not found at depths below 50-75 metres. This ecosystem plays a leading role in global biodiversity. It holds one quarter of all known marine species (Moberg and Rönnbäck 2003).

3. The fisheries resources which live on the seafloor are known as benthic organisms and include fixed shellfish and holothurians; those living near to but with some independence from the seafloor are

in the region (Meyers 1989). This nearshore is the territory of subsistence fishing. Subsistence fishing refers to all fishing activity in which most of the production is destined to be consumed by the fishers and their families, or is given to other village households. Subsistence fishers fix their production objectives according to their needs and home-consumption capacities. Once this objective is achieved, they cease their fishing effort except when they face exceptional cash needs, for example, to pay for their children's school fees. There are thus two types of subsistence fishing: self-consumption fishing, where all the fishing production is consumed in the fishers' household or village (one might also call this home-consumption fishing), and subsistence fishing with trade, where surplus production (e.g., production surpassing a fisher's home-consumption capacities) is sold.

With the development of artisanal fishing (meaning professional commercial fishing) and motorized vessels, two new fishing grounds became accessible to village fishers:

- the *outer slope*, which is the island equivalent of the continental slope. Its upper section begins with the end of the euphotic zone and is composed of dead coral constructions, sometimes covering hundreds of metres⁴ (as such, it is often described as the outer reef slope). This space is associated with demersal resources known as deepwater species because they generally live at depths of between 100 and 800 metres, and sometimes deeper. These species are mainly fish. There are some shrimp stocks, but these stocks generally are too small to be the object of sustainable commercial fishing;
- the *offshore pelagic space*, which extends to the 1,000 metre isobaths and sometimes deeper. The furthest reaches see little activity except when near fish aggregating devices (FADs) are anchored to aggregate tuna resources.

In contrast with subsistence fishing, artisanal fishing is motivated by a sustained desire to fish in order to sell. Earning income from fishing is the main motivation of the fisher's activity and the fishing effort⁵ is continued until the income objectives have been reached.

known as demersal species; and those living in the open water are called pelagic species. In shallow water, the pelagic species are small in size (sardines, mackerel, anchovies) and therefore are described as small pelagic fish, distinguishing them from the large pelagic fish (tuna, dolphinfish, etc.) living further offshore.

4. The volcanic Pacific islands on which the coral develop are slowly sinking by subsidence under their weight.

5. Fishing effort refers to "the ensemble of means used by fishers to capture a stock of aquatic animals during a given period of time", the stock being a capturable resource associated with a fishing zone (Laurec and Le Guen 1981). In Pacific Island village fisheries, fishing effort is measured in number of trips or number of fishing hours per unit of time. The amount of effort spent depends on two main factors: what fishers hope to catch and fishing yield (catch per unit of time or per unit of effort).

The combination of the type of fishing ground, effort type, target species and market components leads to the identification of three types of village fisheries: outer slope artisanal fishery, artisanal fishery around FADs, and nearshore subsistence fishery.

Due to a rising demand for fishery products generated in part by population growth (Bell et al. 2009; Bell et al. 2011; UNFPA 2014), the fishing pressure on nearshore and coastal marine resources will intensify. Climate change is leading to increasing degradation of habitats due to more violent cyclones, ocean acidification (Anthony et al. 2011; Guinotte and Fabry 2008) and temperature peaks inducing increasingly severe coral bleaching (Hoegh-Guldberg 1999). The sustainability of Pacific Island village fisheries is thus a pressing question which should be addressed with regard to these three types of fisheries.

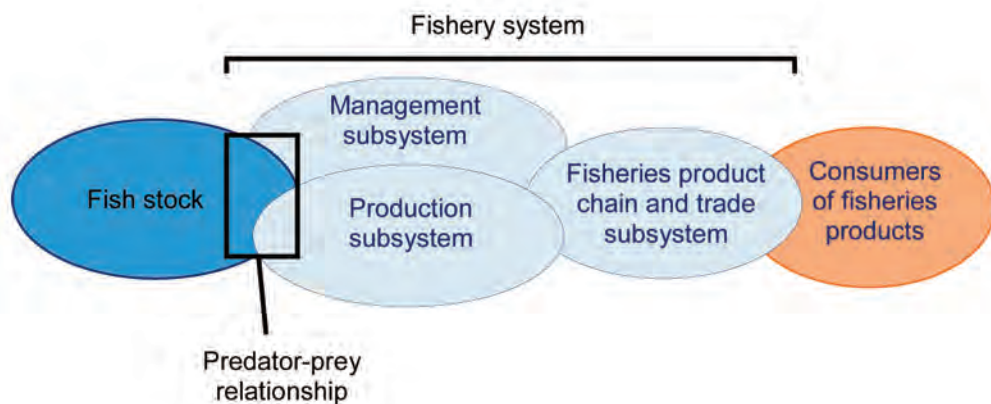
Four main rationales drive this chapter:

- a) Outer slope artisanal fishery, artisanal fishery around FADs and nearshore subsistence fishery work as a fishery system composed of three subsystems which form the link between exploitable fish stocks and fish-consuming populations: the production subsystem, the management subsystem, and the fisheries product chain and trade subsystem (fig. 1).
- b) The predator-prey relationship stands at the interface between the fish stock, the production subsystem and the management subsystem (fig. 1). It requires the presence on the fishing grounds of both fishers and the species they target (which must be available to be capturable). This relationship is expressed by both fishing effort and catches. The fisheries resource management aims to regulate this relationship by acting in a direct and indirect manner on the fishing effort.
- c) The development of artisanal fisheries at the village level has been strongly driven by the Pacific Community (SPC), a regional technical support development organization based in Noumea, New Caledonia. Through the provision of scientific and technical assistance, the SPC has introduced the same fisheries development model throughout the Pacific Island region. The model is based on artisanal fishery of pelagic species around FADs and the exploitation of deep sea demersal species. In this context, detailed knowledge of the development of artisanal fisheries at the country level can contribute essential elements that should be considered to build sustainable fisheries at the village scale and across all Pacific Island countries and territories. This chapter uses Vanuatu as an example. Vanuatu is one of the Pacific countries with well-documented fisheries resources and fisheries. Since achieving independence in 1980, the government of this young country has developed an ambitious fisheries development policy. It has done so based on a complete inventory of its fisheries resources. ORSTOM (now known as IRD)

was extensively involved in this inventory and the analysis of fisheries development. The author of this chapter contributed to this research, notably through the 2001 publication of the coastal fisheries atlas of Vanuatu, which as yet has no equivalent in the Pacific Island area (Cillaurren et al. 2001).

- d) The near future of outer slope artisanal fishery, artisanal fishery around FADs and nearshore subsistence fishery is driven by dynamics which are anchored in the past and which meet new constraints. An understanding of the recent past of these three types of fisheries is thus needed to assess their present and future sustainability in order to move towards sustainable village fisheries.

Figure 1: The fishery system and its three subsystems



In the interest of simplification, commercial fisheries of the outer slope and around FADs will be studied together as both fall under artisanal fishing and are recent creations, unlike nearshore subsistence fishery. They date back to the independence period in Oceania when new resource management frameworks emerged, first in the context of artisanal fisheries of the outer slope and around FADs, and then in the context of subsistence fisheries.

Fisheries on the outer slope and around fish aggregating devices

In Oceania, artisanal fishery focuses on two types of resources. The first are large pelagic fish (notably tuna and dolphinfish) which gather around FADs. FADs are anchored to the sea floor at depths of 500 to 1,200 metres in territorial sea water, meaning no more than 12 miles off the coast (Cillaurren 1999; Désurmont and Chapman 2000). The second are deep sea demersal species living at depths of 100 to

800 metres on the outer slopes of islands. This artisanal fishery aims at commercialization. Distribution networks sometimes go all the way up to the capitals and main urban centres of the countries concerned and rely on air transportation.

The production system

The resources

Mainly composed of Lutjanidae (snappers) and Serranidae (groupers), deep sea demersal species present the advantage of being sedentary and available throughout the year and are untainted by ichtyosarcotoxism,⁶ which facilitates their commercialization. On the other hand, their abundance is closely related to underwater topography and morphology. Their spatial distribution therefore is not homogeneous, and fishing yields can vary sharply according to the fisher's experience and know-how.

Numerous pelagic species swim in the surface and subsurface waters of the Pacific Islands. They are mainly skipjack tuna (*Katsuwonus pelamis*), yellow tuna (*Thunnus albacares*), dolphinfish (*Coryphaena hippurus*), frigate tuna (*Auxis thazard*), wahoo (*Acanthocybium solandri*), tuna (*Euthynnus affinis*), and black and striped marlin (*Makaira indica* and *Teraptemis audax*). These fish are highly mobile and the probability of a fisher coming across them while randomly moving across the water is low. FADs are deployed to significantly increase this probability by aggregating the fishery resource. FADs are rafts floating on the surface which are tied to an anchor by a mooring line that is frequently over 1,000 metre long, and on which strap bands are fixed, near to the surface, to attract small prey which serve in turn to attract tuna. In general, skipjack tuna are the first pelagic species to concentrate around FADs. It takes between two to five weeks for them to appear (Cillaurren 1994). The species then swim regularly around the FADs. Skipjack and yellow tuna form mixed schools on the surface and subsurface. However, these schools do not always remain around the rafts. In Vanuatu, they are reported to be most abundant at sunrise; catches also are reported in the middle of the day while the tuna move away from the raft at night (Cillaurren 1988). In general, pelagic resources are subject to marked seasonality, notably skipjack tuna, with the exception of latitudes around the Equator, from 10° north to 10° south, where Papua New Guinea, Palau, the Solomon Islands, Federated States of Micronesia, Kiribati and Tuvalu are located.

The first FADs were installed in 1977 in the Pacific for "troll" fishing of surface pelagic species. At the end of the 1980s, French Polynesian fishers were the first to

6. Widely known as ciguatera, ichtyosarcotoxism is caused by a toxin (ciguatoxin) produced by a microalgae of dinoflagellates, *Gambierdiscus toxicus*. This dinoflagellate stands as epiphyte of macroscopic algae living in coral reefs, notably branched, fan-shaped ones. The ingestion of *Gambierdiscus toxicus* by fish grazing on the coral contaminates their flesh and organs, with the poison transmitted to their predators (fish and humans). In people, ciguatoxin mainly affects the nervous system and disturbs the assimilation of sodium ions at the level of synapses (Laurent et al. 1993).

try to catch pelagic fish under the surface using vertical lines. They then noticed that new resources were available: large yellow tuna at depths of 40 to 100 metres, long finned tuna (*Thunnus alalunga*) and bigeye tuna (*Thunnus obesus*) from 100 to 200 metres (Leproux et al. 1990).

From fisheries development to overexploitation

In most Oceania countries, the fisheries development programs set up by the national fisheries departments during the 1980s to develop artisanal fisheries represented a veritable “blue revolution”. Loans, subsidies and technical assistance were used systematically across the entire region to equip subsistence fishers with modern material (motorized boats equipped with wooden reels) so that they could become professional fishers, enabling yields unlike any possible using traditional fishing practices (see for instance the “FADIL” boat project in New Caledonia presented by Cornier and Leblac in this volume). The strategies implemented were driven by both economic and scientific rationales. They aimed to increase fish production without surpassing the optimal level of exploitation, the estimate of which was based on fishing experiments conducted by SPC master fishers (Dalzell and Preston 1992). The uniformity of the artisanal fleets⁷ in the Pacific Islands and of the species targeted (pelagic resources aggregated by FADs and deep sea demersal species) is due to the major role played by the SPC in promoting artisanal fisheries (Preston et al. 1999).

A key to this revolution was the training of fishers. This involved taking subsistence fishers attracted by potential profits, and more rarely small entrepreneurs attracted by fishing, to create a core group of professional fishers able to create and sustain their own small fishing businesses. This training focused first on the use of fishing gear and the preparation of fish for sale,⁸ and second on business management and resource-related knowledge. This strategy is well illustrated by Vanuatu’s implementation of a Village Fisheries Development Project (VFDP) in 1983 which sought to train 25 fishing enterprises⁹ with support from European or Canadian marine fishers working

7. Most fishing boats are less than 10 m long and are equipped with three to four lines mounted on wooden reels which can be used both to troll for large pelagic fish and for vertical line fishing of deep sea species. French Polynesia escaped this schema with the development of “Poti Marara”, very rapid vessels initially meant for harpoon fishing of large pelagic fish (Blanchet et al. 1987).

8. All countries in the region chose cold storage, setting up ice block or ice chip production units in the islands to supply ice to fishing companies so that they could keep fish in chests of sea water chilled to 4/5° from the moment of their capture to their commercialization (Preston and Vincent 1986).

9. Each enterprise was made up of five to six fishers and sometimes a manager. In 1984, the price of a “Alia” type catamaran, 8.6 m in length, delivered with a 25hp engine, a spare 5hp engine and fishing gear was US\$9,000; the price of a monohull boat 5 m in length with the same engines and gears was US\$5,400. Fifty-one percent of the cost was covered by a European grant, 47% was loaned by the Development Bank of Vanuatu at a rate of 4%, leaving only 7% to be covered by the fishers (Cillaurren and David 1995).

with the fisheries extension service of the Vanuatu fisheries department. By fishing intensively, these fishers were expected to defray their production costs and generate substantial cash income through the sale of their catch. Their professional success was also expected to inspire subsistence fishers to take up commercial fishing. This was a classic scheme for the diffusion of innovation in which a massive injection of capital and sustained technical assistance are required to take a population which was not, or only slightly, integrated into a market economy and transform the members into production professionals whose success would ensure a growing number of participants.

The scheme initially far surpassed the hopes of its designers. As the deep sea fish had not been previously exploited, the first catches proved to be “miraculous”, with some of the red snappers (*Etelis coruscans*) measuring over 1.5 metres in length. Press coverage led new village groups to apply to be equipped with a boat and fishing gear. Electoral clientelism enabled a large number to receive positive responses. However, the number of fishery extension service agents in charge of providing technical assistance remained unchanged. The agents consequently became overloaded with enterprises to support and the quality of their technical assistance rapidly deteriorated. In the end, the know-how acquired by the new artisanal fishers proved insufficient to achieve the results required to reimburse the loans granted for the purchase of the fishing gear. Three-quarters of the artisanal fishing enterprises ceased operations within the first two years, 53% of them folded during their first year (Cillaurren and David 1995), notably those located too far from the home villages of the fishery extension service agents to benefit from regular technical assistance.

The sensitivity of deep sea species to intensive exploitation due to their slow growth and the low productivity of the deep sea environment are other reasons for the failure of Vanuatu’s artisanal fishery development program. Fishers rapidly were confronted with a drastic reduction in the average size of their catch and in their incomes. Another reason is the low purchasing power of the rural communities living in the vicinity of the fishing enterprises and potential consumers of their production. In the face of insufficient local demand, these companies should have exported their production to urban centres and rural centres with developed cash economies. However, this would have required ice making and chilling facilities and equipment and effective fishery product distribution chains, which were unavailable on most of the islands of Vanuatu (David and Cillaurren 1992).

These market access problems are not specific to Vanuatu; they are encountered in most of the Pacific Island countries and territories. Fishers have adapted themselves to this constraint. They now operate out of urban centres with markets where their production can be sold. This concentration of the fishing effort on limited areas inevitably will lead to the overexploitation of stocks if drastic management measures are not taken (see below). When yields drop, fishers with the necessary capital respond in two ways. They buy longer-range boats in order to move their fishing effort to areas which have not been or are scarcely exploited. They also replace their

vertical lines with much more productive bottom longlines, raising the risk that this intensification of the fishing effort will lead to a geographic extension of the over-exploitation of deep sea fish stocks. The sustainability of this type of fishery thus depends on good management (see below).

Trolling for pelagic fish around FADs requires less know-how than deepwater fishing. Moreover, large pelagic resources (tuna, dolphinfish, etc.) are much less abundant than the demersal stocks and much less vulnerable to any intensive exploitation. When the aggregating raft is productive, any fisher operating nearby is certain to obtain numerous catches.¹⁰ This form of fishing logically is more profitable than demersal fishing, but two constraints and mistakes could dramatically affect this profitability. The first is to locate FADs too far away from boat launch sites for the fishing to be profitable given the vessels used (Cillauren 1988, 1990, 1999). The vulnerability of FADs to hydroclimatic hazards is the second. The most promising sites, such as passageways between two islands used by tuna, often are exposed to high wind and currents, leading to the FADs positioned there to be short-lived.

From 1990 to 2015, artisanal fishery around FADs underwent two important changes. First, there was increasing competition between artisanal fishery and industrial fishery over young yellow tuna and skipjacks, which aggregate around FADs but also can be exploited by canners and seiners hundreds of kilometres away due to the great mobility of tuna.¹¹ Second, a negative image of FADs was propagated by international NGOs, which blamed them for encouraging the overfishing of tuna and the incidental capture of turtles and dolphins by purse seine fishery.¹² Meanwhile, the (high) cost of installing and maintaining an anchored FAD in relation to the life expectancy (often low) and financial resources of Pacific Small Islands Developing States (Pacific SIDS) remained unchanged. All of the FADs set up between 1985 and 1995 in the Pacific SIDS were funded by international donors, notably Europe and Japan through the Japan International Cooperation Agency (JICA). When donors did not renew their financial support to set up new ones, at the end of several years Pacific Island artisanal fishers were left without FADs to aggregate the pelagic resources and only a memory

10. The presence of a large number of sea birds flying over a FAD attests to the effectiveness of the device in attracting pelagic species, notably tuna.

11. Tuna in the Pacific migrate over long distances, as has been shown since 1977 through successive tuna tagging programs organized by SPC at a regional level (see <http://www.spc.int/tagging/en>, Accessed on November 23, 2015).

12. The two following sites are indicative of the “anti-FAD” movement. What are involved here are drifting FADs used for industrial fishing which are very different from the anchored FADs used for artisanal fishing, but which are often considered to be similar by the general public: <http://www.seableue.fr/limpact-des-dcp-aborde-lors-de-la-commission-des-peches-du-pacifique-ouest-et-central-du-2-au-9-decembre/> (Accessed on November 23, 2015), <http://www.greenpeace.org/france/fr/campagnes/oceans/arrethon/?petition&codespec=N15AW&gclid=CNWN66vO5MQCF5r3wgodKjcAoA> (Accessed on November 23, 2015).

of “miraculous” fishing. Recurring requests to fund the deployment of new FADs are made, but donors have little inclination to fund equipment likely to disappear within a few months, or even weeks, even though the FADs built in 2015 are much more solid than those anchored 20 years ago. Nevertheless, a few FADs remain in the region. The last ones deployed were in Kosrae in the Federated States of Micronesia (3), the Cook Islands (3), American Samoa (2) and Vanuatu (4) (Sokimi 2012). A new type of FAD, known as a nearshore FAD because it is anchored at depths of 500 to 300 metres or less, are tending to replace FADs located far offshore, anchored at depths of over 1,000 metres. Although they are less productive, nearshore FADs have the advantages of being much less expensive — US\$2,000 in 2011 (Tacquet 2011), compared to US\$3,000 for an offshore FAD in 1983 (Cillaurren 1988, 1990) — and of not being visited by industrial fishers.

Today, in 2015, artisanal fishers remain multiskilled. They fish around FADs when these are deployed; otherwise, they target deep sea demersal species. The experience of the past 25 years shows that the sustainability of a production subsystem is not only governed by the abundance of the fishery resource. To be able to continue their activity, fishers must above all have access to a nearby market where they can sell their production and earn a sufficient income. A sustainable market outlet is thus the first condition to be able to sustainably produce. The second condition is to have a sustainable access to the fisheries resources required for this production. When fishers have the necessary capital, they purchase vessels that allow them to explore areas beyond the field of action of most boats operating out of urban centres. The largest (15 to 25 metres) then can set down bottom longlines to target export markets. This very productive gear must be deployed carefully so as not to overexploit deep sea fish stocks. This risk also is high around urban centres where most artisanal fishers are concentrated. All exploitation of deep sea demersal fish must therefore be accompanied by rigorous resource management to be sustainable.

Resource management

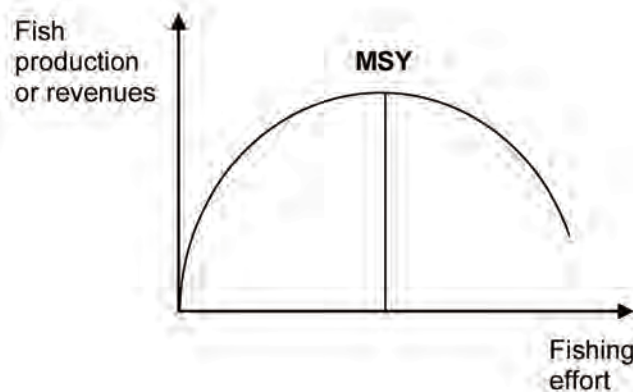
Fish management is characterized by two features, resource dynamics and fishing activities, which are responsible for the fishing mortality of this resource. Managing fishing involves determining an acceptable level of fishing mortality (Brêthes 2000) and controlling the fishing effort. The growth of this management is closely related to the development of a scientific approach to fisheries based on the application of predictive mathematical models.

Global models, the most famous of which being that of Milner B. Schaeffer (1954), rely on data regarding catches and effort; analytic models (Gulland 1983) use demographic indicators drawn from catch lengths and weight measurements. Focused on the “predator-prey” relationship, this approach introduced the concept of overexploitation of stock and made resource conservation the main objective of

fishery management, which relies on the dynamics of the populations exploited (Laurec and Le Guen 1981).

Between the 1950s and the 1980s, these quantitative models became increasingly complex. Applied to multispecies stocks, they integrated biological parameters (recruitment, growth, mortality) of each species in an attempt to provide an estimation of the sustainable exploitation rate based on the optimal capture of each species. However, this type of modelling requires relevant and reliable data sets which are extremely difficult to collect regularly in the Pacific Islands. The fisheries scientists working with Pacific Island fishing departments therefore opted for a pragmatic solution: to consider all of the target species in the same resource space as belonging to the same stock unit, to which is applied a Schaeffer type of global model in order to estimate a maximal sustainable yield (MSY). A critical parameter in the management of a fish stock, MSY is the maximum quantity of fish that can be captured each year without altering stock renewal capacities, a term fisheries scientists use to refer to the exploitable marine population. MSY is represented graphically (fig. 2), with the peak of the parabola indicating the relationship between the fishing effort (along the x-axis) and the fish production (along the y-axis).

Figure 2: The Schaeffer model



When national fisheries departments are staffed correctly (Govan 2015), the management of deep sea commercial fishing relies on the regular collection and computer processing of statistics on fishing effort and the weight and size of captures (Moffit 1993; Polovina and Ralston 1987) in order to assess the MSY at the national level, and more rarely, region by region. With MSY and average boat yield, fisheries departments can manage the resource through the simple management of the inputs and outputs of the fishing fleet. When fishing pressure is well under the MSY,

financial and technical assistance is given to fishers to increase the number of boats and the fishing effort. When the opposite is true, fishers are invited to apply their effort to other resources, notably pelagic fish aggregated by FADs. Ultimately, although based on scientific knowledge of the resource and the use of mathematical models, these management measures are too generalized to manage demersal fishing across a vast archipelago. Optimal management requires MSY to be assessed island by island (Cillaurren et al. 2001). However, few fisheries departments are able to collect the yearly data on catches and effort needed for this assessment, particularly when boats are leaving from scattered villages (Cillaurren and David 2000).

In this context, one might reasonably wonder whether the scientific effort applied is not disproportionate to the outputs expected. This was the opinion expressed by T. Adams in 2002 while director of the SPC marine resources department: *“there is no point in trying to set up western style management models that only can function if they have an immense volume of scientific data and can only be applied to western style commercial fisheries.”* Noting *“the enormous gap between the cost of data collection programs conducted in most developing countries and the more modest means which would suffice to take effective decisions, both in terms of surveillance and management,”* he advocates for a minimal data management mode, emphasizing that, *“we are in desperate need of solutions that are invulnerable to possible system failures, solutions that will allow us to deal with the consequences of inexact stock assessments due to a lack of fundamental environmental data or an overly optimistic distribution of the fishing effort”* (Johannes et al. 2002).

A simple solution consists of using average catch size as the principal indicator of the status of a stock. The method, which was applied in Vanuatu during the 1990s, consists of providing each fishing enterprise with a board to measure fish that indicates the minimum size of each targeted species. Once catches fall under this minimum size, an agreement is reached with fishers to move the fishing effort to other fishing zones to allow time for the stock to reconstitute itself, or at least to allow juveniles to become adults and reproduce at least once. This method involves co-management by fishers and the fisheries departments. The cost is low: all that is required are boards to measure the fish and some visits by agents from the fisheries departments to fishing villages. It therefore should be able to be implemented in most Pacific Island countries and territories.

Subsistence fisheries

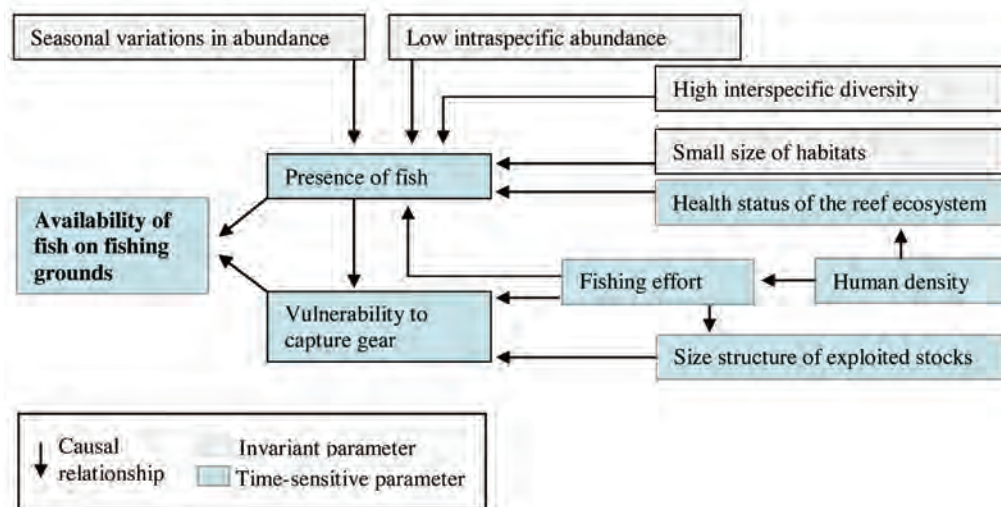
The production system

Availability of fish on the fishing grounds

Subsistence fisheries are always shallow water fisheries. The main characteristic of shallow waters is the extreme diversity of the fish living in them. It is common to find over one hundred fish species on a single hectare of reef. During an inventory

of Vanuatu's marine resources carried out by the Australian Institute of Marine Science in 1988, a total of 469 species of fish were visually identified (Williams 1990). Coral reefs form the ecosystem with the highest diversity of fauna but the coral biotope is very restrictive for the populations living in it. The habitat favourable to each species is quite small: one refers to microbiotopes, generally scattered from each other. The ensemble of these microbiotopes form in the space a kind of three-dimensional mosaic where each element harbours a micropopulation composed of a small number of fish of the same species. This low intraspecific diversity is accompanied by strong specialisation, as much from the perspective of diet as habitat (Kulbicki 1992). Due to their small size, these micropopulations are sensitive to all intensive exploitation on the part of fishers and their abundance per hectare is low. These two factors, combined with the rich species diversity of the fish biomass, constitutes the primary constraints on the fishing activity; added to them are seasonal variations in fish abundance, which are particularly sharp in the case of small pelagic fish (Conand 1987). These constraints are prohibitive for fishers; they cannot circumvent them and have no other choice than to integrate them into their capture strategies and techniques. One is faced here with the invariants inherent in the structure of coral habitats and in the ecology of fish that heavily impact the availability of fish on the capture sites (fig. 3).

Figure 3: The availability of fish on subsistence fishing grounds, a process associating invariance and temporality



The availability of fish on fishing grounds is also sensitive to two parameters which evolve over time. These are the health of marine ecosystems and the density

of human populations on the coast. For the past thirty years, the health of mangroves, seagrass beds and coral reefs has deteriorated in peri-urban areas, around mines, and close to intensive agriculture (Chin et al. 2011; Salvat 1987). Chemical and organic pollution as well as heavy siltation of the water are the main factors behind this negative development. It has led to a heavy reduction in the biodiversity and number of species targeted by fishing as the number of fish species capable of thriving in these degraded areas has been reduced. As a general rule, high human population densities contribute to this degradation, to which can be added the mechanical destruction of coral as it is trampled under fishers' feet, and the cutting of wood in the mangroves for domestic (notably firewood) and professional activities.

The past thirty years have been marked by a growing integration of the Pacific Island countries and territories with a globalized world. This has been translated into a division within the national space between densely populated areas linked to the global system and outlying areas where the population is tending to turn in on itself due to a lack of commercial outlets (David 2003; Ward 1993). For the latter, if fishing pressure remains moderate and the habitats in good health, the abundance and availability of fish on the fishing grounds should remain high with the exception of sea cucumbers and mother-of-pearl shellfish, which already are and will continue to be the focus of important fishing pressure. These resources effectively can be sold at high prices on international markets and can be conserved for several weeks (sea cucumbers in dried form, trochus and green turban snails as empty shells) while awaiting buyers. Sparsely populated areas can thus suffer from severe overexploitation of these resources due to the level of demand on international markets. The same situation holds for densely populated areas, although the reasons are different. There, demand is strictly local and is part of the home-consumption of fish production by families with low cash resources. The sea is thus called upon to cover families' nutritional needs. It therefore is possible to establish a relationship between population density and fishing effort. In the short and medium term, Pacific Island towns will be called on to grow and densify, and the fishing effort around them will therefore increase and the availability of fish will continue to decrease, a dynamic which involves predator-prey relations.

The predator-prey relation

This relationship depends first on the availability of the fisheries resource on the fishing grounds and the presence of fishers.¹³ This refers back to social and economic considerations such as access rights to the fishing grounds, belonging to a fishing clan (Leblic 1989), and family or village demand for seafood products. It also is dependent on climate-related constraints: sea state and weather, in particular wind

13. One considers that a fisher collects from a stock, the effects of which are determined by the fishing effort used and its productivity, comparable to the production of a fisher in one unit of time. This productivity depends on both the abundance of the resource and the effectiveness of the gear used, meaning the relationship between the number of animals present on the fishing grounds and the captures.

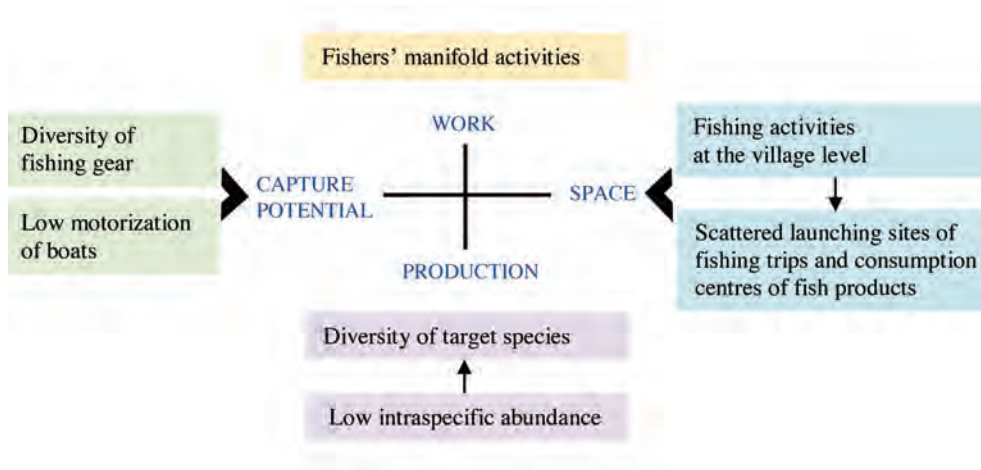
speeds and rainfall. These constraints determine the work conditions on the fishing grounds and affect the decision of fishers to go fishing or not. In this regard, the question is posed differently depending on whether fishing is conducted by boat, on foot, or diving. Most boat fishing trips are made in dugout canoes, which generally are small. Their poor nautical performance¹⁴ does not permit fishing trips on high seas and restricts them to areas sheltered from the wind as soon as there are heavy seas. Widespread before the colonial period (Haddon and Hornell 1975), sailing canoes are now rare. Motorized canoes also are rare, although motorization is spreading; the latter remains largely reserved for commercial fishing, for which fishers favour boats over canoes.

In general, the further fishers move away from shore, and the smaller their vessel, the greater is their vulnerability to the sea state. This is minimal in intertidal zones and in shallow waters such as river mouths, frequently protected by sand and pebble shoals, and the long stretches of beach generally located at the end of bays. As for mangroves and seagrass beds, they only grow on fine sediments whose deposits are found solely in areas sheltered from the swells and waves of the sea created by the prevailing winds. The rain and cold rather than the sea state and wind speed thus determine when fishing grounds are frequented. In general, Pacific Island fishers know how to adapt themselves to downturns in the weather by changing their fishing grounds. When rough sea conditions forbid canoe expeditions, it always is possible to take refuge in river mouths, sheltered bays, or mangroves, and to redeploy the fishing effort on one or several target species according to the abundance of the resource and its species diversity.

A diversity in the means of production is the logical consequence of this diversity of the targeted species and of the biotopes exploited by subsistence fishers (fig. 4). The most common gear are hand lines because they can be used for multiple purposes. They are used for trolling and as vertical drop lines when fishing from canoes or on foot on the reef crest. The other are release gear (spears, bows and arrows, darts, cast-nets, underwater guns) and passive gear (fish traps, gillnets, fish fences). This gear is generally owned by the fisher. Although the materials used to make them are increasingly manufactured industrially, their design and use remain largely traditional. As a rule, this gear is not very cumbersome. It can be easily carried by the fisher and is inexpensive. Fish fences are the one exception; these are fixed fisheries largely used on inner reef slopes and Polynesian lagoon passes (Blanchet et al. 1985). In addition to the materials which are incontestably fishing gear given that the capture of aquatic animals is their main function, there are also multipurpose tools which are applied to fishing as well as other uses. The main one is the machete, at least one of which is owned by all rural households. Iron rods are also commonly used to capture octopus at low tide on the flats and to hunt for shellfish.

14. In the early 1980s in Vanuatu, most expeditions were made in outrigger canoes paddled with oars that were no longer than five metres (Cillaurren et al. 2001).

Figure 4: Main features of subsistence fisheries production system



A study (unpublished) that I conducted at the end of 1984 in collaboration with the National Planning and Statistics Office of Vanuatu demonstrated the extreme diversity of coastal fishing activities in the context of subsistence fisheries. A total of 943 fishing trips were analyzed over the entire archipelago. They resulted in the capture of over 100 species of fish belonging to 32 families. Ten types of gear were identified. Seven were used either alone or in association with one or several other types of gear; three always were used with other gear. In total, 39 types of gear or combinations of gear were identified (22 combinations of two types of gear, 9 combinations of 3 types of gear, one combination of 4 types of gear and 7 uses of a single type of gear), which correspond to 82 different modes of use.¹⁵ For the same type of gear, there can be several capture techniques¹⁶ which vary depending on whether the fisherman uses a boat or not and on the type of biotope exploited. On this basis, these 39 types of gear and combinations of gear generated 97 capture techniques.

This diversity of fishing activity is not specific to Vanuatu but corresponds well to the ecological, physical, and economic constraints shaping the subsistence fisher (predator) – fish (prey) relationship in Pacific Island countries and territories. With the growth of a cash economy, there has been a gradual transformation of fishing material, with homemade gear such as bows and spears being replaced by much more high-yielding gear, notably gillnets and cast-nets.

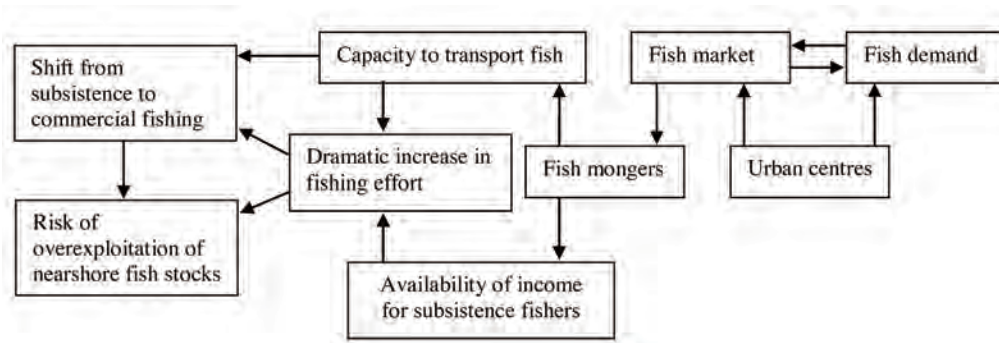
15. $(7 \times 1) + (22 \times 2) + (9 \times 3) + (1 \times 4) = 82$ modes of use of capture gear.

16. The capture technique is defined as the conjuncture of a mode of use of fishing gear (alone or in combination), a motion vector (on foot, diving, boat) and a biotope exploited.

In contrast, the framework in which fishing is practiced has not changed. The village continues to occupy a central place both as the fisher's habitat, the launching site of fishing trips, and the main consumption centre of fish products. Fishing grounds border villages and in numerous regions they form a veritable fishing territory with access reserved to the villagers (Carrier 1981; Dahl 1988). Fishers generally maintain multiple activities (fig. 4) and agriculture often remains the main source of income, with the majority of fishing trips undertaken within a framework of subsistence fishing. Home consumption at the village level remains the main use of fish products; only surpluses are marketed. Commercial fishing, characterized by the desire of the fisherman to sell, only concerns a minority of fishers in rural areas except when there is a need of cash for exceptional expenses (taxes, school fees, festivities) leading numerous fishers to sell their production to balance their budgets. The limited development of commercial fishing is due to the weakness of distribution channels (on many high islands, inland consumption of seafood is impossible) and the poverty of potential consumers. The situation is completely different around urban centres, which provide regular commercial outlets for fishers, particularly when wholesalers assume the task of transporting the fish from the fishers' villages to the sales points.

The presence of a profitable market is a powerful vehicle for the development of the commercial fishing of reef species. Subsistence fishers can then become genuine commercial fishers, even if their fishing gear and target species remain unchanged. As emphasized by Tom D. Brewer (2011) in the case of the Solomon Islands, this shift from subsistence fishing to marked-based fishing can deeply affect the reef fish stocks. The overfished areas in mangroves, meadows, and coral reefs then widen depending on how often fish mongers pass, a parameter determined by consumer demand and the distance to the market (fig. 5).

Figure 5: The possible effects of urbanization on nearshore fish abundance



The introduction of trade in fisheries products in villages dominated by subsistence fishing is not a new phenomenon. Mother-of-pearl shellfish and sea cucumbers have been commercially exploited in Oceania since the first half of the 19th century (Doumenge 1966). Like whales, they contributed to the insertion of this region into the global economy, to such a degree that the vehicular languages spoken in Vanuatu, the Solomon Islands and Papua New Guinea (Bislama, Pijin, Tok Pisin) were developed to facilitate their trade. This exploitation is practiced within a mining economy framework,¹⁷ with beach-combers, often sailors who have deserted, working for a merchant adventurer whose vessel sweeps an area until its holds are full, combing one zone before moving to another (Shineberg 1967). In the past, trade was too infrequent for subsistence fishers to become commercial fishers, as some of their descendants have become in the 21st century with the development of local markets (fig. 5). Trade only allowed them to derive value from products that were little used or not used at all. Sea cucumbers thus were not fished probably because they were deemed inedible. Mother-of-pearl shellfish were consumed for their flesh and their shells were used to make jewellery and hooks (Conte 2010). These were replaced with metal hooks purchased from the beach-combers to whom the sea cucumbers and mother-of-pearl shells were sold.

This mining economy model has changed little over time. To satisfy increasing international demand, notably due to the concurrent increase in the consumer population and their purchasing power in China (Conand 1986), buyers working for large global import companies (often Chinese) travel through the coastal inter-tropical zone organizing the collection of sea cucumbers at the national scale (Kinch et al. 2008). They venture to the most remote Pacific Islands, offering local communities considerable amounts of money in relation to their purchasing power to collect the maximum amount of trochus and sea cucumbers. How can traditional leaders resist this windfall when governments are cutting back their financial commitments, including for the maintenance of health, education and transportation infrastructure? The overexploitation of part of their fish stock has a minimal cost compared to the expected benefits: the renovation of a school or dispensary, or improving a road network which contributes to increasing the viability of their territory.

This type of predator-prey relationship, which involves a chain of decisions reaching up to the global level to plan local and national collections, is part of a mining economy that has no equivalent in coastal fisheries. At the world scale, at any given moment five to ten countries are full-time producers of sea cucumbers, but they

17. When applied to renewable resources, the expression, "mining economy" means a form of exploitation that is unconcerned with the renewal of the resource. Exploitation continues as long as profits are generated, with no concern for the overexploitation of the resource. Once the resource is exhausted, the exploitation moves to another resource which has not yet been exploited.

occupy this role for only a short period — two to three years — before ceding their place to other countries, their stocks having been seriously depleted. A “fallow” period then follows, with several years needed before stocks are reconstituted and these countries can resume their role as leading sea cucumber producers (Carlton et al. 2013). For example, from 1984 to 1988, sea cucumber exports from Fiji went from 50 tons to over 700 tons, only to fall back to less than 300 tons in 1990 (Bettencourt 1995). In 2003, sea cucumbers once again represented a significant part of seafood exports (11% of their value), yet four years later, they were no longer listed among the country’s exports (Gillett 2009). This succession of highs and lows also is illustrated by the case of the Solomon Islands, where sea cucumber exports, after stagnating between 100 and 150 tons between 1986 and 1990, exceeded 600 tons in 1991 to culminate at 715 tons in 1992, only to then collapse due to the overexploitation of stocks. In 2005, sea cucumber exports were again at high levels. They generated a value of US\$766,000 only to dive down to US\$33,000 the following year (Bettencourt 1995; Gillett 2009).

Traditional regulation of fishing activities

Due to the limited size of fishing grounds in some localities, “traditional” solutions for regulating fishing pressure are practiced by some groups (clan or tribe) which consist of controlling access to the resource through temporary fishing bans covering part or all of a fishing grounds (Carrier 1981; Foale et al. 2011; Johannes 1978, 1994; Ruddle and Akimichi 1984; Ruddle and Johannes 1989; South et al. 1994). The objective is to be able to harvest at specific times the resource needed for feasts and customary exchanges or for the survival of the group after a natural catastrophe has destroyed the agricultural resources on which their daily diet depends. These bans are directed at all members of the village community with a fishing ground and to non-resident populations, or sometimes only to the latter, and cover either all of the exploitable species, or only the species most threatened. Their effectiveness depends on two factors. The first is the growth rate of the species present in the protected area, the “record” belonging to the octopus, which can reconstitute its population in six months. The second is the “sink” situation of the fishing ground in relation to the currents carrying the flow of eggs or larvae of fish, molluscs, and shellfish emitted by the reefs called the “sources”, which can be located several dozen, or even several hundred, kilometres away. In this way, habitats which have been in part depopulated by overfishing can be gradually recolonized.

This regeneration potential of fish stock held by reef environments is a considerable advantage which compensates for their high sensitivity to all intensive exploitation. All of the species present do not have the same potential to recolonize an environment. Those whose larvae live on open water are at a clear advantage compared to species which spend most of their larval stage fixed to the sea bottom. Moving with the

currents, the former can cover great distances; in contrast, the latter have a very limited distribution area and only recolonize the environment around where they were laid. To respond to the introduction over the past thirty years of spear guns and gillnets, which are more efficient than “traditional” capture gear, temporary fishing bans have been accompanied by a ban on the use of this gear on the fisheries resources. On the atolls of Tonga, Tuvalu, and southern Kiribati, it has been observed that commercial fishery can be banned and only home-consumption fishery allowed when there is heavy fishing pressure on the environment (Bataille-Benguigui 1994; Zann 1990).¹⁸

Lastly, these temporary fishing bans are a means to manage the village maritime territory of a coastal community and have a dual objective, both social — involving the affirmation that a fishing ground belongs to the community — and economic. The economic objective can be broken down into three subobjectives which can only all be fulfilled if the abundance of the reef fisheries resource is preserved or restored:

- the first is to consolidate the sustainability of subsistence fishing as a steady source of animal protein. This situation corresponds to coastal areas unsuitable for agriculture because fishing generally comes second after agriculture and is only practiced regularly when land is not sufficiently productive. With the increase of human population densities on some islands, this daily food function of fishing grounds is today becoming more commonplace, including on the large Melanesian islands where it was still marginal just thirty years ago.
- the second objective involves the reinforcement of the reef’s food pantry function in difficult situations, notably after a cyclone has destroyed a large part of the gardens producing daily food items.
- the third objective aims to provide fish production sufficient to cover traditional and religious events which work to reinforce intra and inter-community social cohesion. This was the situation found by Edvard Hviding (1990) in the Marovo lagoon in New-Georgia (Solomon Islands).

These traditional forms of management have been given a fresh boost over the past twenty years with the establishment of locally managed marine areas (LMMAs) (Govan 2009; Ruddle 1998). Using “ancestral” fishing ground management rules to develop a fisheries resource management mode at both the village and national scale is an innovative idea compared to so-called modern fisheries management based on

¹⁸. We have only scanty knowledge of the current situation on these atolls.

the dynamics of the exploited resource. As emphasized by Philippa Cohen and Simon Foale (2011:5): “*Area closures are a useful tool for a holistic approach to management suited to multi-species fisheries; managing at the ecosystem level rather than species level.*”

The focus is no longer on managing a resource, but rather the space where the resource lives. The management rules no longer rely on mathematical models but rather on collective decisions regarding the opening or closing of a fisheries resource space which are taken at the village level. In this way, fishers are transformed into managers of the resources that they exploit. In so doing, one avoids the jump in scales between the national level, where fisheries management decisions are taken by public authorities intending to exploit these resources for the good of the national community according to rules they have defined, and the local level, where fishing is practiced daily and where these management rules are generally applied poorly due to a desire to maintain full use of the fisheries resources on the territory. When the decision to set aside fishing grounds is taken in concertation or in agreement with national authorities, it is possible to speak of *co-management*, *collaborative management* or *community-based management* (Barrow et al. 2000; Nurse and Kabamba 2000; Sen and Nielsen 1996).

All the same, the Pacific today is not that of yesterday. Closed, self-sufficient systems have opened, and cash is circulating in even the most remote areas. Given these changes, it is logical to question whether traditional management modes will function correctly in the future just because they worked well in the past, especially if the species are targeted by commercial fishing and can attain a good price on international markets, such as sea cucumbers and mother-of-pearl shellfish. Higher global demand puts greater pressure on national stocks, raising the risk that they will not be able to reconstitute themselves. If sea cucumbers were managed in a “balanced” fashion within a village framework, such a development would be impossible. This is the reason that co-management efforts currently are being made between the fisheries departments and local communities in New Caledonia and Vanuatu (Léopold et al. 2013a) which are taking into account lessons learned from the LMMAs set up in the early 1990s to manage trochus stocks in Vanuatu.

The Port-Vila fisheries department was behind the first LMMAs in Vanuatu. These were set up to secure the development of juvenile trochus produced at the hatchery run by the Port-Vila fisheries department and released into the natural environment to attain the size of adults and become marketable. To keep down poaching and the collection of immature shellfish, agreements were reached between the fisheries department and village communities so that the shellfish would be not be collected during the months needed for their growth. It quickly became apparent that these initial LMMAs did not last long (David 1994), mainly because local political authorities were not strong enough to enforce a fishing ban on a resource which fetched very high prices on the international market (David 2006).

Nonetheless, interest in LMMAs grew in Vanuatu and throughout the Pacific Islands (Bartlett et al. 2009; Veitayaki et al. 2003). In 2009, Hugh Govan reported that 595 LMMAs had been established in the Pacific Islands, covering a total area of 1,107 km². This development is due to two phenomena acting in synergy. The first was international enthusiasm for MPAs, of which LMMAs represent one category. The precautionary approach to fisheries management and the ecosystem approach to fisheries¹⁹ (FAO 1995; Garcia 1996) present these MPAs as effective fisheries management tools because they allow the complexity of marine ecosystems to be preserved and the gradual repopulation of zones damaged by fishing pressure (Pauly 1997). The second phenomenon stemmed from the distrust of large international NGOs and members of certain UN agencies regarding the capacity of governments to ensure “good governance”. To promote sustainable development, they sought to bypass central authorities, which were deemed inefficient and often corrupt, and act directly at the local community level. Managed locally by users and beneficiaries, LMMAs were immediately met with enthusiasm by international conservation NGOs. Nevertheless, LMMAs remain fragile entities. Their longevity in Vanuatu during the 2000s was due in large part to the technical and financial support of NGOs. However, once the latter was withdrawn, the support of the coastal population dimmed in the face of conflicts and disputes between stakeholders (Léopold et al. 2013b). These problems should not *a priori* condemn the LMMA concept, but LMMAs should no longer be considered as a panacea for the management of nearshore resources. The creation of LMMAs also should be reserved to communities with sufficient power to effectively impose and enforce the rules of access to fishing grounds which are inherent to all MPAs (David 2006).

However, even when this political power exists, the effectiveness of LMMAs as a fisheries resource management tool depends on the logics within communities and the rationales of their political leaders, as illustrated by the example of “*Sasi lola*” on Kei Besar island in the Maluku Islands (an archipelago in the eastern part of Indonesia). To preserve trochus resources, traditional bans were renewed at the start of the 1980s. Fishing for them is now open only two to three days a year and is marked by a ceremony: the lifting of *Sasi*, or “the taboo”. However, as shown in the thesis by Isabelle Antunès (2000), the conservation of the resource is not the objective of this LMMA. It is instead a means to ensure the viability of the territory and village community by “maximizing” the cash income earned from trochus exploitation because the village has few other marketable resources. As long as the

19. These approaches emerged from the major crisis which upset fisheries science following the collapse of Canadian cod fisheries. The mathematical models of exploited populations' dynamics on which modern fisheries management was based were revealed incapable of predicting the sustained collapse of stocks and the dynamics of exploited populations lost its “magical science” status, to quote Didier Gascuel (1995).

conservation of the fisheries resource furthers territorial viability, fishing is managed correctly. However, overfishing fish stocks which are highly sought after on international markets may also be considered rational when the income generated helps to strengthen the overall viability of the territory.

Conclusion

Given the importance of village fisheries for the food security of Pacific Island coastal populations, ensuring their sustainability should be a priority of government and village authorities across the ensemble of the Pacific Island countries and territories. The experience of the 1980s and 1990s has shown that national fisheries departments did not have the human and financial resources necessary to directly manage village fisheries. The landing sites are too dispersed to be regularly visited by fisheries officers. A bridge must be established between the national level, where fisheries management is planned and developed by national fisheries departments, and the local level, where fisheries resources are exploited. However, the challenge is considerable. In effect, it is not just a bridge between two geographic levels that is needed, but also a bridge between the reasoning of the actors operating on each of these levels. Villagers aspire to retain the full use of the natural resources in the waters of their village territory while public authorities (the fisheries departments) intend to exploit these resources for the good of the nation in accordance with the rules they have defined.

MPAs are not exempt from these constraints. While reef MPAs are widespread in the Pacific region, they are not all effective. Four main reasons for this lack of effectiveness may be noted:

- a poor location in relation to marine currents transporting the larvae of the species populating the reefs. A lack of recognition of connectivity is widespread in the region. The situation should improve in the future for the “classic” MPAs set up by public authorities in the Pacific Island countries and territories. In effect, to reduce MPAs’ vulnerability to climate change, the conservation of coral reefs must now be planned within the framework of an MPA network. In this context, connectivity becomes a key parameter (David et al. 2015). In contrast, LMMA follow purely local rationales; they respond exclusively to the needs of a village community and under this framework, connectivity is completely ignored;
- high vulnerability to polluting flows and runoff from watersheds that can severely degrade coral habitats; reducing this vulnerability involves setting up integrated watershed/downstream coastal management. This vulnerability only concerns the “classic” MPAs located along the coast of high islands. It results from an absence of integrated territory management, with the people managing watershed resources failing to take into account the negative impacts generated by their

activities on the marine ecosystem, notably reefs. In contrast, LMMAs are not concerned because in principle the marine territory on which area closures are set up is an integral part of the village territory;

- high coastal population densities and severe income poverty ruling out the possibility of purchasing protein-rich food that could take the place of fresh fish products. This constraint is shared by classic MPAs and LMMAs. It is even stronger since fish mongers pass regularly in villages neighbouring MPAs to supply market demand for fresh fish products. The only solution is to develop other income generating activities besides fishing which are compatible with the objectives set for the MPAs;
- MPA managers and rangers, or political authorities in the case of LMMAs, are too weak to enforce fishing bans when all of the members of the village community do not share the logic that led to the imposition of the bans. This constraint raises the issue of the social acceptance of MPAs and the means to reinforce this acceptance.

In the case of LMMAs, establishing a bridge between village communities and national authorities takes place through co-management agreements. These should be understood by the national authorities as a form of recognition that the planning of fisheries management, and the setting up of MPAs and their management, are necessary, but village communities play a major role in marine conservation and management and are needed to ensure the success of these actions. On the side of village communities and NGOs, which often support these communities in setting up LMMAs, these agreements should be understood as a form of recognition that marine conservation and management, including fisheries management, cannot be done exclusively at a local level, and that planning at a national, indeed international level, is necessary. They therefore need to recognize the role played by public authorities as an interface with international organizations such as the SPC and as the designers of national marine conservation and management policy.

It is within this framework that LMMAs need to be organized into a network. Studies also need to be made on the coherence of this network with regard to the connectivity of reefs to maximize the reserve effect on the marine environment and to minimize the negative effects of the inadequacy of the area (about 2 km² each) protected under LMMAs to engender a significant spillover effect on surrounding fish stocks. Temporary fishing reserves set up for several weeks on spawning grounds during egg-laying periods also are a measure which could be taken at the local level to avoid the capture of spawners and consequently encourage the future recovery of fish populations.

It is also within this framework that deepwater MPAs, nearshore FADs and artificial reefs must be set up. Given the vulnerability of deep sea demersal species to

fishing which is intensive or prolonged over time, such deepwater MPAs should be established to secure the future of these fisheries. As for nearshore FADs and artificial reefs, these are much less expensive than deeply moored FADs, which seem to have a limited future given their high purchase and maintenance costs. Their deployment in sedimentary zones should increase the fish biomass and reinforce the sustainability of nearshore fisheries.

Lastly, this brief panorama of the recent history of Pacific Island village fisheries shows that the sustainability of this fishery cannot be achieved if the focus is limited to a geographic dimension — the national level or the local level — or a sectoral view of the fishing system. Regardless of the geographic dimension (local or national) in which one positions oneself, one cannot address the production subsystem if one does not have a clear picture of the management subsystem, and one cannot address the management subsystem without a clear understanding of the production subsystem and the fisheries product chain and trade subsystem. The sustainability of Pacific Island village fisheries therefore must be organized at the level of each of the three subsystems forming the village fisheries system (fig. 1) and at each of the geographic dimensions.

References

- Agardy, Tundi, Peter Bridgewater, Michael P. Crosby, Jon Day, Paul K. Dayton, Richard Kenchington, Dan Laffoley, Patrick McConney, Peter A. Murray, John E. Parks, and Lelei Peau
2003 "Dangerous Targets? Unresolved Issues and Ideological Clashes around Marine Protected Areas". *Aquatic Conservation: Marine and Freshwater Ecosystems*, 13(4): 353-367.
- Anthony, Kenneth R.N., Jeffrey A. Maynard, Guillermo Diaz-Pulido, Peter J. Mumby, Paul A. Marshall, Long Cao, and Ove Hoegh-Guldberg
2011 "Ocean Acidification and Warming will Lower Coral Reef Resilience". *Global Change Biology*, 17(5): 1798-1808.
- Antunès, Isabelle
2000 Le développement local de la pêche en Indonésie, entre unité politique et diversité culturelle. Une approche à partir de deux situations contrastées: Bendar à Java et Watlar aux Moluques. PhD Thesis. Paris: Université Paris IV-Sorbonne.
- Barrow, Edmund, Helen Gichohi, Mark Infield
2000 Summary and Key Lessons from a Comparative Review and Analysis of Community Conservation in East Africa. Nairobi: IUCN.
- Bartlett, C.Y., K. Pakoa, and C. Manua
2009 "Marine Reserve Phenomenon in the Pacific Islands". *Marine Policy*, 33(4): 673-678.
- Bataille-Benguigui, Marie-Claire
1994 *Le côté de la mer: Quotidien et imaginaire aux îles Tonga, Polynésie occidentale*. Bordeaux: Centre de recherche des espaces tropicaux de l'Université Michel de Montaigne (Bordeaux III).

- Bell, Johann D., Mecki Kronen, Aliti Vunicea, J. Nash Walsh, Gregory Keeble, Andreas Deemke, Scott Pontifex, and Serge Andréfouët
2009 "Planning the Use of Fish for Food Security in the Pacific". *Marine Policy*, 33(1): 34-76.
- Bell, Johann D., Johanna E. Johnson, Alex S. Ganachaud, Peter C. Gehrke, Alistair J. Hobday, Ove Hoegh-Guldberg, Robert Le Borgne, Patrick Lehodey, Janice M Lough, Tim Pickering, Morgan S. Pratchett, and Michelle Waycott
2011 *Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change: Summary for Pacific Island Countries and Territories*. Noumea: Secretariat of the Pacific Community.
- Bettencourt, Sofia
1995 *Pacific Island Economies: Sustainable Management of Fisheries*. Washington: World Bank.
- Blanchet, Gilles, Laurence Caillaud, and John Paoaafaite
1985 *Un aspect de la pêche artisanale en Polynésie française: 'Les pièges à poissons de Tikehau'*. Papeete: ORSTOM (Notes et Documents d'Océanographie N°25).
- Blanchet, Gilles, Gildas Borel, and John Paoaafaite
1987 *Petite construction navale et pêche artisanale en Polynésie française*. Papeete: ORSTOM (Notes et Documents d'Océanographie N°34).
- Brêthes, J.C.
2000 « Spatialiser la gestion: Mortalité globale et mortalité locale ». In D. Gascuel, P. Chavance, N. Bez and A. Biseau (eds.), *Les espaces de l'halieutique*. Paris: IRD, p. 567-579.
- Brewer, Tom D.
2011 *Coral Reef Fish Value Chains in Solomon Islands: Market Opportunities and Market Effects on Fish Stocks*. ARC Centre of Excellence for Coral Reef Studies Report to Solomon Islands Ministry of Fisheries and Marine Resources and Secretariat of the Pacific Community.
- Carleton, Crick, John Hambrey, Hugh Govan, Paul Medley, and Jeff Kinch
2013 "Effective Management of Sea Cucumber Fisheries and the Beche-de-Mer Trade in Melanesia". *SPC Fisheries Newsletter*, #140 - January/April 2013: 24-42, http://www.spc.int/DigitalLibrary/Doc/FAME/InfoBull/FishNews/140/FishNews140_24_Carleton.pdf (Accessed on November 11, 2015).
- Carrier, James G.
1981 "Ownership of Productive Resources on Ponam Island, Manus Province". *Journal de la Société des Océanistes*, 37(72): 205-217.
- Chaboud, Christian, and André Fontana
1992 « L'approche système dans les pêches ». In J.C. Brêthes J.C., A. Fontana and Y. Breton (eds.), *Recherches interdisciplinaires et gestion des pêcheries*. Halifax: Centre International d'Exploitation des Océans, p. 111-151.
- Charles, Anthony T.
1995 "Fishery Science: The Study of Fisheries Systems". *Aquatic Living Resources*, 8(3): 233-239.
- Cillaurren, Espérance
1988 *La pêche à la traîne autour des dispositifs de concentration de poissons mouillés à Vanuatu*.

- Un exemple dans le Pacifique sud-ouest. Port-Vila: ORSTOM (Notes et Documents d'Océanographie N°17).
- 1990 "Initial Analysis: Economic Viability of Ships Fishing around FADs off the South-West Coast of Efate". In *Twenty-Second Regional Technical Meeting on Fisheries, 1990/08/6-10*. Noumea: SPC, p. 1-8.
- 1991 « La pêche thonière dans le Pacifique: Evolutions et perspectives ». *La Revue Maritime*, 421: 38-62.
- 1994 "Daily Fluctuations in the Presence of Thunnus Albacares and Katsuwonus Pelamis around Fish Aggregating Devices Anchored in Vanuatu (Oceania)". *Bulletin of Marine Sciences*, 55(2-3): 581-591.
- 1999 « La pêche autour des dispositifs de concentration de poissons à Vanuatu ». In G. Blanchet (ed.), *Les petites activités de pêche dans le Pacifique Sud*. Paris: IRD, p. 145-159.
- Cillaurren, Espérance, and Gilbert David
- 1995 « Dynamique de l'exploitation halieutique d'une ressource vierge en économie insulaire peu monétarisée (Vanuatu) ». In F. Laloë, H. Rey and J.L. Durand (eds.), *Questions sur la dynamique de l'exploitation halieutique*, Table ronde ORSTOM/Ifremer, Montpellier, 1993/11/6-8. Paris: ORSTOM, p. 433-487.
- 2000 « Hétérogénéité spatiale du système pêche et structuration d'un système d'information pour gérer la ressource: L'exemple du Vanuatu, archipel océanien ». In D. Gascuel, P. Chavance, N. Bez and A. Biseau (eds.), *Les espaces de l'halieutique*. Paris: IRD, p. 527-548.
- Cillaurren, Espérance, Gilbert David, and René Grandperrin
- 2001 *Atlas des pêcheries côtières de Vanuatu, un bilan décennal pour le développement*. Paris: IRD/Agence Intergouvernementale de la Francophonie/Secrétariat permanent pour le Pacifique.
- Chin, Andrew, Thierry Lison de Mola, Katie Reytar, Serge Planes, Jarin Gerhardt, Eric Clua, Lauretta Burke, and Clive Wilkinson
- 2011 *Status of Coral Reefs of the Pacific and Outlook: 2011*. Publishers Global Coral Reef Monitoring Network.
- Cohen, Philippa, and Simon Foale
- 2011 "Fishing Taboos: Securing Pacific Fisheries for the Future?" *SPC Fisheries Newsletter*, # 28 - November 2011: 3-13, <http://www.spc.int/DigitalLibrary/Doc/FAME/InfoBull/TRAD/28/Trad28.pdf> (Accessed on November 19, 2015).
- Conand, Chantal
- 1986 *Les ressources halieutiques des pays insulaires du Pacifique. Deuxième partie: Les holoturies*. Document technique sur les pêches N°272.2. Rome: FAO.
- Conand, François
- 1987 *Biologie et écologie des poissons pélagiques du lagon de Nouvelle-Calédonie utilisables comme appât thonier*. PhD Thesis. Brest: Université de Bretagne Occidentale.
- Conte, Éric
- 2010 « Perles et nacres aux temps pré-européens ». In M. Le Pennec (ed.), *Huître perlière et perle de Tahiti*. Papeete: Université de la Polynésie - Gouvernement de la Polynésie Française, p. 7-14.

- Dahl, Christopher
1988 "Traditional Marine Tenure: A Basis for Artisanal Fisheries Management". *Marine Policy*, 12(1): 40-48.
- Dalzell, P., and Garry Preston
1992 Deep Reef Slope Fishery Resources of the South Pacific: A Summary and Analysis of the Dropline Fishing Survey Data Generated by the Activities of the SPC Fisheries Programme between 1974 and 1988. Inshore Fisheries Research Project technical document N°2. Noumea: South Pacific Commission.
- David, Gilbert
1991 « La pêche dans les petits territoires insulaires du Pacifique Sud, situation actuelle et perspectives ». *La Revue Maritime*, 410: 21-37.
1994 "Traditional Village Fishing in Fisheries Development Planning in Vanuatu". In J. Morrison, P. Geraghty and L. Crowl (eds.), *Science of Pacific Island Peoples: Ocean and Coastal Studies*. Suva: The University of the South Pacific, p. 11-40.
2006 "Indicators for Village-Scale Trochus Management as Part of Government/Community Co-Management Arrangements". *SPC Trochus Information Bulletin*, 12: 7-11.
2003 « Mondialisation et recompositions territoriales et identitaires en Océanie insulaire ». In D. Guillaud, C. Huetz de Lempis and O. Sevin (eds.), *Îles rêvées: Territoires et identités en crise dans le Pacifique insulaire*. Paris: Presses de l'Université de Paris-Sorbonne, p. 141-177.
- David, Gilbert, Pascale Chabanet, Erwann Lagabrielle, Gwennaëlle Pennhober, and Jean-Pascal Quod
2015 « Les aires marines protégées face au changement climatique: De la résilience écosystémique à la résilience des territoires ». In M. Bonnin, R. Laë, and M. Behnassi (eds.), *Les aires marines protégées ouest-africaines: Défis scientifiques et enjeux sociétaux*. Marseille: IRD, p.67-80.
- David, Gilbert, and Espérance Cillaurren
1992 "National Fisheries Development Policy for Coastal Waters, Small-Scale Village Fishing, and Food Self-Reliance in Vanuatu". *Man and Culture in Oceania*, 8: 35-58.
- Désurmont, Aymeric, and L. Chapman
2000 "The Use of Anchored FADs in the Area Served by the Secretariat of the Pacific Community (SPC): Regional Synthesis". In J.Y. Le Gall, P. Cayre and M. Taquet (eds), *Pêche thonière et dispositifs de concentration de poissons*. Paris: Ifremer, p. 108-140.
- Doumenge, François
1966 *L'homme dans le Pacifique Sud*. Paris: Musée de l'Homme.
- Food and Agriculture Organization of the United Nations (FAO)
1995 L'approche de précaution appliquée aux pêches. Première partie: Principes directeurs. FAO Document technique sur les pêches N°350/1. Rome: FAO.
2010 Situation mondiale des pêches et aquaculture. Rome: FAO.
2011 Fisheries Management – 4. Marine Protected Areas and Fisheries. *FAO Technical Guidelines for Responsible Fisheries*, N° 4, Suppl. 4. Rome: FAO.
- Foale, Simon, Philippa Cohen, Stephanie Januchowski-Hartley, Amelia Wenger, and Martha Macintyre
2011 "Tenure and Taboos: Origins and Implications for Fisheries in the Pacific". *Fish and Fisheries*, 12(4): 357-369.

- Garcia, Serge Michel
 1996 "The Precautionary Approach to Fisheries and its Implications for Fishery Research, Technology and Management: An Updated Review". In FAO, *Precautionary Approach to Fisheries. Part 2: Scientific Papers*. Prepared for the Technical Consultation on the Precautionary Approach to Capture Fisheries (Including Species Introductions), Lysekil, Sweden, 6-13 June 1995 (A scientific meeting organized by the Government of Sweden in cooperation with FAO). Rome: FAO, p. 1-75.
- Garcia, S.M., C. Zerbi, C. Aliaume, T. Do Chi, and G. Lasserre
 2003 The Ecosystem Approach to Fisheries: Issues, Terminology, Principles, Institutional Foundations, Implementation and Outlook. FAO Fisheries Technical Paper N°443. Rome: FAO.
- Gascuel, Didier
 1995 « Dynamiques complexes et relations simples: Limites et pertinences des modèles de dynamique des populations pour la gestion des systèmes halieutiques ». In F. Laloë, H. Rey and J.L. Durand (eds.), *Questions sur la dynamique de l'exploitation halieutique*, Table ronde ORSTOM/Ifremer, Montpellier, 1993/11/6-8. Paris: ORSTOM, p. 353-386.
- Gillett, Robert
 2009 Fisheries in the Economies of Pacific Island Countries and Territories. Mandaluyong City, Philippines: Asian Development Bank.
- Govan, Hugh
 2009 "Achieving the Potential of Locally Managed Marine Areas in the South Pacific". *SPC Traditional Marine Resource Management and Knowledge Information Bulletin*, 25: 16-25.
 2015 Preliminary Review of Public Expenditure of the Fisheries Agencies of Pacific Island Countries and Territories. National Budget and Staffing Support for Coastal Fisheries. Noumea: Secretariat of the Pacific Community.
- Guinotte, John M., and Victoria J. Fabry
 2008 Ocean Acidification and its Potential Effects on Marine Ecosystems. *Annals of the New York Academy of Sciences*, 1134: 320-342.
- Gulland, J.A. (ed.)
 1971 *The Fish Resources of the Ocean*. West Byfleet: Fishing News.
- Gulland, J.A.
 1983 *Fish Stock Assessment: A Manual of Basic Methods*. New York: John Wiley & Sons.
- Haddon, Alfred C., and James Hornell
 1975 *Canoes of Oceania*. Hawaii: Bishop Museum Press.
- Hilborn, Ray
 2007. "Reinterpreting the State of Fisheries and their Management". *Ecosystems*, 10(8): 1362-1369.
- Hoegh-Guldberg, Ove
 1999 "Climate Change, Coral Bleaching and the Future of the World's Coral Reefs". *Marine and Freshwater Research*, 50(8): 839-866.
- Hviding, Edvard
 1990 "Keeping the Sea: Aspects of Marine Tenure in Marovo Lagoon, Solomon Islands". In

- K. Ruddle and R. Johannes (eds), *Traditional Marine Resource Management in the Pacific Basin: An Anthology*. Jakarta: Unesco-ROSTEA, p. 7-44.
- Johannes, Robert E.
 1978 "Traditional Marine Conservation Methods in Oceania and their Demise". *Annual Review of Ecology and Systematics*, 9: 349-364.
 1994 "Pacific Island Peoples' Science and Marine Resource Management". In J. Morrison, P. Geraghty and L. Crowl (eds.), *Science of Pacific Island Peoples: Ocean and Coastal Studies*. Suva: The University of the South Pacific, p. 81-89.
- Johannes, Robert E., Alison Green, and Tim Adams
 2002 "Coral Reefs in the Pacific: Status and Monitoring; Resources and Management". In M. Kulbicki (ed.), *Les récifs coralliens du Pacifique: État et suivi, ressources et gestion* (A regional symposium – International Coral Reef Initiative (ICRI), 22-24 Mai 2000, Noumea IRD Centre, New Caledonia). Noumea: IRD, Documents scientifiques et techniques II-5, p. 53-67.
- Kinch, Jeff, Steve Purcell, Sven Uthicke, and Kim Friedman
 2008 "Population Status, Fisheries and Trade of Sea Cucumbers in the Western Central Pacific". In V. Toral-Granda, A. Lovatelli and M. Vasconcellos (eds.), *Sea Cucumbers. A Global Review of Fisheries and Trade*. FAO Fisheries and Aquaculture Technical Paper N°516. Rome: FAO, p. 7-55.
- Kulbicki, Michel
 1992 "Present Knowledge of the Structure of Coral Reef Fish Assemblages in the Pacific". In UNEP Regional Seas Reports and Studies N°147, *Coastal Resources and Systems of the Pacific Basin: Investigation and Steps toward Protective Management*. Nairobi: UNEP, p. 31-53.
- Lauck, Tim, Colin W. Clark, Marc Mangel, and Gordon R. Munro
 1998 "Implementing the Precautionary Principle in Fisheries Management through Marine Reserves". *Ecological Applications*, 8(1): 72-78.
- Laurec, Alain, and Jean-Claude Le Guen
 1981 Dynamique des populations marines exploitées. Volume 1 – Concepts et modèles. Rapports scientifiques et techniques N°45. Brest: CNEXO/Centre Océanologique de Bretagne.
- Laurent, Dominique, Geneviève Bourdy, Philippe Amade, Pierre Cabalion, and Dominique Bourret
 1993 *La gratte ou ciguatera: Ses remèdes traditionnels dans le Pacifique Sud*. Paris: ORSTOM.
- Leblic, Isabelle
 1989 « Les clans pêcheurs en Nouvelle-Calédonie. Le cas de l'île des Pins ». *Cahiers des sciences humaines*, 25 (1-2): 109-123.
- Léopold, Marc, Jennifer Beckensteiner, Jeremie Kaltavara, Jason Raubani, and Sophie Caillon
 2013a "Community-Based Management of Near-Shore Fisheries in Vanuatu: What Works?" *Marine Policy*, 42: 167-176.
- Léopold, Marc, Nathaniel Cornuet, Serge Andréfouët, Zacharie Moenteapo, C. Duvauchelle, Jason Raubani, Jayven Ham, and Pascal Dumas

- 2013b "Comanaging Small-Scale Sea Cucumber Fisheries in New Caledonia and Vanuatu Using Stock Biomass Estimates to Set Spatial Catch Quotas". *Environmental Conservation*, 40(4): 367-379.
- Leproux, Frédéric, Georges Moarii, and Stephen Yen
 1990 « Techniques de pêche utilisées autour des dispositifs de concentration de poissons en Polynésie Française ». In Commission du Pacifique Sud, 22^e *Conférence Régionale des Pêches, Noumea, New Caledonia*, 1990/08/6-10. Papeete: EVAAM.
- Meyers, Robert F.
 1989 *Micronesian Reef Fishes*. Guam: Coral Graphics.
- Moberg, Fredrik, and Patrick Rönnbäck
 2003 "Ecosystem Services of the Tropical Seascape: Interactions, Substitutions and Restoration". *Ocean and Coastal Management*, 46(1-2): 27-46.
- Moffit, Robert B.
 1993 "Deepwater Demersal Fish". In A. Right and L. Hill, *Nearshore Marine Resources of the South Pacific*. Suva: Institute of Pacific Studies, p. 73-95.
- Nurse, Mike, and John Kabamba
 2000 *Defining Institutions for Collaborative Mangrove Management: A Case Study from Tanga, Tanzania*. Nairobi: IUCN.
- Pauly, Daniel
 1997 « Les pêches globales: Géostratégie et émergence de nouveaux acteurs ». In G. Fontenellea and D. Gascuel (eds.), *Activités halieutiques et développement durable: Actes des 4^e rencontres halieutiques de Rennes*, 1997/03/14-15. Rennes: ENSAR, Association Agro-halieutes, p. 35-44.
- Polovina, Jeffrey Joseph, and Stephen Ralston
 1987 *Tropical Snappers and Groupers: Biology and Fisheries Management*. Boulder and London: Westview Press.
- Preston, Garry L., and Michael A. Vincent
 1986 *Refrigeration for Small-Scale Fisheries in Pacific Island Countries*. South Pacific Commission Technical Paper N°188. Noumea: South Pacific Commission.
- Preston, Garry L., Paul D. Mead, Lindsay B. Chapman, and Pale Taumaia
 1999 *Deep-Bottom Fishing Techniques for the Pacific Islands: A Manual for Fishermen*. Noumea: Secretariat of the Pacific Community.
- Quensière, Jacques
 1993 « De la modélisation halieutique à la gestion systémique des pêches ». *Nature Sciences Sociétés*, 1(3): 211-220.
- Rey, Hélène, Joseph Catanzano, Benoit Mesnil, and Gérard Biais
 1997 *Système halieutique. Un regard différent sur les pêches*. Paris: Institut Océanographique/ Ifremer.

- Ruddle, Kenneth
1998 "The Context of Policy Design for Existing Community-Based Fisheries Management Systems in the Pacific Islands". *Ocean & Coastal Management*, 40: 105-106.
- Ruddle, Kenneth, and Tomoya Akimichi (eds.)
1984 *Maritime Institutions in the Western Pacific*. Senri Ethnological Studies, 17. Osaka: National Museum of Ethnology.
- Ruddle, Kenneth, and Robert E. Johannes (eds.)
1989 *Traditional Marine Resource Management in the Pacific Basin: An Anthology*. Jakarta, Indonesia: Unesco/ROSTSEA.
- Salvat, Bernard (ed.)
1987 *Human Impacts on Coral Reefs: Facts and Recommendations*. Moorea: EPHE.
- Schaefer, Milner B.
1954 "Some Aspects of the Dynamics of Populations Important to the Management of the Commercial Marine Fisheries". *Inter-American Tropical Tuna Commission Bulletin*, 1(2): 23-56.
- Sen, Sevaly, and Jesper Raakjaer Nielsen
1996 "Fisheries Co-Management: A Comparative Analysis". *Marine Policy*, 20(5): 405-418.
- Shineberg, Dorothy
1967 *They Came for Sandalwood: A Study of the Sandalwood Trade in the South-West Pacific, 1830-1865*. London: Cambridge University Press.
- Sokimi, William
2012 "More FADs Deployed in Four Pacific Islands". SPC Fisheries Newsletter, #138 – May/August 2012: 18-20, http://www.spc.int/DigitalLibrary/Doc/FAME/InfoBull/FishNews/138/FishNews138x_18_FADs.pdf (Accessed on November 19, 2015).
- South, G. Robin, Denis Goulet, Seremaia Tuqiri, and Marguerite Church (eds.)
1994 *Traditional Marine Tenure and Sustainable Management of Marine Resources in Asia and the Pacific*. Suva: University of the South Pacific, International Ocean Institute.
- Secretariat of the Pacific Community (SPC)
2010 *A Community-Based Ecosystem Approach to Fisheries Management. Guidelines for Pacific Islands Countries*. Noumea: Secretariat of the Pacific Communities.
- Tacquet, Marc
2011 "Artisanal and Industrial FADs: A Question of Scale". *SPC Fisheries Newsletter*, #136 – September/December 2011: 35-45, <http://www.spc.int/DigitalLibrary/Doc/FAME/InfoBull/FishNews/136/FishNews136.pdf> (Accessed on November 19, 2015).
- Tanzer, John, Carol Phua, Anissa Lawrence, Aimee Gonzales, T. Rowburgh, and P. Gamblin (eds.)
2015 *Living Blue Planet Report*. Gland: WWF.
- UNFPA
2014 *Population and Development Profiles, Pacific Island Countries*. Suva: United Nations Population Fund Pacific Sub-Regional Office.
- Veitayaki, Joeli, William G.L. Aalbersberg, Alifereti Tawake, Etika Rupeni, and K. Tabunakawai
2003 "Mainstreaming Resources Conservation: The Fiji Locally Managed Marine Area Network

and National Policy Development". In H. Jaireth, *Innovative Governance: Indigenous Peoples, Local Communities and Protected Areas*. New Delhi: Ane Books, p. 105-121.

Ward, Ralph Gerard

1993 "South Pacific Islands Futures: Paradise, Prosperity, or Pauperism?" *The Contemporary Pacific*, 5(1): 1-21.

Williams, David McB

1990 "Shallow-Water Reef Fishes". In T.J. Done and K.F. Navin (eds.), *Vanuatu Marine Resources: Report of a Biological Survey*. Townsville: Australian Institute of Marine Science, p. 66-76.

Worm Boris, Edward B. Barbier, Nicola Beaumont, J. Emmett Duffy, Carl Folke, Benjamin S. Halpern, Jeremy B. C. Jackson, Heike K. Lotze, Fiorenza Micheli, Stephen R. Palumbi, Enric Sala, Kimberley A. Selkoe, John J. Stachowicz, and Reg Watson

2006 "Impacts of Biodiversity Loss on Ocean Ecosystems Services". *Science*, 314(5800): 787-790.

Zann, Leon P.

1990 "Traditional Management and Conservation of Fisheries in Kiribati and Tuvalu Atolls". In K. Ruddle and R.E. Johannes (eds.), *Traditional Marine Resource Management in the Pacific Basin: An Anthology*. Jakarta: Unesco-ROSTEA, p. 77-101.



Policy options for coastal and tuna fisheries in the Pacific Islands: sustaining resources on the same side of the same coin

Joeli VEITAYAKI, Esaroma LEDUA

Introduction

Coastal and tuna fisheries in the Pacific Ocean feed Pacific Islanders and supply global markets, which are the biggest sources of foreign exchange for some of the Small Island Developing States (SIDS) in the region (Pacific SIDS). This makes the health and sustainable use of these resources critical both for the countries holding the solemn responsibility of managing their fisheries resources and for the rest of humanity, which relies on fish catches in Pacific waters. In other words, the future of Pacific SIDS, or their preferred new grouping, Large Ocean Island States (LOIS), depends on the sustainable development of their fisheries resources. Pacific SIDS and their people thus must work individually, collectively and collaboratively to assure the sustainability of these resources, which are important for their national development and global markets. The sustainable development of these resources requires innovation, dedication and commitment from all stakeholders, including governments, regional and subregional organizations, private sector companies, the communities that own these fisheries and the multitudes with whom they share their bountiful food resources.

Coastal and tuna fisheries are two of the main economic sectors in Pacific SIDS. Although characteristically distinct, the two sectors are ecologically interrelated and are on the same side of the same coin. Tuna resources therefore cannot be seen as a convenient solution for depleted coastal fisheries, although this was attempted by Fiji between 1986 and 1990 under its Development Plan 9 (Fiji's Central Planning Office 1985). Under this plan, the Fiji government promoted the movement of surplus coastal fishers into offshore fisheries to facilitate the recovery of the overextended coastal fisheries. At the time, tuna, deepwater snapper and coastal pelagic fisheries were identified as new fisheries that would help Fiji achieve the objectives of Development Plan 9. The Food and Agriculture Organization (FAO) of the United Nations assisted Fiji in the design of a 28-footer fishing vessel and the Japanese government provided inboard engines for these vessels. However, the continuous reduction in snapper catch levels in near coastal areas made the operation of these vessels economically challenging. Some of the fishers who survived the snapper fishing converted into tuna fishing and became pioneers of the fresh tuna

sashimi long-line fishery in Fiji in the early 1990s. In 1995, the total allowable catch for tuna in Fiji was set at 7,500 metric tonnes per annum, but this was increased to 15,000 metric tonnes per annum in 2001 (Amoe 2006; Tavaga 2012), showing Fiji's intention to increase tuna fishing.

There is serious concern about the sustainability of tuna fisheries in countries such as Fiji given the mismatch between what is expected and what is achieved from the use of fisheries resources. In this case, the national allowable catch of 15,000 metric tonnes per annum is far higher than the domestic tuna landings of only around 11,044 metric tonnes per annum in 2013 and 7,747.2 metric tonnes in 2014 (Fiji Government 2014). According to Mr. Graham Southwick, the managing Director of the Fiji Boat Owners Association, tuna within Fiji waters is overfished and fishing effort should be reduced to only 50 tuna fishing vessels.¹ In addition to the threat of high level of fishing effort, Mr. Graham Southwick is also of the view that the national total allowable catch (TAC) of 15,000 metric tonnes is too high and should be reduced to 10,000 metric tonnes as advised by Pacific Community (SPC) scientists (Elbourne 2012). This is the reality that has to be addressed in the Pacific Islands, where it seems that national fisheries scientists do not have an accurate understanding of the stocks of targeted species and the linkages within and between the coastal and tuna fisheries sectors. Despite evidence that both sectors are under pressure and unlikely to provide the resources and services they have provided in the past unless proper management is undertaken immediately, Pacific Island countries continue to focus on maximizing their return from coastal and tuna fisheries. In Fiji, local tuna overfishing has been reported continuously by domestic industries over the last 10 years while regional tuna stocks are argued to be healthy.

Responsible fishing is required at all levels of governance in the Pacific Islands. In addition, efficient monitoring and effective management of fisheries resources are needed to ensure sustainable use. International instruments such as the United Nations Convention on the Law of the Sea, United Nations Conference on Environment and Development conventions and arrangements, and the FAO Code of Conduct for Responsible Fisheries provide the marine resource management framework that must be implemented across the Pacific Islands for the peaceful and sustainable use of marine resources. Pacific Islanders must assume leadership and avoid continually demanding more returns from their increasingly impoverished and depleted marine resources without matching their demands with a commitment to effectively manage their coastal and tuna fisheries resources.

This chapter will discuss the Pacific SIDS setting, the importance of the coastal and tuna sectors, their state, and sustainability challenges. It will also suggest some policy options to address the main challenges and assure the integrity and health of the fisheries resources while securing maximum returns for Pacific Islanders.

1. See Elbourne, "Harvest limit wishful thinking: Southwick". *Fiji Times*, 17 May 2012.

The setting – Pacific SIDS

The Pacific region is home to 14 young democracies, and includes an ancient monarchy and states in “close association” with former colonial powers. The 14 Pacific SIDS are the Cook Islands, the Federated States of Micronesia (FSM), Fiji, Kiribati, Nauru, Niue, Palau, Papua New Guinea (PNG), the Republic of the Marshall Islands (RMI), Samoa, the Solomon Islands, Tonga, Tuvalu, and Vanuatu (tab. 1). Kiribati, the Solomon Islands, Tuvalu, and Vanuatu are classified as Least Developed Countries.

Land in Pacific SIDS constitutes only 2% of the total area and less than 0.4% if PNG, the biggest country, is excluded. Four states have a land area of less than 30 km² each. Yet there are at least 11 km² of ocean for every coastal Pacific Islander (Anderson et al. 2003: 2). In addition, the Pacific is one of the most remote and far flung regions in the world (AusAID 2008: 1).

The estimated population of 10,566,500 people in 2013 makes Oceania numerically minute on the global scale. PNG has the largest population with 7.4 million (70% of the region’s population). Half of the countries have populations of less than 100,000 and Niue has the least with 1,500 inhabitants (SPC 2013). On average, 23% of the region’s population is urban, with almost everyone in Nauru, Northern Marianas and Guam living in urban areas (SPC 2010a).

Pacific SIDS face diseconomies of scale in production and exchange of goods and services, remoteness from export markets and vulnerability to natural disasters and climate change. There is high economic and cultural dependence on the natural environment and primary commodities. A high proportion of national income in many countries comes from aid from metropolitan countries and development partners and remittances from Pacific Islanders working abroad.

PNG has the largest economy (US\$8.2 billion in 2009), which is more than twice the size of the second largest, Fiji (US\$3.5 billion in 2009). PNG and Fiji account for 80% of the region’s Gross Domestic Product (GDP), with the remaining Pacific SIDS having very small economies (UNESCAP 2010: 7). The GDP per capita is generally higher for the metropolitan territories and for the countries with close association with metropolitan states. For most of the Pacific SIDS, serious economic development obstacles are posed by long distances, tiny populations, minute economies and minimal resources. Remoteness has significant economic, environmental, and social impacts: high fuel costs and low economies of scale make the cost of developing and maintaining essential infrastructure restrictive, while small populations offer a narrow range of resources and skills that limit capacity. Small populations and land areas create small markets and reduce people’s income earning potential (Redding and Venables 2004).

Population growth in urban areas places intensive pressure on all marine resources. South Tarawa, Kiribati, with around 54.1% of the country’s total population of 108,800 people in 2013 and an estimated annual growth rate of 5.2%, will see its

**Table 1: Pacific countries and territories, including 14 SIDS:
area, population, density, growth rate, GDP per capita and year.**

Country / Territory	Land Area (km ²)	2010 Population (estimate)	Density (Persons / km ²)	Mid-2010 Growth Rate (%)	Mid-2010 Growth GDP (US\$,000)	GDP per capita (US\$)	Year
American Samoa	199	65,896	331	1.2	558,800	9,041	2005
Cook Islands	237	15,708	66	0.5	230,541	10,875	2008
FSM	701	111,364	159	0.4	235,900	2,183	2007
Fiji	18,273	847,793	46	0.5	2,928,039	3,499	2008
Guam	541	187,140	345	2.7	3,700,000	22,661	2005
Kiribati	811	180,135	124	1.8	144,810	1,490	2008
RMI	181	54,439	301	0.7	149,219	2,851	2007
Nauru	21	9,976	475	2.1	19,115	2,071	2006-07
Niue	259	1,479	6	-2.3	15,639	9,618	2006
New Caledonia	18,576	254,525	14	1.5	9,397,063	37,993	2008
N. Marianas	457	63,072	138	-0.1	948,659	12,638	2005
Palau	444	20,518	46	0.5	170,144	8,423	2007
PNG	462,840	6,744,955	15	2.1	5,552,190	897	2006
Pitcairn	5	-	-		-	-	-
Samoa	2,785	183,123	66	0.3	497,146	2,672	2008
Solomon Islands	30,407	549,574	18	2.7	528,000	1,014	2008
Tahiti	3,527	268,767	76	1.2	5,403,934	21,071	2006
Tokelau	12	1,165	97	-0.2	-	-	
Tonga	650	103,365	159	0.3	270,223	2,629	2007-08
Tuvalu	26	11,149	429	0.5	17,514	1,831	2002
Vanuatu	12,281	245,836	20	2.5	507,454	2,218	2007
Wallis and Futuna	142	13,256	93	-0.6	-	-	-

Source: SPC 2010b.

population double every 13 years. The same situation is faced in Majuro (Marshall Islands), Funafuti (Tuvalu), Pago Pago (American Samoa), Guam and Nauru, where population densities rival those of Hong Kong and other cities in South East Asia. Although Pacific Islanders have customary resource management practices such as the demarcation and ownership of fishing grounds, the clear division of responsibilities and the right to declare resource management arrangements, these are now insufficient for the people who are living in modernizing societies with depleting resources, altered environments and increasing demands that threaten their survival. Although some people still observe their customary fishing practices and management arrangements, these are quickly changing due to modernization.

Future projections in the Pacific SIDS are bleak as natural resources are impacted negatively by human activities (UNESCAP 2010: 10). In addition, climate change will have devastating and economically crippling impacts. Pacific Islanders have unique resilience associated with access to communal land, strong cultural identity, and systems of community governance supported through close kinship ties, sharing of communal resources, and cultural obligations of reciprocity (Bayliss-Smith et al. 1988; Coates 2009: 30; Veitayaki et al. 2011). However, the immensity and immediacy of the effects of climate change will make adaptation insufficient in many of the countries (Barnett 2002).

Pacific Islanders' coping strategies and survival mechanisms are quickly eroding due to the social and economic transformation taking place. Moreover, Pacific SIDS have for too long been mistakenly led by their regional organizations and development partners to adopt continental-centred or focused solutions that are inadequate or inappropriate (Barnett 2002). Patrick D. Nunn supports this view and adds that regional agencies serving the Pacific SIDS "have been largely reactive, uncritically imposing the priorities of international organizations on Pacific Island nations and focusing on short-term pilot studies rather than mainstreaming the lessons learned from these" (2010: 234). Such agencies therefore need to develop "proactive plans independent of either international or national agendas that take into account either the special needs of Pacific Island nations or the importance of developing adaptive solutions that acknowledge their singular cultural and environmental contexts" (2010: 233).

Coastal and tuna fisheries resources

The sustainable management and development of coastal and tuna resources in Pacific SIDS is critical because risks to their health and sustainability threaten the fisheries and those who depend on them. The development of fisheries often takes place haphazardly without a proper assessment at the national level of stocks, feasibility or impacts of fishing activities. More emphasis continues to be placed on achieving regional tuna stock assessments and less effort is focused on improving the level of accurate understanding of national stocks and the percentage of these stocks

that is migratory. At the Western and Central Pacific Fisheries Commission (WCPFC) Scientific Committee meeting held in Bussan, Korea, between the 7-15th of August 2012, John Holdsworth stated that tagged yellowfin tuna do not move more than a few hundred miles, even after long periods at liberty, and approximately 86% of recaptured yellowfin tuna have a tendency to remain near the continental shelf within 250 miles of their release location (Holdsworth 2012). This statement highlights the need to properly reassess the migratory behaviour of tuna and the relationship with the coral reef ecosystem.

There is limited appreciation of the relationships between the tuna resources, coral reefs and mangrove forests in coastal areas, resulting in poor decision-making that threatens the sustainability of the fisheries resources. Linkages between islands and continental slopes, and food webs for tuna, can occur via the planktonic/larval phase of coral reef fish and via micronekton (organisms larger than plankton and including cephalopod, crustacean and fish species). Postlarvae originating from populations of coral reef fish and invertebrates are often entrained in eddies while they develop to the stage where they are competent to settle on reefs and have been recorded in the stomach of tuna (Le Borgne et al. 2011: 212). In addition, many conflicting uses of ocean resources — for food, income, tourism, research and culture — require that the different uses be properly planned, implemented and governed.

Fisheries are the main sources of protein for many coastal dwelling Pacific Islanders. Their annual per capita fish consumption rates range from 16.9 kg in PNG to 181.6 kg in Kiribati (Gillett 2011: 83) (tab. 2). This level of dependence is far above the global average of 16.5 kg per person per year (Gillett 2011) and is supported by coastal fisheries. It shows the importance of nearshore resources to local communities and the pressure on the use of the fisheries stocks. In some remote atolls, annual fish consumption per capita can even surpass 250 kg (SPC 2008).

Data from all of the Pacific Island countries highlight declining and overfished stocks and the impact this situation has on the protein supply of coastal communities as well as the social and cultural consequences on these communities and the national economies (Lang 2008). Fisheries currently feed Pacific Islanders who will have to look for alternative sources of protein if their fisheries resources fail. Concern that tuna resources are being sold cheaply to fish processors overseas who then sell the processed products at much higher prices has been growing for some time.

As mentioned in the chapter by Allain et al. in this volume, over 2.6 million tonnes of tuna were caught in the Western and Central Pacific Ocean (WCPO) in 2013, constituting 82% of the Pacific tuna catch and 58% of the global tuna catch. Skipjack tuna catch dominated with approximately 69% of the total tuna catch in the WCPO. Yellowfin tuna, bigeye tuna and albacore tuna provided 20%, 6% and 5% respectively of the WCPO total tuna catch. The total value of the tuna catch in the region was estimated at US\$6.2 billion in 2013 (Williams and Terawasi

Table 2: Per capita annual fish consumption in the Pacific Islands

Country	FFA data, 1997	FAO data, Average 2001-2003
Cook Is.	67.8	44.6
Fiji	50.7	35.9
Kiribati	181.6	75.2
Marshall Is.	67.8	11.3
Micronesia	73.4	46.9
Nauru	50.0	-
Niue	62.3	-
Palau	107.7	58.8
Papua New Guinea	16.9	13.8
Samoa	31.8	57.3
Solomon Is.	44.8	42.6
Tonga	34.5	49.1
Tuvalu	113.0	40.6
Vanuatu	27.0	30.2

Source: <http://www.spc.int/coastfish/en/countries.html>; Laurenti 2007.

2014). Fishing access revenues also contributed between 11 to 63% of total national revenue for Kiribati, Tuvalu, the Federated States of Micronesia, Nauru, the Marshall Islands and Palau.

Purse seining is the main fishing method. It accounts for 72% of the catch weight from tuna schools and more than 200 other bycatch species caught in fish aggregating devices (FADs) or in unassociated schools. Longline fishing (9%), pole-and-line (8%) and artisanal fisheries (10%) provide the remaining catches. Tuna fishing and processing provide employment for thousands of people in Papua New Guinea, the Solomon Islands, Fiji and American Samoa (Gillett 2009).

According to Allain et al. in this volume, skipjack and South Pacific albacore stocks are biologically healthy and can support additional fishing efforts. The yellowfin stock is approaching the bottom of the acceptable range while the bigeye stock has been severely impacted by fishing and is overfished. The current state of the tuna fisheries underlines the importance of maintaining the health and sustainability of the region's resources, which are critical not only to Pacific Islanders and their economies, but also to the habitats and resources that provide food and livelihoods for coastal communities.

State of coastal fisheries in the Pacific Islands

Coastal fisheries consist of subsistence, artisanal and commercial fisheries, aquaculture and mariculture. They are arguably the most important sector in Pacific SIDS economies but are poorly understood. The lack of information makes these fisheries invisible in terms of their economic importance, their contribution to local livelihoods, and the dire need for their management. Coastal fisheries are the main source of food and income for local communities, the home of unique marine biodiversity, and the stage for varied commercial activities. The fisheries are vulnerable to intensive resource uses that inflict negative impacts on the land, coast and open sea. The multiple species and stakeholders in these fisheries make resource management complicated.

Coastal fisheries are diverse and employ a wide range of fishing methods and gear that mirror the multiple species that are available. These fisheries are highly dependent on the continued productivity of the coastal areas, which are amongst the most dynamic and complex environments. These areas contain important habitats, such as sand and mudflats, sea grass beds, mangroves and coral reefs, which need to be managed and governed to support the local people's diverse ecological, economic, cultural and social interests. An integrated coastal management approach that addresses all of the pertinent resource use issues and involves all of the stakeholders in a fair and transparent way is required in this sector. Reasons for this include the variety of activities that have to be undertaken, the growing population that has to be provided for, overfishing that has to be brought under control, and the erosion of traditional resource management arrangements and of local authority that renders the customary resource management system ineffective (Veitayaki et al. 2011).

Coastal fisheries must be properly sustained because they support the majority of the local protein supply (Gillett 2011). For example, coastal fisheries account for the majority of the protein accessible to Fijians whose annual per capita fish consumption rate rose from 26 kg in 1986 to 47 kg in 1990, then to 50.7 kg in 1997, only to drop to 35.9 kg in 2002 (FAO 2009). Gillett (2011: 83) placed Fiji's annual per capita consumption rate at 36.8 kg in 2011 and mentioned other studies that estimated rates between 44 kg and 62 kg.

About 80% of the Pacific region's coastal fishery production of around 100,000 tonnes annually is used for subsistence and does not enter the market (SPC 2008). Subsistence fishery is restricted to nearby areas that can be reached within three to four hours. "Using various sources of data (including non-fishery surveys), it has been recently estimated that Fiji's coastal fishery production consists of about 17,400 tonnes by subsistence fishing and 9,500 tonnes by commercial fishing" (FAO 2009: 3). Subsistence fishers target everything and consume and share whatever is caught or gathered. Surplus and highly valued species such as lobsters and mangrove crabs are sold whenever possible to provide much needed income.

Since the 1970s, the development and management of coastal fisheries have been important priorities for Pacific SIDS. Coastal fisheries are dominated by local community groups that are increasingly better organized and commercially oriented. Twenty percent of the coastal fisheries catches enter the cash economy through high-value marine products that are exported from the region, such as dried sea cucumber (bêche-de-mer), trochus, mother-of-pearl shells and black pearls from cultured pearl oysters, dried shark fins, chilled deepwater red snapper, live reef fish species, seaweed (*Eucheuma cottonii*), giant clams and coral (SPC 2008).

The commercial fishing of sea cucumbers in Pacific SIDS has not been controlled properly and has led to the characteristic boom-and-bust cycle that has been a feature of this fishery since its introduction in the 1800s; this fishery starts, thrives and then collapses because of overfishing (see also David in this volume). According to Crick Carleton et al. (2013), the boom and bust cycle reduces yields to less than half the volume of production provided before the stock collapses. Sea cucumber fishing is luring local households at the expense of subsistence and other revenue-generating activities and encouraging greater dependence on imported products, requiring households to earn more from sea cucumbers. Although local stakeholders and governments are aware of the need to manage these resources, the implementation of management measures is difficult in practice, resulting in ever-growing pressure and strong motivation for sea cucumber harvests (Carleton et al. 2013). This is why a more considered, strategic and coordinated management approach is required to benefit the industry, national economies, and rural communities at the same time. The commercial use of food sources is contributing to resource overexploitation and food insecurity in local communities. According to a survey in Viti Levu, Fiji, 60% of small-scale fishing took place in the lagoon in the mid-1990s (Rawlinson et al. 1995). This type of fishing in areas close to population centres is causing the overexploitation of commercially important species and the creation of overfishing spheres that are enlarging as the fishers move out to more distant fishing grounds (FAO 2009).

Given the growing population with improved technologies and capabilities and increased coastal development, it is crucial that the management of coastal fisheries resources be seriously pursued. Coastal fisheries are critical for national self-sufficiency and food security and therefore must be managed to ensure that optimum fisheries production is obtained from healthy and vibrant resources (Gillett et al. 2014; Kailola 1995; Pita 1996; Veitayaki et al. 2011).

State of tuna fisheries

Development aspirations in most Pacific SIDS revolve around the attainment of maximum returns from their tuna resources to fund improvements for the well-being of their people. Tuna fisheries remain the main source of foreign exchange for most

of these countries. Since the 1970s, many of these countries have promoted the development of domestic industry (Geen 1994; Gillett 2003, 2008; Philipson 2008; Ram-Bidesi 2003; Waugh 1986). This continued into the 1980s when these domestication strategies were promoted by countries which were dissatisfied with foreign vessels fishing in their waters under access agreements. Allegations were made of underreporting and non-reporting of catches by distant-water fishing nations (DWFNs) causing lost revenue for the countries involved (Maxwell and Owen 1995; Tarte 1998). It was also suspected that some DWFNs were misreporting their data and were paying low access fees, which undermined the capacity of the Pacific SIDS to manage and conserve their tuna resources (World Bank 1996).

Tab. 3 summarizes the development aspirations for tuna fisheries in some of the Pacific SIDS. Common development aspirations include the expansion of the longline fleet and catch and of the purse seine fleet and catch, an increase of non-cannery value adding, new and expanded shore bases and small-scale development, and additional cannery and loining² operations (Gillett 2008).

As mentioned in this volume by Allain et al., Pacific SIDS have agreed and formulated innovative regional arrangements and institutions to maximize their benefits from their tuna resources. They have established the Pacific Islands Forum Fisheries Agency (FFA) to advise them on tuna management and development issues and successfully negotiated their regional fisheries management organisation, the WCPFC, to collaborate with their DWFN partners in the sustainable use of the region's tuna resources. The FFA has facilitated numerous regional tuna management agreements and actions. For example, the agreements formulated by the Parties to the Nauru Agreement (PNA), a subgroup of the FFA countries, and the Palau and the Federated States of Micronesia Arrangements aim to increase domestic landing and processing and in turn increase the benefits from tuna to domestic economies (Aqorau and Bergin 1997a, 1997b, 1998; Gillett 2008, 2010; Lodge 1998; Ram-Bidesi 2003). In the same manner, the Pacific SIDS have implemented some of the conservation and management measures (CMMs) recommended by the Scientific Committee of the WCPFC to protect tuna and associated stocks.

Some of these CMMs include a ban on the use of large-scale driftnets on the high seas and a three-month ban on the use of fish aggregation devices (FADs) on a yearly basis. The permanent closure of high seas pockets (i.e., international waters wholly enclosed by exclusive economic zones — EEZs) has also been agreed together with full catch retention and the elimination of discards in the EEZs of PNA countries.³

2. Loining is the processing of tuna meat for canning overseas.

3. See <https://www.wcpfc.int/conservation-and-management-measures> (Accessed on October 20, 2015).

Table 3: Expressions of national tuna industry development aspirations

Country	Expression of development aspirations
Solomon Islands	Vision for tuna industry in the government policy statement: i) introduction of small-scale tuna fishing for rural residents ii) setting up two new loining facilities iii) strengthening government fishing/processing company for long term survival
Papua New Guinea (PNG)	Expansion of benefits would come from shore-based activities and aspire to increase processing and create new facilities to serve tuna vessels: i) 100% processing of in-zone catches by increasing cannery and loining plants ii) further sourcing of raw materials from outside of PNG to take advantage of relaxed rules of origin iii) providing all necessary facilities to the harvesting and processing of tuna at the “Marine Park” iv) increasing employment of PNG nationals as crew members v) National Tuna Fishery Management Plan specifies the domestication policy through the application of preferential licensing criteria in favour of PNG nationals and companies vi) Government expects that a cumulative investment of US\$192.5 million with a production capacity of 1,115 million tonnes per day will ensure that all catches in PNG waters will be landed on PNG shores (Usu, Kumasi and Baje 2012)
Fiji	i) assuring an adequate flow of fish to processing plants for loining and canning ii) fishing activities based on non-tuna species iii) value-adding activities iv) Marine Stewardship Council Certification v) 60-90 vessels in local fleet and 140 vessels based in Fiji vi) 6 fish exporting processing plants
Kiribati	i) a fresh tuna export operation on Christmas Island ii) participation in a Parties to the Nauru Agreement’s/regional cannery iii) small-scale low technology processing of tuna iv) local crew employment on foreign fishing vessels
Marshall Islands	i) phasing out of distant-water fishing and replacing with locally-based fleet ii) expansion of loining plant to 80 tonnes per day within 5 years iii) all fish caught by locally-based vessels
Tuvalu	i) a fleet of small longline vessels that will be crewed and operated by locals ii) offering access to tuna longline on preferential access terms to employ Tuvaluan crew and management trainees

Sources: Gillett 2008; Usu et al. 2012; National Tuna Management Plans

Fisheries sustainability issues

Sustaining fisheries resources is the ultimate challenge in all Pacific SIDS given the multiple species that have to be managed in a healthy environment, the dependence of people on coastal resources for food, the growing demand associated with higher population, the increasing commercial use of resources and the wide areas that have to be covered. Although sustainable fisheries are included in the strategic objectives of the countries and are commonly part of national plans and poverty reduction strategies (SPC 2008), they have not yet been implemented. The short life span of fisheries development initiatives and ineffective monitoring, control and surveillance associated with poor planning and limited resources illustrate the problems to be addressed and the need to regularly formulate and implement relevant fisheries development policies, strategies and activities. Common issues affecting the sustainability of fisheries development include the pursuit of government development objectives, poor planning, inaccessible markets, lack of attention to environment management, lack of understanding of the complex social and cultural conditions, insufficient human resources and lack of evaluation.

Fish production in coastal areas by local people has increased considerably in recent decades, threatening the health of the fisheries stock. The option of shifting to deeper and distant offshore resources as the nearshore resources are fully used has evaporated with intensively exploited nearshore fisheries. Furthermore, the option of improving production through improved post-harvest processing (such as loining and canning) and collection of products from rural areas for sale in urban and overseas markets has greatly enhanced the commercial use of fisheries in areas farther from the main centres, which makes fisheries management even more challenging. Unfortunately, current post-harvest processing through drying, ice storage and frying has not improved the price of value-added products because the commodities are still sold at relatively low prices.

On the other hand, the many attempts to bring markets closer to people in rural areas through collection arrangements have resulted in overexploited resources and failed initiatives. In such cases, according to C.S. Evening (1983), both the people and the resources are unlikely to support regular intensive collection while the accumulation of catch over a period of time is impossible without proper storage facilities and enabling infrastructure. It also has been argued that the structure of the subsistence sector is not conducive to the regular supply of fish needed in the urban markets (Carleton 1983). Moreover, fish marketing schemes established to involve local communities in commercial fishing should be offered only as a social service after proper planning has been undertaken because government officials, who provide these facilities, are ill-equipped to conduct commercial operations and therefore should not run them (Carleton 1983).

Sadly, the prophetic advice mentioned above has not been taken into consideration in the Pacific SIDS. In the past few decades, approximately 150 fisheries centres have been established in these countries but few, if any, have been commercially viable or sustainable (Gillett 2010). However, with growing urban demand for fish, production spheres are extending further into rural areas, causing resource depletion and the undermining of local communities' food sources and resource use rights. In rural areas, the isolation of fishers from export markets remains a problem because of the time required and the lack of handling facilities, which translates into extra effort and costs for those who dare to be involved. Remote locations, poor infrastructure, the high cost of transportation and the uncertain quality of products harvested by artisanal fishers make the successful operation of export markets in rural areas highly unlikely. Training and services are needed to improve the quality of locally produced fish to meet the rigorous quality standards that are required on export markets.

Collapsed fisheries across the Pacific SIDS emphasise the need for fisheries development to be in line with the capacities of the stock and have the support of local stakeholders. Numerous reports have alluded to the deteriorating state of coastal fisheries (Aqorau 2014; Gillett 2009; Joint Fisheries Strategies Mission 1988; Kailola 1995; Lang 2008; Pita 1996; Veitayaki et al. 2011) but poor data and the multiple species targeted have made it difficult to address the problem as fishers quickly move to a new commodity after noticing depletion signs in the stocks they are fishing.

Tuna stocks in the WCPO are declining while the numbers of fishing boats are high. According to Allain et al. in this volume, longline fishing vessels continue to fluctuate between 3000 and 6000, which is about 10 to 20 times the number of purse seiners. Overfishing is worsened by pollution, climate change, habitat destruction, weak governance and lack of fisheries management knowledge exacerbating the fishing pressure on the EEZs of the Western and Central Pacific nations. Illegal, unreported and unregulated (IUU) fishing remains a major problem because of the lack of capacity on the part of coastal states to enforce compliance. Moreover, exemptions, noncompliance and non-compatibility of national, sub-regional and regional objectives weaken regional management arrangements and compromise their stand for an equitable share of the benefits from the use of their fisheries resources. For example, exemptions and the use of special provisions for SIDS to develop their tuna resource to support shore-based processing facilities resulted in the Philippines fleets recommencing high seas fishing and their increased involvement under the PNG flag (Allain et al. in this volume).

Existing regional and subregional conventions, including the PNA through its Third Implementing Arrangements and the WCPFC Convention, while consistent with international fisheries management and governance, do not apply these international principles and standards in their existing tuna CMMs. In accordance with the exemption provisions provided for in the WCPFC Convention

to accommodate the special requirements and needs of Pacific SIDS to develop their domestic tuna fisheries, the Cook Islands, Samoa, Fiji, French Polynesia and Vanuatu have all increased their domestic longline fleets over the last decade. Pacific SIDS, therefore, must balance the attainment of their national development targets against maintaining the future availability of their most important resources, which funds most of their development aspirations.

The effectiveness of regional CMMs, including some of the ones mentioned earlier, is weakened by inherent contradictions that need to be addressed. For example, exemption provisions intended to support Pacific SIDS development aspirations allowed a 30% increase in purse seine effort over the 2001-2004 average (WCPFC 2009). Despite their own policies to reduce tuna fishing mortality of bigeye and yellowfin tuna in the WCPFC area by 25%, all of the Pacific SIDS embraced this exemption, causing an increase in the number of purse seiners fishing in Pacific SIDS waters under the US Multilateral Fisheries Treaty with the Pacific SIDS. Likewise, the three-month FAD fishing closure that was declared by the PNA was inadequate because of the small reduction in fishing mortality recorded for FAD fishing (Hampton and Harley 2009) due to the uncertain level of fishing around FADs during this short-term closure. Similarly, the high seas pockets closures that were agreed to by the PNA were of little benefit because fishing for targeted species was diverted to other non-closed high seas areas, where the catches were high (Hampton and Harley 2009). Thus, the CMMs for bigeye and yellowfin tuna were undermined by the high fishing mortality of juvenile bigeye tuna in the archipelagic waters (Hampton and Harley 2009). Moreover, the 30% reduction of bigeye longline catch at 2001-2004 average was inadequate to reduce adult bigeye fishing mortality and foster the recovery of bigeye stock.

The International Seafood Sustainability Foundation (ISSF) report of February 2012 (ISSF 2012) also advised members of the WCPFC to be more aggressive in implementing their CMMs to protect the region's tuna stocks and marine environment. There was also concern that the WCPFC's observer program did not ensure compliance and that the granting of exemptions allowed Pacific SIDS to use FADs in some areas even during closure periods. An article published on the Atuna website on 30 November 2012 reported that ISSF encouraged WCPFC members to ban purse seine fishery and emphasised the development of reference points and harvest control rules (Atuna 2012). It recommended that Pacific SIDS effectively regulate, monitor and report transshipments (transfers of catches from one boat to another) in their EEZs and to reduce the number of fishing vessels to levels determined by the productivity of the fisheries. According to the ISSF, not all purse seine vessels fishing in the PNA subregion are Monitoring Surveillance and Control certified and some are using FADs in certain areas during closure periods.

Due to a limited scientific capacity, Pacific SIDS were not able to accurately calculate maximum sustainable yields and continued to set total allowable catch levels that justified more development. Weak governance and noncompliance with catch quotas weakened the sustainable management of tuna in the region. When individual states pursue different objectives based on their own interests, the effectiveness of regional management arrangements is minimized. Indeed, the success of regional tuna resource management arrangements depend on the similarity of objectives of member states and the compatibility of regional and national policies and strategies. This is an area that has to be looked at closely by Pacific SIDS.

A lack of quality data and uncertainties in stock assessment methods affect the effectiveness of the regional management regime. According to ISSF (2012), the WCPFC's observer program is not at the level to ensure compliance, as overfishing is annually reported at the WCPFC Convention but is difficult to manage. Indeed, the sovereign rights exercised by Pacific SIDS enhance their own national interests rather than the collective regional position.

Sustainable fisheries management initiatives

Innovative fisheries management arrangements are now being attempted in the Pacific Islands to safeguard valuable marine resources. Local communities are supporting their governments' resource management projects that are both in accordance with their own interests and global ideals such as ecosystem-based management,⁴ integrated coastal management,⁵ the precautionary principle,⁶ and sustainable development.⁷ These regional and subregional arrangements combine customary and traditional practices and contemporary science-based co-management methods

4. Ecosystem-based management refers to resource management that covers the ecosystem in which the targeted species live. This has evolved after people realized that it is difficult to manage species in isolation given their relations with and within their habitats.

5. Integrated resources management requires the involvement and collaboration of all stakeholders including governments, regional and subregional organizations, private sector companies, the communities that own the fisheries and the multitude of people with whom they share the resources, in the formulation and implementation of management activities. The system allows the consideration of the concerns of all stakeholders and the commitment to have a system that is fair to all of the people involved.

6. The precautionary principle emphasizes the need to manage resources even if there is no concrete scientific evidence that prompts them to do so. It came from the United Nations Conference on Environment and Development (also called the "Earth Summit", 1992) and argues that a lack of scientific data cannot be used to justify a lack of management activities.

7. Sustainable development is usually defined as development that allows present generations to meet their own needs without compromising the ability of future generations to meet theirs.

involving roles for local communities and their governments. For example, the Micronesia Challenge aims to declare marine protected areas (MPAs) over 30% of participant countries' marine areas by 2020, i.e., to reduce fishing effort in their waters and thereby enhance fisheries management. The Micronesia Challenge has secured much needed financial and technical support from the international community to fund community-based resource management activities such as the preparation, declaration, monitoring and control of their MPAs, which are part of the contribution to the national commitment.⁸

Similarly, the Melanesian Spearhead Group's Fisheries Technical Advisory Committee (MSG FTAC) has been mandated by Fiji, the Kanak Socialist National Liberation Front (FLNKS) of New Caledonia, Papua New Guinea, the Solomon Islands and Vanuatu to provide advice on common fisheries matters relating to the development of fisheries in ways that benefit the countries, coastal fisheries and aquaculture management, and the development and downstream processing of fishery products. The MSG FTAC has developed the MSG Road Map to concentrate its intervention in areas not covered by existing regional fisheries management arrangements. In 2014, it was part of the first regional Ministerial Beche-de-Mer and Coastal Fisheries Summit to find ways of improving the management of these fisheries that are vital for coastal communities.

A 2013 Greenpeace study proposed that Pacific SIDS should abandon the contemporary tuna fisheries development trend where they are spectators who receive only fishing access fees amounting to less than 10% of the value of the tuna fished from their waters. According to Greenpeace, the reliance on DWFNs, which presently control all activities from fishing to the marketing of fish commodities, will continue unless Pacific SIDS change to smaller scale and more labour intensive fishing methods. Such methods would be affordable and accessible to their people, who therefore would be able to target higher prices in the more lucrative sashimi markets rather than the low prices at canneries. Indeed, canneries are supporting the decimation of Pacific SIDS's tuna resources while offering only minute financial returns to these countries (Greenpeace 2013). Earlier on in this volume, Allain et al. mentioned the important role of eco-labelling in increasing the value of the PNA member countries' tuna resources and PNG's desire to bolster its pole-and-line fisheries and target the lucrative sashimi market.

These new development options should be carefully studied in Pacific SIDS as they strive to better control the use of their tuna resources, employ more of their citizens, and sustainably utilize their resources while attaining maximum returns from their fisheries resources. The lead taken by the PNA in implementing the Vessel Day Scheme (see Allain et al. in this volume), has increased the income of its member countries close to five times since the scheme was begun in 2010. This is a

8. See <http://themicronesiachallenge.blogspot.fr/> (Accessed on October 21, 2015).

good start that should be built on to change the way business is done in Pacific SIDS. According to the Chief Executive of the PNA and architect of its Vessel Day Scheme, Transform Aqorau (2014), creating scarcity was necessary to add value to PNA's resources. He also warned that finding a solution for overexploited resources such as sea cucumbers will not be easy but can start with the education of local people on the changes that need to be undertaken.

It is clear that policy changes are needed to ensure that the coastal and tuna resources are sustainably used while providing maximum returns to Pacific SIDS. Both coastal fisheries and tuna resources are important and are fully exploited, and in some cases overexploited. They need to be managed effectively to continue to provide the services they currently offer. Business as usual is not an option as Pacific SIDS must now make the difficult decisions and the sacrifices to sustain these sources of livelihood. As Dr. Aqorau recently reasoned, "If the U.S. can't afford to fish in our waters, won't invest with us, and doesn't like the tight controls in our waters, they should go back to fishing in the Eastern Pacific where they originally came from".⁹

Proposed policy changes

The policy changes being proposed here are general and can be adapted by individual Pacific SIDS to suit their specific context. Fisheries development in the atolls will be different from those in higher and larger islands states but the basic principles will be similar. The proposed policy changes include the formulation of an integrated sustainable fisheries development framework for the region, one that offers the individual governments appropriate options which they can choose from. The framework must address the known threats and hindrances that weaken resource management by fostering overexploitation. Existing CMMs must be implemented unilaterally with as few exemptions as possible. Governments, which are responsible for managing national resources, must be proactive and apply the precautionary principle whenever necessary. They must demonstrate political resolve. Resource assessment, marine scientific research and capacity building must be part of the new resource management framework with set procedures and processes to allow transparency in licensing, monitoring, surveillance and control activities.

A carefully coordinated and integrated sustainable fisheries development framework must be formulated for the national governments in the region to use to suit their situation. Pacific SIDS must collaborate to exercise effective control to prevent the depletion of coastal and tuna resources. These countries must make the right

9. PNA media release in *Samoa News*, 21 March 2015, entitled "PNA to New Zealand and U.S. tuna industry: 'If you don't want to play by the rules, fish elsewhere'", <http://www.samoanews.com/content/en/pna-new-zealand-and-us-tuna-industry-%E2%80%99if-you-don%E2%80%99t-want-to-play-by-rules-fish-elsewhere%E2%80%99> (Accessed on October 20, 2015).

choices knowing that little can be accomplished by most of them if the fisheries resources that feed their people and support their economies are lost. Government agencies need to work closely with each other as well as with nongovernmental organizations, civil society and international development agencies to ensure that optimum benefits accrue to the Pacific SIDS and people, who in turn must uphold the health and integrity of their fisheries resources.

Pacific SIDS need to focus attention on formulating their national ocean policies to reflect the principles of the Pacific Islands Regional Ocean Policy (PIROP) that was presented to the World Summit on Sustainable Development (WSSD) in 2002. PIROP proposes the safeguard of a “healthy Ocean that sustains the livelihood and aspirations of Pacific Island communities”¹⁰ and provides a principled approach to responsible ocean governance in the region. The “Pacific Oceanscape” emphasised resource management patterned along the Phoenix Islands Protected Area (PIPA), the world’s largest MPA at the time. The consequent declaration of even larger management areas in the Cook Islands, Tokelau and New Caledonia, and the appointment of an Ocean Commissioner at the Pacific Islands Forum, all demonstrate the commitment in the Pacific region to better manage the ocean because of its importance to Pacific Islanders and the world.

At the 2012 Pacific Forum, Henry Puna, the Prime Minister of the Cook Islands, prompted the leaders of other Pacific Island countries to consider a rethink of their shared identity within the Pacific saying: “it is time that we break the mould that defines us too narrowly and limits us in any way”. Puna called for a recasting of regional identity to one of “Large Ocean Island States”: “Our large ocean island states should demonstrate — now more than ever — renewed commitment to define our future in our own terms. Our intimate and connected relationship is built from a deep spiritual bond and translated across an expanse of ocean in unique and traditional ways”.¹¹ This rhetoric relates directly to the ideas that Epeli Hau’ofa (1993, 2000) articulated.

Sustainable fisheries development is the only way forward for Pacific SIDS. The prospects for the future are not good if current practices, where fisheries development is single-mindedly pursued and management is attempted only after signs of fish stock depletion are encountered, are continued. Fisheries resources are potentially sustainable but this depends only on the effectiveness of the resource management arrangements in place. The experience in the Pacific SIDS in this regard is mixed and now more challenging. The countries have succeeded in formulating conservation and management measures but have not been effective in the implementation of these arrangements to allow for the sustainable use of their fisheries resources.

10. See http://innri.unuftp.is/short_courses/pp_samoao8a/International_Instruments/2004_Pacific_Islands_Regional_Ocean_Policy.pdf (Accessed on November 26, 2015).

11. See *Fiji Times*, 31 October 2012.

Overall changes are needed in the reactive management approach that does not effectively control the use of the region's fisheries resources. Pacific SIDS must now take stock of what they need to ensure the sustainability of their fisheries resources. They have acquired a lot of invaluable lessons through their earlier experiences with their management arrangements to know what works and what does not. The banning of driftnet fishing from the Pacific, the Multilateral Treaty with the US and the PNA's Vessel Day Scheme all demonstrate the improvements that Pacific SIDS can attain when they collaborate.

They need to dedicate themselves to their regional positions on the sustainable use of their fisheries resources to better serve their people and the marine environment. It is sad to note that the issues mentioned here are exactly what Hau'ofa (1993, 2000) warned would arise if countries did not have a strong regional identity or work together for the common good. To maximize their returns from the use of their fisheries resources while preventing the deterioration of fish stock in the region, Pacific SIDS must make serious attempts to protect their fisheries resources and the quality of their marine environment. Pollution, overfishing and the alteration of natural habitats should be effectively addressed using available science and technology. Legislation and regulations on the control of sources of land-based pollution should be closely monitored and enforced by relevant agencies while innovative techniques such as rehabilitation of coastal habitats, re-seeding with the introduction into the wild of organisms spawned and bred in laboratories and research stations, aquaculture and mariculture can be promoted in appropriate situations to maintain and stimulate the recovery of fisheries resources.

Resource monitoring, control and surveillance should be the basis for sustainable fisheries development. Customary fishing rights and national fisheries areas should be regularly surveyed and assessed biologically to determine the guidelines for their sustainable use. The assessments should provide the maximum number and type of licenses that can be offered in these areas. More concerted attempts should be made to record the coastal fisheries catches from national waters. This can be best done at the markets and at the village and island levels. For effective management, fisheries managers at all of the different levels, from individual fishers to their villages and island councils, provincial, national, regional governments right up to regional fisheries management organisations such as the WCPFC, need to know the amount of fish they have and those that are taken from their fishing grounds.

Scientific research should be made the basis of fisheries development. Catch data in relation to the number of fishers in different fishing grounds should be closely monitored to guide fisheries development. It is also important to promote and support local research capacity and to act swiftly to address the sustainable development issues raised by researchers.

Governments should establish reliable and up-to-date databases and information systems to assist in decision-making. The number and type of fisheries and coastal

and offshore development licenses granted for any area should be based on scientific research and data, which should be used to closely monitor the state of the fisheries and the marine environment. It is important that fish catch records are accurately recorded and updated to guide decision-making and management. The provision of catch data should be made a condition of a fishing license, while environment impact assessment reports on the impacts of human activities on fisheries resources should be expected from all proponents of coastal and offshore development. An environmental impact assessment process and model used in Fiji could be adopted to determine the impact of fishing activities. The model used in Fiji includes the following processes:

- The Department of Environment calls for the prequalification process of qualified private consultants to carry out environmental impact assessment work;
- Applicants are assessed and those that meet the selection criteria are approved and registered under the Department of Environment database; and the approved list is printed in the local newspaper for public use;
- Prior to implementing any development project, it is the responsibility of the developer to obtain an environmental impact assessment report signed by one of the approved consultants; and
- The development proposal (with environmental impact assessment report) is then submitted to the Department of Environment for final assessment.

Thorough consultation with appropriate training and follow-up support with all stakeholders should be provided to the people involved in fisheries development and management initiatives. Participants at training events should be carefully picked using objective selection criteria that take into consideration the applicants' experience and suitability to the project's aims and objectives. This will ensure that training is provided to the most deserving candidates who will perform well in the training and in the project activities. Training should improve the participants' understanding of the development activities they are involved in and how their activities relate to the management of fisheries resources. Development assistance must be offered only to people that have been adequately trained, have prior experience in fisheries and have the enabling conditions to succeed with the development activity they want to be involved in.

The process of granting fisheries development licenses and permits should be standardized, transparent and well controlled. Proportions of the standard fees that are set and collected by governments should be shared with the owners of the customary fishing areas who need to not only know the other stakeholders with whom they share their fishing grounds, but also to have the resources to actively monitor and control the activities within their fishing areas. Sustainable development and the precautionary principles must be emphasized at all levels of governance to ensure the effective management of fisheries resources.

Governments must provide the enabling environment to allow other stakeholders such as fishers, tourist operators, customary owners, the private sector, and civil society organizations to be involved in the sustainable development and marketing of fish and fish products. There is a need to improve the use and value of current fish catch through improved postharvest processing. The sale of raw tuna and the increasing import of canned tuna, which is many times more expensive than the exported raw tuna, have driven the domestication aspirations and policies of many regional governments. While this is important, it must be done properly and for the right reasons. The involvement of the private sector will enhance this transition to develop sustainable marine fisheries to maximize returns on the use of fisheries resources.

Governments should avoid the introduction of unilateral projects and must formulate a new system of development funding instead of emphasising three to five-year funding periods. The changes that are necessary for sustainable fisheries development cannot be rushed and must be sensitive to local contexts. In many local communities across the Pacific SIDS, local people have customary resource management practices such as the periodic declaration of no-take areas for a given purpose that can be used for the promotion of sustainable fisheries. The new system of development funding must emphasise sustainable fisheries development by tightly controlling the optimal use of fisheries that maximizes the return on the effort and minimizes the failures. The new funding agencies must conduct technical, managerial and financial evaluation of proposed sustainable fishing ventures and should provide the funds whenever appropriate to people and groups who are prepared to be involved in the development activity.

Pacific SIDS need to commit to their conservation and management measures, which are there to protect their fisheries, countries and communities. Resource depletion has to be effectively controlled before it causes irreversible damage to the fish stock, the fishing industry, and the local and international communities. Pacific SIDS should learn from their ancestors who would take unanimous resource management decision when the need arose. There should be no exemptions and special considerations when it comes to resource management and people should be well rewarded only if they are devoted to their resource management arrangements.

Conclusion

Pacific SIDS must determine whether their future is with the continuation of the current status quo, where resources are threatened with overfishing and countries are complaining about the inequitable share they receive for the use of their fisheries resources while their resources plummet to extinction, as has happened elsewhere in the world in the past, or whether they wish to bring about holistic changes that will provide more returns in terms of control of fishing activities, sustainable use of fisheries,

employment, and income. Moreover, the expected devastation associated with global challenges such as climate change, ever increasing population growth, worsening poverty, food insecurity and irreversible environment changes will demand the total engagement, solidarity and commitment of all Pacific SIDS to sustainable fisheries resources. These countries must work together or they will fail to effectively protect their coastal and tuna fisheries because they are dependent on these resources, rely on their use by outsiders, and are limited in their power to exert effective control on their own.

The attainment of sustainable development in coastal and tuna fisheries has not been satisfactory up to now. Both of these important sectors are now seriously threatened by overexploitation, resource depletion and environmental degradation. The development of the two sectors has not offered the outcomes that Pacific SIDS envisaged. The number of initiatives that have failed in the two sectors are also indicative of the need to adopt a new fisheries management approach — one that is more appropriate to the socioeconomic conditions in Pacific SIDS and conducive to more successful and equitable fisheries development.

Pacific SIDS need to take difficult decisions such as the declaration of marine protected areas in parts of their EEZs to reduce the fishing effort and thereby boost productivity and production when such outcomes are needed. These countries and their fisheries resources are now at the juncture where actions more than plans are expected to save their coastal and tuna fisheries resources. Experiences in other regions such as Canada have demonstrated that resource conservation will always be easier and cheaper than environmental repair, clean up, rehabilitation and restocking. Moreover, the changes that occur as a consequence of overfishing associated with global changes such as climate change and population growth may result in the irreversible degradation of ecosystems.

The management of coastal and tuna fisheries needs to be improved. The long-term solution lies with Pacific SIDS and the choices they make, particularly with regard to their relations with DWFNs. They have achieved remarkable success in the past that should serve them well as they move into the future. They now must rise to the challenge because the price of failure for them, the fisheries and the international community will be unbearable.

References

- Amoe, Jone
 2006 Fiji Tuna Fisheries. Second Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Manila, Philippines, 7-18 August 2006. Annual Report, Part I – Information on Fisheries, Research and Statistics, Fiji Islands.
- Anderson, Edward, Brad Judson, Sione Tu’itupou Fotu, and Batiri Thaman
 2003 Marine Pollution Risk Assessment for the Pacific Islands Region (PACPOL Project RA1), Volume 1: Main Report for Marine Pollution Programme, South Pacific Regional Environment Program (SPREP). Apia: SPREP.
- Aqorau, Transform
 2014 Tragedy of the Commons. Presentation at the Beche-de-Mer and Coastal Fisheries Summit in Nadi, Fiji, 7 August 2014.
- Aqorau, Transform, and Anthony Bergin
 1997a “The Federated States of Micronesia Arrangement for Regional Fisheries Access”. *The International Journal of Marine and Coastal Law*, 12(1): 37-80.
 1997b “Ocean Governance in the Western Pacific Purse Seine Fishery – the Palau Arrangement”. *Marine Policy*, 21(2): 173-186.
 1998 “The UN Fish Stocks Agreement – A New Era for International Cooperation to Conserve Tuna in the Central Western Pacific”. *Ocean Development and International Law*, 29(1): 21-42.
- Atuna
 2012 [Online]. “ISSF Wants Tuna Fishing Ban in WCP”, <http://www.atuna.com/NewsArchive/ViewArticle.asp?ID=12157>.
- AusAID
 2008 o8 Pacific Economic Survey: Connecting the Region. Canberra: AusAID.
- Barnett, J.
 2002 “Environmental Change and Human Security in Pacific Island Countries”. *Development Bulletin*, 58: 28-32.
- Bayliss-Smith, Tim, Richard Bedford, Harold Brookfield, and Marc Latham
 1988 *Islands, Islanders and the World: The Colonial and Post-Colonial Experience of Eastern Fiji*. Cambridge: Cambridge University Press.
- Carleton, Crick
 1983 Guidelines for Establishment and Management of Collection, Handling, Processing and Marketing Facilities for the Artisanal Fisheries Sector in the South Pacific Commission Area. Noumea: SPC/Fisheries 15/WP6, <http://www.spc.int/DigitalLibrary/Doc/FAME/Meetings/RTMF/15/WP6.pdf> (Accessed on November 11, 2015).
- Carleton, Crick, John Hambrey, Hugh Govan, Paul Medley, and Jeff Kinch
 2013 “Effective Management of Sea Cucumber Fisheries and the Beche-de-Mer Trade in Melanesia”. *SPC Fisheries Newsletter*, #140 – January/April 2013: 24-42, http://www.spc.int/DigitalLibrary/Doc/FAME/InfoBull/FishNews/140/FishNews140_24_ Carleton.pdf (Accessed on November 11, 2015).

Coates, Barry

2009 "Getting Serious about Achieving the Millennium Development Goals in the Pacific: Strengthening Economic Development". *Policy Quarterly*, 5(3): 28-37.

Elbourne, Fred

2012 "Harvest Limit Wishful Thinking: Southwick". *Fiji Times*, 17 May 2012.

Evening, Charles S.

1983 The 'West' Hurricane Oscar Fisheries Rehabilitation Programme Report. Lautoka: Fisheries Division.

Food and Agriculture Organization of the United Nations (FAO)

2009 National Fishery Sector Overview – Fiji. Fishery and Aquaculture Country Profile, ftp://ftp.fao.org/fi/document/fcp/en/FI_CP_FJ.pdf (Accessed on November 11, 2015).

Fiji's Central Planning Office

1985 Fiji's Ninth Development Plan 1986-1990: DP 9 policies, strategies and programmes for national development. Suva: Fiji's Central Planning Office.

Fiji Government

2014 Annual Scientific Report to the Western and Central Pacific Fisheries Commission, Part 1 – Information on Fisheries, Research and Statistics for 2013, Fiji. 10th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Majuro, Marshall Islands, 6-14 August 2014 (WCPFC-SC10-AR, CCM-07), <https://www.wcpfc.int/node/18574> (Accessed on November 18, 2015).

Geen, Gerry

1994 Tuna Industry Development in the South Pacific: A Coordinated Approach. FFA Report 94/19. Honiara: Forum Fisheries Agency, http://www.spc.int/DigitalLibrary/Doc/FAME/FFA/Reports/FFA_1994_019.pdf (Accessed on November 18, 2015).

Gillett, Robert

2003 Domestic Tuna Industry Development in the Pacific Islands: The Current Situation and Considerations for Future Development Assistance. FFA Report 03/01. Honiara: Forum Fisheries Agency, http://www.spc.int/DigitalLibrary/Doc/FAME/FFA/Reports/FFA_2003_001.pdf (Accessed on November 18, 2015).

2008 *A study of Tuna Industry Development Aspirations of FFA Member Countries*. Honiara: Forum Fisheries Agency.

2009 Fisheries in the Economies of Pacific Island Countries and Territories. Mandaluyong City, Philippines: Asian Development Bank.

2010 "Fisheries Centres in the Pacific Islands: Lessons Learned". SPC Fisheries Newsletter, #133 – September/December 2010: 29-34, http://www.spc.int/DigitalLibrary/Doc/FAME/InfoBull/FishNews/133/FishNews133_29_Gillett.pdf (Accessed on November 18, 2015).

2011 Fisheries of the Pacific Islands: Regional and National Information. RAP Publication 2011/03. Bangkok: FAO, Regional Office for Asia-Pacific, <http://www.fao.org/docrep/014/i2092e/i2092e00.pdf> (Accessed on November 18, 2015).

- Gillett, Robert, Antony Lewis, and Ian Cartwright
 2014 Coastal Fisheries in Fiji. Resources, Issues and Enhancing the Roles of the Fisheries Department. David and Lucille Packard Foundation, <http://www.gillettprestonassociates.com/GPA%20%20Review%20of%20Fiji%20Coastal%20Fisheries.pdf> (Accessed on November 18, 2015).
- Greenpeace
 2013 Transforming Tuna Fisheries in Pacific Island Countries. An Alternative Model of Development. Ultimo, NSW: Greenpeace Australia-Pacific.
- Hampton, John, and Shelton Harley
 2009 Assessment of the Potential Implications of Application of CMM 2008 – 01 for Bigeye and Yellowfin Tuna. Fifth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Port Villa, Vanuatu, 10-21 August 2009 (WCPFC-SC5-2009, GN-WP-17), <http://www.wcpfc.int/system/files/WCPFC-SC5-2009-GN-WP-17%20%205BAssessment%20of%20CMM-2008-01%20D.pdf> (Accessed on November 18, 2015).
- Hau'ofa, Epeli
 1993 "Our Sea of Islands". In E. Waddell, V. Naidu and E. Hau'ofa (eds.), *A New Oceania: Rediscovering our Sea of Islands*. Suva: Beake House, p. 2-16.
 2000 "The Ocean in Us". In A. Hooper (ed.), *Culture and Sustainable Development in the Pacific*. Canberra: ANU E Press and Asia Pacific Press, p. 32-43.
- Holdsworth, John
 2012 Yellowfin Tuna Fisheries in New Zealand and the Southwest Pacific Ocean. Eighth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Busan, Republic of Korea, 7-15 August 2012 (WCPFC-SC8-2012, SA-IP-04), <http://www.wcpfc.int/system/files/SA-IP-04-Yellowfin-Tuna-Fisheries-New-Zealand-and-SW-Pacific-Ocean.pdf> (Accessed on November 18, 2015).
- ISSF (International Seafood Sustainability Foundation)
 2012 Cordoba Conference on the Allocation of Property Rights in Global Tuna Fisheries.
- Joint Fisheries Strategy Mission
 1988 Opportunity for Fisheries Development Assistance in the South Pacific. A Regional Mission Undertaken by FFA, SPC, UNDP, FAO, USAID and BDDP (2 volumes).
- Kailola, Patricia J.
 1995 Review of Policies and Initiatives to Enhance Fisheries Management and Development in Fiji. Rome: FAO.
- Lang, Marta
 2008 Report of a South Pacific Fisheries Study Tour to Papua New Guinea, Vanuatu and Samoa, November 2008. London: Commonwealth Policy Studies Unit, University of London, in association with the Commonwealth Human Ecology Council and Commonwealth Foundation, <http://www.commonwealthfisheries.org/admin/downloads/docs/Pacific%20Ocean%20Study%20Tour%20Report%20FINAL.pdf> (Accessed on November 18, 2015).
- Laurenti, G. (comp.)
 2007 Fish and Fishery Products. World Apparent Consumption Statistics Based on Food Balance Sheets (1961-2003). Rome: FAO (Fisheries Circular N°821, Rev.8).

- Le Borgne, Robert, Valérie Allain, Shane P. Griffiths, Richard J. Matear, A. David McKinnon, Anthony J. Richardson, and Jock W. Young
 2011 "Vulnerability of Open Ocean Food Webs in the Tropical Pacific to Climate Change". In J.D. Bell, J.E. Johnson and A.J. Hobday (eds.), *Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change*. Noumea: Secretariat of the Pacific Community, p. 189-250, <http://cdn.spc.int/climate-change/fisheries/assessment/chapters/4-Chapter4.pdf> (Accessed on November 11, 2015).
- Lodge, Michael W.
 1998 "The Development of the Palau Arrangement for the Management of the Western Central Pacific Purse Seine Fishery", *Marine Policy*, 22(1):1-28.
- Maxwell J.G.H., and A.D. Owen
 1995 South Pacific Tuna Fisheries Study. Canberra: Australian Agency for International Development.
- Nunn, Patrick D.
 2010 "Bridging the Gulf Between Science and Society: Imperatives for Minimizing Societal Disruption from Climate Change in the Pacific". In A. Sumi et al. (eds.), *Adaptation and Mitigation Strategies for Climate Change*. Tokyo: Springer, p. 233-248.
- Pacific Community (SPC)
 2008 Pacific Islands Regional Coastal Fisheries Management Policy and Strategic Actions (Apia Policy) (2008-2013). Noumea: SPC, http://www.spc.int/DigitalLibrary/Doc/FAME/Reports/Anon_2008_ApiaPolicy.pdf (Accessed on November 18, 2015).
- Philipson, Peter W.
 2008 Lessons Learned: A Review of Successes and Failures in Tuna Fisheries Development in the Pacific Islands. DEVFISH Project, FFA, SPC, http://www.spc.int/DigitalLibrary/Doc/FAME/FFA/Reports/FFA_2008_013.pdf (Accessed on November 18, 2015).
- Pita, Elisala
 1996 Development of a Multi-Disciplinary Masterplan for the Sustainable Management and Development of Fiji's Inshore Fisheries Resources. Rome: FAO.
- Ram-Bidesi, Vina
 2003 Domestication of Tuna Industry in the Pacific Islands: An Analysis of Regional and National Strategies. PhD Thesis. NSW: University of Wollongong.
- Rawlinson, N.J.F., D.A. Milton, S.J.M. Blaber, A. Sesewa, and S.P. Sharma
 1995 A Survey of the Subsistence and Artisanal Fisheries in the Rural Area of Viti Levu, Fiji. Suva: Fisheries Division, Ministry of Agriculture, Forests and Fisheries; Cleveland: Division of Fisheries, CSIRO; http://aciarc.gov.au/files/node/2217/mn35_pdf_78957.pdf (Accessed on November 18, 2015).
- Redding, Stephen, and Anthony Venables
 2004 "Economic Geography and International Inequality". *Journal of International Economics*, 62(1): 53-82.

Tarte, Sandra

1998 *Japan's Aid Diplomacy and the Pacific Islands*. Canberra: Australian National University; Suva: University of the South Pacific.

Tavaga, Netani

2012 Annual Scientific Report to the Western Central Pacific Fisheries Commission, Part 1 – Information on Fisheries, Research and Statistics for 2011. Eighth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Busan, Republic of Korea, 7-15 August 2012 (WCPFC-SC8-AR, CCM-07), <https://www.wcpfc.int/system/files/AR-CCM-07-Fiji.pdf> (Accessed on November 18, 2015).

UNESCAP (United Nations Economic and Social Commission for Asia and the Pacific)

2010 Sustainable Development in the Pacific: Progress and Challenges. Pacific Regional Report for the 5-Year Review of the Mauritius Strategy for Further Implementation of the Barbados Programme of Action for Sustainable Development of SIDS (MSI+5). Suva: ESCAP Sub-regional Office for the Pacific.

Usu, Thomas, Brian Kumasi, and Leontine Baje

2012 Annual Report to the Commission, Part 1 – Information on Fisheries, Research and Statistics 2011, Papua New Guinea. Eighth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Busan, Republic of Korea, 7-15 August 2012 (WCPFC-SC8-AR, CCM-18), <http://www.spc.int/DigitalLibrary/Doc/FAME/Meetings/WCPFC/SC8/AR-CCM-18.pdf> (Accessed on November 18, 2015).

Veitayaki, Joeli, Akosita Nakoro, Tareguci Sigarua, and Nanise Bulai

2011 "On Cultural Factors and Marine Managed Areas in Fiji". In J. Liston, G.R. Clark and D. Alexander (eds.), *Pacific Island Heritage: Archaeology, Identity and Community*. Canberra: ANU E-Press, p. 37-49.

Waugh, Geoffrey

1986 *The Development of Fisheries in the South Pacific Region with Reference to Fiji, Solomon Islands, Vanuatu, Western Samoa and Tonga*. Canberra: National Centre for Development Studies, Australian National University.

Western and Central Pacific Fisheries Commission (WCPFC)

2009 Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean – Summary Report. Fifth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Port Vila, Vanuatu, 10-21 August 2009, <https://www.wcpfc.int/meetings/5th-regular-session-scientific-committee> (Accessed on November 18, 2015).

Williams, Peter G., and Peter Terawasi

2014 Overview of Tuna Fisheries in the Western and Central Pacific Ocean, Including Economic Conditions – 2013. 10th Meeting of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Majuro, Marshall Islands, 6-14 August 2014 (WCPFC-SC10-2014, GN-WP-01).

World Bank

1996 *The World Bank annual report 1996*. Washington DC: World Bank,

<http://documents.worldbank.org/curated/en/1996/08/442241/world-bank-annual-report-1996> (Accessed on November 18, 2015), Section 3 – Subsection “Private Sector Development”, p. 61-69.



The Authors

Valérie ALLAIN is a fisheries research scientist at the Pacific Community (SPC). Her domains of expertise include fish biology and ecology, ecosystem functioning, fisheries, and climate change impact. After studying the deep sea fish populations exploited by trawl fisheries in the north-east Atlantic, she moved to the Pacific where she has spent the last 15 years working on the tuna fisheries of the Western and Central Pacific Ocean. Her work has particularly focused on understanding the tuna ecosystem through studies of the trophic interactions between fish species as well as an analysis of the various compartments of this ecosystem, from primary producers to top predators. She has also studied the impact of seamounts on tuna catches, tuna fisheries by catches, and tuna movement and ecosystem organization through biological markers such as mercury and stable isotopes. Her recent publications include several co-authored articles in specialised journals, such as *Deep Sea Research Part II: Topical Studies in Oceanography* (Volume 113, 2015), and in multidisciplinary scientific journals, such as *PLoS ONE* (Volume 7(5), 2012) and *Proceedings of the National Academy of Science US* (Volume 107(21), 2010). They also include contributions to SPC's publications on various topics, for instance the vulnerability of open ocean food webs to climate change in the tropical Pacific (Chapter 4 in *Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change*, edited by J.D. Bell, J.E. Johnson and A.J. Hobday, 2011, <http://www.spc.int/climate-change/fisheries/assessment/main-book.html>).

Tamatoa BAMBRIDGE is an anthropologist and CNRS (French National Centre for Scientific Research) Senior Researcher at CRIOBE, Centre de Recherches Insulaires et Observatoire de l'Environnement, Moorea, French Polynesia. His research focuses on the relations between society and environment in Eastern Polynesia, in particular on traditional Polynesian management of the land and the sea. He recently published *Rahui in Polynesia. Legal Pluralism in Environmental Management* (2015, ANU Press).

Sarah BERNARD holds a Master of Environmental Anthropology from the French National Museum of Natural History as well as a master's degree from the College of International Agro-Development (ISTOM). In 2014, she spent six months in New Caledonia as an intern at IRD (Research Institute for Development) and GIE Oceanide (an economic interest group offering expertise in territory development in ocean and island environments) in Noumea.

Samuel CORNIER holds a degree in marine engineering (SeaTech, Toulon, France) and a Master of Physical and Coastal Oceanography (COM, Marseille, France). In 2006 he started ethnographic research in New Caledonia on Kanak traditional

systems of sea management and emerging modes of governance of the marine environment. Based on a methodological approach combining political ecology, cultural technology and marine ethnobiology, his research focuses on relations between society and environment, marine biodiversity conservation, marine protected areas, and complex interactions between Kanak cosmopolitical systems and exogenous conservation and development policies. Since the inscription of six marine clusters in the lagoons of New Caledonia on the World Heritage List in 2008, and with the support of the Yambé tribe, he has been interested in the social issues and controversies associated with the Hyabé/Lé-Jao marine protected area. Between 2010 and 2013, he conducted several field investigations in New Caledonia funded by “Labex Corail” (a cluster of excellence on coral reefs and global changes), CREDO and LACITO.

Paul D’ARCY teaches Pacific, Asian, and environmental studies in the College of Asia and the Pacific at the Australian National University (ANU). After graduating with a degree in Pacific and African history from Otago University in Aotearoa/New Zealand, he studied at the University of Hawai’i in Manoa and worked as an archaeologist and for Television New Zealand before completing his MA at Otago and PhD at ANU. His current teaching and research focus on the problems and benefits of interdisciplinary collaboration and the history of conflict and conflict resolution in the Asia Pacific region, especially conflicts over natural resources with particular reference to the Pacific Ocean. In 2016, Paul will publish with Polity Press the first general environmental history of the Pacific Ocean, encompassing its geological history from the start of the Anthropocene up to the present.

Gilbert DAVID is an IRD Senior Researcher (UMR Espace pour le Développement) based in Montpellier, France. As a geographer of the sea and islands, between 1983 and 1991 he studied the development of artisanal fisheries in Vanuatu and the role of village fisheries in this country’s food security. In 1992, after two years as the head of the research branch at ORSTOM/Fisheries Service in Port Vila, he moved to New Caledonia to work on its spatial and economic rebalancing following the Matignon-Oudinot Accords (1988). Since 1997, he has conducted research on integrated coastal area management of Indian and Pacific Ocean Islands, ecosystem services of coral reefs and mangroves, marine protected areas, and village communities’ adaptation to the constraints imposed by insularity. From 2005 to 2009, as part of the CRISP (Coral Reef Initiative for the South Pacific) programme, he coordinated the GERSA project (GEstion intégrée du continuum bassins versants — Récifs coralliens : du Satellite à l’Acteur) focused on integrated management of the continuum watershed — coral reefs in Fiji, New Caledonia, French Polynesia and Vanuatu. Gilbert co-authored the *Coastal Fisheries Atlas of Vanuatu* (2001, IRD Editions), co-edited the volume, *La Nouvelle-Calédonie à la croisée des chemins* (1999, Société

des Océanistes/IRD), participated in the development of the UNESCO methodological guide, *Steps and Tools Towards Integrated Coastal Area Management* (2001, UNESCO), and edited the book, *Espaces tropicaux et risques, du local au global* (2004, Presses Universitaires d'Orléans).

Elodie FACHE is an anthropologist who has conducted research since 2007 on policies and projects combining objectives of environmental conservation, sustainable development and local empowerment in northern Australia. Her PhD thesis, “Ecological Imperialism or Development? The Actors of Natural Resource Management in Ngukurr, Australia” (2013), offers a critical analysis of so-called “community-based natural resource management” initiatives implemented in this region. Her recent publications demonstrate that such initiatives involve complementary processes of mediation (e.g., *Journal de la Société des Océanistes* 132(1), 2011) and bureaucratisation (e.g., *Anthropological Forum* 24(3), 2014) and are extremely complex as they rely on systems of interaction between many social actors, levels of decision-making and action, and rationales (e.g., *Journal of Ethnobiology* 35(1), 2015, with Bernard Moizo). Élodie was also part of the French team (Aix-Marseille University/CREDO) of the EU-funded ECOPAS project (European Consortium for Pacific Studies, 2012-2015). In 2016-2017, she will conduct postdoctoral research on “community-based” management of coral reefs in Fiji at IRD (UMR GRED).

Yan GIRON is an engineer in agronomy specialised in the management and development of maritime fisheries. He has been working for 20 years in the domains of food production for sustainable food security, maritime economic intelligence, and strategy consulting in the Atlantic, Indian and Pacific Oceans, both at national and international levels. His expertise regarding the sustainable development of maritime potentials focuses on capacity-building, the optimisation of formal and informal activities, the creation of tailored methodologies, and the implementation of network approaches. In the domain of strategy, he is interested in public and private plays for power and geopolitical and geostrategic issues. He is also involved in strategic assistance, within and beyond the maritime sector, in the context of enterprises, industries, territories, national policies, and international fora. In parallel with his presentations in scholarly and public contexts, Yan animates the blog <http://bluelobby.eu/>.

John HAMPTON has worked for more than 30 years in the area of tuna biology and ecology, stock assessment and fisheries management. He joined SPC in 1987 after having worked for seven years at the Commonwealth Scientific and Industrial Research Organisation (CSIRO, Australia) on the stock assessment of southern bluefin tuna. He has been instrumental in the implementation of formal assessments for tuna stocks in the western and central Pacific Ocean. Since 2002, he has been the Chief Scientist of the Oceanic Fisheries Programme (OFP) at SPC, one of the world's most respected

pelagic fisheries research programmes and the key provider of scientific services and advice regarding tuna fisheries to the island states and territories of the Pacific, the Forum Fisheries Agency (FFA) and the Western and Central Pacific Fisheries Commission (WCPFC). His key references include articles in *Nature* (Volumes 389, 1997 and 434, 2005), the *Canadian Journal of Fisheries and Aquatic Sciences* (Volumes 55(9), 1998 and 57(5), 2000), and *Science* (Volume 314(5806), 2006).

Shelton HARLEY is currently the Principal Fisheries Scientist and team leader of the Stock Assessment and Modelling section within the Oceanic Fisheries Programme (OFP) at SPC. His team is responsible for undertaking stock assessments for the major tuna stocks in the Western and Central Pacific Ocean. Shelton has 14 years of experience in Pacific tuna fisheries science. In addition to his time at SPC, he was New Zealand's scientific representative for the Western and Central Pacific Fisheries Commission (WCPFC) and the Commission for the Conservation of the Southern Bluefin Tuna (CCSBT) from 2004 to 2008. He also worked as a scientist at the Inter-American Tropical Tuna Commission.

Nathalie HILMI is a specialist in macroeconomics and international finance. In 2010, she joined the Centre Scientifique de Monaco as the head of the environmental economics section and collaborated with the International Atomic Energy Agency's (IAEA) Environment Laboratories to initiate correlation studies between environmental sciences and economics and, thereby, better evaluate the socioeconomic extent of impacts and costs of action versus inaction with regard to carbon emissions. In 2011, she obtained her accreditation to supervise research (HDR) on "Multidisciplinary and Sustainable Development". Her research area encompasses economic impacts of climate change and ocean acidification, evaluation of ecosystem services, such as those offered by coral reefs, sustainable development and environmental policies.

Isabelle LEBLIC is an ethnologist and CNRS Senior Researcher at LACITO (Langues et Civilisations à Tradition Orale), Paris, France. She initiated her research in maritime anthropology in 1979 with her PhD study focused on a small French island (Molène, Bretagne) whose whole history is based on the exploitation of the sea (see *Molène, une île tournée vers la mer*, 2007, Peeters). Since 1982, she has been conducting research in maritime anthropology in New Caledonia, specifically with the Kanak fishing clans of southern New Caledonia. The findings of her research have been disseminated in numerous publications over the years, including the summary book, *Vivre de la mer, vivre avec la terre... en pays kanak. Savoirs et techniques des pêcheurs kanak du sud de la Nouvelle-Calédonie* (2008, Société des Océanistes). Since 1989, she has also oriented her field studies on social change and development projects in New Caledonia, particularly in Ponérihouen (see *Les Kanak face au développement. La voie étroite*, 1993, Presses Universitaires de Grenoble). In parallel, she has worked

on kinship and adoption in the Paicî area through the comprehensive documentation and analysis of clan genealogies. Among other publications on this topic and, more generally, in the field of the anthropology of kinship and childhood, she edited the volume, *De l'adoption. Des pratiques de filiations différentes* (2004, Presses Universitaires Blaise Pascal), and co-edited with Chantal Collard a special issue of the journal *Anthropologie et Sociétés* on childhood at risk (Volume 33(1), 2009). In addition, she has worked on cultural technology and, in this research field, she co-edited a double special issue of the *Journal de la Société des Océanistes* (volume 136–137, 2013) on the “immaterial” components of “material” culture. Isabelle has also been the editor of this journal since 2004.

Esaroma LEDUA is involved in marine resource management activities and advises the Cakaudrove/Tunuloa Customary Fishing Rights Owners Trust, Vanua Levu, Fiji. He also teaches at the School of Marine Studies, University of the South Pacific, Suva, Fiji. After graduating from the University of the South Pacific in 1983, he joined the Fisheries Department of the Ministry of Primary Industries in Fiji as a research worker specializing in giant clam population field surveys on Fijian reefs. Later, realizing that many reef food fishes and shellfish were overfished in Fiji, he expanded his interest into aquaculture. It was in this capacity that he designed the Makogai Mariculture Research Station and the successful breeding of giant clams, trochus, turtles, oysters, milkfish and other species. He graduated from Stirling University, Scotland, with a Master of Science degree in Aquaculture in 1994 and became the head of Fisheries Research and Development Programmes in Fiji. Esaroma also worked for SPC as an Integrated Fisheries Management Associate and Inshore Fisheries Scientist. In 2012, convinced that tuna was overfished in Fiji, he enrolled at the University of the South Pacific and completed a PhD thesis, “Evaluating the Tuna Fisheries Management Framework in Fiji”.

Simon NICOL is currently the Principal Fisheries Scientist and team leader of the Ecosystem Monitoring and Analyses section within the Oceanic Fisheries Programme (OFP) at SPC. He undertakes primary research and analyses on tuna species and the ecosystem they are dependent upon in the Western and Central Pacific Ocean. This work encompasses life-history studies, tagging to estimate exploitation and movement rates, trophic ecology, and the modelling of ecosystem dynamics and climate impacts. He has over 25 years of experience in the field of ecology and has worked closely with senior resource managers, scientists and industry representatives on matters ranging from the implementation and interpretation of applied research to the modelling of ecosystems and applications of adaptive management. His key references include articles in scientific journals such as *Climatic Change* (Volume 119(1), 2013), *Deep Sea Research Part II: Topical Studies in Oceanography* (Volume 113, 2015), and *Fish and Fisheries* (doi: 10.1111/faf.12126, 2015).

Simonne PAUWELS is an anthropologist and CNRS Researcher at CREDO, Centre de Recherche et de Documentation sur l'Océanie (AMU-CNRS-EHESS), Marseille, France. She conducted research in the Tanimbar archipelago in eastern Indonesia. She currently works in Fiji on issues regarding land tenure, chiefdoms and chiefs, and the representations of fertility associated with the *balolo* marine worm (*Eunice viridis*). Her publications include *Metanleru, un voilier prédateur: Renommée et fertilité dans l'île de Selaru* (2009, Les Indes Savantes) and the co-edited volumes *D'un nom à l'autre en Asie du Sud-Est. Approches ethnologiques* (1999, Karthala) and *Living Kinship in the Pacific* (2015, Berghahn Books).

Graham PILLING is currently a senior fisheries scientist at SPC. With over 20 years of experience in analyzing, assessing and providing scientific advice on tropical, temperate and polar marine and freshwater ecosystems and fisheries, he currently performs scientific assessments of tuna stocks and fisheries within the Western and Central Pacific Ocean. He also provides scientific advice to underpin the decisions of regional and subregional tuna management bodies in the region, including the Pacific Islands Forum Fisheries Agency (FFA), Parties to the Nauru Agreement (PNA) and Western and Central Pacific Fisheries Commission (WCPFC). His areas of work include the development of biological and economic reference points for tuna stocks, the examination of effort creep in tuna fisheries, and food security for Pacific Islands. His recent references include articles in scientific journals such as *Food Security* (Volume 7(1), 2015) and working papers for WCPFC (see the "Management issues theme" tab at <https://www.wcpfc.int/meetings/11th-regular-session-scientific-committee>).

Bran QUINQUIS is an economist specialised in climate change issues and the evaluation of ecosystem services. He was a postdoctoral research fellow at CRIOBE in 2013 and currently works for the government of French Polynesia as an inter-ministerial delegate for climate change and as a research and innovation advisor for the Ministry of Health and Research.

Manuel RAUCHHOLZ is a researcher and lecturer of anthropology at Heidelberg University. He was raised and educated in Micronesia, Japan, United States of America and Germany. After a Master of Theology, he completed his PhD in Cultural Anthropology at Heidelberg in 2010 (summa cum laude). In 2011, he received the Frobenius Research Award of the Goethe-University in Frankfurt a.M. for his study on the emotional effects of adoption in Chuuk, Federated States of Micronesia, entitled, *Towards and Understanding of Adoption, Person and Emotion: The Ideal Norm and Reality of Life amongst the Chuukese of Micronesia* (publication in progress with Berghahn Books). His research interests are cross-cultural ethics, legal and political anthropology, religion, gender and kinship studies. His current research inquires into the ethics of micro and macro forms of exchange and exploitation with an article

entitled, “Masculine Sexuality, Violence and Sexual Exploitation in Micronesia” (publication in progress) and an upcoming edited interdisciplinary volume on *Law and Custom in Micronesia* with the journal, *Pacific Studies*.

Catherine SABINOT holds a PhD in ethnoecology from the French National Museum of Natural History. She is a permanent researcher at IRD (UMR Espace pour le Développement) based in Noumea, New Caledonia. Using an anthropological and comparative approach (based on field investigations in Africa, America, and in the Indo-Pacific region), she studies the evolution of interactions between societies and their coastal and marine environments. Her research aims to contribute to the understanding of the way populations acquire, transform and share knowledge, know-how and perceptions relative to their environment, and how local and global environmental norms and values are articulated and negotiated.

Alain SAFA is specialised in macroeconomics and international finance. He is a professor at the University of Nice Sophia-Antipolis and EDHEC Business School, the founder and manager of the research and advisory structure Skill Partners, and a participant in several European and international research projects. He works on the capacity of countries to adapt to major economic, environmental and social changes. His research focuses particularly on the integration of environmental considerations into national, regional and international governance, and the economic and social impacts of ocean acidification. He has recently published several papers on this last topic (e.g., in *Water*, Volume 6(6), 2014 and in *Marine Biology*, Volume 160(8), 2013) and participated in three workshops on the economic impacts of ocean acidification held in Monaco in 2010, 2012 and 2015.

Joeli VEITAYAKI is an Associate Professor at the School of Marine Studies at the University of the South Pacific. He is also the Director of the International Ocean Institute-Pacific Islands Operational Centre at the university. He collaborates with a number of external partners in Norway, France, Scotland, Korea and Japan. Joeli has spent the last decade working with coastal communities around the Pacific Islands to effectively manage their marine resources and to articulate sustainable development. His research is based on the philosophy that a healthy natural environment is critical for the improvement of the livelihoods of all Pacific Islanders. In his view, this is the best way to fight the negative impacts of global changes such as climate change and to respond to local challenges such as overfishing and environmental degradation.

Peter WILLIAMS obtained a BSc in marine biology from Sydney University in 1978. After further professional education in computer programming, he pursued a career in corporate information technology (IT) in Australia from 1979 through 1987. During this time he completed post-graduate studies in IT at Macquarie University,

Sydney. In 1999, he also obtained an MBA (Technology Management) from Deakin University, Melbourne. Peter joined the Oceanic Fisheries Programme (OFP) at SPC in 1987 to take a lead role in establishing the databases which have been fundamental for the stock assessment work conducted by OFP over the past two decades. He is currently the Principal Fisheries Scientist in charge of the Data Management section within OFP. Other than database-related work and interacting with colleagues from Pacific Island countries, he has a keen interest in various tuna-fishery areas, particularly bycatch issues and the Western and Central Pacific Fisheries Commission (WCPFC)'s work on improving fisheries monitoring and data management in the diverse domestic tuna fisheries of Indonesia, Philippines and Vietnam.

