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# A Synoptic Study of the Number of Stars in the Constellations of Hipparchus's Catalogue* 

## Victor Gysembergh

(CNRS, Sorbonne Université, UMR 8061 - Centre Léon Robin
de recherche sur la pensée antique, Paris)

The present study aims to accomplish two things: first, to provide in tabular form all known extant manuscript evidence for the numbers of stars in each constellation of Hipparchus's star catalogue (including two manuscripts not used in previous editions); and, second, to propose a reconstruction of the numbers in the archetype. In doing so, this paper follows in the footsteps of Olivieri 1898, Rehm 1899, Boll 1901 and Weinstock 1951. The results largely confirm Weinstock's edition, although a few significant changes will be suggested. To this extent, the study can be viewed as a preliminary step towards a new edition of the star catalogue, which the author hopes to undertake in due course.

The manuscripts bearing witness to the star catalogue are the following (using different sigla than Weinstock and his predecessors for clarity's sake):

A Rome, Biblioteca Angelica, greco 29 (olim C.4.8), f. 158r. 1388 AD.
O Oxford, Bodleian Library, Selden Supra 17, f. 180v. 15th c.
$\mathbf{P}_{1} \quad$ Paris, BnF, grec 2419, f. 24v. 15th c. (= R Weinstock)
$\mathbf{P}_{2} \quad$ Paris, BnF, grec 2420, f. 194. Early 16th c.
$\mathbf{P}_{3}$ Paris, BnF, grec 2424, f. 141. Late 15th c.
$\mathbf{P}_{4}$ Paris, BnF, grec 2506, ff. 126v-127. Early 14th c.
$\mathbf{P}_{5}$ Paris, BnF, suppl. grec 387, f. 162. 14th c. (= S Weinstock)
S El Escorial, Real Biblioteca, Ф I 16, f. 131v. 1548 AD.
T Toledo, Biblioteca Capitular, 96-37, ff. 248v-249. 16th c.
The first reference to the catalogue in the hitherto untapped manuscripts of El Escorial and Toledo seems to have been made in the Catalogus codicum astrologorum graecorum and in the online database Pinakes, respectively. ${ }^{1} \mathbf{S}$ descends from $\mathbf{P}_{5},{ }^{2}$ and $\mathbf{T}$ is closely related to A. As previously noted by Boll, ${ }^{3}$ $\mathbf{P}_{2}$ descends from $\mathbf{P}_{4}$. On the basis of titles, lacunae and numbers of stars, the

[^0]following groups of manuscripts can be formed (with derivative manuscripts in parentheses): ${ }^{4}$
\[

$$
\begin{aligned}
& \alpha=\mathbf{A T} \\
& \gamma=\left(\mathbf{P}_{2}\right) \mathbf{P}_{3} \mathbf{P}_{4} \\
& \delta=\mathbf{P}_{5}(\mathbf{S}) \\
& \mathbf{o}=\mathbf{O P}_{1}
\end{aligned}
$$
\]

Furthermore, groups $\gamma$ and $\delta$ have the permutation of their entries for Aql and Sga in common. Examination of the number of stars shows that these two groups are closely related, so that (when they agree) they can be called $\beta$ :

$$
\beta=\gamma \delta=\left(\mathbf{P}_{2}\right) \mathbf{P}_{3} \mathbf{P}_{4} \mathbf{P}_{5}(\mathbf{S})
$$

The variations in the language of the manuscripts, though interesting in themselves, have been left aside for further study.

What follows, in tabular form, is the result of collating digital reproductions of all the manuscripts listed above (lac. notes cases when the constellation is named, but no number is given; abest notes cases where both name and number are missing).

Table 1. Northern Constellations


[^1]|  |  |  | $\beta$ |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\alpha$ |  | $\gamma$ |  |  | $\delta$ |  | 0 |  |
|  | A | T | $\mathrm{P}_{2}$ | $\mathrm{P}_{3}$ | $\mathrm{P}_{4}$ | $\mathrm{P}_{5}$ | S | 0 | $\mathrm{P}_{1}$ |
| Aql | abest $^{7}$ | abest | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Del | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 4 | 4 |
| Equ | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 9 | 9 |
| Cep | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 18 | 18 |
| Cas | 24 | 24 | 14 | 14 | 14 | 14 | 14 | 19 | 14 |
| And | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 14 | 19 |
| Tri | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 8 | 14 |
| Per | $8^{8}$ | 8 | 19 | 19 | 19 | 19 | 19 | 3 | 20 |
| Aur | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 19 | 13 |
| Capella | abest | abest | abest | abest | abest | abest | abest | abest | 19 |
| Haedi | abest | abest | abest | abest | abest | abest | abest | abest | 8 |

Table 2. Southern Constellations

|  |  |  | $\beta$ |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\alpha$ |  | $\gamma$ |  |  | $\delta$ |  | o |  |
|  | A | T | $\mathrm{P}_{2}$ | $\mathrm{P}_{3}$ | $\mathrm{P}_{4}$ | $\mathrm{P}_{5}$ | S | O | $\mathrm{P}_{1}$ |
| Eri ${ }^{9}$ | abest | abest | abest | abest | abest | abest | abest | 13 | 13 |
| Нуa | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 17 |
| Crt | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| Crv | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Nav | abest | abest | 13 | 13 | 13 | 13 | 13 | 26 | 26 |
| Cen | 26 | 26 | 26 | 26 | 26 | $27^{10}$ | 27 | 24 | 24 |
| Lup | 13 | 13 | lac. | lac. | lac. | lac. ${ }^{11}$ | lac. | 8 | 20 |
| Ara | 4 | 4 | 4 | 4 | 4 | $8^{12}$ | 8 | abest | 20 |
| CrA | lac. ${ }^{13}$ | lac. | lac. | lac. | lac. | lac. | lac. | abest | 7 |
| PsA | 18 | 18 | 12 | 12 | 12 | 12 | 12 | 12 | 4 |
| Cet | 13 | 13 | 14 | 14 | 14 | 20 | 20 | 13 | 20 |
| Ori | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 13 |

[^2]|  |  |  | $\boldsymbol{\beta}$ |  |  |  |  | $\boldsymbol{\delta}$ |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\boldsymbol{\alpha}$ |  | $\boldsymbol{\gamma}$ |  |  | $\mathbf{o}$ |  |  |  |
|  | $\mathbf{A}$ | $\mathbf{T}$ | $\mathbf{P}_{\mathbf{2}}$ | $\mathbf{P}_{\mathbf{3}}$ | $\mathbf{P}_{4}$ | $\mathbf{P}_{5}$ | $\mathbf{S}$ | $\mathbf{O}$ | $\mathbf{P}_{\mathbf{1}}$ |
| Lep $^{14}$ | 21 | 21 | 26 | 26 | $26^{15}$ | 27 | 27 | 7 | 18 |
| CMa $^{16}$ | abest | abest | abest | abest | abest | abest | abest | lac. | 7 |
| CMi | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

Table 3. Zodiacal Constellations


Branches $\alpha$ and $\beta$ present few problems: the necessary explanations are given in the footnotes to Tables 1-3. As for branch o, a further table will help to understand the several downward shifts in the numerals. In the leftmost col-

[^3]umn is given the number of stars in the sub-archetype of branch o. When $\mathbf{O}$ and $\mathbf{P}_{1}$ disagree, we suppose that agreement with another branch of the tradition indicates the number in the sub-archetype o. Explanations of the less obvious errors are given, when possible, in the footnotes.

Table 4. Branch o

|  | O | $\mathrm{P}_{1}$ | 0 |
| :---: | :---: | :---: | :---: |
| UMa | 24 | 24 | 24 |
| UMi | 7 | 7 | 7 |
| Dra | 15 | 15 | 15 |
| Boo | 14 | 14 | 14 |
| CrB | lac. | lac. | $9^{19}$ |
| Her | 9 | 9 | 24 |
| Oph | 24 | 24 | 23 |
| Lyr | 23 | 23 | 8 |
| Cyg | 8 | 8 | 18 |
| Sge | 18 | 18 | 4 |
| Aql | 4 | 4 | 4 |
| Del | 4 | 4 | 9 |
| Equ | 9 | 9 | 18 |
| Cep | 18 | 18 | 19 |
| Cas | 19 | 14 | 14 |
| And | 14 | $19^{19}$ | 20 |
| Tri | $8^{21}$ | 14 | 3 |
| Per | 3 | 20 | 19 |
| Aur | 19 | $13^{22}$ | 8 |
| Capella ${ }^{23}$ | abest | 19 | abest |
| Haedi | abest | 8 | abest |
| Eri | 13 | 13 | $13^{24}$ |
| Hya | 27 | 17 | 27 |
| Crt | 10 | 10 | 10 |

[^4]|  | $\mathbf{O}$ | $\mathbf{P}_{\mathbf{1}}$ | $\mathbf{o}$ |
| :--- | :---: | :---: | :---: |
| Crv | 7 | 7 | 7 |
| Nav | 26 | 26 | 26 |
| Cen | 24 | 24 | 24 |
| Lup | $8^{25}$ | $20^{26}$ | 8 |
| Ara | abest | $20^{27}$ | $4^{28}$ |
| CrA | abest | 7 | 7 |
| PsA | 12 | $4^{29}$ | 12 |
| Cet | 13 | $20^{30}$ | 13 |
| Ori | 18 | 13 | 18 |
| Lep | 7 | 18 | 7 |
| CMa | lac. | $7^{31}$ | lac. |
| CMi | 3 | 3 | 3 |

For the remainder of this study, the following hypotheses are made (in the belief that they are supported by the evidence given above):

1. branches $\alpha, \beta$ and o have not been contaminated by one another (in particular, voluntary collation seems quite unlikely, considering the small size of the text)
2. since $\alpha$ and $\beta$ often agree, and elsewhere often exhibit errors derived from a similar sub-archetype, the agreement of o with either $\alpha$ or $\beta$ (or a sub-branch of $\beta$ ) indicates the number in the archetype.

If these hypotheses are true, we can deduce the number of stars in the archetype for all entries except Boo, Oph, Cyg, Eri, Nav, Cen, CrA, Cnc and Sag. For the nine entries where the number in the archetype cannot be deduced in

[^5]this way, it must be decided whether other star catalogues (e.g.: the Epitome of the Catasterisms or Ptolemy's catalogue in the Almagest) can serve as guides to the original number.

A preliminary indication is given by the fact that the numbers of stars, for those entries where they can be deduced, agree with the numbers from the latest edition of the Epitome of the Catasterisms in 27 out of 36 cases, that is $75 \%$ of the time. ${ }^{32}$ This prompts us to have a closer look at the rest of the Catasterisms tradition, which is less lacunose: the notes on constellations in Aratus latinus, the Scholia Basileensia and Scholia Strozziana to Germanicus, and Hyginus's De astronomia. The following table gives the totals of stars per constellation as they stand in each of the five texts, without any of the editors' corrections and supplements. ${ }^{33}$ Bold type indicates agreement with the Hipparchan catalogue, and italics indicate those entries where the number in the Hipparchan catalogue cannot be reconstructed mechanically.

Table 5. Stars per constellation in the Catasterisms tradition ${ }^{34}$

|  | Epitome | Arat. Lat. | $\sum$ Basil. | $\sum$ Strozz. | Hyginus |
| :--- | :---: | :---: | :---: | :---: | :---: |
| UMa | $\mathbf{2 4}$ | om. | 23 | $\mathbf{2 4}$ | 21 |
| UMi | $\mathbf{7}$ | $\mathbf{7}$ | $\mathbf{7}$ | $\mathbf{7}$ | $\mathbf{7}$ |
| Dra | om. | om. | $\mathbf{1 5}$ | $\mathbf{1 5}$ | $\mathbf{1 5}$ |
| Her | 19 | 19 | $\mathbf{2 4}$ | $\mathbf{2 4}$ | 19 |
| CrB | $\mathbf{9}$ | $\mathbf{9}$ | $\mathbf{9}$ | $\mathbf{9}$ | $\mathbf{9}$ |
| Oph | $\mathbf{1 7}$ | $\mathbf{1 7}$ | $16(17 \pi)$ | $\mathbf{1 7}$ | 23 |
| Ser | om. | 23 | $28(23 \pi)$ | 30 | $\mathbf{1 7}$ |
| Sco | om. | $\mathbf{1 5}{ }^{34}$ | $\mathbf{1 5}$ | $\mathbf{1 5}$ | $\mathbf{1 5}$ |
| Lib | $\mathbf{4}$ | $\mathbf{4}$ | $\mathbf{4}$ | $\mathbf{4}$ | $\mathbf{4}$ |
| Boo | om. | $\mathbf{1 4}$ | $\mathbf{1 4}$ | $\mathbf{1 4}$ | $\mathbf{1 4}$ |
| Vir | $\mathbf{1 9}$ | $\mathbf{1 9}$ | $\mathbf{1 9}$ | $\mathbf{1 9}$ | $\mathbf{1 9}$ |
| Gem | om. | 15 | $\mathbf{1 9}$ | $\mathbf{1 9}$ | $\mathbf{1 9}$ |
| Cnc | 18 | 10 | 17 | $\mathbf{1 6}$ | 17 |
| Leo | om. | $\mathbf{1 9}$ | $\mathbf{1 9}$ | $\mathbf{1 9}$ | $\mathbf{1 9}$ |
| Aur | $\mathbf{8}$ | $\mathbf{8}$ | $\mathbf{8}$ | $\mathbf{8}$ | om. |
| Tau | $\mathbf{1 8}$ | $\mathbf{1 8}$ | 15 | $\mathbf{1 8}$ | $\mathbf{1 8}$ |
| Cep | om. | $\mathbf{1 9}$ | 17 | $\mathbf{1 9}$ | $\mathbf{1 9}$ |

[^6]|  | Epitome | Arat. Lat. | $\Sigma$ Basil. | $\Sigma$ Strozz. | Hyginus |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Cas | om. | 14 | 14 | 14 | 14 |
| And | om. | 20 | 20 | 20 | 20 |
| Equ | om. | 18 | 18 | 18 | 18 |
| Ari | 17 | 17 | 13 (16 P) | 18 | 17 |
| Tri | 3 | 3 | 3 | 3 | 3 |
| Psc | 43 | 41 | 36 | 39 | 41 |
| Per | om. | 19 | 29 | 18 (19 AM) | 19 |
| Lyr | 9 | 9 | 8 | 9 | om. |
| Cyg | om. | 9 | 13 | 13 (14 PRV) | 13 |
| Aqu | om. | 18 | 18 | 18 | 14 |
| Cap | 22 | 26 | 26 | 24 (26 rell.) | 20 (26 alii) |
| Sag | 15 | 16 | 13 | 15 | 15 (16 alii) |
| Sga | 4 | 4 | 4 | 4 | 4 |
| Aql | 4 | 4 | 4 | 4 | om. |
| Del | 9 | 9 | 9 | 9 | 9 |
| Ori | om. | 18 | 17 | 17 | 17 (18 alii) |
| CMa | 13 | 20 | 20 | 20 | 19 (20 alii) |
| Lep | om. | 7 | 7 | 7 | 6 |
| Nav | om. | 26 | 27 | 26 | 16 |
| Cet | 13 | 13 | 13 | 14 | 13 |
| Eri | 14 | 16 | 13 | 17 | 13 |
| PsA | 12 | 12 | 12 | 12 | 12 |
| Ara | 3 | 14 | 4 | 4 | 4 |
| Cen | 24 | 24 | 53 | 24 | 24 |
| Lup | 7 (8P) | 9 | 10 | $9^{35}$ | 10 |
| Hya | 27 | 3 | 27 | 26 | 27 |
| Crv | 7 | 4 | 7 | 7 | 7 |
| Crt | 6 | 10 | 10 | 10 | 10 |
| CMi | 3 | 3 | 3 | 3 | 3 |
| $\mathrm{CrA}^{36}$ | abest | abest | abest | abest | abest |

The high degree of similarity that is evidenced by the fact that every number from the Hipparchan catalogue appears somewhere in the Catasterisms tradition does not imply that the Catasterisms contaminated the Hipparchan tradition. On the contrary, each branch of the tradition taken separately disagrees so often with every other that contamination seems quite unlikely. Hence, where one or more of the texts deriving from the Catasterisms agree with at least one of the branches in the tradition of the Hipparchan catalogue, this indicates the original number in the catalogue. This plays out as follows (the number agreeing with the Epitome is underscored):

[^7]Table 6.

| Boo | $19 \alpha \beta$ | $\underline{14 \text { o }}$ |
| :--- | :--- | :--- |
| Oph | $\underline{17 \alpha \beta}$ | $\underline{23 ~ o}$ |
| Cyg | $\underline{14 \beta}$ | 18 o |
| Eri |  | $\underline{13 \text { o (absent from all other branches) }}$ |
| Nav | $13 \beta$ | $\underline{26 o}$ |
| Cen | $26 \alpha \gamma$ | $\underline{24 o}$ |
| CrA |  | 7 o (absent from all other branches) |
| Cnc | $6 \alpha$ | $\underline{16 \beta}$ |
| Sag | $\underline{15 \alpha}$ | $\underline{16 \beta}$ |

For Boo, Cyg, Eri, Nav and Cen, agreement with the Catasterisms indicates with absolute certainty what number was in the archetype of the Hipparchan catalogue. The case of Oph is interesting: 17 and 23 appear to have been the numbers of stars in Oph and Ser, respectively, in the Catasterisms tradition; this is proof that the archetype of the Hipparchan catalogue had both constellations, and that the entry for Ser was later omitted (by a haplography of sorts), leading in branches $\alpha$ and $\beta$ to the omission of 23 , and in branch o to the omission of 17. Incidentally, this omission has not been detected by previous editors; we would add the text "Opıs $\kappa \gamma^{\prime}$ ("Serpent, 23") after the entry for Oph. CrA appears to be a later addition, since it is absent from the Catasterisms and from Hipparchus's other work; we would athetize it. ${ }^{37}$ Finally, the number of stars in Sag cannot be decided.
To sum up, the numbers that were in the archetype can be reconstructed as follows (for each constellation the number in parentheses is the one assumed in Weinstock's edition, when different):

Table 7. Stars per constellation in the archetype

| Northern <br> constellations | Southern <br> constellations | Zodiacal <br> constellations |
| :--- | :--- | :--- |
| UMa 24 | Eri 13 | Cnc 16 |
| UMi 7 | Hya 27 | Leo 19 |
| Dra 15 | Crt 10 | Vir 19 |
| Boo 14 (19) | Crv 7 | Lib 4 |
| CrB 9 | Nav 26 | Sco 15 |
| Her 24 | Cen 24 | Sag 15 or 16 (16) |
| Oph 17 | Lup 8 (13) | Cap 26 |
| <Ser 23> | Ara 4 | Aqu 18 |
| Lyr 8 | [CrA 7 (8)] | Psc 41 |
| Cyg 14 | PsA 12 | Ari 17 |

[^8]| Northern <br> constellations | Southern <br> constellations | Zodiacal <br> constellations |
| :--- | :--- | :--- |
| Sga 4 | Cet 13 | Tau 18 |
| Aq1 4 | Ori 18 | Gem 19 |
| Del 9 | Lep 7 |  |
| Equ 18 | CMa 20 (21) |  |
| Cep 19 | CMi 3 |  |
| Cas 14 |  |  |
| And 20 |  |  |
| Tri 3 |  |  |
| Per 19 |  |  |
| Aur 8 |  |  |

The total number of stars in the 46 constellations above (including Ser, excluding CrA ) is 692 or $693 .{ }^{38}$

To conclude, the numbers for the reconstructed archetype are significantly closer to those in the Catasterisms tradition than had previously been assumed. Indeed, the numbers in the archetype may arguably have been identical to the star totals for the common source of the entire extant Catasterisms tradition. These conclusions lead to further questions regarding the texts's authorship.

For instance: Do the traditions ascribed to Eratosthenes and Hipparchus regarding the numbers of stars-per-constellation originate from a common textual or iconographic source, on which one or both of those illustrious names may have been applied pseudepigraphically? If so, this might explain the title of the Latin list of stars B (Maass [1898] 137), with ascriptions to both Eratosthenes and Hipparchus.

Or, conversely, was there a contamination previous to the archetype of the Hipparchan catalogue and to the common source of the extant Catasterisms tradition? Indeed, the existence of the Epitome implies that one or more unepitomized versions of the text preceded it. And these may have derived from a catalogue of stars or other work by Eratosthenes, while the archetype of the Hipparchan catalogue most likely derives from a more complete work - in the form either of a list of star coordinates grouped by constellations or of a (perhaps introductory) treatise on astronomical matters.

If both traditions of numbers do go back to their presumed authors, does this mean that Hipparchus started his own catalogue as a continuation of Eratosthenes'? Does Hipparchus's Commentary on the Phaenomena of Eudoxus

[^9]and Aratus reflect a later stage of this continuation or a catalogue drawn up on an entirely new basis?

These questions and more illustrate the need for further philological work on the fragments of these two scholars and of other ancient astronomers.

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[^0]:    * My thanks go to the participants of the 'Certissima Signa' conference for their remarks and to Aude Skalli and Kristen Lippincott for commenting on the final draft.
    1 For S, see Zuretti 1932, p. 109; for T, see pinakes.irht.cnrs.fr/notices/cote/63499/.
    2 As noted already by Acerbi 2017, p. 177.
    3 Boll 1901, p. 186.

[^1]:    
     $\theta \varepsilon ́ \sigma \varepsilon \omega \varsigma \mathbf{P}_{1}$ om. O. For lacunae and numerals, see Tables 1-4 below.
    5 In $\mathbf{O}$ and $\mathbf{P}_{1}, \mathrm{CrB}$ and Her are merged to form 'kneeling Stephanus' ( $\sum \tau \varepsilon ́ \varphi \alpha v o s$ ó $\dot{\varepsilon} v \gamma$ रóv $\alpha-$ $\sigma t v)$ ! This may be due to a reminiscence of protomartyr Stephanos, who knelt while being stoned to death (Acts 7:60: $\theta \varepsilon i \varsigma ~ \delta \grave{\varepsilon} \tau \grave{\alpha} \gamma o ́ v \alpha \tau \alpha)$.
    6 The corruption of 14 to 24, a misreading of t as $\kappa$, is also attested in $\alpha$ for Cas. That $\mathrm{t} \delta(14)$ was the original reading is shown by its presence in both $\beta$ and o.
    7 In $\alpha$, the entry Aql ( $\dot{\alpha} \tau$ ós) was omitted through haplography (the following entry is $\delta \varepsilon \lambda \tau \omega$ тós, 'Triangle', standing for $\delta \varepsilon \lambda \varphi$ ís, 'Dolphin'). This implies that it had undergone previous corruption (AETO $>\Delta \mathrm{E} \Lambda \mathrm{TO} \Sigma$ in uncial script, the form $\delta \varepsilon ́ \lambda \tau o \varsigma$ being attested in $\beta$ ).

[^2]:    8 In $\alpha, 8$ was probably copied by mistake into the entry Per from the entry Aur.
    9 Note that $\mathbf{O}$ also has 'H@ıঠ $\alpha$ vós (another name for the same constellation), without a number of stars, after Lep.
    10 In $\delta, 27$ is the sum of 26 stars for Cen and 1 for Lup, because, as the manuscripts state, 'it (viz.
    
    11 In $\delta$, the entry for Lup was taken for a single star, as noted above. Thus, the numeral 8 shifted down to Ara.
    12 The numeral 8 has shifted down from Lup, causing the elimination of the original 4 present in $\alpha, \gamma$ and o (for o see Table 4 below).
    13 A has a dotted omicron with spiritus asper after the constellation name. As noted by Olivieri 1898 , p. 23, although the letter looks like a theta $(\theta=9)$, this is a highly unlikely reading, and the absence of the abbreviation for $\dot{\alpha} \sigma \tau \varepsilon ́ \varrho \varepsilon \varsigma ~(' s t a r s '), ~ o t h e r w i s e ~ u s e d ~ t h r o u g h o u t, ~ i n d i c a t e s ~$ that there is a lacuna.

[^3]:    14 As explained below, the entry CMa was quite prone to being omitted. It seems that the numbers for Lep in $\alpha$ and $\beta$ were compounded with those for CMa. Indeed $\mathbf{P}_{4}$, with its strange sign similar to the abbreviation for $\eta \mu \bar{\varepsilon} \varrho \alpha$ and, hence, to the Arabic numeral 6, harbors traces of confusion. This manuscript may well be an illustration of the intermediate stage that led to 26 in the rest of $\gamma .21$ in $\alpha$ is a plausible number for CMa (which contains 20 stars in the Epitome of the Catasterisms); but another possibility is that $\kappa \zeta$ (27) is the mere juxtaposition of original $\kappa(20)$ for CMa and $\zeta$ (7) for Lep (this last is attested by o, see Table 4 below). This second possibility, although more complicated in terms of paleography, seems preferable, because the vast majority of entries in the Catalogue give the same number as the Epitome of the Catasterisms.
    15 The numeral 6 is written with the sign for $\mathfrak{\eta} \mu \varepsilon ́ \varrho \alpha$ (as noted by Boll 1901, p. 187 and Weinsтоск 1951, p. 190).
    16 The entry CMa (Kú $\omega v$ ) was doubly prone to being omitted: first, through haplography (with the neighboring entry CMi Поокט́ $\omega v$ ); and, second, because the name Kú $\omega v$ is often used for the sole star Sirius instead of the constellation CMa.
    17 The number 6 ( $\varsigma$ ) could be a corruption of 16 ( $\llcorner\varsigma$ ), or vice-versa. The $t(10)$ could result from the misreading of a random vertical stroke, or an original $\operatorname{l}$ could have been omitted, perhaps due to misinterpretation as such a stroke. Comparison with the Epitome of the Catasterisms, registering 18 stars for Cnc, indicates that 16 is the more likely reading. On the use of the Epitome to establish the original number in the Hipparchan catalogue, see below.
    18 In T, $\kappa(20)$ is a corruption of $\mu(40)$ in minuscule script, as indicated by comparison with $\beta$, where only the number 41 is attested.

[^4]:    19 See n .5 above. The error here causes a shift in the numbers, with the number for CrB moving down to Her, and so on. In the far right-hand column, we restore the numbers at their original place. number better matches the constellation's name.
    $22 \gamma(13)$ seems to be a corruption of $\gamma(3)$. Random vertical strokes are easily taken for the numeral t .
    23 The stars Capella (Goat) and Haedi (Kids), consisting respectively of one and two stars from the constellation Auriga, are only present in $\mathbf{P}_{1}$. They scarcely belong with the rest of the entries, and appear to be an addition made to account for the two otherwise meaningless numbers pushed down by the double shift in this manuscript.
    24 The shift in numbers ceases here, suggesting that the northern and southern constellations were originally listed in separate tables.

[^5]:    25 The numeral $8(\eta)$ comes after an entry merging three constellations (Lup, Ara and CrA ). Weinstock thought that it belonged to the entry CrA . The rest of the tradition, however, shows that it belongs to Lup.
    $26 \kappa(20)$ is a corruption of $\eta(8)$ in minuscule.
    27 Here, in $\mathbf{P}_{1}$, the number 20 is carried over from the previous entry, due to the similar names of
    
    28 After Lup, O writes $\lambda \alpha \alpha_{0} \rho \varsigma \delta$ (i.e. 4) i $\chi \theta \dot{v} \varsigma \iota \beta$ (i.e. 12). The original name of PsA has long puzzled scholars. Whatever it may have been, it is clear that the numeral $\delta$ is out of place (compare the name of the constellation in the rest of the tradition: ó $\lambda \alpha$ ógos ix $\theta \dot{v}$ s in $\mathbf{P}_{1}$, $\dot{\alpha} \delta$ oòs í $\theta \dot{v}$ s in $\mathbf{A P}_{5} \mathbf{S T}$, and $\alpha \dot{\alpha} v \delta$ @òs i $\chi \theta \dot{v} \varsigma \mathbf{P}_{2} \mathbf{P}_{3} \mathbf{P}_{4}$ ). Comparison with the other branches $\alpha$ and $\beta$ shows that it must come from the entry Ara ( $\theta$ v七ŋ́ŋเov), the name of which is deleted through haplography due to the resemblance with the previous entry Lup ( $\theta$ ŋ́@เov).
    The numeral $\delta(4)$ has most likely wandered down from the entry Ara following its deletion through haplography (see note above on Ara). This addition causes all following numbers to shift downwards once as compared to those in $\mathbf{O}$. whe the branches shows to be the cor ruption of $12(\iota \beta)$ to $20(\kappa)$. Fortunately, not all errors must receive a purely paleographical explanation, as the scribes were also affected by psychological factors such as distraction!
    31 In $\mathbf{P}_{1}$, the entry CMa is after CMi, but this is the original order (as followed by Weinstock in his edition), for the numeral 7 is at its expected place here (following the downward shift of numerals starting from the entry Ara in $\mathbf{P}_{1}$ ).

[^6]:    32 See ed. Pàmias i Massana - Zucker 2013.
    33 Both sets of scholia as well as Hyginus were excerpted alongside the Epitome in the synoptic edition of the Catasterisms by Robert 1878. For Aratus Latinus, see ed. Masss 1898, pp. 180-271; for the Scholia Strozziana and Scholia Basileensia, see ed. Dell'Era 1979a and 1979b, respectively; for Hyginus's De astronomia, see ed. Le Bgeuffle 1983. According to Dell'Era 1979b, the archetype of the Scholia Strozziana may be considered as an independent manuscript of the Scholia Basileensia tradition; here, the star totals from the Strozziana are given in a separate column. Not all manuscript variants are reported: in general, only the one selected by the editor is given, along with variants rejected by the editor but agreeing with the numbers from the Hipparchan catalogue.
    34 In all four texts, the manuscripts in fact give the total of stars for Sco and Lib, i.e. 19. We substract 4 to arrive at the number for Sco (19-4=15).

[^7]:    35 In the Schol. Strozz., the manuscripts in fact give the total of stars for Cen and Lup, i.e. 33. We substract 24 to arrive at the number for $\operatorname{Lup}(33-24=9)$.
    36 CrA is omitted in the entire Catasterisms tradition.

[^8]:    37 See Boll - Gundel 1937, col. 1018.

[^9]:    38 As a comparison, Ptolemy's catalogue in Almagest VII-VIII gives the coordinates of 1025 stars.

