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Captured on paper: fish books, natural history and questions of demarcation in eighteenth-century Europe (ca. 1680-1820)

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CHAPTER 3

A True Ichthyologist? Peter Artedi's *Ichthyologia* (Leiden, 1738) and Making Classifications

Some decades after the *Historia piscium* was published, the young Swedish naturalist Peter Artedi picked up a copy, and it was a revelation. He had been trying to match his own observations of fish to species descriptions published in books, they had been too vague and insufficient. That changed when he encountered the history of fishes by Willughby (regarding him as the sole author of the work), who he found “stood out above all others in his descriptions of species.”¹ Artedi nevertheless believed the work lacked a firm grasp on the morphological relations between species of fish on different taxonomical levels. As he explains in the preface to his *Ichthyologia, sive opera omnia de piscibus* [Ichthyology, or complete works about fish] posthumously published by his friend Carl Linnaeus in Leiden in 1738:

I then noticed that by not one of the Ichthyologists up to that time the distinct genera, nor their characteristics, nor their Species had been established; hereupon I began to examine all parts of Fish with great effort, so that I would see which parts of these were most similar according to Number, Figure, and Position, and which would be the most dissimilar, especially in regard to the fish which are consistent in their external

¹ Original Latin: “[...] in descriptionibus specierum omnes supererat.” Peter Artedi, *Ichthyologia, sive opera omnia de piscibus* (Leiden: Coenraad Wishoff, 1738), *Praefatio auctoris*, sig. *r. The *Ichthyologia* will henceforth be referred to as *Ich.*, followed by the title of the part of the book from which the citation derives.

appearance, from which the *Characteristics of Genera* and the *Genera* themselves are born [...].²

Despite its modest octavo format and lack of any illustrations, the *Ichthyologia* was a far from unassuming book. In it, Artedi presented an elaborate system for the classification of fishes, introducing the taxonomical ranks of class, order, and genus, and offering clear definitions of both species and varieties. As we saw in the previous chapters, naturalists had grouped species together based on their habitat, their letter of the alphabet, or according to their morphological characters. Artedi clearly and distinctly allocated species into ranks based on shared characteristics, which could consist of intricate combinations of external features and inner parts. His aim was to uncover the intricate, taxonomical arrangements of fishes through the application of uniform and consistent rules for their description, naming and classification. In so doing, he sought to impose a unity, consistency and logical order onto the natural history of fish that he found to be sorely lacking.

Artedi's system was an expression of the widely shared search for regularities and patterns in nature. Three years before the *Ichthyologia* appeared, Linnaeus had published the first edition of his *Systema naturae* (Leiden, 1735) in which he unfolded his classification system for minerals, plants, and animals. In the case of fish, he adopted Artedi's method of classification.³ Both Linnaeus' and Artedi's works fitted well into the broader development in eighteenth-century Europe that saw the quantification of nature, of measuring and calculating, ordering and systematizing it.⁴ This entailed turning observations rich with detail and tied to a specific time and place, for example medical cases or weather diaries, into synthetic, general observations on the changing character of a disease or deviations of an average climate.⁵ Observations of nature were compressed into tables

² Original Latin: "Deinde distincta genera, eorumque characteres & Species à nullo Ichthyologorum adhucdum constituta esse animadvertabam; hinc magno nisu omnes Piscium partes examinare incipiebam, ut viderem quanam illorum partes secundum Numerum, Figuram & situm maxime convenirent, & quanam maxime discrepant, imprimis in Piscibus facie externa convenientibus, unde *Characteres Generum* & ipsa *Genera* nata sunt [...]" *Icht., Praefatio auctoris*, sig. *r.

³ Broberg, *Carl Linnaeus*, 142.

⁴ John Heilbron, "Introduction," in *The Quantifying Spirit in the Eighteenth Century*, eds. Tore Frängsmyr, J.L. Heilbron, and Robin E. Rider (Berkeley: University of California Press, 1990), 2.

⁵ J. Andrew Mendelsohn, "The World on a Page: Making a General Observation in the Eighteenth Century," in Daston and Lunbeck, *Histories of Observation*, 69–89.

from which correlations might be deduced.⁶ Analogous to this development, naturalists like Artedi and Linnaeus increasingly set their sights on arriving at uniform and consistent principles with which they could name, describe and classify minerals, plants and animals.⁷ In formulating these principles, numbers and measurements played a role to such a considerable extent that historians have characterized such pursuits as mathematical, arithmetical, or geometrical.⁸

But how could one quantify a fish? Plants and animals were not that easily condensed in formulae, precisely because of the sheer variety of parts, shapes and colours they exhibited. While categorisations of nature based on morphological features had been around for quite some time, as we have seen in the previous chapters, over the course of the eighteenth century naturalists began to place strong emphasis on the enumeration of characteristics that they considered consequential, such as the pistils of flowers or, in the case of Artedi, the fin rays of fish. Artedi's ambition to design a comprehensive system to classify nature was thus not, in itself, unique. The seventeenth and eighteenth centuries in particular saw a proliferation of competing models aimed at classifying animals based on their physiologies. The one that Artedi devised for fish proved to be particularly successful however, and naturalists would apply his system in their examinations of fish for decades to come. Bloch, the subject of the next chapter, was one of them.

What makes Artedi's book a compelling source is its painstaking discussion of the principles that underpin his classification, and how he equates his method with the self-defined field of 'ichthyology.' His work offered rules for how ichthyology should be done – and by whom. As such, it almost reads like a handbook or code of practice. That there was a need for ichthyologists was, according to Artedi, demonstrated by the enigmatic case of the siren. The question of whether such a being existed, and how it fitted into the larger scheme of creation if it did, had

⁶ Lorraine Daston, "Super-Vision: Weather Watching and Table Reading in the Early Modern Royal Society and Académie Royale des Sciences," *Huntington Library Quarterly* 78, no. 2 (2015): 189.

⁷ John E. Lesch, "Systematics and the Geometrical Spirit," in Frängsmyr, Heilbron and Rider, *The Quantifying Spirit*, 75.

⁸ See: Heilbron, "Introduction," 20–21; Lesch, "Systematics and the Geometrical Spirit," 73–111; William T. Stearn, "Carl Linnaeus and the Theory and Practice of Horticulture," *Taxon* 25, no. 1 (1976): 24.

long been a matter of contention.⁹ Merman or mermaid parts were rare and coveted collectables – as we saw in Chapter 2, the Royal Society held the rib of a merman in its Repository.¹⁰ Artedi included the siren as a genus belonging to his order of cetaceans, or whale-like fishes (which continued to be counted among the fish).¹¹ He subjected it to the same natural historical principles as other fishes, but the uncertainty surrounding its existence put him in a delicate position. It led him to exclaim: “if only there were a true Ichthyologist, that could examine this animal, and find whether it is a fable, or a true fish? Not having seen the matter for myself, I prefer to not form a judgment, rather than to make any bold claim.”¹² A ‘true ichthyologist’, then, could settle the matter, after having had the opportunity to examine a specimen in the flesh.

The example of the siren highlights the questions that form the core of this chapter. How can one arrive at true, certain knowledge about fish? How can all species be fitted into one system? Who gets to decide, and on the basis of what? Who was a true ichthyologist? This chapter explores these questions through the *Ichthyologia*. It examines how Artedi offered the first explicit articulation of what ‘ichthyology’ was (or, at least, what he thought it ought to be) and how its practitioners were to operate. Besides seeking to understand what this term meant according to Artedi, it is also worthwhile considering how he wielded it to lend credence to his own system. This entails being attentive to the context in which the term ‘ichthyology’ emerged to denote a specialized knowledge on fish, a process that is seldom reflected upon by historians of natural history. The chapter will first introduce Peter Artedi, and shed light on his attempts to establish his name as a naturalist. It will then look more closely into his *Ichthyologia* and analyze its

⁹ A standard work on sirens in early modern Europe is Bernd Roling, *Drachen und Sirenen: Die Aufarbeitung und Abwicklung der Mythologie an den europäischen Universitäten* (Leiden: Brill, 2010).

¹⁰ See: Marjorie Swann, *Curiosities and Texts: The Culture of Collecting in Early Modern England* (Philadelphia: University of Pennsylvania Press, 2001), 28; Tara E. Pedersen, *Mermaids and the Production of Knowledge in Early Modern England* (Farnham: Ashgate, 2015), 51; Eric Jorink, *Reading the Book of Nature in the Dutch Golden Age, 1575–1715* (Leiden: Brill, 2010), 295, 298, 310–311.

¹¹ Artedi postulated that while most fishes respired through gills, some species of fish could also breathe through lungs. Linnaeus later ruled that cetaceans were mammals and not fish: see Carl Linnaeus, *Systema naturae*, ed. 10 (Stockholm: Lars Salvi, 1758), 17.

¹² Original Latin: “Utinam existeret verus Ichthyologus, hoc qui examinaret animal, fabula utrum sit, an verus piscus? De re non visa potius est non judicare, quam audacter quid pronuntiare.” *Ichth.*, *Genera piscium*, 81.

structure and the rhetorical strategies it employs. Subsequently, it will examine Artedi's classification system, *viz.* his division into classes, orders, genera, and species. Lastly, it will reflect on what impact the publication of this system had on what was considered to be of import to learned inquiries into fish, and how, by privileging certain characteristics of fish over other ones, it prescribed which aspects of the piscine population should be studied, preserved, and presented.

The Short Career of Peter Artedi

Relatively little has been, so far, published on Artedi.¹³ He was born in 1705 in the Swedish province of Ångermanland, in a family of modest means. His father was a minister in the Anundsjö parish. When the family moved to the coastal province of Nordmaling in 1716, Artedi was sent to grammar school in Härnösand – where he spent his free hours collecting plants and dissecting fish.¹⁴ As he was expected to follow in his father's footsteps and become a clergyman, he enrolled at the School of Divinity at Uppsala University in 1724 with the support of an annual stipend.¹⁵ After two years, however, he switched to the faculty of medicine so that he could fully apply himself to the study of natural history.¹⁶ He mostly worked alone, not being surrounded by students as eager as he. This changed when the young Linnaeus arrived at Uppsala university in 1728. Linnaeus, who came from a similar humble background, had transferred from Lund to take up the study of natural history. The students struck up a friendship based on their shared enthusiasm. For the next seven years, they examined nature in tandem. Three manuscripts that Artedi produced in the late 1720s are still

¹³ The most extensive biographical sketch is well over a century old, *viz.* that of Einar Lönnberg, *Peter Artedi: A Bicentenary Memoir Written on Behalf of the Swedish Royal Academy of Science*, trans. W.E. Harlock (Uppsala: Almqvist & Wiksells, 1905). More recent publications are, in chronological order, Daniel Merriman, "Peter Artedi – Systematist and Ichthyologist," *Copeia* 25, no 1 (1938): 33–39; Gunnar Broberg, "Petrus Artedi in his Swedish Context," in *Proceedings of the Fifth Congress on European Ichthyology*, eds. Sven O. Kullander and Bo Fernholm (Stockholm: Swedish Museum of Natural History, 1987): 11–15; and Alwyne Wheeler, "Petrus Artedi, Founder of Modern Ichthyology," in Kullander and Fernholm, *Proceedings of the Fifth Congress on European Ichthyology*, 3–10.

¹⁴ Lönnberg, *Peter Artedi*, 5; Artedi's father had "been admonished by the bishop on account of his connection with an adventuress, Maja Stina Fröling, who had acquired both the parish funds and the little money he had [...]," see: Broberg, "Petrus Artedi in his Swedish Context," 11.

¹⁵ *Ibid.*, 15.

¹⁶ Some of his lecture notes and a bound manuscript of book summaries remain. The letter is glued to the inside of the cover of the latter (communication via email with Thomas Artedi, descendant of the Artedi family). Kungliga Biblioteket (hereafter KBS), Stockholm, MS X1002; I used the transcription offered at http://artedi.nu/?page_id=24 (last accessed 9 April 2021). I thank Anna Svensson for translating this letter into English.

extant: an overview of the herbs and trees of Nordmaling; a classification system for hirsute animals, and a catalogue of fish of the Baltic region.¹⁷ Each of these works, to be discussed in more detail below, reveal his preoccupation with the categorization of species. It was also around this time that he started preparing his extensive manuscript on the study of fish.¹⁸ Linnaeus recounts how, on leaving Uppsala, they promised one another that should either of them die, the survivor would see to it that their late friend's observations and investigations would be published.¹⁹

A decade after enrolling at Uppsala University, Artedi left Sweden to seek out new flora, new fauna and, most pressingly, new opportunities. In September 1734, he set sail for England.²⁰ He visited naturalists and collections. He then set course for the Dutch Republic in the summer of 1735, where he was, by chance, reunited with Linnaeus in Leiden. Linnaeus had received his doctorate at the University of Harderwijk a month previously. He had also been commissioned by the wealthy merchant banker George Clifford (1685–1760), to curate the garden of his estate Hartekamp, near the village of Heemstede. Upon learning of Artedi's financial struggles, Linnaeus introduced him to the wealthy apothecary and collector Albertus Seba (1665–1736), who commissioned Artedi to describe the fish in his collection. The manuscript containing his notes still remains, and shows how he carefully described and classified these species.²¹ Before he could complete the task, however, Artedi drowned in an Amsterdam canal after a convivial evening at Seba's house in 1735.²² Now that his friend's life had been

¹⁷ Peter Artedi, *Kärt Förteckning på de Träen, Buskar åg Örter, såmm wäxa sponté wid Nordmalings Prästebord äller i de närmaste byar där ämmkring Äfter Dänn Alldra-simplaste åg Klaraste Methoden i årdning satte av Petro Arctadio A:o 1729 in Febuario*. Special Collections Department of Uppsala Universitetsbibliotek (hereafter UUB), D 82 a; *Catalogus Piscium Maris Balthici ut et Fluviorum ac Lacuum Sueciae*, BL, Add MS 3870; and *Idea Institutionum Trichozoologiae*, Bergius Library, Universitetsbibliotek Stockholm (hereafter SUB), Stockholm, H.VII.8.1.n.4.

¹⁸ In the preface, dated 1735, Artedi explains that he had began his examination of fishes eight years ago. *Ich.*, *Praefatio authoris*, n.p.

¹⁹ Lönnberg, *Peter Artedi*, 22.

²⁰ Merriman, "Peter Artedi," 35.

²¹ Peter Artedi, *Manuscriptum ichthyologicum quod Petrus Artedi elaboravit in usum Thesauri Sebani*, Library of Congress (hereafter LC), Washington D.C., QL618.15 A78 1735; it is mentioned in Pietsch and Aili, "Peter Artedi's Catalogue," 3, and described in more detail in Peter Merriman, "A Rare Manuscript Adding to our Knowledge of the Work of Peter Artedi," *Copeia* 2, no. 1 (1941): 64–69. This is the manuscript Margócsy writes having looked for in vain in *Commercial Visions*, 243.

²² The possibility that this unfortunate event might not have been, in fact, an accident is explored in a murder mystery by Theodore W. Pietsch, *The Curious Death of Peter Artedi: A Mystery in the History of Science* (New York: Scott & Nix, 2010).

brought to an abrupt halt, it was left to Linnaeus to prepare his nearly finished manuscript on fish in print. Although Seba initially was unwilling to release the manuscript,²³ Linnaeus managed to secure it for a little less than 100 guilders with the financial support of his patron Clifford.²⁴ He finally published the *Ichthyologia* in 1738.

In his recent biography of Linnaeus, Gunnar Broberg has characterized Artedi as one of the big mysteries in Swedish history of science.²⁵ It is, indeed, not exactly easy to examine Artedi's life. He died young and left relatively few sources behind. Most of what is known about him comes from the biography that was written by his much better-known friend and collaborator Linnaeus, and which opens the *Ichthyologia*. As a result, Artedi's name has become almost inextricably connected with that of Linnaeus. Conversely, few of the works that detail Linnaeus' life mention Artedi's name.²⁶ The lack of source material surrounding Artedi is especially marked when compared to those concerning Linnaeus, who was very eager to make himself known to the learned world. This contrast becomes clear at once when considering their respective correspondences that have come down to us: while only one letter by Artedi is known to remain, the Linnean Society of London alone retains several thousand letters sent by and to Linnaeus.²⁷ During his long life, furthermore, Linnaeus published a plethora of natural historical works and issued updates of some of these, like the *Systema naturae* (Leiden, 1735), of which he published the twelfth and last edition in 1767. As we saw, of Artedi's manuscripts, only his *Ichthyologia* appeared in print. The friendship between the two naturalists, and its unfortunate end, offers a striking parallel to that of Willughby and Ray. Linnaeus himself was aware of this connection, likening his collaboration with Artedi to that of the English naturalists.²⁸

²³ Seba appeared to have taken the manuscript as collateral for unpaid bills. Broberg, *Carl Linnaeus*, 135.

²⁴ *Ibid.*, 136.

²⁵ *Ibid.*, 74.

²⁶ Lisbet Koerner [Rausing], "Linnaeus in His Time and Place," in Jardine, Secord and Spary, *Cultures of Natural History*, 150.

²⁷ The Uppsala Universitetsbibliotek holds hundreds more, digitized as part of the *The Linnaean Correspondence* and accessible via <http://www.alvin-portal.org> (last accessed 9 April 2021).

²⁸ Charmantier, Johnston and Smith, "The Legacies of Francis Willughby," in Birkhead, *Virtuoso by Nature*, 380.

To the extent that Artedi has been written about (which has, incidentally, seldom been done by historians of science) these writings often have had a commemorative character, sometimes veering into the hagiographic.²⁹ Due to his rigorous reform of the study of fish, for example, he has often been called the ‘father’ or ‘founder’ of ichthyology.³⁰ On a monument that was unveiled in the Zoological Garden of Amsterdam in 1905, Artedi was crowned ‘Prince of Ichthyology’, just as Linnaeus has often been dubbed ‘Prince of Botanists.’³¹ While the classification system he devised was indeed consequential for the natural history of fishes, as the last part of this chapter will discuss in more detail, it is by focussing only on this system’s merits that one loses sight of the larger cultural context in which it was devised. An internalist tendency also colours the well-rehearsed discussion of whether it was Artedi who made significant contributions to the development of Linnaeus’ taxonomic thinking or vice versa, and whether the two were competitors or close collaborators.³² This chapter is less concerned with questions of primacy, and all the more with the epistemological meanings of new classification systems for natural history at large, and the emerging field of ichthyology in particular.

In the past years, Linnaeus has been the focus of historical inquiries going well beyond a celebration of his accomplishments to in-depth studies of his ideas and working practices; so much so that Linnaean studies has become a flourishing subset of the history of science.³³ Some of the insights on Linnaeus’ work that have emerged from this scholarship also pertain to Artedi’s life and works. Both Artedi and Linnaeus developed a classification system that entailed a hierarchical taxonomy based on clearly defined rules and proposed a reform of naming practices. Although Artedi never used the kind of binomials that

²⁹ Such as Lönnberg, *Peter Artedi* and the Dutch translation by C. Kerbert, *Peter Artedi 1705–1785, Rede uitgesproken bij de onthulling van zijn gedenkteeken, in den tuin van het Koninklijk Zoölogisch Genootschap “Natura Artis Magistra”* (Amsterdam: J.H. de Bussy, 1905).

³⁰ Daniel Merriman, “Peter Artedi – Systematist and Ichthyologist,” *Copeia* 25, no 1 (1938): 33; Alwynne Wheeler, “Petrus Artedi, Founder of Modern Ichthyology,” in Kullander and Fernholm, *Proceedings of the Fifth Congress on European Ichthyology*, 6.

³¹ Original Latin: “Ichthyologorum longe princeps”, Kerbert, *Peter Artedi*, 15.

³² Cf. Broberg, *Carl Linnaeus*, 74; Lönnberg, *Peter Artedi*, 37–38; Merriman, *Peter Artedi*, 36.

³³ Hanna Hodacs, Kenneth Nyberg and Stéphane Van Damme, “Introduction: De-centring and Re-centring Linnaeus,” in *Linnaeus, Natural History and the Circulation of Knowledge*, eds. Hodacs, Nyberg and Van Damme (Oxford: Voltaire Foundation, 2018), 9–15.

Linnaeus introduced in his *Species plantarum* in 1753, he did, as we will see, have specific ideas about how species and genera names should be selected. This chapter can thus draw on the work done in Linnaean studies to better situate and understand Artedi and his work, and the implications of his system for the field of natural history. At the same time, it is perhaps precisely by looking at this, still rather unknown, character bent upon establishing a place for himself in the study of natural history, that light can be thrown on the efficacy of various strategies for doing so.

The similarities between Linnaeus' and Artedi's approach to natural history are not surprising. After all, they spent the larger part of their student days (from the late 1720s to early 1730s) in close contact. We can infer from Artedi's manuscripts that he spent much of his time observing his immediate, natural surroundings, examining plants, mammals, and fish. Given that his species descriptions include some subsurface anatomical detail that extends beyond those features visible on the outside of the fish, we can conclude that he must have occasionally performed dissections. Linnaeus devoted his days to similar pursuits. As he explains, he had daily meetings with Artedi during which they disclosed whatever they had discovered.³⁴ Together, they discussed how they might bring order to nature's varied productions. Their collaboration also entailed competition. Linnaeus remarks how after a few years and some "[...] protracted labour to attain premier position in Ichthyology, I was finally fain to admit my inferiority to my rival, and thenceforth I left that subject entirely in his hands, as also the study of Amphibia, while, on the other hand, he willingly acknowledged that I was ahead of him in knowledge of Birds and Insects."³⁵ Linnaeus and Artedi thus each came to focus themselves on particular types of animals.

Artedi's zeal for classification is already evident in his earliest manuscript. In February 1729, he completed a flora of his native Nordmaling under the title *Kårt Förtekning på de Träen, Buskar åg Örter, såmm wäxa sponté wid Nordmalings*

³⁴ Carl Linnaeus, "Vita authoris," in Artedi, *Ichthyologia*, sig. *4r.

³⁵ Original Latin: "[...] certabat uterque nostrum de victoria obtinenda in Ichthyologicis, donec post diuturnos labores ei victas deberem dare manus, totum hinc studium hoc ipsi commisi, ut & amphibiorum notitiam; contra vero in Avium & Insectorum notitia ille libens mihi cedebat primas." Ibid., sig. *3v, adapted translation from Lönnberg, *Peter Artedi*, 11.

Prästebord äller i de närmaste byar där ämmkring [A Short List of the Trees, Bushes and Herbs that are Indigenous to the Glebe-Lands in Nordmaling and the Villages Lying in its Immediate Vicinity].³⁶ The title went on to indicate that it was “put in order after the most simple and clear method”;³⁷ something that, as we will see, was a recurrent theme for Artedi. His taxonomical organisation was inspired by the system of the French naturalist Joseph Pitton de Tournefort (1656–1708).³⁸ In his *Institutiones rei herbariae* (1700), de Tournefort had made a clear distinction between a genus and species in the realm of plants, grouping those plants together that resembled one another in flower and fruits.³⁹ Genera were collections of species that corresponded to one another in certain parts (for example, the number, shape and symmetry of the petals), and differed in these respects from the members of other genera.⁴⁰ Artedi came to consider the rank of genera as an integral part to the study of natural history because of its value for grouping species. In his (undated) manuscript entitled *Idea Institutionum Trichozoologiae* [Outline of principles of the zoology of hirsute animals] he proposed a classification scheme for mammals that subdivided them into genera.⁴¹ He did the same for fish, as will be discussed in more detail later in this chapter.

Artedi and Linnaeus came into contact with contemporary ideas in natural history through their university’s library, rather than through lectures. Linnaeus complained about the lack of instruction in the field of natural history at their university, saying that: “I myself never had the opportunity of attending a single lecture on Botany, either private or public.”⁴² After the two students had finished their degree, and their funding had run out, they sought to leave Uppsala and try their hand elsewhere. In order to effect this, they applied for stipends with

³⁶ As cited in note 16.

³⁷ Original Swedish: “Äfter Dänn Alldra-simplaste äg Klaraste Methoden i ärdning satte [...]” UUB, D 82 a, title page.

³⁸ Artedi probably took hold of the Tournefort’s work through Lars Roberg (1664–1742), who was professor of medicine at Uppsala University. A catalogue of his library, which can be found in UUB, D60, shows he possessed at least one of Tournefort’s botanical books.

³⁹ Yves Cambefort, “How General are Genera? The Genus in Systematic Zoology,” in *The Oxford Handbook of Generality in Mathematics and the Sciences*, eds. Karine Chemla, Renaud Chorlay, David Rabouin (Oxford: Oxford University Press, 2016), 260.

⁴⁰ This definition comes from Merriman, “Peter Artedi – Systematist and Ichthyologist,” 38–39.

⁴¹ The contents of this manuscript have been transcribed in Orvar Nybelin, “Tvenne Opublicerade Artedi-Manuskript,” *Svenska Linnésällskapets Årsskrift* 18 (1935): 58–77.

⁴² Lönnberg, *Peter Artedi*, 8.

the Royal Society of Letters and Sciences in Uppsala (known as the *Societas regia literaria et scientarium*). This society, modelled after the Royal Society in London, had been founded in the early eighteenth century.⁴³ Linnaeus subsequently received the support of the Uppsalian Society for his natural historical expedition to the province of Lapland in 1732.⁴⁴ Artedi seems to have applied for another funding stream offered by this academy, the ‘Stipendium Stiglerianum’ set up by the merchant Jacob Stiegler (1649–1716) in May 1734; probably without success, for he later appealed to his inlaws Peter Biur and Jonas Liungberg for funding.⁴⁵ One still needed to be prosperous to be a naturalist.

Artedi’s entreaty to his inlaws was successful, and he ventured to London. As the previous chapters has shown, this was a suitable destination for someone interested in natural history. Artedi had prepared this trip well. Besides securing financial support from his inlaws, he also capitalized on his connections in another way. He found Jacob Serenius (1700–1776), chaplain to the Swedish congregation in London, willing to write him a letter of recommendation to Hans Sloane, who had by this time become the president of the Royal Society. In this letter, Serenius stated that he thought that Sloane would be “pleased to grant him [Artedi] when you find his skill in ictyology [*sic*] and other parts of natural history.”⁴⁶ When Artedi visited Sloane in London, he brought along a gift: his manuscript entitled *Catalogus Piscium Maris Balthici ut et Fluviorum ac Lacuum Sveciae* [Catalogue of Fish in the Baltic Sea and the Rivers and Lakes of Sweden]. It was a result of his prolonged study of fishes in his vicinity; the last few pages gave a brief summary of the *Ichthyologia*, which he probably intended to publish in the foreseeable future.⁴⁷ Artedi presented himself, and was presented by others,

⁴³ Tore Frängsmyr, “Linnaeus in his Swedish Context,” in *Contemporary Perspectives on Linnaeus*, ed. John Weinstock (Lanham: University Press of America, 1985), 183–186.

⁴⁴ For the background of this enterprise, see: Lisbet Koerner [Rausing], *Linnaeus: Nature and Nation* (Cambridge, Mass.: Harvard University Press, 1999), 56–81.

⁴⁵ Application, dated 22 May 1734; UUB, Waller Ms se-00136. This stipend is described in *Samling af testamenten och författningar om stipendien* (Uppsala: Johan Fr. Edman, 1795), 62–78.

⁴⁶ Jacob Serenius to Hans Sloane, 26 October 1734 (OS) as reproduced in Orvar Nybelin, “Kring Petrus Artedi’s vistelse i England 1734–1735,” *Svenska Linnésällskapets Årsskrift* 49 (1966): 23–25.

⁴⁷ BL, Add MS 3870. The contents of this manuscript have been reproduced in Nybelin, “Tvenne Opublicerade Artedi-Manuskript,” 78–90. For an English translation, see: Theodore W. Pietsch and Hans Aili, “Peter Artedi’s Catalogue of the Fishes of the Baltic Sea: An English Translation with an Introduction and Commentary,” *Zoological Journal of the Linnean Society* 189, no. 3 (2020): 975–997.

as a naturalist particularly skilled in the study of fishes. As broad as his natural historical interests ranged, he made name as an ichthyologist.

The species descriptions in the *Ichthyologia* make it possible to retrace some of Artedi's itinerary in London. He made use of the opportunity to study Sloane's expansive collection by describing some of its species of boxfish.⁴⁸ Sloane was also the patron of James Salter (d.1728), who preferred to call himself Don Saltero, and owned a Chelsea coffee house in which he displayed a broad range of *artificialia* and *naturalia*.⁴⁹ In this coffee house, Artedi further saw species of boxfish.⁵⁰ He took note of the whale that found its way into the city in November 1734.⁵¹ Artedi also visited the Swedish publican Lars Lilja (d.1744) at his establishment in Shadwell, as well as the taverns called Nag's Head, Green Dragon and White Bear.⁵² These pubs were frequented by sailors returning from a journey to faraway places, and Ovar Nybelin has conjectured that they may have used dried exemplars of fish acquired during these travels to pay their drinking bills – a hypothesis that does correspond to the value that was attributed to rare natural historical objects.⁵³ Artedi's visits to collections in London, and later Amsterdam, led him to remark that the fish he had seen were "altogether rare and curious, so I have seen more curiosities in this part of natural history than someone who has travelled through all of Europe."⁵⁴ As centres of global commerce, after all, these cities were hubs for the study of specimens from faraway places.

After a brief, albeit expensive, stay in London Artedi travelled to the Dutch Republic in 1735, with the hope of attaining a doctorate in medicine.⁵⁵ He had, however, used up all his financial reserves and could not afford to enrol straightaway. Linnaeus' introduction to Albertus Seba must have appeared propitious. Seba was a renowned collector of *naturalia* from the East and West Indies and beyond –

⁴⁸ Original Latin: "vidi in museo Hans Sloane", "vidi apud Sir Hans Sloane", *Ich.*, *Genera piscium*, 56–57.

⁴⁹ For an idea of the contents of this collection, see: James Salter, *A Catalogue of the Rarities, to be Seen at Don Saltero's Coffee House*, vol. 10 (London: s.n., 1731).

⁵⁰ *Ich.*, *Genera piscium*, 58.

⁵¹ Original Latin: "Ex observatione propria, Londini 1734 in Novembri", *Ich.*, *Genera piscium*, 77 and "visa a me Londini anno 1734" and *Ich.*, *Descriptiones specierum*, 107.

⁵² Nybelin, "Kring Petrus Artedi's vistelse i England 1734–1735," 27.

⁵³ *Ibid.*, 10–12.

⁵⁴ Original Swedish: "[...] allesammans rare, och curieuse, så att jag sedt flera curieusiteter utj den delen af Hist. naturali, än den som rest genom hela Europa." KBS, MS X1002.

⁵⁵ Merriman, "Peter Artedi," 35.

tsar Peter the Great (1672–1725) had visited his collection in Amsterdam and purchased it for an enormous sum in 1716.⁵⁶ Seba had meanwhile built another impressive collection of natural curios, which he was codifying into print under the abbreviated title *Thesaurus* [Treasure].⁵⁷ In the one letter of Artedi's that has survived, written to his relatives a few days before his death in September 1735 in Amsterdam, Artedi narrates that: "[t]he first time I was in Amsterdam, there was much talk of an Apothecary, that will soon publish a great work of natural history, I visited him, and when he noticed that I was at home in Ichthyology, he convinced me to stay on a while in Amsterdam and describe his East-Indian and American fish, for he does not know any of them."⁵⁸ Artedi's intimate knowledge of the natural history of fish, which he explicitly refers to as ichthyology, made him a suitable candidate for this task.

Artedi assumed this task on the understanding that his name would be included in the work as an author.⁵⁹ It is likely that he had seen the book's first volume, which was published in 1734. The second volume had either just appeared or was close to doing so. In his letter, Artedi states to have heard that Her Majesty of Sweden, Queen consort Ulrika Eleonora (1688–1741), had bought these splendidly illustrated volumes for the library of Drottningholm Palace. Being a recognized contributor to Seba's project would help further Artedi's reputation. Possibilities like these seem to have been something of a preoccupation for him, as he continued to write: "[i]t is a hard thing when one first begins to show oneself in the world and one's name begins to be known, but can't fulfil his ambition and rise as far as he would wish."⁶⁰ He goes on to explain that he was glad to have met Seba, because the commission he received meant that he could exert himself and get something

⁵⁶ Margócsy, *Commercial Visions*, 89. For details of the sale, see: Jozien J. Driessen-van het Reve, *De Kunstkamera van Peter de Grote: De Hollandse Inbreng, Gereconstrueerd uit Brieven van Albert Seba en Johann Daniel Schumacher, uit de Jaren 1711–1752* (Hilversum: Verloren, 2006), esp. 107–117.

⁵⁷ Albertus Seba, *Locupletissimi rerum naturalium thesauri accurate description et iconibus artificiosissimis expressio* (Amsterdam: apud Wetstenium, & Gul. Smith, & Janssonio-Waesbergios, 1734–1765).

⁵⁸ Original Swedish: "När jag första gången kām hit till Amsterdam taltes mycket ām en Apothecare, sām hārstādes gjer ut ett stort werck utj historia Naturali, jag hālsade pā hānom, och effter han mārchte jag war hemma utj Ichthyologien, sām ōwertalte han mig att bliwa en tid qwar i Amsterdam och gifa en beskrifning pā hans Ost-Indiska och Amerikanska fiskar, ty han kiānner sielf icke en enda." KBS, MS X1002.

⁵⁹ Ibid.

⁶⁰ Original Swedish: "Det ār en swār ting nār man först begynner wisa sig i werlden och ens namn begynner bli bekant att man dā intet kan hālla fort och bringa det sām hōgt sām man vill, hwilket āfta obigerar en att han icke wāndar att bliwa det han kan." Ibid.

for his trouble. The aforementioned manuscript of the original descriptions Artedi made of these specimens has the title *Manuscriptum ichthyologicum quod Petrus Artedi elaboravit in usum Thesauri Seba* [Ichthyological manuscript compiled by Peter Artedi for the use of Seba's *Thesaurus*].⁶¹ Just like Artedi's other manuscripts, it offers species descriptions listing the main characteristics of each species ordered according to their genus; he used some of these descriptions in the *Ichthyologia*.⁶²

While Artedi's name was indeed mentioned in the preface to the third volume of the *Thesaurus*, which was entirely devoted to aquatic flora and fauna, he would never see it in print (nor, incidentally, would Seba – the book was finally published in 1759).⁶³ Artedi died before his efforts to establish a name for himself as a naturalist had borne fruit. Linnaeus, by way of contrast, would have ample chance to make his name, and he took full advantage. Through the patronage of various wealthy individuals and the awarding of various stipends, Linnaeus published a plethora of works which succeeded in getting both his name and his ideas out onto the stage of the natural historical world. In 1741, he was appointed professor in Medicine, with special emphasis on botany, at the University of Uppsala. He became rector in 1750, and was ennobled in 1761, all the while continuing his research.⁶⁴

Even though Artedi's life was cut tragically short, the career trajectories both he and Linnaeus travelled illustrate some of the hardships that aspiring naturalists encountered when building a name for themselves. As with other fields of knowledge, salaried positions in the field of natural history remained few and far between, so that the ability to dedicate one's life towards investigating nature often depended on one's financial resources, or those of one's family. It is apparent from the little remaining material pertaining to Artedi just how preoccupied he

⁶¹ LC, QL618.15 A78 1735; it is mentioned in Pietsch and Aili, "Peter Artedi's Catalogue," 3, and described in more detail in Peter Merriman, "A Rare Manuscript Adding to our Knowledge of the Work of Peter Artedi," *Copeia* 2, no. 1 (1941): 64–69. This is the manuscript Margócsy writes of having looked for in vain in *Commercial Visions*, 243.

⁶² Its title page states it is "an ichthyological treatise describing more than a hundred of the principal fishes of Amboina and Surinam, which are arranged according to the natural method, with their distinct genera and new specific differences, and with the principal synonyms used by authors in previous descriptions"; translation taken from Merriman, "A Rare Manuscript," 66–67.

⁶³ Artedi's descriptions were edited by Arnout Vosmaer (1720–1799), who would later be appointed director of the menagerie of Stadholder William V in The Hague. See: Margócsy, *Commercial Visions*, 98, 105–106; L.B. Holthuis, "Albertus Seba's 'Locupletissimi rerum naturalium thesauri ...' (1734–1765) and the 'Planches de Seba' (1827–1831)," *Zoologische Mededelingen* 43, no. 19 (1969): 243, 247.

⁶⁴ For the honours that Linnaeus accrued towards the end of his life, see: Broberg, *Carl Linnaeus*, 339–342.

was with establishing his name. The remainder of this chapter will discuss how Artedi confidently presented a new approach for the natural historical study of fishes, and how he allocated himself an important role in this process.

Demarcating a Field

The *Ichthyologia* was published in 5 volumes in 1738. Linnaeus had lived up to his promise by ensuring the work of his friend made it into print. He found a suitable publisher in Coenraad Wishoff (c. 1690–1763), the Leiden bookseller with whom he had printed a few of his own works and who appears to have specialized in scholarly publications.⁶⁵ In the newspaper the *Leydse courant*, Wishoff advertised the work alongside Linnaeus' *Classes plantarum* and a reissue of Johannes Swammerdam's 1667 *Tractatus physico-anatomico-medicus de respiratione usuque pulmonum*, revised by Albert von Haller (1708–1777) – some serious scholarly tomes.⁶⁶ It praised the *Ichthyologia* as an “opus sine pari, curante Linnaeo”, an incomparable work that had been attended to by Linnaeus.⁶⁷ No price was listed, but it must have been relatively affordable.⁶⁸

At first sight it appears a quite unassuming book, especially when compared to the luscious, illustrated natural historical folios that were published in the eighteenth century, like Seba's *Thesaurus*.⁶⁹ Not only was the *Ichthyologia* published in smaller, cheaper octavo format, but not a single image was to be found amongst its five hundred or so pages. The book opens with the biographical sketch by Linnaeus, as said, followed by Artedi's own preface that expatiates on the genesis, aim and structure of his work. The book comprises five parts, each endowed with its own title page. The first, *Bibliotheca ichthyologia*, offers a bibliographic overview; the second, the *Philosophia*, a theoretical framework laid

⁶⁵ Wishoff seems to have specialized in learned books: among his portfolio were works on medicine and natural history, as well as many academic dissertations and a mathematical dictionary. No extensive study on the Wishoff booksellers exists, but they are mentioned in André Bouwman, Ed van der Vlist, Berry Dongelmans and Paul Hoftijzer, eds., *Stad van Boeken: Handschrift en Druk in Leiden, 1260–2000* (Leiden: Primavera, 2008), 202, 223; Rietje van Vliet, *Elie Luzac (1721–1796): Boekverkoper van de Verlichting* (Nijmegen: Vantilt, 2005), 53.

⁶⁶ Advertisement for books of Conrad Wishoff, *Leydse Courant*, May 7, 1738, verso.

⁶⁷ Ibid.

⁶⁸ As has been argued for Linnaeus' similarly slender work (albeit without mention of specific prices), see for example: Broberg, *Carl Linnaeus*, 272; Koerner, *Linnaeus*, 40.

⁶⁹ Benjamin Schmidt, *Inventing Exoticism: Geography, Globalism, and Europe's Early Modern World* (Philadelphia: University of Pennsylvania Press, 2015), 18.

out in aphorisms; the third, *Genera piscium*, a discussion of genera; the fourth, *Synonyma*, an overview of synonyms; and the fifth and last, *Descriptiones specierum piscium*, species descriptions of fishes. The third part of the book is preceded by a pair of dedicatory letters from Linnaeus' hand. One is addressed to his maecenas Clifford, praising his financial support in printing this work, the other to Artedi's inlaws Liungberg and Biur, for having done the same.⁷⁰ The publication of this work gave Linnaeus the occasion to further strengthen these ties.⁷¹

Linnaeus had a hand in shaping the book. But how much? As the original manuscript is unfortunately lost, it is difficult to know whether, and to what extent, he altered it in the process of preparing the book for publication. A copy of the manuscript was listed among the sale of the estate of the Leiden naturalist Laurens Theodorus Gronovius (1730–1777), but its subsequent fate is unknown.⁷² The *Ichthyologia*'s title page states that Linnaeus had not only saved it from oblivion, but had also examined, adapted and edited it⁷³ – although Broberg claims that it was the medicine student Tiburtius Kiellman (dates unknown) who actually did the editing.⁷⁴ From the inventory of Artedi's possessions that an Amsterdam notary drew up after his death we learn that though Linnaeus did adapt the titles both of the book as a whole and its constituent parts, these parts did, in fact, exist as discrete entities.⁷⁵ Some scholars have argued that as Linnaeus mentions in his biographical note that Artedi had read his entire manuscript to him, Linnaeus

⁷⁰ *Icht.*, *Genera piscium*, sig. 2r/v and sig. *3r/v.

⁷¹ For a discussion on dedications, see: Rienk Vermij, "On the Function of Dedications in Early Modern Scientific Books," *Nuncius* 33, no. 2 (2018): 171–197.

⁷² An annotated copy of the auction catalogue of Lauren Theodorus Gronovius' books lists the sum for which every item was sold, but indicates that the manuscript was 'uytgehouden', which likely means that it was excluded from sale. *Catalogus librorum exquisitissimorum [...] Laurentius Theodorus Gronovius* (Leiden: Th. Haak & socios, nec non J. Meerburg, 1778) at the Koninklijke Bibliotheek (hereafter KB), The Hague, Verzcat. 4612, items 169 and 170 on page 177. See also: Sten Lindroth, "The Two Faces of Linnaeus," in *Linnaeus, The Man and His Work*, ed. Tore Frängsmyr (Berkeley: University of California Press, 1983), 176. At least two other copies of the manuscript were made, one for Clifford and the other for Wishoff, but these have also been lost, see: Hans Aili and Theodore W. Pietsch, "Jacob Theodor Klein's Critique of Peter Artedi's *Ichthyologia* (1738)," *Svenska Linnésällskapets Årsskrift* 97 (2014): 62.

⁷³ Original Latin: "Vindicavit, Recognovit, Coaptavit & Edidit Carolus Linnaeus", *Icht.*, title page.

⁷⁴ Broberg, *Carl Linnaeus*, 136.

⁷⁵ Notary minutes, Stadsarchief Amsterdam (hereafter SA), Amsterdam, Archief van de Notarissen, 344 Salomon Dorper, 10695, 30 September, 1735, no. 91. The names of these parts were *Historia literaria ichthyologiae* (probably corresponding to the first part of the printed book) *Prolegomena Institutionum manuscript* (the second part), *Synonymologia manuscript* (the fourth part) and the *Historia piscium universalis manuscript* (the third and/or fifth part). See: Hendrik Engel, "Some Artedi Documents in the Amsterdam Archives," *Svenska Linnésällskapets Årsskrift* 34 (1951): 56–57.

impact on the work was actually rather minimal.⁷⁶ If Linnaeus' statement were true, the manuscript must have been as good as finished. But Linnaeus' editorial hand is unmistakably visible in the book whenever he refers to his own *Systema naturae* (Leiden, 1735) and *Fundamenta botanica* (Leiden, 1736), which had not yet appeared at the time that Artedi completed his manuscript. In certain passages Linnaeus explicates his own ideas: "In this part Mr. Linnaeus has acted on his own, since he very recently laid this very axiom in his *Botanica*, which to the greater part is valid in Ichthyology, a few things having been changed, excluded, or added."⁷⁷ All in all, Linnaeus appears to have made additions to, rather than any real changes in, the system.

This chapter is not designed to settle the matter of who, precisely, contributed what to Artedi's *Ichthyologia*, but rather to understand how it made an effort to demarcate ichthyology as a separate field of natural history by considering the work both with regard to its content and its paratexts. As said before, the book's modest looks are deceiving. The hefty claims it makes begin with the title. The aforementioned inventory indicates that Artedi had given his manuscript the general title *Institutiones ichthyologiae*.⁷⁸ This decision is telling for various reasons. First, it uses the term *ichthyologia*, which was not a common practice at the time; most natural historical works on fish used the term *historia piscium*, and on those few occasions that *ichthyologia* did find its way into a book's title, the term itself was not explicitly addressed or explained.⁷⁹ Artedi defined ichthyology [*ichthyologia*] as "the science [*scientia*] that first specifically indicates all parts of the Fish, subsequently exposes the true Genera and Species names, and finally commemorates the noteworthy Characteristics observed."⁸⁰ The term *scientia*, too, was laden with meaning, for – as we have seen – it denoted causal, certain

⁷⁶ Lönnberg, *Peter Artedi*, 36, cf. Linnaeus, "Vita authoris," *Icht.*, sig. *5v.

⁷⁷ As cited in Aili and Pietsch, "Jacob Theodor Klein's Critique," 47. Original quote *Icht.*, *Philosophia*, aphorism 189, at 64. The term "aphorism" will henceforth be abbreviated as aph., as is common in Linnaean studies.

⁷⁸ The title of the published work was thus not invented by Linnaeus. Engel, "Some Artedi Documents in the Amsterdam Archives," 56. The contents of this manuscript have been reproduced in Orvar Nybelin, "Tvenne Oppublicerade Artedi-Manuskript," 58–77.

⁷⁹ See, for instance, Carolus Figulus, *Ichthyologia seu dialogus de piscibus* (Cologne: Eucharius Cervicornus, 1540) and Stephan Schoenevelde, *Ichthyologia et nomenclaturae animalium marinorum, fluviatilium, lacustrium* (Hamburg: ex Bibliopolio Heringiano, 1624).

⁸⁰ Original Latin: "Ichthyologia est scientia, quae primum omnes Piscium partes nominatim indicat, deinde nomina Generica et Specifica vera ostendit, & denique Proprietates quasdam observatu dignas interdum commemorat." *Icht.*, *Philosophia*, aph. 5, at 2. Original in emphasis.

knowledge.⁸¹ That, decades later, the article on ‘Ichthyologie’ in the *Encyclopédie* of Denis Diderot (1713–1784) opened with this triad of indicating and naming parts, naming species and genera, and exposing particularities, attests to the durability of Artedi’s definition.⁸² A detailed breakdown of what precisely these steps entailed will be provided in the following section.

The second striking thing about the title chosen by Artedi, is that by using ‘institutions’ [*institutiones*], he underlined that his work was meant to serve as the foundations for this emerging field. The term *institutiones*, after all, had been used to refer to the foundations of learning of a certain branch of knowledge, such as law in Ancient Rome, and was applied to other branches of learning in the early modern period. The aforementioned Tournefort, for example, published the *Institutiones rei herbaria* (Paris, 1700), and the Dutch physician Herman Boerhaave (1668–1738) gave his medical series the title *Institutiones medicae* (Leiden, 1708). Artedi owned an edition of the latter work.⁸³ His choice of title thus suggests that Artedi longed to give the study of fish a similar foundational and standardised footing. Even if the original manuscript remains elusive, therefore, its title already offers valuable clues as to its author’s aspirations. The remainder of this chapter will depart from the printed version of the *Ichthyologia*.

Similar to Linnaeus’ *Bibliotheca botanica* (Amsterdam, 1736), the first part of Artedi’s monograph is entitled *Bibliotheca ichthyologica*. It offered an *historia literaria ichthyologiae*, a bibliographic overview of ichthyological learning.⁸⁴ The genre of the *historia literaria* emerged in the context of sixteenth-century humanistic learning, and entailed a history of all human knowledge recorded in writing.⁸⁵ Artedi applied the genre of bibliographic overview to the field of ichthyology, like Linnaeus did for

⁸¹ Pomata and Siraisi, *Historia*, 10.

⁸² Original French: “L’affaire de l’Ichthyologie est premierement de distinguer toutes les parties des poissons, par leurs noms propres ; secondement, d’appliquer à chaque poisson ses noms génériques et spécifiques, c’est-à-dire ceux qui constituent son genre et ses espèces ; troisiemement d’exposer quelques-unes des qualités particulières de l’animal.” Louis de Jaucourt, “Ichthyologie,” in *Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers*, vol. 8, eds. Denis Diderot and Jean le Rond d’Alembert (Neuchâtel: Samuel Faulche, 1765), 483.

⁸³ SA, 344 Salomon Dorper, 10695, 30 September, 1735, no. 91.

⁸⁴ How Artedi managed to consult all these books remains unclear. The inventory drawn up after his death includes the works of Jan Jonston and Willughby and Ray, and were probably on loan from Seba.

⁸⁵ Michael C. Carhart, “Historia Literaria and Cultural History: From Mylaeus to Eichhorn,” in *Momigliano and Antiquarianism: Foundations of the Cultural Sciences*, ed. Peter Miller (Toronto: University of Toronto Press, 2007), 186–187.

botany.⁸⁶ Both works offered insight not only into how these naturalists envisaged the past of these fields of natural historical knowledge, but also their present status and even future directions.⁸⁷ The overview was preceded by an index in which the various authors who had written on fishes arranged neatly by time period, from the centuries before Christ up until the moment of Artedi's own writing. In this way, Artedi put himself as the newest in an old and venerable tradition, while indicating that he ushered in a new phase in the study of fishes.

In his bibliographical overview, Artedi briefly summarised the contents of each book he listed and evaluated its merits and pitfalls, discussing its structure, the quality of the images, as well as the style. These book reviews, however concise, offer illuminating insight into his beliefs about how natural history should be done. Several things stand out. First of all, he paid particular attention to whether books displayed a certain method. Artedi distinguished between those natural histories of fishes that were based on some form of method, and those histories without. In assessing the work of others, for example, he uses 'method' for any organizing principles that they may deploy: fish could be grouped according to their external shape (Willughby and Ray), the kind of water in which they dwelled (Rondelet), according to the alphabet (Gessner), or no method may be used at all, and the fish themselves positioned at random (Salviani).⁸⁸ He noted, furthermore, if authors had, rather than drawing from their own observations, transcribed the descriptions of others (Jonston, Aldrovandi).⁸⁹ In discussing Gessner, he qualified the naturalist's style as discursive, "in the manner of the ancients."⁹⁰ Artedi contended that descriptions ought to be short and succinct because diffuse and long descriptions served no purpose. After all, he declared, the one and only goal of natural history was the discovery of the genera and species of *rerum creatarum*, created things.⁹¹

⁸⁶ Gessner also listed earlier authors in his natural historical works, but he did not annotate them as Artedi did; I thank Sophia Hendriks for sharing this with me.

⁸⁷ Alix Cooper, *Inventing the Indigenous: Local Knowledge and Natural History in Early Modern Europe* (Cambridge: Cambridge University Press, 2007), 156.

⁸⁸ *Icht.*, *Bibliotheca ichthyologia*, 64–65.

⁸⁹ *Ibid.*, 63.

⁹⁰ Original Latin: "more veterum." *Ibid.*, 30. Incidentally, the year of publication that Artedi gives for Gessner's *Thierbuch* (1558) is incorrect.

⁹¹ Original Latin: "[...] diffusae & longae descriptions proprietatum & qualitatum in Ichthyologia & reliqua Historia Naturali inutiles sunt, quatenus vera & naturalis methodus in dignoscendis Generibus & Speciebus rerum creatarum, unicus & praecipuus finis Historiae Naturalis fit." *Icht.*, *Philosophia*, aph. 6, at 2.

On the whole, little is known about Artedi's religious ideas, but his use of the phrase *rerum creatarum* does point to the physico-theological underpinnings of his work. He believed that the task of the naturalist was to uncover God's divine blueprint by finding patterns and order in created beings: in the case of fishes, this meant looking carefully at their physical features, such as the number and position of their fins and teeth. Artedi took a quantifying approach in which number, order and structure were key concerns – very much in the spirit of early-eighteenth century science. The system that emerged from this, Artedi believed, would then reflect the actual structure that God had unfolded, and thus constitute a true and natural system. He does not explain what precisely made a system natural and true. The search for the 'natural method' in arranging plants and animals was a discussion of much longer standing and continued to be hotly debated in the eighteenth century.⁹² The natural method entailed grouping plants alongside each other according to their morphological similarities, and it was widely held that by employing it one could uncover the blueprint of Creation.

As it perhaps is today, therefore, 'method' was a relatively loose concept. A late seventeenth-century dictionary, for example, dubbed as methodical that which was done "with art and with a certain order."⁹³ As mentioned above, in discussing the work of others, Artedi equated method with a degree of structure in presentation. When it comes to his own work, however, Artedi uses 'method' in a different way. Here, he defines his classification system as a 'natural method', which is also the 'true' method (which he opposed to an 'artificial method', which is 'false'). Linnaeus famously brought forward an 'artificial system' for classifying plants, also known as the sexual system. It entailed observing flowers' stamen and pistils to group them into genera, and was easy to understand and apply. This user-friendliness set it apart from the natural method, which was so immensely complex that Linnaeus thought it might well never be understood by anyone.⁹⁴ As he put it, "[n]atural orders are useful for getting to know the nature of plants; artificial ones for telling

⁹² For the background to this discussion in the seventeenth and eighteenth centuries, see: Scharf, "Identification Keys," 86–91; Lesch, "Systematics and the Geometrical Spirit," 76–80; and James L. Larson, "Linnaeus and the Natural Method," *Isis* 58, no. 3 (1967): 304–320.

⁹³ Original French: "Ce qui se fait par art, & avec un certain ordre." Antoine Furetière, *Dictionnaire universel*, vol. 2 (The Hague and Rotterdam: Arnoud and Reinier Leers, 1701), s.v. methodique.

⁹⁴ Scharf, "Identification Keys," 94.

different plants apart.”⁹⁵ He even likened the effort of finding a natural method to that of squaring the circle – a mathematical metaphor that underlined his search for certitude in natural history.⁹⁶ In contrast to Linnaeus, who contended that a natural division was what the naturalist should strive for but was not attainable in practice, Artedi did believe that arriving at a natural system was possible.⁹⁷

Certain kinds of knowledge had no place in this quest. While Artedi acknowledged that there were different authors who had written about fish, doing so for various reasons and to diverse ends, he declared that he would omit writings from “Physicians, Chemists, Physicists, Mechanics, Oeconomists, and of those who wrote of Culinary matters or about Fishery.”⁹⁸ He does not specify what these categories of fishy knowledge entail, but only qualifies them as being *amethodicis*, or ‘without method’, and therefore not meriting a place in his ichthyological work. In practice, however, the groups he specified relied, albeit to varying degrees, on their own form of method. Chapter 2 has shown, for example, how fishermen distinguished species by their physical resemblances or differences. Artedi in this case, therefore, did not equate method with *any* systematic manner, but with *his specific* method of classification that he delineated in his own work. The exclusion of knowledge with regards to culinary matters or fishery constituted a clear move away from earlier traditions of learned inquiries into fish; as we have seen in the previous chapters, natural historical volumes that discussed fish published in the sixteenth and seventeenth centuries encompassed remarks on the culinary uses of mackerel, or longer discourses on subjects such as the curing herring for trade and commerce, as found in *Historia piscium*. In examining Artedi’s definition of ichthyology (and, by extension, of an ichthyologist), attention thus should not be paid only to what it includes, but also what it excludes.

Like Artedi, Linnaeus attempted to organize and classify those that inhabited his world, though of course this was the world of plants, and included gardeners

⁹⁵ Linnaeus, *Genera plantarum*, as cited in Scharf, “Identification Keys,” 95.

⁹⁶ As cited in Larson, “Linnaeus and the Natural Method,” 319.

⁹⁷ On Linnaeus’ notion of a “natural” system for botany, see: Staffan Müller-Wille, “Collection and Collation: Theory and Practice of Linnaean Botany,” *Studies in History and Philosophy of the Biological and Biomedical Sciences* 38, no. 3 (2007): 541–562.

⁹⁸ Original Latin: “Alii vero pro varia intentione & fine aliter quoque de Piscibus agunt, ut Medici, Chemicci, Physici, Mechanici, Oeconomi, Coquinarie et rei Piscariae scriptores, ut jam de Amethodicis nihil dicam.” *Ichth., Philosophia*, aph. 6, at 2.

and horticulturists.⁹⁹ For the botanist, he drew up the following job description: “he who knows to call similar vegetables with similar names and distinctly different plants with distinctive names, intelligible to everyone.”¹⁰⁰ In his *Fundamenta botanica* (Leiden, 1736) Linnaeus had distinguished between *botanici*, who operated according to the systematic principles of botany, and *botanophili*, whose engagements with plants were not based on the fundamentals of botany, such as anatomists, gardeners and physicians.¹⁰¹ Here it is pertinent to note that Linnaeus himself was involved in horticulture and that this garden work informed his theoretical, taxonomical thinking, again indicating that in truth these apparently distinct areas of knowledge were not fenced off from one another.¹⁰² Both Artedi and Linnaeus demarcated their particular kind of learned, systematized knowledge from practical or artisanal knowledge. They also set natural historical knowledge apart from the kind of knowledge they considered the prerogative of physicians and anatomists: in discussing the various parts of fish, for example, Artedi remarked that the study of their blood vessels and nerve systems did not properly relate to ichthyology, but rather to the domain of comparative anatomy, and that it, therefore, did not require discussion in his book.¹⁰³ What all of this makes abundantly clear was that, for Linnaeus and Artedi, not anyone who busied themselves with plants or fish was to be considered a botanist or an ichthyologist, respectively.

The orderly manner in which the contents of the *Ichthyologia* are structured, not least the regular use of lists, is of particular note. The authors discussed in the *Bibliotheca ichthyologia*, for instance, are divided into methodic authors and a-methodic authors.¹⁰⁴ Artedi’s reviews of their publications take the form of consecutively numbered lists. While lists had figured in natural historical studies

⁹⁹ Hodacs, Nyberg and Van Damme, “Introduction,” 3.

¹⁰⁰ Linnaeus, *Genera plantarum*, 1, as translated in Staffan Müller-Wille and Karen Reeds, “A Translation of Carl Linnaeus’s Introduction to *Genera plantarum* (1737),” *Studies in History and Philosophy of Biological and Biomedical Sciences* 38, no. 3 (2007): 265.

¹⁰¹ Original Latin: “BOTANOPHILI (6) sunt, qui vegetabilia, licet non ex fundamentis Botanici (151), tractant, ut: *Anatomici, Hortulani, Medici, Anomali*.” Carl Linnaeus, *Fundamenta botanica* (Amsterdam: Salomon Schouten, 1736), aph. 43, at 4.

¹⁰² See, for example: Stearn, “Carl Linnaeus,” 21–31.

¹⁰³ Original Latin: “Descriptio Arteriarum, Venarum, Vasorum Lymphaticorum & Nervorum in Piscibus, non proprie ad Ichthyologiam seu Historiam Piscium naturalem, sed ad Anatomiam Comparatam pertinet [...]” *Ichth., Philosophia*, aph. 113, at 44. Original in emphasis.

¹⁰⁴ Linnaeus also arranged the authors discussed in his *Bibliotheca botanica*, see: John L. Heller, “Linnaeus’s *Bibliotheca Botanica*,” *Taxon* 19, no. 3 (1970): 363–411, esp. 365.

for centuries, the rigorous way in which they are applied in Artedi's book is remarkable, as almost every part of it takes the form of a list, table or index: not only the descriptions of genera and species of fish, but also the people writing and otherwise engaged with fish. James Delbourgo and Staffan Müller-Wille have characterized lists as tools that "simultaneously inventoried and organized the accumulated world."¹⁰⁵ To this it may be added that, besides offering a practical way for overwhelmed naturalists to keep track of the abundance of knowledge available to them, the making of lists also gave them an opportunity to actively shape the corpus.

Other tried and tested ways of structuring knowledge could be found in scholastic works. In explaining his principles for the study of fish, Artedi presents them in the form of a *definitio* followed by a *scholion*: a definition of a certain concept and a commentary to that definition. This is the structure of the *disputatio* that was very common to the scholastic method that still predominated university curricula.¹⁰⁶ In other instances, he offered his principles in short propositions which he called *theses*, and which he then elaborated upon with a *demonstratio* or *observatio*; such reasoning structures stretch back to traditional Euclidean forms of argumentation.¹⁰⁷ In presenting his new approach to fish, therefore, Artedi drew on traditional ways of organising and conveying knowledge, such as the *historia literaria* and the *disputatio*, to get across his method.

In short, as a document showing how one could demarcate ichthyology as a separate field of knowledge, the *Ichthyologia* is quite unique. In it, Artedi drew up the definition for ichthyology, and surveyed and commented on its history. Central in all these aspects was the notion of 'method'; which in its broad sense entailed an orderly and systematic approach, and its narrowest sense referred to the 'natural method.' Despite the ambiguities of the term prevalent in Artedi's work, the overall idea was that any method was better than no method, and that *his* method was the best. In the process, Artedi excluded certain types of knowledge

¹⁰⁵ James Delbourgo and Staffan Müller-Wille, "Introduction: Listmania," *Isis* 103, no. 4 (2012): 713.

¹⁰⁶ For a historical overview, see: Alex J. Novikoff, "Toward a Cultural History of Scholastic Disputation," *American Historical Review* 117, no. 2 (2012): 331–364.

¹⁰⁷ Tore Frängsmyr, "The Mathematical Philosophy," in Frängsmyr, Heilbron and Rider, *The Quantifying Spirit*, 39.

and their practitioners, whittling away their authority in the process. This ambition was present in its content as much as in its structure: it listed what was important. So far, the main tenets of Artedi's system have only been discussed briefly. It will now be discussed more thoroughly, both because it was consequential for the natural historical study of fish, and because it demonstrates how Artedi's principles worked in practice.

Classifying Fish

What ought an ichthyologist do? According to Artedi, instilling *order* into the world of fish should be the principal aim. To do so, clear concepts and categories were required. These he offered in the second part of his book, the *Philosophia ichthyologia*. Artedi laid out an elaborate set of rules to which the ichthyologist should adhere. These rules explained, for example, how one could demarcate fish from other classes of animals, how one might first group them into orders and subsequently these orders into genera, and how one unambiguously distinguished one species from the other. Artedi also proposed a reformation of genus and species names. His focus on clear and distinct categorisation of species also entailed a process of abstraction, as we will see, in which focus was on measuring and counting and the *historical*, qualitative component of natural history came to matter less. We might recognize in this abstracted approach a distinct Cartesian influence.

The first step in classifying fish was to decide what a fish actually was. Artedi described that there were six general classes in zoology: the hairy quadrupeds, the amphibians, the birds, the fish, the insects and the zoophytes.¹⁰⁸ Each of these classes formed their own field of study, which were, respectively, “the natural history of hirsute animals, ornithology, amphibiology, ichthyology and entomology.”¹⁰⁹ Artedi defined fish as “an animal without feet, always endowed with fins, breathing either through gills or lungs, dwelling mostly in water, there swimming either only with its fins, or simultaneously flexing the body, sometimes willingly venturing onto land, and in some instances flying in the air above the water with the help of

¹⁰⁸ *Ichth., Philosophia*, aph. 134, at 49.

¹⁰⁹ Original Latin: “[...] ut in 1°. in Historiam Naturalem Animalium Quadrupedum Pilosorum. 2°. In Amphibiologiam seorsim. 3°. Ornithologiam. 4°. in Ichthyologiam & 5°. in Entomologiam.” *Ibid.*, aph. 132, at 48–49.

pectoral fins.”¹¹⁰ Comparing this definition to the one drawn up by Willughby and Ray, as cited in Chapter 1, some things stand out: both studies label a fish as an aquatic animal lacking feet, but where Willughby and Ray hold that a fish never comes out onto dry land, Artedi contends that certain fish sometimes venture ashore out of their own volition, and also that one may encounter them flying in the air.

After having defined what ichthyology is, and what a fish is, Artedi proceeds to describe each and every part of a fish. In doing so, he wanted to offer an “explanation of the technical terms common to ichthyology” – that is, a consistent terminology and vocabulary that could henceforth be applied in the describing of fish.¹¹¹ He discussed what, among other parts, fins, tails, scales, and gills, as well as stomachs or swim bladders, looked like in different taxonomical groups of fish, and also indicated their worth for classification. Fins, he explained, were those parts of the body of fish that protruded from the body and that had membranes that could either be soft or thorny, the latter being the fin rays.¹¹² Although, as we saw in Chapter 1, Willughby and Ray every now and then counted the number of rays in the fins of fish, they did not use it as one of their main taxonomical criteria, whereas Artedi saw them as key characteristics for assigning fish to both orders and genera. A proper understanding of each of part of the fish helped in the classification of species. This section dives into Artedi’s classification system in more detail, discussing his taxonomical ranks in turn, from orders to genera to species, and finally, varieties. It offers us insight into the various parts from which his system was composed.

Orders

Now that the class of ‘fish’ had been defined, the next step was to divide it into orders. Artedi thought that the existence of this taxonomical level should be

¹¹⁰ Original Latin: “Piscis est Animal apodum, Pinnis semper praeditum; vel branchiis, vel Pulmonibus respirans; plerumque in aqua habitans, ibique vel solis Pinnis, vel flexuoso corporis impulsu simul natans, interdum vero in terram sponte egrediens, & quandoque in aëre supra aquam ope pinnarum Pectoralium volans.” Ibid., 1–2. Original in emphasis.

¹¹¹ *Icht., Praefatio auctoris*, sig. **r.

¹¹² *Icht., Philosophia*, 3.

obvious to everyone. After all, where certain genera of fish were much alike, others differed greatly from one another. While the genus of the carp, for example, much resembled that of the herring, the genus of the herring and of the whale were different in nearly all of their parts.¹¹³ From this one could infer that the herring and the carp belonged to one and the same order. Such a subdivision into orders was useful to natural historians, because by combining species into groups of several sizes one obtained a clearer view of how they interrelated.¹¹⁴ Aiming to devise a natural system, Artedi urged:

[...] that the *Orders* should be *Natural*; for very many and diverse Orders can be formed by Number, Form, and placement of Parts without much effort, but such orders must not be tolerated, where fish of the same kind are separated badly and diverse ones are often put together in one [Order], and indeed the square things are mixed with the round and the highest with the lowest.¹¹⁵

Those jumbled orders of dissimilar-looking animals and plants emerged when one took ‘accidental things’ [*res accidentales*], such as place, time of bloom or procreation, nourishment, quantity, or height as the grounds for grouping them.¹¹⁶

In order to prevent such disorder, Artedi formulated a set of strict rules that should be assumed by any naturalist. The identification key that he designed unlocked the five different orders [*clavis ordinum*] (**Figure 3.1**). It can be used as a kind of flow chart, taking the reader stepwise through several physical characteristics. At every step, the reader selects the physical characteristics of the specimen at hand, from the general to the more specific, narrowing down the options so as to eventually arrive at the correct order. Linnaeus published a similar diagram in his *Philosophia botanica*, which displays Tournefort’s key for the orders of plants in the same fashion. Both Matthew D. Eddy and Isabelle

¹¹³ Ibid., aph. 125, at 47.

¹¹⁴ Ibid., aph. 127, at 47.

¹¹⁵ Original Latin: “[...] monui ejusmodi *Ordines* debere esse *Naturales*; nam plurimi & diversi *Ordines* à Numero, Figura & situ Partium sine magna opera effingi possunt, sed tales ordines non tolerari debent, quatenus Pisces congeneres male separantur & diversi in unum saepe conjunguntur, adeoque quadrata rotundis & summa imis miscentur.” *Ichth., Praefatio authoris*, sig. *v.

¹¹⁶ *Ichth., Philosophia*, aph. 128-1, at 47.

Charmantier have drawn attention to the Ramistic roots of this particular way of organizing knowledge.¹¹⁷ The French humanist Peter Ramus (1515–1572) had proposed a logical method of structuring knowledge according to dichotomous divisions, set out in tables or diagrams, and his teachings remained part of the curriculum of some European universities in the time of Artedi and Linnaeus.¹¹⁸ We can encounter the organisational method in the works of both.

To decide to which order a certain fish belonged, the first thing one needed to look for was the position of its tail. Firstly, any fish with a horizontal tail belonged to the order of cetaceans (*Plagiuri*). Those fish with perpendicular tails could be divided into those with cartilaginous skeletons (*Chondodropterygii*) and those with bony skeletons. That latter group, in turn, could be further subdivided in those fish that did not have any rays in the gill flap (*Branchiostegi*) and those that did possess such rays.¹¹⁹ The last dividing feature was whether a fish was ‘unarmed’ (*Malacopterygii*) or ‘eager to fight’ (*Acanthopterygii*); rather than implying something about the temper of the fish, this indicated whether the rays in its fins were soft or thorny.¹²⁰ The names that Artedi gave his five orders of fishes are, in fact, Greek descriptions naming the primary distinctive feature of each order (these were, in the same sequence as just followed: flat fins, cartilaginous fins, large gill lids, soft fins, and thorny fins).¹²¹ One word thus sufficed to place each fish in its proper order.

¹¹⁷ Isabelle Charmantier, “Carl Linnaeus and the Visual Representation of Nature,” *Historical Studies in the Natural Sciences* 41, no. 4 (2011): 370–371; Matthew D. Eddy, “Tools for Reordering: Commonplacing and the Space of Words in Linnaeus’s *Philosophia Botanica*,” *Intellectual History Review* 20, no. 2 (2010): 227–252, esp. 243.

¹¹⁸ On Ramus and his influence, see: Walter Ong, *Ramus, Method and the Decay of the Dialogue: From the Art of Discourse to the Art of Reason* (Cambridge, Mass.: Harvard University Press, 1958).

¹¹⁹ The gill flap, also known as the operculum, is the part of the fish that covers the slits of the gills.

¹²⁰ Artedi subdivides these two orders on the level of the *manipules*, a category resembling what we might now call ‘families’ and which he does not fully define or develop. See also: *Ichth.*, *Philosophia*, aph. 136 at 50 and Lönnberg, *Peter Artedi*, 29.

¹²¹ For this observation, I thank Hans Aili.

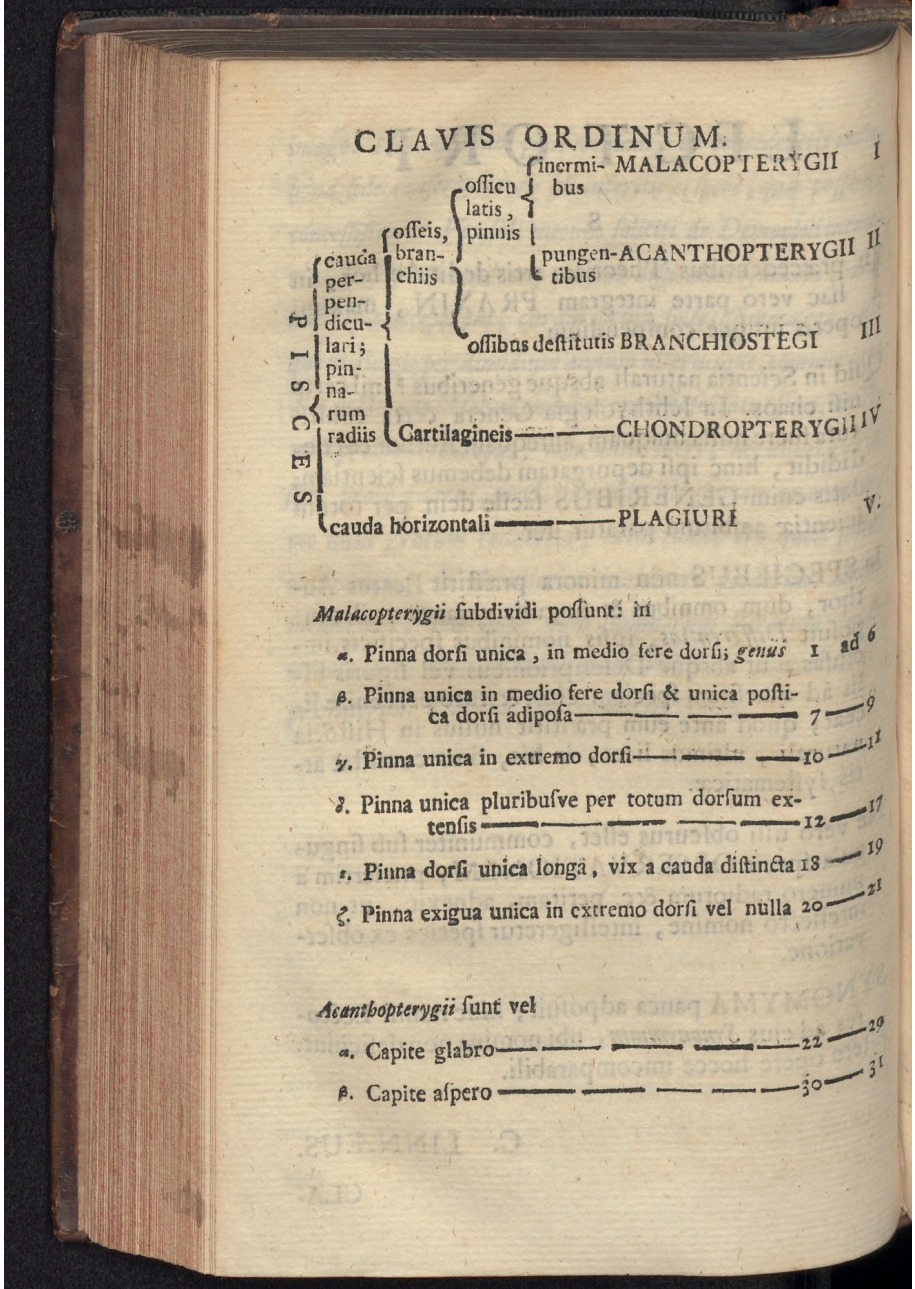


Figure 3.1 Clavis ordinum | Peter Artedi, *Ichthyologia, sive opera omnia de piscibus* (Leiden: Conrad Wishoff, 1738), n.p. | © Universiteitbibliotheek Leiden

Genera

Below the order, one entered the rank of the genus. Chapter 1 has shown that the notion of ‘genus’ or its plural, ‘genera’ had been used since Antiquity to denote groups of plants or animals that resembled one another. There was no clear agreement, however, on *what*, exactly, a genus was. As we saw in Chapter 1, for example, Willughby and Ray had applied the term rather loosely to indicate species that shared certain similar external characters. While they grouped species together based on the resemblance of their external characteristics, they did not formally establish taxonomical ranks and neither did they endow groups of species with names. Fish were sorted into broad or long fish. Subsequently, fish from the latter category were further described as elongated or shorter long fish.¹²² Not of all their groupings were devised in such a way that they were necessarily mutually exclusive of one another: one species could belong to more than one group.¹²³ Thus, although the concept of genus was not unknown, it had never been clearly defined.¹²⁴

Artedi, as we saw, considered the establishment of genera as the first and foremost aim of natural history, and this required a consistently defined and applied genus concept. Artedi defined a genus as a group “assembled of some certain species, or resemblance of certain fish from diverse species, that *always* convene in the placing of its external parts, *usually* in number, and *often* in figure and proportion.”¹²⁵ Artedi was well aware that assigning species to their correct genera was an intricate process, and explained that general characteristics [*characteres generici*], i.e., marks that were indicators of a certain genus, had to be chosen judiciously.

He contended that even though it was important to take a good look at a species’ external parts, one should at the same time not be deceived by its general outward appearance. At first glance, for example, one might be led to believe that

¹²² *Hist. pisc.*, 46.

¹²³ Lönnberg, *Peter Artedi*, 27.

¹²⁴ *Ibid.*, 30.

¹²⁵ Original Latin: “Genus Ichthyologiae est convenientia quaedam certarum specierum, seu similitudo quorundam Piscium ad speciem diversorum, qui in situ Partium externarum *semper*, numero *plerumque*, Figura & Proportione *saepe* conveniunt.” *Ichth., Philosophia*, aph. 139, at 51. Original sentence in emphasis, which is not reproduced here for readability; the emphasis of the original, however, is retained.

the tench and the lake-trout belong to one and the same genus. The overall shape of these fishes was, after all, rather similar. On closer inspection, however, Artedi argued that it was plain that the fish displayed different general characteristics.¹²⁶ The three bones in the gill flap of the tench meant it had to be assigned to the genus of the carp; the lake-trout had no fewer than ten such bones, and thus belonged to the genus of the salmon.¹²⁷ So far, so good. What complicated matters, however, was that general characteristics were not the same for every order of fish. This makes sense: there were no perfectly constant characters that could be used to determine each and every genus, simply because no one part was found in every fish. For the bony fishes, as we just saw, the best course of action was to count the number of bones in the gill flap.¹²⁸ For the cartilaginous fishes, the thing to pay attention to was the shape of their body and their gill apertures.¹²⁹ In the cetaceans, as the introduction to this chapter already mentioned, the salient generic characteristics were the number of fins and teeth. As every system seeking to refine and simplify matters had, inevitably, to contend with exceptions and anomalies, the genera had to be demarcated on a case-by-case basis.

After painstakingly examining this complex web of physical features, Artedi eventually arrived a grand total of fifty-two genera. These he discussed in the third part of the *Ichthyologia*, entitled *Genera piscium*. Like the rest of his book, this part is tightly structured. Organized by order, the *Genera piscium* describes each genus and lists the species it comprises. A discussion of the genus called ‘Osmerus’ – a type of smelt – can stand as example of his theory put to practice (**Figure 3.2**).¹³⁰ This description is given in the first order, the *Malacopterygii*. Of this order, the Osmerus was the eighth genus and is assigned a corresponding roman numeral (VIII). It then lists the defining physical characteristics of this genus: the bones in its gill flap number seven or eight, the dorsal and the ventral fins are positioned equally far from the tip of the snout, the teeth in this mouth

¹²⁶ Ibid., aph. 143, at 51.

¹²⁷ *Ich.*, *Philosophia*, aph. 148, at 52; see also Lönnberg, *Peter Artedi*, 31.

¹²⁸ Ibid., aph. 182, at 62.

¹²⁹ Ibid., aph. 153, at 54.

¹³⁰ *Ich.*, *Genera piscium*, 10.

are big, and the tongue comes from the palate. Any species conforming to each and every one of these characteristics could be safely assumed to belong to the genus of the Osmerus. This description is exemplary for how carefully selected combinations of characteristics were used to discern one genus from the other.

Confusion over genera could be prevented with a rigorous naming protocol. Artedi therefore proposed a reformation [*reformatio*] of naming practices.¹³¹ The first rule stated that each fish belonging to the same genus must be given the same generic name. While this might sound obvious to us, Artedi showed the necessity for this measure by explaining that the various species belonging the genus *Cyprinus* (carp) were referred to by no fewer than twenty-five different generic names.¹³² Artedi furthermore dictated that a generic name should consist of one word only, banning composites or diminutives.¹³³ Instead of vernacular (or, in Artedi's words, 'barbaric' [*barbara*]) names, only those originating from Latin or Greek were to be allowed; the ancients had offered plenty such names to draw from.¹³⁴ Yet not each Greek or Latin name met his requirements. Any similitude between the names of animals living on land and those living in the water should be avoided. Fishes were not to share their species names with mammals like the wolf [*lupus*], birds like the eagle [*aquila*], insects like the scarab [*scarabaeus*], nor vegetables like parsnip [*pastinaca*].¹³⁵ Unambiguous, clearly defined and named genera were integral to Artedi's system.

Species

With Artedi's key in hand, a naturalist may have decided that the fish specimen before him belonged to the order of the *Malacopterygii* on account of it having a bony skeleton and soft fin rays. Judging from the number of bones in the gill flap, the position of its dorsal and ventral fin, and its teeth and tongue, it was part of

¹³¹ Original Latin: "Reformatio Nominum Genericorum" *Icht., Philosophia*, 64; "Reformatio Nominum Specificorum" *ibid.*, 80.

¹³² *Icht., Philosophia*, aph. 191, at 64–65.

¹³³ *Ibid.*, aph. 196, at 71 and aph. 202, at 78.

¹³⁴ *Icht., Praefatio authoris*, sig. **v. Linnaeus contended the same for plants: Carl Linnaeus, *Critica botanica* (Leiden: Conrad Wishoff, 1737), aph. 229, at 48.

¹³⁵ *Icht., Philosophia*, aph. 194–1/6, at 66–70.

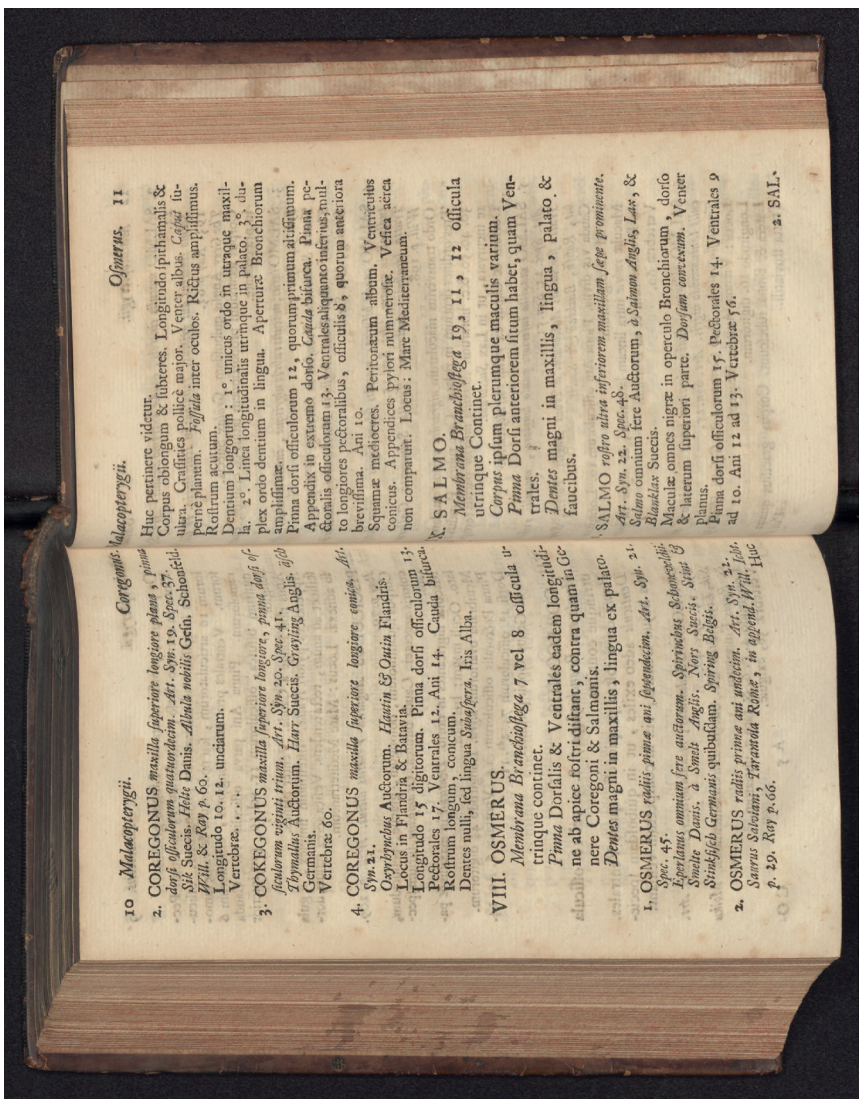


Figure 3.2 Genus description of Osmerus | Peter Artedi, *Ichthyologia, sive opera omnia de piscibus* (Leiden: Conrad Wishoff, 1738), 10 | © Universiteitsbibliotheek Leiden

the *Osmerus* genus. The question then arose precisely with which of the two species in this genus he was dealing. Artedi gave the following definition of a species:

In *Ichthyology*, every Fish constitutes a species if it is different from the other species of its genus with regard to a certain external Part being absent or present, either as regards number, Proportion, or Shape, or owing to some constant difference in colour.¹³⁶

This definition is an example of Kärin Nickelsen's contention that species are "not concrete objects the properties of which can be gathered just by looking at them", but rather "abstract concepts designating whole classes of objects whose definitions depend on the taxonomic system used at the time."¹³⁷ Species, then, are not self-evident entities, but they require a certain effort to be conceptualized as such. Artedi's definition can serve as a reminder that the way in which one species is demarcated from the other is a result of decisions made by the taxonomist. In this case, the taxonomically relevant properties that Artedi asserted as relevant were number, proportion, figure, and colour.

In his letter to the reader, Artedi asserted that he had seen each and every fish described in his book for himself (with the exception of some of the whales, including, as we have seen, the siren).¹³⁸ This attests to the weight that continued to be attached to direct observation. Like Linnaeus, Artedi had built up his system through rigorous investigation of hundreds and hundreds of specimens.¹³⁹ Unfortunately for historians wishing to reconstruct his working practices, however, his species descriptions seldom mention exactly how and where he had come across the specimen at hand. An exception are the few instances where he has added 'I have seen' [*vidi*] or 'I have discovered' [*inveni*] to his descriptions.¹⁴⁰

¹³⁶ Original Latin: "Species in *Ichthyologia* appellatur unusquisque Piscis, qui a reliquis sui generis speciebus in Parte quadam externa, secundum defectum vel excessum, numerum, Proportionem, Figuram & colorem constantem variantem, diversus est." Ibid., aph. 209, at 74. Emphasis from original has been reversed.

¹³⁷ Kärin Nickelsen, *Draughtsmen, Botanists and Nature: The Construction of Eighteenth-Century Botanical Illustrations* (Dordrecht: Springer, 2006), 73.

¹³⁸ *Ich.*, Praefatio authoris, sig. ***r.

¹³⁹ Cf. Müller-Wille, "Collection and Collation," and Mary P. Winsor, "Linnaeus's Biology Was Not Essentialist," *Annals of the Missouri Botanical Garden* 93, no. 1 (2006): 2–7.

¹⁴⁰ He mostly used 'vidi' to specify that he saw a specimen, and 'inveni' for describing the internal organs of the fish. e.g., *Ich.*, *Descriptiones specierum piscium*, 19, 28, 35, 39, 59, 71, 79, 89, 110.

It is perhaps by not detailing the particular context of his observations, that he emphasized their general nature. It implied that his observations were universal: what he saw was, in effect, the platonic form of the fish rather than a particular fish. If this indeed was Artedi's intention, it presents a compelling contrast: while Willughby and Ray asserted the reliability of their observations by specifying where and when they had seen a certain specimen, Artedi made his reliable by leaving said information out.

While this often makes it difficult to establish where Artedi made his observations, a letter by Linnaeus offers a rare insight. It discusses that Artedi saw a species of smelt, known in Sweden under the name of Slom, every spring, and that he was intent on finding out whether it constituted a distinct species from the similar-looking Nors.¹⁴¹ The species description of the latter can give us a sense of the practical application of Artedi's system (**Figure 3.3**).¹⁴² Every species was discussed under the header of its corresponding genus. The number of its genus (which in the case of *Osmerus* was 8) was supplied for easy reference, so one could look up the characteristics of this genus in the *Genera piscium*. The species itself was also assigned a number: the Nors was the first – and only species – of the eighth genus. The description opens with the capitalized genus name ('OSMERUS'), followed by a short diagnostic sentence – this is the species name, as will be discussed in more detail.

Artedi divided the species descriptions in numbers, “so that all [parts] are distinguished more readily.”¹⁴³ The description of the smelt consisted of 29 consecutively numbered items, which documented its main attributes of the fish: for example, its gills, the gill cover, as well as each of its fins and the exact number of rays in them. He also measured the sizes of the fish's various parts with almost geometric precision in inches (unc.) and twelfths of inches (lin.). These measurements, both longitudinal and latitudinal, were formatted into a table (**Figure 3.4**). It shows that the Nors measured up to 3 inches long, and that the

¹⁴¹ Linnaeus to Johan Ernst Gunnerus, 4 March 1769, UUB, L4202.

¹⁴² *Ich.*, *Descriptiones specierum piscium*, 45.

¹⁴³ Original Latin: “[...] easdemque in Numeros divisi, ut omnia clariora & magis distincta essent.” *Ich.*, *Praefatio auctoris*, sig. **v.

distance from the tip of its snout to the middle of its eye was 5 twenty-fourths of an inch. These measurements are given for several intervals (for example, the first dorsal fin and the second one), with the base of the tail as the last measuring point. Artedi's examination of species clearly demanded some laborious effort. Linnaeus described having seen Artedi "spending in many cases several whole days over one single fish" over which time he "would count over the fins, and the individual rays in them, not once only but many times [...]."¹⁴⁴ In one breath, Linnaeus draws attention to both Artedi's careful and disciplined study of fish and his impulse to identify and classify them through quantification.

As we saw in the previous chapters, Willughby and Ray had been somewhat troubled by the abundance of names by which species could be known. They had tried to restore order to the nomenclature of fish, but did not propose a reformation of naming practices. Rather than simply restore order to the nomenclature under which fish laboured, Artedi proposed a reformation of naming practice. He contended that a species name should take the form of an "epithet, consisting of some few words, which is appended to the name of the genus, in order to distinguish one species from the other in the same genus."¹⁴⁵ This meant that a fish's name was comprised of a short, diagnostic summary of its defining characteristics. Take, for instance, the name Artedi gave to the common perch: *Perca lineis utrinque sex nigris pinnis ventralibus rubris*, a perch with six black fins on both sides and a red belly.¹⁴⁶ Artedi's naming system was somewhat more cumbersome than the binomial system that Linnaeus became well known for with the publication of the tenth edition of his *Systema naturae* in 1758. This system meant that one referred to a certain species by combining its genus name with its species name: for example, the above described perch became *Perca fluviatilis*.¹⁴⁷ It was decidedly less cumbersome than the nomenclature that Artedi

¹⁴⁴ *Ich.*, *Descriptiones specierum piscium*, introduction by Linnaeus; translation from Lönnberg, *Peter Artedi*, 41.

¹⁴⁵ *Ich.*, *Philosophia*, aph. 223 at 80; translation from Lönnberg, *Peter Artedi*, 35.

¹⁴⁶ *Ich.*, *Descriptiones specierum piscium*, 74.

¹⁴⁷ Linnaeus, *Systema naturae*, ed. 10, 289.

used.¹⁴⁸ Nonetheless, the naming system proposed by Artedi was practical: as brief summaries of its main external features, they helped the reader distinguish between two species at a glance.¹⁴⁹

However useful this new naming system was, naturalists still had to contend with the conundrum of names under which earlier authors had described species of fish. Artedi had come up with a solution for that, too. In the fourth part of his book, the *Synonymia nominum piscium*, Artedi compiled all the synonyms of fish names in various languages by means of indices. These included Latin, Swedish, Danish, German, Dutch, English, French, Italian, Spanish and Greek, as well as some ‘miscellaneous’ languages, such as Ambonese and Hispanic. Collecting these synonyms, Artedi stated, “created much work for me in comparison with the other parts of this work; for in reading so many authors about nearly every single species most of my time and my indefatigable mind were needed [...]”.¹⁵⁰ It allowed him to showcase his comprehensive grasp of natural historical literature and his tireless industry. This part of the book functioned as a sort of fish dictionary. He also indicated where each species had been described by earlier authors, including page numbers.¹⁵¹ Any naturalist wondering, for example, how the species of smooth hound shark described in the *Historia piscium* (**Figure 1.4a**) was described by Artedi could readily find out that it was Artedi’s “shark with blunt or granular teeth.”¹⁵² In this way, Artedi synchronised earlier names and descriptions of fish species with those that he himself drew up for them.

¹⁴⁸ Linnaeus considered the binomial name to be a ‘trivial name’, a useful shorthand for the actual species name, the *nomen specificum*, which, as in Artedi’s naming method, consisted of the generic name followed by a short descriptive phrase giving the plant’s distinctive characters which set it apart from other species, see: Nickelsen, *Draughtsmen*, 80.

¹⁴⁹ Lönnberg, *Peter Artedi*, 35.

¹⁵⁰ *Ich.*, *Praefatio authoris*, sig. **r/v.

¹⁵¹ *Ich.*, *Synonymia nominum piscium*, 1–118.

¹⁵² *Ibid.*, 93.

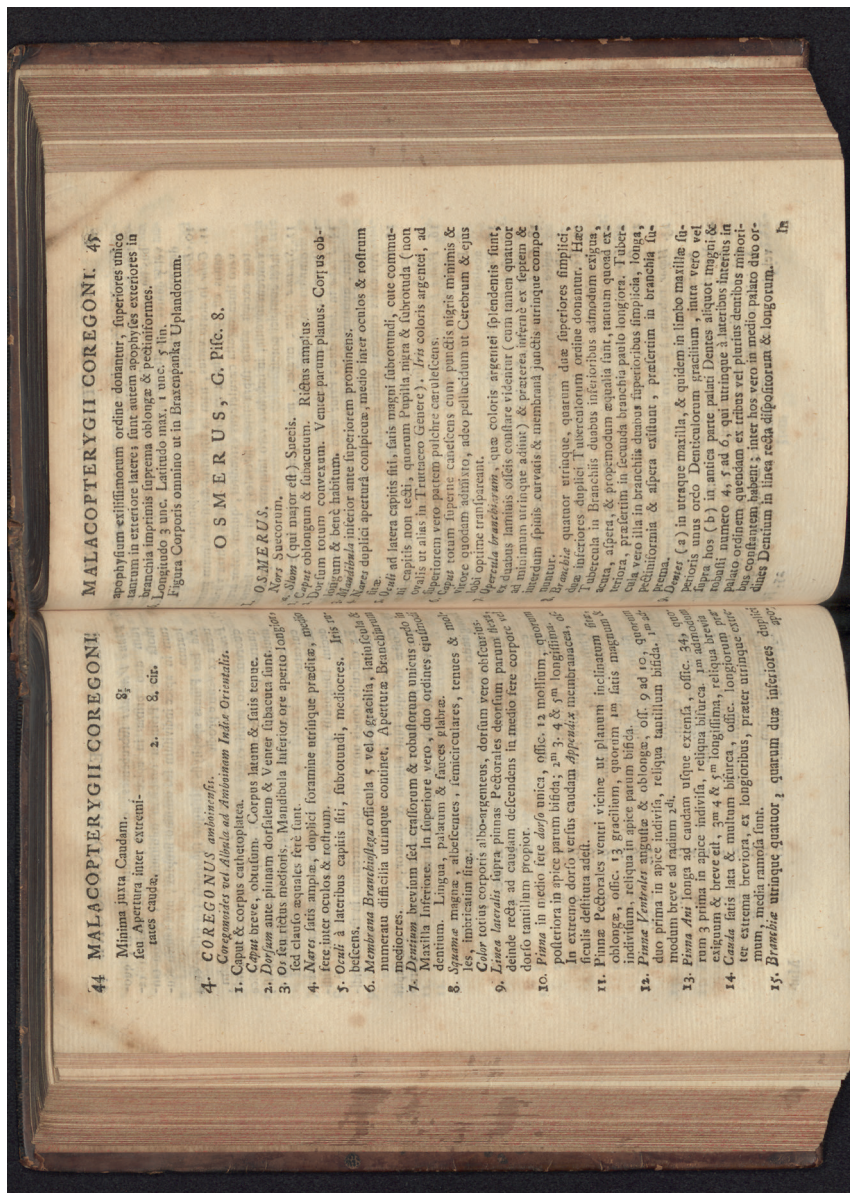


Figure 3.3 Species description of Nors | Peter Arredi, *Ichthyologia. sive opera omnia de piscibus* (Leiden: Conrad Wishoff, 1738), 45 | © Universiteitsbibliotheek Leiden

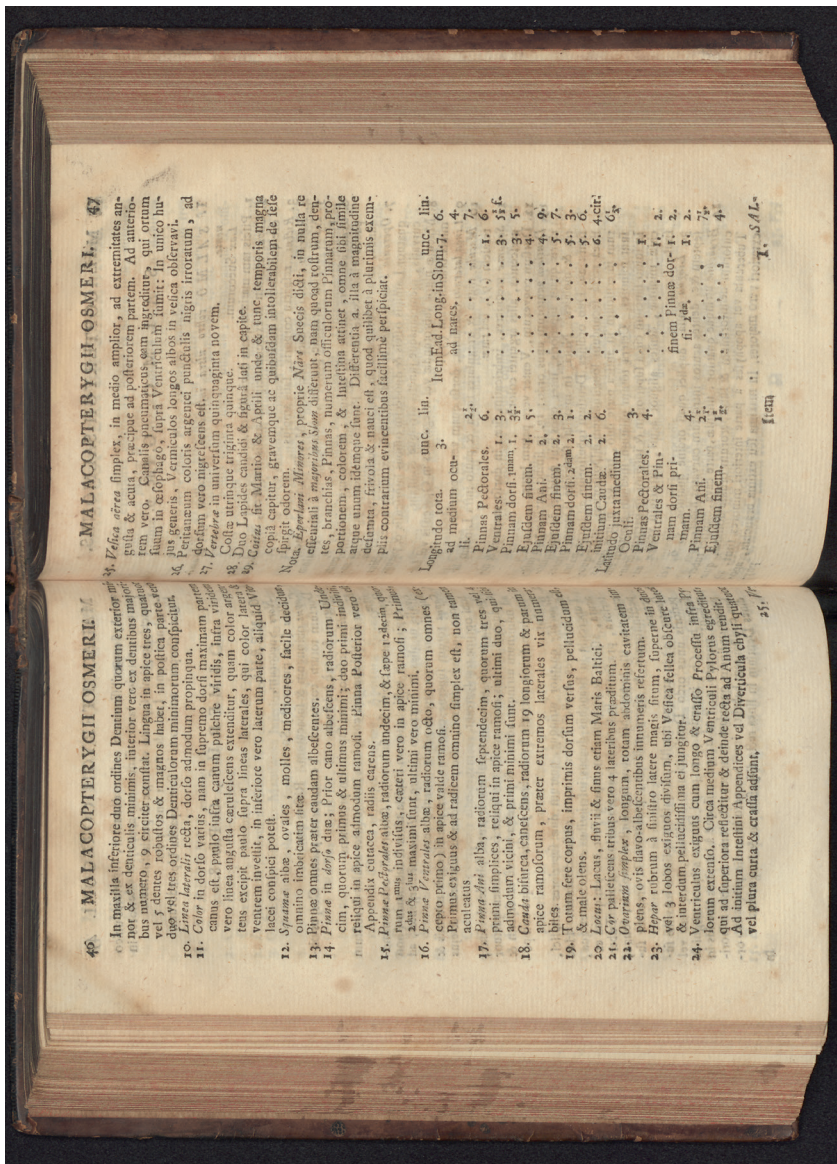


Figure 3.4 Species description of Nors | Peter Artedi, *Ichthyologia, sive opera omnia de piscibus* (Leiden: Conrad Wishoff, 1738), 47 | © Universiteitsbibliotheek Leiden

Varieties

The last and final level of the taxonomical hierarchy were the varieties. The aforementioned species description of the smelt ('Nors') ends with a note addressing whether this particular species differed from the similarly looking fish (Artedi's beloved 'Slom' that he saw each spring in Sweden):

The smaller Eperlani, properly called *Närs* [sic] by the Swedes, do not differ in any essential way from *the bigger Slom*, for as far as it concerns their mouth, teeth, gills, Fins, their number of rays in the Fins, their proportion, colour, and Intestines, all are similar to each other and one and the same. The difference between them, which is selected on the basis of size, is frivolous and useless, because anyone can very easily perceive the contrary on the basis of very many evincing examples.¹⁵³

Artedi concluded that the Nors and the Slom were the same species. For good measure, he included his calculation of the dimensions of the latter species in a table alongside that of the former (**Figure 3.4**). This example shows how ambiguities could also remain at species level. As we already saw in Chapter 1, Willughby and Ray wondered how to decide if a certain specimen constituted a separate species, or was in fact a variation within a species. This problem was also well known to Artedi, and he lectured the reader on the matter in the second part of his book, the *Philosophia*. He stated that certain things were of little consequence for demarcating one species from the other. Fishermen, Artedi contended, distinguished between species based on matters such as the colour of the fish, whether they resided in fresh or salt water, or the time of year in which they reproduced. He deemed these kind of distinctions 'false and frivolous' [*falsa et frivolae*].¹⁵⁴ The colour, he expounded, of one individual fish could vary depending on its age, the season, and even the type of water it inhabited.¹⁵⁵ It also differed from specimen to specimen. Species could and should not be assigned on

¹⁵³ Original Latin: "*Eperlani Minores*, proprie *Närs* Suecis dicti, in nulla re essentiali à *majoribus Slom* differunt, nam quod rostrum, dentes, branchias, Pinnas, numerum ossiculorum Pinnarum, proportionem, colorem, & Intestina attinet, omne sibi simile atque unum idemque sunt. Differentia a. illa à magnitudine desumta, frivola & nauci est, quod quilibet à plurimis exemplis contrarium evincentibus facillimè perspiciat." *Icht., Descriptiones specierum piscium*, 47.

¹⁵⁴ *Icht., Philosophia*, aph. 220, at 79.

¹⁵⁵ *Ibid.*, aph. 213, at 75–76.

the basis of these unstable characteristics, but only on those features that he had determined to be relevant.

Because aspects such as these were too ambiguous to have meaning in any classificatory system, Artedi largely disregarded them in his species descriptions. He only occasionally mentioned the means of nutrition or procreation of a species, or the taste of its flesh, and never comments on matters relating to trade or consumption. This is what set his approach apart from earlier naturalists who had written about fish: he deliberately excluded any associations surrounding the fish, and rather focussed on the animal *in itself*, its physical presence. Zooming in on matters such as habitat or nutrition also would prove an impractical way of examining plants or animals for the naturalist who might peruse many of his or her specimens in various cabinets: these matters, after all, could not be glimpsed from looking at a specimen that had been taken out of its environment and preserved in a collection. Rather, one would have to have studied fishes for a prolonged amount of time, alive and in their own habitat. That was far from common practice for the average naturalist, however, who might combine field trips with visits to cabinets and collections. It was, in contrast, also the kind of knowledge that artisans such as fishermen, fishmongers, and cooks would be well aware of – and that, as we have seen in the previous chapter, naturalists before Artedi had made glad use of. While it is plain from the previous chapter that a fisherman's observation could be useful when it came to deciding which species was which, such individuals rarely figure in Artedi's descriptions, even though he drew on their experiences, albeit indirectly – for example, when using the descriptions of Willughby and Ray, he was benefitting from the knowledge that these practical men had given them.

The salient characteristics were, as we saw, the number, shape and position of fins, the number of rays in the fin, or the number or shape of the teeth, or the number and shape of other parts. Artedi shared this averseness to colour with Linnaeus, for whom only 'Number, Shape, Position, and Proportion' counted in describing plants, and who railed against the – in his eyes – excessive attention of his fellow botanists to the colourisation of plants.¹⁵⁶ Here, too, it is worthwhile

¹⁵⁶ Daston, "Description by Omission," 12. Linnaeus indeed complemented Artedi's aphorisms with references to equivalent rules in the *Fundamenta botanica*.

considering not only what a species description may contain, but also what has been left out. As has been discussed in the first chapter, natural historical works had long been an *encyclopedic* exercise bringing together past works and writings. Artedi's descriptions were, by and large, stripped of such historical components. While, in the *Synonymia*, he did refer to species descriptions published in earlier works, it was only with the purpose of synchronizing these descriptions and identifications with his own. In so doing, he stabilized his own species identifications, subsuming and overwriting earlier ones. His descriptions were quantitative rather than qualitative, and numerical rather than narrative.

Artedi concluded his *Philosophia* with a firm 'thus it has been demonstrated' [*quod erat demonstrandum*].¹⁵⁷ This phrase was commonly used to show that the proof or an argument was completed, especially in mathematical contexts.¹⁵⁸ It further asserted the degree of certainty with which Artedi presented his system, as well as the method that underpinned it. As we have seen, his focus on order and classification had repercussions for his species descriptions, which became, in essence, simple lists of pertinent characteristics. They are examples of what Daston has characterized as the 'description by omission' in which the description of nature changed "from long accounts bristling with particulars to concise reports made deliberately bland by summary, repetition, and omission of details."¹⁵⁹ She locates this development between the late seventeenth and the early eighteenth century – which is also the period that separated the *Historia piscium* and the *Ichthyologia* – and a comparison of the descriptions that these works contain substantiates this hypothesis. What Artedi introduced for fish (but also for other realms of nature, as we saw) were strictly defined taxonomical ranks. In his book, he remarks that such a system of classes, orders and genera was useful not only to ichthyology, but to natural history as a whole.¹⁶⁰ This system would prove highly

¹⁵⁷ *Ichth., Philosophia*, 92.

¹⁵⁸ It is listed in the glossary of terms in John Kirkby, *Arithmetical Institutions: Containing a Compleat System of Arithmetic* (London: B. Motte, C. Bathurst and J. Clark, 1735), table of contents.

¹⁵⁹ Lorraine Daston, "Description by Omission: Nature Enlightened and Obscured," in *Regimes of Description: In the Archive of the Eighteenth Century*, eds. John Bender and Michael Marrinan (Stanford: Stanford University Press, 2005), 13.

¹⁶⁰ Original Latin: "[...] primum et praecipuum Fundamentum, non solum Ichthyologiae, sed totius reliquae Historiae Naturalis [...]" *Ichth., Philosophia*, aph. 143, at 51–52.

useful to later naturalists as they attempted to understand the taxonomic relations between new and already known species.

Lost in Preservation?

As mentioned in the introduction to this chapter, Linnaeus presented his own classification system consisting of orders, genera and species into the first edition of his *Systema naturae*.¹⁶¹ As he explained, “[i]n Ichthyology, I have not prepared my own Method, but the greatest Ichthyologist, the famous Swede mr. Petrus Artedi [...] has given me his.”¹⁶² He indeed copied the taxonomical ranks that Artedi had established with only slight alterations.¹⁶³ In the preface to the (now famous) table of orders and genera in the realm of animals of the first edition of his work, Linnaeus introduced Artedi to his readers as “the best ichthyologist of our time”¹⁶⁴, who had perfected the classification of fishes. While the readers could get the gist of Artedi’s classification system in the present work, Linnaeus announced they could expect a more elaborate account of the underlying principles in a forthcoming publication, ‘*Institutiones nempe totius Ichthyologiae*’ [*Institutions*, that is, *all of Ichthyology*] – which was, of course, eventually published as the *Ichthyologia*.¹⁶⁵ Where this chapter has so far analysed Artedi’s *Ichthyologia* and its contents, this final section examines how Artedi’s system found its way to other naturalists. It examines the consequences it had for the way in which fish were studied, and pays particular attention to discussions of whether fishes were best preserved as textual descriptions, images or objects.

We can get a better sense of how Artedi’s *Ichthyologia* was received by reading the reviews that appeared in various learned journals not long after its publication. These periodicals were specifically geared towards reporting on new research and publications, and offer insight into how books were regarded by

¹⁶¹ Carl Linnaeus, *Systema naturae*, ed. 1 (Leiden: Theodoor Haak, 1735).

¹⁶² As translated by Broberg, *Carl Linnaeus*, 142.

¹⁶³ In the order of the *Malacopterygii*, Linnaeus left out the genera of *Argentina*, *Exocoetus*, *Stromateus*, *Ophidion* and *Anableps*; in the *Acanthopterygii* order, he moved the *Blennius* genus to the *Malacopterygii* (spelling it *Blennus*), and cut the genera *Sciaena*, *Scorpoena* and *Chaetodon*. From the *Plagiuri*, he omitted the *Physeter* genus and that of the *Siren*. See: Linnaeus, *Systema naturae*, ed. 1, n.p.

¹⁶⁴ Original Latin: “In *Ichthyologia* nullam ipse elaboravi Methodum, verum Suam nobiscum communicavit summus nostri temporis Ichthyologus Cl. D. Petr. Artedi [...]” Linnaeus, *Systema naturae*, ed. 1, n.p.

¹⁶⁵ With the addition of ‘all’ [*totius*], this title was perhaps even more ambitious than the one Artedi had originally envisaged. Ibid.

scholars.¹⁶⁶ French-speaking *savants* were served by the review that appeared in the *Bibliothèque germanique*, a periodical devoted to the learning of Germany and the countries of northern Europe,¹⁶⁷ while the one published in the *Nova Acta Eruditorum* catered to a Latinate audience.¹⁶⁸ The German polymath Johann Peter Kohl (1698–1778) wrote a glowing review of *Ichthyologia* for the *Hamburgische Berichte von den neuesten Gelehrten Sachen* in 1738, stating that the book was “arranged in a careful and provable way [...] thereby, the foundations of this science are presented with a lasting power of proof [...]”¹⁶⁹ He noted that “[f]or every fish, all the rays in the fin and all the vertebrae are counted; every single thing is noticed and investigated.”¹⁷⁰ He concluded that “[...] the work has so cleared up this part of Natural History, otherwise the most difficult of all, to such a degree that one must be astounded.”¹⁷¹ Artedi would probably have been pleased with this critique; the words the reviewer uses to characterize his system, such as ‘provable’ and ‘foundational’, mirror the terms that he himself applied to it.

Other indications of how Artedi’s work was received and used, and by whom, can be found in the correspondence between both well and lesser-known eighteenth-century naturalists. Paul Heinrich Gerhard Möhring (1710–1792) for example, inquired with Linnaeus from Jever when the work would be available and how much it would cost.¹⁷² Christian Gottlieb Ludwig (1709–1773) asked him to send him a copy to Leipzig, so that he could pass it on to Jacob Theodor Klein (1685–1759).¹⁷³ Alexander Garden (1730–1791) affirmed to have used

¹⁶⁶ Thomas Munck, “Eighteenth-Century Review Journals and the Internationalization of the European Book Market,” *The International History Review* 32, no. 3 (2010): 417.

¹⁶⁷ Jacob Theodoor Klein, “Peter Artedi, *Ichthyologia*,” in *Bibliothèque germanique ou Histoire littéraire de l’Allemagne et des pays du Nord*, vol. 45, ed. Paul-Emile de Mauclerc (Amsterdam: Pierre Humbert et fils, 1739), 143–159. The attribution of this review to Klein, a translation of the Latin review that he proffered Sloane, has been done by Pietsch and Aili, “Jacob Theodor Klein’s Critique,” 53.

¹⁶⁸ “Petri Artedi,” in *Nova acta eruditorum*, ed. Friedrich Otto Mencke (Leipzig: Johann Friedrich Gleditsch, 1741), 652–657.

¹⁶⁹ Johann Peter Kohl, “Opera posthuma ichtyologica,” *Hamburgische Berichte von den neuesten Gelehrten Sachen* 16 (1738): 131–132. As translated in Pietsch and Aili, “Jacob Theodor Klein’s Critique,” 57.

¹⁷⁰ Pietsch and Aili, “Jacob Theodor Klein’s Critique,” 57.

¹⁷¹ *Ibid.*

¹⁷² Paul Heinrich Gerhard Möhring to Linnaeus, 4 October 1737, UUB, L0217.

¹⁷³ Christian Gottlieb Ludwig to Linnaeus, 22 October 1737, UUB, L0210. For Klein’s assessment of the work, see Aili and Pietsch, “Jacob Theodor Klein’s Critique,” 39–84.

both Linnaeus' *Systema naturae* and Artedi's *Ichthyologia* while describing species of fish that were new to him in and around Charlestown in the province of Caroline, one of Britain's colonial territories in North America.¹⁷⁴ In a letter to Arnout Vosmaer (1720–1799) in October 1751, Laurens Theodorus Gronovius promised to show him his arrangement of the genera of Dutch fishes, organized according to Artedi.¹⁷⁵ From Montpellier, Antoine Gouan (1733–1821) wrote to Linnaeus that he found Artedi's system useful, although he proposed some small changes.¹⁷⁶ When Klein received the work from Ludwig, he wrote a review of it that he then sent to Sloane.¹⁷⁷ He noted with some surprise that the sea horse had been assigned to the order of *Malacopterygii*, even though it lacked the perpendicular tail fin this order required.¹⁷⁸ He did agree, however, with the premise and structure of the system itself.

For a considerable group of naturalists, Artedi's classification system became a common point of reference. The lists of genera and species that both Linnaeus and Artedi compiled were used to catalogue collections of *naturalia*, as the following chapter will discuss in more depth. Eighteenth-century naturalists, ever more inundated with specimens hitherto undescribed, found a welcome source of order in these systems. Linnaeus' binomial names, in particular, made it easier to compile data on plant and animal species, to produce clear lists of specimens. This is probably why the British naturalist and explorer Joseph Banks (1743–1820) had 'updated' his copy of the *Ichthyologia*, which formed part of the library he took on board with him on his voyage to Iceland in 1772, by adding the binomial names of Linnaeus.¹⁷⁹ Linnaeus did the same with his own copy of the *Ichthyologia*.¹⁸⁰ Just as Artedi had imposed his new standard name

¹⁷⁴ Alexander Garden to Linnaeus, 12 April 1762, UUB, L2902.

¹⁷⁵ Laurens Theodorus Gronovius to Arnout Vosmaer, 28 December 1751, Special Collections Department of Universiteitsbibliotheek Leiden (hereafter UBL), Leiden, BPL246, 51r.

¹⁷⁶ Antoine Gouan to Linnaeus, 8 January 1760, UUB, L2656.

¹⁷⁷ Jacob Theodor Klein, *Petri Artedi operum brevis recensio*, BL, Sloane MS 4020.

¹⁷⁸ He later published his own work on fish: Jacob Theodoor Klein, *Historiae piscium naturalis* (Gdansk: Thomas Johann Schreiber, 1740–1749).

¹⁷⁹ Banks's annotated copy of *Ichthyologia*, BL, 956c16.

¹⁸⁰ Linnaeus's annotated copy of *Ichthyologia*, Linnean Society (hereafter LS), London, BL.144. For more on this practice, see: Edwin Rose, "Specimens, Slips and Systems: Daniel Solander and the Classification of Nature at the World's First Public Museum, 1753–1768," *British Journal for the History of Science* 51, no. 2 (2018): 205–237.

onto the previous ones existing for a species, therefore, Linnaeus and his adherents synchronised his carefully constructed species names with the Linnaean binomial names.

If all that was needed was to summarize nature's multifarious productions in a kind of linguistical matrix, was there any need to still bother with making illustrations? As has been mentioned, Artedi's book encompassed none. He does not explicitly address this lack of illustrative material, but it is possible to fathom some reasons, such as the practical, financial constraints on publishing illustrated natural histories that Chapter 1 has touched upon. Engraved images were costly, and thus rendered books too expensive for the average student of natural history.¹⁸¹ It might well be the case that he did not consider it worth the effort. Linnaeus' *Systema naturae*, for example, appeared virtually without images because he found that his system was best expressed linguistically rather than visually.¹⁸² While admitting that illustrations "conveyed something to the unlearned", he also said that it was his intention to "try to express by words all features just as clearly – if not more clearly – as others with their splendid drawings."¹⁸³ Artedi's readers expressed similar sentiments. In another review of the *Ichthyologia*, published in the *Neue Zeitungen von gelehrten Sachen* in 1738, the reviewer stated that "[...] in his descriptions [Artedi] has shown such clarity that one can understand everything without illustrations, such that one is capable of placing them in their proper classes, a thing that nobody has managed before him."¹⁸⁴ Perhaps it was alien to Artedi's approach to produce illustrations, as these were only a poor substitute for the essence of the fish itself.

This is not to say that, for Artedi, illustrations did not merit attention. In his bibliographical overview of fish books, Artedi opined on the quality of images. In his *judicium* of the illustrations in Willughby's and Ray's *Historia piscium*, for example, he criticizes the wood-cut images of Marcgraf for being particularly crude

¹⁸¹ See: John L. Heller, "Linnaeus on Sumptuous Books," *Taxon* 25, no. 1 (1976): 33–52.

¹⁸² Daniel Margócsy, "Refer to folio and number": Encyclopedias, the Exchange of Curiosities, and Practices of Identification before Linnaeus," *Journal of the History of Ideas* 71, no. 1 (2010): 83.

¹⁸³ Linnaeus, *Genera plantarum* (Leiden: Conrad Wishoff, 1737), aph. 13, at 8; as translated in Müller-Wille and Reeds, "A Translation," 568.

¹⁸⁴ "Petri Artedi," *Neue Zeitungen von gelehrten Sachen* 24, no. 1 (1738): 347–351, as translated in Pietsch and Aili, "Jacob Theodor Klein's Critique," 58.

[*rudissimae*].¹⁸⁵ Those images taken from Rondelet and Belon had been executed slightly better, but were nonetheless underdeveloped. He was most pleased with those of Leonhard Baldner's drawings that had been copied into the book: he found them truly very handsome and, in all, most accurate [*vero nitidissimae et omnium accuratissimae*], although he did not specify what exactly made them so good.¹⁸⁶ Abstaining from using illustration in one's work does thus not necessarily indicate an aversion to the visual representation of nature. Charmantier has argued that the latter played a considerable role in Linnaeus' thinking; while he rarely included images in his work, he did include ample maps, diagrams and tables.¹⁸⁷ It was thus not that Linnaeus and Artedi were blind to the visual representation of nature, but rather that they did not consider illustrations indispensable for the identification of species, and at times even problematic.

Illustrations were also considered less advantageous than preserved specimens. To understand why, we turn to the aforementioned Laurens Theodorus Gronovius and his father, Johan Frederik (1690–1762). Civil servants of the city of Leiden, they were also avid collectors who knew Artedi's system intimately – as discussed earlier, they even seem to have been in the possession of one of the *Ichthyologia's* original manuscripts. When Linnaeus resided in the Netherlands between 1735 and 1738, Gronovius the Elder had promptly recognized the merits of his classification scheme and helped to finance the first edition of the *Systema naturae*. Gronovius the Younger shared this appreciation, such that his father wrote of him: “he wants to describe all his pieces according to the manner of Linnaeus, [...] and has already studied more than a hundred fishes, both indigenous and exogenous ones.”¹⁸⁸ Even though Gronovius the Elder referred to it as ‘the manner of Linnaeus’, when it came to fish, ‘the manner of Linnaeus’ was largely that of Artedi – at least in the first few editions of the *Systema naturae*. That father and son Gronovius were familiar with Artedi's system becomes clear when perusing the *Museum ichthyologicum* (Leiden, 1754–1756). This catalogue of all specimens

¹⁸⁵ *Ich.*, *Bibliotheca ichthyologia*, 52.

¹⁸⁶ *Ibid.*

¹⁸⁷ Charmantier, “Carl Linnaeus and the Visual Representation of Nature,” 371.

¹⁸⁸ As translated by me from Dutch quotation in Bert Sliggers, *De Verzamelwoede van Martinus van Marum (1750–1837) en de Ouderdom van de Aarde: Herkomst en Functie van het Paleontologisch en Mineralogisch Kabinet van het Teylers Museum* (PhD diss., Leiden University, 2017), 156.

in their fish collection closely resembles the format of the *Ichthyologia*, following Artedi's sequence of orders, genera and species. It also makes frequent reference to Artedi's work: in describing a species of smelt, for example, the author added 'Arted. Gen. 8' and 'Synon. p. 21', so that the reader would know which genus this was in the *Ichthyologia*, where he might find a description of it, as well as a survey of the synonyms for this species.¹⁸⁹

According to Margócsy, the need for classificatory repertories, like catalogues enumerating brief morphological descriptions of many species, was intimately linked to the increasing exchange of specimens. Plants, shells and insects were traded with particular avidity, on account of their modest size and weight, and the demand for ways with which collectors might clearly categorize them grew accordingly. For birds, fish and quadrupeds, there was less need for classificatory repertories because they were too expensive to ship in equally large numbers.¹⁹⁰ There is certainly truth to that pronouncement: whether, as we saw, in the case of larger fish, specimens were stuffed with hay, or, with smaller fish, submerged in spirits, specimens prepared in either way would take up considerable space in the hold of a ship or on a carriage. But, as we will now see, this was not necessarily always the case. Naturalists did have ways of preserving fish in a more compact fashion.

In the sixteenth century, Salviani had wondered whether it would be possible "to find a way to preserve dried fish in their own shape, like one does with these herbs."¹⁹¹ The herbarium, in which plants were often fixed to pages with glue or thread, was a favoured method of botanical preservation at the time.¹⁹² What Salviani thus proposed was what we might call an 'ichthyarium'; a term reminiscent of the term herbarium as a genre of preservation.¹⁹³ Despite Salviani's efforts to glue fishes to paper in the sixteenth century, it seems that his particular style of ichthyarium did not catch on widely, even if archives contain

¹⁸⁹ Laurens Theodorus Gronovius, *Museum ichthyologicum, sistens piscium indigenorum et quorundam exoticorum* (Leiden: Theodoor Haak, 1754–1756), 18.

¹⁹⁰ Margócsy, *Commercial Visions*, 32.

¹⁹¹ Findlen and Toledano, "Materials of Natural History," 158.

¹⁹² The history of the herbarium is described in detail by Ogilvie, *Science of Describing*, 165–174.

¹⁹³ Naming it a 'fish herbarium' would be incongruous, as the term herbarium refers to herbs (from the Latin *herba*). The Greek word 'ichthus' or ἰχθύς refers to fish, and ἰχθυῖα can also refer to the skin of a fish. *Logeion*, s.v. ἰχθύς and ἰχθυῖα.

evidence of occasional use: there is, for example, an instance of a fish skin glued on paper among Sloane's papers.¹⁹⁴ The paper ichthyrium became a widespread practice for circulating fish specimens only after Gronovius the Elder wrote out his method for preserving fish on paper in the early 1740s.

In 1742, Gronovius the Elder communicated his method to Peter Collinson (1694–1768), who read the letter aloud during a meeting of the Royal Society and had it published in the *Philosophical Transactions*.¹⁹⁵ To enact the procedure successfully, one needed a pair of scissors with very fine blades and sharp points, small wooden plates (preferably of the lime tree), a very fine needle, slips of parchments as large as the fishes, and finally some very small pins. With all these materials in place, the preservation process could commence. The method, which Gronovius laid out in his letter step-by-step, entailed gently cutting a fish open with a pair of scissors, removing all of its intestines, patting it dry with a linen cloth, exposing it to the sun (in summer) or to the hearth (in winter) for further drying. The skin could then easily be separated from the flesh and was to be put between papers and pressed flat. Gronovius advised the application of a fresh sheet of parchment after two hours, “as a sort of glutinous Matter, in pressing, is always forced out from betwixt the Scales and the Skin” which might cause the fish to stick to the paper.¹⁹⁶ Only a few materials and a little time were needed, as Gronovius stated that “in the Space of 24 Hours, the Fish is prepared.”¹⁹⁷ Even if the parchment were changed to absorb excess quantities of the glutinous matter that emanated from the remains of the fish, enough of the substance might have well remained to give the specimen a self-adhesive quality.¹⁹⁸

In 1751, Gronovius sent a package to Pennsylvania that included “a few specimens of dried fishes, to be kept as plants in an herbarius; the great

¹⁹⁴ Fish skin pasted on paper, BL, Add MS 5267 (part of Sloane's collection), f99r; it is dated 1732. I thank Felicity Roberts for bringing it to my attention.

¹⁹⁵ J.F. Gronovius, “A Method of preparing Specimens of Fish, by drying their Skins, as practised by John Frid. Gronovius M.D. in Leyden,” *Philosophical Transactions of the Royal Society* 42, no. 463 (1742): 57–58. For the practice of reading letters aloud around this time, see: Aileen Fyfe and Noah Moxham, “Making Public Ahead of Print: Meetings and Publications at the Royal Society, 1752–1892,” *Notes and Records of the Royal Society of London* 70, no. 4. (2016): 361–379.

¹⁹⁶ Gronovius, “A Method of preparing,” 57–58.

¹⁹⁷ *Ibid.*

¹⁹⁸ Fish glue has historically been used for a wide range of artistic practices, see: Tatyana Petukhova, “A History of Fish Glue as an Artist's Material: Applications in Paper and Parchment Artifacts,” *The Book and Paper Group Annual* 19 (2000): 111–114.

misfortune is, that the colour perish, else it shows a good way to find out the characters 1. by number of the bones in the gill flap [...]; 2. by the number and position of the fins, and the bones in them. 3. by the course of the linea lateralis running in each fish from the back part of the head to the tail.”¹⁹⁹ As Gronovius’ letter indicates, the method preserved precisely those characteristics that were of most pertinence for classification according to Artedi’s system. One of the things that unfortunately could not be salvaged was colour; on the goldfish, Gronovius the Younger remarked that “the colour in life is gold or silver, shining and most radiating, which in death gradually disappears and whitens.”²⁰⁰ The colour thus died together with the fish. Upon receiving a species of sandfish from the Cape of Good Hope, which he submitted was ‘entirely new’ [*plane novus*], he declared he could “barely guess the colour from this dried specimen.”²⁰¹ The specimen that he referred to, and which he called the *Gonorynchus*, is still among the Gronovius Fish Collection at the Natural History Museum in London (**Figure 3.5**).²⁰²

Certain matters were definitely lost in preservation. As has already been discussed in Chapter 2, illustrations could convey liveliness in ways that dead, preserved specimens could not. The addition of colour to illustrations was significant, as this was one of the things that disappeared after death. Because colour carried no value for classification, however, Gronovius the Elder found there was no need to take the trouble. Furthermore, illustrations were mediations, and often did not relay the characteristics that the classifying naturalist desired to know – which might be because the artist was not aware of these marks, or because these could not easily be conveyed on paper. Gronovius stated, for example, that “Mr. Catesby hath indeed painted the American fishes very well. But I wish to know of all them fishes, how many bones there are in the gill flap, which is sufficient

¹⁹⁹ J.F. Gronovius to John Bartram, 26 June 1751, as reproduced in *The Correspondence of John Bartram 1734–1777*, eds. Edmund Berkeley Jr. and Dorothy Smith Berkeley (Gainesville: University Press of Florida, 1992), 330.

²⁰⁰ Original Latin: “Color in vivus aureus vel argenteus, splendidus & fulgentissimus, qui in mortuo sensim perit & albescit.” Laurens Theodorus Gronovius, *Zoophylacium Gronovianum: exhibens animalia quadrupeda, amphibia, pisces, insecta, vermes, mollusca, testacea, et zoophyta* (Leiden: Theodoor Haak, 1781), 109.

²⁰¹ Original Latin: “Colorem ex siccato specimine divinare haud potui [...]”. Ibid., 55.

²⁰² Specimen of *Gonorkynchus greyi* [*sic*], Natural History Museum (hereafter NHM), London, Gronovius Fish Collection, 53.11.12.120; the NHM keeps the ichthyarium of Gronovius, consisting of loose pages, in several dozen boxes. The fish retain some of their original odour.

to determine the genus together with the number of fins.”²⁰³ He referred to the *Natural History of Carolina, Florida and the Bahama Islands* (London, 1731) by the English naturalist Mark Catesby (1683–1749), a work that contemporaries praised for its perfectly executed watercolours.²⁰⁴ Gronovius remark underscores the earlier mentioned belief that illustrations were superfluous, even if they had been done well.

Quite a few did take up the method proposed by Gronovius the Elder. Among them were the French naturalists Michel Adanson (1727–1806) and Philibert de Commerson (1727–1773), as well as Linnaeus.²⁰⁵ In his autobiography, Linnaeus wrote how in his collection “were innumerable stones, in his herbarium and Garden innumerable plants, in his cabinet innumerable insects that he had assembled and pinned, in his cupboards innumerable fish glued on paper as if they were plants [...]”.²⁰⁶ The fact that fish specimens were pressed flat enough to be inserted into an a letter wrapper facilitated their circulation between various countries and continents in large quantities and at relatively low cost, and with less chance of being damaged en route.²⁰⁷

While the spread of the ichthyarium as preservation practice was partly induced by practical circumstances, it was also welcomed because it adhered to the epistemological requirements of classification. As we saw, the essential characteristics, such as the fins and their rays and the bones in the gill flap once preserved in this manner, could be pressed into the service of the inquisitive naturalist. Using this method, naturalists could receive the actual specimens

²⁰³ Johan Frederik Gronovius to Bartram, 6 December 1745, as reproduced in Berkeley and Berkeley, *The Correspondence of John Bartram*, 265.

²⁰⁴ Amy R.W. Meyers and Margaret Beck Pritchard, “Introduction: Toward an Understanding of of Catesby,” in *Empire’s Nature: Mark Catesby’s New World Vision*, eds. Amy R.W. Meyers and Margaret Beck Pritchard (Chapel Hill: University of North Carolina Press, 1998), 5.

²⁰⁵ Amandine Péquignot, “Une peau entre deux feuilles, l’usage de l’herbier en taxidermie aux XVIIIe et XIXe siècles en France,” *Revue d’histoire des sciences* 59, no. 1 (2006): 131–132. This article explains how the skins of birds as well as fishes were pressed between pages in herbarium fashion.

²⁰⁶ Wilfrid Blunt, *The Compleat Naturalist: A Life of Linnaeus* (London: Collins, 1971), 151. Most of the fishes in his collection are now in the Linnean Society in London and the Gustavianum, the universitetsmuseum of Uppsala, and many are considered type specimens. See also: Alwhyne Wheeler, “The Linnaean Fish Collection in the Linnean Society of London,” *Zoological Journal of the Linnean Society* 84, no. 1 (1985): 1–76; Alwhyne Wheeler, “The Linnaean Fish Collection in the Zoological Museum of the University of Uppsala,” *Zoological Journal of the Linnean Society* 103, no. 2 (1991): 145–195.

²⁰⁷ Whitney Barlow Robles, “Flatness,” in *The Philosophy Chamber: Art and Science in Harvard’s Teaching Cabinet, 1766–1820*, ed. Ethan W. Lasser (New Haven: Yale University Press, 2017), 196.



Figure 3.5 Specimen of *Gonorynchus greyi* (above) Gronovius Fish Collection 53.11.12.120 | © Trustees Natural History Museum | Photo by Lucie Goodayle

rather than mediated illustrations, and therefore did not need to rely on artists whom they had never met and whose skills they therefore had little way to assess. For adherents of Artedi's classification system, this method was thus not only a practical way to preserve fish given the constraints of money and material. As 'incarnations of themselves' (to borrow a phrase by Daniela Bleichmar)²⁰⁸ fish prepared in this manner were considered by naturalists epistemologically better suited than images to base their classifications on.

What was the impact of Artedi's system? Charmantier and Staffan Müller-Wille have argued for Linnaeus' works that they were useful to naturalists in the complex process of comparing specimen to specimen, distinguishing one species from the other, and in drawing up their own species diagnoses.²⁰⁹ It made it easier to count and categorize species, and to assign names and numbers to them.²¹⁰ Even though Artedi, unlike Linnaeus, did not present his readers with binomial names, his *Ichthyologia* did offer a clear overview of both genera and species, their characteristics enumerated in the form of numbered lists. It was praised by naturalists for its precise and distinct method of classification. The clear species descriptions meant that illustrations were not necessary. Because the ichthyarium method made popular by Gronovius allowed for the dispatching of fish specimens from all corners of the world in an economical fashion while retaining those characteristics that were important in classification, it was privileged as a form of preservation. It allowed naturalists to count these characteristics for themselves.

Conclusions

Artedi's book was not only an attempt to classify fish, but also to classify past and present knowledge about fish and, by extension, people who studied and worked with fish. Moreover, it was an attempt to establish ichthyology as a science; to define its object, and to unfold its epistemology. In what would be the last letter he wrote to his relatives, Artedi spoke confidently of his mastery of ichthyology, asserting that "in the Dutch Republic, there is no one who understands zoology

²⁰⁸ Bleichmar, *Visible Empire*, 63.

²⁰⁹ Isabelle Charmantier and Staffan Müller-Wille, "Carl Linnaeus's Botanical Paper Slips (1767–1773)," *Intellectual History Review* 24, no. 2 (2014): 227.

²¹⁰ Staffan Müller-Wille, "Names and Numbers: 'Data' in Classical Natural History, 1758–1859," *Osiris* 32 (2017): 120–126.

anyway, and where Ichthyology is concerned, I admit neither there nor elsewhere anyone for my master.”²¹¹ It reveals how Artedi considered himself as a specialised naturalist with an authoritative command of the natural history of fish. We will now recall the opening story of this chapter, where Artedi longed to confer with an ichthyologist – not any, but rather a ‘true’ [*vero*] one. Similar qualifications were made by Linnaeus, who referred to botanists as ‘sound’ [*sanis*].²¹² So what did it take to be a sound botanist or true ichthyologist?

For Artedi, the answer to this question was his own method. In developing it, he seems to have had mind how it would distinguish him from other naturalists and serve to establish his name. We see this, for example, in his interactions with Sloane, to whom he gave a manuscript displaying his classification method for fish, and with Seba, who hired Artedi to describe his species according to it. As his life was cut short before he had fully prepared his work for publication, we cannot know to whom his dedicatory letters would have been addressed. Earlier studies of the *Ichthyologia* have overlooked the social context in which the work was produced; so far, attention has always been directed to the classificatory contents of the book itself rather than its style of writing, layout, or structure. This chapter has shown the rhetorical effects of such decisions. In unfolding his new system, Artedi grafted his book onto traditional models, drawing on humanist and scholastic models of organizing knowledge, such as the genre of the *literaria* and the format of the *disputatio*, as well as by selecting Greek and Latin as the only languages acceptable for the names of genera and species. By doing so, he anchored his novel approach to long-standing scholarly traditions of organizing and presenting knowledge.

His method was novel indeed. As we saw in Chapter 1, Renaissance naturalists had grouped species together based on a wide range of characteristics, for which they consulted a diversity of sources including literary ones. Willughby and Ray had proposed a strict focus on external characteristics, and had used these to construct taxonomical groups, albeit loosely. While they eschewed

²¹¹ Original Swedish: “Här i Holland är ingen särdeles såm förstår sig på Zoologien, och hwad Ichthyologien angår, så ärkiänner jag hwarken där eller annorstädes någor för min maitre [...]” KBS, MS X1002.

²¹² Linnaeus, *Genera plantarum*, 3.

humanistic learning, their species descriptions nonetheless incorporated various anecdotes, proverbs and matters relating to fishery. For Artedi, it was not relevant whether a fish dwelled in fresh or salt water, with which letter of the alphabet its name started, or how it figured in trade. Artedi drew up strict definitions for taxonomical ranks on all levels, arranging his descriptions in list format. What earlier authors had written on a certain species only mattered in the extent to which they corresponded with his own descriptions. Artedi's method imposed abstraction by including only those characteristics that were pertinent to classification, and leaving out the rest. The innovative character of this system cannot be overstated. In the process, the study of fish became an increasingly visual and almost quantitative pursuit, as closely observing species and carefully counting their physical characteristics became one of its hallmarks. Although one would expect that this would make images a vital part of natural historical study, this was not necessarily the case for Artedi and his adepts. Images were not only expensive to produce, they might also be unreliable if artists were either unaware or unable to capture these aforementioned characteristics. A preserved specimen with its fins, teeth, and other parts intact would better perform its function for classification.

The model that Artedi developed for classifying fish meant that one could take any fish, known or unknown, and through close observation navigate one's way through the correct order, via the genus, and arrive at the correct species. With this system, Artedi widened the realm of possible observers, as a fish could now be assigned its proper place in Creation simply by counting fins and checking other characteristics. He also narrowed it down, however, by deeming only particular kinds of knowledge pertinent for the field that he defined as ichthyology. As we have seen in the previous chapter, early modern natural history took place in a composite social space. In excluding artisanal and vernacular knowledge, Artedi whittled away this longstanding practical knowledge from the body of natural historical knowledge about fish, lending his own methodical principles more authority in the process. He thus narrowed the kind of knowledge that was of possible import to learned inquiries into fish.

Linnaeus, similarly, placed those who worked with nature into various categories and assigned different values to them. For him, observers of plants were interchangeable as long they had mastered a standardised set of skills, namely knowing what to look for (such as the numbers of stamen and pistils).²¹³ This only held, however, for the practical work of recognizing and defining species of plants; the more theoretical and abstract work of drawing up a scheme of genera, orders, and classes would have to be done by those with specialist knowledge: the botanist.²¹⁴ Harriet Ritvo has argued that after the introduction of classification systems, “taxonomy itself became a characteristic of the highest taxonomical significance.”²¹⁵ In other words, an understanding of classification systems became to be seen as an indication of one’s proficiency in natural history, as well as one’s ability to reduce living creatures to some underlying pattern.

Staffan Müller-Wille has argued that Linnaeus’ success was to no small degree due to the ‘templates for communal annotation’ that his taxonomic works offered.²¹⁶ These templates created a community that worked towards the collective goal to complete the system by fitting ever more species into it based on observations in the field, the museum or the library.²¹⁷ As a result, the system that Linnaeus had designed to contain and instill order into information about species contributed to the propagation of this kind of information.²¹⁸ While barely registering by comparison with the copious translations, adaptations and editions that Linnaeus’ work inspired, Artedi’s work was also revisited. In 1789, for instance, a revised edition of his book was issued in the German states. Johann Julius Walbaum (1724–1799) saw fit to publish the *Petri Artedi Renovati*, in which he amended Artedi’s species descriptions, and added species and genera that had been described after the publication of the book.²¹⁹ Like the system of

²¹³ Cooper, *Inventing the Indigenous*, 171.

²¹⁴ Nickelsen, *Draughtsmen*, 74.

²¹⁵ Harriet Ritvo, “New Presbyter or Old Priest? Reconsidering Zoological Taxonomy in Britain, 1750–1840,” *History of the Human Sciences* 3, no. 2 (1990): 260.

²¹⁶ Staffan Müller-Wille, “Linnaean Paper Tools,” 210.

²¹⁷ Staffan Müller-Wille and Sara T. Scharf, “Indexing Nature: Carl Linnaeus (1707–1778) and His Fact-Gathering Strategies,” *Svenska Linnesällskapets Årsskrift* 94 (2011): 57.

²¹⁸ Isabelle Charmantier and Staffan Müller-Wille, “Natural History and Information Overload: The Case of Linnaeus,” *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 43, no. 1 (2012): 4.

²¹⁹ Johann Julius Walbaum, *Petri Artedi Renovati* (Greifswald: Anton Ferdinand Röse, 1789).

Linnaeus, that of Artedi was flexible enough to allow for adaptations by later naturalists while keeping its basic structure intact.²²⁰ The following chapter will look at one such naturalist, Marcus Élieser Bloch, who drew on this classification system, but took other approaches to both description and illustration.

²²⁰ Bettina Dietz, "Linnaeus' Restless System: Translation as Textual Engineering in Eighteenth-Century Botany," *Annals of Science* 73, no. 2 (2014): 155.