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Nomenclature of the Larger Toothed Whales (Odontocetes)

A Historical Review

Thomas A. Jefferson, James G. Mead, and Carl C. Kinze

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ABSTRACT

Jefferson, Thomas A., James G. Mead, and Carl C. Kinze. *Nomenclature of the Larger Toothed Whales (Odontocetes): A Historical Review*. Smithsonian Contributions to Zoology, number 655, x + 78 pages, 33 figures, 5 appendixes, 1 table, 2023. — More than 100 species of large odontocete cetaceans (i.e., families Ziphiidae, Physeteridae, and Kogiidae) have been described since our binomial nomenclatorial system was initiated by Carl Linnaeus in 1758. Only a fraction of these are currently recognized as valid species. The taxonomic revisions that are being recommended by recent and ongoing studies within this group require a detailed understanding of their nomenclatural history. We here review all 114 nominal species of extant beaked and sperm whales. Of these, 27 species are currently considered valid, 6 are *nomina dubia*, 10 are *nomina nuda*, and the rest (71) are junior synonyms. In addition, we provide several appendices that attempt to settle the controversy over the name of the sperm whale (*Physeter macrocephalus*), provide biographies of the main authors of names, give a glossary of terms, and summarize information on the status of type specimens. Because beaked whales are still so poorly known, there are likely to be future splits and descriptions of new species and/or subspecies. This paper is intended to assist in sorting out nomenclature in such taxonomic cases.

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Cover image: Two views of the holotype of *Berardius bairdii* (USNM 20992), a complete skull stored at the National Museum of Natural History, Smithsonian Institution.

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Nomenclature of the Larger Toothed Whales (Odontocetes): A Historical Review

Thomas A. Jefferson,[1] James G. Mead,[2] and Carl C. Kinze[3]*

INTRODUCTION

History

The sperm whale (*Physeter macrocephalus*) has been of great interest to people for many centuries, not so much because of its fascinating and unique morphology and biology, but largely because of the commercial interest in products obtained from the animals, once killed. Thus, Linnaeus (1758) provided detailed descriptions of several "species" of sperm whales in his tenth edition of *Systema Naturae*, the origin of our system of binomial nomenclature-based taxonomy. However, beaked whales, with rare exceptions, have never been the primary objects of the whaling industry. As a result, their taxonomy and nomenclature were not seriously investigated scientifically until much later and are still imperfectly known (Ellis and Mead, 2017).

Linnaeus (1758) did not include any beaked whales in his tenth edition. The first beaked whale was described only in 1770 (the northern bottlenose whale, *Hyperoodon ampullatus*), and most species that we currently recognize were not described until much later (some even in the last 50 years; see Rice, 1998). More than any other group of marine mammals, new species (and perhaps subspecies) of beaked whales are still being discovered. This is largely due to the relative inaccessibility of specimens of these relatively large oceanic animals, which are usually not commercially exploited. There is a common belief among marine mammal researchers that, while mostly relatively minor taxonomic revisions are still to be made for many marine mammal groups (i.e., species resurrections, generic recombinations, etc.), the beaked whale family (Ziphiidae) still contains a number of undescribed species (and subspecies) – see Carroll et al. (2021).

The large odontocetes (i.e., the sperm whales, great and lesser, and the beaked whales) currently comprise only 27 species, yet 114 species names have been provided for these animals since Linnaeus (1758). Thus, more than 75% of the names are not considered valid (either junior synonyms, junior homonyms, *nomina nuda*, or *nomina dubia*). When taxonomic revision is recommended by new studies, as is happening more frequently these days, it is critical to have an understanding of the nominal species that have been described for the group and to have at hand details of original descriptions and type specimens. As much of this information is buried in old, obscure, and often difficult-to-locate literature, the need for guidance has become apparent. This monograph is intended to provide such assistance for the student of large odontocetes.

As is true for the small cetaceans, the "heyday" of large odontocete discovery and description was in the mid-nineteenth century (1840s to 1880s; Figure 1). This was due to

[1] Clymene Enterprises, 13037 Yerba Valley Way, Lakeside, California 92040, USA.
[2] National Museum of Natural History, Smithsonian Institution, 10th St. & Constitution Ave. NW, Washington, D.C. 20560, USA.
[3] Cetacean Atlas of Denmark, Rosenørns Alle 55 2tv, DK-1970 Frederiksberg C, Denmark.
* Correspondence: sclymene@aol.com
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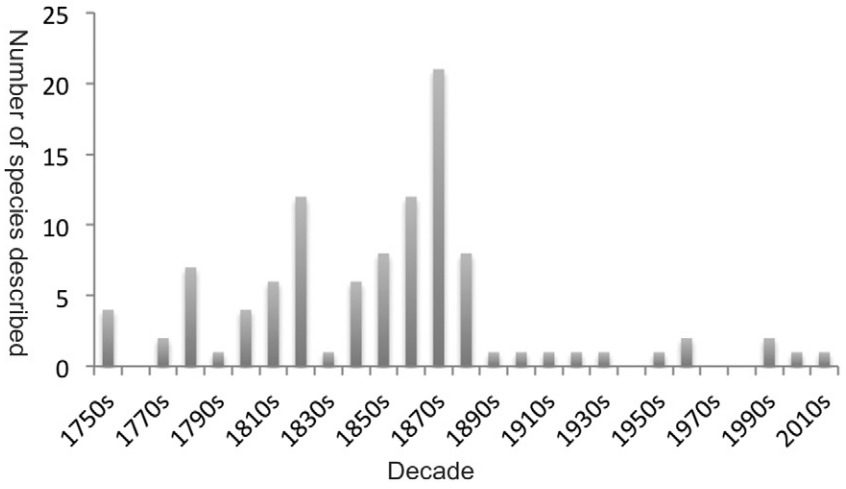


FIGURE 1. The number of large odontocete species described, by decade.

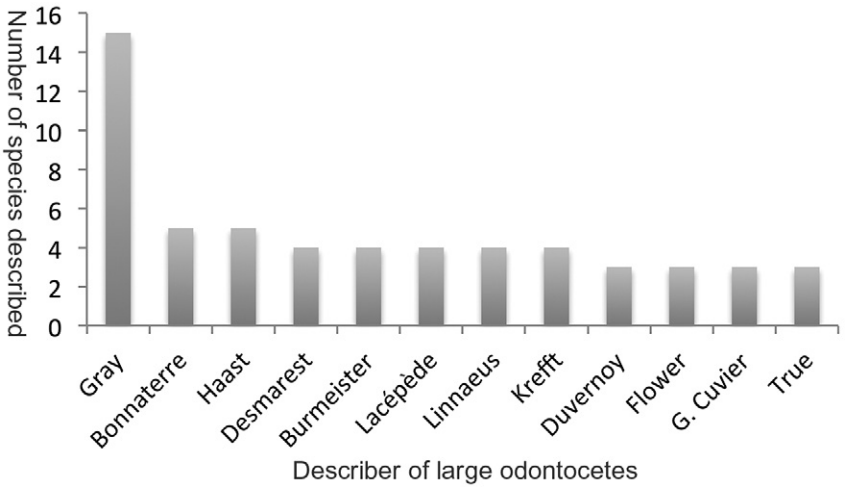


FIGURE 2. The major describers of large odontocete species, showing the number of species described by each, from greatest to least amounts.

both increased access to specimens, often a result of new interest in cetacean strandings, and to the industriousness of a few men who showed great interest in these animals and in their taxonomy. Although there are several workers who described similar numbers of nominal species (e.g., Bonnaterre, Burmeister, G. Cuvier, Desmarest, Duvernoy, Flower, Haast, Krefft, Lacépède, Linnaeus, and True), John Edward Gray of the British Museum was the standout. He described over three times more species than any other biologist (Figure 2).

Relatively recent and detailed reviews of the biology of the great sperm whale and of the beaked whales have been provided by Whitehead (2003) and Ellis and Mead (2017) respectively. Such a review has not yet been written for the two species of "lesser" sperm whale, the pygmy and dwarf sperm whales.

Materials and Methods

We visited museums that contained significant numbers of large odontocete type specimens. For those that we were not able to visit, we contacted curatorial staff to obtain relevant information (see Appendix C for a list of museum and collection acronyms).

At each museum visited, the relevant curators were queried about what large odontocete type specimens the institution maintained. Then we attempted to document each type

specimen identified. The following types of information were collected on each:

1. Species identification: Regardless of the original identification, each specimen was examined to determine the identification to species level, using the list of recognized marine mammal species maintained and regularly updated by the Society for Marine Mammalogy's Committee on Taxonomy https://www.marinemammalscience.org/species-information/list-marine-mammal-species-subspecies/ (SMM, 2021).
2. Nature of material and condition: The material making up the type (e.g., skull, cranium, postcranial skeleton, stuffed skin, etc.) was noted, and the condition that it was in (e.g., undamaged, damaged, stored in alcohol, fixed in formalin, etc.).
3. History: The museum's records and tags on specimens were consulted for information on the collector, collection details, and history of the specimen, to see if that information matched what was recorded in published literature.
4. Photographs: Standard photographs were taken of each type specimen; for skulls, dorsal, ventral, lateral, and mandible views were taken.

About This Monograph

The current paper is the second in a planned series of four that are intended to summarize the state of taxonomic nomenclature for the main groups of marine mammals of the world. The first, covering the small cetaceans, was published in 2021 (Jefferson, 2021). The need for such a set of documents became apparent to the first author in 2017 or 2018. The highly useful and informative *Catalog of Living Whales* (Hershkovitz, 1966) was becoming out of date and, in any event, covered only the cetaceans and not the pinnipeds.

The nomenclature of the large odontocetes has not been as confused as has that of the small odontocetes (see Jefferson, 2021). Nonetheless, the large number of species described that are not considered valid, and the inaccessibility of much of the relevant literature, has made it at times confusing and challenging to sort out the taxonomy of these animals, especially when taxonomic revisions are required.

It should be noted that the terms "type" and "type specimen" (including holotypes, syntypes, lectotypes, and neotypes) are used in this paper in a broad sense. The type method has been in use in zoology only since the mid-nineteenth century (Mayr, 1969), and the concept of types as nomenclatorial name bearers was adopted gradually through the latter half of the 1800s (Witteveen, 2016). When we discuss types collected and published in the 1700s and early 1800s, we recognize that, despite their being viewed as nomenclatorial types in modern times, they were often not designated or intended as such by the original describers.

NOMINAL SPECIES ACCOUNTS

Baird's beaked whale *Berardius bairdii*

Berardius bairdii Stejneger, 1883

This species was described by Stejneger in honor of Spencer F. Baird, the second secretary of the Smithsonian Institution, from a single skull obtained from a specimen stranded at Stare Gavan, Bering Island, Commander Islands, Russia, in 1882. Based on the size of the skull, the specimen was likely immature, estimated to have been approximately 5.5 m in total length. Though an extensive set of measurements of the type skull was given, there were no photos presented of the external appearance, nor of the skull. The species's morphology was later well described by True (1910), who also provided good photos of the holotype skull (plates 26–28). The type specimen is in the National Museum of Natural History in Washington, D.C. (USNM No. 20992; Figure 3; Hershkovitz, 1966; Fisher and Ludwig, 2016). This is the senior synonym of what is now known as Baird's beaked whale. An alternate spelling is *bairdi*.

Berardius vegae Malm, 1883

Malm described this as a new beaked whale species, based on a very damaged and incomplete skull from the Komandorskye [Commander] Islands in the Russian Bering Sea. His description is moderately detailed, complete with several illustrations of the skull and a few measurements. The Swedish title of this paper, "Skelettdelar af hval insamlade under Expeditionen med Vega 1878–1880" translates to "Skeletal parts of whales collected during the expedition with Vega 1878–1880." The specimen is confirmed to be still present in the Swedish Museum of Natural History (NRM-MA633499—D. Kalthoff, Swedish Museum of Natural History, personal communication, 12 April 2022). This name is considered to be a junior synonym of *Berardius bairdii*. Alternative spellings include *vegaae* and *vegana*.

Rostrifer nestoresmirnovi Zenkovich, 1947

In a paper on whaling in the Soviet Union, Zenkovich used this new name for the "far eastern bottlenose whale," which is generally recognized as Baird's beaked whale. Because Zenkovich provided no description of the supposed distinctive features of this nominal species, the name is considered a *nomen nudum*.

Arnoux's beaked whale *Berardius arnuxii*

Berardius arnuxii Duvernoy, 1851

Duvernoy's description of this species contains a significant amount of detail, mostly on the skull. There is a good illustration of the skull and tusks. The type specimen (skull from a 9.7 m specimen in the Muséum National d'Histoire Naturelle in Paris, France (MNHN-ZM-AC-A10733) was collected in 1844 on a French expedition, by M. Arnoux near Akaroa Port, Banks Island, New Zealand (Figure 4). The specimen was a male 975 cm long (Robineau, 1989), and it is still in the Paris museum

FIGURE 3. The holotype of *Berardius bairdii* (USNM 20992).

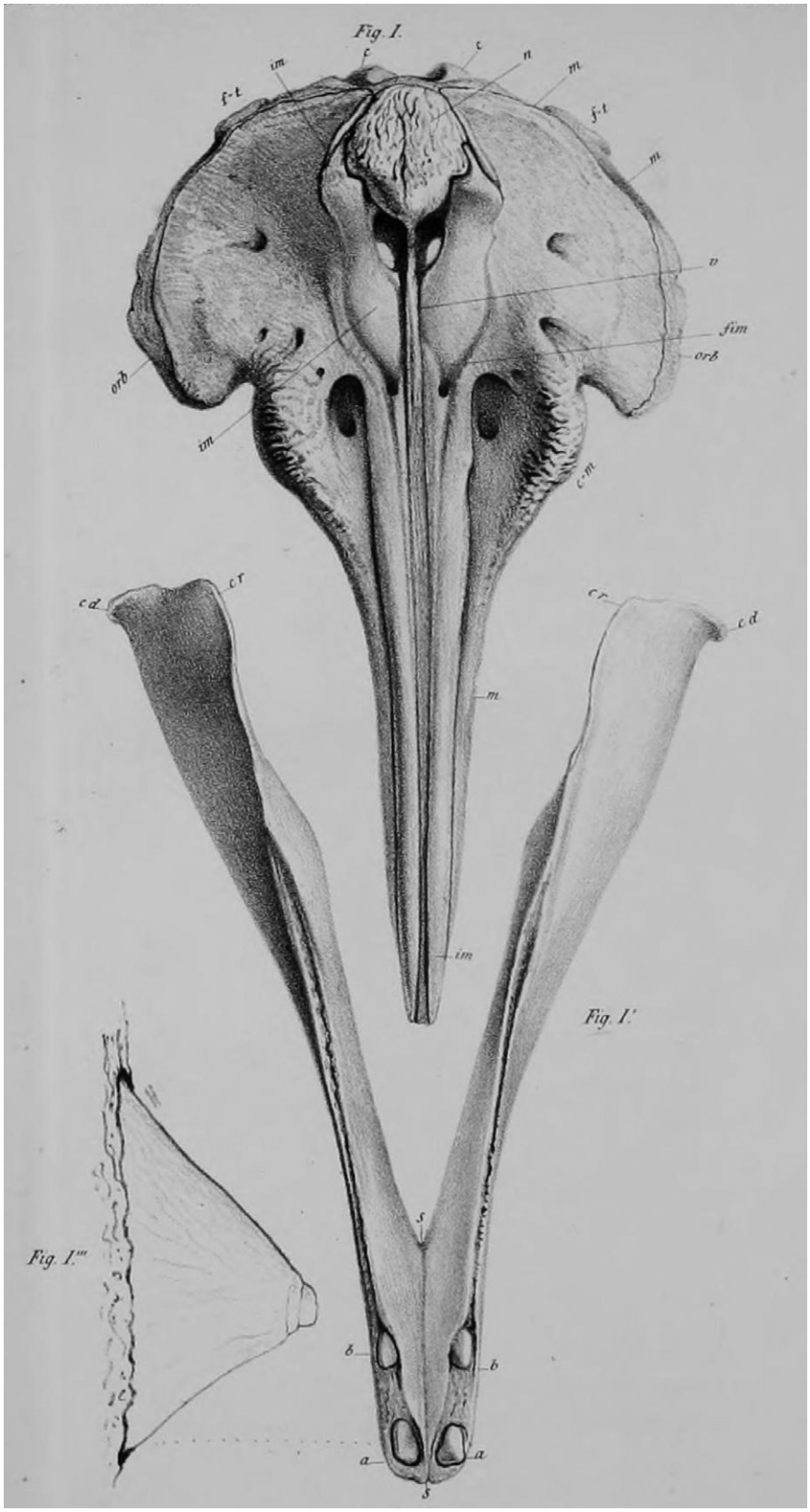


FIGURE 4. Skull of the holotype of *Berardius arnuxii* Duvernoy, 1851, in the MNHN.

(C. Callou, MNHN, pers. comm., 20 September 2021). Though the species name was in honor of him, the *o* was left out for unknown reasons (a *lapsus calami*), and the scientific name must continue to be spelled "*arnuxii.*" This is the senior synonym of the species known as Arnoux's beaked whale. Alternative spellings include *arnouxi* and *arnuxi*.

Mesoplodon knoxi Hector, 1873

Hector's (1873) type description mainly concerns the skull of this nominal species. There are two syntypes. The first was collected at Taitai Beach, New Zealand, and the second was collected at Kaiapoi Beach, New Zealand. McCann (1975) stated that the first specimen was in the Natural History Museum in London, UK (NHMUK; No. 1677b.76.2.16.3), though recent records of the museum do not show it in that collection (R. Sabin, NHMUK, pers. comm., 6 August 2021). The latter specimen was said to be in the Colonial Museum, Wellington. It might still be in the Museum of New Zealand Te Papa Tongarewa (the current name for the Colonial Museum; abbreviated now as NMNZ), but this needs to be confirmed (F. Marx, NMNZ, pers. comm., 29 March 2022). Hector presented a few skull measurements, and also illustrations of the ear bones (Hector, 1873, pl. 4). The name is considered to be a synonym of *Berardius arnuxii*.

Sato's beaked whale *Berardius minimus*

Berardius minimus Yamada et al., 2019

The most recent beaked whale species to be recognized, *B. minimus,* was actually known for decades by whalers in Japan as a distinct type of beaked whale. It was scientifically described by Yamada et al. in great detail, with information on the external appearance, skull and skeletal morphology, and even genetic comparisons. Several useful photos are included in the type description. The holotype (complete skeleton, soft tissue, stomach contents, NSMT M35131), an adult male, was found stranded on 4 June 2008, and is present in the National Science Museum Tokyo (NSMT; T. Yamada, NSMT, pers. comm., 9 July 2021). It was collected from Tokoro Town (44°07′14.5N, 144°06′29.6E), Hokkaido, Japan. This is the valid name of the species known commonly as Sato's beaked whale, a small form of *Berardius*.

Northern bottlenose whale *Hyperoodon ampullatus*

Balaena ampullata Forster in Kalm, 1770

Although bottlenose whales had been described in earlier accounts from the North Atlantic, this is the first post-Linnaean scientific name applied to these animals. Forster's account is very brief; it appears in a footnote (clearly written by Forster) within his English translation of Peter Kalm's *Travels into North America,* and thus the name credit should be "Forster in Kalm." The footnote has few details other than some general information on the whale's appearance (noting that the species has no teeth) and some behavioral notes. There are no illustrations or measurements provided. It was based on a whale that stranded near Maldon, Essex, England, in 1717 (Hershkovitz, 1966). Though Dale (1730) described the whale (giving it common names and the pre-Linnaean "*Balaena tripinnis edentela*"), no type specimen was collected. Dale did, however, provide an illustration (his plate 14), which shows a rather stocky, but recognizable, bottlenose whale. Forster's footnote alone links Kalm's observations with a bottlenose whale, referring to the beaked whale described by Thomas Pennant (1769) in his *British Zoology* vol. 3, part IV on cetaceous fish, who assigned it to the first genus, that is, cetaceans without teeth, more specifically to number V, the beaked whale, with reference to Pontoppidan's (1753) "nebbe-hval" and Dale's (1732) description of a 1717 Maldon stranding of a bottle-head or flounder-head whale. Hershkovitz (1966), following Rhoads (1902) and others, designated the Thames estuary as the type locality for the bottlenose whale. Although Rhoads's (1902) proposal is grounded solely on Forster's overreaching interpretation of the German edition of Kalm's travel account, for the sake of nomenclatorial stability the present scientific name should be conserved. This name, now written as *Hyperoodon ampullatus*, is the senior synonym of the northern bottlenose whale. An alternate spelling is *ampulatus*.

B[alaena] rostrata Müller, 1776

Müller's type description is based on earlier references by Danish and Norwegian whalers, who were familiar with this species as the "nebbehval" or "butskopf." No type specimen was collected or described by Müller, and there are very few details (and no illustrations) provided in the original description. Due to the relative obscurity of the Forster (in Kalm, 1770) reference (in a footnote of a translated travel book), Müller's name *B. rostrata* was more commonly used for this species than the senior synonym until the twentieth century. It was Rhoads (1902) who pointed out that Müller's name was antedated six years by Forster's *Balaena ampullata* (see above). Müller (1776) listed the species under the name *Balaena rostrata* with reference to Pontoppidan's (1753) first (but pre-Linnaean) usage of the name. This name is a junior synonym of *Hyperoodon ampullatus*. Alternative spellings include *rostratum* and *rostratus*.

D[elphinus] bidentatus Bonnaterre, 1789

Bonnaterre based this name (his *le dauphin a deux dents*) on the "bottlenose whale" of Hunter (this specimen was collected from the river Thames, England). His illustration (which is a copy of Hunter's 1787 painting—see Figure 5) of the external appearance (Bonnaterre, 1789: pl. 11, fig. 3) is quite good, and makes it very clear that this is what today is known as the northern bottlenose whale, *Hyperoodon ampullatus*.

D[elphinus] butskopf Bonnaterre, 1789

According to Hershkovitz (1966), Bonnaterre's name is based on the Honfleur whale, earlier described by Baussard (1789), the type skull of which was reportedly in the Natural History Museum of Caen, France (Muséum d'histoire naturelle de Caen). However, the museum was destroyed in the Battle of Normandy during World War II, and it is assumed that the specimen was

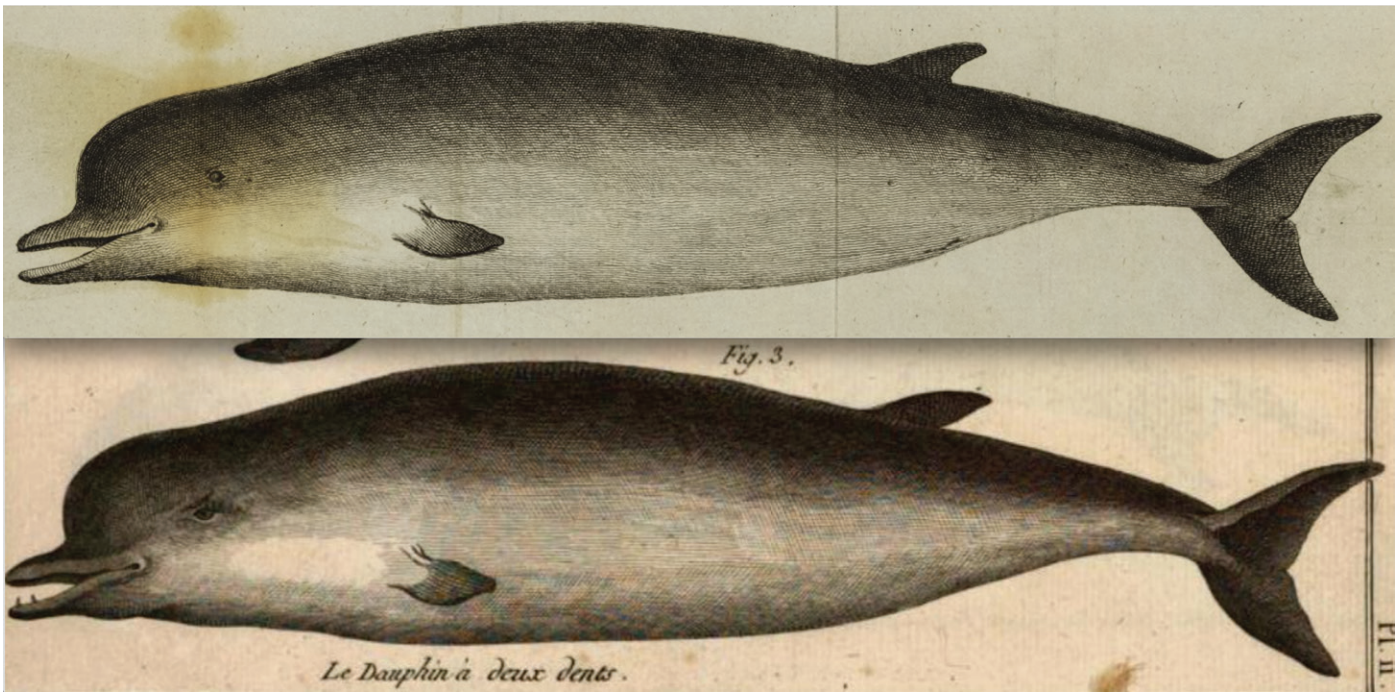


FIGURE 5. Original illustration of a northern bottlenose whale from Hunter (1787—top), and a copy of the same in Bonnaterre (1789—bottom). Bonnaterre based his species *D[elphinus] Bidentatus*, 1789, on the earlier illustration and description by Hunter.

also lost (M. Frénéa, Musée d'Initiation à la nature, Caen, pers. comm., 14 April 2022). Honfleur is a city in northern France's Normandy region. While Bonnaterre's original description is somewhat detailed, and contains some measurements, it does not include any illustrations of the species. Bonnaterre's name is now considered to be a junior synonym of *Hyperoodon ampullatus*. Alternative spellings include *Butzkopf* and *Butzkoff*.

Delphinus bidens Shaw, 1801

Shaw provided this name for the "bottle-nose whale of Dale" (Dale, 1730), which was described and illustrated, but not named, by Hunter (1787). Hunter provided an illustration of the external appearance in his plate 19. Referring to the "bottle-nose whale of Dale" implies that the 1717 Maldon stranding was indicated. However, Hunter described a later occurrence in 1783. Shaw's description of the species is very brief: a single paragraph, mostly on the external appearance. Shaw provided no illustrations or sets of measurements, and no type specimen appears to have been collected. This is a junior synonym of *Hyperoodon ampullatus*.

Delphinus diodon Lacépède, 1804

Lacépède provided this name for the "bottle-nosed whale" described by Hunter (1787). The species account is brief, but it does give accurate details of the external appearance and also some of the skull. In addition, the illustration of the body (Lacépède, 1804: pl. 13, fig. 3) shows what is obviously a northern bottlenose whale. Although we have seen a type listed for this species (RCS 2479), we suspect this is an error. Lacépède generally did not designate type specimens for his new species, and there appears to be no existing type. This is therefore a junior synonym of *Hyperoodon ampullatus*.

Delphinus chemnitzianus Blainville in Desmarest, 1817

Blainville (in Desmarest) introduced this name for a bottlenose whale described by Chemnitz (1779), from a specimen originating in Spitzbergen, Svalbard. Chemnitz examined the specimen on location. We know of no part that was preserved as a type. Desmarest's account is very short and does not give much in the way of details, nor any illustrations or measurements. Nevertheless, the name is considered to be a junior synonym of *Hyperoodon ampullatus*.

Hyperoodon borealis Nilsson, 1820

This is a replacement name for the "bottle-head whale" of many earlier authors. Nilsson listed the following as synonyms (in part): *Balaena rostrata* and *Delphinus edentulus*. Nilsson's species account is quite brief and contains no illustrations or measurements. The name is a synonym of *Hyperoodon ampullatus*.

Delphinus hunteri Desmarest, 1822

This new name was introduced for the "bottle-nosed whale" of Hunter. Desmarest provided a short description, with few

details and no illustrations. The name is a synonym of *Hyperoodon ampullatus*.

Delphinus hyperoodon Desmarest, 1822

This is another new name for *Delphinus Butskopf* of Bonnaterre, which in turn was based on the Honfleur whale earlier described by Baussard. The descriptive account is short, with only brief details, and the name is a junior synonym of *Hyperoodon ampullatus*.

Ceto-diodon hunteri Jacob, 1825

This species is described in a detailed account of a specimen stranded near Killiney, near Dublin, Ireland, though the paper concerns itself largely with specifics of the internal soft anatomy, which are of little use in determining identity. However, Jacob (1825) provides enough details on the external structure, skull, and skeletal anatomy, along with comparisons to known bottlenose whales, to determine that this species should be considered a synonym of *Hyperoodon ampullatus*. There is supposedly a type specimen (dissected by Jacob) at the Royal College of Surgeons in Dublin, but it is not present in that collection (S. Timmins, Royal College of Surgeons, Dublin, pers. comm., 4 April 2022). When located, it should be examined to confirm its identity, as the figures accompanying Jacob's paper appear to show a minke whale (*Balaenoptera acutorostrata*), which we suspect may have resulted from the fact that Arthur Jacob published two papers in 1825, the other one on a minke whale. Jacob's descriptions certainly seem to match *Hyperoodon*.

Hyperoodon honfloriensis Lesson, 1828

This is another new name for *Delphinus Butskopf* of Bonnaterre and Lacépède. The moderately detailed account gives measurements of the Honfleur whale, which was described by Baussard. Interestingly, the name *Hyperoodon honfloriensis* never appears in the descriptive account (instead, the account is headed by the common name "*l'Hyperoodon de Honfleur*"), but only appears in the table of contents on p. 440. The name is now considered synonymous with *Hyperoodon ampullatus*.

Hyperoodon rostratum Wesmael, 1841

This is not a usage but a separate account and scientific name. Wesmael (1841) credits plate 347 of the Schreber plates (Wiegmann, 1840–1844) to Schreber himself, speculating whether 1802 is the correct year of publication of this plate. A moderate amount of detail is presented, along with some measurements, and illustrations of the external body and the mandibles, the latter showing tooth placement. The name is a junior synonym of *Hyperoodon ampullatus*.

Delphinus? edentulus Wiegmann, 1842

This name was introduced in plate 347 by Wiegmann, whose plates were issued in batches at various times after they were completed (see Jefferson, 2021). The date of issue can not be determined reliably, but according to Poche (1911), was in the period from 1840 to 1842. By the rules of the International Commission on Zoological Nomenclature (ICZN), the latter date (1842) is to be used. The figure in the plate shows a species recognizable as the northern bottlenose whale, but there is no text, only the caption with the species name. According to ICZN rules that applied to this time, the name is available with this indication. Wagner (1847) later published the plate, with a description and list of synonyms, as *D[elphinus (Chaenodelphinus)] edentulus,* in his volume (see appendix in Jefferson, 2021). However, the name may be of much older origin. Plate 347, according to Wagner (1847), is a copy of Baussard (1789) and the name is credited to Schreber without year. Nilsson (1820) refers to the name as well, as does Wesmael (1841). So, the date is to be placed between 1802 and 1820. Johann Christian von Schreber, the founder of the series, had died in 1810 and the contracted artist Johann Eberhard Ihle in 1814. Because Nilsson referred to the name in 1820, Wiegmann had no part in it. The plate may have been found in Schreber's estate. The name is now considered a synonym of *Hyperoodon ampullatus*.

Delphinus quadridens Burguet, 1843

This new species name was given in the species account for *Delphinus diodon?*. There was little in the way of description and there were no illustrations, but Hershkovitz (1966) said that there was a type specimen (skeleton) in the now-defunct Muséum d'histoire naturelle de Bordeaux, France. There was no mention of it in the catalog of the Muséum de Bordeaux published by van Bree and Duguy (1977). The type is now apparently lost (Fischer 1881; L. Charles, Muséum de Bordeaux, pers. comm., 14 June 2022). The name is a synonym of *Hyperoodon ampullatus*.

Hyperoodon latifrons Gray, 1846

Gray described this as a new species of beaked whale, based on perceived differences in the skull from species known at the time. The description is very short, typical for Gray, with some details on the skull and a few measurements. Gray's illustrations of the skull (pl. 4) of the type specimen from the Orkney Islands, Scotland, which is still present in the NHMUK (skull and skeleton, No. 1845.7.4.1; Figure 6), show it to be a northern bottlenose whale, and the name is thus synonymous with *Hyperoodon ampullatus*.

H[yperoodon] baussardi Duvernoy, 1851

Duvernoy proposed this name as yet another replacement for the "butskopf" or Honfleur whale of Baussard, whom he named it after. There is a very short description of the skull, but with no illustrations or measurements. The name is synonymous with *Hyperoodon ampullatus*.

Southern bottlenose whale *Hyperoodon planifrons*

Hyperoodon planifrons Flower, 1882

A worn and damaged beachcast cranium was the basis for Flower's description of this new species of beaked whale, discovered

FIGURE 6. The holotype of *Hyperoodon latifrons* (NHMUK 1845.7.4.1). From the collections of the Natural History Museum, London.

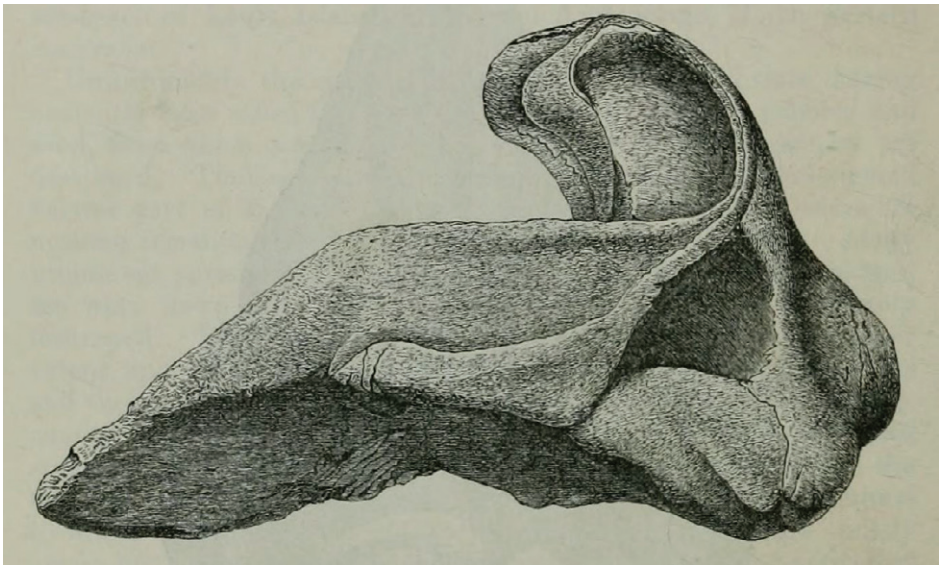


FIGURE 7. The holotype of *Hyperoodon planifrons* Flower, a cranium in the NHMUK (1882.3.24.1).

at Lewis Island, Dampier Archipelago, Australia (Figure 7). The account contains significant details on the type specimen (NHMUK 1882.3.24.1, 1814a), including a few measurements, comparisons, and two illustrations of the type. The holotype is confirmed to be still present in the NHMUK (Figure 8). Flower (1883), although apparently published later, does not mention *H. planifrons*. The name is the senior synonym and valid name of the southern bottlenose whale. An alternate spelling is *planifronts*.

Hyperoodon burmeisterei Moreno, 1888

Moreno (1888:22) briefly mentioned this new name in his progress report for the Museo de la Plata, Argentina (MLP), but provided no description or illustration, nor even an indication from previous literature. The name is therefore to be considered a *nomen nudum*, though it is certain that the name was intended for the species now known as *Hyperoodon planifrons*. In a later publication on beaked whales at the museum, Moreno (1895) stated that the specimen for which he earlier used the name *Hyperoodon Burmeisterii* was in fact not thought to be a new species, and that it was of the species *Hyperoodon planifrons*.

Cuvier's beaked whale *Ziphius cavirostris*

Ziphius cavirostris G. Cuvier, 1823

Georges Cuvier described this species from a partial skull at the MNHN, Paris, of what he thought was a fossilized extinct species. The holotype was collected in 1804 by R. Gorsse, from near the village of Fos, Department de Bouches-du-Rhône, France. Cuvier was mistaken about the holotype being a fossil, as the densely ossified rostrum is a characteristic of adult males of this species. The fact that it was from a living species was pointed out by Gervais (1869), and later confirmed by Turner (1872), through comparison with extant specimens of the same species from the Shetland Islands. The type, an incomplete skull of an adult male, was illustrated in plate 27, fig. 3 of Cuvier's (1823)

FIGURE 8. The holotype of *Hyperoodon planifrons* (NHMUK 1882.3.24.1). From the collections of the Natural History Museum, London.

account and is still in the MNHN (MNHN-ZM-AC-A3554; Robineau, 1989; C. Callou, pers. comm., 20 Sep 2021). Cuvier's description is moderately detailed but contains mostly information on the skull (because this was all he had available), with no measurements. This name is the senior synonym and valid name of Cuvier's beaked whale.

D[elphinus] desmaresti Risso, 1826

This species description is not very detailed, though there is a painting of the type in Risso's (1826) plate 2, fig. 3, which (though highly fanciful, with exaggerated proportions) shows an animal recognizable as a Cuvier's beaked whale (reproduced here in Figure 9). It was described from the Mediterranean Sea, and it is not thought that a holotype is in existence. The name is a synonym of *Ziphius cavirostris*. An alternate spelling is *Desmarestii*.

Hyperoodon doumetii Gray, 1846

Gray referred to this taxon in 1846; however, the reference to the earlier report by Doumet (1842) was given incorrectly as "*Bull Soc Cuvier*," unfortunately repeated by Hershkovitz (1966). Doumet's paper actually appeared in *Revue Zoologique*. The description is based on that of Doumet's "Hyperoodon." Gray's description of this species is brief, as was typical for him. Information is presented on external appearance, along with a few measurements, but none is presented on the skull and apparently no type specimen was collected. This is a synonym of *Ziphius cavirostris*.

Hyperoodon gervaisii Duvernoy, 1851

The descriptive account for this species contains moderate detail, but essentially only on the skull. There are no illustrations provided in the account. The name was based largely on a skull from a specimen stranded at Aresquiers, Département de l'Hérault, France, along the French Mediterranean coast. The holotype (a probable female 6–7 m long) is still in the collection of the MNHN (MNHN-ZM-AC-A3553; C. Callou, pers. comm., 20 Sep 2021) and consists of the badly damaged skull and some "skeletal fragments." Gervais (1850) described the skull, but did not name it, as he (correctly) considered it conspecific with *Ziphius cavirostris*. It was actually the female of *Z. cavirostris*. Duvernoy (1851), however, was of the opinion that it was a new species and later named it *Hyperoodon Gervaisii*. Robineau (1989) provided a detailed history of the type specimen and name, and included a few measurements. This is a junior synonym of *Ziphius cavirostris*.

Ziphius indicus Van Beneden, 1863

Van Beneden gives a short account of this species based on a skull collected from the Cape of Good Hope, South Africa (Figure 10). The type was said by Hershkovitz (1966) to be in the Louvain Museum (currently known as the Musée L in Louvain-la-Nueve, Belgium), but it has been donated to the Institut royal des Sciences naturelles de Belgique (IRSNB 4027). Based on the open cranial sutures, well-developed prenarial basin, and filled mesorostral groove, this appears to be a young male (O. Lambert, IRSNB, pers. comm., 27 April 2022; Figure 11). The cranium is largely intact but the mandibles are damaged. A plastotype (plaster cast) of the anterior portions of the cranium and mandible is located in the Academy of Natural Sciences in Philadelphia, Pennsylvania (ANSP) (No. 3005; Koopman, 1976), and is still present in that collection (N. Gilmore, ANSP, pers. comm., 16 July 2021). There are good illustrations of the

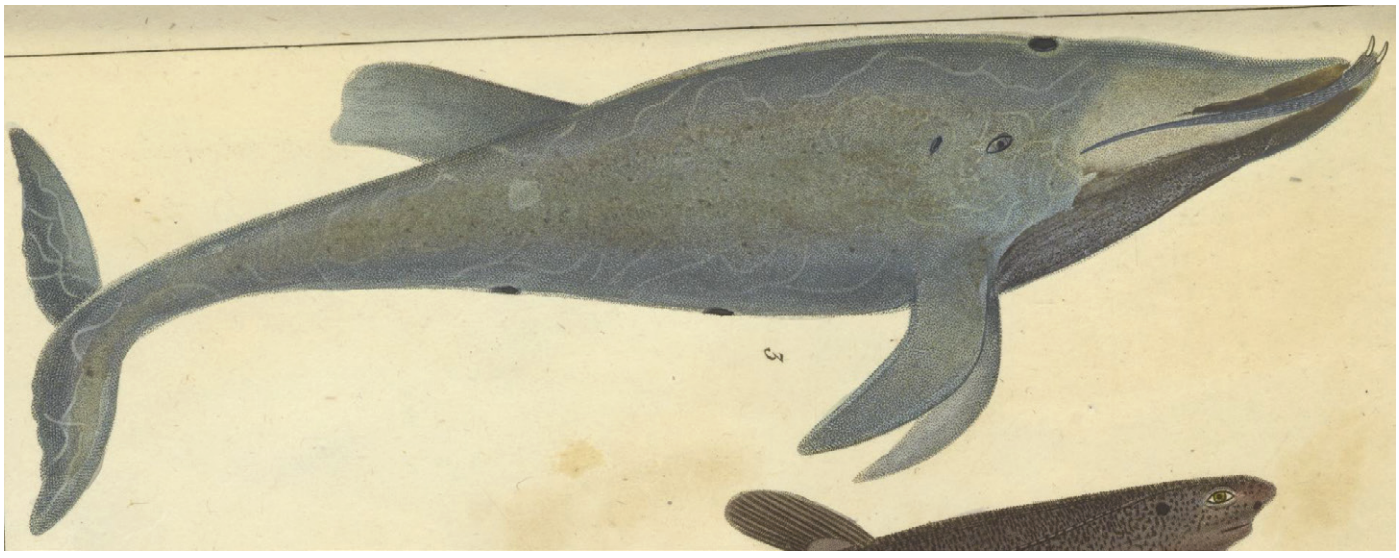


FIGURE 9. Rather fanciful painting of the type of *Delphinus desmaresti* Risso, 1826. No specimen from the type is thought to have been saved, but it is recognizable as a specimen of *Ziphius cavirostris*.

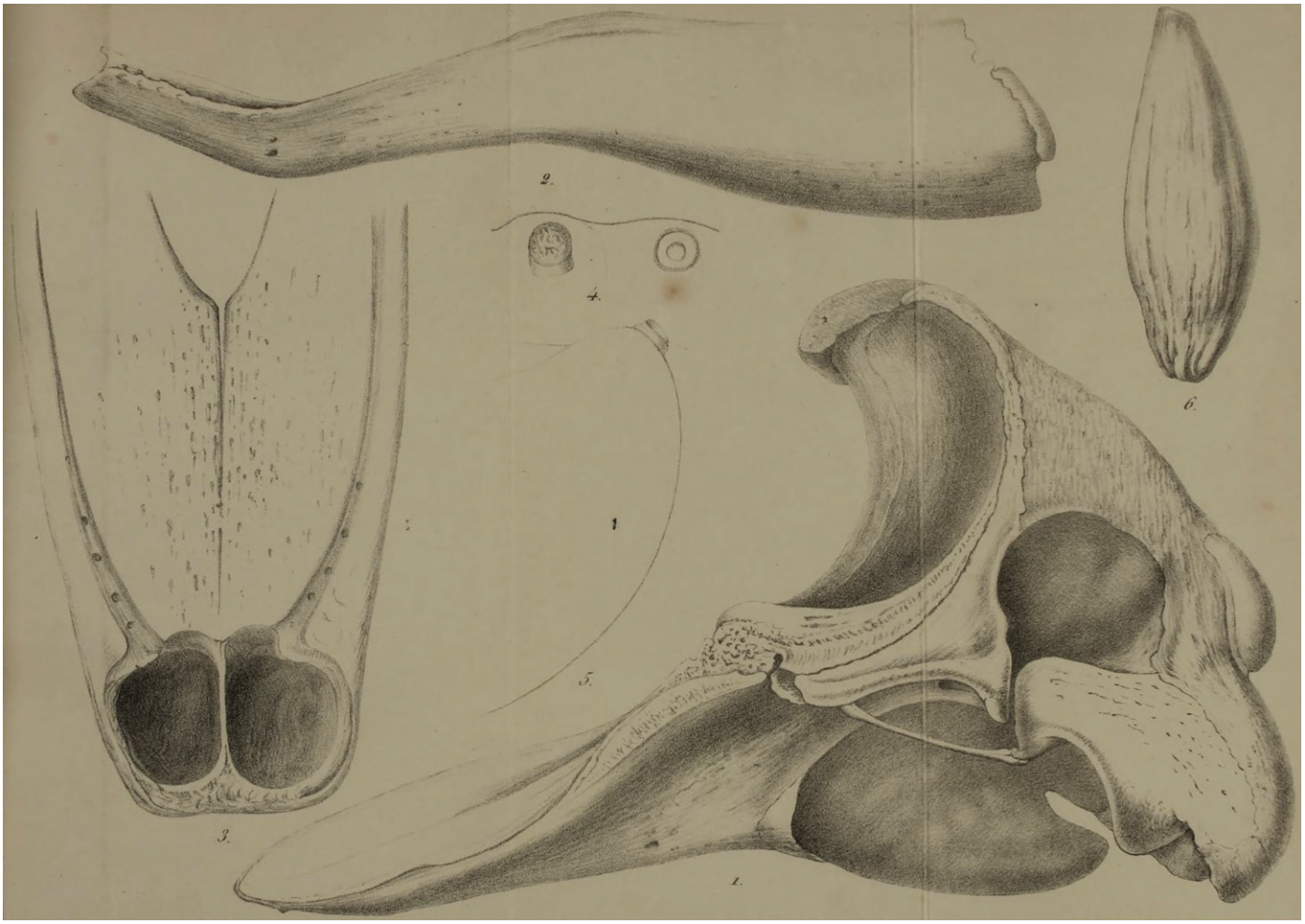


FIGURE 10. Type of *Ziphius indicus* Van Beneden, 1863. In addition to the actual holotype skull, there is a plastotype (plaster cast) of the anterior portions of the cranium and mandible in the ANSP.

skull in Van Beneden (1863: pl. 1), which clearly show this species is associated with *Ziphius cavirostris*. An alternate spelling is *Indica*.

Hyperoodon capensis Gray, 1865

This species was described by Gray (1865a) from a skull in the British Museum, collected off the Cape of Good Hope in South Africa. The type description is brief, with a few skull measurements, and a rather poor illustration of the skull in the second figure. The type skull is still present in the NHMUK (No. 1869.4.5.1, 1517a; Figure 12). The name is confirmed to be a junior synonym of *Ziphius cavirostris*.

Hyperodon [sic] *semijunctus* Cope, 1865

Cope described this as a western North Atlantic species of beaked whale, based largely on skeletal and skull features of a 360-cm-long young female collected in 1861. His description is fairly short with few measurements and no illustrations. The type locality is Charleston, South Carolina, and the holotype skull/skeleton was originally in the Charleston Museum and later acquired by the USNM (No. 21975; Fisher and Ludwig, 2016). There are photos of the type in Cope (1890) and True (1910), which clearly show it to be of the genus *Ziphius*. The genus name Cope used is apparently a misspelling of *Hyperoodon*. This name is a junior synonym of *Ziphius cavirostris*.

Delphinorhynchus australis Burmeister, 1865

Burmeister (1865a) provided a moderately detailed account complete with measurements, but no illustrations, to describe this new species of beaked whale. The type locality was off Buenos Aires, Argentina. The holotype was a stranded male specimen—a skeleton with some soft tissue. It was deposited in the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (MACN-Ma), but the specimen has now been lost and it is not listed in Vaccaro and Piantanida (1998). Many specimens were lost lost during the museum's move in the 1930s (P. Teta,

FIGURE 11. The holotype specimen of *Ziphius indicus* Van Beneden, 1863 (IRSNB 4027). Photos by O. Lambert.

FIGURE 12. The holotype of *Hyperoodon capensis* (NHMUK 1869.4.5.1), a junior synonym of *Z. cavirostris*. From the collections of the Natural History Museum, London.

MACN-Ma, pers. comm., 22 July 2021). However, the museum apparently retains a watercolor painting of the type (Figure 13), painted by Burmeister himself (Castello, 2012). This is a synonym of *Ziphius cavirostris*. An alternate spelling is *australe*.

Ziphiorrhynchus cryptodon Burmeister, 1865

This new name for his species *Delphinorhynchus australis* was provided by Burmeister (1865b) in an obscure pharmacological journal, but an English version of the paper was later published in a prominent British journal (Burmeister, 1866). The accounts are fairly detailed, with a lot of information about the external morphology and internal anatomy. Only very few skeletal details were included, as the specimen had not yet been prepared. The English account (Burmeister, 1866) includes a good illustration of the external appearance of the specimen and some internal anatomy. Another paper (1869), in which Burmeister suggested the species should be moved to the genus *Epiodon*, provided good illustrations of the skull. The type specimen, the same as that listed above for *Delphinorhynchus australis,* has been lost (P. Teta, pers. comm., 22 Jul 2021). This name is clearly a synonym of *Ziphius cavirostris*.

Epiodon patachonicum Burmeister, 1867

This is simply a replacement name Burmeister proposed for his *Ziphiorrhynchus cryptodon* (= *Epiodon cryptodon*). The account provides text details but no illustrations. It is also a *Ziphius cavirostris* synonym.

Epiodon australe Burmeister, 1869

In introducing this name, Burmeister renamed his earlier species (for which he had used the names *Delphinorhynchus australis, Ziphiorrhynchus cryptodon, Epiodon cryptodon*, and *Epiodon patachonicum*). With this description he provided much more detailed information on the external morphology, coloration, skull and skeleton, and even the internal anatomy of this species. The account is very long, with good illustrations of all aspects of the anatomy and morphology of the type specimen. It is apparently the watercolor of the type shown in Burmeister's (1869) plate 15, which he painted himself, retained in the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia." This is all that is left of the type (Castello, 2012; P. Teta, pers. comm., 22 Jul 2021). The name is another synonym of *Ziphius cavirostris*.

Petrorhynchus mediterraneus Gray, 1871

This name was provided by Gray (1871a) as a replacement name for several older names used to describe Cuvier's beaked whales from the Mediterranean Sea. No information is provided about the animals in the very short account, other than the Mediterranean range and a list of synonyms. It is a junior synonym of *Ziphius cavirostris*.

Ziphius aresques Gray, 1871

Gray (1871a) did not provide any description but simply introduced this name in the synonymy of *Epiodon desmarestii*. He

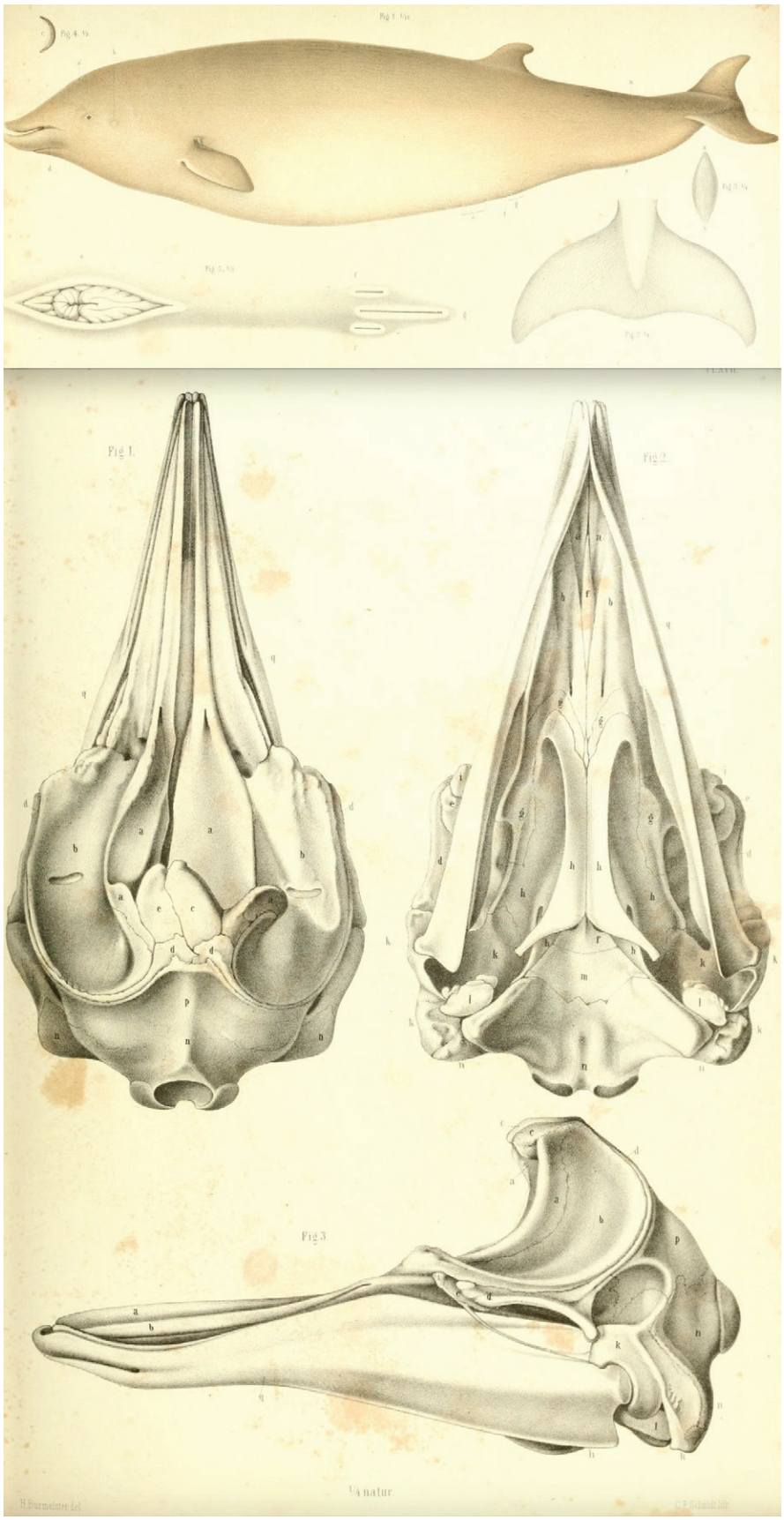


FIGURE 13. Watercolor painting of the external appearance (top) and drawing of the skull (bottom) of the type of *Epiodon patachonicum* Burmeister, 1867. This specimen also serves as the type for *Delphinorhynchus australis* Burmeister, 1865a; *Ziphiorhynchus cryptodon* Burmeister, 1865b; and *Epiodon australe* Burmeister, 1867. It appears that the actual specimen has been lost, but this painting, by Burmeister himself, still exists in the Museo Argentino de Ciencias Naturales "Bernardo Rivadavia."

attributed the name to P. Gervais, who originally described it but did not provide a name for it. Robineau (1989) stated that the type specimen of *Hyperoodon Gervaisii* Duvernoy, 1851 is the same one that this species is based on (MNHN-ZM-AC-A3553), thus making the two names objective synonyms. The name is now in the synonymy of *Ziphius cavirostris*.

Ziphius decavirostris Gray, 1871

This is another new name provided by Gray (1871a) within the synonymy of *Epiodon desmarestii*, as with the above. See Hershkovitz (1966) for corrections to Gervais's figure numbers. This may have been a *lapsus*, Gray intending to write "cavirostris," but it is different enough to have been considered a new name in previous literature. It is therefore considered a synonym of *Ziphius cavirostris*.

Epiodon heraultii Gray, 1872

Gray apparently meant this name to be a replacement for *Epiodon desmarestii*, which was figured in Van Beneden and Gervais (1880: pl. 21, figs. 1–4). Robineau (1989) stated that the type specimen of *Hyperoodon Gervaisii* Duvernoy, 1851 (MNHN-ZM-AC-A3553) was also used as the basis for this name and for *Ziphius aresques* Gray, 1871, thereby making the three names objective synonyms. The name is in the synonymy of *Ziphius cavirostris*.

Epiodon chathamiensis Hector in Hector and Gray, 1873

Hector (in Hector and Gray, 1873) described this new beaked whale from a skull from the Chatham Islands, New Zealand, collected by G. H. Travers. The holotype (a bisected skull with mandibles) is in the Museum of New Zealand Te Papa Tongarewa (NMNZ MM000021, F. Marx, pers. comm., 22 Jul 2021). The original description, dated 1873, gives a short account with skull details and a few measurements but no illustrations. In what is clearly a later paper (Hector, 1873, though imprinted with the date 1872), Hector provides the previous information plus more details gleaned from additional specimens. This latter paper also includes good illustrations of the skull and teeth. The dates of one or both papers must be in question. The species is in the synonymy of *Ziphius cavirostris*. Alternative spellings are *chathamensis* and *chatamensis*.

Ziphius savii Richiardi, 1873

This species was named by S. Richiardi, who apparently prepared a species description for publication in the journal *Archivio per la Zoologia*. However, Richiardi's (1873) paper was never published, due to termination of the journal (see Paulus, 1962). Two large (58.3 × 40.5 cm) unpublished plates for the description of *Ziphius savii* with specimen drawings were available at the Pisa Museum (Figure 14). The plates were drawn by E. Cristofani and executed by the Gozani Lithograph. Copies of the plates were distributed to colleagues and relevant scientific institutions. Physical verification of the skeleton of the type specimen confirmed that it belongs to an 1823 stranding near Pisa, in Italy's Ligurian Sea, which was later reported by Richiardi (1875: tables 1, 2), though this time using the name *Ziphius cavirostris*. Richiardi apparentely decided that this was not a new species after all. Hershkovitz (1966) stated that the holotype was in the Natural History Museum of the University of Pisa and this is confirmed by Braschi et al. (2007). Richiardi's 1873 plates, in line with ICZN rules, serve as an "indication" and the name dates from that "reference." See further detailed history in Braschi et al. (2007) and Nicolosi et al. (2014). This name is a junior synonym of *Ziphius cavirostris*.

Ziphius novae-zealandiae Haast, 1876

A female whale stranded in 1872 at Lyttleton Harbour, Banks Peninsula, New Zealand, was the basis for this species description. Haast's (1876a) account provided a short description of the flensed external body and extensive details about the skull and skeleton of the type specimen, plus several skull measurements. Further information was provided in Haast (1876b). The skeleton of the type was reported to be in the Canterbury Museum, New Zealand (Hershkovitz, 1966) and a handwritten list by F. W. Hutton records the holotype as stored at Canterbury in 1898–1900, but it appears to have been moved. A complete skeleton (NMNZ MM001380) currently in the Museum of New Zealand Te Papa Tongarewa seems to match the description and is believed to be the holotype (F. Marx, pers. comm., 10 Mar 2022). In a note immediately following Haast's paper, Flower (1876) cast serious doubt on the evidence that this was a species different from other *Ziphius* whales known at the time, and went so far as to say there might be only one species in the genus, which is in line with the current taxonomy. *Ziphius novae-zealandiae* is now considered a junior synonym of *Ziphius cavirostris*.

Ziphius grebnitzkii Stejneger, 1883

Stejneger described this species from a skull of a presumed adult male that he found on Bering Island (Ostrov Beringa) in the Komandorskye Islands, Bering Sea, in 1882. The holotype is now in the USNM (No. 20993; Fisher and Ludwig, 2016). Stejneger's account is not very detailed and though it contains some skull measurements, it does not include any illustrations. He said that he would publish a more detailed account later, but we are not aware of such an account ever being published. True (1910) later published photos of the type specimen. The species is synonymous with *Ziphius cavirostris*.

Sowerby's beaked whale *Mesoplodon bidens*

Physeter bidens Sowerby, 1804

In a very short note in the *Transactions of the Linnaean Society of London* (published on 21 November 1804; Raphael, 1970), Sowerby (1804a) mentions the name of his new species, *Physeter bidens*, but other than stating the length of the animal it does not provide any information about its distinctive features. Technically,

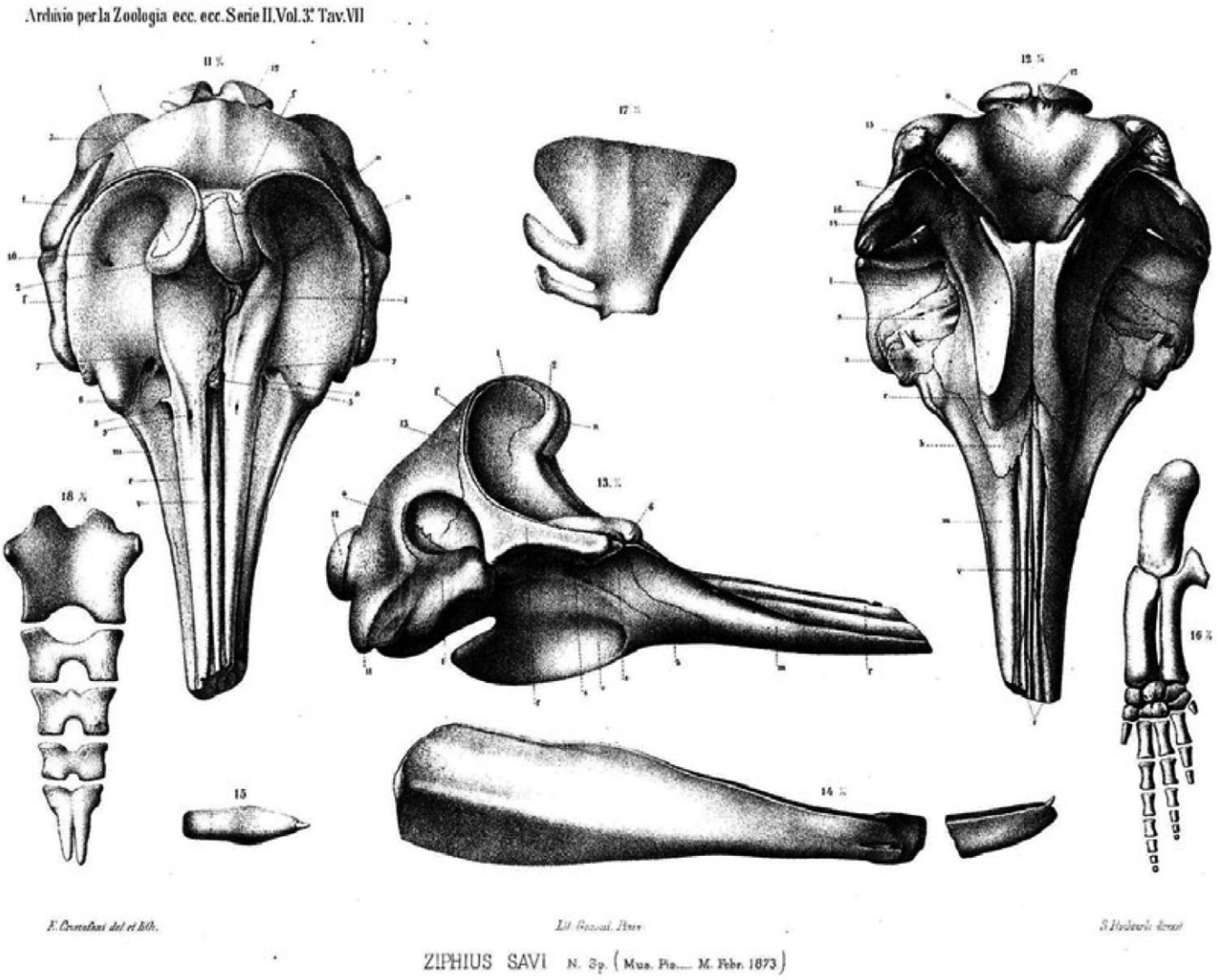


FIGURE 14. Type skull of *Ziphius savii* Richiardi, 1873. The holotype is still present in the Natural History Museum of the University of Pisa, Italy.

this name is a therefore a *nomen nudum*, though the point is somewhat moot, as he made the name available by providing a detailed description in the same year, less than two weeks later—see below.

Physeter bidens Sowerby, 1804

The original mention (Sowerby, 1804a) of this, the first species of mesoplodont beaked whale to be described by science, is very short, with essentially no details on the animal other than that it was a 16-foot long male (456 cm). Later in the same year (published on 1 December 1804), Sowerby (1804b) provided more details on the type specimen (Figure 15). What he received was just the head, but the specimen was collected on the beach at Elginshire, Scotland, in 1800. Sowerby offered details of the external appearance (from descriptions of the specimen by the collector, James Brodie) and some details of the head anatomy. There was no description of the skull, but he did include a good illustration of the external appearance of the specimen. Hershkovitz (1966) stated that the holotype was in the museum of the University of Oxford. Waller (2013) and Smith et al. (2021) also stated that the type is now located in the Oxford University Museum of Natural History (No. ZC.06998, confirmed by M. Carnall, Oxford University Museum of Natural History, pers. comm., 12 July 2021). Waller (2013) also provided very good illustrations and photos of the type skull. There is a cast of the type in the NHMUK

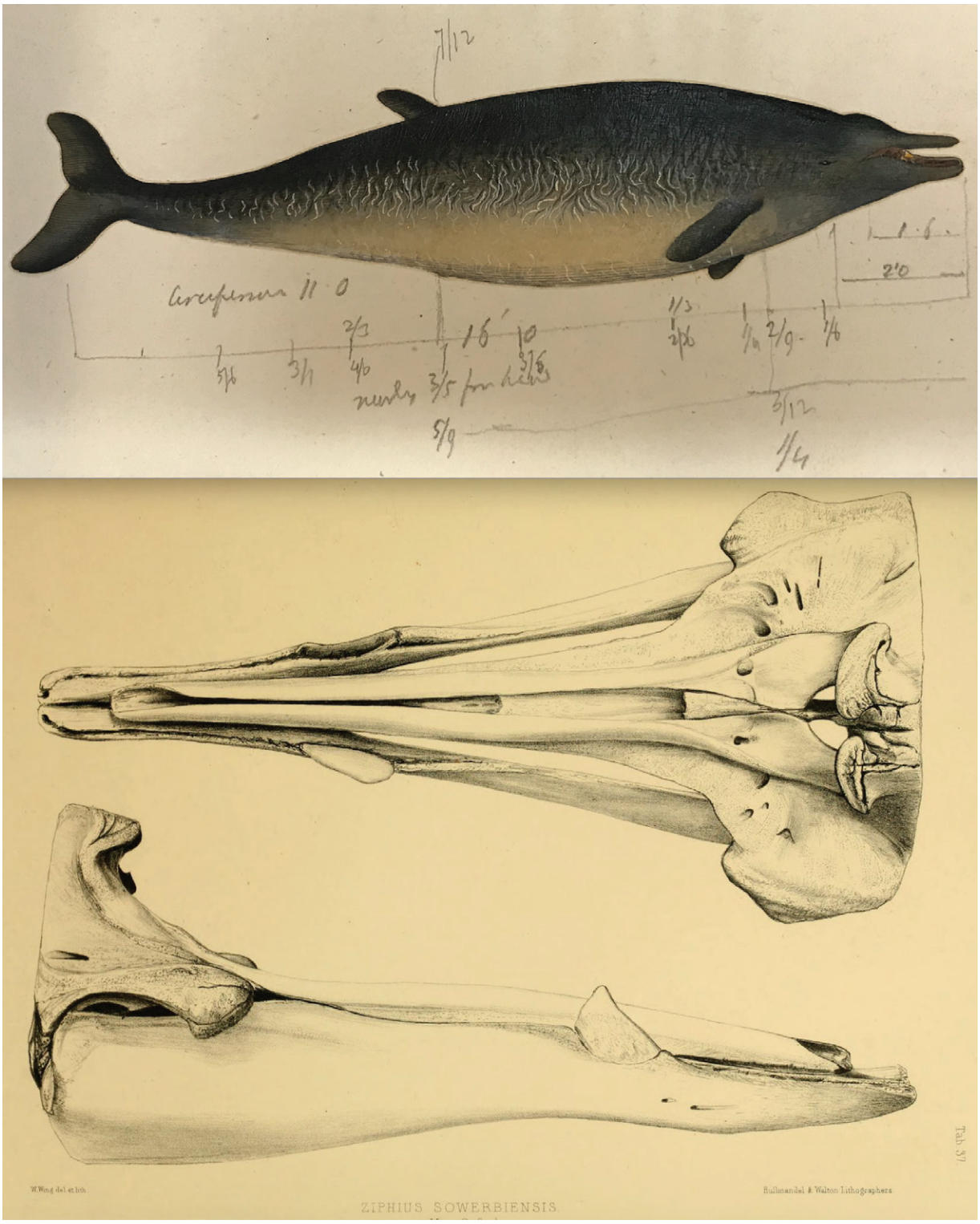


FIGURE 15. Illustration of the external appearance of the holotype of *Physeter bidens* Sowerby, 1804, with handwritten notes by J. E. Gray (top), and the skull of the holotype specimen (labeled as *Ziphius sowerbiensis*, in Gray, 1846) (bottom). The type skull is currently located in the Oxford University Museum of Natural History, though there are several casts of the type in other institutions.

(No. ZD 1982.318), and apparently another in the Museum of Comparative Zoology (MCZ) in Harvard, Cambridge, Massachusetts (MCZ Mammalogy BOM-8645). This is the senior synonym and valid name of Sowerby's beaked whale, *Mesoplodon bidens*.

Delphinus sowerbensis Desmarest, 1817

The authorship of this species is often listed as Blainville, but the account was actually written by Desmarest. The description is short, with some details provided on the external morphology, coloration, and teeth, but nothing about the skull or skeleton. No figures are provided. As this is a new name for *Physeter bidens* Sowerby, the type specimen and locality "Elquishire" (= Elginshire) are the same as for that earlier species. This is a synonym of *Mesoplodon bidens*. Alternative spellings are *Sowerbyi*, *Sowerbi*, *Sowerbiensis*, and *Sowerbyensis*.

Heterodon dalei Lesson, 1827

Lesson provides only a very short description of the external body, based largely on literature records. No figures or measurements are provided. A type specimen (skin and skull; in the MNHN) was collected from Le Havre, France, but it has been lost (C. Callou, MNHN, pers. comm., 20 Sep 2021). Although Lesson called it a "bottle nose whale," Hershkovitz (1966) regarded the name as a synonym of *Mesoplodon bidens*. Bottlenose and Sowerby's whales in early cetological works were often mixed up; the name might best be considered a *nomen dubium*.

Delphinus micropterus G. Cuvier, 1829

This is apparently a renaming of the "dauphin de Dale" of Blainville. No specific type is known for this name, and the name is a junior synonym of *Mesoplodon bidens*. An alternate spelling is *micropteron*.

Delphinus philippii Cocco, 1846

The description of this species contains a significant amount of anatomical detail and several measurements given in Sicilian and Rhineland/Prussian units. Provided were total length (15½ ft.; 488 cm), girth, flipper length, height of dorsal fin, fluke span, and eye dimensions), and even a total weight (15 quintals; ~1,250 kg). The female specimen was collected, but it was lost overnight. The type locality was the Straits of Messina in the Mediterranean Sea. There is also a painting of the external appearance of the animal. It is not highly accurate—it could show one of several species of beaked whale. While Hershkovitz (1966) listed the name as a junior synonym of *Ziphius cavirostris*, the account further contains a footnote by Wagner assigning it to *Delphinus micropterus* = *Mesoplodon bidens*.

Gervais' beaked whale *Mesoplodon europaeus*

Dioplodon europaeus Gervais, 1852

This species name was mentioned in a list of known species of beaked whales in Gervais (1852), though no description or indication was provided. This makes the name a *nomen nudum*.

Dioplodon europaeus Gervais, 1855

In 1855, Gervais briefly described the species that he had mentioned by name three years earlier (see above), finally making this name available. This species was based on the skull of a specimen harpooned (sometimes reported as found floating) in the English Channel in 1840 and given to M. Deslongchamps. In the early twentieth century, the holotype was in the Muséum d'histoire naturelle de Caen in France (Musée d'Initiation à la nature; A.7737; Brasil, 1909; Hershkovitz, 1966), but this building was destroyed in the Battle of Normandy during World War II, and presumably the specimen was lost with it (M. Frénéa, pers. comm., 14 Apr 2022). The description by Gervais was very brief, with no information other than a short account of the type skull and an estimate of total length. No illustrations were provided. However, Brasil (1909: pls. 1, 2) later presented a good description and excellent photos of the type skull. This is the senior synonym and valid name of Gervais' beaked whale, *Mesoplodon europaeus*.

Dioplodon gervaisi Deslongchamps, 1866

This is a renaming of *Dioplodon europaeus* Gervais. However, in this account, Deslongchamps provided a moderately detailed description of the skull of this species. The name is a *Mesoplodon europaeus* synonym.

True's beaked whale *Mesoplodon mirus*

Mesoplodon mirum True, 1913

The initial description of this species was from a very short note dated 14 March 1913, which provided a diagnosis of the species including a few measurements but no figures (True, 1913a). Later in the same year, a very detailed description of this species, including some details of internal anatomy and extensive information on the external morphology and skull morphology, was published by True (1913b). His latter account includes several sets of measurements and good photos of the external appearance and the skull. The 480-cm-long adult female holotype specimen was stranded on Bird Island Shoal in Beaufort Harbor, North Carolina, in 1912. The holotype (skull and part of the postcranial skeleton, along with a cast of the head [a body cast has apparently been lost; Fisher and Ludwig, 2016]) is still in the possession of the USNM, with the catalog No. 175019 (Figure 16; Fisher and Ludwig, 2016). This is the valid name of True's beaked whale, though the species name has been emended to *Mesoplodon mirus* (for correct Latin agreement). An alternate spelling is *mirum*.

Gray's beaked whale *Mesoplodon grayi*

Mesoplodon grayi Haast, 1876

A mass stranding of 28 beaked whales occurred in 1874 at Waitangi Beach, Chatham Islands, New Zealand. Three skulls collected from these animals in 1875 were the basis of this new species, named in honor of J. E. Gray. Although there was essentially no information about the biology or overall appearance of the animals, Haast (1876c) described the skulls in some detail and

FIGURE 16. The holotype of *Mesoplodon mirus* (USNM 175019).

included a short list of measurements and an illustration of part of the upper and lower jaws and teeth, plus drawings of the rostrum and mandible. These three syntypes (apparently sent to the Canterbury Museum, Christchurch, New Zealand) were the basis of Gray's beaked whale, *Mesoplodon grayi*. Unfortunately, it appears that the types have been lost (F. Marx, pers. comm., 22 Jul 2021).

M[esoplodon] haasti Flower, 1878

Flower (1878a) considered one of the skulls described by Haast above, that of an adult male, to be different enough to represent a new species, *M. haasti*. The name is mentioned in this short note, but there is no description or indication; thereby this name should be considered a *nomen nudum*.

M[esoplodon] haasti Flower, 1878

In a paper published later in the same year, Flower (1878b) finally described his new species, *M. haasti*, based on the partial skull he had available to him. The incomplete skull was in the Museum of the Royal College of Surgeons, London, and the only illustrations Flower provided were a cross-section outline of the rostrum shape and illustrations of the anterior portions of cranium and mandible. The type is presumably the specimen mentioned by Flower and Garson (1884), RCS 2905 (rostrum and part of mandible with two teeth). This name is now considered to be a junior synonym of *Mesoplodon grayi*.

Mesoplodon australis Flower, 1878

Flower (1878b) introduced this species, based on a beaked whale specimen that had previously been described by Hector (1874) under the name *Berardius hectori* Gray. The holotype is a complete skeleton with skull, obtained from Lyall Bay, New Zealand, and is currently in the NHMUK (No. 1876.2.16.2, 1677a; Figure 17). Flower (1878b) described the skull and skeleton of this species (with measurements), believing it to be a distinct species, and illustrated them in great detail in his plates 71–73. This name is now known to be a synonym of *Mesoplodon grayi*.

FIGURE 17. The holotype of *Mesoplodon australis* (NHMUK 1876.2.16.2). From the collections of the Natural History Museum, London.

Ginkgo-toothed beaked whale *Mesoplodon ginkgodens*

Mesoplodon ginkgodens Nishiwaki and Kamiya, 1958

Nishiwaki and Kamiya nearly simultaneously published three accounts of this new species, which was based on a 472 cm specimen killed (by some boys, using a baseball bat) when it appeared near shore in September 1957 at Oiso Beach, Sagami Bay, near Tokyo, Japan. The first (1958a, the official type description) was published in September 1958. It included a highly detailed description of the events surrounding the stranding and a full description of the external appearance, skull, and skeletal morphology, complete with extensive photographs, measurements, and comparisons with related species. Second and third, shorter accounts (1958b, 1958c) with less detailed information were published in October and November of 1958. The entire skeleton of the holotype specimen was preserved and is still present in the NSMT (No. 08744, T. Yamada, pers. comm., 9 Jul 2021). This is the senior synonym and valid name of the ginkgo-toothed beaked whale.

Deraniyagala's beaked whale *Mesoplodon hotaula*

Mesoplodon hotaula Deraniyagala, 1963

Deraniyagala's (1963a) initial account of this new species was short: a brief description of the external appearance and skull of the type specimen, with a few measurements. The type was collected at Ratmalana, Sri Lanka (then called Ceylon), in January 1963. In a paper published later that year, Deraniyagala (1963b) indicated that the holotype specimen (consisting of the skull, dorsal fin, flukes, and a cast of the head) was deposited at the Colombo Museum (No. 3WZS). This specimen was confirmed to be present in the Colombo Museum (mis-identified as *M. ginkgodens*) in the mid-1980s by Stephen Leatherwood (Leatherwood and Reeves, 1989). More detailed information on the species along with several illustrations, sets of measurements, and comparisons, was provided in a later paper (Deraniyagala, 1965). However, the species was not accepted and for many decades the name was thought to be a junior synonym of *M. ginkgodens* (see Mead, 1989a). Dalebout et al. (2014) provided a thorough redescription of the species as valid, complete with molecular and morphometric comparisons to related species, based on multiple specimens and tissue samples. They also reexamined the holotype (a 445 cm female), and determined the type locality to be 6°49′N, 79°52′E.

Strap-toothed beaked whale *Mesoplodon layardii*

Ziphius layardii Gray, 1865

The basis for this species was the skull of a beaked whale collected from South Africa (possibly near the Cape of Good Hope), which, unlike any whale known at the time, had two tusks in the middle part of the lower jaw arching up over the upper jaw (Gray, 1865a). Gray had only drawings of the skull provided by Mr. E. Layard (curator at the South African Museum, Cape Town [ZAM]) available to him for the type description, which is therefore quite brief. The holotype specimen (skull) was transferred from the ZAM to the NHMUK in 1869 and is still in that collection (NHMUK 1869.4.5.2; Figure 18). This is the valid name of the strap-toothed beaked whale, *Mesoplodon layardii*. An alternate spelling is *layardi*.

Mesoplodon güntheri Krefft, 1871

Krefft's one-paragraph type description is based only on the tusk of an 18-foot female specimen caught in Little Bay, near Long Bay, Sydney, New South Wales, Australia, in 1870. The unique curved structure of the tooth was the basis for distinguishing it, and in a short note at the end of the account, J. E. Gray stated that the tooth was so unique as to justify its placement in a new genus, *Callidon*. A drawing of the tooth was included in the description. The entire skeleton of the holotype specimen was said to be in the Australian Museum, Sydney (AM). Parnaby et al. (2017) located what they suspected to be the type specimen in the museum (AM PA.358–359, 363–364), but their research could not confirm this with certainty. The bones are badly damaged, with some replaced by artificial casts—see Parnaby et al. (2017) for a detailed historical account and description of the type material. This name, now spelled *Mesoplodon guentheri,* is considered to be a junior synonym of *Mesoplodon layardii*.

Mesoplodon longirostris Gray, 1873

This name has a very confusing history. Gray (1873a) first published the name in January 1873 (see Parnaby et al., 2017) in reference to a photograph of a beaked whale skeleton obtained from Little Bay, near Sydney, and sent to him by Krefft of the Australian Museum. Gray suspected that this skeleton and the tooth that Krefft used to describe *Mesoplodon guentheri* were, in fact, from the same specimen. In June 1873, Gray (1873b) again used this name to denote the skeleton in Sydney, but with no mention of the earlier paper and essentially no new information. Based on information available to him at the time, Gray now considered the name *Mesoplodon longirostris* (which he credited to Krefft) to be either a junior synonym of *Berardius (=Mesoplodon) hectori* or a new species (Gray, 1873b, 1874a), though he seemed to favor the latter based on the apparent absence of teeth and very long rostrum (both mistaken impressions, the latter of which stemmed from a misleading reconstruction of damage to the skull). Gray did not seem to be aware at that time that the type material for both *Mesoplodon guentheri* and *M. longirostris* were from the same specimen (AM PA.358–359, 363–364; Parnaby et al., 2017). Because this species name is based on the same type material, it is also a junior objective synonym of *Mesoplodon guentheri* (see above and Parnaby et al., 2017 for a detailed historical account of this complicated issue). Parnaby et al. (2017) considered this name a *nomen nudum* based on the alleged absence of a description, but we disagree, as there is a short description of supposedly unique features in the original publication of Gray (1873a). The name is therefore available from that publication and is now a junior synonym of *Mesoplodon layardii*.

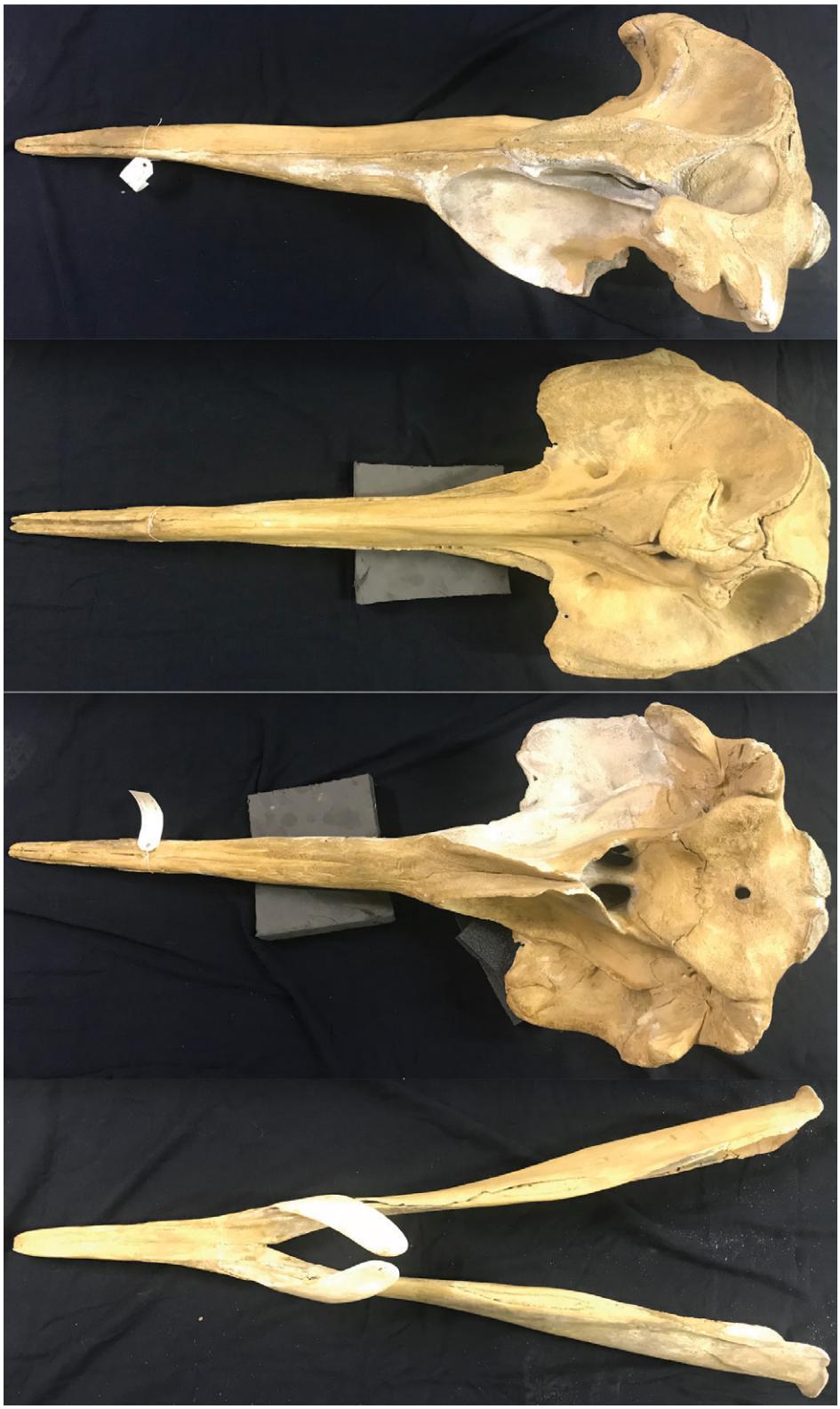


FIGURE 18. The holotype of *Ziphius layardii* (NHMUK 1869.4.5.2). From the collections of the Natural History Museum, London.

Mesoplodon thomsoni Krefft in Scott, 1873

This name first appears in Scott's (1873) book on Australian mammals, within the synonymy of *M. sowerbiensis*, with no description or indication. Ogilby (1892) used the name, again with no description or illustration of any sort. Both Scott (1873) and Ogilby (1892) attribute the name to a manuscript by Krefft (which may never have been published), and Iredale and Troughton (1934) later attributed the name to Flower (1878b)—in error, as the name does not appear anywhere in that reference. There was no designated type, but Parnaby et al. (2017) considered that the holotype of *Mesoplodon guentheri* might also be considered the type for *M. thomsoni*. Although this name may have been intended to describe a female of what we now know as *Mesoplodon layardii*, because the name was published without any description or valid indication, by ICZN rules it must be considered a *nomen nudum*. See Parnaby et al. (2017) for a detailed historical account.

Mesoplodon floweri Haast, 1876

In a paper on another species of beaked whale (*Mesoplodon Grayi*), Haast (1876c) mentioned the name *Mesoplodon floweri*, but provided no description or indication of the features of the species. There was no type. Therefore, although this name is known to be associated with *Mesoplodon layardii*, it must by ICZN rules be considered a *nomen nudum*.

Mesoplodon floweri Haast, 1876

In the same year as he first introduced the name, Haast (1876b) provided a detailed account of the skull and skeleton of his *Mesoplodon floweri*, thereby making the name available. The holotype was a skull and skeleton from Saltwater Creek, north of the Banks Peninsula, New Zealand, collected in April 1874 (Figure 19). The type (NMNZ MM001379, complete skeleton, male) is still in the Museum of New Zealand Te Papa Tongarewa (F. Marx, pers. comm., 10 Mar 2022). Haast's description

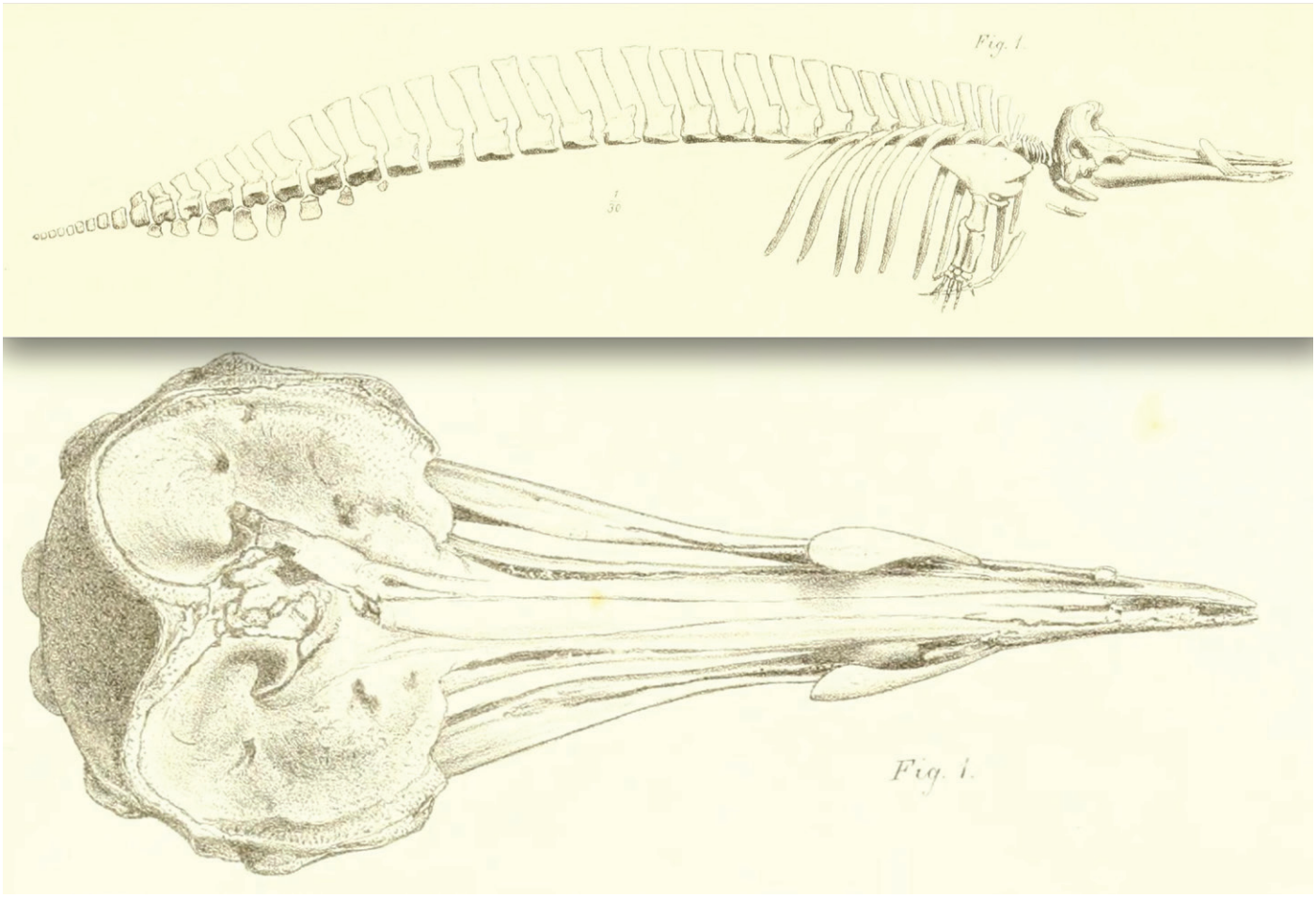


FIGURE 19. The holotype of *Mesoplodon floweri* Haast, 1876. The current location is not known (possibly the Canterbury Museum, Christchurch, New Zealand).

included extensive details of the complete skeleton, with some measurements and good illustrations of the mounted skeleton and a dorsal view of the skull. The name is a junior synonym of *Mesoplodon layardii*.

Spade-tooth beaked whale *Mesoplodon traversii*

Dolichodon traversii Gray, 1874

Gray's (1874b) very brief account (with almost no description) proposed this new name for the specimen earlier described by Hector (1873) and misidentified with the name *Dolichodon layardii* (=*Mesoplodon layardii*). Gray recognized it as a different (and new) species, and gave it the name *Dolichodon traversii*, although for many years thereafter it continued to be confused with *Mesoplodon layardii*. Hector's account is only a little more detailed, with some information and measurements of the type skull. The type locality was Pitt Island, Chatham Islands, New Zealand. The holotype is still in the collection of the Museum of New Zealand Te Papa Tongarewa. It is from a male specimen and consists of both mandibles, but with the left ramus missing (No. NMNZ MM000546, F. Marx, pers. comm., 22 Jul 2021). Good photos of the type specimen and an account of its history can be found in van Helden et al. (2002), which includes comparisons with other species and molecular information. This name is now considered the valid name of the spade-toothed beaked whale, *Mesoplodon traversii*.

Mesoplodon bahamondi Reyes et al., 1995

This was described as a new species of beaked whale, from a skull found at Robinson Crusoe Island, off the coast of Chile, in 1986. The holotype specimen was deposited in the Museo Nacional de Historia Natural, Santiago, Chile (MNHNS, No. 1156). The species account is detailed, with a thorough description of the skull, along with photos and measurements but no information on external appearance. Not long after its description as a new species, however, this was determined to be a junior synonym of *Mesoplodon traversii* (van Helden et al., 2002)

Blainville's beaked whale *Mesoplodon densirostris*

Delphinus densirostris Desmarest, 1817

Desmarest founded this species based on an incomplete anterior portion of the rostrum provided by H. M. D. de Blainville (only 9 inches [22 cm], according to Hershkovitz, 1966). Blainville is often erroneously credited with the species type description, though the specific credit for this account names Desmarest as the author. The type description does not contain much useful information, and nothing was said about the external appearance (as only a small portion of the skull was known at the time). The type specimen, from an unknown locality, is still in the MNHN (MNHN-ZM-AC-A3552; C. Callou, pers. comm., 20 Sep 2021). This name is the senior synonym and valid name of Blainville's beaked whale, *Mesoplodon densirostris*.

Ziphius sechellensis Gray, 1846

Gray describes *Ziphius sechellensis* in little more than a single paragraph, with some details of the skull morphology but nothing on the external shape. Gray's report (1846: pl. 6), however, includes a good drawing of the cranium and mandible of an adult male, showing the tusks. The holotype, a cranium collected in 1839 from the Seychelles, is still in the MNHN (MNHN-ZM-AC-A3551; C. Callou, MNHN, pers. comm., 20 Sep 2021). Measurements of the type are provided in Robineau (1989). The skull illustration in Gray's plate 6 confirms that this is a junior synonym of *Mesoplodon densirostris*.

Stejneger's beaked whale *Mesoplodon stejnegeri*

Mesoplodon stejnegeri True, 1885

A skull of a young beaked whale found by L. Stejneger in 1883, on Bering Island in the Commander Island group of Russia, was the basis for this new species described by True. His account is short, with no information on the external appearance but a moderately detailed report on the holotype cranium, which was deposited in the USNM (No. 21112; Figure 20; Fisher and Ludwig, 2016). Plate 25 of the original description (True, 1885) contains two good illustrations of the skull, and there are photos of the skull in True (1910). This is the valid name of Stejneger's beaked whale.

Andrews' beaked whale *Mesoplodon bowdoini*

Mesoplodon bowdoini Andrews, 1908

Andrews proposed this new beaked whale based on a mounted skull and skeleton of a 422 cm adult male specimen in the American Museum of Natural History in New York City (AMNH) (No. 35027; Goodwin, 1953; still present in the collection, N. Duncan, AMNH, pers. comm., 4 August 2021). He named it in honor of George S. Bowdoin, a donor to the museum, whom he credited with expanding its cetacean collection. It was collected from New Brighton Beach, Canterbury Province, New Zealand, in 1904. Andrews's account of the species is detailed, with a thorough description of the skull (and teeth) and postcranial skeleton, complete with various sets of measurements and photos. Nothing was known of the external appearance of the species at the time, though it is now known primarily from a few stranded specimens. This name is the valid name of Andrews' beaked whale.

Hubbs' beaked whale *Mesoplodon carlhubbsi*

Mesoplodon carlhubbsi Moore, 1963

In his diagnostic review of beaked whales, Moore (1963) recognized a skull previously identified as *M. bowdoini* (by Hubbs, 1946) to be an undescribed species. Moore named the new species in honor of its collector, the famous ichthyologist Carl L. Hubbs, and described the skull in detail, along with

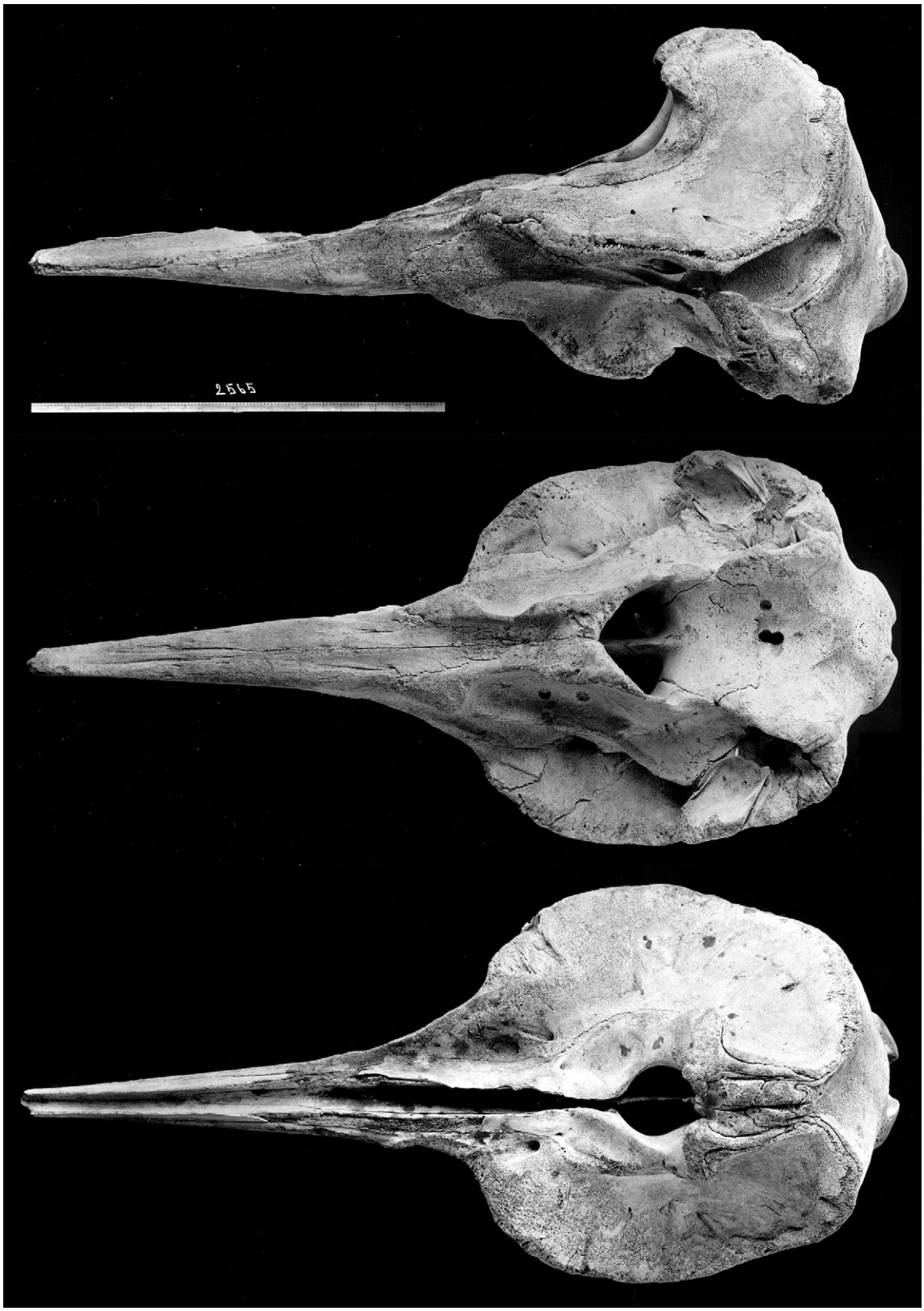


FIGURE 20. The holotype of *Mesoplodon stejnegeri* (USNM 21112).

photos and comparisons to related species. Over the years, there has been repeated question about the distinctness of this species from *M. bowdoini*, but that has now been largely resolved. The holotype specimen, an adult male (505 cm total length) live-stranded in 1945 at La Jolla, California, USA, was deposited in the USNM (No. 278031; Figure 21). It consists of the entire skeleton including the skull, plus the larynx and one eye. (The dorsal fin and fluke tip may have been lost [Fisher and Ludwig, 2016].) This is the valid name of Hubb's beaked whale.

Hector's beaked whale *Mesoplodon hectori*

Berardius hectori Gray, 1871

Gray's (1871b) new species was based on a previous description by Knox and Hector (1871), who did not provide a

FIGURE 21. The holotype of *Mesoplodon carlhubbsi* (USNM 278031).

name for the species, thinking it was a young specimen of the large southern beaked whale, *B. arnuxii* (McCann, 1962, would later resurrect this idea, but it has since been proven wrong). Gray recognized it as a new species but kept it in the genus *Berardius*. The type specimen was collected at Taitai Bay, Cook Strait, New Zealand, in January 1866. The type was designated as the smaller specimen of Knox and Hector (1871; pls. 14, 15), a juvenile male. It is confirmed to be in the NHMUK (No. 1876.2.16.3, 1677b; Figure 22; Mead and Baker, 1987). It consists of the skull, scapulae, hyoids, cervical vertebrae, and flippers. This is the valid name of Hector's beaked whale, *Mesoplodon hectori*.

Perrin's beaked whale *Mesoplodon perrini*

Mesoplodon perrini Dalebout et al., 2002

This species was identified genetically from several specimens that were initially misidentified as *M. hectori*. The account of Dalebout et al. is extremely detailed, with information on external and internal anatomy, coloration, skull and skeletal morphology, molecular genetics, and extensive comparisons. Many sets of measurements and photos are provided. The holotype specimen, an adult male, is the complete skeleton and stomach (in preservative) of a specimen (USNM 504853; Figure 23) found at Carlsbad, California, USA, in September 1978, and named in honor of cetologist William F. Perrin (Fisher and Ludwig, 2016). Other soft tissues may have been lost. There are also four paratypes, two at the USNM, and a further two at the Los Angeles County Museum of Natural History, in California (LACM). This is the valid species name of Perrin's beaked whale.

Pygmy beaked whale *Mesoplodon peruvianus*

Mesoplodon peruvianus Reyes et al., 1991

This is one of the most recent species of beaked whales described, and the account of Reyes et al. is full of details on external appearance, skull and skeletal morphology, and general biology, and includes many photos and measurements. The holotype specimen is an adult male collected in November 1988 at Playa Paraíso, Lima, Peru, and preserved as a complete skull and skeleton at the Museo de Historia Natural "Javier Prado" (MHNJP) (No. 1146) in Peru. There is also a paratype in the Naturalis Biodiversity Center, Leiden, Netherlands (RMNH) (subadult female, skull, No. MAM.38234; P. Kamminga, RMNH, pers. comm., 29 July 2021). This is the valid name of the world's smallest species of beaked whale, the pygmy beaked whale.

Ramari's beaked whale *Mesoplodon eueu*

Mesoplodon eueu Carroll et al., 2021

This is the most recently described species of beaked whale. Ramari's beaked whale, *Mesoplodon eueu,* was described by Carroll et al. (2021) as a distinct species, but previously these animals were thought to be a Southern Hemisphere population of *M. mirus*. The type specimen (female, complete skeleton, NMNZ MM003000) was collected as a beach stranding, and is in the Museum of New Zealand Te Papa Tongarewa (F. Marx, pers. comm., 10 Mar 2022). There are also several paratypes: adult females (PEM N0136 and PEM N3438) and an adult male (PEM

FIGURE 22. The holotype of *Berardius hectori* (NHMUK 1876.2.16.3). From the collections of the Natural History Museum, London.

FIGURE 23. The holotype of *Mesoplodon perrini* (USNM 504853).

N1114) at the Port Elizabeth Museum in South Africa (PEM), and adult males (SAM-ZM-041596 and SAMZM- 039840) held at Iziko South African Museum in Capetown.

Longman's beaked whale *Indopacetus pacificus*

Mesoplodon pacificus Longman, 1926

For many years considered a species of *Mesoplodon* (see Mead, 1989a), Longman's beaked whale is now considered distinct enough to warrant its own genus. Longman described the species from a single skull, with no teeth, discovered in 1882 at Mackay, Australia, and deposited in the Queensland Museum in Brisbane (QM) (No. J.2106). It is confirmed to be still present there (J. Janetzki, QM, pers. comm., 12 July 2021). The account has extensive information about the skull (119 cm long, see Dalebout et al., 2003) and includes some measurements and a plate (Longman, 1926: pl. 43) with good photos of the skull from different angles. Dalebout et al. (2003) redescribed the species based on several fresh specimens and molecular and morphometric comparisons, also providing the first indications of its external appearance. This is the valid name of Longman's beaked whale, and the only species known in the genus.

Shepherd's beaked whale *Tasmacetus shepherdi*

Tasmacetus shepherdi Oliver, 1937

A new genus and species of beaked whale was described by Oliver from a near-complete skeleton found stranded at Ohawe, Taranaki, North Island, New Zealand, in 1933. Oliver named the genus after Abel Tasman, discoverer of Tasmania and New Zealand, and the species after George Shepherd, curator of the Wanganui Museum, who collected the type specimen. The location of the type is reportedly in the Wanganui Alexander Museum, New Zealand (Mead, 1989b), now known as the Whanganui Regional Museum. The type description of the species has a short account of the external appearance and extensive details on the skull and some elements of the postcranial skeleton. It includes some measurements, and the plates contain various photos of the skull and some skeletal parts. This is the valid name of the species now known as Shepherd's beaked whale.

Sperm whale *Physeter macrocephalus*

[Physeter] macrocephalus Linnaeus, 1758

Sperm whales were well known to biologists in the eighteenth century when Linnaeus published his tenth edition—the start of our current system of zoological nomenclature. The description for this species provided by Linnaeus was quite short, with no illustrations or measurements. No type specimen was explicitly established, but the species is described in reference to seven previous publications, Linnaeus noting specifically the large size (60 ft.; 18 m), teeth only in the lower jaw, and spermaceti oil in the head. The specimens on which these were based have effectively become syntypes, and Husson and Holthuis (1974) have determined that these were all sperm whales. In order to clarify the taxonomy, these authors chose one of these, a specimen stranded in Berkey, Netherlands, on 3 February 1598 (Clusius, 1605) as a lectotype. Though the actual specimen (male, 52–70 ft. long) is not known to exist anymore, there are drawings of it at the Teyler's Museum at Haarlem, and one is reproduced in Boschma (1951: pl. 1) and Husson and Holthuis (1974: pl. 3). Although controversial for many years (and contrary to the opinion of Hershkovitz, 1966), *Physeter macrocephalus* has now been accepted as the senior synonym and valid name of the sperm whale (see Husson and

Holthuis, 1974; Holthuis, 1987). See also Appendix A for a detailed history of the naming controversy.

[Physeter] catodon Linnaeus, 1758

This name was published in the same volume as *Physeter macrocephalus*, and for a long time there was controversy about which of the two was to be viewed as the valid name of the sperm whale. The original description is brief and the listed features (short lower jaw, dorsal fin) are not adequate to unambiguously determine that Linnaeus intended this as a description of a sperm whale. Again, Linnaeus did not designate a type specimen, but listed four references in describing this species. Husson and Holthuis (1974) in their detailed historical account have determined that *P. catadon* is likely a composite species (based on material from sperm and pilot whales) and thus the name might be considered a *nomen dubium*. However, those authors have designated a sperm whale specimen (RMNH.MAM.5828, a 16 m male specimen stranded at Middenplaat, Netherlands, on 24 February 1937) as a neotype for the name, and this specimen is still present in the collection (P. Kamminga, pers. comm., 29 Jul 2021). With this clarification of the nomenclature, the name *P. catadon* now becomes a junior synonym of *P. macrocephalus* (see Husson and Holthuis, 1974; Holthuis, 1987 for the detailed history). See also Appendix A for a detailed history of the naming controversy.

[Physeter] microps Linnaeus, 1758

Described based on an earlier description from Artedi's (1738) Physeter #1, the features Linnaeus presented for this species (long dorsal fin, lower jaw longer than the upper) do not indicate it as a sperm whale, though it has traditionally been considered as such by previous authors (e.g., Boschma, 1951; Berzin, 1972; Tomilin, 1967), thereby effectively making it a junior synonym of *Physeter macrocephalus*. This seems to have been largely influenced by Thomas (1911) and Hershkovitz (1966), who regarded Linnaeus's *P. microps* as an inaccurate or fanciful version of the sperm whale. However, as there was no type specimen collected, it is impossible to know for sure. The description might be based on a mix of species. Considering this uncertainty, we feel it is best to consider this name a *nomen dubium*.

[Physeter] tursio Linnaeus, 1758

Linnaeus described this species based on the earlier description of Physeter #2 by Artedi (1738). There was no type specimen designated or collected, making it difficult to identify this name with any known species of cetacean, and the features Linnaeus listed for this species (three fins, high dorsal fin, ends of teeth flat) are not those usually associated with the sperm whale. As with the species above, most recent authors have considered the name to be a junior synonym of *Physeter macrocephalus*. However, noting the lack of a type specimen and diagnostic features not fitting the sperm whale (the high dorsal fin may suggest a killer whale), we feel the name is more appropriately considered a *nomen dubium*.

Physeter novae angliae Borowski, 1781

Borowski's very short type description does not explicitly designate a type specimen; nor does it include any illustrations or measurements. It references an indication from Brisson (1756) of what is considered a sperm whale from New England, but no type specimen was deposited. The correct date is 1781, as the name was given only in the text volume, and not in the plates volume published in 1780. The name would now be written as *Physeter novaeangliae* and is considered a synonym of *P. macrocephalus*.

Physeter andersonii Borowski, 1781

In a somewhat longer descriptive account than that above, Borowski introduces this name for a sperm whale earlier described as "cachalot á dents pointues" of Brisson (1756). The type locality is Iceland and Greenland, but no specific holotype specimen was designated. No illustrations or measurements accompany the account. The correct date is 1781, as the name was given only in the text volume, and not in the plates volume published in 1780. Borowski's plate 56 (labeled *Physeter microps*) is a copy of Anderson's (1746:224) plate, which depicts a 48-foot (14.6 m) sperm whale stranded in 1738 on the German North Sea coast. This name is a junior synonym of *P. macrocephalus*.

Phiseter [sic] *trumpo* Bonnaterre, 1789

Bonnaterre's descriptive account is based primarily on a specimen stranded in Bayonne, France, and this is considered the type locality. It does not appear that the type specimen was deposited in any museum. The account includes some external measurements and a good illustration of the external appearance (Bonnaterre, 1789: pl. 8), demonstrating clearly that this is indeed a sperm whale. The name is a junior synonym of *P. macrocephalus*.

Phiseter [sic] *cylindricus* Bonnaterre, 1789

No measurements are included in the short description of this species, which is based on the accounts by Anderson (1746). There is, however, a good illustration of the specimen described, clearly a sperm whale (Bonnaterre, 1789: pl. 7). There is no type specimen. The name is a junior synonym of *P. macrocephalus*.

Phiseter [sic] *Mular* Bonnaterre, 1789

In the last of three new species of sperm whale introduced by Bonnaterre (1789), *Phiseter mular* is briefly described, though with no measurements or illustrations of the body or skull. His description is in reference to Anderson (1746). There is an illustration of a tooth from this species in Bonnaterre's plate 8. This illustration and those of the bodies in plates 6–8 clearly show that he understood the genus *Phiseter* (=*Physeter*) to refer to cachalots, or sperm whales. The specific name is adopted from the vernacular name given in Bayer (1733). Bayer's depiction also clearly identifies it as a sperm whale about 10 m

(*5 orygiæ* = 5 fathoms) in length, caught or stranded in the harbor of Villefranche-sur-Mer near Nice, France, (the type locality) in November 1716. This name is now a junior synonym of *P. macrocephalus*.

Physeter maximus G. Cuvier, 1798

Cuvier introduced this name for the "grand cachalot" of Bonnaterre (1789). His very brief account includes no illustrations or measurements. The type concept is one of the 31 sperm whales live-stranded near Audierne, Rivage de Primelin, France. There is apparently a skull (holotype specimen) from this stranding at the La Rochelle Museum (No. M646), collected on 14 March 1784. The condylobasal length was reported as 267 cm (Duguy and van Bree, 1968), which indicates a juvenile. This is a junior synonym of *P. macrocephalus*.

Catodon svineval Lacépède, 1804

Lacépède gave this name to what he considered a "petit cachalot" from the North Atlantic region. The short species account does not include any illustrations or detailed measurements and mainly describes schools stranded in the Orkneys and Norway, the latter of which is the type locality. No particular type specimen appears to have been collected. The description seems to apply to female sperm whales, and so is considered a junior synonym of *P. macrocephalus*. However, this needs to be checked, as this could also refer to pilot whales.

Physeter orthodon Lacépède, 1804

This was a name provided by Lacépède for an arctic species of sperm whale originally described by Anderson (1746) from the German North Sea coast, possibly based on adult males of the species as we now know it. The description mainly covers external morphology and coloration. The type locality is Greenland, though no type specimen was explicitly designated. *P. orthodon* is in the junior synonymy of *P. macrocephalus*.

Physeter urganatus Rafinesque, 1814

Rafinesque's species is introduced with little description but was based on the illustration in Mongitore (1743; fig. 61), which serves as an indication. There is no type specimen. The illustration is rather fanciful, though it clearly shows evidence of being a sperm whale (Woodman et al., 2020). The name is thus considered to be a junior synonym of *P. macrocephalus*.

Physeterus [sic] *sulcatus* Lacépède, 1818

In 1818, a sperm whale from Japan was described under this name by Lacépède. The very brief description appears to have been made in reference to a drawing of a Japanese sperm whale, apparently not published. No type specimen was designated, and the name is considered a junior synonym of *P. macrocephalus*.

Physeter australasianus Desmoulins, 1822

This species name was given by Desmoulins to the "cachalot Bossele" in Quoy and Gaimard (1824: pl. 12). Desmoulins must have seen the plate before it was published, given that his account appeared two years earlier. The name was based on a specimen that was apparently described by Capt. B. Hammat, though there does not appear to be any description of it in the text of Quoy and Gaimard (1824). However, plate 12 of the associated atlas does include an illustration of what can be considered the type specimen (apparently not deposited in any collection), which clearly indicates that it is a sperm whale. Hershkovitz (1966) indicated the Moluccas and New Zealand as the type locality. The name is in the synonymy of *P. macrocephalus*. Alternative spellings are *asiaticus* and *australis*.

Tursio vulgaris Fleming, 1822

This is a replacement name for *Physeter tursio* Linnaeus and is therefore also a synonym of *P. macrocephalus*. There is no description, other than the statement that it has a high dorsal fin.

Physeter polycyphus Quoy & Gaimard, 1824

Although there is no real description of this species, which Quoy and Gaimard called the "physeter boselle," the illustration (a reasonably accurate drawing of the external appearance) in plate 12 of their 1824 atlas clearly shows this to be a sperm whale, making the name synonymous with *P. macrocephalus*. No type specimen is known. Alternative spellings are *polyscyphus*, *polycephus*, and *polycystus*.

D[elphinus] bayeri Risso, 1826

Risso based this new species on a whale specimen stranded at Nice, France, along the Mediterranean coast. The descriptive account contains some details, but there are no illustrations or measurements. It is not known if a holotype specimen was collected and retained. Bayer's plate depicting a 5 fathom (30 ft.; 10 m) male sperm whale stranded at Villa Franca harbor (the type locality) on 10 November 1716 is that on which Risso based his description. This species has been regarded as synonymous with *P. macrocephalus*.

Physeter gibbosus Wiegmann, 1840

This name first appeared in 1840 among plates prepared by Wiegmann for the volume of *Die Saugethiere* on marine mammals, which was authored by Wagner (1847). This set of plates was apparently distributed prior to the publication of the text volume in 1847 (see Jefferson, 2021). Plates 338 and 338b of Wiegmann (1840) and Wagner (1847), respectively, both contain good illustrations of the external appearance of *Physeter gibbosus,* clearly showing the name to apply to the sperm whale. Wagner credits the name correctly to Schreber. Plate 338b is a copy of Robertson (1771) and a plate from Pennant (1769). Both the illustrator (Ihle) and engraver (Bock) indicate that the plate dates from much earlier than 1840 (likely early 1800s). See further under *Delphinus edentulus*. No type is known. The only place the name appeared in the text was in the synonymy of *P. macrocephalus* on page 247 of Wagner (1847), but with no description.

Catodon colneti Gray, 1850

Gray used this name to describe a whale caught off Point Angels, Mexico (16°13′N), which was mentioned by Colnett (1798:78–79). Gray called it the "Mexican sperm whale" but did not describe a type. It was supposedly found in equatorial oceans, the North Pacific, South Seas, and off Japan, but as there was no description of any identifying features, and no illustration of the species provided, we regard this name as a *nomen nudum*.

Catodon australis Wall, 1851

A detailed description of this species, based on an entire skeleton, appears in Wall's monograph. It includes much information about the skeleton, measurements, and an illustration of the entire skeleton, with details of certain parts (Wall, 1851: pl. 1). The type locality is off Port Jackson, Sydney, NSW, Australia, where it was found floating at sea and towed to shore on 5 December 1849. The holotype specimen consists of the skull without dentaries, located at the Australian Museum (AM PA.326; Parnaby et al., 2017), and there is detailed information about the specimen, along with a historical account of the nominal species in Parnaby et al. (2017). This name is a junior synonym of *P. macrocephalus*.

Catodon (Meganeuron) krefftii Gray, 1865

This species of sperm whale (Gray, 1865b) is based on supposedly unique features of several of the vertebrae of a holotype specimen from New South Wales, Australia, in the Australian Museum (atlas and fused vertebrae; No. PA.339, by subsequent determination; Parnaby et al., 2017). Krefft sent photos of the vertebrae to Gray, who used them in describing this species. While the account contains several illustrations of the vertebrae along with descriptive details, there is no reason to believe that there is anything of a species-level distinctness to them. Therefore, the name is widely regarded as synonymous with *P. macrocephalus*. See historical account in Parnaby et al. (2017).

[Physeter] pterodon Trouessart, 1898

Trouessart lists this species name in the synonymy of [*Physeter*] *macrocephalus*. He credits the name to Lesson (p. 167) but does not provide a specific reference (giving only "Descr. Mam."). No information is given about the species, no illustration is provided, and no type appears to have been collected. Unless otherwise allocated, we suggest that this name be considered a *nomen nudum*.

Pygmy sperm whale *Kogia breviceps*

Physeter breviceps Blainville, 1838

The brief description of this species really describes only the skull, based on a holotype specimen collected by E. Verreaux and his associates, obtained from near the Cape of Good Hope, South Africa. The account includes a single plate with several good illustrations showing different views of the skull. The type specimen is still in the MNHN (MNHN-ZM-MO-1927-3 – Robineau, 1989; C. Callou, pers. comm., 20 Sep 2021). This is the senior synonym and valid name of the pygmy sperm whale, *Kogia breviceps*. An alternate spelling is *brevirostris*.

Euphysetes grayii Wall, 1851

Wall provided a very detailed description of what he considered a new species of small whale. It was described from a specimen washed up at Maroubra Beach, New South Wales, Australia (Figure 24). When the carcass was recovered some time later, it

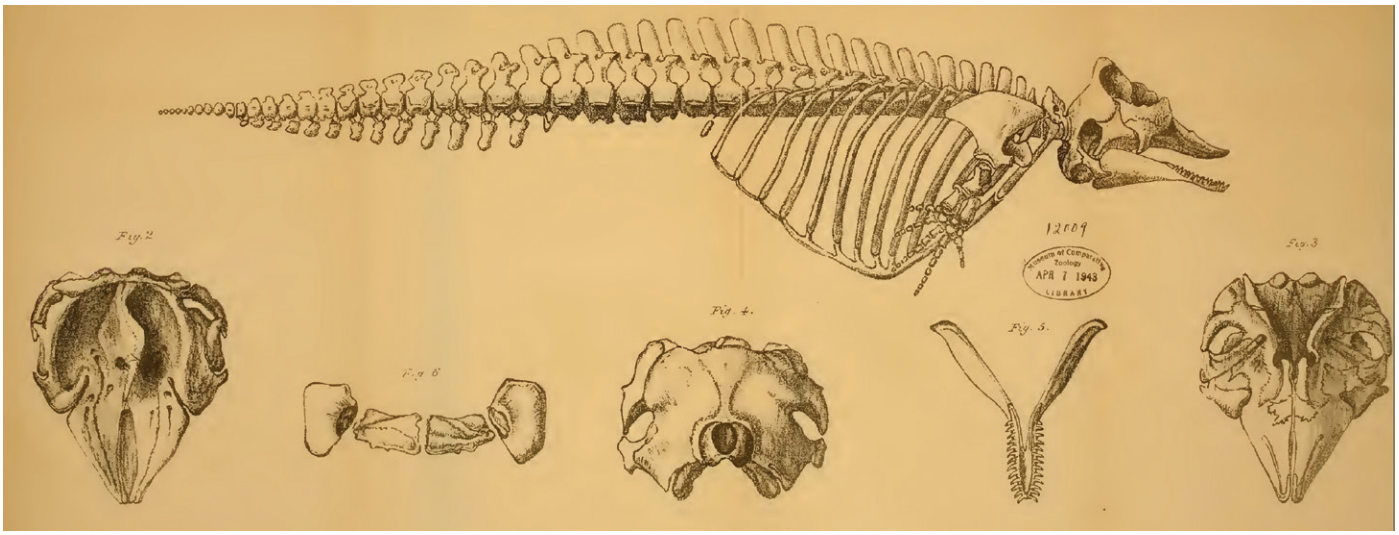


FIGURE 24. Type of *Euphysetes grayii* Wall, 1851, the skull and skeleton of which are currently located in the Australian Museum.

was quite damaged. Nonetheless, the skull and skeleton (holotype) were collected for the Australian Museum, Sydney (AM PA.368; Parnaby et al., 2017). In addition to a description of external appearance and very detailed accounts of the skull and postcranial skeleton (along with measurements), Wall's (1851) plate 2 provides good illustrations of the skull and articulated skeleton. Only the incomplete skull remains at the AM (S. Ingelby, pers. comm., 13 July 2021). The name is considered to be a junior synonym of *Kogia breviceps*. Alternative spellings are *grayi* and *greyi*.

Euphysetes macleayi Krefft, 1866

A male pygmy sperm whale stranded at Manly Beach, NSW, Australia, and was obtained by Krefft on 13 August 1865; it was the basis for this new species description (Figure 25). The description is fairly detailed and contains good illustrations of the external appearance, skull, and some aspects of the skeleton, plus a few measurements. The type specimen (skeleton and stuffed skin) was reported to be in the AM (No. PA.366 is suspected to be the type skeleton, though this could not be confirmed by

FIGURE 25. Type of *Euphysetes macleayi* Krefft, 1866: illustration in type description (top), and photo of specimen on the beach (bottom; from J. E. Gray's records at the NHMUK Library Archives). A stuffed skin and skeleton in the Australian Museum is suspected to be the type specimen, but this cannot be confirmed with the available information.

Parnaby et al., 2017, who gave a detailed historical account of the presumed type). This name is in the synonymy of *Kogia breviceps*.

Kogia floweri Gill, 1871

Gill's very short account of this proposed new species of *Kogia* is based on a painting of the external appearance, and a partial lower jaw with teeth. The type specimen was reportedly 9 feet (274 cm) in length, and was obtained from near Mazatlán, Mexico (method of capture unknown). The description does not contain much information other than a short summary of the external form and color and a description of the lower jaw and teeth. There is an illustration of the holotype in fig. 172 of the paper. The holotype (mandible only) is in the USNM (No. 8016; Fisher and Ludwig, 2016), and the name is a synonym of *Kogia breviceps*.

Euphysetes pottsii Haast, 1874

On 17 August 1873 a small whale (7 ft., 2 in.; 218 cm) was stranded at Governors Bay, New Zealand. The female specimen was collected and sent to the Canterbury Museum, forming the holotype specimen for this species (Figure 26). It has been transferred to the Museum of New Zealand Te Papa Tongarewa, where it still resides (complete skeleton, NMNZ MM001389; F. Marx, pers. comm., 22 Jul 2021). The descriptive account is quite detailed, with information on both the external appearance and osteology. There is an accurate illustration of the articulated skeleton, and several sets of measurements are provided. This is considered a junior synonym of *Kogia breviceps*.

Kogia goodei True, 1884

True (1884:630) mentioned this species name in a table of his catalog, and again briefly in his annotated list appended to the paper. He explained that the species was known only from two specimens from the east coast of the United States and said that one was preserved as a photograph and lower jaw. However, he did not provide any description or illustration of the species, nor any indication to one, thereby relegating this name as a *nomen nudum*.

Kogia goodei Goode, 1884

Later in the same year as True's account above, Goode made this name available (though crediting the species to True). Goode provided a reasonably accurate illustration of a whole body cast of the type specimen (preserved as USNM 13738) in his (1884) plate 2, though he did not provide any verbal description of the species in the text of his account. The actual type specimen consists of the skull, skeleton, body cast, and some preserved soft tissue of an adult female (skull and skeleton: USNM A20909; Figure 27), which is apparently the same specimen that True (1884) mentioned above (Fisher and Ludwig, 2016). The specimen (a 271 cm female) was stranded at Spring Lake, New Jersey, on 17 April 1883. The name is a junior synonym of *Kogia breviceps*.

Dwarf sperm whale *Kogia sima*

Physeter (Euphysetes) simus Owen, 1865

In June 1865, in the Zoological Society of London's proceedings, Thomas Huxley reported that Richard Owen read a paper before the society that contained the name of his forthcoming *Physeter (Euphysetes) simus* type description (see below). The short account contains no details or illustrations, but simply mentions that Owen would publish a full paper with a description of this species at a later date. The name *Physeter (Euphysetes) simus* at this point would therefore be considered a *nomen nudum*.

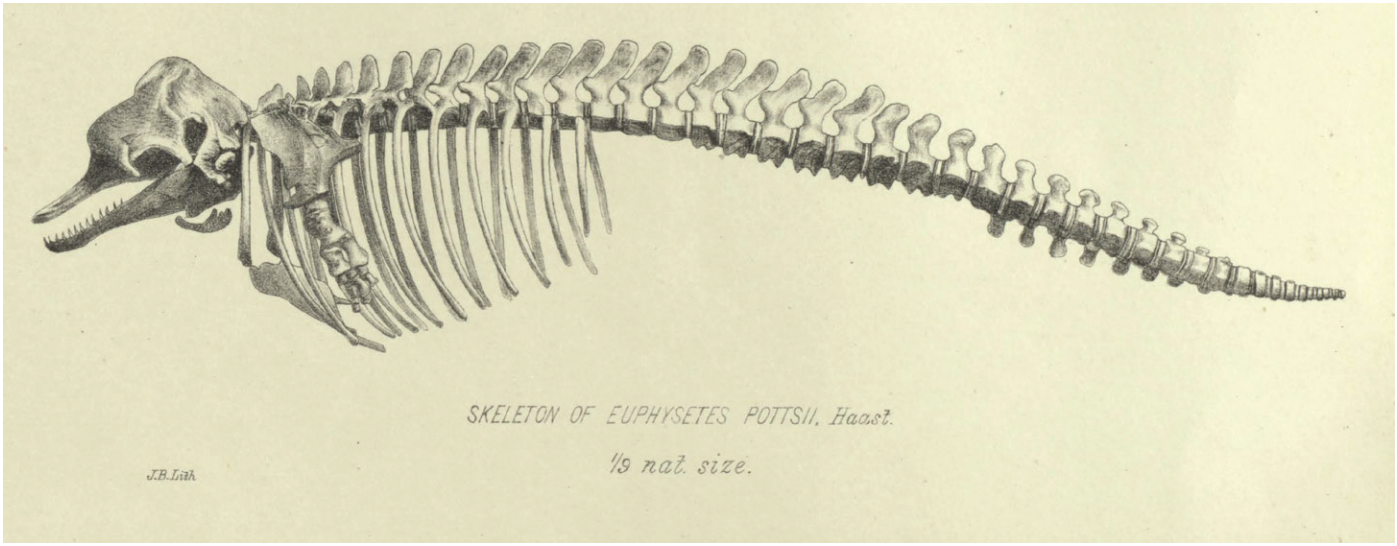


FIGURE 26. Type of *Euphysetes pottsii* Haast, 1874, currently held by the Museum of New Zealand Te Papa Tongarewa.

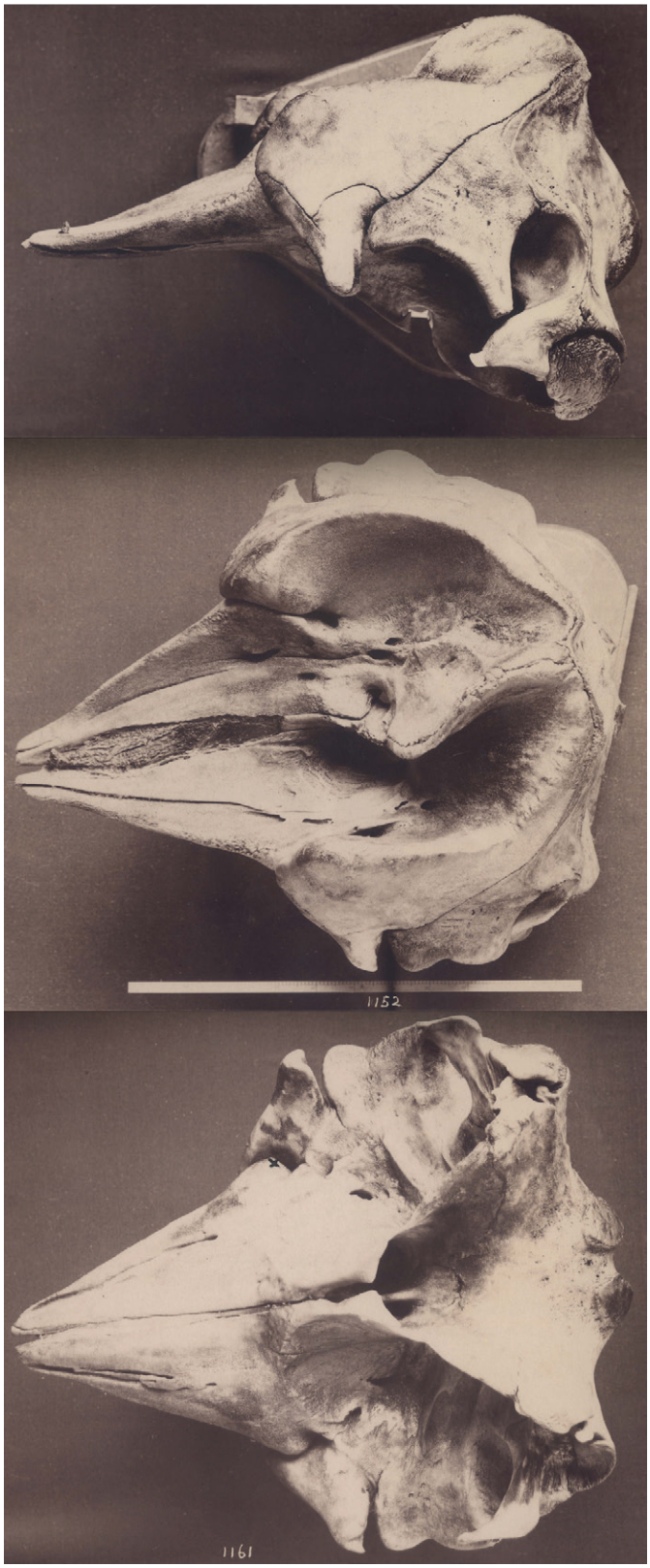


FIGURE 27. The holotype of *Kogia Goodei* (USNM A20909).

Physeter (Euphysetes) simus Owen, 1866

The published description of this new species of small whale by Owen is quite thorough, with extensive details on the external morphology, coloration, skull, and skeleton. Included are some measurements and plates with good illustrations of the external appearance and osteology (Owen, 1866: pls. 10–14). There were supposedly two type specimens collected, a male measuring 2.0 m (coll. in February 1853) and a female of 1.8 m (coll. in March 1853) (Figure 28), both from near Waltair, India, by Walter Elliot. However, Owen (1867) later clarified that a mistake was made and there was actually only the single female specimen. The skull of this holotype specimen is confirmed be to still present in the NHMUK (No. 1866.2.5.6, 1474a; Figure 29). The condylobasal length is 259 mm (Jefferson, unpublished data). This is the senior synonym and valid name of the dwarf sperm whale, *Kogia sima*. An alternate spelling is *sima* (emended in order to agree with new genus name, *Kogia*).

Unknown species (*nomina dubia*)

[*Delphinus*] *coronatus* Freminville, 1812

This "dauphin" (dolphin) was described by Freminville, apparently from observations in the North Atlantic. No type specimen was collected. Jefferson (2021) listed this species as a *nomen dubium* in his review of dolphin and small whale nomenclature, but indicated it seemed to have more in common with beaked whales. We believe that this species likely refers to the northern bottlenose whale (*Hyperoodon ampullatus*). Most of the characters stated by Freminville fit that species: common in icy seas from 74–80°N; 10–12 m in length; small head; convex forehead; short, strong beak; dorsal fin close to tail; blow < 2 m tall. Even the mention of concentric circles on the forehead could refer to the lighter color and/or the flattened forehead of *Hyperoodon* bulls. The statement that it has 48–50 small teeth is puzzling, but northern bottlenose whales often have several dozen small vestigial teeth buried in the gums of both jaws. It is possible that one or more of these whales were examined and dissected. (Though this is not mentioned in the paper, Freminville likely had such opportunities, as vessels that he served on attacked English whalers—see Arvy, 1972.) Despite indications that this may very well be a junior synonym of *Hyperoodon ampullatus*, with no type specimen to confirm this, we keep it as a *nomen dubium* within the Ziphiidae for now.

Epiodon urganatus Rafinesque, 1814

The very short descriptive account of this species lacks details needed to identify it. It was based on a sighting at sea near Sicily in the Mediterranean, so there is no type specimen. Hershkovitz (1966) says that it is not a *Ziphius,* nor a *Hyperoodon*. It has traditionally been considered a beaked whale (Woodman et al., 2020), but the described characteristics (no dorsal fin, teeth only in the upper jaw, and upper jaw extending beyond the lower) leave this in serious doubt. Although likely an odontocete, the name is best considered a *nomen dubium*. In fact, Mead

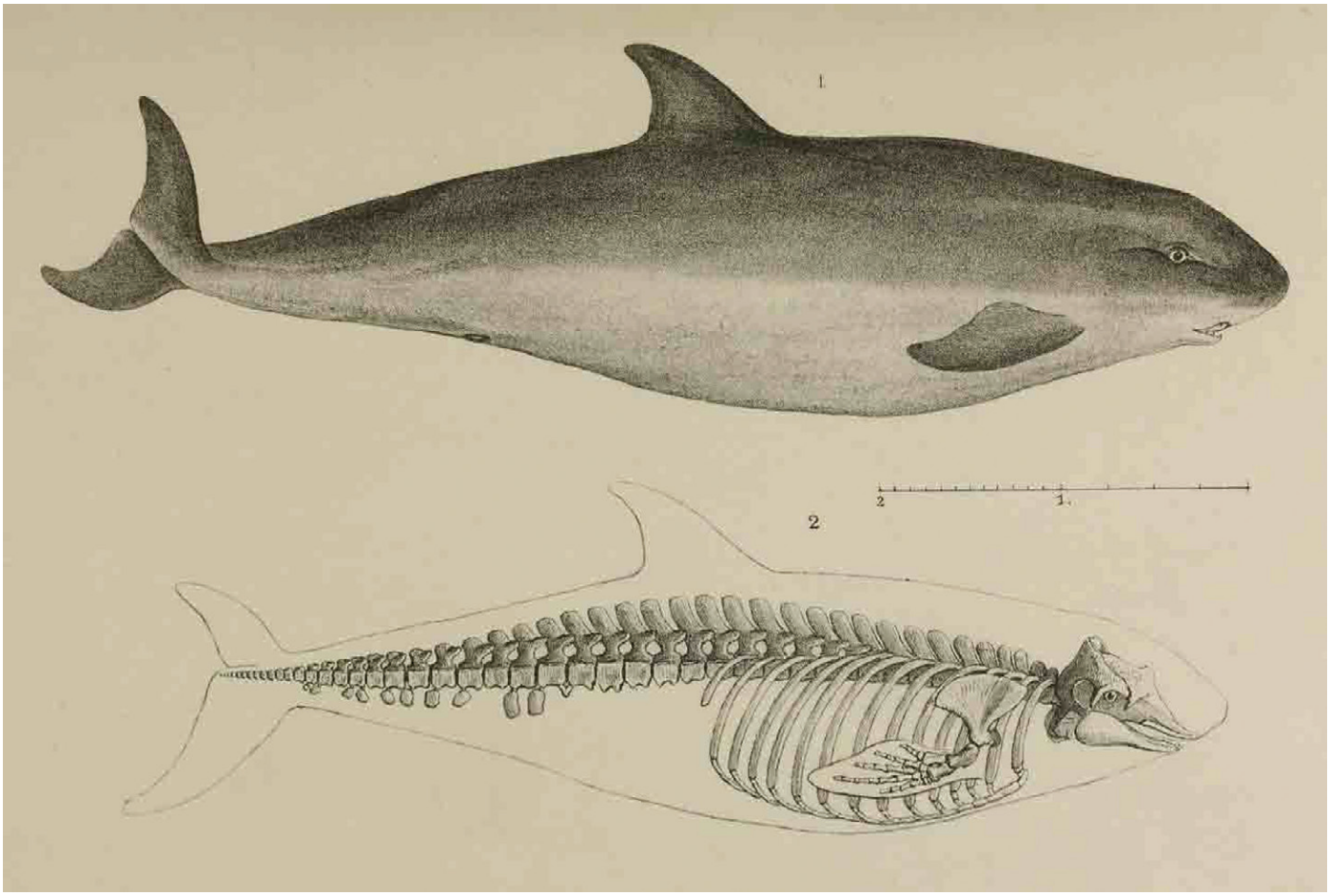


FIGURE 28. External appearance and skeleton of the holotype specimen for *Physeter (Euphysetes) simus* Owen, 1866.

(1989a) pointed out that this species (and genus) may be based on either an anomalous or imaginary specimen.

Oxypterus mongitori Rafinesque, 1814

This is another species from the Mediterranean Sea that cannot be identified, as no specimen was collected. It was described as having two dorsal fins, though little other information was provided. This name was proposed by Rafinesque for a species originally described and figured by Mongitori (1743), which serves as the indication. Besides the double dorsal fin, Mongitori's illustration (reproduced in Woodman et al., 2020) shows an animal with characteristics of both cetaceans and fish. The name should therefore be considered a *nomen dubium*, and it cannot even be certain that this was a cetacean.

CONCLUSIONS

Above we review all 114 nominal species of large odontocetes in the families Ziphiidae, Physeteridae, and Kogiidae. Of these, 27 species are currently considered valid, and most names (71) are junior synonyms. However, 6 are *nomina dubia*, and 10 are *nomina nuda*. The confusion over nomenclature in this group is not nearly so problematic as it is for the small odontocetes (see Jefferson, 2021), with fewer cases of unknown species identity (i.e., only 6 *nomina dubia*). In the case of the beaked whales, the biggest issue over the next several decades may relate to situations in which current species are split and new species or subspecies are described, as our knowledge of these mysterious creatures accumulates. We hope that the current review will be helpful in these endeavors.

FIGURE 29. The holotype of *Physeter simus* (NHMUK 1866.2.5.6). From the collections of the Natural History Museum, London.

Acknowledgments

The authors thank those museum curators and collection managers who assisted us in our examination of, and provided information on, type specimens in their care: M. Carnall (Oxford University Natural History Museum), C. Callou (MNHN), S. Farina (Natural History Museum, University of Pisa), M. Frénéa, (Musée d'Initiation à la nature, Caen, France), N. Gilmore (ANSP), S. Ingleby (AM), D. Janiger (LACM), H. Janetzki (QM), P. Kamminga (RMHN), O. Lambert (IRSNB), N. Duncan (AMNH), F. Marx (NMNZ), M. McGowen (USNM), R. Sabin (NHMUK), P. Scofield (Canterbury Museum, New Zealand), E. Smets (RMNH), P. Teta (MACN-Ma), and T. Yamada (NSMT). We also appreciate the kind assistance of R. L. Brownell Jr., S. Kromann, and D. Losey in finding hard-to-locate references. We thank the journal editors, and two anonymous reviewers for their suggestions on improving the manuscript.

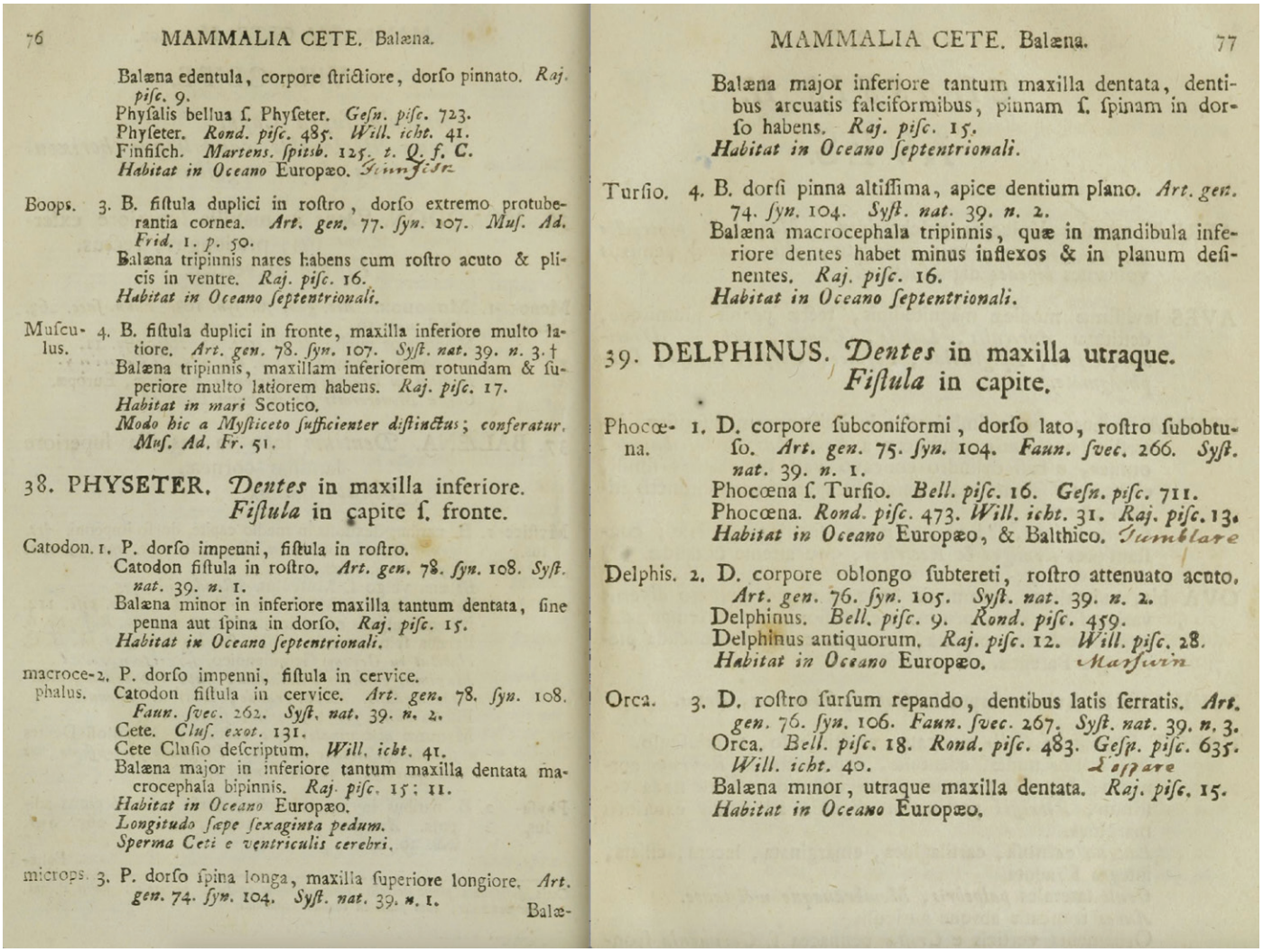
Appendix A: The Controversial Case of the Valid Name of the Sperm Whale

ABSTRACT. Since its description by Linnaeus in 1758, the sperm whale has gone by two different scientific names, *Physeter macrocephalus* and *P. catodon*, both attributed to Linnaeus (1758). Proponents of each name have stated their respective cases and each name has enjoyed periods of predominant use. Although most authors currently accept *Physeter macrocephalus* as the correct name for the sperm whale, the matter has still not been settled and there are dissenting opinions. We have thoroughly reviewed the case and consulted the International Commission on Zoological Nomenclature, and we find that *P. macrocephalus* is the valid name of the sperm whale.

In his tenth edition of *Systema Naturae* (which was the starting point of our current system of taxonomic nomenclature), Linnaeus (1758) described four species of whales, under the genus *Physeter*: *catodon, macrocephalus, microps*, and *tursio*. Although there were no illustrations and the diagnoses were quite brief (Figure A1), most biologists have interpreted these as Linnaeus's intention to describe multiple species of sperm whales, a notion not uncommon in the latter eighteenth and early nineteenth centuries (e.g., Artedi, 1738; Bonnaterre, 1789; Borowski, 1781; Lacépède, 1804). Ever since Cuvier (1823) proposed that there is but a single species of sperm whale, most cetologists have accepted that idea, and the choice of which of Linnaeus's four names should be used for the species has become a serious point of contention and controversy. As it turns out, Linnaeus's wording in his diagnoses ("*fistula in rostro*" for *P. catodon* and "*fistula in cervice*" for *P. macrocephalus*) would cause confusion and controversy that would last for more than 250 years.

Linnaeus based his *Physeter* species on earlier descriptions that originated from Sibbald (1692); those descriptions, despite their inadequacies, had been repeated by later authors, many of whom had no actual experience with sperm whales. Linnaeus was a botanist (Blunt, 1971), and it is doubtful whether he ever saw a sperm whale, living or dead, or even any part of a sperm whale. He cited several references to document his new species, and the descriptions and illustrations in those references are recognized by the International Code of Zoological Nomenclature (hereafter referred to as "the Code") as indications (similar to "proxies") for type specimens, which were not officially used in taxonomy until the mid-1800s.

While the other two names have traditionally been considered "junior" synonyms by later authors, the names *macrocephalus* and *catodon* have each been proposed as the correct name of the sperm whale, both enjoying periods of widespread acceptance. Throughout most of the nineteenth and early twentieth centuries, *macrocephalus* was nearly universally accepted as the sperm whale's valid name. It was not until Thomas (1911) opined that *catodon* should be the correct name that the tide shifted. Thomas (1911) considered all four



76 MAMMALIA CETE. Balæna.

Balæna edentula, corpore ſtrictiore, dorſo pinnato. *Raj. piſc.* 9.
Phyſalis bellua ſ. Phyſeter. *Geſn. piſc.* 723.
Phyſeter. *Rond. piſc.* 485. *Will. icht.* 41.
Finfiſch. *Martens. ſpitsb.* 125. *t. Q. f. C.*
Habitat in Oceano Europæo.

Boops. 3. B. fiſtula duplici in roſtro, dorſo extremo protuberantia cornea. *Art. gen.* 77. *ſyn.* 107. *Muſ. Ad. Frid.* 1. *p.* 50.
Balæna tripinnis nares habens cum roſtro acuto & plicis in ventre. *Raj. piſc.* 16.
Habitat in Oceano ſeptentrionali.

Muſculus. 4. B. fiſtula duplici in fronte, maxilla inferiore multo latiore. *Art. gen.* 78. *ſyn.* 107. *Syſt. nat.* 39. *n.* 3. †
Balæna tripinnis, maxillam inferiorem rotundam & ſuperiore multo latiorem habens. *Raj. piſc.* 17.
Habitat in mari Scotico.
Modo hic a Myſticeto ſufficienter diſtinctus; conferatur. Muſ. Ad. Fr. 51.

38. PHYSETER. *Dentes* in maxilla inferiore. *Fiſtula* in capite ſ. fronte.

Catodon. 1. P. dorſo impenni, fiſtula in roſtro.
Catodon fiſtula in roſtro. *Art. gen.* 78. *ſyn.* 108. *Syſt. nat.* 39. *n.* 1.
Balæna minor in inferiore maxilla tantum dentata, ſine penna aut ſpina in dorſo. *Raj. piſc.* 15.
Habitat in Oceano ſeptentrionali.

macrocephalus. 2. P. dorſo impenni, fiſtula in cervice.
Catodon fiſtula in cervice. *Art. gen.* 78. *ſyn.* 108. *Faun. ſvec.* 262. *Syſt. nat.* 39. *n.* 2.
Cete. *Cluſ. exot.* 131.
Cete Cluſio deſcriptum. *Will. icht.* 41.
Balæna major in inferiore tantum maxilla dentata macrocephala bipinnis. *Raj. piſc.* 15; 11.
Habitat in Oceano Europæo.
Longitudo ſæpe ſexaginta pedum.
Sperma Ceti e ventriculis cerebri.

microps. 3. P. dorſo ſpina longa, maxilla ſuperiore longiore. *Art. gen.* 74. *ſyn.* 104. *Syſt. nat.* 39. *n.* 1.
Balæ-

MAMMALIA CETE. Balæna. 77

Balæna major inferiore tantum maxilla dentata, dentibus arcuatis falciformibus, pinnam ſ. ſpinam in dorſo habens. *Raj. piſc.* 15.
Habitat in Oceano ſeptentrionali.

Turſio. 4. B. dorſi pinna altiſſima, apice dentium plano. *Art. gen.* 74. *ſyn.* 104. *Syſt. nat.* 39. *n.* 2.
Balæna macrocephala tripinnis, quæ in mandibula inferiore dentes habet minus inflexos & in planum deſinentes. *Raj. piſc.* 16.
Habitat in Oceano ſeptentrionali.

39. DELPHINUS. *Dentes* in maxilla utraque. *Fiſtula* in capite.

Phocæna. 1. D. corpore ſubconiformi, dorſo lato, roſtro ſubobtuſo. *Art. gen.* 75. *ſyn.* 104. *Faun. ſvec.* 266. *Syſt. nat.* 39. *n.* 1.
Phocæna ſ. Turſio. *Bell. piſc.* 16. *Geſn. piſc.* 711.
Phocæna. *Rond. piſc.* 473. *Will. icht.* 31. *Raj. piſc.* 13.
Habitat in Oceano Europæo, & Balthico.

Delphis. 2. D. corpore oblongo ſubtereti, roſtro attenuato acuto. *Art. gen.* 76. *ſyn.* 105. *Syſt. nat.* 39. *n.* 2.
Delphinus. *Bell. piſc.* 9. *Rond. piſc.* 459.
Delphinus antiquorum. *Raj. piſc.* 12. *Will. piſc.* 28.
Habitat in Oceano Europæo.

Orca. 3. D. roſtro ſurſum repando, dentibus latis ſerratis. *Art. gen.* 76. *ſyn.* 106. *Faun. ſvec.* 267. *Syſt. nat.* 39. *n.* 3.
Orca. *Bell. piſc.* 18. *Rond. piſc.* 483. *Geſn. piſc.* 635. *Will. icht.* 40.
Balæna minor, utraque maxilla dentata. *Raj. piſc.* 15.
Habitat in Oceano Europæo.

FIGURE A1. The original (Latin) descriptions and diagnoses of Linnaeus's (1758) four species of sperm whales, genus *Physeter*: *catodon*, *macrocephalus*, *microps*, and *tursio*.

of Linnaeus's *Physeter* species to be sperm whales, but he chose to give priority to *catodon* (apparently using "line priority," a concept that is not accepted in the current version of the Code). The first detailed historical overview and examination of the controversy was by Boschma (1938), who concluded that while the specific identity of *catodon* was in question (possibly being based on composite material from pilot [*Globicephala* spp.] or beluga [*Delphinapterus leucas*] whales, in addition to sperm whales [Husson and Holthuis, 1974]), *macrocephalus* was certainly a sperm whale and therefore should be accepted as the valid name. Boschma (1938) also pointed out that Linnaeus and many other authors later than Sibbald (1692), such as Ray, (1713), had simply copied Sibbald's diagnoses into their classifications, often verbatim.

In his exhaustive review of cetacean nomenclature, Hershkovitz (1966) added fuel to the fire by concluding that *catodon* was the sperm whale's correct name. He based this on the wording related to dorsal fin and blowhole placement in Linnaeus's diagnoses for *macrocephalus* and *catodon*. He considered the references cited by Linnaeus as largely irrelevant, and to determine priority, he resorted to the Principle of the First Reviser. In his viewing of Thomas (1911) as the first reviser, Hershkovitz gave priority to *catodon*. It would be interesting to know if he would have ruled differently had he known of earlier references that give *macrocephalus* precedence (see below).

In his extensive monograph on the biology of the sperm whale, Berzin (1972) also provided a detailed historical account of the taxonomic issues associated with the sperm whale, and sided with Boschma (1938), noting that *macrocephalus* was the name most widely used in the late nineteenth and early twentieth centuries. This was until Thomas (1911) proposed that *catodon*

was in fact the correct name. Berzin (1972) felt that Thomas (1911) made an error in identification of the mass stranding of 105 individuals from the Orkney Islands that *catodon* was based on. He believed that the identities of the animals in the mass stranding were actually pilot whales. This purported error prompted Thomas to cite "line priority," thus giving *catodon* priority over *macrocephalus*, since it appears higher on the page. Berzin flatly rejected this argument, noting that the blowhole placement statements of Linnaeus should not be taken too literally, as the translations of the terms he used were not specific enough to indicate the exact location of the blowhole.

However, controversy continued. Husson and Holthuis (1974) attempted to resolve the confusion once and for all, providing a very detailed historical review and explaining that the Code dictates that the specimens represented in the "indications" on which Linnaeus based his species *macrocephalus* and *catodon* should be considered type series, and therefore that each specimen within the respective series is a syntype. They further designated a lectotype for *macrocephalus* (the relevant specimen is no longer in existence, but there is a detailed drawing available—see Figure A2) and a neotype for *catodon* (a specimen in the Naturalis Biodiversity Center in Leiden, Netherlands; RMNH 5828).

FIGURE A2. Lectotype of *Physeter macrocephalus*, a whale stranded in Berkey, Netherlands, on 3 February 1598 (Clusius, 1605). The actual specimen is not present in any collection, but there are drawings of it (including this one) at the Teyler's Museum at Haarlem, Netherlands. Photo by Uko Gorter.

These acts removed any uncertainty and made it clear that both names should be synonyms of the sperm whale. Since line priority is not recognized in the Code,[1] this meant that the "priority" issue needed to be resolved by resorting to the Principle of the First Reviser (as earlier suggested by Hershkovitz, 1966). The question of who should be considered the first reviser introduced another element of controversy, but the leading candidates appear to favor *macrocephalus*. Husson and Holthuis (1974) concluded from their review that a strict reading of the relevant rules of the Code required that *macrocephalus* be considered the valid name of the sperm whale, with *catodon* being relegated to synonymy.

In 1986 marine mammal biologist William E. Schevill waded into the controversy, promoting *catodon*. Schevill argued that there is no need to invoke the Principle of the First Reviser, as in his view the diagnoses provided by Linnaeus (1758) suggest that only *catodon* aligns with the sperm whale, and the other three *Physeter* species were intended for other species. This was a rather radical idea, as most earlier cetologists assumed that all Linnaeus's *Physeter* species described some form of sperm whale. Schevill argued that Linnaeus's statement about blowhole placement ("*fistula in . . .*") meant that *catodon* alone was meant for the sperm whale, and that the references cited by Linnaeus were not adequate to alter the wording of the diagnosis. Schevill also felt that types must always be actual specimens and rejected the type series and syntype designations of Husson and Holthuis (1974). Since Schevill's reading of Linnaeus (1758) led him to believe that only *catodon* was meant for the sperm whale, to him, this was clearly the valid name of the species.

In a final volley in the battle, Holthuis (1987) refined the argument for *macrocephalus*, and a response by Schevill (1987) countered it, pleading the case for *catodon*. Holthuis evaluated Schevill's (1986) argument, but pointed out that Linnaeus likely never saw a sperm whale and that his diagnoses were based on those of Sibbald (1692) and Artedi (1738). From the latter reference, Linnaeus appears to have copied the words "*fistula in rostro*" and "*fistula in cervice*" verbatim in his diagnoses. Although Sibbald's sperm whale description shows most of the general features we now know to be associated with the species (i.e., length about 40 "pedum" [feet], small dorsal fin placed far back on the body, lower jaw shorter than upper, and teeth in the lower jaw only), the blowhole is placed too far back (Figure A3), and this illustration error is suggested to have led to the confusion.[2] Holthuis stated that Schevill's argument about the invalidity of the syntypes and lectotype were not supported by the Code. He also proposed a new "first reviser" (De Sélys-Longchamps, 1839), which again supported *macrocephalus* as the valid name, and listed *catodon* only as a synonym. Schevill's response essentially repeats his earlier arguments and attempts to refute Holthuis's claims one by one.

Schevill's (1986, 1987) insistence that the statement "*fistula in cervice*" be taken to exclude the identity of Linnaeus's *P. macrocephalus* as a sperm whale is not supported by an examination of the totality of the evidence.[3] Early impressions of the sperm whale from the 1700s through early 1900s often did not represent the blowhole at the front of the head. In Boschma's (1938) compilation of such early illustrations, equal numbers (seven each) show the blowhole at the front and at the middle part of head (between the front and the level of the eye). One even shows it at the level of the eye. This seems to have been a sperm whale trait not widely recognized until the twentieth century. The other characteristics that Linnaeus listed for *macrocephalus* clearly exclude other species and point to a sperm whale: large whale with teeth only in lower jaw, 60 feet in length, spermaceti in the head. Finally, virtually all specimens indicated in the references that Linnaeus cited for this species are considered to be sperm whales (Husson and Holthuis, 1974). The weight of the evidence provides little doubt about *macrocephalus* being a sperm whale.

Although Schevill (1987), in some sense, had the "last say" on the subject, the argument for the validity of *macrocephalus* seems to have won out. Rice (1989, 1998) used *macrocephalus* as the valid name of the sperm whale, essentially accepting the arguments of Boschma (1938), Husson and Holthuis (1974) and Holthuis (1987). Most (though not all) important cetacean works published since then have followed this precedent (see Mead and Brownell, 1993, 2006, for an alternative view). The Taxonomy Committee of the Society for Marine Mammalogy (the body considered by most marine mammalogists to produce the "official" taxonomic scheme for marine mammals) uses *P. macrocephalus* as the valid name of the sperm whale, though its website does not provide an explanation of why this name was chosen.[4] The International Union for the Conservation of Nature's Red List also uses *macrocephalus* (Taylor et al., 2019).

Relevant parts of the current version of the Code (ICZN, 1999) are as follows:

> **Article 12. Names published before 1931.**
> 12.1. Requirements. To be available, every new name published before 1931 must satisfy the provisions of Article 11 and must be accompanied by a description or a definition of the taxon that it denotes, or by an indication.
> 12.2. Indications. For the purposes of this Article the word "indication" denotes only the following:
> 12.2.1. A bibliographic reference to a previously published description or definition even if the description or definition is contained in a work published before 1758, or that is not consistently binominal, or that has been suppressed by the Commission (unless the Commission has ruled that the work is to be treated as not having been published [Art. 8.7]) [. . .]
>
> **Article 23. Principle of Priority.**
> 23.1. Statement of the Principle of Priority. The valid name of a taxon is the oldest available name applied to it, unless that name has been invalidated or another name is given precedence by any provision of the Code or by any ruling of the Commission. For this reason

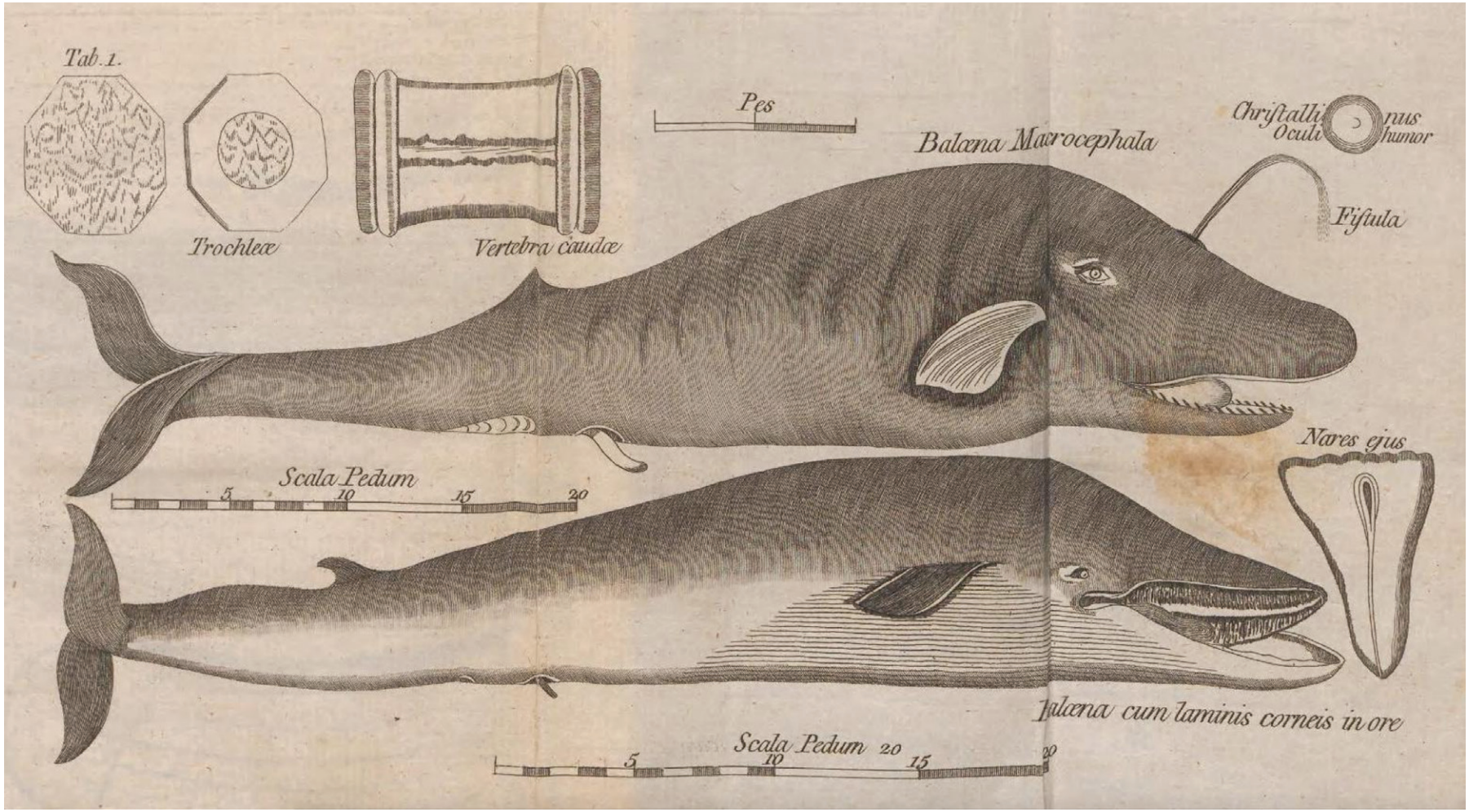


FIGURE A3. Sibbald's (1773) plate 1, the upper figure of which shows an animal obviously intended to be a sperm whale, but with the blowhole located too far back on the head. An earlier version of this plate from Sibbald (1692) appears to have been the source for much of the controversy surrounding whether *P. macrocephalus* or *P. catodon* is the correct scientific name of the sperm whale.

in mehrere Arten ſich ſondert, iſt gleichwohl vor der Hand zu behaupten, daß man wenigſtens bis jetzt keine ſtichhaltigen Gründe für eine ſolche Annahme beigebracht hat.

Nächſt dem eigentlichen Wallfiſche gewährt der Pottwall unter allen Waſſerthieren den größten Nutzen, und er macht daher gleich jenem den Gegenſtand eines ausgedehnten Fangbetriebes aus. Mit Ausnahme der höchſten Breitengrade iſt er in allen Meeren verbreitet, doch am häufigſten in denen der ſüdlichen Halbkugel.

1. Ph. macrocephalus Linn. Der Pottfiſch.

Tab. CCCXXXVII—CCCXXXIX.

Ph. supra ex schisticolore nigricans, subtus albus.

Physeter macrocephalus. Linn. XII. p. 107. — Erxl. syst. p. 612. — Blumenb. Abbild. tab. 84. — Schreb. tab. 337 A. (holl. Kopie) tab. 337 (fig. Bonn.). — Fabr. faun. groenl. p. 41. — Bonnat. cét. p. 12 tab. 6 fig. 1, tab. 7 fig. 2. — Pall. zoogr. I. p. 287. — Cuv. règn. anim. I. p. 294; rech. V. 1. p. 334 tab. 24 (Knochengerüſte). — Desmar. mamm. p. 524. — Desmoul. dict. class. II. p. 617. — Less. compl. de Buff. I. p. 302. — Fr. Cuv. cét. p. 286. tab. 19 fig. 1 (Thier) 2—5 (Schädel). — Brandt u. Ratzeb. med. Zool. I. S. 91. tab. 12 fig. 1 (nach Bonn.), fig. 2 (nach Jonſt.), tab. 13 (Schädel). — Rapp Cet. S. 49. — Jard. nat. libr. mamm. VI. p. 154 tab. 8—10. — Bell brit. quadrup. p. 506. — De Kay nat. hist. of New York mamm. p. 128 tab. 31 fig. 2. — Schleg. Abh. I. S. 34. — D. Bennett, narrat. of a Whal. voy. II. p. 153. — Keyſ. u. Blaſ. europäiſche Wirbelth. S. XXIV u. 74.

Catodon macrocephalus. Lacep. cét. p. 165 tab. 10 fig. 1. — Tileſ. Iſis 1835. S. 735.

Balaena macrocephala. Sibb. phalainolog. nov. p. 30.

Physeter trumpo. Bonnat. cét. p. 14 tab. 8 fig. 1 (Robertſ.). — Desmar. mamm. p. 524. — Desmoul. dict. class. II. p. 618. — Brandt u. Ratzeb. med. Zool. I. S. 94 tab. 14 fig. 2 (nach Robertſ.).

Catodon trumpo. lacep. cét. p. 210. tab. 10 fig. 2 (nach Robertſ.).

Catodon svineval. Lacép. cét. p. 216.

? Physeter catodon. Linn. XII. 1. p. 107. — Erxl. syst. p. 611. — Fabr. faun. groenl. p. 44. — Bonnat. cét. p. 14. — Desmar. mamm. p. 525. — Desmoul. dict. class. II. p. 618. — Brandt u. Ratzeb. med. Zool. I. S. 95.

Physeter gibbosus. Schreb. tab. 338. (fig. Penn.) u. 338 B. (fig. Roberts.)

Physeter polycyphus. Quoy et Gaim. voy. de l'Uranie. zool. p. 77 tab. 12. — Brandt u. Ratzeb. med. Zool. I. S. 99 tab. 14 fig. 1 (nach Quoy).

Physeter australasianus. Desmoul. dict. class. II. p. 618.

Physeter cylindricus. Bonnat. cét. p. 16 tab. 7 fig. 1. — Desmar. mamm. p. 525. — Brandt u. Ratzeb. S. 95 tab. 12 fig. 3 (fig. Anders.).

Physalus cylindricus. Lacép. cét. p. 219. tab. 9. fig. 1. (nach Anderſ.).

Physeter tursio. Linn. XII. 1. p. 107. — Erxl. syst. p. 615. — Brandt u. Ratzeb. S. 96. — Bell. brit. quadr. p. 512.

Physeter mular. Bonnat. cét. p. 17. — Lacép. cét. p. 239. — Desmar. mamm. p. 526.

? Physeter microps. Linn. XII. 1. p. 107. — Erxl. syst. p. 614. — Bonnat. cét. p. 16. — Fabr. faun. groenl. p. 44. — Schreb. tab. 339 (fig. Sibb.). — Lacép. cét. p. 227. — Desmar. mamm. p. 525. — Brandt u. Ratzeb. S. 96.

? Physeter orthodon. Lacép. cét. p. 236. — Dermar. mamm. p. 526. — Brandt u. Ratzeb. S. 98.

Blunt-headed Cachalot. Roberts. philos. trans. LX. p. 321 tab. 9 (Original-Fig.). — Penn. brit. zool. p. 61 tab. 6. n. 21 (fig. Rob.). — Shaw gen. zool. II. 2. p. 497 tab. 228 (fig. Penn.).

Sperma Ceti Whale. Dudley, philos. transact. XXXIII. p. 258.

Leviathan Jobi s. Cetus Jonae. T. Hasaeus de Leviathan Jobi et Ceto Jonae disquis. Brem. 1723. tab. 2.

Cete admirabile. Clus. exotic. libr. X. lib. 6. c. 17.

Cete Clusio. Willughb. hist. pisc. lib. 2. c. 8. tad. A. fig. 1.

Spoating-Whale. Sibb. Scot. illustr. II. p. 23.

Cachelotte. Anderſ. Nachr. v. Isl. II. S. 186. tab. 4.

Cachelot oder Pottfiſch. Egede Groenl. überſ. v. Krünitz. S. 79. — Cranz Grönl. S. 148. — E. v. Baer Beitr. z. Kenntn. des ruſſiſch. Reichs I. S. 56.

Cachelot. Franzöſiſch.

FIGURE A4. Pages 246–247 of Wagner (1847), the first reviser, based on our current understanding, showing his classification of the sperm whale, with *P. macrocephalus* clearly indicated as the valid name, and *P. catodon*, *P. tursio*, *and P. microps* all listed as junior synonyms of *macrocephalus*.

priority applies to the validity of synonyms [Art. 23.3], to the relative precedence of homonyms [Arts. 53–60], the correctness or otherwise of spellings [Arts. 24, 32], and to the validity of nomenclatural acts (such as acts taken under the Principle of the First Reviser [Art. 24.2] and the fixation of name-bearing types [Arts. 68, 69, 74.1.3, 75.4]).

23.6. Application to nomenclatural acts**.** In accordance with the Principle of Priority the first nomenclatural act taken in respect of a name or a nominal taxon to achieve any of the following constitutes the only valid such act: i.e. acts taken under the First Reviser Principle [Art. 24.2], fixation of type species [Arts. 68, 69], first inclusion of nominal species in a genus-group taxon [Art. 67.2], designation of lectotypes [Art. 74.1.3] and neotypes [Art. 75.5] (types in the family group are fixed automatically and are not subject to subsequent fixation [Art. 63]; but for names published after 1999 see Article 16.2).

Article 24. Precedence between simultaneously published names, spellings, or acts.

24.2.2. Determination of precedence of names or acts by the First Reviser. If two or more names, different or identical, and based on the same or different types, or two or more nomenclatural acts, are published on the same date in the same or different works, the precedence of the names or acts is fixed by the First Reviser unless Article 24.1 applies.

Article 72. General Provisions.

72.4. Type series.

72.4.1. The type series of a nominal species-group taxon consists of all the specimens included by the author in the new nominal taxon (whether directly or by bibliographic reference), except any that the author expressly excludes from the type series [Art. 72.4.6], or refers to as distinct variants (e.g. by name, letter or number), or doubtfully attributes to the taxon.

72.4.1.1. For a nominal species or subspecies established before 2000, any evidence, published or unpublished, may be taken into account to determine what specimens constitute the type series.

Article 74. Name-bearing types fixed subsequently from the type series (lectotypes from syntypes).

74.4. Designation by means of an illustration or description. Designation of an illustration or description of a syntype as a lectotype is to be treated as designation of the specimen illustrated or described; the fact that the specimen no longer exists or cannot be traced does not of itself invalidate the designation.

Schevill's argument hinges on the assumption that the wording order of Art. 12.1 is indicative of an intention by the ICZN that if both are provided, the indication is subordinate to the diagnosis. Taking this as a starting point, he sees this as justification for strict adherence to the literal wording of Linnaeus's diagnosis (despite indications of imperfections noted above), and essentially ignoring the cited references (Linnaeus's indications). In Schevill's view, the Principle of the First Reviser is not required, and the diagnoses dictate that only *catodon* be considered a sperm whale, the other three species being supposedly intended for other cetacean species. These views go against those of the vast majority of historical and contemporary cetologists, who seem to view all the described species under the genus *Physeter* as intended for sperm whales. Husson and Holthuis (1974) gave a particularly strong case for this in relation to *macrocephalus*.

There is no reason to believe that the Code designates either a diagnosis or an indication as more important than the other (Art. 12.1), and the intent of the Code suggests that both should be taken into account in determining identity (Art. 72.4.1.1). Contrary to Schevill's opinion, the syntype and lectotype designations of Husson and Holthuis (1974) are indeed legitimate (Art. 74.4) and clearly indicate that both *macrocephalus* and *catodon* are now to be considered sperm whale synonyms. Most of Schevill's points appear to be invalidated by a careful reading of the Code, and his insistence that we need to take Linnaeus's statement about blowhole placement literally, to the exclusion of all other information, is simply not supported by the totality of the evidence. If one does not subscribe to Schevill's views on this, and instead sees *catodon* and *macrocephalus* as synonyms referring to the same species (the sperm whale, as we now know it),[5] then the Code makes it clear the First Reviser principle must be invoked and the sections of Articles 23, 24, 72, and 74 listed above all are relevant and apply.

In regard to that issue, De Sélys-Longchamps (1839) does not satisfy the ICZN's requirements for the first reviser. We have discovered that the actual first reviser is Wagner (1847), who explicitly chose *P. macrocephalus* as the name of the sperm whale and listed *catodon*, *microps*, and *tursio* as junior synonyms—see Figure A4. Since the true first reviser (Wagner, 1847) used *macrocephalus* as the species name, unless an earlier reviser using *catodon* is discovered, *P. macrocephalus* must stand as the valid name of the sperm whale. The International Commission on Zoological Nomenclature has been consulted on this issue and agrees with our assessment above (Gwynne Lim, ICZN, personal communication, 24 May 2021).

NOTES

1. Although line priority is not specifically mentioned in the Code, the ICZN's web page of frequently asked questions says this: "Is there such a thing as page priority? Generally no. The page, or position on a page, on which a name (or act) appears does not in itself influence its precedence relative to other names (or acts) in the same work." (https://www.iczn.org/outreach/faqs/)
2. Sibbald's (1692) plate 1 contains the illustration, which shows a whale generally fitting the sperm whale, but with the blowhole located too far back. A slightly modified version of the plate appears in the second edition (Sibbald, 1773).

3. It is important to note that the diagnosis that Linnaeus provided for the genus *Physeter* listed "*fistula in capite f. fronte*," indicating that all species in this genus had the blowhole at the front of the head.
4. The list's basis stems from Rice (1998), with relatively few revisions having been made in the intervening 23 years.
5. The controversy over the true species identities of *macrocephalus* and *catodon* has now become moot, with the designation of a relevant sperm whale lectotype and neotype for these species by Husson and Holthuis (1974).

Appendix B: Short Biographies of the Major Describers of Large Odontocetes

It is useful and important to know something about those men (both their professional and personal lives) who have described the most species of large odontocetes. The short biographies below provide some background on 11 of those that we perceive to be the most important such natural historians.

Pierre Joseph ***Bonnaterre*** (1752–1804): The French naturalist Bonnaterre studied diverse subjects in natural history and is best known for his series of monographs on various groups of animals, entitled *Tableau encyclopédique et méthodique des trois règnes de la nature*, published in the 1780s and 1790s. The volume on cetaceans, published in 1789, describes several new nominal species (including five large odontocetes) and includes a series of useful illustrations.

Karl Herman Konrad ***Burmeister*** (1807–1892): In South America, Herman Burmeister was one of the most famous zoologists of the nineteenth century. Although German by birth, he spent much of his career in Argentina and published a good deal of his work in Spanish. Although an early critic of Darwin, he later changed his views somewhat and at least partially accepted some of Darwin's evolutionary ideas. He is known mostly for his work in entomology, herpetology, and botany, but also conducted very important work in mammalogy, which included critical studies on South American cetaeans and pinnipeds. Burmeister named four species of large odontocetes. All were different names given to a single type specimen of what is now known as Cuvier's beaked whale (*Ziphius cavirostris*): *Delphinorhynchus australis* (Burmeister 1865a), *Ziphiorrhynchus cryptodon* (Burmeister 1865b), *Epiodon patachonicum* (Burmeister, 1867a), and *Epiodon australe* (Burmeister, 1867b).

Jean Léopold Nicolas Frédéric, Baron ***Cuvier*** [known as *Georges* ***Cuvier***] (1769–1832): Perhaps one of the two greatest biologists of the nineteenth century (the other being Charles Darwin), French zoologist Georges Cuvier (his younger brother, Frederic, also published important works on cetaceans) had extensive influence in several areas of natural history, including through his revolutionary (but ultimately, largely incorrect) ideas about the evolution of life and the extinction of species. He published massive numbers of papers and books; his bibliography lists 908. Most importantly, he produced several of the most influential treatises of the day on the animal kingdom, with detailed coverage of both living and extinct species. He is still known as the founder of comparative

anatomy. He described four species of large odontocetes, and Cuvier's beaked whale is named after him.

Anselme Gaetan ***Desmarest*** (1784–1838): Desmarest was a French biologist and professor, a disciple of Georges Cuvier. His work was mostly on other groups of animals, but he did publish several important summary works on cetaceans, which included the description of four nominal species of large odontocetes. Among his most important mammalogical works was *Mammalogie ou description des espèces de mammifères*, published in the 1820s.

William Henry ***Flower*** (1831–1899): A major figure in zoology in the latter half of the nineteenth century, Flower was initially trained as a surgeon. He was well known as a scientist and lecturer and published extensively on various biological topics, primarily on mammals. Whales, dolphins, and porpoises held a strong interest for him throughout much of his career, and he produced many important papers on these animals. Unlike some, Flower accepted Darwin's theory of evolution and saw in it no threat to his religious beliefs. He became the director of the British Museum of Natural History and, after J. E. Gray's death, exposed the serious shortcomings of Gray's work with marine mammals. Four species of large odontocetes were described by him.

John Edward ***Gray*** (1800–1875): British biologist John E. Gray described more large odontocetes than any other person (15 species)—in fact, three times as many. Gray was associated with the British Museum (Natural History) for his entire career and was Keeper of Zoology from 1840 until his death in 1875. He published extensively, producing at least 1,164 publications on a wide variety of natural history topics, with marine mammals as a major focus of his later career. Gray was not a theorist or a field biologist and largely stayed at his post in the museum compiling lists and catalogs of specimens that were being collected all over the world by British colonial expeditions and voyages. He is remembered as a highly productive, but somewhat sloppy and ornery, naturalist of the great Victorian era of scientific discovery (see Jefferson, 2021). Gray's beaked whale is named after him.

Julius Von ***Haast*** (1822–1887): Born in the Kingdom of Prussia, Von Haast developed an early interest in natural history and in 1858 was sent to New Zealand, primarily to investigate its suitability for German immigrants. Based mostly in Auckland and, later, Canterbury, he explored a wide range of natural history and geological topics over his career and published several papers on the beaked whales of the southern oceans, naming five nominal species.

Johann Ludwig (Louis) Gerard ***Krefft*** (1830–1881): Krefft was born in Germany and spent part of his early life in the United States before moving to Australia in 1852. In 1858, he obtained a position with the Australian National Museum, cataloging specimens. Among his most important zoological works were monographs on the snakes and on the mammals of Australia. He was unceremoniously fired from the museum (literally thrown out, in fact) in 1874, over accusations of abuse of his powers and alleged drunkenness. He fought the charges and obtained some vindication. Krefft described four nominal species of large odontocetes.

Bernard Germain Etienne de Laville-sur-Ilon ***Lacépède*** (1756–1826): Lacépède was a French zoologist, who wrote one of the first compilations and reviews of the cetaceans, covering those types known at the start of the nineteenth century. This book, *Histoire naturelle des cetacees*, first published in 1804, was widely cited and reprinted in various forms over the next several decades. It provided color illustrations of the known species and Lacépède added several new species that he described himself. He described four nominal species of large odontocetes. His species accounts tended to be very flowery and somewhat fanciful; nonetheless, his works form an important part of the early taxonomic history of the Cetacea.

Carl ***Linnaeus*** (1707–1778): Linnaeus is one of the most famous biologists of his time, and his life and work are well documented (see Blunt, 2002). "Linnaeus" was his original Swedish surname; it is not a Latinization of "Linne," as is often stated. Although he considered himself primarily a botanist, he is perhaps best known for his book *Systema Naturae*, in the tenth edition (Linnaeus, 1758) of which, he proposed his new system of binomial nomenclature that applied to both plants and animals. In it he coined a binomial Latin name (genus and species) for virtually every species of animal known at the time. This book has been designated as the starting point for our current system of zoological nomenclature and is still in use today. Four species of *Physeter* "sperm whales" were included, but there were no beaked whales. Linnaeus was the first biologist who formally classified whales and dolphins as mammals rather than fishes, and he placed them in an order "Cete" (now generally replaced by Brisson's "Cetacea").

Frederick William ***True*** (1858–1914): Without a doubt, the greatest American marine mammal biologist of the late nineteenth and early twentieth centuries, True started his work at the U.S. National Museum (now the Smithsonian's National Museum of Natural History) as a clerk and then librarian, but moved into studies of biology. He initially investigated invertebrates, but his poor eyesight led him into studies of mammals and cetaceans in particular. He published widely on both fossil and extant marine mammals throughout his career and is best known for his three seminal monographs on the baleen whales, beaked whales, and delphinoids (dolphins, porpoises, and small whales). He described four species of large odontocetes, and True's beaked whale is named after him.

Appendix C: Museum and Collection Acronyms

Abbreviations and acronyms used for museums and collections mentioned multiple times in the text are defined in the list below.

AM	Australian Museum, Sydney, Australia
AMNH	American Museum of Natural History, New York City, N.Y., USA
ANSP	Academy of Natural Sciences, Philadelphia, Pa., USA
IRSNB	Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium
LACM	Los Angeles County Museum of Natural History, Los Angeles, Calif., USA
MACN-Ma	Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires, Argentina
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Mass., USA
MHNJP	Museo de Historia Natural "Javier Prado," Lima, Peru
MLP	Museo de La Plata, La Plata, Argentina
MNHN	Muséum National d'Histoire Naturelle, Paris, France
MNHNS	Museo Nacional de Historia Natural, Santiago, Chile
NHMUK	Natural History Museum, London, UK (formerly the British Museum of Natural History, BMNH)
NMNZ	Museum of New Zealand Te Papa Tongarewa (formerly the Colonial Museum; the Dominion Museum; the National Museum of New Zealand), Wellington, New Zealand
NRM	Swedish Museum of Natural History, Stockholm, Sweden
NSMT	National Science Museum, Tokyo, Japan
PEM	Port Elizabeth Museum, South Africa
QM	Queensland Museum, Brisbane, Australia
RCS	Museum of the Royal College of Surgeons, London
RMHNB	Musee Royal d'Histoire Naturelle de Belgique, Brussels, Belgium
RMNH	Naturalis Biodiversity Center, Leiden, Netherlands
USNM	National Museum of Natural History (formerly the United States National Museum), Smithsonian Institution, Washington, D.C., USA
ZAM	Iziko South African Museum, Cape Town, South Africa

Appendix D: Glossary of Taxonomic Nomenclature Terms

Definitions are modified from Wikipedia (https://www.wikipedia.org/), Jefferson (2021), and *The International Code of Zoological Nomenclature*, 4th ed. 1999. International Trust for Zoological Nomenclature.

Availability: An available name must be taken into account as a part of zoological nomenclature. Names that are not available effectively do not exist for the purposes of zoological nomenclature, cannot enter into synonymy or homonymy, nor be used as the names of taxa. For instance, a *nomen nudum* or any name published before 1758 is considered unavailable.

Basionym: The original name on which a new name is based. Also called original combination or protonym.

Emendation: An intentional change in the original spelling of an available name. The change must be consciously made along with justification for altering the spelling originally used by the taxon author while describing the species. Any other spelling changes are considered to be unjustified. Valid emendations include changes made to correct.

Holotype: A single type specimen upon which the description and name of a new species is based.

Homonym: A name that is spelled the same as another name, which is in common use, but established for a different nominal taxon. A junior homonym cannot be a valid scientific name for a taxon.

***Incertae sedis*:** Latin for "of uncertain placement." This is a term used for a taxonomic group where its broader relationships are unknown or undefined. Alternatively, such groups are frequently referred to as "enigmatic taxa." In a synonymy, such a species name is usually called a *nomen dubium*.

Indication: In the case of a name proposed before 1931 in which no description or type specimen was provided, a reference to previously published information or an act that serves to satisfy the conditions of ICZN Articles 10 and 11, making the name available (i.e., **not** a *nomen nudum*).

Junior synonym: A name that describes the same taxon as a previously published name. The later published of two or more names based on specimens considered to be conspecific.

***Lapsus calami*:** Literally "slip of the pen." Similar to *lapsus manus* (slip of the hand). These terms are used to refer to situations in which an unintended spelling error is

made in the use of scientific names in published literature. Although they may be listed in synonymies, these are not considered to be new scientific names, as they are variations that were introduced unintentionally.

Lectotype: A specimen later selected to serve as the single type specimen for a species originally described from a set of syntypes. In zoology, a lectotype is a kind of name-bearing type.

***Nomen conservandum* (or conserved name):** A name otherwise unavailable or invalid that the ICZN, by the use of its plenary power (through a vote of the commission members), has enabled to be used as a valid name by removal of the known obstacles to such use.

***Nomen correctum*:** A name with change of spelling, because of incorrect spelling of stem form (rarely used in cetology).

***Nomen dubium*:** A name that is of unknown or doubtful application. It may be impossible to determine whether a specimen belongs to that group or not. This may happen if the original type series is lost or destroyed, or if its name-bearing type is fragmentary or lacking important diagnostic features.

***Nomen inquirendum*:** Name that should be investigated (rarely used in cetology).

***Nomen novum*:** New replacement name, proposed as a direct substitute for an invalid existing name.

***Nomen nudum*:** A name that looks like a scientific name, and may have originally been intended to be one, but fails to be one because it has not (or has not yet) been published with an adequate description. (Note that names published before 1931 can be accompanied by an "indication" instead of a description, which can simply be a reference to a previously published description, or even just an illustration.) A *nomen nudum* is a "bare" or "naked" name, and thus it is unavailable. It can be made available if it is published again in a way that meets the criteria of availability; however, if so, it is attributed to the author who first made it available, not the person who first used it.

***Nomen oblitum*:** A name shown not to have been used as a valid name within the scientific community since 1899, and when it is either a senior synonym or a homonym, and when the preferred junior synonym or homonym has been shown to have been in wide use in 25 or more publications in the past few decades. Once formally declared to be a *nomen oblitum*, the disused name is to be "forgotten." By the same act, the next available name must be declared to be a *nomen protectum*; from then on, the latter takes precedence.

***Nomen protectum*:** A specific kind of conserved name that is a junior synonym given precedence over a senior synonym, primarily when the senior name has not been used since 1899 and the junior name is in common use. The older name becomes a *nomen oblitum*, and the junior name is declared a *nomen protectum*. A ruling of the ICZN is not required.

Objective synonym: One based on the same type material as another (earlier) named form. Because it is based on type material, it cannot be disputed. This may be species-group taxa of the same rank with the same type specimen, genus-group taxa of the same rank with the same type species, or if their type species are themselves objective synonyms, of family-group taxa with the same type genus, etc.

Paratype: A specimen of an organism that helps define what the scientific name of a species and other taxon actually represents, but it is not the holotype. Often there is more than one paratype, and they are usually held in museum research collections.

Principle of Homonymy: This is the principle that the name of each taxon must be unique. Consequently, a name that is a junior homonym of another name must not be used as a valid name.

Principle of Priority: This is the principle that the correct formal scientific name for an animal taxon, the valid name, is the oldest available name that applies to it. It is the most important principle—the fundamental guiding precept that preserves zoological nomenclature stability.

Senior synonym: The earliest published name of a taxon. In most cases, this is the specific name applied to the taxon

Subjective synonym: One of two or more different names that a specialist considers as belonging to the same taxon. Because they do not share a type, the synonymy is open to taxonomic judgment or opinion; thus they may be disputed or changed.

Syntype: Each of a set of type specimens of equal status, upon which the description and name of a new species is based. Sometimes called co-types.

Type series: The full set of type specimens of equal status upon which the description and name of a new species is based.

Validity: A valid name is the correct name for a taxon—that is, the oldest potentially valid name of a name-bearing type that falls within an author's concept of the taxon. "Potentially valid" means the name must be available and not invalid for any other reason, such as being a junior homonym.

Appendix E:
Summary of Nominal Species

TABLE E1. Summary of nominal species, along with relevant information about their description and type specimens. An X indicates the species name is valid or is available; a dash (—) indicates the name is not available or not valid; a question mark (?) indicates our best guess. Current species abbreviations are listed and defined in a footnote below the table.[a] Type disposition includes abbreviations for institutions and specimen numbers when known. The abbreviated institutions are listed and defined in Appendix C.

Current species	Nominal species	Authority	Page	Name available?	Name valid?	Status	Current species[a]	Type disposition	Notes (if any)
Berardius bairdii	*Berardius bairdii*	Stejneger, 1883	75	X	X	Valid name	B BAI	USNM 20992	
	Berardius vegae	Malm, 1883	109	X	—	Junior synonym	B BAI	NRM-MA633499	
	Rostrifer nestoresmirnovi	Zenkovich, 1947	15	—	—	*Nomen nudum*	B BAI	None	
Berardius arnuxii	*Berardius Arnuxii*	Duvernoy, 1851	52, pl. 1	X	X	Valid name	B ARN	MNHN-ZM-AC-A10733	
	Mesoplodon knoxi	Hector, 1873	167, pl. 6	X	—	Junior synonym	B ARN	NMNZ?	
Berardius minimus	*Berardius minimus*	Yamada et al., 2019	2	X	X	Valid name	B ARN	NSMT M35131	
Hyperoodon ampullatus	*Balaena ampullata*	Forster in Kalm, 1770	18 (fn)	X	X	Valid name	H AMP	None	
	Balaena rostrata	Müller, 1776	7	X	—	Junior synonym	H AMP	None	
	D[elphinus] Bidentatus	Bonnaterre, 1789	25, pl. 11	X	—	Junior synonym	H AMP	None	
	Delphinus butskopf	Bonnaterre, 1789	25	X	—	Junior synonym	H AMP	Musée d'initiation à la nature, Caen; lost?	
	Delphinus bidens	Shaw, 1801	514	X	—	Junior synonym	H AMP	None	
	Delphinus diodon	Lacépède, 1804	xliii, 309, pl. 13	X	—	Junior synonym	H AMP	RCS 2479?	
	Delphinus Chemnitzianus	Desmarest, 1817	175	X	—	Junior synonym	H AMP	None	
	Hyperoodon borealis	Nilsson, 1820	404	X	—	Junior synonym	H AMP	None	
	Delphinus hunteri	Desmarest, 1822	520	X	—	Junior synonym	H AMP	None	
	Delphinus hyperoodon	Desmarest, 1822	521	X	—	Junior synonym	H AMP	None	
	Ceto-diodon Hunteri	Jacob, 1825	72	X	—	Junior synonym	H AMP	[museum in Ireland?]	
	Hyperoodon honfloriensis	Lesson, 1828	137, 440	X	—	Junior synonym	H AMP	None	
	Hyperoodon rostratum	Wesmael, 1841	9	X	—	Junior synonym	H AMP	None	
	Delphinus? edentulus	Wiegmann, 1842	pl. 347	X	—	Junior synonym	H AMP	None	
	Delphinus quadridens	Burguet, 1843	304	X	—	Junior synonym	H AMP	Muséum d'histoire naturelle de Bordeaux; lost	

	Hyperoodon latifrons	Gray, 1846	27, pl. 4	X	—	Junior synonym	H AMP	NHMUK 1845.7.4.1	
	H[yperoodon] Baussardi	Duvernoy, 1851	67	X	—	Junior synonym	H AMP	None	
Hyperoodon planifrons	*Hyperoodon planifrons*	Flower, 1882	393	X	X	Valid name	H PLA	NHMUK 1882.3.24.1, 1814a	
	Hyperoodon Burmeisterii	Moreno, 1888	22	—	—	*Nomen nudum*	H PLA	None	
Ziphius cavirostris	*Ziphius cavirostris*	G. Cuvier, 1823	350, 352, pl. 27	X	X	Valid name	Z CAV	MNHN-ZM-AC-A3554	
	D[elphinus] Desmaresti	Risso, 1826	24, pl. 3	X	—	Junior synonym	Z CAV	None?	
	Hyperoodon Doumetii	Gray, 1846	26	X	—	Junior synonym	Z CAV	None	
	Hyperoodon Gervaisii	Duvernoy, 1851	49	X	—	Junior synonym	Z CAV	MNHN-ZM-AC-A3553	
	Ziphius indicus	Van Beneden, 1863	23, pl. 1	X	—	Junior synonym	Z CAV	Royal Belgian Inst. Nat. Sci., ANSP 3005 (cast)	Plaster cast of type at ANSP
	Hyperoodon capensis	Gray, 1865	359	X	—	Junior synonym	Z CAV	NHMUK 1869.4.5.1	
	Hyperodon semijunctus	Cope, 1865	280	X	—	Junior synonym	Z CAV	USNM 21975	
	Delphinorhynchus australis	Burmeister, 1865a	262	X	—	Junior synonym	Z CAV	None; lost	
	Ziphiorrhynchus cryptodon	Burmeister, 1865b	363	X	—	Junior synonym	Z CAV	None; lost	
	Epiodon patachonicum	Burmeister, 1867	5	X	—	Junior synonym	Z CAV	None; lost	
	Epiodon australe	Burmeister, 1869	309, 312	X	—	Junior synonym	Z CAV	None; lost	
	Petrorhynchus mediterraneus	Gray, 1871a	98	X	—	Junior synonym	Z CAV	None	
	Ziphius aresques	Gray, 1871a	98	X	—	Junior synonym	Z CAV	MNHN-ZM-AC-A3553	
	Ziphius decavirostris	Gray, 1871a	98	X	—	Junior synonym	Z CAV	None	
	Epiodon heraultii	Gray, 1872	469	X	—	Junior synonym	Z CAV	MNHN-ZM-AC-A3553	
	Epiodon chathamiensis	Hector in Hector and Gray, 1873	105	X	—	Junior synonym	Z CAV	NMNZ MM000021	
	Ziphius savii	Richiardi, 1873	3, pl. 7–8	X	—	Junior synonym	Z CAV	Nat Hist. Mus., Univ. Pisa 270	Paper describing type never published
	Ziphius novae-zealandiae	Haast, 1876a	466	X	—	Junior synonym	Z CAV	NMNZ MM001380	
	Ziphius grebnitzkii	Stejneger, 1884	77	X	—	Junior synonym	Z CAV	USNM 20993	
Mesoplodon bidens	*Physeter bidens*	Sowerby, 1804a	310	—	—	*Nomen nudum*	M BID	None	

(*continued*)

TABLE E1. (*Continued*)

Current species	Nominal species	Authority	Page	Name available?	Name valid?	Status	Current species[a]	Type disposition	Notes (if any)
	Physeter bidens	Sowerby, 1804b	1	X	X	Valid name	M BID	Oxford University Museum ZC.06998	Also casts in NHMUK and MCZ
	Delphinus Sowerbiensis	Desmarest, 1817	177	X	—	Junior synonym	M BID	None?	
	Heterodon dalei	Lesson, 1827	419	X	—	*Nomen dubium*	M BID	MNHN; lost	
	Delphinus micropterus	G. Cuvier, 1829	288	X	—	Junior synonym	M BID	None	
	Delphinus Philippii	Cocco, 1846	104, pl. 4	X	—	Junior synonym	Z CAV	None?	
Mesoplodon europaeus	*Dioplodon europaeus*	Gervais, 1852	12	—	—	*Nomen nudum*	M EUR	None	
	Dioplodon europaeus	Gervais, 1855	320	X	X	Valid name	M EUR	Musée d'initiation à la nature, Caen; lost?	
	Dioplodon Gervaisi	Deslongchamps, 1866	176	X	—	Junior synonym	M EUR	None	
Mesoplodon mirus	*Mesoplodon mirum*	True, 1913	1	X	X	Valid name	M MIR	USNM 175019	
Mesoplodon grayi	*Mesoplodon Grayi*	Haast, 1876a	9	X	X	Valid name	M GRA	Canterbury Museum; lost	
	M[esoplodon] haasti	Flower, 1878a	684	—	—	*Nomen nudum*	M GRA	None	
	M[esoplodon] haasti	Flower, 1878b	417	X	—	Junior synonym	M GRA	RCS 2905?	
	Mesoplodon australis	Flower, 1878b	417	X	—	Junior synonym	M GRA	NHMUK 1876.2.16.2	
Mesoplodon ginkgodens	*Mesoplodon ginkgodens*	Nishiwaki and Kamiya, 1958a	53	X	X	Valid name	M GIN	NSMT 08744	
Mesoplodon hotaula	*Mesoplodon Hotaula*	Deraniyagala, 1963a	13, fig.	X	X	Valid name	M HOT	Colombo Nat. Mus. 3WZS	
Mesoplodon layardii	*Ziphius Layardii*	Gray, 1865	358	X	X	Valid name	M LAY	NHMUK 1869.4.5.2	
	Mesoplodon Güntheri	Krefft, 1871	368	X	—	Junior synonym	M LAY	AM PA.358–359, 363–364	
	Mesoplodon longirostris	Gray, 1873a	145	X	—	Junior synonym	M LAY	AM PA.358–359, 363–364	
	Mesoplodon Thomsoni	Krefft in Scott, 1873	116	—	—	*Nomen nudum*	M LAY	None	
	Mesoplodon floweri	Haast, 1876c	8	—	—	*Nomen nudum*	M LAY	None	
	Mesoplodon floweri	Haast, 1876b	478	X	—	Junior synonym	M LAY	NMNZ MM001379	

Mesoplodon traversii	*Dolichodon traversii*	Gray, 1874b	96	X	X	Valid name	M TRA	NMNZ MM000546	
	Mesoplodon bahamondi	Reyes et al., 1995	31	X	—	Junior synonym	M TRA	MNHNS, Santiago 1156	
Mesoplodon densirostris	*Delphinus densirostris*	Desmarest, 1817	178	X	X	Valid name	M DEN	MNHN-ZM-AC-A3552	
	Ziphius sechellensis	Gray, 1846	28, pl. 6	X	—	Junior synonym	M DEN	MNHN-ZM-AC-A3551	
Mesoplodon stejnegeri	*Mesoplodon Stejnegeri*	True, 1885	584	X	X	Valid name	M STE	USNM 21112	
Mesoplodon bowdoini	*Mesoplodon bowdoini*	Andrews, 1908	203	X	X	Valid name	M BOW	AMNH 35027	
Mesoplodon carlhubbsi	*Mesoplodon carlhubbsi*	Moore, 1963	422	X	X	Valid name	M CAR	USNM 278031	
Mesoplodon hectori	*Berardius Hectori*	Gray, 1871 (AMNH)	117	X	X	Valid name	M HEC	NHMUK 1876.2.16.3, 1677b	
Mesoplodon perrini	*Mesoplodon perrini*	Dalebout et al., 2002	577	X	X	Valid name	M PERR	USNM 504853	
Mesoplodon peruvianus	*Mesoplodon peruvianus*	Reyes et al., 1991	1	X	X	Valid name	M PERU	MHNJP 1146; RMNH. MAM.38234 (paratype)	
Mesoplodon eueu	*Mesoplodon eueu*	Carroll et al., 2021	1	X	X	Valid name	M EUE	NMNZ MM003000	
Indopacetus pacificus	*Mesoplodon pacificus*	Longman, 1926	269	X	X	Valid name	I PAC	QM J.2106	
Tasmacetus shepherdi	*Tasmacetus shepherdi*	Oliver, 1937	371, pl. 3-5	X	X	Valid name	T SHE	Wanganui Regional Museum	
Physeter macrocephalus	*[Physeter] macrocephalus*	Linnaeus, 1758	76	X	X	Valid name	P MAC	Lectotype lost	Syntypes are indications from literature
	[Physeter] catodon	Linnaeus, 1758	76	X	—	Junior synonym	P MAC	RMNH.MAM.5828 (neotype)	Syntypes are indications from literature
	[Physeter] microps	Linnaeus, 1758	76	—	—	*Nomen dubium*	P MAC	None	
	[Physeter] tursio	Linnaeus, 1758	76	—	—	*Nomen dubium*	P MAC	None	
	Physeter Novae Angliae	Borowski, 1781	32	X	—	Junior synonym	P MAC	None	
	Physeter Andersonii	Borowski, 1781	33	X	—	Junior synonym	P MAC	None	
	Phiseter [sic] *Trumpo*	Bonnaterre, 1789	14, pl. 8	X	—	Junior synonym	P MAC	None	
	Phiseter [sic] *Cylindricus*	Bonnaterre, 1789	16, pl. 7	X	—	Junior synonym	P MAC	None	
	Phiseter [sic] *Mular*	Bonnaterre, 1789	17, pl. 8	X	—	Junior synonym	P MAC	None	
	Physeter maximus	G. Cuvier, 1798	176	X	—	Junior synonym	P MAC	La Roch. Mus. M646	
	Catodon svineval	Lacépède, 1804	xxxix, 216	X	—	Junior synonym	P MAC	None	

(*continued*)

TABLE E1. (*Continued*)

Current species	Nominal species	Authority	Page	Name available?	Name valid?	Status	Current species[a]	Type disposition	Notes (if any)
	Physeter orthodon	Lacépède, 1804	xli, 236	X	—	Junior synonym	P MAC	None	
	Physeter urganatus	Rafinesque, 1814	13	X	—	Junior synonym	P MAC	None	
	Physeterus [sic] *sulcatus*	Lacépède, 1818	474	X	—	Junior synonym	P MAC	None	
	Physeter australasianus	Desmoulins, 1822	618	X	—	Junior synonym	P MAC	None?	
	Tursio vulgaris	Fleming, 1822	211	X	—	Junior synonym	P MAC	None	
	Physeter polycyphus	Quoy and Gaimard, 1824	77, pl. 12	X	—	Junior synonym	P MAC	None	
	D[elphinus] Bayeri	Risso, 1826	22	X	—	Junior synonym	P MAC	None?	
	Physeter gibbosus	Wiegmann, 1840	pl. 338, 338B	X	—	Junior synonym	P MAC	None	
	Catodon Colneti	Gray, 1850	52	—	—	*Nomen nudum*	P MAC	None	
	Catodon australis	Wall, 1851	1	X	—	Junior synonym	P MAC	AM PA.326	
	Catodon (Meganeuron) Kreftii	Gray, 1865b	440	X	—	Junior synonym	P MAC	AM PA.339	
	[Physeter] pterodon	Trouessart, 1898	1056	X	—	Junior synonym	P MAC	None	
Kogia breviceps	*Physeter breviceps*	Blainville, 1838	337, pl. 10	X	X	Valid name	K BRE	MNHN-ZM-MO-1927-3	
	Euphysetes Grayii	Wall, 1851	37	X	—	Junior synonym	K BRE	AM PA.368	
	Euphysetes macleayi	Krefft, 1866	713	X	—	Junior synonym	K BRE	AM PA.366?	
	Kogia Floweri	Gill, 1871	738, f. 172	X	—	Junior synonym	K BRE	USNM 8016	
	Euphysetes pottsii	Haast, 1874	97, pl. 15	X	—	Junior synonym	K BRE	NMNZ MM001389	
	Kogia goodei	True, 1884	630	—	—	*Nomen nudum*	K BRE	None	
	Kogia goodei	Goode, 1884	pl. 2	X	—	Junior synonym	K BRE	USNM 13738, 20909	Type illustrated in Goode (1884: pl. 2)

Kogia sima	*Physeter (Euphysetes) simus*	Owen, 1865	511	—	—	*Nomen nudum*	K SIM	None	
	Physeter (Euphysetes) simus	Owen, 1866	30	X	X	Valid name	K SIM	NHMUK 1866.2.5.6	
Uknown species	*[Delphinus] coronatus*	Freminville, 1812	71	X	—	*Nomen dubium*	UNK	None	Probably *H. ampullatus*
	Epiodon urganatus	Rafinesque, 1814	13	X	—	*Nomen dubium*	UNK	None	
	Oxypterus mongitori	Rafinesque, 1814	13	X	—	*Nomen dubium*	UNK	None	

[a] Abbreviations used for current species:

B ARN: *Berardius arnuxii*
B BAI: *Berardius bairdii*
H AMP: *Hyperoodon ampullatus*
H PLA: *Hyperoodon planifrons*
I PAC: *Indopacetus pacificus*
K BRE: *Kogia breviceps*
K SIM: *Kogia sima*
M BID: *Mesoplodon bidens*
M BOW: *Mesoplodon bowdoini*
M CAR: *Mesoplodon carlhubbsi*
M DEN: *Mesoplodon densirostris*
M EUE: *Mesoplodon eueu*
M EUR: *Mesoplodon europaeus*
M GIN: *Mesoplodon ginkgodens*
M GRA: *Mesoplodon grayi*
M HEC: *Mesoplodon hectori*
M HOT: *Mesoplodon hotaula*
M LAY: *Mesoplodon layardii*
M MIR: *Mesoplodon mirus*
M PERR: *Mesoplodon perrini*
M PERU: *Mesoplodon peruvianus*
M STE: *Mesoplodon stejnegeri*
M TRA: *Mesoplodon traversii*
P MAC: *Physeter macrocephalus*
T SHE: *Tasmacetus shepherdi*
UNK: Unknown
Z CAV: *Ziphius cavirostris*

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Subject Index

This subject index focuses primarily on personal names (including taxonomic authorities), publication titles, placenames for specimens collected, museum names, methods, and other relevant information found in the text.

Index of Scientific Names

Index of Common Names