

THE SCIENTIFIC DISCOVERY OF THE
AMAZON RIVER DOLPHIN
INIA GEOFFRENSIS

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ABSTRACT

Analysis of little-known manuscripts revealed that there have been at least two pre-Linnean descriptions of the South American freshwater dolphin *Inia geoffrensis* (Blainville, 1817). The earliest one that we found was made by Frei Cristóvão de Lisboa in a manuscript written around 1627. The second one was by Pehr Löfling, a disciple of Linnaeus, who wrote a very detailed and accurate description of this mammal in 1755. He used the binomial system to designate this species, and his description was much more complete and sophisticated than the ones used by Linnaeus in the 10th edition of *Systema Naturae* for other cetaceans. This and other zoological work by Löfling remains almost completely unexamined to date. Like the outcome of other field work carried out by many Spanish scientists in America, failure to publish the findings of the expeditions resulted in scientific information being largely lost.

Key words: boto, tonina de río, *Inia geoffrensis*, Frei Cristóvão de Lisboa, Pehr Löfling, history of science.

Alexander Rodrigues Ferreira (born Bahia, Brazil, 1756; died Lisbon, Portugal, 1815) is often mentioned (*e.g.*, Best and da Silva 1989) as the discoverer of the Amazon river dolphin ("boto" in Portuguese, "tonina de río" or "bufeo colorado" in Spanish) known today as *Inia geoffrensis* (Blainville, 1817). He collected a specimen of this species somewhere in the lower Amazon basin no later than 1790, classified it as *Delphinus delphis*, and sent it to the Museu de Ajuda in Lisbon, together with a description and a drawing (Rodrigues Ferreira 1790). The specimen was later plundered by Geoffroy St. Hilaire in 1810 on orders of Napoleon Bonaparte and sent to the Muséum d'Histoire Naturelle de Paris where it can be found today (de Miranda Ribeiro 1943, van Bree and Robineau 1973). Henri-Marie Ducrotay de Blainville (1817) described *Del-*

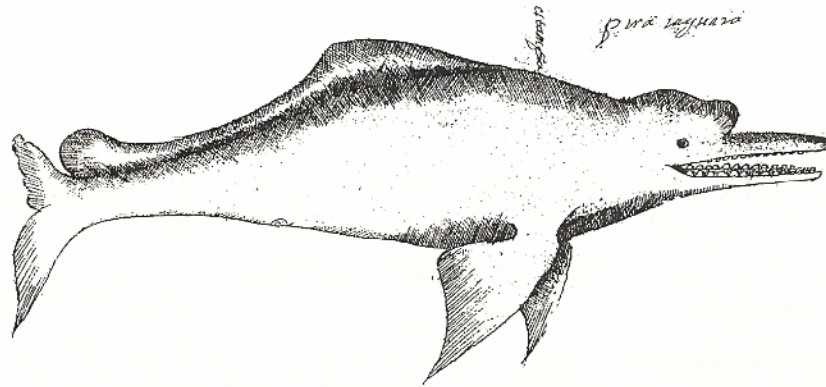


Figure 1. "Pyraiguara" of Frei Cristóvão de Lisboa.

phinus geoffrensis based on this specimen. The genus *Inia* was created for *I. boliviensis* (d'Orbigny 1834), making this the type species, but Gervais (1856) later recognized that *D. geoffrensis* also belonged in *Inia*. We have found documentation, however, that at least two authors described this species much earlier: one no later than 1647 and the other in 1755, *i.e.*, well before Rodrigues Ferreira's collection. Both descriptions were unknown to Linnaeus and are still unfamiliar to cetologists today.

Frei Cristóvão de Lisboa (born Lisbon, Portugal, 1583; died Santo António do Curral, Portugal, 1652) is the author of the earliest scientific description of the boto or tonina de rio that we have uncovered. A Capuchin priest, he arrived in Brazil in 1624 and stayed there until sometime between 1627 and 1631. Between 1624 and 1626 he traveled extensively throughout the Maranhão (lower Amazon) region. Apparently, by 1627 he was already working on a manuscript on the natural history of the animals and trees of the area titled *História dos animais e árvores do Maranhão* (da Fonseca 1952) and what appears to be the final draft is dated 1647, in Lisbon. The manuscript was rediscovered in 1934 when it was bought from a bookseller in Lisbon by the Arquivo Histórico Colonial of Portugal in Lisbon where it remains today. A facsimile version of the manuscript, including contemporary historical notes, was published in 1967 (de Lisboa 1647).

On page 175 of the manuscript, there is a description of the "Pyraiguara" among the "fishes of Pará." The paragraph-long description reads as follows: "he especie de porco marinho no sabor he como porco principalmente o figado tem as partes genitais como o porco tem noue palmos de comprimento e grosso nesta proporção face do rabo manteiga as femeias parem como os animais tem hû buraco asima do naris por onde respira e lanca agua" ("it is a species of sea-pig; with the taste of a pig, particularly the liver, it has the genital parts like a pig and has nine palms of length, and the bulk is proportional; butter can be obtained from it; the females give birth like the animals; it has a hole on top of the nose through which it breathes and throws water"). On page 54 an illustration of this dolphin (Fig. 1), with its long snout and short dorsal

fin, leaves little doubt that de Lisboa referred to what is known today as *Inia geoffrensis*. Although this manuscript does not have the exhaustive descriptions of some of the most popular and influential natural history works of its time that also describe cetaceans (for a list of books of the above-mentioned period see Allen 1881), it is a fair description of this species, especially considering that Cristóvão de Lisboa was not a professional naturalist.

The second description that we found for this species was made by Pehr Löfving in 1755. Born in Valbo, Sweden, in 1729, he was one of Carolus Linnaeus's (born Stenbrohult, Sweden, 1707; died Upsala, Sweden, 1778) students (for biographical details on Löfving see Rydén 1957, Pelayo and Puig-Samper 1992). Löfving went to Spain (1751–1754) where he did valuable botanical and zoological work, some of which was incorporated into the 10th and 12th editions of Linnaeus's *Systema Naturae*.

Although a botanist by training, Löfving was also interested in animals, particularly in fish (including cetaceans as they were considered at the time). His interest was apparently prompted by Linnaeus's instructions that the Queen of Sweden wanted some specimens for her private museum. In Linnaeus's letter to him, dated 2 October 1753, Linnaeus told Löfving to collect all the fish he could find (Rydén 1957, pp. 73–74). Among the "fishes" described by Löfving in his unpublished ichthyological work on the Bay of Cádiz ("Piscis Gaditana, Observato Gadibus et ad Portus Sa. María 1753, Mens Nov. et Decemb.," MS at the Royal Botanical Garden, Madrid), which he wrote while waiting to depart for South America, there is a "Delphinus" (*sensu* Artedi, Syn 105 & Gen 72:2; probably a *Delphinus delphis*; Pelayo 1990, p. 121).

Löfving arrived in Cumaná, eastern Venezuela, on April 1754 as part of an expedition whose primary goal was to fix the borders of Spain's and Portugal's possessions in America. Löfving's main mission was to survey natural products that could have economic value for the Spanish Crown (Ramos Pérez 1946, Lucena Giraldo and de Pedro 1992). In May 1755 he reached the Orinoco River, where he made extensive botanical and zoological collections despite illness and the expedition's numerous logistic problems. He worked, according to his diary deposited at the Madrid's Royal Botanical Garden, until October 1755 when he fell sick. On 22 February 1756, he died at the Caroní River, near the confluence with the Orinoco. He had only a few months of time for real work in South America (Pelayo and Puig-Samper 1992, p. 14).

Among Löfving's documents known today there are more than 1,700 papers (folios), 200 drawings, and a few watercolors of plants and animals (Rydén 1957, p. 150). One of the unpublished manuscripts left by Löfving (today in Madrid's Royal Botanical Garden) was "Ychthyologia Orinocensis" ("Ichthyology of the Orinoco"). On sheet II,4,4,1, p. 7 of that manuscript where he lists the species, which he later described in greater detail, he writes "Delphinus tonina (Δελφίς), Artedi p. 105 n 2, Linei System. N. Delphinus, corpore oblongo subtereti rostro longo acuto, Jonston 2b.c.2., Rondel. Li6c8., Charlton p 168, Aldrov. Cet. C7 p 103."

He lists the common names used by the Spaniards and by local tribes for

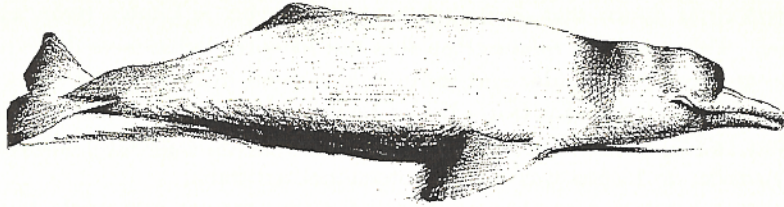


Figure 2. "Tonina" of Pehr Löfling.

this species as follows: Spanish—Tonina; Cabre—Muna; Maypure—Muna; Guama—Yufa; Guayana—Urinugna.

Then, in sheet II,4,4,1, p. 56, he describes the major characteristics of the "tonina," as follows: "Caput subrotundum Rostro acuminato obtuso. Oris Rectum prolongatum Lingua ampla subovata (drawing) Dentes minuta in margine maxillarum. Oculi paris ad prope rictus oris. Fistula transversalis in capite loro narum? per quam aquam recipis olfato. Pinae pectorales cartilaginae. Pina dorsalis culta! forma acuta rel. Cauda orinzontalis bifurca angulis obtusis. Anos foramen subrotundi. Membrum femeninum prope anum muliebri similisimum. Mamae dua ad latris utrum que naturae membre." ("Head suboval. Rostrum bluntly pointed. Beak straight and prolonged. Tongue broad and suboval. Teeth are small and located at the sides of the maxillae. Two eyes near the base of the rictus [posterior end of the beak]. Blowhole is transverse with respect to the head in place of a nose? [*sic*] through which water is swallowed while sniffing. Pectoral fins are cartilaginous. Dorsal fin is elevated! [*sic*] with a form relatively acute. Horizontal tail is bifurcated in an obtuse angle. Anus hole is semicircular. Female membrane is in the place of the anus, as it happens similarly among females. Two breasts one at each side that are present at birth"). (Please note that the original Latin text is defective in both grammar and spelling; his penmanship is also somewhat difficult to read).

This description, much more detailed and different in style and content than Artedi's (1738) and Linnaeus's (1748) descriptions of similar species, is accompanied by two drawings (one dorsal and one lateral), the latter being very accurate (Fig. 2).

The information contained in "Ychthyologia Orinocensis" suggests the following:

Sources of information—Löfling used Peter Artedi's (born Anundsjö, Sweden, 1705; died Amsterdam, Holland, 1735) book (1738) and Linnaeus's *Systema Naturae* 6th edition (1748) for this dolphin species diagnosis and mentioned Jonston, Rondelet, Charleton, and Aldrovandi as further sources. From an inventory of his belongings made after his death, we know that he possessed (among others) Artedi's and Linnaeus's books when he died, as well as 14 "authorless books in good shape" and 20 "in bad shape and virtually worthless" (Pelayo and Puig-Samper 1992, pp. 56–61). Thus, it is unclear whether or not he had copies of the other zoological books mentioned in the list of references for the tonina. We hypothesize here that one possibility is that he removed the covers of books that the Spaniards may have considered offensive

at that time. Book censorship started in Spain in 1502 (more stringent regulations followed in 1558) and such censorship continued until 1812. The Inquisition banned many scientific books that were standard at the time, including classical natural history references such as Conrad Gesner's books (Herr 1958, pp. 201–213; Beddall 1983). Gesner is cited by Löffling in his manuscript when he describes the manatee (*Trichechus manatus*) that he observed.

Species identification and nomenclature—Löffling designates this dolphin as "Delphinus tonina (δελφίς)." Was he proposing a new species based on the striking differences between this freshwater species and the delphinoids known then? That is difficult to answer given that: (1) Löffling's manuscript seems to be far from polished, so we cannot know what his final thoughts on this were; (2) although he seems to be inclined to follow Linnaeus's practice of using the common name as the specific name, the fact that he adds the then monotypic species name in parentheses and in Greek (the only time he does so in his "Ychthyologia Orinocensis") may indicate that he was following descriptive procedures of the time for plants, which gave a generic name in Latin followed by a specific epithet in Greek characters expressing several features (Stearn 1959). Furthermore, it is even uncertain that Löffling intended to use a binomial designation for this (new?) species. Given that most of the "fish" species he described were totally new to science (no fish collections had ever been made in northern South America), he used mostly the common names to designate the Orinoco fishes. Linnaeus's first introduction of consistent binomial nomenclature for species dates to his *Species Plantarum* (1753) (which Löffling carried with him to America), but it is not until the 10th edition (published two years after Löffling's death) that Linnaeus first gave binomials to all the known species. Linnaeus's *Systema Naturae* 6th edition of 1748, which Löffling also carried with him to America, does not employ binomial nomenclature (Stearn 1959). Before that, the use of this system was occasional (Stearn 1971). Whenever possible, Linnaeus chose epithets that preserved an association with earlier literature (nouns in apposition). Löffling followed Linnaeus in employing the common name (often invented when necessary). In his *Critica Botanica*, aphorism 237, Linnaeus (1737) ruled that the specific name should distinguish the plant from all others of the genus. By specific name (nomen specificum) he then meant a diagnostic phrase. Hence when a genus had only one species, the generic name by itself was enough (Stearn 1971).

In Löffling's time there were only three differentiated species among the known delphinoids. They were grouped in the genus *Delphinus*: *D. delphis* (basically a conglomerate of what we know today as *Tursiops* and *Delphinus* itself), *D. phocaena* and *Orcinus orca*. This same classification was followed by Linnaeus in his 10th edition. Given the unpolished state of his manuscripts and that almost all of the Orinoco "fish" were new to science, Löffling might have just decided to gather as much field information about them as possible and to take care of the taxonomy later.

Higher classification—Löffling keeps the "tonina" among the fishes, although, as can be read in the description, he knew that the female of this species had mammary glands. That is not surprising. Although at that time there was

strong evidence that cetaceans were, at least, different from other fishes, it is not until Linnaeus's 10th edition that the class Mammalia is created; it then included today's cetaceans. Furthermore, Löffling's characterization of "tonina" is almost exclusively on external morphology (there is no record of Löffling ever practicing a dissection), while Linnaeus's bases for classifying cetaceans as mammals are their warm, two-chambered heart, their breathing by lungs, their hollow ears, a penis that enters the female, and mammaries that exude milk (10th Edition, Vol 1, p. 17).

Löffling's notes and manuscripts were sent to Spain after his death. However, some have been lost (Rydén 1957, pp. 9, 75, 80, 120, 144). Most of the surviving documents have been preserved in the archives of the Royal Botanical Garden of Madrid since 1801. The Spanish naturalist Casimiro Gómez Ortega (born Añover de Tajo, Spain, 1740; died Madrid, 1818) was commissioned to put together all of Löffling's papers. He wrote some notes on the drawings of the expedition's artists Bruno Salvador Carmona (born Madrid?, 1737?; died Madrid, 1801) and Juan de Dios Castel (born 1738?; died ?). "Ichthyologia Orinocensis" has Castel's penmanship. Castel may have written what was dictated to him by an ill Löffling, or just copied the notes when he came back to Spain and worked with Gómez Ortega on Löffling's papers. Through the chaplain of the Swedish embassy in Madrid, Daniel Scheidenburg (born Västerhaninge, Sweden, ?; died Spain, 1744), Linnaeus obtained a copy of some of Löffling's manuscripts and notes (Rydén 1957, p. 148). With that and the material that Löffling himself had sent from Spain, Linnaeus put together and published in 1758 Löffling's *Iter Hispanicum* ("Spanish Journey" or part of Löffling's botanical work in Spain and Venezuela) (Stockholm 1758; for the English version see Bossu 1771). Further attempts by Linnaeus to obtain the rest of Löffling's material were unsuccessful. Löffling's specimens, including his herbarium, are today lost (Pelayo and Puig-Samper 1992, p. 100).

Löffling's zoological work remains almost completely unexamined; only a mammal, an amphibian, and a reptile are mentioned in the *Iter Hispanicum*, and there are some references to the Bay of Cadiz fishes in the 10th and 12th editions of the *Systema Naturae*. Löffling's diagnosis of the Cadiz fishes found in the catalog of the Queen of Sweden published by Linnaeus as *Museum Ludovicae Ultricæ Reginae* (1764) does not mention the collector's name (Pelayo and Puig-Samper 1992, p. 100).

There is no evidence that any of the animal specimens of this expedition ever reached Spain. Cetaceans, because of their size and skin, are difficult to preserve. It was not until the 1750s that the use of salt and alum allowed permanent preservation of mammal and bird skins (Farber 1977).

Like most of the work by other naturalists at the service of the Spanish Crown in Spain's colonies before and after him, Löffling's work was largely lost. Basalla (1967) considers both Spain and Portugal to be special cases, not only because modern science (1450–1800) had not been extensively cultivated by either of the countries, but also because of the failure to publish the findings of the expeditions.

There are other references *in passim* to freshwater dolphins in South America found in pre-Linnean times such as Pedro de Magalhães de Gandavo's (born Braga, Portugal, 1540?; died ?) 1576 (although not published until 1922 as "The Histories of Brazil") or Jacinto de Carvajal's (born Spain, 1567?; died Venezuela?, 1648?) "The discovery of the Apure River" (1647, not published until 1805). A vernacular description of this species can also be found in Gilij's "Essay of American History" (published in 1782; see Paolillo and Romero 1989 for analysis of this source), although it lacks the details and scientific accuracy of his predecessors Cristóvão de Lisboa and Löffling.

Thus, the descriptions by Cristóvão de Lisboa and Löffling are to date the only known examples of pre-Linnean scientific description for any freshwater cetacean in South America.

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