
Portuguese Sealing and Whaling Activities as Contributions to Understand Early Northeast Atlantic Environmental History of Marine Mammals

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1. Introduction

The 16th century maritime Atlantic journeys were one of the most ground breaking and prolific sources of scientific knowledge in nautical cartography, geography and ethnography, and also in the natural sciences [1]. The European pioneering exploration of Africa and Brazil resulted in writer and naturalist records of the new, exotic and useful, originating natural history studies in Europe based on observations in zoology, botany and tropical medicine [2]. Since then, explorers, travellers and traders have brought animals and natural objects to Europe. Previously, however, coastal inhabitants all over the world used near shore habitats and resources, altering marine ecosystems and their dynamics [3].

The marine environmental history refers to the mutual interactions between humans and the marine natural world [4], ambitioning to understand how humans have integrated the sea into their living style through the changes brought by time [5]. The environmental historical approach offers a multidisciplinary and long term research approach to anthropogenic interactions with marine life, albeit being largely incomplete when compared to its terrestrial counterparts [3]. Most of the available literature pertains to the study of invertebrates [6] and fish [7, 8], while historical research on the presence of cetaceans over time remains largely incomplete, particularly for the Northeast Atlantic [9]. Marine mammals are very useful tools to evaluate marine environmental changes as they are easily identified in historiography (particularly in letters, journey diaries, natural history treaties), making it possible to relate their presence records with their environmental conditions [10]. Marine mammals are of relatively large proportions that require surface visits to breathe, features that enhanced the awareness and interest in different human cultures around the

world. Marine mammals were historically targets of hunting with economic purposes. During the 16th and 17th centuries, tortoiseshell, shark teeth, marine mammals' blubber and baleen, seal skin, ambergris [11], narwhal tusks, pearls and coral [12], and a host of other products were trade commodities of considerable value. Some exotic marine animals and products, especially if they were rare and difficult to catch and possess, were of particular interest and priceless to European royalty, scientists, and collectors. This was because of their perceived economical and spiritual values, but also due to their applications with mundane (medicine, food, condiments, aphrodisiacs), symbolic, talismanic or superstitious purposes. [13]. The transaction process, the local natural ecosystems on which they acted and perceptions towards the marine environment changed [3] [5]. Remains of seals, whales and dolphins are currently found at museums, universities, and even private collections [2].

The present work contemplates a large timeframe from early modern to modern times and is based on Portuguese sources. Aspects of marine environmental history will be addressed engaging with elements from the history of science and framing Portuguese maritime history within an Atlantic history. Atlantic history is an analytic construction and a specific category of historical analysis that helps to organize the study of the emergence of this ocean basin as a site for several and distinct forms of commercial exchange [14]. In order to approach the Atlantic history, a novel approach was chosen in this work, based on the exploitation patterns, trading features and scientific knowledge of Atlantic marine mammals collected in various sources over the years, all aspects still to be covered. Seals and whales are historically linked to local communities that exploited their body parts. This commerce was affected by changing markets, evolving technologies, scientific studies, regulations regarding access, and contradictory opinions regarding sustainability. Records on this commerce represent a valuable source of information about the characteristics and fluctuations of the exploitation market and indirectly about the condition of its inherent marine environment. Studies on whaling must include historical and an economics insight so as to provide a comprehensive interpretation of the natural resources shifts. By historically approaching marine mammals as a case study has a great potential to enhance our understanding of the interactions between the human culture and nature in the early modern and modern world.

2. Integrating natural and social sciences sources

Environmental history is an interdisciplinary field of History that receives inputs from different areas of human, social and natural sciences. Reliable data on historical occurrences provides relevant information on how communities, populations and species have shifted over long timelines [15, 16] and allows establishing baseline datasets [17]. Of paramount importance and more precisely, historical accounts on marine mammals may be extremely useful to add new data to their occurrence and distribution in poorly studied regions [17], and to compare past information with recent data [18]. The historical relationships between humans and marine mammals, such as sealing, whaling, use and trade of goods, strandings and naturalist sightings, have been regularly documented throughout time though various sources. However, for some regions such as for the Atlantic Ocean, data is still sparse and

requires collection of the various sources and subsequent interpretation. There are several advantages in using historical data to extract biological information. Usually, in a historical source it is possible to find abundant and novel information on unspoiled populations, and on species (or groups) occurrence and distribution. This information can then be used as an indicator of past biodiversity, enabling the study of baseline levels and changes in cetaceans' presence and importance, as well as making the connection of biology with history, economics and culture.

In the present work, inter-cultural trade of exotic marine animals has a well-documented history that changed dramatically with the European Overseas Expansion. From the 16th century onwards many animals were brought to Europe mainly by the Portuguese, starting a new period in natural history [2]. The Portuguese reports correspond mainly to descriptions based on empirical knowledge accumulated in successive maritime routes, where the occurrence of species or animal groups was recorded. Navigators associated the presence of frequent animal to specific location so as to estimate their position.



Figure 1. Representation of whaling in Portuguese shores and the encounter of Portuguese navigators with sea wolves upon arrival at the island of Madeira. This image represents a clear manifestation of the 16th century Portuguese intention of domination over the seas and everything found in it, including all marine animals with economic value. It corresponds to a *fresco* from 2000 in the ceiling of the Church of Ponta Delgada, Madeira, representing all air, land and sea animals, with symbols related to the Portuguese Atlantic Discoveries. Photographed in 2009 by the author.

Portuguese sources for the 16th and 17th centuries Atlantic in the form of letters, chronicles, and scientific treaties, as well as illustrated broadsheets, leaflets, maps, images, paintings, objects and products were compiled and reviewed here (see Figure 1). The present research includes historical sources and accounts from the period between late 15th century and early 19th century, and will present two distinct case-studies for the Atlantic Ocean: (1) first encounter and posterior hunting of monk seals in the Atlantic; and (2) medieval and early modern whaling in the Iberian Peninsula and shifting of this activity to the Atlantic.

3. The Mediterranean monk seals in the Atlantic

The Mediterranean monk seal (*Monachus monachus*) is distributed across different countries but is also currently the most endangered pinniped, largely due to its small and isolated populations. The monk seal current distribution is severely contracted and fragmented due to Human pressures, however historic records indicate that it inhabited the entire Mediterranean Basin and the south-eastern North Atlantic, from the Azores islands to near the equator. In Portuguese territory, the Mediterranean monk seal persists to present days and was historically present both in the Azores and Madeira archipelagos, which was only very recently recognized [19]. The seal species displays a high site-fidelity, tends to occupy only a restricted part of the suitable habitat and, presently in the Atlantic, it can only be found in colonial aggregations [20, 21]. Similarly to the other two monk seal species, the living Hawaiian monk seal, *M. schauinslandi* and the extinct Caribbean monk seal *M. tropicalis*, the Mediterranean monk seal has been greatly impacted by human activities and has been exploited since ancient times. These seals have been hunted in the Mediterranean Sea for their oil and furs as early as since the classical Greek period [22, 23].

In the Atlantic, early captures began as soon as they were discovered by the Portuguese in the newly found Atlantic islands and in the then recently explored West African coast. Around 1420, new fauna and flora found during the maritime journeys were typically seen with scepticism and surprise, even though occasionally some animals appeared familiar to what was known in Europe [24] and their presence was normally recorded in explorer diaries.

The first new marine animal the Portuguese came across with was the Mediterranean monk seal, called sea wolf ('*lobo marinho*'), which was present in Madeira and in the West coast of Africa [26]. Early reports of monk seals show that, as for other sea animals, seals were interpreted as strange, monstrous and frightening beings [24]. In the case of sea wolves, however, shortly after acknowledging their docile characteristics, they started to be considered as an alternative and wealthy food source and resources. They were indeed the first product to be obtained and traded from the new Atlantic space to Europe [25].

When the first seals were recognized in Madeira in 1420, these animals were found in the form of a group of strange and calm animals with vocalizations very similar to those of wolves. Considering the medieval spirit, it is likely that men believed that all terrestrial animals had their equivalent on the ocean, and as such they named the seals sea wolves. Despite the initial surprise of finding such sea creatures, the subsequent encounters

triggered a continuous period of intense captures [26]. Despite more than a century of continuous exploitation since the first capture, these animals are still present in the Madeira island by 1580 to 1590 [25]. Even though the number of sea wolves in the Azores was smaller than in Madeira in 1420, there are several reports and descriptions also testifying their historical presence in that archipelago during the 15th century [26, 27]. For example in the São Miguel (Azores) island: *'While fishing here with some fishermen from Ponta Delgada city, who ate every night at shore or better on the stone or over the sandbank, a big sea wolf appeared which looked like a calf. He leaned against the rocks and they gave him lots of fish bones of what the fishermen were eating. ... and sometimes the fishermen, who have seen this sea wolf, also known as white mesh because he brought a piece of mesh behind his ear'* [27].

Portuguese navigators found once again sea wolves on the West African coast, in the 15th century, where they were also very easily captured [25, 28]. These quiet animals were encountered in large groups and the following account from 1436 is most probably the first description for this species on the Atlantic coasts: *'... he saw at the brook entrance a big crowd of sea wolves (according to some they were up to five thousand), he killed as many as he could and took their entire hide to the ship. It was a great slaughter ... and this happened in the year of 1436'*. The abundance and economic value of sea wolves justified the risks and the delays in exploiting these animals in the *Rio do Ouro's* coast [28].

The discovery of the multiple usages of their oil, fur and meat made the sea wolves very economically important. Their hides, after tanning, were used to manufacture clothes and shoes, and their fat was mostly used to manufacture soaps. In many soap-works, the quantities of fat were so high that it surpassed the quantity of olive oil used in this kind of product, being their oil frequently used [25, 28]. Machado [25] refers in his work that according to a list of imported products, sea wolves' hides were also quite solicited in European markets. The commercial value of sea wolves' products was extremely high [27]: *'As before, in Rio do Ouro, the Moors gave sea wolves' hides to Gomes Pires and promised him that they were going to search for gold and slaves if he came back there'*. Sea wolves were in fact a target of commercial marine exploiters, looking to obtain and trade their hides and oil.

To understand historical trends of presence and abundance, as well as the chronology of decline of sea wolves, we can estimate numbers for Madeira's population prior to the Portuguese exploitation of these resources judging by the capture levels and declining reports. This was achieved considering from published bibliography the historical known size of Africa's West coast population (population in *Rio do Ouro* was of five thousand individuals, according to the historical description by Zurara). In the present work, it was calculated that for Madeira in the early 15th century, i.e., prior to human arrival and exploitation, there was an estimated population size of almost 2000 monk seals. Sources and estimates show a historic baseline for the number of seals in both populations, prior to its exploitation, which allowed obtaining historical trends in a 580 years' time span (Figure 2 and 3). A chronology of decline was obtained reporting since the 15th century, and the trend of decline shows a reduction to half of its population during the first one hundred years and a smoother reduction over the last four centuries, until near extinction in present days. These events reflect heavy and intense exploitation of a marine resource preventing the natural recovery of the populations.

After the first encounter with sea wolves in *Rio do Ouro* in 1436, at least six trips were made to the African coast until 1447, with the exclusive purpose of capturing sea wolves. According to the chronicles, only one ship returned to the kingdom with no cargo [28]. The commercial value of sea wolves' products was extremely high and, at least in the Azores and Madeira, these resulted in a severe reduction in the population size. In the Azores, where probably only a small population lived, sea wolves were rapidly exterminated. In Madeira and for *Rio do Ouro* early takes resulted in a severe depletion during the subsequent couple of decades after the first encounter, which continued declining over the centuries, even though more smoothly [25,26, 28].

In certain cases, comparing abundance of animals from historical reports with present day animals could be considered by some as conjectural. For instance, historical descriptions of Madeira are very clear and are supported by their presence nowadays. However, for the Azores, there was no proof of sea wolves presence in the islands for a very long time. However, Azorean historical descriptions are quite similar to descriptions for Madeira, in terms of time and historical context, and there are clear resemblances in the morphological characteristics and behaviours described. We know very little about the sea wolves' life in the Azores in the past five hundred years and, as other authors have referred, this probably very small population (or vagrant individuals) did not survive due to the intense human exploitation in the 15th century [19, 29].

According to estimates for *Rio do Ouro* in 1550, the abundance of seals was likely to be considerable, allowing for a strong exploitation activity, however, there are no historical accounts reporting this activity. Although based on theoretical evidence, calculations of captures and boat capacity suggest that the reported abrupt decline in seals population between 1420 and 1450 was due to intense hunting. Since then, numbers are likely to have oscillated relating to hunting peaks from foreign ships or even from local people. Natural growth cannot overcome intense and continuous capture events and natural populations decrease severely under an anthropogenic predatory pressure. Typically, a species or population that endures a drastic event of overexploitation follows a path to extinction if no conservative measures are taken. Historical sources show that, following the discovery and commercial exploitation of the large West African sea wolf herds in the 15th century, monk seal colonies remained relatively undisturbed until the twentieth century. At the end of the 20th century, the largest population of the species lived in West Africa. The mean numbers, in the period 1993–97, were estimated to be 317 individuals and the population was thought to be stationary or changing at a very slow rate [29, 30].

All the documental sources comprised in the present work, led to the conclusion that sea wolves were abundant in Portugal and in the West African coast, from *Rio do Ouro* to Cape Blanco, and that the African coast was visited by the Portuguese navigators with the intentional purpose of exploiting its natural resources. It's also clear that sea wolves had an enormous commercial importance, and because of that were repeatedly and intensively captured [25, 28].

At the end of the 20th century, two major events regarding Portuguese and African monk seal colonies occurred. In West Africa, in the spring of 1997, a severe mass mortality reduced

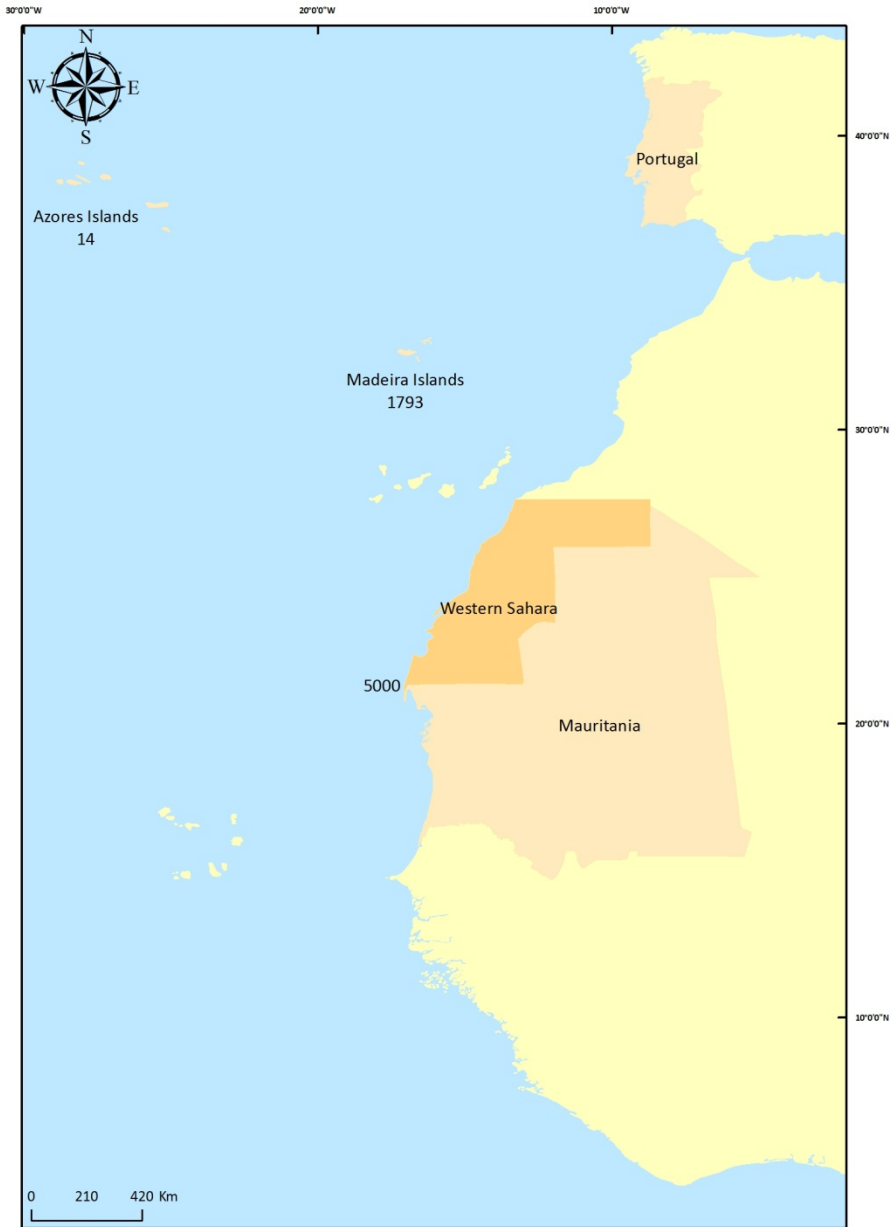


Figure 2. Map indicating the Mediterranean monk seal presence in some Atlantic locations in the 15th century and number of possibly pristine populations (known for the West African coast and the Azores, from historical sources, and estimated for Madeira).

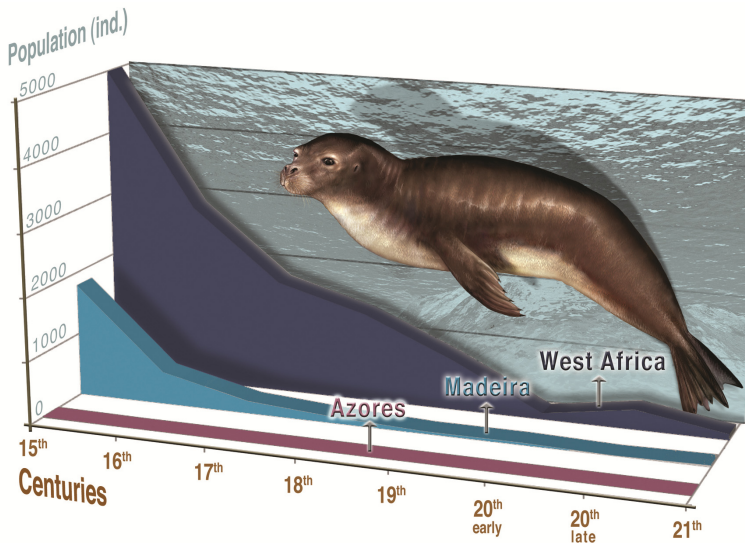


Figure 3. Graphic representation of early modern populations, from the beginning of the 15th century, in the West coast of Africa, Madeira and Azores and their probable decline over the centuries. Image credits of Mediterranean monk seal illustration: authorship and © by Fernando Correia (www.efecorreia-artstudio.com).

their numbers by 70%, compromising the recovery of the species in the Atlantic. Scientists were unable to determine whether the deaths were due to a virus or toxic algae, however the mass mortality had a significant effect on total numbers for species' abundance. In Madeira, from a surviving population of just six to eight animals, at the end of the 20th century, monk seal numbers have increased to an estimated twenty-four individuals. This was due to a special conservation effort from the Portuguese government, beginning in May 1990, which established a marine reserve and severe legislation protecting monk seals [31].

Presently, only these two breeding populations are known in the Atlantic, the one in Cape Blanc peninsula, with approximately 120 seals in a colonial structure, [32] and a smaller group in the *Desertas* Islands at the Madeira archipelago, with approximately 25 seals. Sightings are now rare in other areas within the historical range considered here, and only an immediate and significant reduction in anthropogenic pressures and range-wide coordinated actions will allow their survival [30, 32].

4. Iberian whaling and transatlantic whales

Whales have for long being of great interest for people. Whales figured in ancient legends and visual representations as terrifying sea monsters, and inspired poets and artists with their strange grace and immense size. Over the years, an entire whale mythology thrived, inspired by the mystery surrounding these creatures' habits [33]. Whales have mainly been hunted throughout the centuries for their economically valuable oil, meat, bones and baleen.

Scientifically, the interest in the ecology of whales and their preservation are in fact relatively very recent. It was not until the 18th century that the whale was designated as a mammal rather than a fish, while cetology, as a scientific discipline and a branch of zoology, dates back only to the 1960s [33]. Historically, studies about whaling can be found since the early 20th century [e.g. 34] to the present day [e.g. 35].

Next is given an overview of two different perspectives for the starting of a similar maritime activity in two relative similar regions and by the same period. One based on transfer of technology from Europe to Portuguese South America, based on already known hunting techniques, and the other based mainly on local native knowledge in English North American colonies. It will be possible to understand that it was the implementation of the Basque whaling technique that allowed the early establishment of a continued and lucrative industrial activity in Brazil, since the beginning of the 17th century, in opposition to what happened in North America.

The Basques were the first western people to intentionally hunt large whales, establishing the characteristics of the industry for the following hundreds of years [36, 37]. The hunting procedure encompassed pursuits in small open boats and captures with hand harpoons and lances. This procedure began being used in 1050s and was used for many centuries [35, 38-40]. In mainland Portugal, the first references to whales date back to the 12th century, in the form of local records related to stranding, scavenging of whale remains or whaling related activities [10, 41]. The Portuguese history of cetaceans and humans has been documented in reports, descriptions, tales, legal documents, laws and regulations and tithes.

The Biscay right whale (*Eubalaena glacialis*) was the main targeted species in the Basque country [42], [37, 43]. Initially, The Basques expanded their whaling captures locally and regionally from the shores of the Bay of Biscay, to the south of France and north of Spain [36]. As shown by Aguilar [40], Basque historical sources indicate that whaling started in the Basque French country and continued south and west over the years, through a transfer process of information and technology. Basque navigators had shown the way on whaling enterprises and, for a long time, Basque whalers and pilots were employed on many ships, transmitting the experience gained during their activity [37]. Later, the Basques established permanent or semi-permanent shore stations for whale processing across the Atlantic Ocean, encompassing also the provinces of Santander, Asturias and Galicia [37, 40, 42, 44, 45]. For Basque whaling in European shores, many of the sources specify black whales as the target species. This is consistent with knowledge about the distribution and migration patterns of North Atlantic right whales, in medieval Basque times and early modern whaling. By the 16th century Basque whalers were regularly migrating and conducting expeditions to northern European seas and across the Atlantic to North America [46, 47]. They depleted right whale and bowhead populations in the Strait of Belle Isle, between Labrador and Newfoundland, by killing tens of thousands of whales from 1530 to 1620. And later, between 1660 and 1701, they were hunting whales in the western Arctic, reducing stocks considerably and affecting the whales' migratory patterns [3]. In later periods, especially after the 16th century, Dutch, British and other non-Basque entrepreneurs and

whalers were also involved in the whaling trade from European ports and their overseas territories [for a review see 46 and 47].

The whaling activity was much more reduced in mainland Portugal. In the 20th century, there were two periods when short-lived enterprises operated whaling stations and used modern, Norwegian-type, whaling technology [48]. Also for the 20th century, besides the important presence of land based whaling in the archipelagos of Madeira and Azores (Figure 4) no other significant whaling episodes were historically recognized for Portugal. In previous works by the author [41, 48] a total of 38 historical sources recovered date from the 13th century, suggesting that Portuguese whaling began earlier than in the previously thought 20th century. There was a peak of whale-related events in the 13th and 14th centuries, contemporary to those found for the French and Spanish Basque countries, suggesting whaling started approximately at the same time in the both North and South Europe. Hence, it is now considered that whaling was not introduced in Portugal by the Basques, who instead spread westward from the French Labourd (11th century), via the Gulf of Biscay, to Asturias, and southward to Galicia (14th century). The Portuguese whale captures is thus thought to have originated independently of Basque influence. The Portuguese sources do not clarify the species captured, numbers of whales taken, nor to the whaling technology used, but the activity was sufficiently well organized and developed to warrant the levying of tithes in the feudal system of 13th century Portugal [41].

In the 13th century, several whale products started to be utilized in Portuguese fishing villages [49]. The exploitation of large whales and small cetaceans in the near shore waters of mainland Portugal seems to have originated in the medieval times. However, a comprehensive study is still missing for Portugal shores. For instance, whaling and the presence of whales in the Basque shores has originated typical iconography and culture in that region over the centuries [36, 50]. Such historical pattern has not been observed in mainland Portugal and it is one important aspect to be considered in the future to understand on the species exploited and the intensity of this exploitation. During the 15th and 16th centuries, whaling expanded from the Portuguese shores, through the Atlantic Islands to overseas countries, particularly to Brazil. In Brazil and since the early 17th century, Portuguese settlers started a shore whaling business but a Basque crew was recruited for the first couple of seasons [51]. Since that time, and for two centuries, a structured shore based whaling enterprise developed in the coastal waters of Brazil, mainly devoted to the hunting of humpback whales during the calving season [51].

Hence, historical records allow to understand that Portugal together with the French and Spanish Basque Country were important whaling locations where a whale culture was developed and spread [41]. Portuguese whalers always conducted a land-based type of whaling while the Basques conducted a typical offshore whaling when moving into the Atlantic away from their Iberian shores (Figure 5).

For the West North Atlantic, a certain type of native whaling was referred for the North America by the 16th century. Following the descriptions by Acosta [52], the natives seemed to capture near shore whales with sticks and ropes. Additionally to the native resource exploitation, John Smith seems to have been the first European trying to systematically

exploit this resource in North America [11]. He writes that the purpose of his 1614 New England journey was to hunt whales. This explorer, aware of the Basques expertise in whale hunting, asked in 1616 for permission to accompany their whaling expeditions to the North Sea, a goal he did not accomplish.

Since that time, settlers have tried to exploit this potentially profitable resource, although no records exist on the procedures and techniques used. Probably they have conducted a rather simple and primitive method of whaling, as shore-based whaling was not yet developed in West North Atlantic. In the Bermudas, for instance, the first whaling season only occurred in 1663, and only from that time onward did the operations intensify. Initially captures focused on the humpback whale (in 1700, 200 individuals captured), but as soon as these species became rare by the mid-18th century, captures were re-directed towards sperm whales [11]. Again, from the Bermudas example, it was only when the settlers from different European nationalities were permanently fixed in the overseas territories that it was possible to develop a whaling activity.

The beginning of whaling in the overseas regions was mostly supported on Basque expertise [36]. The Basque whaling model using small open boats and hand harpoons is particularly relevant in a context of globalization of techniques and ways of handling captured animals, their remains and products.

Hence, the historical information discussed here provides insight on the environmental history of whales and the importance of certain maritime extractive activities across the Atlantic. The interest on implementation of whaling overseas is indicative of the abundance and distribution of whales in those regions and of its value as local and global marine resources.



Figure 4. Oil painting (private collection) by an anonymous author, dated from 1876, showing a scene of sperm whale hunting in the Azores, with the subtitle: “On the 30th of March of the year 1876, thanks to the Lord, this whale on my harpoon was struck”. Photographed in 2005 by Cristina Picanço.

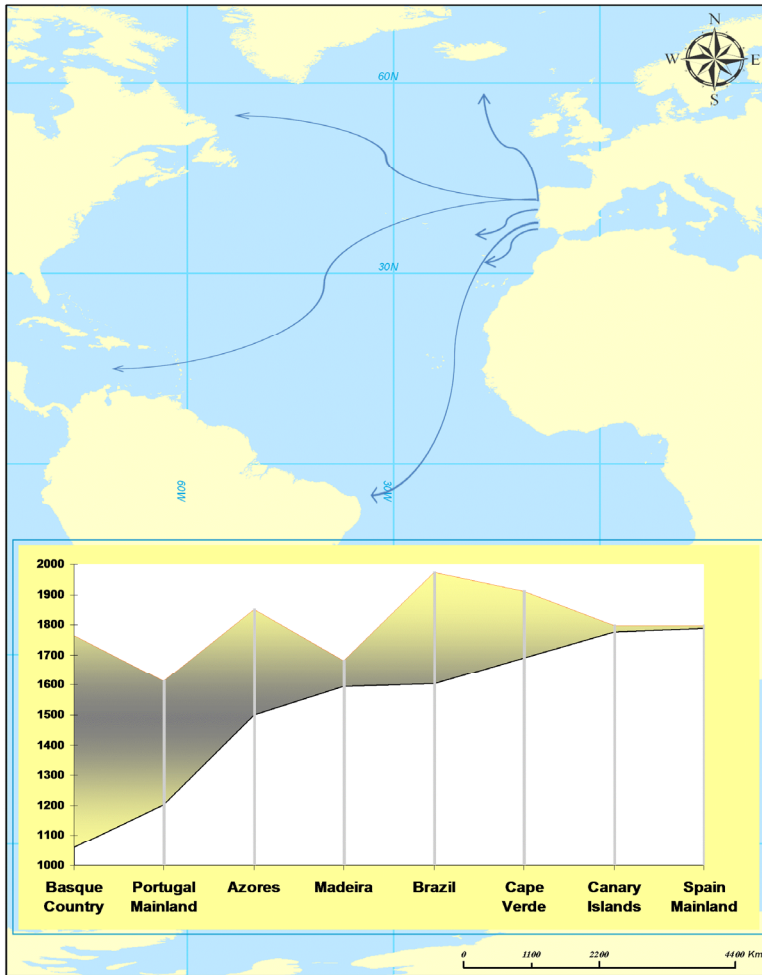


Figure 5. Geographical migration of Basque and Portuguese early modern whaling through the Atlantic (map) and temporal migration (graph) showing the years of the beginning and end of the activity in each area. Data compiled from Aguilar (1986), Reeves & Smith (2006) and Brito (2011).

5. A future glimpse into the environmental history of marine mammals

Many centuries ago, the Atlantic experienced a (near) pristine situation regarding ocean environmental equilibrium. Levels of the populations of predators and prey were relatively stable and fluctuated naturally. Natural disasters happened with much more localized effects and the impacts of climatic shifts were gradual and predictable. Marine resources were historically exploited, however, until the advent of industrialization, rapid depletion and ecological tipping effects were hindered by lack of technological advances. Industrial

Revolution provided the combination of sudden increases in manpower accompanied by new tools and technology which caused overfishing, produced changes in the environment, and cause shifts in ecosystem services and global cycles. The impacts of anthropogenic actions have accelerated in the last decades and are ubiquitous, fast and intense, and exceed the ability of the natural world's adaptation potential. However, the history of human interactions with marine environments remains largely unstudied. The marine environmental history is, now, a useful tool to understand the past ecological and cultural Human driven transformations in oceans worldwide at small and large spatial and temporal scales.

Marine mammals (either whales, dolphins, and seals, or even manatees and dugongs) represent good case studies for the single-species approach to marine environmental history. The two case-studies presented in this chapter are an example of the valuable outcomes of an interdisciplinary analysis to recreate the environmental history of marine mammals. This history can then be used to frame present traditions as well as population levels of mammals.

The future of marine environmental historians, dedicated to the study of marine mammals, will greatly benefit from focusing on the research of the relation of people with species, with special interest in specific economic and/or cultural isolated situations, such as African and Brazilian manatees, or cetaceans' historical presence around oceanic islands. For instance, historically in some Atlantic cultures, cetaceans were considered "a different kind of fish", as their recognisable natural behaviour and some morphological characteristics are distinct from fish [53]. Studies related to local perceptions changing over time can also provide inputs to the environmental history of marine mammals and contribute for the implementation of long-term and continuous scientific research, interactive environmental education plans and conservation measures. This type of research may include different kinds of historical sources, such as written, iconographic or material sources, and all types of accounts from the period since the late 15th century. European reports of Atlantic (or other oceanic basins) journeys contain information about natural elements and marine mega fauna and represent invaluable sources of research. For a later period (from late 19th century onwards), scientific articles, newspapers, illustrations, maps, non-published scientific reports and some other grey literature, such as unpublished thesis, may also be used. Good history begins with good sources [3], but good marine environmental history needs also to be framed into interdisciplinary boundaries.

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