



PROCEEDINGS OF THE ECS WORKSHOP

MARINE MAMMAL HISTORY

**Held at the
European Cetacean Society's 21st Annual Conference,
The Aquarium, San Sebastián, Spain, 21st April 2007**



Editors:

Cristina Brito and Peter G.H. Evans

**ECS SPECIAL PUBLICATION SERIES NO. 50
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INTRODUCTION

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Marine mammals and humans have a long common history of ecological and cultural interactions. Despite the great interest of the general public towards marine mammals, a number of conflicts on the use of the marine environment have also been historically present. The historical relationship between humans and marine mammals through harvesting is one of the oldest of these, and San Sebastian (in the Spanish Basque Country) has played an important role in the history of whaling.

From strange and frightening sea monsters to stranded or captured animals used by humans and, more recently, as natural populations that need to be studied and protected, marine mammals have always been a part of different coastal human cultures all around the world. But it was after the 16th and 17th Centuries' encyclopaedic naturalism that science, mentalities and knowledge started to develop, and only during the second half of the 20th Century that significant understanding of these animals arose.

This workshop on “Marine Mammal History” was held on 21st April 2007 in the Aquarium at San Sebastian, Spain at the 21st Annual Conference of the European Cetacean Society.

The purpose of the workshop was to bring together experts and other interested parties to review the types of information that can be gleaned from historical literature, and to relate this to scientific advances in the study of marine mammals. Particular emphasis was placed upon the situation in Europe.

Six invited speakers were present (three with a history/human sciences background and three with a biology/natural sciences background), and a total of 21 participants attended the workshop. We thank all the speakers and those that participated in the workshop. This volume contains the six presentations on this theme.

HISTORICAL WHALE STRANDINGS: SOURCE CATEGORIES AND RECENT RESEARCH TRENDS

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INTRODUCTION

The analysis of historical whale stranding records yields valuable data on past spatial and temporal distribution, and iterative occurrence of various species of cetaceans in coastal waters, and sometimes even on the relative composition of stocks with respect to age-groups and sex, thereby giving clues to the social structure of certain stocks (Kinze, 1995; Jacques and Lambertsen, 1997; Tougaard and Kinze, 1999). Such data are of prime importance in the context of the ongoing History of Marine Animal Populations (HMAP) Project. Historical stranding records may also be a source of information on cetacean behaviour displayed under the stress of stranding, which in turn can yield lessons for on-site management in cases of cetacean live strandings. To the historian of science, historical stranding records impart insight into popular and scientific knowledge about cetaceans and the mutual influence between these two fields of cognition, which are equally of interest to the cultural historian, whom they serve to reconstruct the historical cosmology of the society in which the respective record was created. Additionally, illustrated records of cetacean strandings document the development of our visual perception of whales, not only for the scientist researching the history of Cetology, but also for the art historian studying humankind's age-old fascination with the psychological archetype of the "Great Fish", which in all maritime cultures is represented by the whale (Barthelmess and Münzing, 1991; Sliggers and Wertheim, 1992; Barthelmess, 1998; Faust *et al.* 2002; Barthelmess, 2003).

The awe inspired by this psychological archetype has never prevented humans from chopping up stranded whales to avail themselves of their useful body parts: protein for human consumption; fat for warming (body ointment, heating fuel) and lighting (fuel); hard tissue (bones, baleen, teeth) for construction, tools, ornaments; and butchering offal for fertilizer where agriculture was practised. Whales were a valuable commodity. In the 12th century at the latest, legal regimes in various maritime parts of feudal Europe formulated legal claim to stranded whales as they did to wrecked ships; they regulated ownership shares and the distribution of the profits accrued from them.

LEGAL REGIMES

Whereas legal regimes do not provide concise data on historical whale strandings, they reflect an awareness of the medieval legislators of such occurrences, although great care must be taken not to draw conclusions about the frequency of such events. Theoretically, a single event might have stipulated relevant legislation, possibly the product of "wishful thinking" rather than of the need to regulate cases that frequently raised property disputes (Lindquist, 1997; Barthelmess, 2003).

CHRONOLOGICAL AND HISTORICAL LITERATURE

Both the traditions of legal regimes concerning stranded, valuable whales and the human awe of the "Great Fish" are the background for early written records of stranded whales. They are found in local and regional chronicles recording much of what was perceived "news-worthy" by the writers or the people on whose behalf they wrote. Sometimes excerpts from such chronicles found their way into more comprehensive historical literature (Barthelmess, 2003).

COMMEMORATIVE DISPLAY OF WHALE BONES

Sometimes whale strandings were commemorated by displaying spectacularly large bones on buildings of religious or worldly powers, such as churches, castles or town halls. These displays, however, usually have to be interpreted as sacred samples of the “hierozoikon”, in other words, animals hallowed by being mentioned in the Bible. Very rarely are they accompanied by inscriptions or related texts that give a date of an actual stranding event. It is not until the social emancipation of the non-nobility in the late Renaissance or early Modern Period that wealthy merchants started to display the bones of stranded whales (or hunted whales, if they were whaling entrepreneurs) on their property (Redman, 2004).

COMMEMORATIVE PAINTINGS OF STRANDED WHALES

At the same group of buildings of religious or worldly powers, such as churches, castles or town halls, one may also find examples of a different way to commemorate the noteworthy stranding of a whale, viz. by a painting. These usually were of a large, if not monumental, format. Some were life-size “portraits” of the whale. Here, one normally finds a commemorative inscription giving details about the stranding event, and the image gives further clues as to species and sex (Barthelmeß, in press).

BROADSIDES AND PAMPHLETS

Broadsides and pamphlets are the precursors of the newspaper. They started to appear within one generation after the invention of the letterpress. Broadsides are printed on one sheet of paper, normally on one side only. They were sold by mountebanks at fairs and other events attracting large crowds, in print shops, but also by migrant peddlers wandering from farm to farm or house to house. Given early modern printing technology, runs will mostly have been in the range of a few hundred to two thousand copies at maximum. Throughout much of their history, broadside retail prices amounted to approximately half a day’s income of an average artisan or craftsman. Illustrations sought to increase the attractiveness of these news-sheets for the mostly illiterate clientele. The peddler had to know the story printed in the accompanying text, sometimes written in ballad form so that he could sing it to his audience. The proud buyers could then show the image to other people and tell them what they remembered of the peddler’s or mountebank’s performance. Almost anything of interest to newspaper readers today was covered in broadsides and pamphlets – small booklets of four to 24 pages, sometimes illustrated as well, of similar scope – in their time, although religious issues played a more dominant role than today. Besides these, we find crime, sex (here: adultery), politics, war, catastrophes, accidents, executions, social events, unusual phenomena, and also media hoaxes.

A German research project (Faust *et al.*, 2002) on zoological broadsides and pamphlets prior to 1800, calculates the proportion of animal-related ephemeral broadsides among the body of German broadsides in the second half of the 16th century, as ca. 7%, but this figure diminishes in subsequent centuries, and may not be representative of other countries. But of almost 1,000 zoological broadsides recorded so far by this research team, ca. 15% relate to whales. This is by far the largest proportion of any taxon represented in this body of early news media. Broadsides and pamphlets are therefore one of the most important source categories when attempting to reconstruct historical whale strandings.

Unfortunately, after some time of use, these ephemeral prints were treated as we treat our newspapers today ... they were thrown away. With very few exceptions, academics, scholars, and collectors did not extend their bibliographical diligence to these products of ephemeral

print shops and popular culture. Thus, there are almost no bibliographies that facilitate any systematic access to these prints.

In their time, the local agents of the big international merchant houses – such as the Fuggers and Welsers – often added illustrated broadsides to the correspondence, in which they reported news and market trends to their “mother company” in South Germany or Northern Italy. These wealthy merchant houses often were patrons of the arts and the sciences. The same applies to some Renaissance sovereigns with an astute interest in the rapidly advancing knowledge about the world. Some of them owned cabinets of curiosities or “wunderkammern”, which are the origins of our museums. Often, merchants and sovereigns would pass such information on to academics and amateur scholars compiling systematic works on zoology. In the papers, scrapbooks and albums of these academics and scholars, some illustrated broadsides have survived, being untapped repositories in which to look for such documents.

Illustrated broadsides and pamphlets transmitted from agents via merchants to scholars are frequently the basis for knowledge and images published in their compilation works on zoology. Any study of cetology in the Renaissance Period must take this important source group into account.

Stranded whales are featured in broadsides and pamphlets in all European countries as well as Russia (in the form of *luboki*). They are also featured in Japanese colour woodblock prints (*ukiyo-e*). Coverage of whale strandings was particularly common in areas where the strandings occurred in the vicinity of metropolises where arts and printing presses were concentrated (Barthelmess, 2003).

DRAWINGS WITH A SCIENTIFIC, ADMINISTRATIVE AND ARTISTIC BACKGROUND

This group of source material is not substantially different from published broadsides and pamphlets. Some eye witnesses of strandings made sketches or drawings, supplying additional textual information on the event. The motivation for preparing these may have been purely artistic – there are a few sketches, especially by Dutch or Flemish artists – administrative, such as the accurate location map and, much less accurate, image drawings by Sande of ten sperm whales stranded near Algeciras in 1784, or scientific, such as some detailed Dutch whale drawings from the 16th-century (Barthelmess, 1994; Barthelmess and Svanberg, 2006).

RECORDS OF THE COMMERCIAL EXHIBITION OF WHALES

Exhibiting whales for popular entertainment – and money, of course – has an incredibly long history. The logistics of these exhibitions were quite varied. The earliest record of a commercial exhibition of whales, whale skeletons, or parts of whale carcasses, is a report of a skeleton from the coast of Jaffa in Palestine that was transported to Rome for public edification in 58 BC. This was of a stranded animal, and, in fact, stranded animals were the source of most of the commercial exhibitions of whales prior to 1900. Sometimes the carcasses were just displayed on the beach for a few days before being cut up, with a tarpaulin set up to shield them from the views of non-paying visitors. Sometimes skeletons of dried body parts were put on carts or river barges, to be shown at fairs and other events of popular entertainment. Like “quacks” and other migrant peddlers, jugglers, circuses and menageries, the business of travelling road shows did not enjoy high social prestige. Authorities tried to keep a keen eye on them, and their profession was looked upon as intrinsically dishonest. In fact, the mountebank character of many of their advertising handbills, posters, and souvenir

broadsides and pamphlets give evidence of shameless exaggeration and little regard for fact. Nevertheless, with proper scholarly interpretative care, some of their publications yield useful data on historical whale strandings (Barthelmess, in preparation).

MODERN MEDIA

Whale strandings today tend to generate a public awareness and culture that is often quite different from that of the past (Rose, 1989; Linnman, 2003). Modern print and electronic media are much more easily searchable for records of whale strandings, and are therefore not covered here.

TRENDS

The ongoing research on historical stranding records, making use of the sources outlined above, sheds light on diachronic patterns of distribution, migration and the erratic occurrence of cetaceans. Resulting insights can be put in the context of interdisciplinary research concerning, for example, trends in abundance and environmental change including habitat degradation, ocean current variation, and global warming. A most interesting research approach is that of Vanselow and Ricklefs (2005), who convincingly correlated sperm whale strandings in the North Sea with sun spot activity.

Their findings counteract the hysteria of the popular media and donations-collecting organisations, who thrive on real and perceived catastrophes. But they also can have repercussions on the national research policy and the funding of research, for it is easier to obtain funding if a grant application is formulated with an urgency that corresponds to public opinion, non-expert and hysterical as it often may be.

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WHALING ON THE MAINLAND OF PORTUGAL SINCE THE 13TH CENTURY: A FIRST APPROACH

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INTRODUCTION

Whaling is an activity occurring all over the world since prehistoric times. Whaling in the Iberian Peninsula dates back from at least the 11th Century. The early hunt, mostly carried out by the Basques, concentrated in the northern part of the Peninsula (Aguilar, 1986).

During the 12th Century, whaling was also frequent along the Portuguese coasts. At the moment it is not clear if this technology reached Portugal from the Basque country or if Portuguese fishermen were using the same methods independently. Probably the presence of such a natural resource was the starting place for the development of similar hunting techniques and achievements. There were already indications that whaling occurred in the central region of the country, through a reference to the Berlengas islands, referring that “king D. Manoel offered [to the monks of the Berlengas monastery] the islands (...) as well as fishing within a mile around these islands, which included as fishes all whales” (Brito, 2002).

METHODS

Historical based research was conducted during 2006, which allowed obtaining of data and historical records from fishing and whaling on the Portuguese mainland since the 13th Century. Historical research of Old Portuguese documents was conducted at the National Library of Lisbon and other regional libraries. Whaling data for the beginning of the 20th Century were obtained through Sanpera and Aguilar (1992). More recent statistical information was obtained from the Statistics of Maritime Fishing of the Continent and Adjacent Islands Industrial (Anonymous, 1896/1906), the Industrial Statistics (Anonymous, 1943/1964), the Agriculture and Feeding Statistics (Anonymous, 1965/1968), and the Fishing Statistics (Anonymous, 1969-1985). This research revealed whaling references for several sites along the mainland Portuguese coast (Fig. 1).



Figure 1. Map of Portugal showing the coastal regions with historical whaling references

RESULTS

Whaling in the Middle Ages

By the late 12th Century, the movement at Atouguia seaport was already intense mainly with respect to fishing activities, maritime commerce and salt industrial exploitation, in such a way that under the economic point of view it was considered one of the most important ports in the Portuguese coast during the first centuries after Portuguese independence from Spain. Whaling was certainly well known (Calado, 1994). Frequently, during the breeding season, the whales stranded on the beaches and died suffocated by their own weight, in such a way that the right to the “sea spoils” included “ship, boat or anything with its merchandise, or a whale and everything else the sea throws away”. We can admit that some of the “whaling sites” mentioned by early documents from the 1st dynasty were places only for whale’s oil extraction, slaughter and meat drying. In this sense we can understand a determination from the Ericeira *foral* (1229) to not allow “any other whaling processing sites” (Castro, 1966). This same *foral* prescribed the taxes to be paid by fishermen, including fees upon captured whales and dolphins. Thus, in the 12th Century, at Ericeira and other maritime locations, the hunting of those cetaceans was very frequent (Alves, 1965).

Whale hunting was current since the Court of Leiria in 1254, once the king ordered the compulsory payment of a convent’s debt with the incomes “from the whale’s oil and other parts processed in Salir and Atouguia seaports”. By that time, in the 13th Century, while whale hunting was under strong development in Atouguia, many fishermen settled down in Baleal (“the rent of the living houses that the king built up in Baleal for whalers”), and they were the owners of an important fleet of ships equipped for whaling. This location was used not only for butchering but also as a processing centre for extraction and preparation of cetaceans’ oil (Calado, 1994). Besides the grass with which the oil is made, and the bones from where the glue is taken, “there was an extended use of the meat for cooking purposes in such a way that the price of their wide beef was largely bargained by fish vendors dealing with a good business proportionate to the high consumption of fish in Portugal”. At least, it was very much appreciated by the Portuguese royalty, for instance “we are aware of one bill ordered by King D. Afonso III to its intendants regarding the collection of 2,658 incoming whale’s slices into the royal storehouse, as a result of services and crops of fishing villages” (Calado, 1994). So all the whales were used, including the ones that had died on the beaches, and those others that were killed at sea. Later on, this fact was publicly recognised under a rental contract for the entire whaling campaign from “the mouth of the river Minho to the mouth of the river Guadiana”, signed by the King and the marketer Vasco da Serra in 1335 or 1336, containing the following item: “and the referred marketer has the right upon all the whales and similar maritime animals killed by the whalers” (Marques, 1992).

By that time, 14th Century, in Almada, Sesimbra, Palmela, Setúbal and Alcácer regions, there were important fishing activities for tuna, sword-fish and dolphins. On the other hand, it was always possible that some whales and other cetaceans or big fishes might die at Sesimbra, Sines or any other place, where special apparatus was required for their capture (Silva, 1953). The people of Lagos also gained a strong interest in whale hunting due to the privileges’ confirmation attributed to the whaling masters in March 1359. From this confirmation, it is reasonable to assume there was already an industry existing since the previous kingdom. By this time, a letter had also been signed on the 1st September 1352 by the Municipality of Tavira claiming the whales that had died at Porto Novo and were undertaken by caretakers. Then, “looking at the national industry, whale hunting all along the Algarve coast was an important objective” (Silva, 1953).

By September 1367, the whaling in Atouguia was still rather important and the whalers would remain there once the fishermen were given by the King the cancellation of the previously paid tax, which was replaced by another tax (1/20th part of all fished products), together with the right not to be recruited for the galleys' 30 rowers nor serving on the royal whaling (Calado, 1994). The Atouguia's commerce was still large enough and its Baleal sufficiently famous in such a way that by the end of the 14th Century, there was a record of incoming whales from there and from Algarve at the Lisboa portage *foral* (Silva, 1953). Another indicator of this activity's economic growth is that in 1370 Aires Gomes da Silva was given royal rights on Atouguia except for the whaling (that would remain as a crown utility).

Whaling in Portugal during the discoveries and Renaissance Period

During the 15th and 16th Centuries, the Atouguia's coast filled up with sand, and Peniche moved to the continent so the fishing activity, namely the whaling, lost its importance as a consequence. However, from the north to the south of Portugal, there are many similar locations (not yet investigated), e.g., Osso da Baleia (*Whale's Bone*), Cruz da Baleia (*Whale's Cross*), and several Baleiras (*Whaleboats*), which indicate that such an activity was carried out in other locations in the country.

By the mid-15th Century, the whales moved far away from the coast. In accordance with a document from 1486, "some houses were rebuilt over the 30 to 40 year old ruined facilities previously used for whale processing". In the kingdom of D. Sebastião, there were reports of many stranded whales in Algarve "from which oil was extracted as a profit to the royal properties". From one whale 20 metres length, one could take 10,000 litres of oil, or 15.000 kilos of meat that was even eaten at the King's table (Pedrosa, 1987). Also, in Ericeira, by the 16th Century, all the whale and dolphin captures were totally replaced by the capture of common fish species, such as rays (Alves, 1965). Further, during the 15th and 16th Centuries, the Portuguese sea discoveries and the related marine experience focused the Kingdom's interests on far ocean waters instead of coastal ones, as well as on the fauna and maritime resources from the Atlantic islands and the new-found African and Brazilian coasts.

Whaling during the 20th Century

In the early 20th Century, common dolphins (*Delphinus delphis*), locally known as "toninhas", were frequently captured off Sesimbra as indicated by the number of individual hand harpoons registered in the national statistics. Fishing data show that, at least, between 1896 and 1906, dolphins were captured, but there are only references to 1902, 1904, and 1906, with 39, 41, and 41 harpoons respectively officially listed. Even though data were found only for some of the years, the absence of data does not mean the absence of harpoons in the other years, but rather the lack of registered information found on the fishery. After this, two other periods of fishing data referring to the capture of great whales were found, the first between 1921 and 1927 (Fig. 2, and the second from 1942 to 1985 (Fig. 3).

Considering the whaling period of 1942 to 1985, great whales were only captured during eight years. In this period, 584 whales were captured, and 1,252 tons of fresh meat and 63 tons of conserved meat for human consumption, 730 tons of meat flour and 451 tons of bone flour were all obtained, and 2,141 tons of debris for guano production were produced.

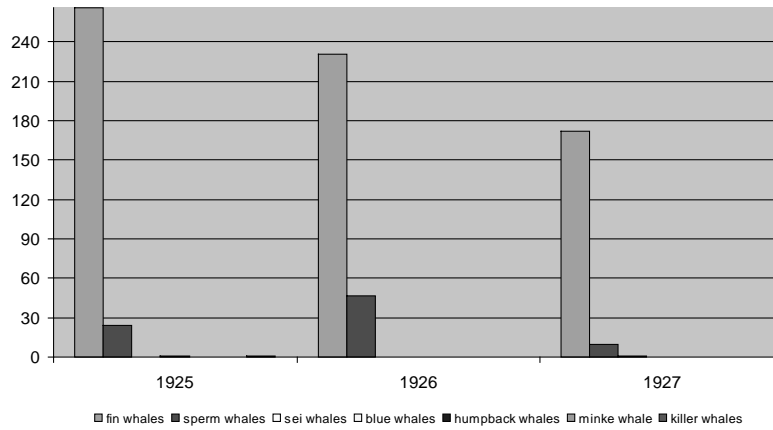


Figure 2. Captures of fin and sperm whales during three years (whaling period of 1921-1927).

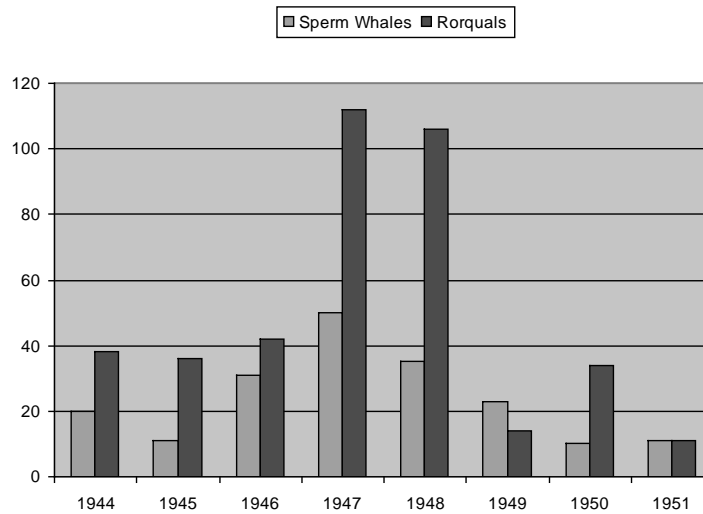


Figure 3. Captures of rorquals and sperm whales during eight years (whaling period of 1942-1985).

In a more global view, from 1921 to 1985, there is at present evidence of only 10 years of effective mainland whaling. In a comparison of the total number of years of whaling and the number of large whales captured in each year (Fig. 4), an inverse significant correlation was found (Spearman $R = -0,7697$; $p < 0.05$).

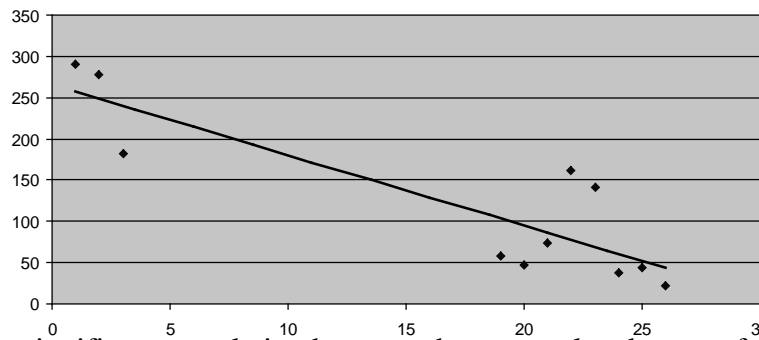


Figure 4. Inverse significant correlation between the accumulated years of whaling and the number of great whales captured in each year

CONCLUSIONS

The commercial exploitation of whales was an important business on the mainland of Portugal since the Middle Ages and along the centuries, even though there were peaks at certain times. Whales were historically hunted for their main resources: oil and meat. Early in the 13th Century, the seaport of Atougia was one of the most important sites for whale

exploitation, as well as Ericeira. Despite it being not completely clear, it seems that Portuguese whalers were going out to fish for whales near-shore, and that the so-called whaling stations on the beaches were actually not mainly places of meat and bone cutting and oil extraction. This activity declined during the 15th and 16th Centuries with the decrease in whale numbers on the coast, and with the adventure of Portuguese discoveries overseas. After that, whaling re-started only with more industrial techniques at the end of the 19th Century. By the mid-20th Century, again with the depletion of stocks and the new increase of public awareness for conservation and scientific interests in these animals, whaling was considerably reduced. On the Portuguese mainland, whaling officially ended in 1981 with the implementation of national protection legislation, although there are no records of whales or dolphins captured since 1951. Nevertheless, it is important to remember that this is the first approach to the subject, and that missing data may still emerge from the investigation of different or not yet found fishing statistics and other historical records.

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19TH AND 20TH CENTURY WHALING IN FLORES AND SANTA MARIA (AZORES, PORTUGAL) AND SÃO TOMÉ AND PRÍNCIPE (GULF OF GUINEA): A BRIEF REVIEW OF EASTERN ATLANTIC WHALING

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INTRODUCTION

Whaling has existed in Portugal since the Middle Ages (Aguilar, 1986), and in the Atlantic Portuguese islands since its discoveries in the 15th Century, at least in an opportunistic way and with rudimentary technology (Frutuoso, 2005). It was only much later in the 19th Century that more industrial techniques started to be used, and these activities became economically significant.

The islands of Flores and Santa Maria are on opposite extremes of the Atlantic archipelago of Azores (Portugal) and, as with some of the other islands, an important whaling industry was established there. In fact, Flores was the first island to conduct commercial whaling early on in the 19th Century under the American influence, probably due to its western geographical localization (Gomes, 1988). In Flores whaling started in 1864 and in Santa Maria whaling started in 1896 (Puim, 2001). São Tomé and Príncipe are also historically known for being a breeding ground for humpback whales, which have been the main target of whale captures since the 19th Century. In this equatorial archipelago, early in the 20th Century and until middle of that century, large numbers of sperm whales, humpback whales, and other great whales were captured (Mouzinho de Figueiredo, 1958). After that, the industry was abruptly abandoned when the number of cetaceans dramatically decreased.



Figure 1. Map of the Atlantic Ocean, showing the Portuguese mainland, the archipelago of Azores in the northern hemisphere, and the archipelago of São Tomé and Príncipe in the southern hemisphere

We conducted an historic and socio-cultural research to collect whaling information in order to recognise large-scale temporal and spatial changes of this activity in the Eastern Atlantic. Our objective was to proceed to a brief review of whaling during the 19th and 20th Centuries in some small Atlantic islands (Fig. 1). We also tried to generally understand the development of the activity, and its impacts upon natural populations of cetaceans.

WHALING IN FLORES AND SANTA MARIA

The data on whaling numbers were obtained from several sources, such as Clarke (1954), Gomes (1988), Puim (2001), as well as from Portuguese statistical publications (Anonymous, 1943/1964; Anonymous, 1965/1968; Anonymous, 1969-1985).

From 1864 until 1977, a total of 1,904 sperm whales were captured in Flores (Fig. 2), whilst in Santa Maria, a total of 867 were captured between 1896 and 1966 (Fig. 3).

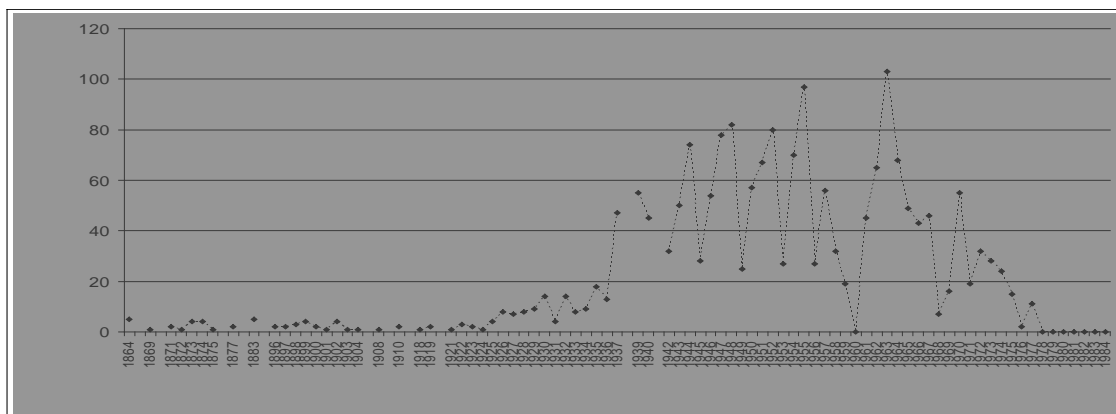


Figure 2. Number of sperm whales systematically captured in Flores islands over a period of more than 100 years.

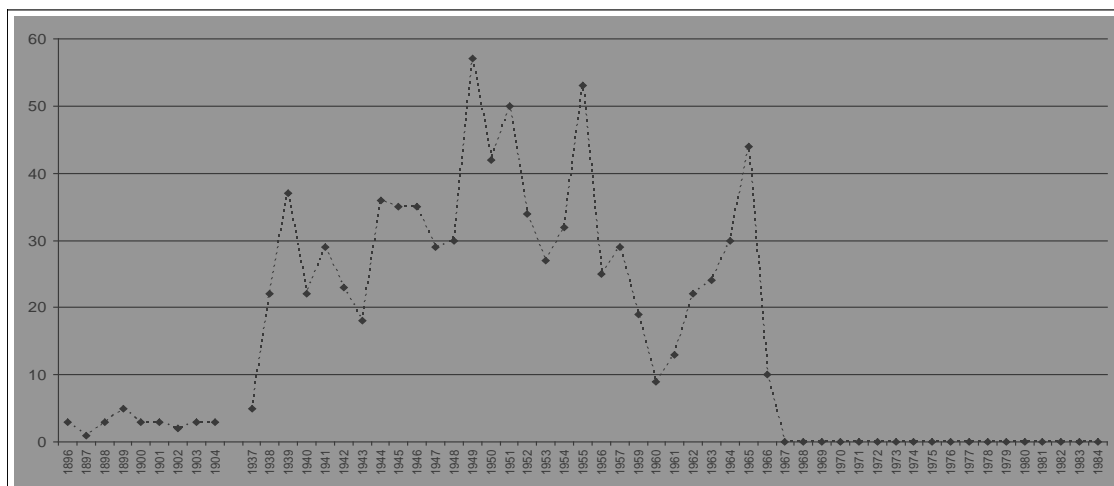


Figure 3. Number of sperm whales systematically captured in Flores islands over a period of almost 100 years.

By the end of the activity in these islands, a total of 156 years of whaling (in Flores) and 87 years (Santa Maria) was accumulated, and its destructive impact has been enforced on the natural populations of sperm whales. A strong and significant negative correlation was obtained when we correlated the accumulated years of whaling and the number of captured

sperm whales over those years, both for Flores (Spearman $R = -0.69281$; $p=0.00$) and Santa Maria (Spearman $R = -0.74414$; $p=0.00$). This indicates that the number of sperm whales available in their natural habitat was decreasing as the whaling industry was developing. Studies still taking place indicate that this pattern may be similar to all Azorean and other Atlantic islands, as well as to the Portuguese mainland.

WHALING IN SÃO TOMÉ AND PRÍNCIPE

Between 1913 and 1959, commercial whaling occurred in the coastal waters of São Tomé and Príncipe. Between 1922 and 1924, whaling activities also took place but there are no data on the captures and the same applies for the period after 1952 (Fig. 4).

Between 13 July and 25 October 1951, different species of great whales were captured: sperm whales (*Physeter macrocephalus*), fin whales (*Balaenoptera physalus*), Bryde's whales (*Balaenoptera edeni*) and humpback whales (*Megaptera novaeangliae*) (Fig. 5). This more detailed information is available because during this one season a Portuguese company (with Norwegian involvement) operated from the coast of the São Tomé islands (Mouzinho de Figueiredo, 1958). Also, according to the German daily newspaper "Die Welt" of 5 May 1951, the São Tomé whaling station got substantial parts of its equipment from the German Company Gebrüder (brothers) Böbbing, builders of industrial machinery, piping systems and apparatuses (Klaus Barthelmeß, *pers. comm.*).

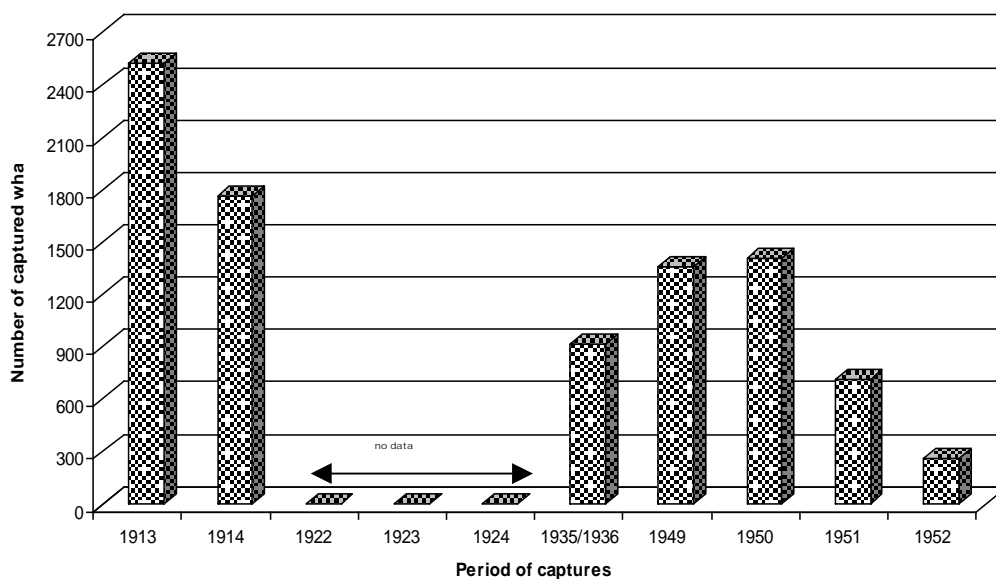


Figure 4. Number of captured whales during all the whaling period in the coastal waters of São Tomé and Príncipe.

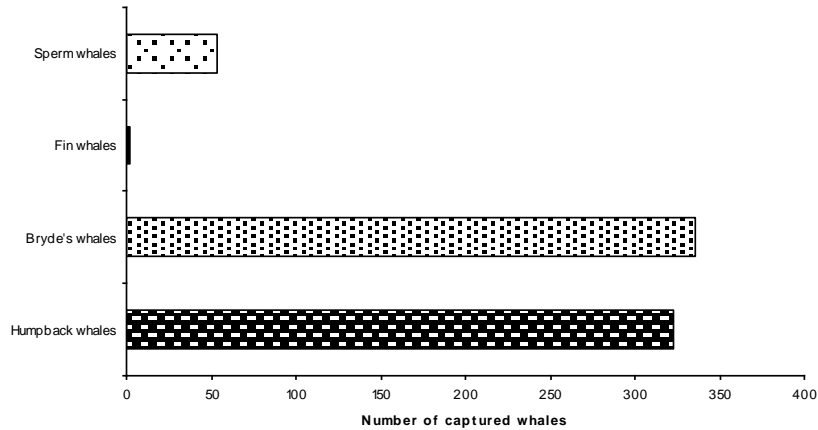


Figure 5. Captures of large whales between during the 1951 whaling season off São Tomé.

CONCLUSIONS

The year of 1984 was the last official year of whaling in the Portuguese islands of the Azores, while since 1959 there was no whaling in Sao Tomé and Príncipe. Nevertheless, no whales seem to have been captured in Flores since 1977, in Santa Maria since 1966, and in Sao Tomé and Príncipe no data exist after 1952. In all islands the end of commercial whaling occurred quite suddenly after several productive, even though relative unstable, whaling seasons.

Flores and Santa Maria (Azores, Northeast Atlantic), São Tomé and Príncipe (Gulf of Guinea, Southeast Atlantic) may be representative of whale captures throughout the Atlantic and, more especially, the abrupt end of whaling in all these small oceanic islands may be indicative of natural population status of the great whales at the time. The decrease in the number of catches indicates the depletion of both stocks in the two different Atlantic archipelagos. Probably, the earlier end of whaling in the Gulf of Guinea indicates a smaller initial stock (prior to commercial exploitation) than in the Azores.

The most common captured species were the sperm whales in the Azores, and mainly humpback whales in the Gulf of Guinea. It is important to remember that the volcanic origin of all these islands produces great depths near to the coast, which may favour the presence of more pelagic species (Aguilar, 1985). Both Atlantic areas are extremely rich in diversity and number of cetaceans, and the end of whaling reveals an increase in occurrence and allows for the recovery of stocks.

ACKNOWLEDGEMENTS

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BUILDING MARINE MAMMAL KNOWLEDGE: SCHOLARS AND SEAMEN

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INTRODUCTION

Obviously, knowledge about natural history has been built gradually, with unexpected discoveries and large periods of stagnation, during which science did not step forward, because scientists merely resume their predecessors' works. That process has affected all of natural history, but especially marine mammals, because of their habitat, which makes relatively easy studies impossible: to see such animals alive is almost impossible except to seamen, or from the coast, with the help of optical instruments). Dissecting dead stranded animals provides anatomical data but no real idea about their shape and features at sea, nor information about their way of life, their feeding techniques, breeding habits, and so on. So, it became possible to acquire knowledge of cetaceans from the very moment that men began to cross the seas and meet such animals, and had technical resources to do it, especially when they had geographic survey or mapping projects. Hence when scientific curiosity led them to cross the seas with open eyes and ready to learn – "*cupiditas sciendi*", a desire for learning, was the original sin! Seamen had to master some rudiments of science to really improve the knowledge of the entire scientific community. Although sailors generally went on with their practical knowledge, both seamen and scholars finally derived benefit from combined efforts.

As a matter of fact, some periods are particularly productive, especially when curiosity and sea traffic get connected. The works of classical Antiquity give some examples of scientific treatises on natural history: at the same time, scientists were learning in all fields, and travelled in Greece and in fact in the Mediterranean Sea. Aristotle gathered all his observations in the eastern part of Mediterranean. Then during the Alexandrine Period, scientists developed compilation and popularization more than basic research. In the late Middle Ages, bestiaries continued to assume a role, keeping the memory of the scientific tradition, but without real innovation. Between the late Roman period and Renaissance, ancient literature was not accessible to everyone. Hidden in private libraries and monasteries, books were gradually forgotten, and known only by second sources and commentaries, until the fall of Constantinople in 1453 led to exiled Greek scholars, who then came into Western Europe, particularly in Italy, with their books and manuscripts. At the right moment, invention of printing systems greatly improved the circulation of texts and printed books. That process was conducted to rediscover during the 16th Century all the Antiquity's literature – with enthusiasm. At the time of the Discoveries, when seamen crossed the seas more frequently, both scientists and travellers began to consider again knowledge as it was developing. During the 18th Century, scientists were taken on board with a long list of natural history observations to realise during the voyages. Their reports were supposed to give a boost to knowledge, and they actually did.

HISTORY OF TRADITIONAL SCIENCE

Every scientist is supposed to examine former scholars' works - read, learn and choose what he considers as correct. On a case by case basis, scholars may simply copy or reproduce previous treatises, without referring to them: in that case, the references are supposed to be obvious or useless: according to scientific pre-supposition that remains generally accepted. Knowledge is a common property that everybody has at his free disposal.

Compilation and analysis

Evolution of science depends upon the uses of previous treatises: Aristotle has been read since the third century before Christ (*Ton peri ta zoa istorion*, *Animals History* written between 347 and 342 BC, which is a data collection, laced with plates, about all the animals that Greeks can have heard of, or studied – Aristotle worked for a while on the Black Sea coast; that is a sort of reserve that he could draw upon to write systematic treatises, such as *Animals parts* (*Peri ton zoion morion*) probably written in 330 BC, or *Animals generation* (330-322), and so on: these treatises were most probably used for lectures, and, in fact, are much less popular than the *Animals History*). A lot of scholars wrote after him, taking his observations into account: for example Pliny the Elder, in his *Natural History*. Pliny did not explicitly quote from Aristotle, but obviously used his examples and remarks. That is the most frequent case: this knowledge is assessed by experience, observation, dissection, and finally synthesis. Aristotle was a real naturalist, who built a system on the basis of facts, and did not affirm fantasies. That is why his work has been admired and considered as an absolute necessity.

Scholars are more or less obliged to read previous writings, and the general way they are compiled, for example, Aelianus of Preneste, who was a Latin rhetorici writing in Greek at the end of the 2nd Century, made a compilation of works about animals, called *Peri zoon idiotetos*, *About animals singularities*: “To speak of animals requires culture and education. I am perfectly aware of the fact that this subject has been already and carefully studied by a lot of scholars. My own work consisted of gathering as many data as possible, and presenting them in a wholly accessible language, and I am convinced that the result of my research constitutes a useful mine of information¹.” He compiles Oppien (*Halioutika*, *About fishing*, 180 AD), Alexander of Myndos, Plutarch (46-125), who wrote *Animals intelligence*, and several other zoologists, or writers. He considers that his work is important because he summarises all the texts about animals. He never pretends to be original. Aelianus dedicates 31 articles to marine mammals. Among these, some are specifically devoted to zoology, and others to legends and anecdotes. In fact he was not a zoologist, and his text is written after reading others, because there was no way for him to check whether it was true or not.

During the 16th Century, some texts are particularly well-known, written by scientists like Gesner (1516-1565); Belon (1517-1564), who wrote *Natural History of strange fishes*, in 1551, and *About aquatic life*, in 1553; or Rondelet (1507-1566), who published *De piscibus*, *About Fishes*, in 1554, and *Complete history of fishes* in 1558. These scientists explicitly cite their sources, quoting from Aristotle’s *Natural History* for example. According to this method, the reader may recognise the first source of truth or error. Belon explains in the first chapter about *Strange fishes*, that he wants to write about dolphins: “By now, modern authors begin to explain the nature of animals or plants that they do not know at all [...]. So I will not do the same and waste my time compiling the legends and fantasies that they put in their books. But I shall refer to major ancient writers, because of their authority. What is more, they did their work so meticulously that they almost did not leave anything to say after them, and as a consequence, writers after them merely repeat their observations².” Rondelet quotes authors, exact titles and even book and chapter. Belon closes his first book with these words: “Whoever wants to know more can see the 5th book of Oppien [*Halioutika*] and the 9th of Pliny, because I do not want to narrate the whole story. I have written enough to prove what I pretended to.” (p. 32, v°).

¹ Aelianus, « Prologue », *La personnalité des animaux*, Les Belles Lettres, 2004, A. Zucker, p. 1 (we translate).

² Belon, *Des étranges poissons*, chap. 1, p. 4 r°. <http://gallica.bnf.fr> (we translate).

Sometimes they try to check by themselves, but they often copy the most plausible affirmations. Aelianus in his time already began his chapter by saying “I heard that...” but we must understand “I read that...”. Aristotle quoted sometimes from fishermen, and so did Pliny the Elder. The original way that Belon and Rondelet, for example, composed their works consists above all in trying to evaluate whether the assertion is correct or not. We read in Rondelet’s *De piscibus*, when he estimates the duration of dolphins’ life: “It is a matter of fact that some live twenty-five years; others thirty; Aristotle proves it when he writes that fishermen, having cut the tail, then put the animals back to water, recognized them when they caught them again, and so knew how old these animals were. Albert wrote that they live thirty years.”(pp. 462-463).

In fact, Aristotle had already written exactly the same (*Peri ta zoia historia* VI, 12): “They live many years: some are said to live more than twenty-five years, and others thirty. Because fishermen, having cut the tail of some dolphins and sent them back to water, in order to know their age when they catch them again.” It may be a problem of the word: “pokøptv” which signifies: “cut out”: a dolphin whose tail is cut out could maybe not survive so long. On the contrary, “Êpokøptv” means “make an incision”, which is more appropriate in this situation. Another problem is the translation of the Greek word “-ste” (oste): it may be “in order to” or “and so, as a consequence”. However Pliny had already copied Aristotle and translated (*Natural History*, IX, VIII, 7): “They live even thirty years, which is known by cutting (or making an incision on the top of) the tail, as an experience”. It is the first mention of photo-identification by mark and recapture...!

Assessment

Generally speaking, Belon and Rondelet, for example, try to interrogate the data: can we believe Aristotle and the ancient scientists? In the chapter “De delphino”, Rondelet asks: “It has no hole either to smell or to hear, *if we believe Aristotle*, but nevertheless it is certain that he smells and hears.” Or: “In the middle of their back, there is one fin, partly bony, partly cartilaginous, without any spine or sting, *even if Pliny, Appien, Pausanias, said that they have a spine on their back.*” (p. 459)

Aelianus even narrates the story of a young boy, a friend of a dolphin for a number of years, who died playing with it, riding it, because being exhausted he bent too much on his back, and impaled himself on its spine (VI, 15). Aelianus does not put into question that possibility, because he admits he is fascinated by the beautiful love story between a dolphin and a boy, which is similar and even more beautiful than Arion’s story. But Aelianus can be very serious in zoological accounts, whether they are true or not, it doesn’t matter: he narrates the way that dolphins sleep, for example, in an original manner. Considering that dolphins cannot stop moving, and on the other hand, cannot prevent themselves from sleeping, he explains that they swim up to the surface, then sink when they are asleep, until they reach the bottom. When they hit the bottom, they wake up and swim again towards the surface. Then they fall asleep once more, and sink, and so on (XI, 22, “On dolphin’s sleep”).

By contrast, even if his sources may be more often books than dissection, Rondelet, in the middle of the 16th Century, analyses the data and tries to find the scientific truth.

COMPOSITION AND STYLE OF NATURAL HISTORY ESSAYS

The order in the presentation of the natural history or the plan of the treatises has changed. Aristotle wonders if one has to study each animal, one after another, or if it is better to proceed to a general and systematic study of all the characters which all the animals have in common, because of course a lot of things are similar (sleep, respiration, growth, decline, death, and so on), and if you study one creature after the other, you must repeat the same items a lot of times in a boring way (« General observations about method in biology », *Animals' Parts*). So he gathers all animals according to anatomical features, considering as more important the similarities rather than the differences. He intends to make up an all-encompassing view of the system of nature.

On the contrary, Aelianus, the compiler, does not choose a logical order in his articles: elephant, birds, ants, snakes, ostriches, dolphins, horses and other animals appear as if we visited Noah's ark: for him, the wonders of creation are so numerous and various that any organisation is difficult.

But scientists of the Renaissance try to organize the treatise on another pattern. In fact, they follow Pliny, who takes into account the environmental criterion: animals who live in the water are "fishes", and after "fishes" they can speak of other animals living in the water such as hippopotamus, sea horse, nautilus, and so on. Pliny follows a clear scheme: observation at sea (breaching, swimming speed...), natural history data (period and duration of breeding, pregnancy, hypothesis of summer migration...), interaction between men and dolphins...

At last, the "modern science" organises its matter according to a binary classification based on discrimination of differences, that means of characteristics of the Phylum (odontocetes/mysticetes), as proposed by Linnaeus.

Finally, we can determine another order, following fishermen: some species can be eaten, some cannot. Some are easy to catch, some not, according to the whalers... Travellers' or sailors' logbooks note down every time that they see marine mammals, birds, jellyfishes, and whatever else they come across. This information can be used to determine repartition (and actually some historical accounts can be compared with modern data).

The style of the texts

Ancient science used to collect all the details that it could: the reason is that the more you collect, the more chance you have to get the truth within the amount of information. If previous writers have assessed a fact, you cannot easily get rid of it: you must prove that it is false, and whatever it is, quote it as it has been once considered as true.

Bestiaries were very popular during the Middle Ages: catalogues of animals, of animals' habits, and finally, with moralizing conclusions about the philosophical and religious meaning. Guillaume Le Clerc (1210) explains, for example, the way that whales can eat small fishes: "this fish, when it becomes hungry, keeps the mouth wide open: its breath is so sweet, that a bunch of small fishes rush into its mouth because of the good smell; the whale closes its cheeks when it feels that its mouth is full, and swallows the whole into its large belly." (*The Bestiary*, v. 2239-2329). The meaning of it is a parable of the devil: at first it seems fine and the scatterbrained people rush into the trap.

The *Physiologos*, the best-known of its kind, during the Middle Ages, also gives moral significance to every description of animals: the most important aim of the genre is not the zoological description but a hermeneutic lecture. However, dolphins and whales are not to be

put on the same level: dolphins are depicted as benevolent creatures, whereas whales, larger, black or darker, potentially more threatening, are generally depicted as “monsters” and representations of the devil.

Moreover, the way these treatises were written has nothing to do with technical language: it may often be poetry, or parables, or fables, with a more or less philosophical or mystical meaning to discover. In that way, scientific descriptions in the Middle Ages and early sixteenth century often seem so strange: they mix known and unknown details, and this confusion reflects the reverence for divine creation; they mix anatomical details, legends, and use of it, with sometimes even cooking recipes (Brunetto Latini). No wonder if you remember that “*craspois*” (or *graspois*, a possible root for *grampus*), or salted whale meat, was sold during catholic Lent, as “sea pig”.

SCHOLARS AND SEAMEN

Rondelet, after others, had heard from fishermen: “fishermen and sailors say it’s true.” (p. 463). The same process occurs with another problem: do whales blow water or air? Aristotle assumes that they blow water: according to him, (*Peri ton zoion morion*, 696b): “Dolphins, whales and all cetaceans of that sort, haven’t got branchia but a blowhole, because they have lungs. The seawater, that they swallow by the mouth, is thrown out by the blowhole. They are obliged to swallow water because they find their food in the water. And after having swallowed it, they must evacuate it”. This question is important and the right response difficult to give. Lacépède, in 1804, assesses the right whale’s two blowholes: “the use of them is to throw out the water that penetrates into the whale’s mouth, or give air to the lungs...³”. He also assesses the incredible length of their lives (p. XIV): some of these great whales lived more than thousand years... Bullen explains, in 1898, in a very clear way that “everybody imagines that a cetacean has on the top of its skull a sort of natural fountain which, due to mysterious reasons, regularly throws water jets in the air. In fact, a whale is as unable to throw water jets through its blowholes than you through your nostrils; it breathes air at the surface and blows like us, but its warm blow condenses in the cold air and makes visible steam as a man’s blow in icy weather⁴.”

The way to verify theory is obviously to be at sea, because seafarers are particularly disposed to observe marine animals. But most of the time they are not especially educated, and are led to confuse some species, depending on the length, or the “blow”, and a small series of criteria. Whalers paid more attention to “commercial” species, and they were obliged to look with a keen eye at the whales they can see. They had very good knowledge of marine mammals, because of everyday experience in the field. Bullen, for example, describes the dentition of the sperm whale, as he narrates the flensing of it. But, for example, the names they gave are different, although they were perfectly trained to recognise whales by their shape and behaviour. Scammon, in 1874, gives an almost perfect description of a sperm whale dive and surface cycle⁵. Sailors noted in their logbooks only the common names, and insisted on generic aspects. At the time, people did not know about whales (merely seen when stranded), which caused terrible fear to travellers at the Age of the Renaissance. Seafarers were the only men who had really seen such monsters. That is why seamen have always been a third kind of people, beside the living and the dead.

³ Lacépède, *Histoire naturelle des cétacées*, p. 7, Paris, chez Plassan, an XII, 1804 (on line : BNF, <http://gallica.bnf.fr>). (we translate).

⁴ Bullen, *The Cruise of the « Spermwhale », La Croisière du “Cachalot”* (we translate p. 178, Payot, 1993).

⁵ Scammon, *The marine mammals of the northwestern coast of North America*, [1874], New York, Dover Publication, 1968.

But, as Bullen, the whaler, says as a proverb: on board a merchant ship, there are not more cats than needed to catch the mice: so, there was no scientist taken aboard before it seemed to be useful, that means before the end of the eighteenth century. Scholars like the botanist, Commerson, for example, taken on Bougainville's ships (*l'Etoile*), were also employed at another function: Commerson served as ship's doctor. But he gave his name to a dolphin. So scholars, until very recently, were not taken on board just to observe animals at sea.

In fact, travellers' or seamen's log books are a mine of information: between sailors and scholars, information had to be passed: that was the aim of Fleurieu, marine minister during the French Revolution, who officially edited Marchand's *Voyage around the world* (1790-1792)⁶, although it was a commercial cruise. He even gives a zoological encyclopaedia in the last volume of the travel, and almost in a pocket format as he intends it to be a reference book that seamen can consult if they need to - a guidebook that sailors will improve with their own observations. And so a form of cooperation is useful with one another, to make science progress.

Some whalers' logbooks are food for thought and further investigation. Melville, Bullen, Scammon, Frouin, and even Maynard can give some indications of what they observe all year round, and over the world. By now, scientists sail in order to improve their knowledge, and seamen try to know more about marine mammals. There is no doubt about science's progress if there are still whales to observe in the end!

This is how we were maybe twenty years ago. Scientists were sailing to improve their knowledge, and seamen made some efforts to know more about marine mammals. Technical resources, data transmission programs involving various research teams... We could have expected to know everything about all the marine species, and to definitively reconcile scholars and seamen. Scholars continue interrogating sailors and fishermen, but they do not completely believe their testimonies. On the other hand, scientists tend to yield to temptation of those modern mermaids - modelling programs! Keen eyes do not survey the waves any longer, but the computer screen. Unexpected results can be produced by the way, because they may proceed less from factual observations than from hypothesis, hidden behind complicated statistical processes.

So, paradoxically, the status of science did not make great progress regarding collaboration between scholars and seamen, as Fleurieu had thought at the beginning of the nineteenth century, as if there was always a gap between theory and practice. However, the style has changed: Aelianus was proud to speak a common but beautiful language. Nowadays, scientists' statements are technical, and inaccessible to most of the people. At the same time, marine mammals are more popularised than ever before through colour magazines and TV programmes. Finally we are not so far from the Middle Age bestiaries: pleasant, illustrated, causing admiration, philosophical remarks on animals' intelligence and conceptual conclusions, as Aelianus did. According to his epilogue of *Peri zoon idiotetos*: "while hunters are very satisfied when they startle an animal, I consider, as for me, that it is less extraordinary to follow tracks or kill so many animals, than to point out all the qualities given by nature".

⁶ Marchand's *Voyage around the world* (1790-1792): *Journal de bord d'Etienne Marchand. Le voyage du Solide autour du monde* (1790-1792, édition Odile Gannier et Cécile Picquoin, éditions du CTHS, 2005, 2 vols.

SCIENTIFIC LITERATURE ON CETACEANS IN THE AZORES REGION: AN HISTORICAL OVERVIEW

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INTRODUCTION

A review of scientific literature was performed concerning cetacean research in the Azores archipelago based upon available references. It does not provide an update of the present scientific knowledge on cetaceans regionally, but rather consists of a framework for a more extensive review, and for historical and bibliographic purposes.

METHODS

A reference database was developed in DOP-UAç/IMAR (Department of Oceanography and Fisheries, University of Azores/Institute of the Seas, Associated Laboratory) from citations and publications available in national libraries, scientific journals, on-line reference lists and available databases held by the Azorean cetologists Mónica Silva and Rui Prieto. Portuguese libraries consulted were DOP-UAç library (Horta), the central library from the University of Azores (São Miguel), and the central library of the University of Algarve (Faro). Publications considered here as scientific literature include a wide range of documents such as: articles published in peer-reviewed journals, proceedings and abstracts from oral and poster presentations at academic meetings and workshops, academic theses, books on cetacean fauna, governmental and other technical/scientific reports.

A total of 166 references were plotted against a time scale, covering almost 150 years of publications on cetaceans with scientific content, from the first records to recent works still “in press”. Even though an extensive research was performed, there are probably a few still missing from the last two decades, and for this period, results should be considered preliminary.

RESULTS

The existence of occasional captures in ancient times is referred at least from 1574 (Antão, 1981; Frutuoso, 1922), and is most likely to have resulted from earlier learning on the Portuguese mainland, where whaling was already frequent by the 12th Century (Brito, 2002).

The first record of hunting sperm whales (*Physeter macrocephalus*) on a commercial scale around the Azores dates back to 1765 (Macy, 1935 *in* Clarke, 1954). By the first half of the nineteenth century, whaling voyages to the Azores had become a customary part of the Atlantic whaling voyages (Clarke, 1954). Around 1850, shore-based whaling was established profitably by local inhabitants, spreading in subsequent decades to different islands.

The French naturalist Drouët (1861), might have been the local pioneer of a scientific approach to cetaceans, leaving the first species check-list with taxonomic references in a catalogue of Azorean fauna. The first references with interest for natural sciences, consisted of simple species lists in catalogues, ranging from Henri Drouët in 1861 to present faunal reviews. The following decades saw some cetacean references in European faunal catalogues (Carus, 1886; Simroth, 1888; Trouessart, 1899). Later reviews are found throughout the

twentieth century by Chaves (1924), Ferreira (1935), and, more recently, by others such as Clarke (1981), Reiner (1981, 1986), Galhardo (1990), Reiner *et al.* (1993), and Steiner *et al.* (1999).

Most contributions to biology, physiology and parasitology concern sperm whales, deriving from the whaling period (Prince Albert of Monaco, 1888; Pouchet and Beauregard, 1889; Pouchet and Chaves, 1890; Richard, 1936; Pouchet, 1940; Clarke, 1953; 1956a,b; Figueiredo, 1957), while present advances came almost strictly from stranding data.

In the early twentieth century, the whaling ship era ended, and the shore-based industry saw its peak in the following decades, benefiting from new applications of whaling products and radio communications with look-outs (Clarke, 1954; Galhardo, 1990). Around the 1950s, whaling in the Azores was a relic industry, although starting to decline, due to heavy emigration (Clarke, 1954) and a shift to a better-paid tuna fishery (Clarke, 1981), and ending completely in 1984. Around the 1980s, the end of whaling for most countries in the “western world” coincides with the publication of several international cetacean catalogues, referencing Azorean fauna (e.g. Watson, 1981; Leatherwood and Reeves, 1983; Ridgway, and Harrison, 1985).

The mid-second half of the twentieth century became a turning point in cetacean research in the Azores, characterised by a clear increase and diversification of research, and publications from the late 1970s onwards (Figure 1).

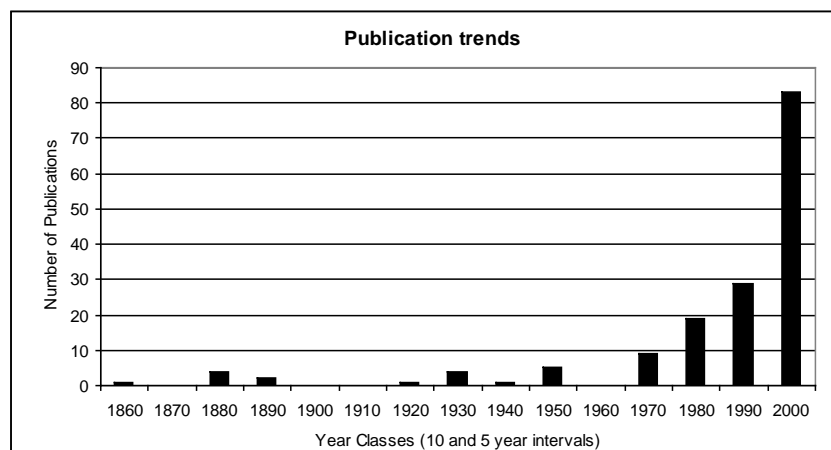


Figure 1. Amount of cetacean scientific literature in time.

There was a transition period until the mid 1980s, with some authors widening publications to other species (Duguy and Aloncle, 1974; Allen *et al.*, 1977; Reiner, 1981; Clarke, 1981) and also starting to publish on different branches of cetology such as strandings data (Teixeira, 1978; Martin, 1982; 1986; Martins *et al.*, 1985; Reiner, 1985), while in many cases still taking advantage of available information from fisheries (Von Brandt, 1973; Ramos, 1977; Sousa, 1977; Avila de Melo, 1978; Avila de Melo and Martin, 1985; Melo, 1986). This epoch of transition coincides with the establishment of a resident scientific community with the creation of the University of Azores in 1976. Cooperation with foreign institutions (e.g. the University of Cambridge; International Fund for Animal Welfare) initiated the modern dedicated research.

Like many other institutes, in parallel with distinct scientific disciplines, the number of publications has since been growing exponentially. Present literature still includes new species' records and behaviour descriptions of less frequently observed species from sightings

at sea and strandings. These last have also been supplying information for diet, pollution, and by-catch studies.

Population and ecological information on cetaceans started to appear from the early 1970s, with publications from the last decade representing around half of the published literature (techniques include visual census, photo-ID, acoustics, radio and satellite telemetry, GIS studies). Other main publication themes include whale-watching oriented research, conservation and management, interactions with fisheries, as well as marine conservation site proposals and reviews. Molecular references have had the largest increase in the last decade. Research on new techniques, such as GIS, biochemical and acoustic technologies form a recent group of publications, a sign of an ever-growing body of research.

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DECORATIVE AND PRACTICAL USES OF THE BONES OF LARGE WHALES

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The huge skulls, jawbones, shoulder blades, vertebrae and ribs of blue, sei, fin, right, minke and sperm whales are the largest bones to be found in any creature that lives or ever has lived, and it is not surprising that people should have been, and continue to be, so impressed by their great size and weight. Even today, people are unable to resist bringing home large bones that may have been washed up on the shore to put in their gardens as a feature or curiosity.

Over the centuries, whales' bones have been used in many interesting and unusual ways, sometimes practical, sometimes decorative. Examples can be found all over the world, from South Island, New Zealand to Japan to Yttygran Island, Siberia; from South Africa to Gibraltar to the far north of Norway; from the Falkland Islands to the West Indies and Alaska, but in most cases they are isolated instances, and outside Europe they are relatively recent. The greatest concentration of bones in the world is to be found around the North Sea, down the east side of Britain, and in The Netherlands, North Germany, and Denmark.

In Europe, there are early instances of the use of bones, and some surviving old bones, and interesting variations in type of use between the different countries. The Dutch were particularly keen on large bones hanging in chains on the facades of their town halls; the use of jawbones standing vertically in fields as cattle rubbing posts seems to have been almost entirely confined to the Netherlands, where the practice was widespread. The English have many more examples of jawbone arches than any other country, and nearly 100 of them are still hanging. The remarkable and beautiful German painted shoulder blades are not to be found in other countries, while the Italians have many bones in churches as ex-voto items. In Sweden, the east side of Germany, Poland, and into the Balkans, bones are often associated with legends of giants and monsters. Obviously, most bones are to be found near the coast, although France, Spain and Portugal have surprisingly few. They are also scarce in Mediterranean countries, as might be expected. Some made their way into the heart of the continent far from the sea, for example, in southern Poland.

Whales' bones have served as arches (see Fig. 1), gateposts, fencing, cattle rubbing posts, gravestones, roof supports, foot bridges, sledge runners, road fencers, ships' ballast, crane hoist supports, quayside mooring bollards. They have been used to help haul boats over stony beaches, as weavers' weights, mill waterwheel bosses, footstools, chopping blocks, sawing stands, milking stools, chairs and benches, mallet heads and stepping stones. They have been displayed at castles, manor houses, town halls (see Fig. 2), churches, and used as signs at inns, and trades. Articulated skeletons have been set up in public parks, on a seaside pier, in a rocky grotto, in a cathedral cloister, or taken on tour.

The most commonly used bones were the mandibles. Many were erected as decorative arches. Some were sawn in half and served as sturdy gateposts. Others did duty as cattle rubbing posts. Sometimes the bones were painted. Occasionally they formed part of the structure of buildings. Shoulder blades served as inn signs, appropriately painted for the purpose. Many ribs were placed in churches. Skulls were sometimes featured in gardens. Vertebrae tended to

be used for strictly practical purposes, such as stools or chopping blocks, or as piles to support wooden flooring.

The earliest uses of bones were mainly for practical purposes, particularly in those parts of the world where there are few or no trees, and the bones were excellent substitutes for wood, for example Alaska, Shetland, the Dutch Friesian Islands, and the south coast of Australia. Until the beginning of a significant whaling industry, most bones were obtained from stranded whales. In the 17th, 18th, and early 19th centuries, the peak period for whaling, large numbers of bones were brought back. In England in the 18th century, it became fashionable for gentlemen to have a jawbone arch as an eyecatcher on their estate, and bones were brought back to order by the whaling ships' captains.

Today, with effectively no whaling, the supply of bones has dried up. Stranded whales are usually acquired by the authorities, and the bones are not available to individuals. Many of the historic bones have disappeared, steadily reduced by neglect, old age, vandalism, ignorance and indifference. Others have been removed from their original locations and placed in the custody of museums, safe but sterile. Now, in the Netherlands, for example, once home to large numbers of exceptionally interesting uses of bones, there are very few indeed still to be found, apart from those on the islands, and most of those are not *in situ*. So the bones that have survived need to be cherished and taken care of - remarkable memorials to the great Leviathan of the deep.

This paper is a very brief overview showing the wide variety of bone uses from around the world with just a couple of images as illustration. A more global view can be found in Redman (2004).



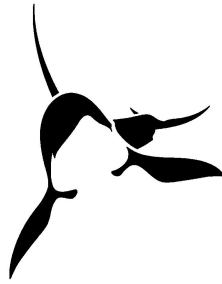
Figure 1. Arch bone used as a lamp support in Rothwell, England.



Figure 2. Bone displayed at Amsterdam Town Hall (1641).

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