FROM NATURE TO SCIENCE: SCIENTIFIC ILLUSTRATION ON MARINE MAMMALS THROUGHOUT THE CENTURIES. OLD CHALLENGES AND NEW PERSPECTIVES

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1. INTRODUCTION

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Describe, sketch and draw, take up since the dawn of humanity as part of the human nature and the relation man-nature. Among the apprehension and representation of reality, the building of an image of the world or the transmission of knowledge, the idea of associating an image to something that describes it remained as a necessity until today. The ways of doing it and the new technical ways to approach it have changed, but the idea persists, and today old techniques find new ways to emphasize the importance of the relationship between the reality and the image of that same reality.

In this sense this workshop aimed to look into the path of scientific illustration with regard to marine mammals, reflecting on its role as a working paper and outreach tool of scientific knowledge not only on the different species that over time have been known and studied, but also on those missing today, persisting only in descriptive and visual memories that still remain in our archives.

However, as the scope of scientific illustration is very large, we thought it would also be a good idea to extend the discussion to the more general topic - nature / scientific illustration. By opening up the discussion we were able to go deep in the debate on the present day role of scientific illustration and of science illustration as an important part of science.

In the age of computers, digital photographs and easy access to web information, one could imagine that illustration is now old fashion and completely inadequate in the face of new technologies that allow us to obtain and manipulate images of nature in a way so unthinkable 20 or 30 years ago. The fact is that what we see today is exactly the opposite. Scientific illustration is getting more and more prominence in the current scientific discourse either because it is a very particular visual record of a certain species or specimen showing minor details that hardly can be seen in a photograph, or because sometimes it is the only visual testimony of a species that no longer exists and therefore allows its reconstruction and study.

This means that the visual testimony of a species (for example) is also a document that can be approach from a historical perspective thus contributing not only to their knowledge in the past and the way nature was perceived and represented but also enabling the constitution of a documental corpus of reference concerning specimens or species disappeared or even natural phenomena, in a moment where drawing and writing were the only way to “catch the moment”.

Thus, the central topics of discussion in this the workshop went far beyond the scientific illustration on marine mammals while trying to answer three main questions: How can we approach scientific illustration as a historical document? How can we combine historical evidence and science? What is the present day role of scientific illustration, namely in the history of the marine mammals’ research?
This workshop was convened on Saturday, 6th April 2013 in Setúbal, Portugal, in association with the 27th Annual Conference of the European Cetacean Society. It was organized by the Tropical Research Institute in association with Escola de Mar and was partly supported by the Fundação para a Ciência e Tecnologia, through the project “Knowledge and recognition in areas of Portuguese influence: registries, scientific expeditions, traditional knowledge and biodiversity in Subsaharian Africa and Insulindia” (FCT HC0075/ 2009). The workshop ran from 2.30 pm 10 6.00 pm. It consisted of 5 presentations, with time for questions and discussion, and was attended by 12 people.

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2. ILLUSTRATING NATURAL PHENOMENA: THE VOLCANO ERUPTION OF THE ILHA DO FOGO (CAPE VERDE ARCHIPELAGO) IN 1785
BY JOÃO DA SILVA FEIJÓ

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INTRODUCTION

Illustration is probably as old as men itself and scientific illustration has been a “natural” practice throughout history. The observation of these facts brings us to some of the questions we will discuss here. Though they go far beyond the issue of marine mammal’s representation, most of these questions address directly to the role of scientific illustration and its importance.

In fact, no matter the subject of the illustration, what is actually the role of scientific illustration? (not only in the present days but in general). To what extent, those in the past, usually called by the Portuguese in the XVIII century as “riscadores” - literally those you were able to scratch with a pencil - had a real perception of what they were doing? Were they conscious of the importance of their drawings as a scientific document? What was their purpose? What were they trying to communicate through their drawings? To what extent were these drawings the real testimony of “catching the moment”, or simply a complement of the written description?

How come illustration became decisive in the diffusion of science in Europe and in the world? Well-known names of science in the Renaissance owed the diffusion of their works in Europe to their translator’s initiative of introducing illustrations in the original texts. Visual support helped in the appropriation of the new objects described, no matter they were animals, plants or natural phenomena. Writing and drawing were like the two faces of a coin.

However, what once might have been no more than a sketch to help memory in the production of a later elaborate work became sometimes, centuries before, scientific illustration. And when this process happens, what is its real meaning? What gives those drawings the status of scientific illustration? How come, in modern times, some of these drawings became scientific illustration and others not? What are the criteria for this selection?

We believe there is no single answer for these questions and that several criteria might interfere in this so called “classification”. Nevertheless, illustration had (and has) always a purpose and throughout the times has been used to record specific or unique moments and subjects.
Durër engravings immortalize the Indian Rhinoceros (Figure 1), Gândavo´s description of the “peixe-mulher” would not have had the same impact without the fantastic illustrations that embody its visualization (Figure 2), Clusius enhanced Orta’s work by adding illustrations of the several plants described (Figure 3) and the royal naturalist Feijó, from whom we are going to talk, didn’t make any drawing except the two sketches of the volcano eruption of the Ilha do Fogo we will present here. Of all things worthy of admiration, it seems he just draws what he thought he probably would not have the opportunity to see again.

**Figure 1.** Albrecht Dürer, Indian Rhinoceros, 1516.

**Figure 2.** “Fish-woman”. Marine monster, locally known as *Ipupiara*, killed by Balthasar Ferreira in S. Vicente (Brasil) in 1566. Pêro de Magalhães de Gândavo (1576) História da província Santa Cruz a que vulgarmente chamamos Brasil.
ILLUSTRATING THE VOLCANO ERUPTION OF THE ILHA DO FOGO

Volcanic phenomenon has always attracted men’s attention. A terrible fear allied to an immense curiosity has always been a natural reaction to the experience of an event of this nature.

Unable to understand these "mountains spitting fire," the volcanoes were seen by many as a manifestation of divine wrath. With the 18th century scientific expeditions the origin and characteristics of these natural phenomena were also questioned. At the time of the discovery of the Cape Verde islands, volcanic phenomena were not familiar to Portuguese navigators at all, thus being likely that, at first, the true nature of the island was not perceived by its occupants. Described as a very high island, with a great hill in the middle, it was initially named São Filipe. Only later, after the first eruptions, the island was renamed as Ilha do Fogo.

As early as 1500, a few decades after the Portuguese settled in the islands, the first eruption took place. In the words of Valentim Fernandes:

The island of Fogo which is called Fogo (Fire) because in the middle of it there is a very high hill, where fire is always burning, and which seems to the eye, and in certain times of the year, to boil. And the surrounding hills fall down inside and then a great amount of pumice rocks and ashes and other things come out (Fernandes, 1951[1506]:114).

In the following centuries, many eruptions occurred, spreading great apprehension among the inhabitants of that island and of the island of Santiago (Ribeiro, 1997). Portuguese and foreign travellers passing through have always taken note of these natural occurrences, and admired the majestic mountain that arouse from the sea, forming a great peak. Legendary stories about the origin of the volcano of Fogo even circulated in the islands, of which we can't resist to transcribe one:

The islanders kept quite extravagant a fable about its origin. They say that the first inhabitants of the island were two priests or friars, who had retired there in order to live in solitude, and who had found a gold mine near which they established themselves. Having gathered a great amount of that metal, they lost the taste for the solitary life, and awaited the occasion to return to Europe. When they split the treasure, one of them, ascribing to himself a
greater knowledge of alchemy, took the biggest cut, consequently broke out a quarrel so great that they, putting all their wizardry in action, set the island on fire, perishing both. The fire was eventually extinguished, but in the centre the element of destruction remained permanently alight. (Chelmick, 1841: 80-81).

Fortunately the naturalist Feijó was working in the Archipelago in 1785 when the volcanic eruption took place and he had opportunity to demystify old stories no matter the fact these stories persist till nowadays (AHU, C.U. - C.V. 43, 53A).

Feijó arrived in Cape Verde in 1783 and his first works were in Brava and Ilha do Fogo (AHU, C.U.- C.V. 41-35). He collected and recorded scientific information relating to soils, animals, plants and minerals of these small islands and he sent all them to Lisbon in the beginning of 1784 (Figure 4). By 1785 he was already working in the northern islands of the Archipelago. However, as soon as he became aware of the volcano eruption, he headed back to Fogo to record the different stages of this natural phenomenon in order to document the occurrence and provide detailed information for further scientific studies.

He did 3 surveys in the area around the volcano’s crater. During these surveys he collected samples and organized them in order to write a Report - Memoir about the new volcanic eruption of the Pico of the island of Fogo (Figure 5) -, in which he listed all the different products formed and spread out after the eruption. To this report he added two pictures drawn by himself that can be considered the scientific register of the eruption (AHU, CARTm, C.V. doc. 1323 e 1324).
By August of 1786, all his work on Ilha do Fogo was finished and he was able to send to Lisbon, to the *Real Gabinete de História Natural* not only the report on the volcano’s eruption, which includes twenty-one pages of the natural products of the island of Fogo, but also eight more boxes with the mineral samples gathered near the volcano (AHU, C.U. - C.V. 43, 62). At the same time he was already able to send also a cask with different fishes in *aguardente*, a tin box with three boards of butterflies collected in the island of Santiago and several mineral samples of Brava island, together with their respective records.

Unlike most of the previous Portuguese registries on natural objects, Feijó not only described in detailed what he was observing but, in the case of the volcano’s eruption, also draw what he saw.

As mentioned above, João da Silva Feijó produced two illustrations referring to the volcano’s eruption (Figure 6 and Figure 7), both unique in the scope of the history of science in Cape Verde, and to the history of volcanism in the island of Fogo, since they are the first known drawings of this natural phenomenon.

The two drawings are, in the naturalist's own words, a complement to two written documents: his 5th letter written in 1783, included in the *Itinerário Filosófico que contem a Rellação das Ilhas de Cabo* desposto pelo method hepistolar dirigidas ao Ilustrissimo e Excelentíssimo Senhor Martinho de Mello e Castro pelo Naturalista Regio das mesmas ilhas João da Sylva Feijó (BNP, Sessão de Reservados, Códice 12984) and the already mentioned *Memoir about the new volcanic eruption of the Pico of the island of Fogo*.

On the one hand, the pictures alone would impart a visual testimony of the volcano. However, they were not enough to give an extensive account for the multiple aspects involved in the eruption (type of soil, duration, type of eruption, affected regions, natural accidents appearing in the aftermath, etc.); on the other hand, the written texts
alone, though rich in detail, demanded an effort of visualization that was difficult to anyone who didn't know the geographical space of the island of Fogo.

**Figure 6.** J. S. Feijó, 1786. Fogo Island - Volcano eruption (1st drawing). AHU, CARTm, C.V. doc.1323

**Figure 7.** J. S. Feijó, 1786. Fogo Island - Volcano eruption (2nd drawing). AHU, CARTm, C.V. doc.1324
Therefore, the two drawings are complementary representations of Fogo's volcano. In the first one, the volcano is represented from a bird's eye view, and inserted in the eastern part of the island – since the picture represents the whole island – with some written indications; in the second one, the volcano is represented sideways and in eruption, not only of the central peak but also of some of its flank craters, without any written indication.

Both drawings are oriented according to the four cardinal points. The first picture includes rudimentary cartographical information on the main features of the island (Figure 8) - localization of Mosteiros, Ponta de Vale Cavaleiros, Fonte de Praia Ladrão, and of several beach flats -, albeit with an almost exclusive focus on the Pico of Fogo. In this case he adds the particulars for the identification of Pico and of the Xã da Caldeira as well as identification features of the all the surrounding areas. In fact, what mattered to João da Silva Feijó was to draw and “immortalize” the volcano of the island of Fogo, and distinctly bring out the geographical accidents related to it. Hence, the detailed register of all those indications in the subtitles of the first drawing.

In our opinion, these two illustrations seem to be possible sketches to be use later in a more accurate representation. Not being a “riscador”, not having had any proper training in drawing, Feijó was apparently concerned with registering a natural phenomenon which he would hardly ever witness again in his lifetime.

Figure 8. J. S. Feijó, 1786. Fogo Island - Volcano eruption (1st drawing) including rudimentary cartographical information on the main features of the island. AHU, CARTm, C.V. doc.1323
A close observation of the first drawing elicits justification for our supposition that these might be sketches for future and more elaborated drawings.

Three arguments support this hypothesis:
- First, the contours of the island are drawn in charcoal in a very primitive basis, without any effort of precision;
- Second, only a segment of the paper is used, leaving the rest of the space unoccupied, and the island is not even centred in relation to the available space of the support;
- Third, captions for the geographical accidents appear throughout the paper, divided in little text boxes bordered by lines traced in charcoal, and although the captioned places are organized alphabetically, they do not always appear sequentially.

CONCLUDING REMARKS

Whether sketches or final drawings, it is certain that these illustrations, of less than great quality and somehow very “naive” are, however, excellent elements of scientific illustration of the Fogo's volcanism in the eighteenth century, and constitute unique documents for the history of science in the Cape Verde islands.

We are aware that the main purpose of this workshop is to present and discuss scientific illustration on marine mammals. However, by presenting Feijó illustrations we dare to propose a more general discussion on the present day role of scientific illustration and how illustration have been of prior importance to disclose information on natural phenomenon, helping to clarify or complement descriptions with a visual support. In this sense, we think that a combined analysis of scientific illustrations and texts, like the ones produced by Feijó, may be interesting to discuss in this workshop.

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INTRODUCTION

Historically from the sea, this vast space of salty water, although it is the primary and essential source and unit of life, only came chaos, threat and destruction. And so, following the natural disorder of this element, inevitably, sea monsters arose. They have always been elements strange to people, unknown beings that are born and live and emerge from the sea. Even that they are, in fact, real marine mammals, they are perceived as monsters and retold in stories and paintings as monsters (Almaça, 1998; Brito, 2010). We could be referring to whales, dolphins, seals, as well as to marine reptiles and birds, and large fish, but in this example we are using manatees and dugongs as a case study. Here, the sea and its beasts emerge in a real duality between the mundane and the mythical and mystic and, consequently, above and beyond manatees we are studying mermaids.

Mermaids and manatees exist through time and cultures in a limb, in between the real life and the world of imagination, in the middle of the everyday life of the sailors and the world of every people’s dreams, allegories, beliefs, superstitions and even fears (Carrington, 1957; Brito, 2010). Their environmental, cultural and folk manifestations, and its presence and expression in forms either of myths and natural histories, will be addressed in this work. Having as main sources written material and iconography, the stories and the images are presented in a temporal journey from Europe to the West coasts of Africa, from the Caribbean Islands, the Brazilian shores and rivers, to the Indian Ocean.

Marine mammals are a highly specialized group of mammals that have adapted to the sea and that depends on it totally (cetaceans and sirenia) or at least during part of its life cycle (seals, sea lions, sea otters and walruses). Manatees (Family Trichechidae) and dugongs (Family Dugongidae) are herbivorous marine mammals (Order Sirenia) also named sea cow, ox-fish or fish-woman. These animals are at the origin of a complex discussion about mermaids and the biological or scientific basis behind the fabulous descriptions of these mythological beings. It was based on knowledge from the New World and the Atlantic explorations, during the sixteenth and seventeenth centuries, that much of this myth was unveiled and new information enriched the natural history archives. However, while natural sciences were not truly developed, it was mostly the legends and the myths that dominated all the stories around mermaids and manatees.

With regard to European natural history it was Aldrovandi (1613) that published a description and a drawing of the manatee, a copy of the one published by Clusius (1605). In fact, all European descriptions for these animals are based on natural knowledge obtained from Oviedo (1995) in his work published in 1526 and Clusius for
the Caribbean’s shores. But regarding the Atlantic natural history, and considering sources that combine both written and iconographic descriptions, it can be mentioned the work by Cavazzi (1965) for West Africa published in 1687 where he describes and illustrates with detail the fish-woman of those shores. It must also be highlighted the work written between 1624 to 1627 by Cristóvão de Lisboa (1967) that together with the written description presents an extremely detailed and accurate illustration of a manatee.

Later European encyclopedic treaties do not reach for this new Atlantic/Portuguese knowledge, maybe because it was not printed and disseminated, but rather they remain true to previous European authors (Brito, 2010). Some records of manatees from the Atlantic world where lost for its time, and the natural knowledge contained within was only recovered during the twenty century. This allows us now to address its historical value but the coeval instructive and scientific value that they hold was lost.

**MERMAIDS: FROM THE MIDDLE AGES INTO THE RENAISSANCE**

Mermaids also known as Sirens are, typically, the representation of all types of threats in the sea (Kaplan, 2013). Mermaids are legendary creatures, sometimes considered as sea monsters, with head and chest of a woman and the rest of the body as a bird or, according to later North European legends, to a fish (Chevalier & Gheerbrant, 1982). They appear in the folklore of many cultures worldwide and, sometimes even within the same tradition; they are represented as contradictory beings (Carrington, 1957). Mermaids or Sirens are depicted as perilous creatures associated with floods, storms, shipwrecks, and drowning. They lured sailors with the beauty of their face and the melody of their songs, drawing them into the sea and devouring them. Usually they represent the dangers of sailing and navigations and the very image of death. But, on the other hand, they can also represent benevolence and love (Chevalier & Gheerbrant, 1982). Since the classical antiquity to the Middle Ages, throughout the early modern period, to the modern times, historical sightings by sailors may have been the result of misunderstood encounters with these aquatic mammals. And consequently, there has always been some confusion between the legend and the animal (see figures 1, 2 and 3).

![Figure 1](www.arkyves.com)
In the medieval herbary *Hortus Sanitatis* (1497), *syrenas* are considered deadly animals that have the figure of a woman with a hideous face. In his treaty, the author goes on to say that appear with *cetibus*, and that females have fetuses and breast-feed their young. Since the end of the 14th century, following the Iberian Atlantic expeditions to Africa and the overseas, new encounters with large and strange marine mammals revived the legend of mermaids. First encounters should have been during the sailing and explorations of the West coasts of Africa during the 15th century. But descriptions from
this period mainly reflect encounters with manatees. In 1493 while sailing off the coast of Hispaniola, Christopher Columbus reported seeing three "female forms" which "rose high out of the sea, but were not as beautiful as they are represented" (see Brito, 2010). But also for the kingdom of Portugal, Damião de Góis (2002) in his description of the city of Lisbon (Urbis Olisiponis description, 1554) refers sirens, nereids and tritons as such:

(...) a kind of people that the locals start calling marine men because they have the skin surface with scales scattered almost over the entire body (...) such people owed their origin to marine men or tritons (...) The Tritons jumped to the shore and, once in a while, had the custom to come to the beach (...)

Figure 4. Depictions of mermaids, tritons and marine men in the work “Hortus Sanitatis” 1491 (Library of the National Museum of Natural History Madrid).

Either by written words or by visual depictions, these types of human-like marine monsters, are part of European natural history treaties (see figures 5 and 6).

Figure 5. Representation of mermaid, triton and marine monsters in the work by Ambroise Paré, On monster and marvels 1585.
In fact, both Ambroise Paré (1982), in his 1585 treaty on monsters and marvels including several entrances for mermaids or marine monsters with human figures, and Adriaen Coenen (2003) with his double tailed mermaids inserted in his 16th century fish and whale books, made note of the existence of such beings. These descriptions are often side by side with description of real marine species and also with other exotic singularities.

**MANATEES: NEW MARINE ANIMALS FROM THE NEW WORLD**

As soon as news reports from the New World arrive to Europe, it becomes clear that a particular exotic marine animal is being described and illustrated: the manatee (see figures 7 and 8). These descriptions are the result of observations conducted in the Spanish New World and written and disseminated by European naturalists. António Galvão (1989) wrote for the Antilles in 1497:

> *Is there a fish called manatim; is big and has a cow's head and face, and also in the flesh it looks very like it (...) and the female has breasts with nipples that feeds its children who are born alive.*

In another example, Acosta (1590) also refers to the manatees in the Antilles:

> *In the islands of Barlavento, namely Spanish Cuba, Puerto Rico, Jamaica, there is the so called manatee, a strange kind of fish, if one can name fish to an animal, whose cubs are born alive, and has teats, and with milk they are raised, and eats herb in the fields; but indeed, usually resides in the water. Due to the mentioned reasons, they eat it as fish, but when in the Holy Sunday, when I ate it in a Friday, it almost had scruples, because the colour and flavour seemed like nothing but veal chops or knuckle chops, the slices of this fish: Is big as a cow.*
In Europe, Rondelet (1554) had already described the manatees. However, he did not provide any illustration. To the European natural history, it was Aldrovandi who in 1613, assembled the description and illustration of the manatee, an exact copy of the illustration that had been published by Clusius. All the European descriptions of the manatee, even the latest from Jonston, are based on Oviedo’s and Clusius’ knowledge of the Caribbean and on their publications on the subject (Brito, 2010).

Figure 7. A manatee in the work by Carolus Clusius “Exoticorum” 1605 (Library of the Madrid Botanical Garden).

Figure 8. A manatee in the work by Aldrovandi (1613), a copy of the image published by Clusius (1605) (Library of the National Museum of Natural History Madrid).
Considering the sources for the Portuguese Atlantic in the 17th century, we can find two very important references: Father Cavazzi (1965) writing for West Africa and Father Cristóvão de Lisboa (1967) writing for Brazil.

Frei Cristóvão de Lisboa (1967) in his “História dos Animaes e Árvores do Maranhão”, published in Lisbon in 1647, presents a brief but detailed description of the Brazilian manatee and accompanies it with a very good illustration of the animal (Figure 9).

Cavazzi (1965) in his “Relação dos três reinos do Congo”, published in 1687, also gives a very detailed description of the so called fish-woman, which is also accompanied by a very interesting image:

There is one [fish] that Europeans call fish-woman and local name is Ngulu-maza [literally, Kikongo or pig water], beautiful name, but so horrendous. Has the muzzle gaping but small in comparison with another that appears to be a male. I think this is the famous triton from fables of mythology, the female may be considered the naiad of the old.

This illustration is inspired in observations of African manatees, in a representation which clearly mixes the morphology of animals with earlier preconceptions of the mythological mermaid. This representation may be one of the links of the passage from the knowledge with a classical and mythological influence to the Renaissance new natural knowledge. According to the author (Cavazzi, 1965):

I was unable to make myself understood about the appearance of this beast to the one who drew his picture, and I forgot the have it painted in those regions. Hopefully this lack will be corrected by the courtesy and common sense of the reader.
Even though with some intermixture with the mythological marine being, we can find in these reports a glimpse of the real animal, its anatomical and behavioral characteristics. Anyhow, manatees were only classified as a species (*Trichechus manatus*) by Linnaeus, 1758, and the Order Sirenia was only formed and named in 1811 by Illiger.

**FROM MERMAIDS TO MANATEES**

Old observations of animals in a limited geographical range may have resulted in the creation of a direct connection between natural beings and its mythological counterparts. Also, the absence of new natural and biological knowledge in Europe is shown by the continuous repetition of myths and superstitions in several types of publications. New encyclopedic natural treaties in the 16th and 7th centuries were mostly repeating classical knowledge, with limited new information on the nature of the new world, either by choice (because European naturalists were simply doing translations and adding comments) or, maybe, due to lack of knowledge. But again, in this period, and following the Atlantic Discoveries, new natural knowledge from the Portuguese Overseas on Atlantic marine mammals comes to light. But it is mostly lost to the central European scientific world and with suffers no influence from it.

To conclude, it was based on knowledge from the New World and the Atlantic explorations, during the 16th and 17th centuries, that much of this myth or mermaids and human marine beings was unveiled and new information enriched the natural history archives. We cannot simply say that since the moment manatees (Figure 11) appeared in human written history, mermaids vanished from memories (Figure 12). Mermaids
are a good example of the persistence into comparatively modern times of a legend that is nearly as old as the written records of man. There is not an age, and hardly a country in the world, whose folklore does not contain some reference to mermaids or to mermaid-like creatures (Carrington, 1957). Certainly, while natural sciences were not truly developed it was mostly the legends and the myths that dominated all types of stories around the subject of mermaids and manatees. And even today, in some cultures, the myth prevails.

Figure 11. Manatee illustration by Fernando Correia, Portugal 2013 (authorship and © by Fernando Correia).

Figure 12. Schematic representation of all known names for mermaids and of how a marine mammal should have been in the origin of all the legends.
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4. WHALE SHAPING: FROM GOLDSMITH TO THE SPACE AGE

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THE FIRST POPULAR NATURAL HISTORY BOOKS

This paper concerns the evolution of the images of cetaceans used in the popular books about animal life and nature, now usually termed ‘natural history books’ that first blossomed in the nineteenth century. The first natural history book (at least in the English language) was arguably Oliver Goldsmith’s *A History of the Earth and Animated Nature*. The first edition of this appeared in 1774, but it was published as some twenty further editions over several decades and well into the Victorian era. Later editions contained substantive added commentary authored by experts, much of it updating and extending Goldsmith’s original text. All editions were highly illustrated and the later editions (and other natural history books of the era) promoted the number and quality of their illustrations on their opening pages. The 1879 two volume edition of Goldsmith’s book, for example, states on its title page: ‘With numerous engravings on steel and on wood, comprising many hundreds of illustrative figures’. Similarly, the Reverend J.G. Wood, a prolific author of natural history texts, boasted on his 1907 title page that his book contained three hundred and thirty illustrations (Wood, 1907). Illustrations were clearly an important aspect of such books, including as a selling point.

Goldsmith is best known as an author of poems and plays including *The Deserted Village* (1770) and *She Stoops to Conquer* (1773). He is also the author of the novel *The Vicar of Wakefield* (1766) but, in addition, he wrote factual works, including on British and Roman history. In the 1879 edition of *A History of the Earth and Animated Nature*, the publisher comments that ‘No English writer possessed in a higher degree the faculty of popularizing knowledge than did Oliver Goldsmith’ (Anon, 1799). By the time of this edition, the added commentaries were actually more extensive than the original text. Goldsmith was almost certainly influenced by the *Histoire Naturelle* of Georges-Louis Leclerc, Comte de Buffon. This was a 36 volume series originally published in French, which was also very popular and ran to 42 editions (for example, Buffon, 1793).

Both Buffon and Goldsmith were writing before books were popular household items but, after the advent of steam-driven book presses and paper mills brought the price of books down (in the 1820s, editions of Goldsmith’s book would have been widely available to many more readers). Perhaps his status as a celebrated literary figure aided the book’s popularity and these various editions and their evolving illustrations would undoubtedly have helped to shape the view of the growing literate classes about the natural world, including animals that they might never encounter in life such as the cetaceans.
THE CHANGING IMAGES OF WHALES IN THE VICTORIAN PERIOD

The earlier images of whales and other marine mammals in Goldsmith’s books show oddly shaped animals; almost cartoons (Figure 1). Compared to the other depicted mammals their forms are clearly only poorly known. However, in the 1879 edition, embedded in the commentary (and therefore likely to be of the same date) there is a far more accurate rendering of a sperm whale (Figure 2), showing that by this time the appearance of this species at least was far better known.

Figure 1. Plate from Goldsmith’s *A History of the Earth and Animated Nature*.

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1 It is difficult to put a date on the primitive illustrations of cetaceans in Figure 1. The picture is signed Captain Brown and this is almost certainly Captain Thomas Brown (1785–1862) who is known to have been an editor of Goldsmith’s book and a natural history author in his own right. Brown presumably copied the cetacean images in this figure from earlier sources. There are no cetacean illustrations in the editions of Goldsmith’s book produced in the 1700s, although other animals are depicted. There are images of whales in Buffon’s 1793 edition (but again there are none in the earlier editions). The 1793 illustrations show a ‘Whale’, a ‘Nar Whale or Sea Unicorn’ and a ‘Spermaceti Whale’. The Nar Whale has a horse-like head with a unicorn horn protruding from its forehead and fish-like fins.
There are some common themes in the early illustrations of cetaceans in the Victorian natural history books:

- First, they tend to feature only a limited number of species (including the very distinctive narwhal with its ‘unicorn’ tusk usually erupting like a nose front the middle of its face, rather than from its mouth where it actually originates);
- second, the tail and pectoral fins often resemble those of teleost fish, including the tail’s orientation;
- third, whales are often bloated and blimp-shaped and sometimes have odd bulges or indentations;
- fourth, the animals are often depicted on land; and.
- fifth, and, perhaps most distinctively, fountains of water are often shown coming from their heads.

The illustrations from a later edition of Goldsmith’s book (probably the 1825) one (Figure 3) and a school text of 1851 (Figure 4: Anon, 1851), help to illustrate these points.
The Victorian illustrators concerned were presumably working from images produced by earlier artists and, at best, views of occasional decayed specimens cast onto the shore or perhaps brought to fish markets. Decomposition gases can cause bodies to bloat, perhaps explaining the ‘blimp-whales’, and the appearance of stranded cetaceans is often distorted by the pressure of whatever they are lying on.

In the later part of the 19th century, some popular books that featured cetaceans continued in Goldsmith’s vein of popularizing science. For example, M and E Kirbys’ *The Sea and its Wonders* published in 1871. This included illustrations of whaling activity, including a gold embossed image of a hunter spearing a narwhal on its front cover. Others were written by mariners, including those that served on whaling vessels such as the Rev D.D. Scoresby whose *The Whaleman’s Adventures in the Southern Ocean* was first published in 1859. The influence of those that served on whaling ships on the images of whales through this period is considered by Tim Smith and Randall Reeves (this volume).

Emerging also at this time were specialists in popular natural history writing of various kinds such as Francis T. Buckland. His *Curiosities of Natural History* was first published in 1865 and then at least twelve more times (for example, Buckland, 1859). Others included the Rev. J.G. Wood (for example Wood, 1891) and Frank T. Bullen who produced more than 30 volumes featuring adventures at sea, including *The Cruise of Figure 5. Struck Sperm Whale from Bullen’s A Whaleman’s Wife. (1902).*
the "Cachalot": Round the World After Sperm Whales (1902); first edition probably 1898 and A Whaleman’s Wife (1902). By this time, images were generally more accurate if a little fanciful. For example, the struck and leaping whale in Figure 5, although the monstrous water-spouting blimp-whale certainly lingered on in some natural history books until at least the end of the 19th century (see Figure 6; Anon, 1898).

![Figure 5](image)

**Figure 6.** A Spouting Whale from Anon (1898).

Natural history publishing eventually became so popular that it led one author at least to complain (whilst promoting his own work thus): ‘Although the number of works on Natural History might deter any new writer from venturing on so extensively handled a subject, there is at present no work of a really popular character in which accuracy of information and systematic arrangement are united with brevity and simplicity of treatment’ (Wood, 1907).

**MODERN WHALE IMAGES**

The 20th century brought with it still photography, which was soon featured in popular natural history books. Moving images soon followed and, ultimately, film techniques gained the ability to reveal the natural shapes and behaviours of whales and their kin in their underwater habitats. Perhaps most famously it was Jaques Cousteau who brought images of live cetaceans into people’s living rooms via television, including, for example via *Le Monde du Silence* (first released in 1956). Whale and dolphin watching also became (and remains) popular and, come the 21st century, the world-wide web provided further opportunities to view these animals. Indeed, one popular natural history book at least was illustrated almost wholly from a web-based photo-library (Simmonds, 2007).

Yet there remains an important role for natural history illustration of a more classical (non-photographic kind) in identification guides and elsewhere where the appearance of species, and even differences between populations, needs to be accurately shown. See
for example, Figure 7, from a new UK marine mammal guide (Simmonds and Molleson, 2012). The work of such a modern-day illustrator is now underpinned by a variety of sources to ensure the accuracy of images. Lucy Molleson (pers comm.), for example, used her own field experience; notes and photographs and video; access to dead bodies facilitated by the UK’s strandings projects; images and film available on the world wide web; museum collections; and, where appropriate, she has also used access to clients own specialist photographic libraries and feedback from field researchers.

![Figure 7. Orcas from the NE Atlantic drawn by Lucy Molleson (Simmonds and Molleson, 2012).](image)

However, some myths about whales still persist to the present day. For example, in the very popular Disney animated film, *Finding Nemo* (released in 2006), a whale of otherwise accurate shape and proportions swallows the two fishy heroes, Dory and Marlin. They escape when the water in its voluminous mouth is blown into the air via its blowhole creating a fountain of water that might have pleased some Victorian illustrators, but which has always been anatomically impossible for a whale to do.

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INTRODUCTION

Before naturalists being familiar with the great whales that inhabited the seas, there were many encounters of fishermen and sailors with these mysterious unknown beings. This lead to legends and myths that have fed generations of men at sea, also result from fear and hallucinations. In the Middle Ages the unexplored sea was above all a world of imaginary and fantastic, inhabited by monsters and a series of fabulous creatures. A topic that stimulated much curiosity and interest was the description of different monsters and creatures, and stories of sea monsters have rise in almost all cultures that have contact with the sea. Consequently the use of drawings of sea monsters were frequently used to illustrate maps, a practice that fell into disuse with the advent of modern cartography.

At this time and at the beginning of the Renaissance people were convinced that inhabited the North Atlantic terrible monsters, whales, sea serpents, giant lobsters, and fabulous beasts with strong and sharp teeth (Van Duzer, 2012). From the fifteenth century, during their travels, the sailors opened new paths and proved that the ocean was not so terrible, going to be a progressive accumulation of knowledge about their natural reality that led to the demystification of some marine fauna. However the sea monsters were present in marine cartography until the middle of the seventeenth century.

CARTOGRAPHY

Cartography is the science that studies the maps, its conception, production, dissemination and use. The maps serve as a mediator between the mental world and the physical world, enabling the visualization of spatial data and are fundamental to that Man is aware of his universe at various levels (Harley, 1987).

The construction of an old map was not a simple process involving firstly art and science second (Harley, 1987). Since antiquity that maps exist, even before the invention of writing, knowing some made on clay tablets and papyrus. The main function of 90% of the maps prior to 1350 who survived was pedagogical, didactic or exegetical. However, most maps of classical antiquity did not survive, so the emphasis is given to mapping the medieval and Renaissance periods (Van Duzer, 2012).

During the Middle Ages, the geographical knowledge in Western Europe stagnated somewhat, producing essentially maps TO. The medieval conception of the world was very diagrammatic representation of the earth exists in the idea of the East Paradise, location sought by the Portuguese in their voyages, and they remained until the fifteenth century (Brito, 2009). Cartographers journeyed from different principles of
contemporary, emphasizing more the sensitivities of individuals in relation to the world. The maps were constructed to further illustrate cosmological ideas. In the fifteenth century the Ptolemaic maps were considered the authority of the world map, that idea was abandoned and the application of printing to cartography (Harley, 1987).

With the opening of the Mediterranean Sea, the maps gain more importance, being developed mainly by Arabs. The mapping undergoes a revolution and reborn during the fifteenth and sixteenth centuries, reflected in the maps all the knowledge acquired with the Portuguese discoveries. The maps produced at this time were considered small geographical encyclopedias described the region, including many descriptions of flora and fauna, people, their customs and habits (Brito, 2009).

The oldest Portuguese charts show a cartographic style resulting from experience gained on the African coast. The Portuguese left so a great base of hydrographic information, rules of nautical science and several screenplays that were translated into several languages and that served to support countries like Italy, France or Holland (Brito, 2009). Very few letters of the fifteenth century Portuguese reached our days, due in part to the policy of secrecy D. John II, as well as the destruction of copies by the earthquake of 1755 (Gaspar, 2009). Much of the existing letters in the sixteenth and seventeenth centuries was not intended for navigation, given its lavish decor and the absence of telltale marks of use.

With the development of cartography, there is the introduction of maps in an iconography related to the new natural worlds, including animals, where natural elements persist as little real mermaids, with true as the great whales (Cazeils, 1998). The unknown and unseen were revealed something so mysterious and confusing, so chaotic until, as the result of combining the experience of people, mythological and Biblical truths, the influence of Aristotelian categories and imagination of the author.

THE REPRESENTATION OF SEA MONSTERS

The ocean was a dangerous and mysterious place in the classical and medieval periods. Pliny the sea called "the wildest part of nature," coming to curse the inventor of the boats, so have brought great danger to humans. Also considered that the open sea tended to produce sea monsters (Van Duzer, 2012). The existence of monsters and their stories always haunted the human imagination, even in classical antiquity, being a source of interest from the entire audience, but getting a little serious attention by some historians. At this time the monsters were associated with remote and unexplored places such as Asia and Africa (Daston & Park, 1981).

There were two very important geographic principles that have traditionally determined the regions were inhabited by monsters, the idea that these were the product of extreme weather, mostly hot, or that were located beyond the ends of the earth. The distant lands and seas of the authors of the works or stories of mythical wonders and exotic places were privileged to appear, since the distance would be difficult to refute the story and for being unknown places where anything could happen. The islands, separated from the known and distant places of the world, were also conducive to the occurrence of monsters and other wonders, from the time of Ptolemy, including existing myths about the existence of islands that were ultimately whales or other beings. There was also a psychological issue to keep the monsters at a safe distance, an ambivalence that made
them both attractive and fascinating, because they were near the fascination quickly give way to terror (Van Duzer, 2012).

The reference to monsters was common in geographical texts of all periods, appearing subtitles and images of them in medieval and Renaissance maps more elaborate. The term monster emerges from the fifteenth century, not necessarily related to a medieval mythical creature resulting from collective imagination, but associated with the glimpse of real animals, a huge and frightening creature, which had hitherto remained a mystery (Brito, 2006). The very definition of monster is no consensus over the centuries, and sometimes even contradictory. Many classical and medieval authors define as something unnatural monster, while others consider them as part of God's work, from which one can draw some lessons about the dangers of sin (Van Duzer, 2012). This work will be considered as a sea monster creature amazing and exotic whether real or mythical, even if we can identify it as an animal fauna existing in the current.

The sea monsters that are on the maps could work as records charts the geography of these creatures in literature or indicate possible dangers to mariners or, on the other hand, as decorative elements to animate the image of the world, adding visual interest, variety and vitality to hazardous seas and oceans. In the latter case, also served as evidence of the artistry of the cartographer or the author of the images, function compatible with any of the above and that could be performed simultaneously. Had paid particular artists to paint images of marine creatures such as maps and decorative elements that did not seek information about the location of these works on natural history, making the illustrations stay separated from their original geographical and natural sources (Van Duzer, 2011). Marine animals were often described and illustrated in a mixture of actual observations and concepts derived from the science of time, resulting in being fictional with anatomical features of various animals. You could also make the case for these "monsters" match representations inaccurate, distorted or derived from observations of misinterpretation of real animals that inhabited the seas unknown. Moreover, the distortion characteristics of the animals could be purposeful, thus highlighting the enormity of the animal in question, which would arouse more interest in the subject (Brito, 2009). Despite the hype sometimes depicted in the light of biological knowledge that we have today of animal diversity and its distribution, it is possible to distinguish some of the groups represented, as dolphins and whales, seals or large cephalopods.

From the sixteenth century, ships of discovery and enormous beings were the main motifs of naturalistic works, maps and marine charts. The oceans were an empty space on a map, which was appropriate to the decor with fantastic sea creatures. The discovery of the new world also potentiated the appearance of several other myths, since there exist some creatures were so strange in the eyes of Europeans that were interpreted as being monsters. These explorers, and cartographers, tended to interpret what they saw or heard according to categories that were familiar to them (Van Duzer, 2012).

To be able to understand the emergence of these creatures, we must be able to put ourselves in context and thinking of different times and cannot do the analysis in the light of the knowledge of geography, biology, anatomy, genetics or even today, because if it did not do any direction (Richards, 1994).
MARINE ANIMALS ON MAPS

As already mentioned, the distant sites and unknown were preferred for the representation of monsters. However there are known work that put them at the center of the world, as the Mappa Mundi of Hereford, the largest known medieval map, dated around 1300 and whose authorship is attributed to Richard de Bello, a prebendary of Lincoln Cathedral. This map can be classified as a modification of the very elaborate maps and TO is likely to have been copied from a descendant of the first or fourth-century Roman maps, with enormous detail. It is unknown precisely what the purpose of this map, may have merely a decorative function of one of the many altars of the cathedral of Hereford, or used in education and spreading the Christian faith. In this map are represented various sea monsters in the Mediterranean Sea, as the case of a mermaid or a sea serpent, as well as monsters that derive from Homer's Odyssey (Van Duzer, 2012). Contrary to what was usual in the surrounding and distant ocean have only two representations of sea monsters (Figure 1).

Figure 1. Mappa Mundi in Hereford, dated around 1300 and whose authorship is attributed to Richard de Bello. The map is oriented according to the standards of the time, standing atop the East, West down, left North and South on the right. In the center of the map, the brown is represented the Mediterranean, where the marine animals (some of which are marked with red circle (http://users.abo.fi/mgill/medlink.htm image)).

Despite the influence of recognized sources such as the Bible, Pliny or Isidore of Seville (Westren, 2001), it is possible that the representation of some of these animals in this particular map correspond to its real existence in places designed, albeit with exaggerated features. The southern map shows an island with the caption "Hic sirenae abundant" (Sirenia abound here) (Van Duzer, 2012), currently Sirenia corresponding to the group of manatees and dugongs, but here indicate probably mermaids.
Olaus Magnus, Swedish cartographer and ecclesiastical writer has pioneered the development and dissemination of works on the northern community. The famous Carta Marina (The Book of the Sea and description of the northern lands and its wonders) published in 1539 contains a map that represents Northern Europe, Scandinavia and Iceland and that represents not only a considerable number of sea monsters in the Northeast Atlantic, but also a wide range of them (Figure 2). This map, which proved to be the most accurate representation of these lands for the time, perhaps it would also be a faithful representation of marine fauna at the site. It is a magnificent map, whose detailed interpretation of the representation of marine animals was, in itself a very ambitious project and time consuming. Much of the natural history encyclopedias illustrated in Renaissance will seek information to this work.

Figure 2. Charter Marina Olaus Magnus, published in 1539. Featured are representations of animals identified with the name and other representing hazards to humans (http://en.wikipedia.org/wiki/File:Carta_Marina.jpeg).

It can be seen that some of the animals depicted in this chart are identified with the name, as in the case of a whale and a killer whale, a zīffio or a bear that have matching with animals that are currently known and which are possible to occur at the site where they were represented. However, the empty space of the sea would be a good canvas on which the artist could let their imagination, drawing several imaginary animals, resulting from local observations or copied from other works, such as the Hortus Sanitatis, the late fifteenth century. This imaginary component is also visible through some representations where these animals are associated with great dangers for humans, especially for navigators, some of which fed stories and legends for centuries, with the example of sea snakes or large whales that were sinking the ships and caravels. This map, unlike most existing at the time, put these monstrous creatures in contact
with population, having served as a reference to the copy of the same to other works. Although the creatures were copied in form, were placed in other jobs in other geographical locations, may not be representative of the existence of animals on site. Sebastian Münster, German geographer and mathematician, was one of the authors responsible for the publication of a Latin edition of Ptolemy's Geography with illustrations in 1540. His work Cosmographia from 1550 features one of the world's most popular maps from the sixteenth century, which is decorated with sea monsters and with the winds, based on several sources, including the work of Ptolemy. This was the map when first appear the name of the Pacific Ocean (Mare pacificum) (Figure 3). Although some of the characteristics exaggerated, it is still possible to identify some animals, as whales, cephalopods or a sea lion. In the case of whales, these may be identified either by their size, either by having beards and no teeth, so as to have two breathing holes, from where two cones of water, resulting from respiration of these animals (Brito, 2009). This seems like a case where animals have a decorative function.

**Figure 3.** Map of the world's authorship of Münster, which first appeared in the 1550 edition of the work Cosmographia, which can identify various representations of marine animals as a possible sea lion, a cephalopod (http://www.alexandremaps.com/map_detail.php?MapID=740 image).

This same work included a sheet describes where sea monsters exist in the Atlantic, a representation of the marine environment that shows its importance and grandeur when compared with terrestrial monsters who have virtually no expression and where marine animals are also represented exaggerated. The inclusion of these work sheet shows the diversity of animals in the sea and how difficult were to navigate at the time. The author may have been influenced by the ideas of Pliny's almost "spontaneous generation" of monstrous creatures in the open sea. Another influence present in this work seems to be the Charter Marina Olaus Magnus, (see Figure 2), which is
practically the same animal with slight differences, thus verifying the importance of the work that had the authority at the time, whose parts were repeated in various contexts.

Figure 4. The land and sea monsters (almost without expression in northern Europe are represented in the second sheet in this Cosmographia of Sebastian Münster, 1550.

Abraham Ortelius was a Flemish cartographer and geographer that became a great reference for the cartography of the sixteenth century and is considered the creator of the first modern atlas, the *Theatrum Orbis Terrarum* in 1570 (Figure 5). This book contains 53 maps of all countries known until then, with descriptive texts about them and reference sources used. It was a work with great spread, published in several editions for about 40 years in various languages. In the map are shown some large marine animals, by ignoring the intention with which they have been placed there. For the type of drawings also realizes that Ortelius was aware of the Charter marina Olaus Magnus (Figure 2).

One map has not yet been the subject of a study about the representations of marine animals in their waters date from 1569, written by Giovanni Francesco Camocio. It is known that Camocio was one of the first compilers and publishers of Lafreri maps, marking the transition between the Ptolemy and Mercator and Ortelius maps. Produced a large number of decorated maps using a style quickly copied by his contemporaries, considered by some as one of the most important publishers of geographical maps of the sixteenth century (Arkway, sd).
Figure 5. Map world-authored by Abraham Ortelius, in his Theatrum Orbis terrarum. Some of the large marine animals represented are marked with red circles (http://www3.slv.vic.gov.au/latrobejournal/issue/latrobe-41/fig-latrobe-41P001a.html).

Figure 6. Map authored by Giovanni Camocio, 1569, in his Cosmographia Universalis Et Exactissima Ivxta Postremem Neotericorvm Traditionem. Below detail of the creatures represented mermaid, b man-marine, c sea cow near the Azores (http://jcb.lunaimaging.com/luna/servlet/detail/JCBMAPS~1~1~64~10019:32642?qvq=q:camocio%2B1569;lc:JCB~1~1,JCBBOOKS~1~1,JCBMAPS~1~1,JCBMAPS~2~2 &mi=2&trs=3).

This map shows a configuration similar to Ortelius world map (Figure 5). Represented in all seas and oceans boats and sea creatures scattered and oversize territories. The
animals and sea monsters represented here, birds, fish and mammals and mythological beings are not original, acknowledging the influence of other works, as the compendium of natural history and plant Hortus Sanitatis, published in 1491 by Jacob Meydenbach or Letter marina Olaus Magnus.

**Figure 7.** Representation of a mermaid present in the work Hortus Sanitatis (Meydenbach Jacob, 1491), where we see the similarity with the one shown in Figure 6 (http://vionajessica.wordpress.com/2011/06/10/bab-iii-tinjauan-lapangan-starbucks-part-1/ image).

Despite these representations seem to have a decorative function and void fill, sea monsters may have represented a connection to the unknown and the dangers posed to the sea, contrasting with the representation of vessels in a sign of conquest of more territories in the period of Iberian maritime expansion. This map of the sixteenth century is not an isolated case as the lack of a detailed study of the creatures represented in the empty spaces of the oceans.

**Figure 8.** World map authored by Antonio Millo, sixteenth century, where the points with red circles representing some animals / monsters. Image courtesy of Chet Van Duzer.
Antonio Millo was a Greek captain and cartographer, active during the sixteenth century in Venice, responsible for several world-maps and nautical charts, many of them of great detail and which are now in major libraries and museums worldwide. One of these maps, dated 1582, announcing that the title represents "everything that has been discovered on a nautical chart of calm sea" (Tuto el discoperto in carta marina in piano), where the author strives to be accurate, innovative and honest, showing several ships and fabulous sea monsters (Figure 8). Millo sought work from current and reliable sources, such as the work of Gastaldi or Camocio.

Also in this map marine creatures represented are oversized and dispersed across oceans. It is possibility to identify flying fish, whales, sea serpents and other monsters, in a style similar to what was observed in previous maps, thus verifying the importance of reproduction and copying of information that was present in works considered authorities for science time.

One of the pioneering works on images of marine creatures in literature analysis was done by Van Duzer (2011) to existing maps in a Latin manuscript of Ptolemy's Geography, dated 1455-1460. The maps contained in this manuscript are the ones in all the work that are decorated with a large number and variety of sea monsters, more precisely 476. For this author, the maps areas where there are more exotic sea creatures have to do with the fact that they are areas with more sea, and as such with more free space to draw, coupled with inspiration and the artist's freedom to innovate and change animals and not so much due to the creatures really exist in these areas. Sometimes the existence of monsters was related to potential dangers in certain places, as in the case of aggressive monsters indicating dangers of depth (Van Duzen, 2011).

CONCLUSION

During the Middle Ages the representations in world maps were considered a true story, the most important source of information safe from east to inspire other work taking these fantastic creatures enrich the role of narratives. The impression made by the wonderful creatures had a very important role in historical mystification that excite people of twelfth and thirteenth centuries, also finding an echo in Europe from the seventeenth century.

The medieval maps represented the accumulated geographical knowledge, describing essentially the earth's surface. With the discoveries, the cartographic science was a high point in his development, and that the maps produced as small encyclopedias geographic regions described, including a series of descriptions of flora and fauna (Brito, 2006). The Portuguese discoveries allowed diminish fear and ignorance as to what was known about the ocean and the creatures that inhabit it, a very important contribution to natural history (Brito, 2010). In most maps of the second half of the sixteenth century the sea monsters have a bizarre image, leading us to believe that the beliefs and legends of the time will have a large influence on how they are represented.

Reports of maritime experiences multiplied and led to increasingly accurate information from the sixteenth century and the classifications and descriptions of marine animals gain more importance, however mixing with actual observations earlier tradition, especially fantastic (Gannier & Gannier, 2005).
Unfortunately there are few sources on the study of sea monsters on maps where we can build. By analyzing the maps presented here, you can check that represented the creatures were common to maps of different authors and periods, showing the importance of knowledge of the natural world, which led to the amendment of the mechanisms for validating information. With the Iberian navigations of fifteenth to the seventeenth centuries, the mechanisms by which they attributed to the validity information is modified, returning to experience the phenomenon of witnesses or the evocation of view to be the most important criterion of authority, (as they were in ancient Greek or Roman) and not the great texts scholars as hitherto.

In summary, the maps can thus be seen as an image of the world (imago mundi), a veritable encyclopedia of knowledge of the period they represent, portraying much information, whether true or not, which is indicative of the beliefs and conceptions that had the world (at least the cartographer). These true works of art do not reveal what is real, but the way we see the world and what is in it more significant.

If the eyes of medieval and Renaissance sea monsters on maps representing real dangers, to modern eyes these beings are among the most attractive elements of the old maps. Considering the importance of this topic in the history not only of cartography and art, but also in illustration and geography of animals, it is surprising that a subject is still so little studied (Van Duzer, 2011). A further study on marine animals represented on the maps can provide very important clues about the sources, influences and methods used by cartographers or by the artists who drew them.

Only a very thorough and comparative study using several sources and original maps may give a better idea of why these creatures representation on maps over several centuries.

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6. ESTABLISHING “CORRECT FIGURES” OF THE GREAT WHALES OVER THE 19TH CENTURY

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INTRODUCTION

Despite centuries of human interactions with the great whales, images of them in the 18th and even the early 19th century were based largely on observations of stranded animals. As a result, the drawings were not particularly accurate or revealing about the creatures’ appearance in life. As Thomas Beale (1807-1849) noted in 1839, it was
difficult to find a correct drawing of the sperm whale, on account of those which have been stranded on various parts of Europe becoming so much misshapen from their own weight, while lying in the mud, and moreover from their being surrounded by great numbers of eager spectators

Experienced whalemens, however, such as William Scoresby Jr. (1789-1857) and Charles W. Scammon (1825-1911), were able to bring first-hand at-sea observations of living whales, as well as fresh carcasses, to bear. Over the course of the 19th century, this would greatly improve the level of understanding of what whales really look like. This was not easy, however. For example, Scammon (1874) noted:

It is extremely difficult to delineate accurately the forms of the larger Cetaceans. When one of these animals is first captured, but a small part of its colossal form can be seen, as, usually, only a small portion of the middle section of the body is above the water; and when the process of decomposition has caused the animal to rise, so that the whole form is visible, it is swollen and quite distorted in shape.

The improved drawings came in two forms, line drawings (including silhouettes) and shaded drawings (including stippled). Line drawings were basically outlines of the whale's body as seen from the illustrator’s perspective, with varying amounts of detail indicated by simple lines, depending on how familiar the illustrator was with whales and the point(s) he was trying to emphasize. In contrast, shaded or stippled drawings attempted to convey details of the morphology and color patterns of the animals through dark to light shading or texturing.

SPERM WHALES

Early images demonstrate the difference between line and shaded drawings. For example, a line drawing by Captain Colnett in 1793 (Figure 1) clearly displayed the basic shape of a sperm whale. In contrast, shaded drawings published by the famed naturalist Bernard Lacépède (1756-1825) in 1804 (Figure 2) were badly distorted.
Figure 1. Colnett’s Sperm Whale, 1793. Drawn by Captain Colnett on the Rattler from 15 foot specimen hoisted aboard off the west coast of Mexico (from Burnett 2007 Fig.7).

Figure 2. Lacépède’s sperm whales, 1804.
Another French naturalist, Frédéric Cuvier (1773-1838), perhaps unaware of Captain Colnett's drawing, stated in 1836 (quoted here from Beale 1839):

*Figures drawn from whales when floating freely, would be in a condition to inspire more confidence, but if such figures are possible, we believe that science, as yet, does not possess any.*

Cuvier’s own drawing of a sperm whale (Figure 3), although better than Lacépède’s, was no match for those produced by whalers. For example, a British whaling ship’s surgeon, Thomas Beale (1807-1849), published a whaling scene showing sperm whales in an 1839 book (Figure 4). Boatsteerer Dean C. Wright in 1842 included a drawing of a sperm whale in his journal (Figure 5, from Frank 1991) that is more detailed. But even this image has obvious weaknesses in comparison to Scammon’s of several decades later (Figure 6). The whalers’ drawings were obviously informed by their direct experience of whaling, and this developed over many years.

**Figure 3.**
Cuvier’s sperm whale, 1836.

**Figure 4.**
Beale’s Sperm Whales, 1839.
Figure 5. Wright’s Sperm Whale, 1842.
The Commonplace Book of Dean C. Wright, Boatsteerer, Ship *Benjamin Rush* of Warren, Rhode Island, 1841-45

Figure 6. Scammon’s Sperm Whale, 1874

WHALERS’ DRAWINGS

Whalers made other line and shaded drawings in the first half of the 19th century, varying in form and detail. In the late 1840s Matthew Fontaine Maury (1806-1873) began a study of whaling based on voyage logbooks, and in response to his request, many whalers sent letters answering his questions, some complete with illustrations of whales (Maury 1851). These illustrations were attempting in some cases to clarify distinctions between similar-appearing animals (Figure 7). For example, the distinction between right whales and bowhead whales was a matter of some concern in that period. Other illustrations attempted to show aspects of behavior (Figures 8, 9 and 10).

Figure 8.
Whalers’ whales.
From Maury, 1851.
Entries concerning catches in logbooks or journals were often illustrated using wooden stamps. Figure 11 shows such stamps depicting catches for an entire voyage, organized by each of the three whale boats. These stamps changed over the century, becoming increasingly detailed as more species became targets of the whaling (e.g. bowhead whales, humpback whales, gray whales). Figure 12 is a stamp showing how a humpback calf was harpooned, which the logbook text said made “the old cow furious.” The text goes on describing how, after sundown when the cow had calmed enough to be approached, she was harpooned. The second stamp shows how she was harpooned twice, and eventually yielded 70 barrels of oil.
Several sperm whales and pilot whales are shown, along with one right whale and four turtles. Stamps of whales were retouched and annotated with numbers of barrels obtained. From Burnett 2007 Plate 8.

**Figure 11.** Whale Stamps & Drawings mid-1850s.

**Figure 12.** Humpback Whale Stamps from the logbook of the Ship Dr. Franklin, August 1857, with stamps indicating the catch of a 70 barrel humpback whale and calf.

**Figure 13.** True’s Whale Silhouettes, 1884.
The continued utility of line drawings is evident from Frederick True’s (1858-1914) array of partial line drawings (Figure 13) that he sent to lighthouse keepers, asking them to report stranded cetaceans by telegraph to his office at the Smithsonian Institution (True 1884). Careful scientist that he was, True deliberately avoided encouraging the keepers to identify the animals to species but instead asked them to describe features they observed, leaving it to him to narrow the possibilities based on the information provided.

**Figure 14.** Whaler Dean Wright’s 1842 “The Whaleman Takes Stock” 1842 (from Burnett, 2007 Plate 9).

Some whalers used shaded drawing techniques to illustrate whales. Dean Wright’s illustrations of whales, dolphins, fish and sharks were intermediate between line drawings and shaded drawings, showing some characteristics of both (Figure 14).

**Figure 15.** Whaler John F. Martin’s Images of Whales in 1843 From Logbook of the Lucy Ann (from Burnett, 2007).
Another mid-century whaleman, John Martin, produced similar but much more sophisticated images of whales and dolphins (Figure 15).

**THE MARINE MAMMALS OF THE NORTH-WESTERN COAST OF NORTH AMERICA**

One whaler in particular, Charles W. Scammon, developed a method of illustrating whales that greatly advanced our understanding of the shapes of whales. His drawings were initially published in 1872 and in final form in 1874 in his book, *The Marine Mammals of the North-western Coast of North America* (Figure 16). These images were far superior to those of his contemporaries, as we saw above for sperm whales. Scammon (1874) acknowledged, but from a more informed perspective, the difficulty earlier noted by Cuvier of accurately depicting “free floating” whales, noting that these animals

> change their appearance in the most remarkable manner with every change of position, so that it is only from repeated measurements and sketches, and as the result of many comparisons, that I have been able to produce satisfactory illustrations of these monsters of the deep.

**Figure 16.** Title page of Charles M. Scammon’s 1874 book: The Marine Mammals of the North-western Coast of North America, together with an account of the American whale fishery.

**Figure 17.** Scammon’s Gray Whale, 1869.

That satisfactory images were not easy is seen in a drawing of a gray whale by Scammon himself, published in 1869 (Figure 17). This was more a decorated silhouette, or even a cartoon, when compared to the sophisticated shaded drawings that
Scammon would become known for. The form and style of his drawings of whales, a fetus and an adult, changed markedly between his 1869 and 1872 drawings of gray whales (Figure 18).

In addition to the images of sperm whales described earlier, Scammon's drawings of several baleen whales were also great improvements. Three drawings of bowhead whales demonstrate the progress in our understanding of this species, starting with Lacépède (1804) (Figure 19), followed by Scoresby in 1820 (Figure 20), and then Scammon in 1874 (Figure 21). Contrasting Lacépède's and Scammon's images of right whales (Figures 22-23), humpback whales (Figure 24-25) and blue whales (Figures 26-27) shows the influence of whaling experience in dramatically improving understanding of what these whales actually look like. Figure 28 shows Scammon's baleen whale images together, illustrating his knowledge of the differences among these species.

Scammon also illustrated whales in their environment showing various types of behavior, obviously informed by first-hand observations. Humpback whales active at the sea surface are shown in Figure 29 and gray whales “spyhopping” in the ice in Figure 30. A humpback whale nursing two calves (a rare and far from typical occurrence) is depicted in Figure 31, and a sperm whale presumably searching for prey (in a probably unrealistic and only imagined manner) is shown in Figure 32.

Figure 18.
Scammon’s Gray Whale, 1874.

Figure 19.
Lacépède’s Bowhead Whale, 1804.
Figure 20.
Scoresby’s Bowhead Whale, 1820.

Figure 21.
Scammon’s Bowhead Whale, 1874.

Figure 22.
Lacépède’s Right Whale, 1804.

Figure 23.
Scammon’s Right Whale, 1874.
Figure 24. Lacépède’s Humpback Whale, 1804.

Figure 25. Scammon’s Humpback Whale, 1874.

Figure 26. Lacépède’s Rorqual, 1804.

Figure 27. Scammon’s Blue Whale, 1874.
Figure 28. Poster showing Scammon’s Images of Baleen whales

Figure 29. Scammon’s Humpback Whale Lobtailing, Bolting, Breaching and Finning, 1874.

Figure 30. Scammon’s Gray Whale Among the ice, 1874.
DISCUSSION

The realism and accuracy of images of whales increased markedly over the 19th century, and this improvement was possible because of whalers’ increasing familiarity with the animals, including the species they targeted as well as those they did not. The improvements can be traced in both line drawings and shaded drawings by contrasting drawings made by people involved with whaling and drawings by people who were not. Many of the whalers’ drawings were intended to demonstrate how to distinguish among similar species at sea, for example right whales and bowhead whales. Other drawings went further, showing the animals in their habitat and illustrating their behavior.

Scammon’s drawings of both sperm and baleen whales were especially significant because they fundamentally altered previous impressions of these animals. His images were informed by direct, first-hand observation of living whales and of whales as they were killed and butchered. Scammon was ahead of his time in some ways, seeking to portray whales (and other cetaceans) as the streamlined, agile animals that they are. In doing so, he greatly improved on the work of others in the 19th century, although he did take some liberties at times by imagining what things looked like under water.
The progression of sperm whale drawings over the century demonstrates the role of whalers in refining our understanding of sperm whales. The interactions between the different sources of information (strandings and whaling) and types of drawings (line drawings and shaded drawings) over the century are suggested here by several simple comparisons. However, further and more systematic examination of archival records of both images of whales and written explanations of those images would be useful to better understand how we came to know what the great whales look like.

REFERENCES


7. CONCLUSIONS

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The papers presented in this Workshop provided the opportunity for a general discussion of scientific illustration and historic and continuing role and importance in scientific work.

All the presentations underlined the importance of images as powerful tools to convey and implement ideas, especially those not always easy to verbalize, in order to be understood by those who are confronted with them.

Similarly, all the papers highlighted that no matter the object, drawings were used to demonstrate differences as well as specificities, enhancing particulars that could often not be seen again, observed elsewhere or readily by others. In any case, even for the mythic images of mermaids and “sea monsters”, geographic space and precise time (month, year, season…) of observation and drawing was essential information that was inscribed, explicitly or implicitly, in the illustration itself or in accompanying verbal description.

We focus mainly on manual drawings of images, sometimes intended as scientific illustrations but often historical images drawn for various reasons, trying to understand the degree to which the original purpose (scientific, instruction, ‘art’, decoration) of an image affects our use and value of it. This discussion allowed us to recognize the importance of these images to disclose information on marine mammals and natural phenomenon and to conclude that, no matter the variety of motivations of the authors, we can often use today historical images that were not intended as scientific illustrations to understand nature.

While modern use of camera and other recording devices are of course invaluable, drawings often help to clarify or complement other descriptions by elucidating specific features that are often unseen. Further, we recognized the importance of a combined analysis of scientific illustrations and written accompanying texts for conveying a better comprehension of the objects of observation.

Therefore, Science Illustration persists as an important visual support helping in the appropriation of the objects described no matter they are animal, plants or natural phenomena.