



# The genetic history of whaling in the Cantabrian Sea during the 13th–18th centuries: Were North Atlantic right whales (*Eubalaena glacialis*) the main target species?

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## ABSTRACT

For millennia, whales have been used as a food source, initially probably opportunistically, with the use of stranded animals on beaches, and later by active hunting. The Basques pioneered commercial whaling first in the neighbouring Cantabrian Sea (11th century) and then in Newfoundland and Labrador (16th century). The North Atlantic right whale (*Eubalaena glacialis*) is believed to have been the main target species of the Cantabrian fleets off the coast of Spain although other large whale species could have occasionally been targeted. At present, no molecular identification study has been performed to corroborate which species constituted the main catch for local whalers. Here we use historical bone remains to identify the main target species of medieval whaling in the Cantabrian Sea (13–18th centuries). Our results confirm the North Atlantic right whale as the main target species in Iberia suggesting that direct hunting could have played a role in the depletion of the species.

## 1. Introduction

Marine mammals have been part of the diet of coastal human populations for millennia (Stringer et al., 2008), including several coastal societies such as the Vikings, Inuits, Japanese and Basques that have been using whales as a resource for centuries (e.g. Ellis, 1991; McCartney, 1980; McCartney and Savelle, 1993; Szabo, 2008; Kalland and Moeran, 2010). Initially, these resources were probably restricted to the opportunistic use of stranded animals on beaches (Szabo, 2008). During the Roman period, marine mammals were occasionally, but not systematically, targeted for food (López, 2014). Today, whales belong to one of the most threatened group of mammals, almost exclusively due to the industrial hunting practices of the last few centuries (Denny, 2008). Archaeological investigations into the history of whaling and marine mammal hunting in general are vital for understanding the long-term exploitation of these important resources, and also to provide essential ecological baseline data on whale populations prior to industrial overhunting. Even though these materials are abundantly present in the archaeological collections their exploration for scientific purposes has been minimal, probably due to its fragmentary nature

which hinders species or even genus identification; making tracking of species distributions and investigating changes in exploitation through time almost impossible.

The first records of dedicated whaling were in medieval times when it became an important economic activity. The blubber, the most valuable good, was melted into oil and used for lighting the streets of Europe and America up to the advent of better fuel. The meat was salted and the baleens and bones were used to make tools, utensils and load bearing columns in houses (López, 2014). Industrial whaling was probably pioneered by the Basques in the 11th century, even though Norse and other populations hunted whales for subsistence years before that (Szabo, 2008; Seersholm et al., 2016). The earliest whaling dates by the Basques correspond to references from Bayonne (Gulf of Biscay) in 1059 CE and Navarre (Northern Spain) in 1150 CE (Aguilar, 1986). In the Basque Country, the first whaling reference dates to 1190 CE (Ciriquiain-Gaiztarro, 1961). In 1199 CE and 1232 CE, there are references to whale hunting in Cantabria and Asturias (Northern Spain) and in 1286 CE in Galicia (North-western Spain) (Ciriquiain-Gaiztarro, 1961), while in Portugal the first reference to whaling is from 1229 CE (Teixeira et al., 2014). This temporal pattern suggests this activity

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spread from east to west due to the transfer of whaling experience and techniques, rather than a fast depletion of stocks in the Cantabrian Sea (i.e. northern coast of Spain and the southwest side of the Atlantic coast of France) or the search of better hunting grounds (Azpiazu, 2000).

In the Cantabrian Sea, Basque whaling peaked during the 16th and 17th centuries (Aguilar, 1986). From the 13th–18th centuries Basque whalers had settlements in up to 47 ports along the coasts of Northern Spain and Southern France (French Basque country, Spanish Basque Country, Santander, Asturias and Galicia) (Aguilar, 1986). Even though catch numbers may not have been high, additional factors would have had a negative effect on the whale population (i.e. whalers showed a preference for mother and calf pairs) (Aguilar, 1986). In the 16th century, Basque whalers started annual journeys to the NW Atlantic in search of new hunting grounds due to a reduction of whale stock in the Cantabrian Sea (Aguilar, 1986). The local coastal whaling activities had paved the way for the Newfoundland enterprise (Azpiazu, 2000). From approximately 1530 CE to 1630 CE, Basques whalers travelled from the Cantabrian Sea to the Strait of Belle Isle, a narrow strait located between Newfoundland and Labrador, to hunt whales (McLeod et al., 2008). This represented the first directed commercial whale hunting in the western North Atlantic (McLeod et al., 2008). It has been suggested that between 25,000 and 40,000 whales were killed during this time (Aguilar, 1986). Basque whaling in Newfoundland not only had an economical impact, but also a great effect on the whale populations. Gaskin (1991) suggested that Basque whaling in the 16th–17th centuries in the western North Atlantic might have been one of the largest right whale human-induced reductions.

Five species have been identified as the main targets of the local coastal whaling period, 13th–18th century, in the Cantabrian Sea: the North Atlantic right whale (*Eubalaena glacialis*), the bowhead whale (*Balaena mysticetus*), the gray whale (*Eschrichtius robustus*), and to a lesser extent the humpback whale (*Megaptera novaeangliae*) and the sperm whale (*Physeter macrocephalus*) (López, 2014). While most evidence (e.g. historical records, drawings) suggests the North Atlantic right whale dominated the catch (López, 2014), this has not yet been confirmed by biological or archaeological evidence. McLeod et al. (2008) used ancient DNA to identify the main target species along the coasts of Newfoundland and Labrador (Canada). The study found that bowhead whales were the main catch species, as opposed to the general belief that the most caught species in that area were North Atlantic right whales.

Here, we attempt to uncover the main target species of the early whaling period (13th–18th century) along the Western Cantabrian Sea. To do this we collected historical specimens from museums and private collections or from the seabed off historical whaling harbours (Table S1, Fig. 1). We used two fragments of mitochondrial DNA to genetically identify the species of the different specimens. Bone has been extensively used in ancient DNA studies to uncover past population dynamics (e.g. Campos et al., 2010), phylogenetic relationships among extinct and extant species (e.g. Willerslev et al., 2009) and for species identification (e.g. McLeod et al., 2008; Schlumbaum et al., 2010; Sremba et al., 2015). This work reveals, for the first time, which species dominated the catch during the early whaling period in the Western Cantabrian Sea and brings some insight into the past diversity of large marine mammals.

## 2. Material and methods

### 2.1. Sample collection

A total of 300 whale bones were collected by CEMMA (Coordinadora para o Estudo dos Mamíferos Marinos, Galicia) and collaborators during the spring and summer of 2014. Permission was obtained from all museums and institutions to access the collections and all samples were on loan for scientific purposes. A subset of 72 samples, representative of all the surveyed ports, was used in this study (Table S1). Samples were collected from local museums, private collections and in underwater sampling campaigns. Underwater sampling targeted areas described in several historical records (Valdés Hansen, 2010) as medieval whaling ports, and they were concentrated in Galicia (Bares and San Cibrao; Fig. 1). Several written records confirm the ports of Bares, Luanco and San Cibrao (Ciriquiain-Gaiztarro, 1961; Valdés Hansen, 2010; López, 2014) as old whaling ports active between the 13th and 18th century, which allow us to confidently place our samples in this time interval. All studied samples, even the ones from private collections, can be confidently assigned to these areas.

Underwater sampling was conducted by either snorkelling or using autonomous diving equipment. The latter underwater sampling was carried out by CEMMA as part of a dedicated project to study historic whaling in the Cantabrian Sea, while snorkelling sampling was usually opportunistic (e.g. carried out while spearfishing). Detailed information

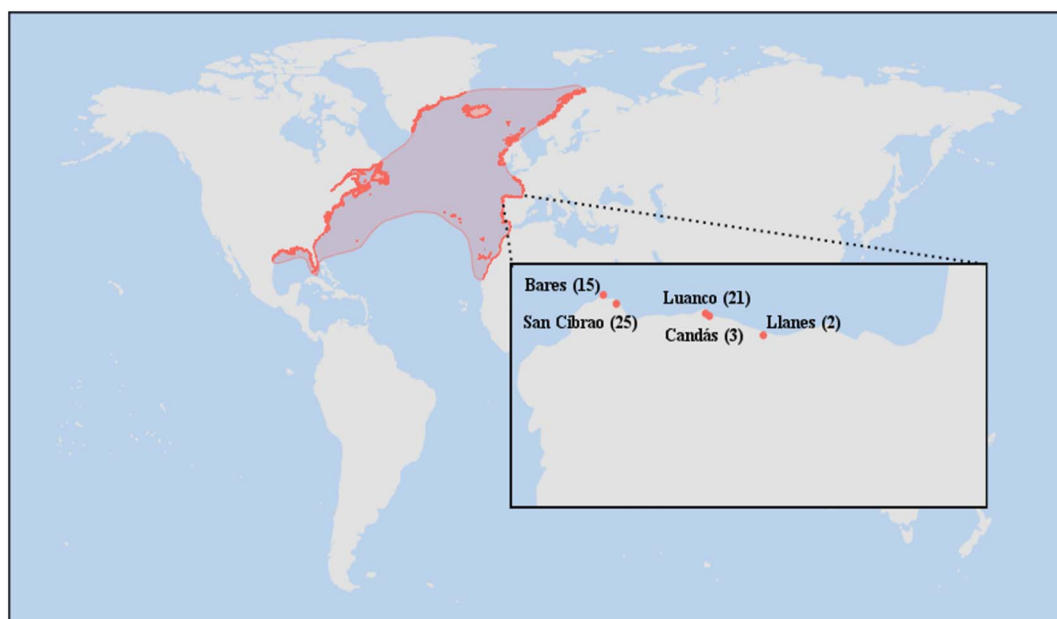


Fig. 1. Sampling locations. Geographical range of NA right whale (red polygon), with an insert of the geographical locations of sampling sites, historical whaling harbours in Galicia and Asturias, Western Cantabrian Sea. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

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