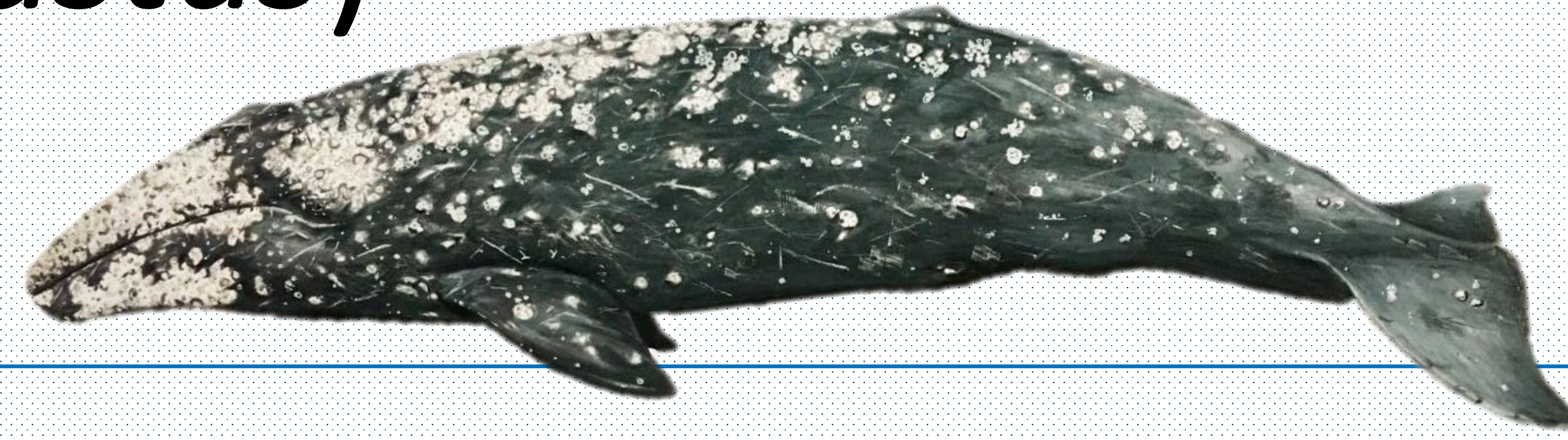
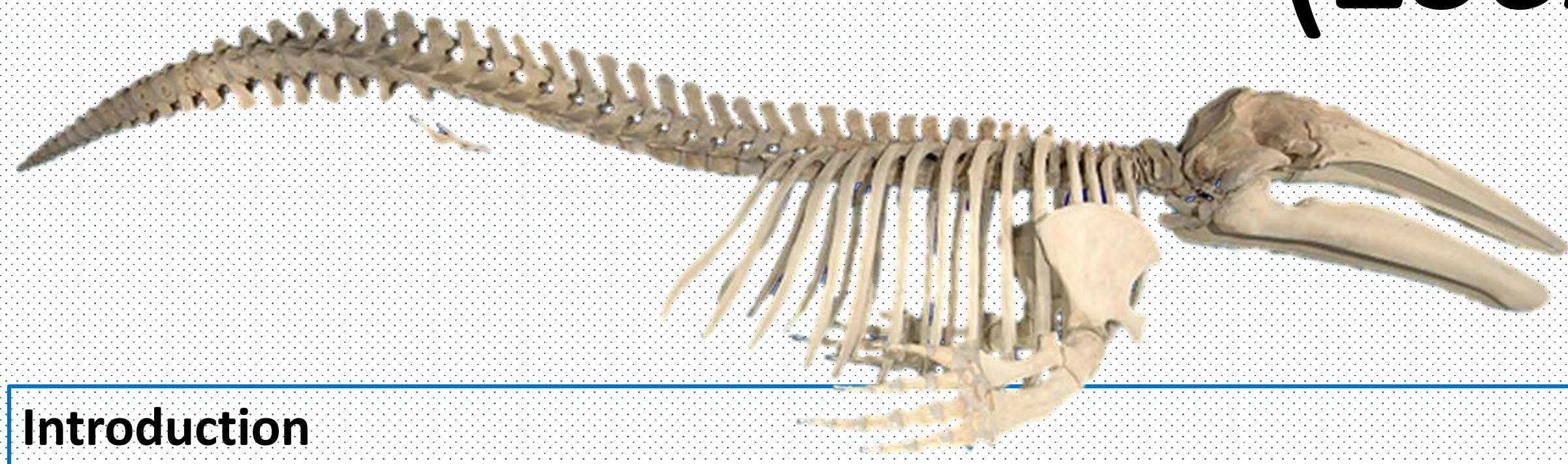


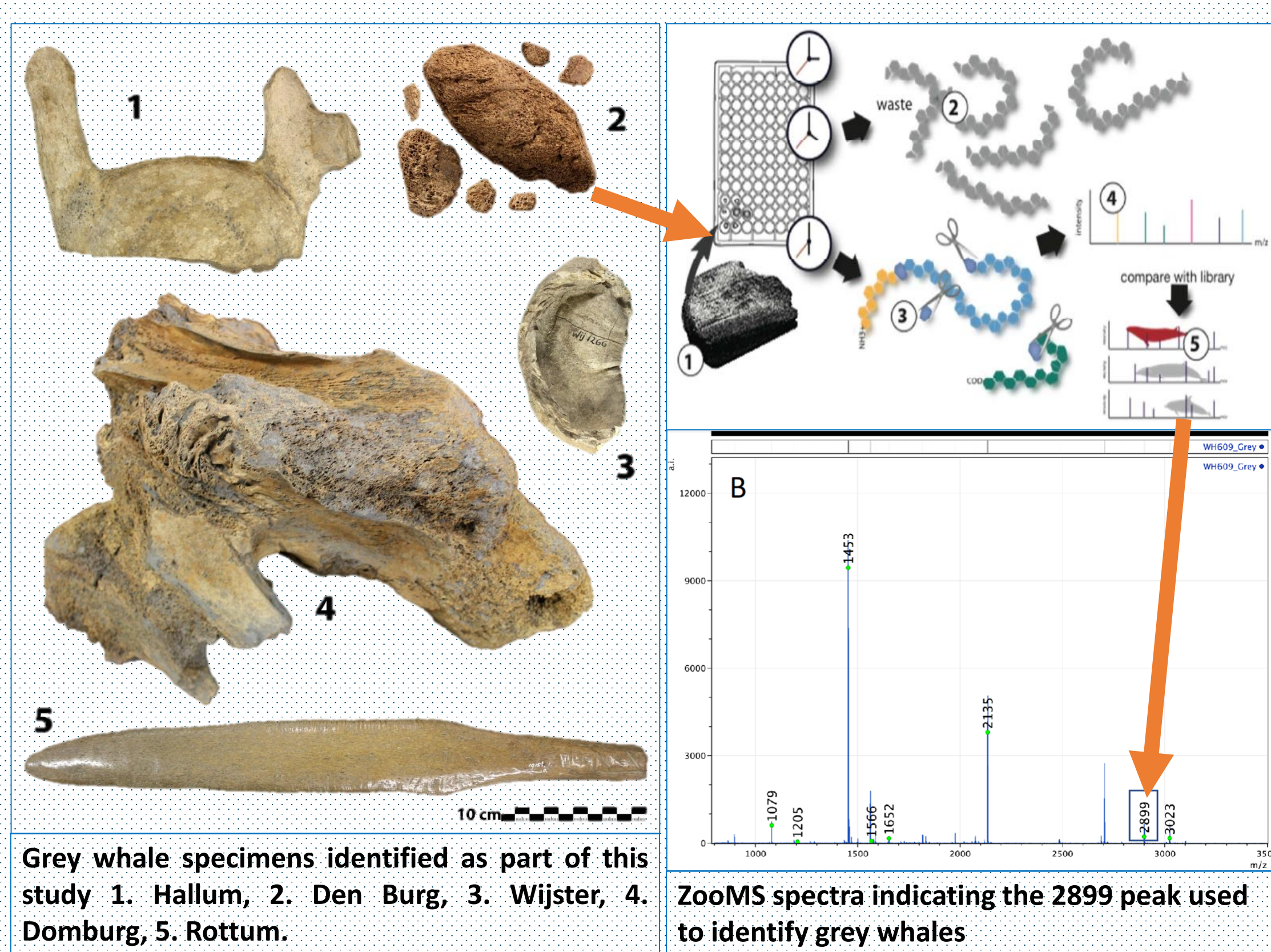
The Demise of the Atlantic Grey Whale (*Eschrichtius robustus*)

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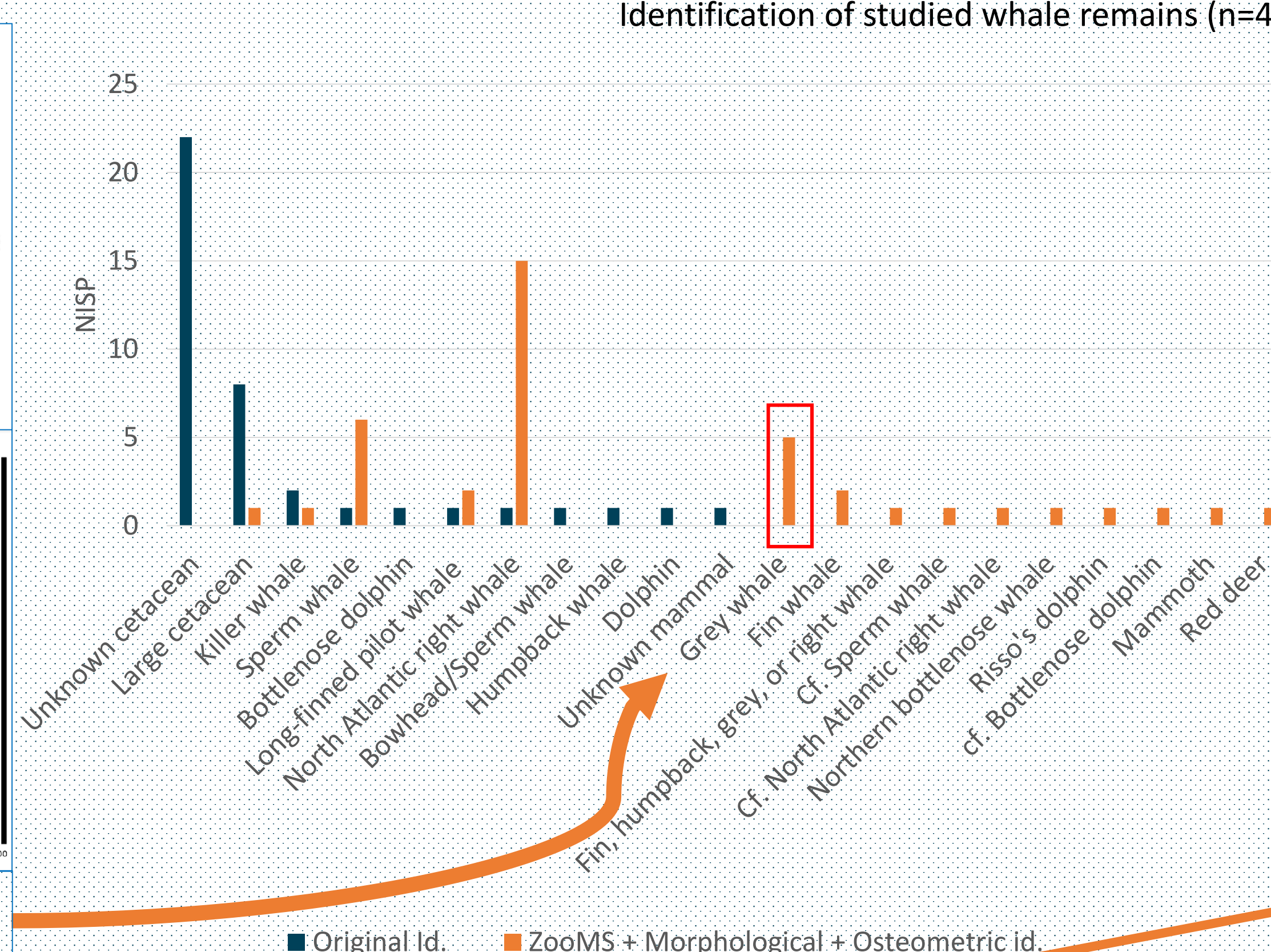
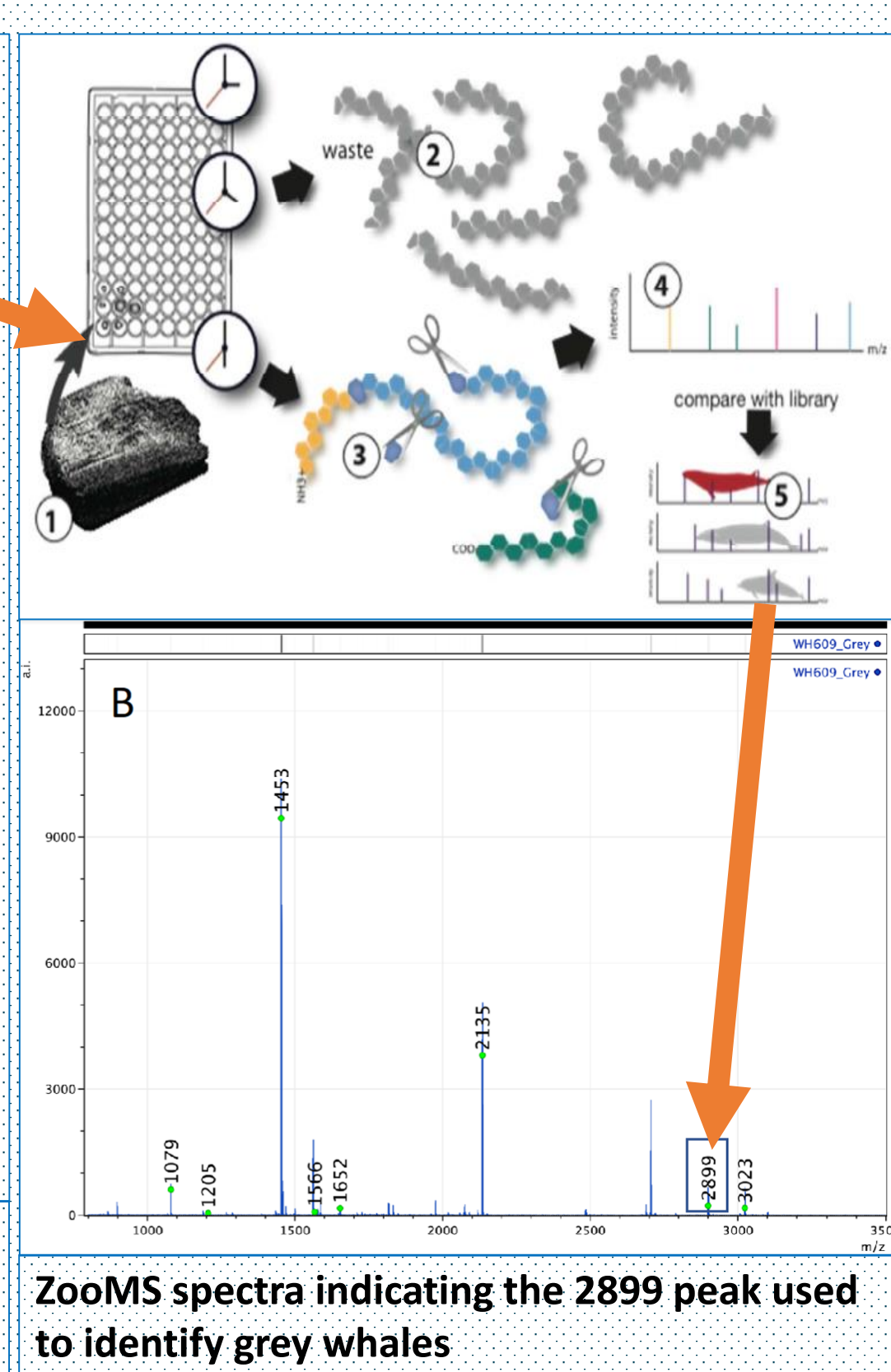


Introduction
The grey whale (*Eschrichtius robustus*) is a baleen whale of the Eschrichtiidae family. Currently there are two recognized populations. The first is a small population of between 100 and 150 individuals that migrate between the waters off South Korea and the Sea of Okhotsk. The second is a large population of between 20,000 and 23,000 individuals that migrate between Baja California Sur and Alaska. The second population displays a migration distance of between 15,000 and 22,000 kilometres and is the longest migration distance of any mammal. The grey whale is normally only present in shallow waters. There it feeds on benthic lifeforms such as shellfish, starfish, and worms. For this it uses its baleen plates and filters its prey from the soil. Based on palaeontological sub-fossil remains it has been indicated that the grey whale was also present in the North Atlantic in the past. It is assumed the species disappeared from the North Atlantic around the 17th/18th century AD. The reason of its disappearance is not clearly understood. One of the theories is that whaling activities led to this, but remains have until recently never been recovered from archaeological contexts. As part of this study archaeological remains from whales were studied in order to answer the question "Was the grey whale hunted in Europe during historical periods?". Zooarchaeological material from the Netherlands was studied and was compared to other grey whale findings from the North Atlantic region.

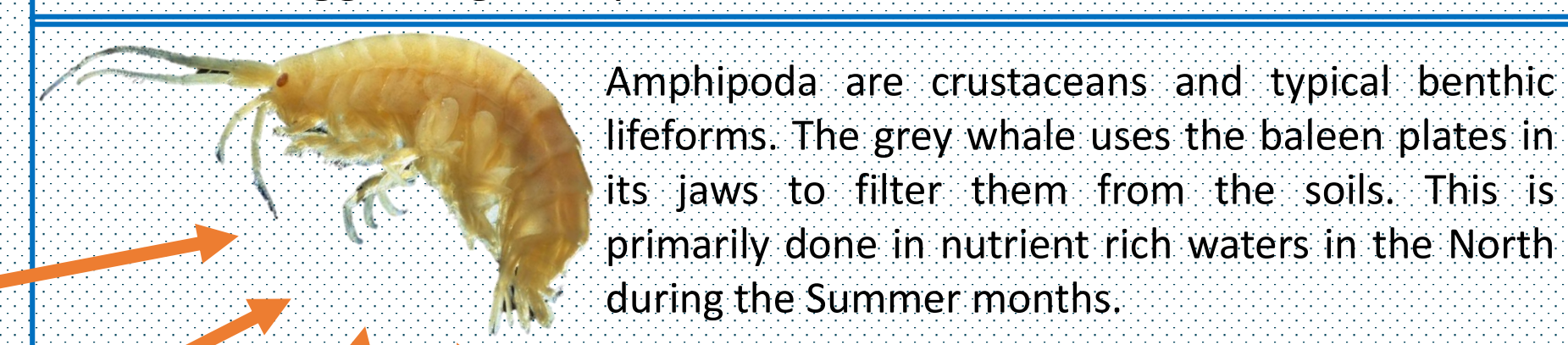
ZooMS
Whale bones are occasionally recovered from archaeological contexts in the Netherlands. However, the often fragmented state of the material and the lack of extensive osteological cetacean reference collections makes identification to the species level often impossible. This frequently leads to specimens merely being identified as "unknown cetacean", "unknown whale", or even "unknown marine mammal". The recently developed Zooarchaeology by Mass-Spectrometry (ZooMS) method has revolutionized the way of identifying cetacean remains. This method is based on the slow rate evolution of collagen that varies between families, genera and sometimes even species. The method practices peptide mass fingerprinting allied to high throughput Time of Flight Mass Spectrometry. Bones are identified by differences in the mass of the different peptides which arise as a result of sequence differences between species. In comparison the aDNA analysis, ZooMS is faster, cheaper and less destructive. However, the methods is a little less precise and not always able to identify specimens to the species level. For the large whale species, ZooMS is however often able to identify specimens to the species level, making it the ideal method for the identification of cetacean remains. Therefore, the method allows for the reconstruction of early human-cetacean interaction and reveal which species were targeted by early whalers.



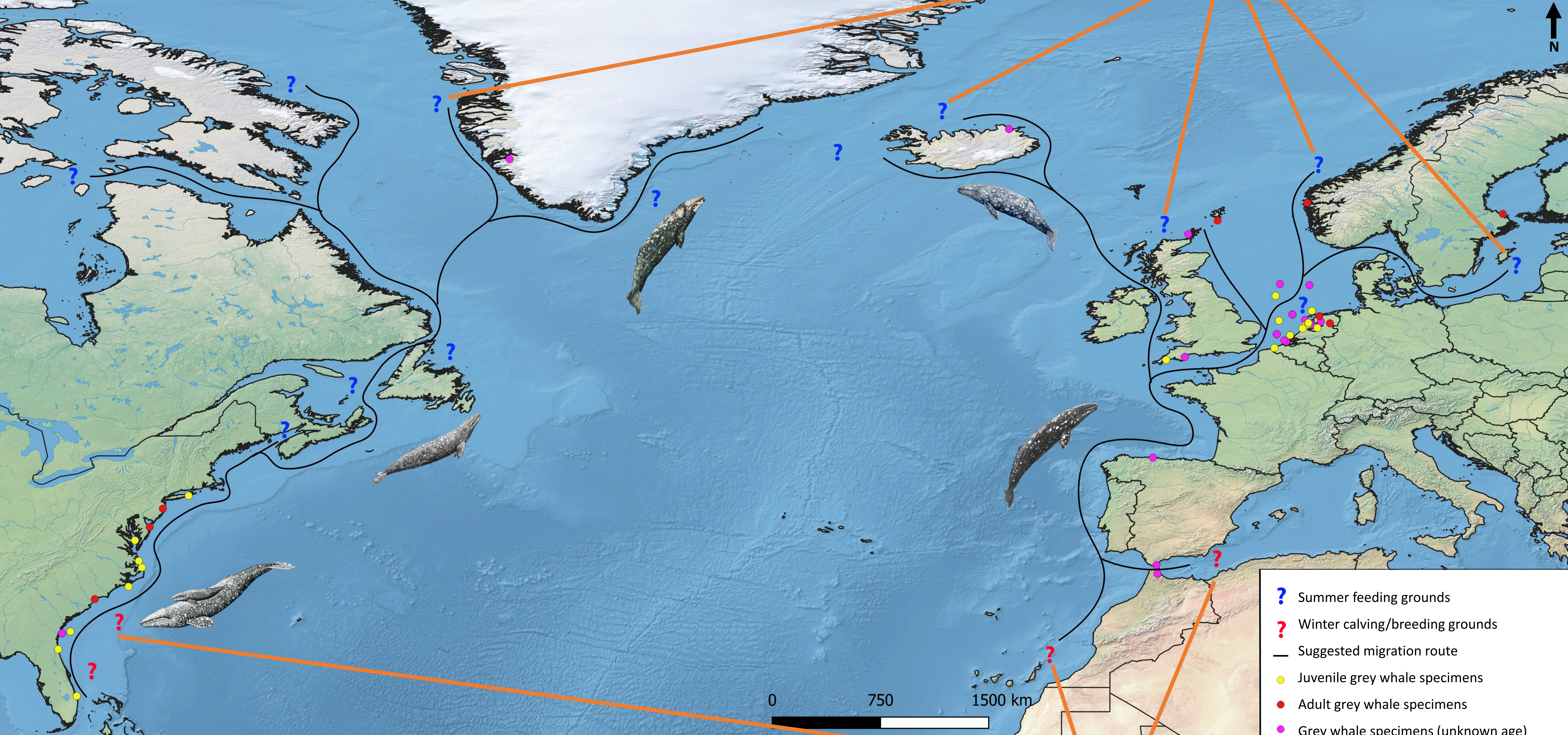
Grey whale specimens identified as part of this study 1. Hallum, 2. Den Burg, 3. Wijster, 4. Domburg, 5. Rottum.



Archaeology
As part of this study 40 whale bone specimens from Medieval (AD 400-1600) contexts from the Netherlands were analysed. ZooMS was practiced on these specimens at the University of York, UK and the bones were additionally analysed based on their morphology and osteometry. This was undertaken in order to get an overview of whaling activities in the Medieval period. Several species were identified, including large numbers of the North Atlantic right whales (*Eubalaena glacialis*). Five specimens were identified as being grey whale (depicted to the left). A sixth specimen was recently identified by the author, and derived from an Iron Age context on the Shetland Islands, Scotland. Furthermore, four other palaeontological specimens from Heerhugowaard and the Flevopolder (The Netherlands) were also identified as being grey whale. By far the highest number of grey whale specimens derive from Dutch contexts, suggesting the species was once abundant there.



Amphipoda are crustaceans and typical benthic lifeforms. The grey whale uses the baleen plates in its jaws to filter them from the soils. This is primarily done in nutrient rich waters in the North during the Summer months.



Conclusion

- First identification of grey whale specimens deriving from archaeological contexts in the Netherlands.
- Grey whales were present in the Netherlands until at least AD 1100 (potentially the last individuals in the eastern North Atlantic Ocean).
- Findings of the grey whale have also been done in Spain, Morocco, France, Scotland, Norway, Sweden, and Iceland.
- Southern North Sea with its many shallow inlets was potentially an ideal foraging ground for the grey whale.
- Romans, Basques, Normans, and Frisians might have performed whaling on the grey whale.
- Whaling activities might have potentially led to the demise of the Atlantic population of the grey whale.

Return to the Atlantic Ocean?
In 2010 a grey whale individual was sighted off the coast of Israel and later Spain. Subsequently in 2013 another individual was sighted off the coast of Namibia. These two sightings in the Atlantic Ocean were probably lost individuals of the Pacific populations. Due to climate change the Northwest Passage is ice free for longer periods of time allowing individuals to circumnavigate the North American continent and enter the North Atlantic Ocean. Whether this signals the return of the species the future will tell.

In the winter months the grey whale migrates to more southern waters. There the pregnant females deliver their young in secluded bays and inlets. For the eastern North Atlantic Ocean it is assumed this was primarily undertaken in the Mediterranean Sea, but potentially as well in bays off the north-western African coast. For the western North Atlantic Ocean it is assumed they young were delivered in bays and inlets in the USA states of Georgia and Florida.

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