

# The extinct population of walrus in Iceland

Snæbjörn Pálsson<sup>1</sup>, Keighley X<sup>2</sup>, Fernán-Coll M<sup>1,3</sup>, Jordan P<sup>6</sup>, Bjarni F. Einarsson<sup>4</sup>, Ævar Petersen<sup>5</sup>, Olsen M.T.<sup>2</sup>, Hilmar J. Malmquist<sup>3</sup>

<sup>1</sup> University of Iceland, <sup>2</sup> University of Copenhagen <sup>3</sup> Icelandic Museum of Natural History, <sup>4</sup> The Archeological Office, <sup>5</sup> Brautarland 2, <sup>6</sup> Arctic Centre/Groningen Institute of Archaeology.  
snaebj@hi.is, hjm@nmi.is

## 1. Introduction

Walrus *Odobenus rosmarus* is today an Arctic circumpolar species which is divided into two subspecies, the Pacific and the Atlantic walrus (*O. r. rosmarus*). Historical records from 13-14th centuries, old place names and hundreds of fossil and subfossil skeletal remains suggest that walrus was more common in Iceland during the settlement and Commonwealth period (c. 870–1262 AD) than in present times. The nature and status of the walrus in Iceland and possible human interference has until now remained unclear.

## 2. Aim

To understand the origin and existence of the walrus remains found in Iceland. More specifically:

- what is the age of walrus skeletons found in Iceland?
- what is their genetic origin?



Figure 1: Walrus skull found in Snæfellsnes 2015

## 3. Material and methods

Historic samples: 38 tusks in Iceland (fig. 1) 46 samples from across the North Atlantic. 34 Icelandic samples were radiocarbon dated at Aarhus University. DNA was extracted at the ancient DNA at the Copenhagen University. A 450 bp of the mtDNA control region (CR) of 26 Icelandic specimens were sequenced. The whole mtDNA genome was obtained from 7 Icelandic samples and 30 samples from across the North Atlantic. 359 published CR sequences from the Atlantic subspecies and 16 from the Pacific subspecies were retrieved from genbank. These sequences come from the current distribution range and the extinct Canadian Maritimes population. mtDNA genomes from artifacts and museum samples were used for comparisons.

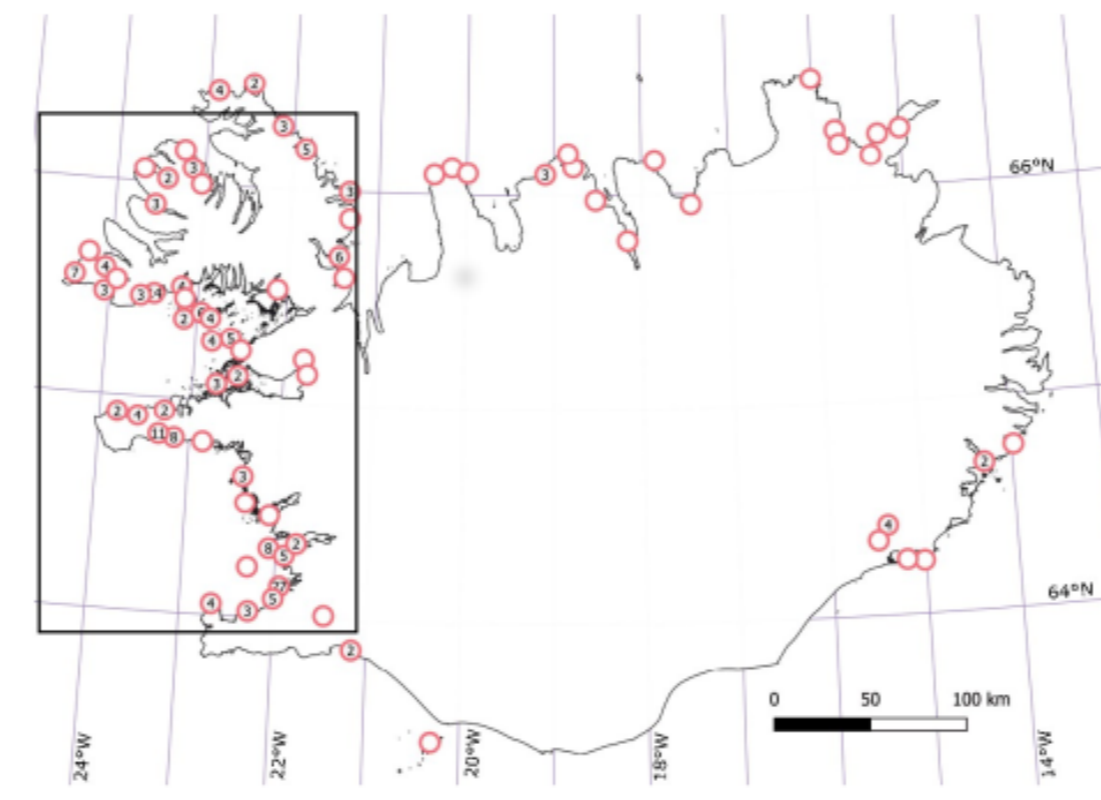


Figure 2: Finding sites of Walrus remains in Iceland. Most finding sites are in west Iceland where place names referring to walrus are most common.

## 4. Results

The results support a local walrus population up from 6500 BCE until the 12th century AD, well within the period of Norse settlement. Comparison of mtDNA-sequence variation from 28 bone remains in Iceland with 367 sequences from walrus from the species range within the N-Atlantic shows a clear distinction of a unique and now extinct Icelandic population. A sequence of five mtDNA genomes support there was a monophyletic ancient Icelandic walrus mitochondrial lineage, with 12 unique SNPs.

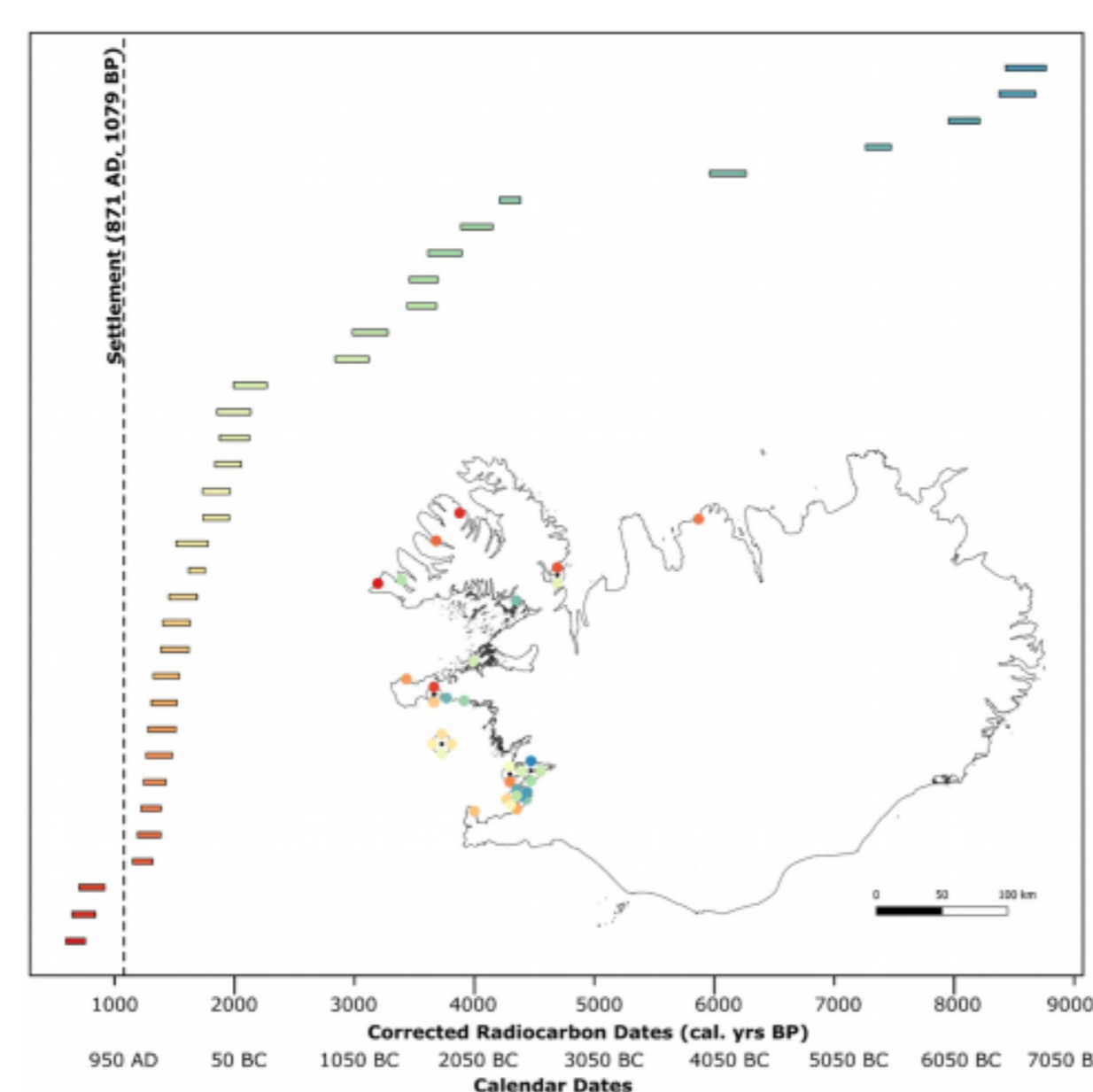


Figure 3: Radio carbon dates of Walrus remains in Iceland. Dates were corrected by the marine model calibration curve

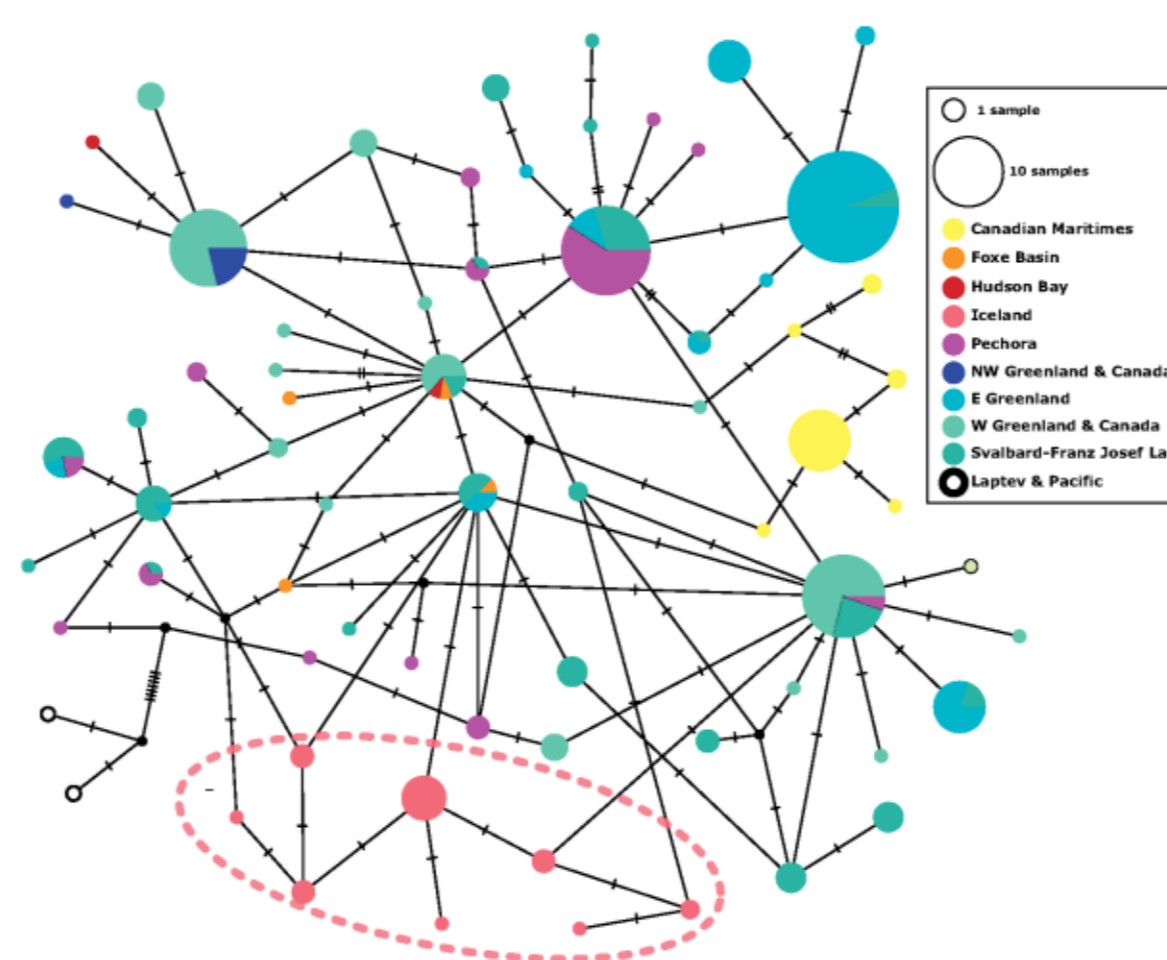


Figure 4: Haplotype network based on the control region.

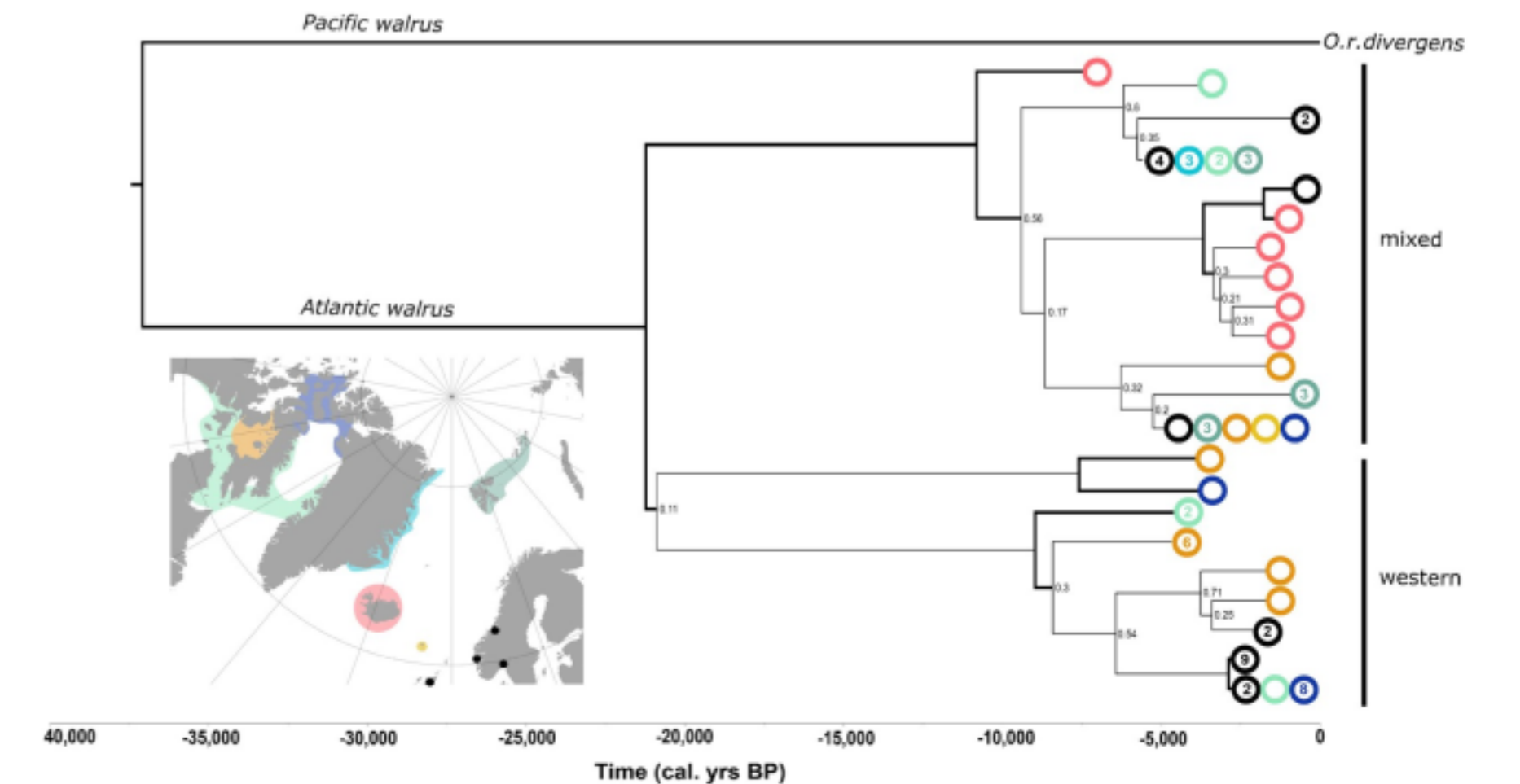


Figure 5: Bayesian phylogeny of entire mitochondrial genomes (minus D-loop). Dots are color coded based on the sample's geographic region, corresponding to the inset map, based upon the current distribution and stock structure of Atlantic walrus. Black dots represent previous published sequences of archaeological rostrums found in institutional collections of unknown geographic affinity

## 5. Conclusions

- Walrus in Iceland had unique mtDNA lineages which are not found in the species today and which differed also from the historic samples. This suggests that there was a separate population of walrus in Iceland.
- The dating and the genetic evidence suggests that the population went extinct following Norse settlement, environmental causes not overruled.
- Our findings lend support to theories claiming that the settlement of Iceland may have been driven to a larger extent by demand for valuable natural resources, such as walrus ivory, meat and fat, than previously anticipated.
- Similar extinction of walrus occurred in the Canadian Maritimes in the 18th century, following the arrivals of Europeans and extensive hunting. There a special mtDNA lineage disappeared with the walrus.

## 6. References

Keighley et al 2019. Molecular Biology and Evolution, <https://doi.org/10.1093/molbev/msz196>

## 7. Acknowledgements

Special thanks to the Icelandic Institute of Natural History, Natural History Museum of Denmark and their staff who assisted with samples. Thanks to private owners and other institutes who kindly provided specimens. Tom Gilbert for support, Liselotte W. Andersen and Erik Born for access to mtDNA control region data, as well as Bastiaan Star and Sanne Boessenkool for access to published mitochondrial genomes.