'Severe reduction' in killer whale numbers during last Ice Age

February 4 2014

This photo shows a killer whale pod from the Eastern North Pacific. Credit: Rus Hoelzel, Durham University

Whole genome sequencing has revealed a global fall in the numbers of killer whales during the last Ice Age, at a time when ocean productivity may have been widely reduced, according to researchers at Durham University.

The scientists studied the DNA sequences of killer whale communities across the world.

They found a severe decline in whale numbers leading to a bottleneck and consequent loss of genetic diversity approximately 40,000 years ago when large parts of the Earth were covered in ice.

The only exception to this was found in a killer whale population off the coast of South Africa that retained high variations in genetic diversity.

As greater genetic diversity indicates larger population size, the researchers believe the South African community of killer whales escaped the bottleneck faced by other communities.

They said an important factor could have been the Bengeula upwelling system – which delivers nutrient rich cold water to the oceans off South Africa – remaining stable despite the last glacial period.

This nutrient rich water would have been able to sustain the supplies of fish and dolphins that killer whales in this part of the world feed on.

The researchers added that other major upwelling systems around the world – the California current off North America; Humboldt off South America; and the Canary current off the coast of North Africa – were either disrupted or collapsed altogether during the last glacial or Pleistocene periods (40,000 to 2.5 million years ago).

This photo shows killer whales. Credit: Rus Hoelzel, Durham University

This could potentially have reduced the food supply to killer whales in these areas, leading to the fall in their numbers.

Further research looking at the genetic diversity of the ocean's other top predators, such as sharks, might potentially suggest a negative impact on their numbers too, the researchers suggested.

Such a finding could support concerns about the potential impact changes in climate could have on ocean ecosystems in future, the researchers added.

The reseach, funded by the Natural Environment Research Council in the UK, is published in the journal *Molecular Biology and Evolution*.

During earlier glacial periods, killer whale populations were likely to

have been stable in size, the researchers said.

While it was likely that other factors affecting killer whale populations were "overlapping and complex", the researchers ruled out hunting as an effect on the bottleneck in populations, as hunting by early man could not have happened on a sufficient enough scale to promote the global decline in killer whale numbers during that period.

Corresponding author Professor Rus Hoelzel, in the School of Biological and Biomedical Sciences, said: "Killer whales have a broad world-wide distribution, rivalling that of humans. At the same time, they have very low levels of genetic diversity.

"Our data suggest that a severe reduction in population size during the coldest period of the last ice age could help explain this low diversity, and that it could have been an event affecting populations around the world.

"However, a global event is hard to explain, because regional modern-day killer whale populations seem quite isolated from each other. What could have affected multiple populations from around the world all at the same time?

"The uniquely high levels of diversity we found for the population off South Africa suggest a possible explanation. These whales live in an environment that has been highly productive and stable for at least the last million years, while some data suggest that ocean productivity may have been reduced during the last glacial period elsewhere in the world.

"If this is the case, then further research may suggest an impact on other ocean top predators during this time. It would also support concerns about the potential for climate disruptions to impact ocean ecosystems in future."

Provided by Durham University