Minke whales lunge 100 times per hour to feed under sea ice

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Highly manoeuvrable and built like torpedoes, minke whales are the most common whales in Antarctic waters, yet the animals could be living on a knife edge as their sea-ice homes dwindle rapidly. 'Sea ice in the area around the Antarctic Peninsula has decreased dramatically in the last 30 years', warns Ari Friedlaender from Oregon State University, adding, 'yet we do not know how critical the sea ice is as a habitat for the whales'. Given the pressing need to understand what the whales require to survive in their challenging and changing environment, Friedlaender and colleagues from the Southern Ocean Research Partnership – an international group of researchers dedicated to non-lethal whale research – headed south to tag minke whales in their Antarctic home to find out more about their lifestyle.

The team has made the first live observations of minke whales lunging to feed by engulfing mouthfuls of krill under the sea ice. They show that it is not necessary to kill the whales to understand their feeding behaviour and publish their discovery that the animals have the highest lunge rate of any whale measured to date, lunging once almost every 30s, in *The Journal of Experimental Biology*.

However, tagging a minke whale is much trickier than tagging other species that inhabit the icy waters. 'Minke whales are fast moving and they don't spend a lot of time at the surface,' says Friedlaender. However, when Nick Gales, Doug Nowacek, Andy Read and Friedlaender encountered a pod of 35-40 minke whales in the Antarctic's Wilhelmina Bay, the team's luck was in. 'We very rarely see these large

groups, so we knew that this was an extraordinary case,' says Friedlaender. He recalls that the whales appeared to be socialising and were distracted from the scientists, which allowed them to manoeuvre the boat gently in amongst the animals. Describing how he took his chance to land the tag on a whale's back just as the animal descended beneath a chunk of ice, Friedlaender chuckles and says, 'It was a textbook delivery'. But then he recalls the next nail-biting 3 minutes while the team waited for the whale to resurface. 'We realised that we had just put a $25K tag on an animal that went under the ice and if it fell off there we were never getting it back', he laughs. Fortunately, the tag stayed in place for an incredible 19 h, and when the team successfully tagged another whale a few days later, they were able to collect a further 8 h of precious dive data.

Teaming up with Jeremy Goldbogen and Dave Johnston to analyse the whales' orientation, depth and acceleration – which showed when the whales lunged to engulf mouthfuls of krill – Friedlaender could see that the minkes' behaviour was very different from that of other whales. Blue whales lunge up to four times during a dive and smaller humpbacks lunge up to 12 times per dive, so Friedlaender and his colleagues were astounded to see the minke whales lunging as many as 24 times during a single dive. 'They lunge over 100 times an hour, almost once every 30 seconds,' marvels Friedlaender. And when the trio analysed the dive patterns, they realised that the whales have three different strategies.

Friedlaender explains that the first two types of dive looked like classic whale dives. In the first, the animals remained near the surface and lunged 1-2 times, while in the second dive-type the whales plummeted to depths of 100 m and lunged about 15 times. However, when they analysed the third type of dive, they realised that it was completely unique. The whales were swimming just beneath the surface of the water and were feeding at incredibly high rates. And when the team checked the locations of the dives they realised that the whales were skimming

the underside of the ice. 'The whales were feeding just underneath the surface where the sea ice meets the water and where the krill were aggregating,' says Friedlaender.

Having proved that it is not necessary to kill whales to understand their feeding behaviour, Friedaender and his colleagues are keen to return to tag more minke whales to learn more about how the animals interact with their surroundings. 'Tagging opens up a huge window of opportunity to study the Antarctica ecosystem in a much more holistic way', says Friedlaender.

More information: Friedlaender, A.S. , Goldbogen, J.A. , Nowacek, D.P. , Read, A.J. , Johnston, D. , Gales, N. (2014) Feeding rates and under-ice foraging strategies of the smallest lunge filter feeder, the Antarctic minke whale (Balaenoptera bonaerensis). *J. Exp. Biol.* 217, 2851 jeb.biologists.org/content/217/16/2851.abstract

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