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News

Narwhals transmit climate data from Arctic seas

Marine mammals armed with thermometers return temperature readings from icy Baffin Bay.

Lucas Laursen

Narwhals have been recruited to help collect climate data in Baffin Bay.

D. B. Fleetham/Photolibrary

The cold water beneath the winter pack ice in Baffin Bay is getting warmer, according to measurements taken by thermometer-wearing narwhals[1]. The data collected from the diving mammals fill in a geographical and seasonal gap in the region's climate records, as no winter temperatures were previously available from the area. The data also confirm that a warming trend measured during earlier summer-only studies of the West Greenland Current continued in the three years to 2007.

"We basically knew nothing about winters up in Baffin Bay," says physical oceanographer Mike Steele at the University of Washington in Seattle, who co-authored the study, which appeared last week in the *Journal of Geophysical Research*[1]. "But there is a lot of interest in the flow of seawater around Greenland."

The idea is not new: other polar research teams have placed oceanographic instruments on marine mammals, including elephant seals, which dive around 2,000 metres below the surface in the Southern Ocean, and bearded seals, which swim up fjords in Greenland[2,3,4]. But this is the first time that researchers have used narwhals (*Monodon monoceros*) for oceanography, and it is the first such study to target Baffin Bay, a data-scarce area of some 689,000 square kilometres.

Other Arctic researchers welcome the hard-to-get data as a way of improving climate predictions. "We need more observations to check and change and fine-tune our models so I think it's brilliant to get winter-time data," says oceanographer Lars Böhme at the University of St Andrews in Scotland, who was not involved in the study.

Data gap

Traditionally, researchers take seawater temperatures by hanging devices below a survey ship or a helicopter, or by leaving a team on the pack ice over a season to periodically lower a conductivity-temperature-depth (CTD) probe into the water below.

But these options are not practical at Baffin Bay in winter, when it is often inaccessible or inhospitable to researchers. As a result, for oceanographers hoping to add data to temperature databases — such as the Polar Science Center's Hydrographic Climatology (PHC), which Steele curates and which climate forecasters use in their models — "there was this gigantic embarrassing hole," Steele says.

"The animals have what we call high site fidelity."

Before the narwhal study, the nearest winter-time measurements came from small coastal settlements on the western edge of Baffin Bay and the west coast of Greenland, says Steele — two coasts that are between 110 and 650 kilometres apart. Interpolation from those data points in the PHC gave an average winter temperature of about 3.3 °C in southern Baffin Bay, but that could only be an estimate.

So in 2006, when marine biologist Kristin Laidre, now also at the University of Washington, offered to share temperature data from her biological study of narwhals, Steele signed up. "The animals have what we call high site fidelity," Laidre says, "We can catch some during summer, instrument them, and have a pretty good idea where they're going to go during winter."

Laidre says the method provides comprehensive coverage of the bay. She and her colleagues from the Greenland Institute of Natural Resources in Nuuk tracked 14 narwhals with satellite transmitters for three winters. The narwhals dived as deep as 1,773 metres in their search for Greenland halibut. Laidre and colleagues obtained temperature readings, supplemented with a series of 15 CTD casts taken from a helicopter and a ship in the spring of 2007, showing that the centre of Baffin Bay had an average winter-time temperature about 0.9 °C warmer than the temperature assigned to the region by the PHC.

"It's always exciting to fill in a gap," Steele says, "but to find warming was not surprising". The data will go into the next version of the PHC and may help make future climate models of the region more accurate, he says.

However, both Steele and Böhme noted that the temperature sensors were not as precise as those normally used by physical oceanographers. "I would have liked to see a paragraph about the data accuracy" of the small, animal-borne sensors,

Böhme says, and "it is important to include salinity measurements to be a true ocean observing platform".

"We were a little constrained as to how large an instrument we want to put on a narwhal," Laidre adds; the instruments were about the size of a deck of cards. "But if we were to continue this in the future we would like to talk more to oceanographers about what they need — for example salinity measurements."

References

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