

Webinar: Observing the changing Arctic Ocean with Acoustics
April 29, 2026
Q&A

1) How will the melting of ice in the Arctic Ocean affect wildlife? While nature is adaptable, could this process also create new habitats? Although it may adversely affect species such as polar bears, are there other species that might benefit? Given that our planet has experienced long periods in the past when Arctic ice did not exist, this suggests that nature is resilient.

Melting sea ice does come with significant impacts on many marine species that have a direct or indirect relationship with the icy habitat. Some species rely on ice cover for reproduction, resting, and feeding. Conversely, the lack of sea ice makes the area more accessible to other animals, such as grey whales, humpback whales, or fin whales that may spend more time in the arctic as ice cover diminishes. This has the potential to increase competition for resources, such as food. Additionally, lack of sea ice makes the arctic more accessible for vessel traffic, which also increases the potential for marine mammal mortality due to vessel strikes. You can read more about the effects of the changing arctic on marine life here:

<https://dosits.org/people-and-sound/investigate-marine-animals/how-is-acoustics-used-to-monitor-arctic-marine-mammals/>

2) Are underwater drones used to collect information and how?

Uncrewed systems can be used to supplement data collection efforts during ocean acoustic thermometry experiments, such as CAATEX and the ongoing HiAOOS. For example, gliders and floats can be equipped with sensors to collect in-situ measurements of temperature and salinity, while at the same time they can sense the coded acoustic signals and increase the number of transmission paths measured and used in thermometry. This has been done in experiments similar to CAATEX, such as CANAPE in the Beaufort Sea and the PhilSea10 acoustic tomography experiments.

3) Was an analysis of the impacts of the CAATEX experiment to Arctic marine life done? If so, what were the conclusions?

There was an analysis of the impacts of the CAATEX and the HiAOOS experiment to Arctic marine life. You can read more at this link: <https://researchportal.bath.ac.uk/en/publications/environmental-impacts-of-high-arctic-ocean-observation-systems-ch/>. The duty cycle was kept as short as possible. If there are any animals near the source, the ramp up that precedes full power transmission will give that animal enough time to swim away if they are bothered by the signal.

4) 35hz is very similar to Blue and Fin whale communication. Are those pulses in some way setup not to impact them or is it just not an issue in Arctic region in view of what you mentioned above?

The signals used for acoustic thermometry are designed to minimize potential effects by being encoded as m-sequences to keep the source level as low as possible. There is more information on this Wikipedia page: https://en.wikipedia.org/wiki/Ocean_acoustic_tomography#

The signals are coded signals, very much like white noise, and it is only by special processing that we are able to perceive the signals, and wildlife do not recognize the signals in their environment.

5) In the western Arctic profile, is that the Beaufort Duct observed in the SSP?

The Beaufort Duct is a sound-speed minimum centered at about 175 m that is present in sound-speed profiles in the western Arctic Ocean north of Alaska. The duct is due to the presence of warm Pacific Summer Water at roughly 70 m depth that is above colder Pacific Winter Water centered at about 175 m. The warm Atlantic Water layer that is below the Pacific Winter Water forms the bottom of the duct. The Beaufort Duct has become stronger in recent years as the Pacific Summer Water has warmed and become more prominent due to the changing climate.

6) In acoustic thermometry you use a lot of calculation of sound propagation. If sound bounces of the sea ice, how can you be sure that it is properly reflected and not scattered (as the bottom of sea ice is not always even)? How are polynyas taken into account in sound propagation?

The predicted acoustic arrival patterns shown in the webinar made the simplifying assumption that the sea ice is a perfect reflector. At the low acoustic frequency used in recent experiments (35 Hz), the sound wavelength is approximately 50 m. This long wavelength means that ice that is a few meters thick looks relatively smooth to the sound waves. Nonetheless, it is of course not true that the ice is a perfect reflector, and sound is scattered as it interacts with the rough sea ice. The scattering reduces the signal intensity but does not have a significant effect on the modal travel times that are used to infer the ocean sound speed (temperature) between the source and receiver. Making quantitative predictions of the scattering is challenging, in part because it is difficult to accurately characterize the ice cover and its roughness (including the presence of leads and polynyas).

7) Does the predicted change in the AMOC (Atlantic Meridional Overturning Circulation) potentially affect the increasing warmer inflow to the Arctic Ocean?

Changes in the AMOC could affect the flow of warm Atlantic water through Fram Strait in the West Spitsbergen Current and/or through the Barents Sea Opening, potentially either increasing or decreasing the volume of warm water entering the Arctic Ocean.