



Arctic Research

How is climate change affecting fauna in the Arctic?

Polarstern expedition explores the interplays between the atmosphere, ice and ocean - and the effects on the ecosystem

[18. May 2017] On Wednesday, 24 May 2017, 49 atmospheric and cloud researchers, sea-ice physicists, marine biologists and biogeochemists will embark on a joint expedition headed for Svalbard. On board the research vessel Polarstern from the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI) all of these disciplines are focused on just one question: How is the climate changing the Arctic? At the same time, the AWI research aircraft Polar 5 and Polar 6, launching from Longyearbyen (Svalbard), will engage in atmospheric measurement flights.



Dwindling sea ice is one of the most visible indicators for the rapid warming of the Arctic Ocean. Whereas in the 1980s, more than seven million square kilometres of the ocean were covered with ice in the summer, in the past ten year its minimum area was often less than five million square kilometres. As such, sea ice is both a central subject of research and an important site for the planned work north of Svalbard: the icebreaker Polarstern will go alongside an ice floe, where the atmospheric researchers will spend two weeks continuously measuring how the energy balance on the surface varies with changing cloud cover. By doing so, they hope to address open questions concerning the feedback mechanisms between sea ice, clouds, and particles in the air, which contribute to the warming of the Arctic.

“Our hypothesis is that the low-hanging clouds typically found in the Arctic are to a large part responsible for the fact that, over the past few decades, the region has warmed at more than twice the speed of the rest of the planet.



The research aircraft Polar 5 and RV Polarstern (Photo: Alfred-Wegener-Institut / Thomas Krumpen)

This phenomenon is commonly referred to as ‘Arctic amplification’ and hasn’t yet

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been reflected in global climate models, because we still don't sufficiently understand the mechanisms involved," explains Prof Andreas Macke from the Leibniz Institute for Tropospheric Research (TROPOS), who will serve as Chief Scientist for the first leg of the expedition. His project is intended to help us understand in detail which processes are making the sea ice vanish so dramatically in the Arctic, and to what extent. In this regard, the atmospheric measurements taken on board RV Polarstern will be supplemented by a weather balloon tethered to the ice floe, the flights of the AWI research aircraft Polar 5 and Polar 6, and parallel measurements taken at the AWIPEV Station in Ny-Ålesund, so as to arrive at as complete a picture of atmospheric processes in the Arctic - which ultimately also influence the weather in Europe - as possible.



Ice station (Photo: Alfred-Wegener-Institut / Mar Fernandez)

As Polarstern drifts alongside the floe, the scientists on board will also gather a broad range of biological, biogeochemical and sea-ice-physical measurements. One focus of this early-summer expedition is on the living conditions at the beginning of the melting period, when the space

between the floes fills with open water, which, given its darker colour, absorbs more energy than the surrounding ice. As a result, more light makes its way beneath the surface, offering a source of energy for single-cell algae in the water. These phytoplankton form the basis of the Arctic food web, as they are fed on by zooplankton, which are in turn a food source for predatory animals like birds, seals and polar bears.

"We're especially interested in the polar cod, which, as the primary food source for seals and birds, plays a key part in the Arctic ecosystem," says Dr Hauke Flores. The biologist from the Alfred Wegener Institute will join the expedition in Bremerhaven and, following a brief stop in



An Arctic key species: Polar cod (*Boreogadus saida*) (Photo: Alfred-Wegener-Institut / Hauke Flores)

Longyearbyen (Svalbard) on 21 June, will take over the reins for its second leg. Young polar cod tend to frequent the underside of sea ice, which simultaneously serves as a hunting ground and offers them protection from predators. As a result of climate change, the spatial extent of this under-ice habitat is shrinking rapidly. "We will simultaneously investigate the polar cod's spatial distribution, primary food sources, predators that feed on it, and other environmental parameters. This will allow us to assess the survivability of the cod, and of the endotherms that depend on it, and to make informed statements on their sensitivity to climate change," relates Flores. Looking ahead to the two months before the expedition's end (in Tromsø, Norway in mid-July), he enthuses, "In addition to the latest observations, I'm especially excited about the talks with fellow researchers from

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research in the polar regions and the oceans of mid and high latitudes. As one of the 19 centres of the Helmholtz Association it coordinates polar research in Germany and provides ships like the research icebreaker Polarstern and stations for the international scientific community.

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a range of disciplines; while on board, we'll have an unparalleled opportunity to exchange notes on our research interests for an extended period."

Following the expedition, AWI deep-sea researchers and their colleagues will use RV Polarstern for long-term biological and oceanographic investigations in the AWI's "Hausgarten" deep-sea observatory. In August and September, members of the Helmholtz Alliance ROBEX will travel to the Fram Strait between Greenland and Svalbard, where they will e.g. retrieve the deep-sea robot Trampler, which just completed a year of operations in the Arctic. The destination of this year's last expedition to the Arctic, beginning in mid-September, will be eastern Greenland, where oceanographers and glaciologists will join forces to get to the bottom of the mechanisms involved in melting glaciers. The research vessel Polarstern is scheduled to return to its home port, Bremerhaven, in mid-October.

