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Since Tuesday we are back in our research area, and the work at the various stations runs well. The winter is now taking control, with temperatures down to -22°C and a wind-chill below -45°C. Working on the ice is only feasible with special protective closing.

Last week we reported on the problems planktonic organisms encounter during winter due to the sea ice cover and accompanying darkness. However, just by looking out of the porthole we can see that while the sea ice may be a problem for many planktonic organisms, it is in fact also the solution to the problem since it has become a haven for a multitude of small organisms, which have actually chosen to live within the ice and thrive there.

As Polarstern breaks the ice near the ice edge, floes are overturned and, not only expose the brown coloured pieces of ice revealing a high algal biomass, but thousands of krill larvae which have been feeding on the underside of the ice and have been washed onto the ice floes. Several sea ice biologists have chosen to study this unique habitat. They want to understand which organisms live in the ice and how they succeed to survive these apparent hostile living conditions. How is it possible that sea ice constitutes a habitat for such a wide range of minute organisms ranging from viruses to small crustaceans? In contrast to freshwater ice which freezes to a solid block, seawater, because it contains salts which during freezing are not incorporated into the ice crystals, excludes the salts and they collect in small pockets and channels between the crystals. This labyrinth of brine channels and pockets becomes the home of sea ice biota. In order to study the sea ice, the scientist every day descend from the ship onto the ice where the primary method to obtain samples is to core the ice. The cores are sectioned into smaller portions, which are returned to the ship and allowed to thaw.

Sea ice physicists will have taken the core temperature and recorded other abiotic parameters directly after core extraction. The biologists will determine salinity and a multitude of parameters such as nutrient concentrations, alkalinity, Chlorophyll a and the species present in each sample. Some sea ice biologists are particularly interested to find out how the organisms survive a temperature gradient of for example -2°C at the bottom of the ice to -20°C at the surface and corresponding salinities of between 34 to above 100 per mil. Many algae such as diatoms as well as small multicellular animals such as copepods, flatworms, small jellyfish and nudibranch snails live and proliferate under these conditions. The advantages of living within sea ice are manifold: For the algae, there are higher and stable light conditions and the ice provides protection from consumers (> 1mm), which cannot enter the brine channels. The small animals on the other hand find a rich food supply and they too find protection there.

Which physiological mechanisms prevail to prevent the freezing of body fluids? These questions are studied at the molecular level using modern gene technological methods. Genes responsible for the adaptation and found only in these “ice loving” organisms are sought after. But this research, while promising to shed new light on many aspects of life within sea ice, is only at its beginning and will occupy sea ice biologists in the future.

Many greetings from the chilly side of the Earth on behalf of all par--tic-i--pants of the cruise,

Yours Peter Lemke
Polarstern, 60°45’S, 48°20’W