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We reached the edge of the shelf ice barrier by Saturday morning 8 July. Snowfall over the Antarctic continent accumulated during the last millennia and formed the several thousand meters mighty Antarctic ice cap that very slowly flows downhill where it floats into the ocean by getting thinner until it breaks off and icebergs are released. We are very lucky to see this shelf ice edge at 70° S in the midst of winter and even can have a sampling station nearby. The other side of the coin came when we tried to go north again. Meanwhile the wind had changed its direction and pressed the sea-ice towards the continent. More than one day of ramming through heavy pack ice was necessary to free us again, an exercise that not only cost more time but also more fuel than anticipated. Now we are on track again and search for krill at the prime meridian going north toward the sun.

At 66° north we found reasonable numbers of adult and larvae krill deeper down in the water and directly under the sea-ice. The latter is now 30 to 60 cm thick and has a nice brown colour. The algae living in the protected environment of channels and creeks inside the sea-ice are growing slowly but steadily even in winter and build up quite substantial biomass so that the algae pigments are detectible even with the naked eye. Especially krill larvae may exploit such rich gardens by scraping off the underside of the sea-ice and feed on the algae and other biota, a hypothesis that is tested during our cruise.

The diving team searches such larvae. To do so, a stepwise action plan is performed. First a team of two people leave Polarstern by a "mummy-chair", a transportation device that is lifted onto the sea-ice by the ships crane. One person drills a 10 cm hole through the 60 cm thick ice, the other person cuts a 40 cm square block around this hole by means of a chain saw. A small boots anchor is pushed through the hole and unfolds so that the two can pull out the ice block using a pulley. The water surface of the hole is cleared from ice and snow by using an ordinary kitchen sieve so that the plankton net can be deployed under the ice and pulled back in again without any problem. The entire exercise takes about 1 hour. The animals caught are in much better physiological condition than those obtained by our standard nets towed behind the steaming ship. For the physiological and biological experiments we need animals in perfect condition, to answer the open question how such larvae can sustain the long winter under low food conditions.

On 14 July we positioned Polarstern at a suitable 1 km large ice flow, comprised of flat parts of 60 to 80 cm thick ice. Parts of that flow were compressed some time ago so that 2 to 4 m high ice ridges were also present. The ice had a nice greenish-brown colouring. Underwater video did show krill larvae associated to the green spots, the net catch was full of

larvae. We decided that this was the ideal flow to establish a diving camp for obtaining much more of the urgently needed krill. Two shiny red igloos were lifted off the ship and flown out 500 m by helicopter to form the protected basis for the diving camp. Diesel generators provide electricity for heating and light. One igloo serves as resting station for the divers, the other as first-aid station in case of any emergency. Several more holes are cut, for underwater video and acoustic observation, as entrance holes for the divers and for security reasons. The Dutch bird and mammal specialist took a helicopter flight in a 4km range to search for any predators like leopard seals or Orcas, but beside ten crab-eater seals, nine Adelle and three Emperor penguins no other mammals were spotted. In fact we had not seen one leopard seal the entire cruise. The next day the diving took place and many krill larvae were gently caught directly under the sea-ice by hand towed nets, by a special floating and closing net and by a special plankton pump. The larvae are carefully stored and immediately transferred to the laboratory containers on board Polarstern.

Unlike adult krill that can starve for several weeks if not months, krill larvae have to find food rather continuously. The time period in which krill larvae can sustain without any food is determined on board Polarstern in temperature controlled laboratory containers. For the experiments the larvae have to be caught as gentle as possible. The catch is sorted under a stereo microscope and krill larvae are grouped in lumps of several hundred according to their developmental stage, to determine their respiration rates, their growth and their enzymatic activities as metabolic indicators. We also need to learn more about the consumption of krill larvae in winter to determine the mechanisms how they can survive into the next spring. So we feed the krill with phytoplankton and also with ice algae that are obtained by melting blocks of brownish ice in a batch of filtered seawater.

The fact that krill has a slow growth and developmental rate and that the species is long living brings us to the conclusion that krill developed evolutionary an optimal adaptation to the Antarctic environment. The environment does not provide suitable conditions for sufficient growth and survival of the larvae every year. A population of long living invertebrates, capable to reproduce in several subsequent years, will not be much affected by unfavourable conditions, if at least every fourth year turns out to be a good year for krill, with heavy ice, good ice algae and large plankton biomass production. This time the Antarctic winter seems to be quite good in this respect, as we have low temperatures, a lot of ice, and nice feeding and hiding conditions for krill. We (humans) can hardly believe that the cold and icy conditions outside the ship provide just the right and cosy environment for the happy living of krill.

During the last days a mild northerly wind brought warm temperatures of minus 5°C. Snow and ice on the ship are very soft and people start taking off their sweaters.

We are reasonably good in time according to our schedule as work smoothly

progresses.

With best regards from a busy ship  
Uli Bathmann