

ANT XXIII/6 Weekly Report No. 8 (Cape Town - Cape Town)
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Four times during this cruise we now have successfully crossed the 1800 km ice-covered area between the northern rim of the Antarctic treaty area at 60°S and the continent at 70° S. We are ahead of the time schedule and currently working stations on the northern flank of the Lazarev Sea. During last week, moderate sea-ice conditions allowed fast steaming between stations. In consequence there was little time for rest for those who had to be active on every position. Some groups as the physical oceanographers work in shifts; they work for 2 hours on the instruments than perform some calibrations in the laboratory for about 6 hours, followed by another 4 hours for rest and recreation. Other groups like the krill teams have to run every single net and process the samples in between. Consequently sleeping time is often becoming much more important than meal hours.

Polarstern is equipped with a hull-mounted acoustic measuring system to detect zooplankton and krill in the water column several hundreds of meters beneath the steaming ship. Vertically directed, narrow acoustic beams of four different frequencies send out pulses in regular intervals of about 2.5 seconds and the reflecting echo from particles is passively recorded and analysed. Each zooplankton group, each species or even different developmental stages, of e.g. krill has a typical reflection pattern (backscatter). These species perform rather distinct vertical migrations on a daily basis but also in an annual pattern. These migrations are regulated by ocean physics (e.g. light, temperature, currents) and ocean biology (e.g. presents of prey and predators, reproduction cycle). By means of the under water acoustics we attempt not only to study the vertical migration pattern but also to estimate the biomass of single groups of zooplankton, krill and fish all of that being prey for whales, seals, penguins and flying birds. Many of these species feed on the ocean surface during night time when the prey appears in the uppermost water layers. These acoustic measurements are performed in the international context of the Convention for Conservation Antarctic Marine Living Resources (CCAMLR).

The underwater acoustic system detects a pronounced echo layer between 500 and 800 m water depth; a second layer appears in even greater depth. From the acoustic information alone it is not known how much krill, fish and zooplankton is concentrated in these layers and we therefore trawl some krill nets to those water depths. Each trawl takes up to 6 hours while the ship has to maintain course against the wind with a low speed of 2 knots constantly. For the upper 400 m the six opening and closing nets of the multiple RMT retrieve samples from three distinct layers; these are typically the 400m to 300m, between 300m and 200m and the upper 200 m layers. Several species are perfectly alive and can be observed in the various aquaria exposed in the five cooled laboratory containers. On Thursday 10 August the interested eyes of a 35 cm long squid, which was caught directly under the ice, looked silently into the lenses of many scientist's cameras. Another 3000 m trawl again harvested bizarre species of the deep-sea world.

Besides the weird organisms pictured in my 6th weekly report, an about 10 cm long dark brownish fish (*Sio nordenskjöldii*) appeared in the catch; the occurrence of this fish species in the Atlantic sector of the Southern Ocean has not been described before.

Marine birds and mammals are amongst the top predators harvesting krill and small fish in the Lazarev Sea. The biomass of these vertebrates is estimated based on band-transect counts during helicopter flights and from observation posts on the flying bridge. Thanks to relatively good weather in the ice-areas, 22 flights covered a total of about 2500 km transect line (950 km² area surveyed) with poor coverage on first grid-leg, but very fine coverage on second and reasonable success on the third grid-leg. From the top deck more than 700 ten-minute counts (or more than 110 hrs of systematic observations) are performed so far in spite of short days of winter light and harsh conditions. Only a limited number of species is able to withstand the winter conditions in sea-ice: Minke Whales, Crabeater Seals, Emperor Penguins, Adélie Penguins, Snow Petrels and Antarctic Petrels. A highlight was the sighting of the very rare Ross Seal. Only the larger animals the Minke whale, Crabeater seal and Emperor penguin are able to cope with the heaviest winter-ice conditions in the south. The remarkably abundant Minke whales are able to push their own breathing holes through ice up to at least 15cm thickness. Their numbers indicate considerable food-supplies of krill, fish and possibly squid under the 100% ice-cover in the southern parts. The smaller Adélie penguins and Petrels are almost restricted to the northern half of our study area (north of 65°S). The pattern of overall abundance of the top predators suggests enriched waters around the western slopes of Maud Rise.

To operate the various instruments successfully, crew and scientists have to work as a team. The scientists have outlined the research before the cruise started and added projects from PostDoc's and PhD students. The ship's crew helps to transform scientist's wishes into reality. Personal from other companies provide support in running the helicopter, providing computer services and other technical knowledge. In other words, our ship is functioning like a small community where everything is interrelated. This becomes rather obvious by the hard work in the freezing cold outside on deck, where heavy and large instruments like the krill nets are deployed and retrieved day and night in nearly every weather condition. The officer on the bridge finds or creates an open water spot within the otherwise dense sea-ice cover and keeps the ship's speed in the limited range allowed for the delicate net. The winch man lowers the cable so that scientists can connect the electrical plugs from net and cable and is in charge for the safe winch operation. Sailors secure the net when it's lifted to avoid that wind and swell swings the instrument and bang it to ship's structures. Commands are precise so that work is handed over smoothly from one key position on deck to the other, occupied by either a sailor or a scientist. The prerequisite for such labours is reliability and knowledge that both have evolved over the long years working together in good spirit.

We are still kept in the cold accompanied by frequent snow-showers, but our minds are directed north towards home, as will be the ships course in due time. For some of us it becomes a touching time to say good bye to Antarc--tica especially when watching golden sunsets that paste ice sur----faces and icebergs with reddish and rose-pink aquarelle colours against the dark purple sky of the falling night.

We will be back before long.

Uli Bathmann