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"Gardening" off Spitsbergen

For a week we are now operating in the study area of this expedition, the LTER (Long-Term Ecological Research) Observatory HAUSGARTEN. We have been visiting this area in the Fram Strait for 20 years now in order to investigate the influence of global climatic changes on a polar marine ecosystem in a multidisciplinary approach.

The HAUSGARTEN stations are sampled annually during the summer months both in the water column and on the seabed. Water samples are collected with a CTD/Rosette Water Sampler. Sampling at the seabed is carried out with cabled instruments, the so-called multicorer and the box corer, which cut out certain sediment volumes at the deep-sea floor and bring them on board. The fibre-optic cable of Maria S. Merian allows us to follow the sampling at the deep-sea bottom "live" on the TV screen. The camera system on the Multicorer transmits razor-sharp images of a hidden world. A towed photo/video system gives us information about large-scale distribution patterns of larger organisms at the bottom of the HAUSGARTEN area. The comparison with photographs from the past decades gives us information about temporal changes in the density and composition of the so-called epibenthos.

Our Autonomous Underwater Vehicle (AUV) "PAUL" (Fig. 1) has already been sent three times on lonely journeys through the cold Arctic Ocean. PAUL is mainly used to carry out physical, chemical and biological investigations in surface water. During the current cruise, however, we will also use the AUV at ground level to carry out seabed mapping in selected areas. The underwater vehicle is equipped with sensors for a long range of parameters. These include the temperature and conductivity of the water, the concentration of nitrate, chlorophyll *a*, oxygen and carbon dioxide as well as the amount of dissolved organic substances (CDOM). In addition, the intensity of the photosynthetically active radiation (PAR) is continuously measured. A water sampler integrated into the underwater vehicle is able to take up to 22 samples with a total volume of 4.8 litres to determine the plankton composition and to calibrate the nitrate and chlorophyll sensor.

The transport of organic material (dead phyto- and zooplankton) from the sea surface into the deep sea removes the carbon from the upper ocean layers and thus allows the

further absorption of carbon dioxide from the atmosphere. However, it is still not clear which factors favour the formation of sinking particles and ultimately control the degradation of these particles on their way into the deep sea. The HGF Young Investigators Group SEAPUMP, which cooperates closely with the HAUSGARTEN group, is dedicated to this field of research. In addition to optical devices (particle cameras), various sampling devices (a so-called "Marine Snow Catcher" as well as drifting sediment traps) are used to investigate the quantity and quality of the sinking material.

Free-falling systems, so-called "bottom-landers" (Fig. 2), are used to carry out various measurements and experiments on the seabed. They consist of a steel frame, bottom weights that drag the system down to the seafloor and floats that ensure that the frame rises again to the sea surface after the weights have been dropped. Depending on the scientific question, bottom-landers can be equipped with a variety of measuring and recording devices. For example, we use profiling microsensors to determine the oxygen content in the upper sediment layers with high resolution. Incubation chambers which enclose a certain volume of water and sediment are used to determine the oxygen consumption of the small sediment inhabiting organisms. Last Monday, a bottom-lander deployed at the southernmost HAUSGARTEN station was successfully recovered from the seabed after about 65 hours of standing time.

In addition to these stationary devices, we also operate various mobile platforms (so-called “benthic crawlers”) on the seabed. One of these autonomous vehicles, our "TRAMPER" (Fig. 3), was successfully recovered by the beginning of last week after 12 months of operation at 2500 m water depth. TRAMPER is equipped with a micro profiler, which measured oxygen profiles at the seabed once a week, then drove a short distance, only to carry out the next measurement a week later. Autonomous devices such as TRAMPER allow us to obtain seasonal data from the Arctic deep sea, which is very difficult to access especially during the winter months.

Everyone on board is doing well!

With best regards to the loved ones at home,

Thomas Soltwedel