

## ESONET NoE / Arctic Observatory – Arctic Ocean

Arctic water exiting into the Atlantic ocean between Europe and Greenland is an important component of the global deep water circulation of the planet and its heat budget. Establishment of a long term station here is important for tracking global change as ice cover decreases but there are also important deep sea habitats such as mud volcanoes in the ‘Hausgarten’ region, off Svalbard.



*Figure 1 : Sea Ice in the Arctic Ocean*

### **Scientific context and relevance**

Arctic ecosystems are adapted to extreme environmental conditions with large seasonal forcing and the increasingly rapid rate of recent climate change poses new challenges to the resilience of arctic life. The entire system is faced by fast changing ice and water conditions, varying primary production and food availability to faunal communities, an increase in contaminants, and possibly increased UV radiance. The adaptive capacity of a number of arctic populations and ecosystems is probably not strong enough to withstand the sum of these factors that might lead to a collapse of subsystems.

### Scientific objectives

To detect and track environmental changes in the transition zone between the northern North Atlantic and the central Arctic Ocean, and to determine experimentally key factors controlling deep-sea biodiversity, the German Alfred Wegener Institute for Polar and Marine Research (AWI) established the deep-sea long-term observatory HAUSGARTEN. This observatory is located in Fram Strait, the only deep connection between the central Arctic Ocean and the Nordic Seas, where exchanges of intermediate and deep waters take place. Circulation patterns in Fram Strait result in a variable sea-ice cover, with permanent ice-covered areas in the west, permanent ice-free areas in the south-east, and seasonal varying ice conditions in central and north-eastern parts, i.e. in the wider HAUSGARTEN area. The dramatic decrease in sea-ice extent observed over the last decades causes an ongoing northward shift of the ice-edge related primary production.

### Existing national and international programmes on the site

Multidisciplinary research activities at HAUSGARTEN are carried out in close co-operation with national and international colleagues, and cover almost all compartments of the marine ecosystem from the pelagic zone to the benthic realm, with some focus on benthic processes. Some aspects of the research activities carried out at HAUSGARTEN are embedded in the institutional research programme “MARCOPOLI” of the AWI. This concerns benthic biodiversity studies, particle flux studies, and geochemical studies on exchange processes across the sediment-water interface. Other intended research efforts such as habitat mapping and classification, automation of underwater image analysis are pending.

### Preliminary design of the implementation and possible schedule

Phase 1: autonomous nodes

Phase 2: cable and first nodes

Phase 3: cabled observatory

In its actual design HAUSGARTEN (Phase 1) is an autonomous observatory consisting out of 15 permanent sampling sites along a depth transect from Vestnesa Ridge to the Molloy Deep (1000-5500 m) and along a latitudinal transect following the 2500 m isobath crossing the central HAUSGARTEN station. The central station serves as an experimental area for long-term experiments at the deep seafloor. Repeated sampling and the deployment of moorings, different long-term lander systems, which act as local observation platforms, and the installation of other long-term *in situ* instruments has taken place since the beginning of the station in summer 1999. Frequent visual observations with towed photo/video systems allow the assessment of large-scale distribution patterns of larger epibenthic organisms. At regular intervals, a working-class Remotely Operated Vehicle is used for targeted sampling, the positioning and servicing of autonomous measuring instruments, and the performance of *in situ* experiments and geo-referenced video-footage. A 3000 m depth rated Autonomous Underwater Vehicle (AUV) extends our sensing and sampling programs of the near future.

Phase 2 (2007-2009) will include the installation of a junction box (free-falling device) with local energy supply for short- and medium-term observations, measurements, and experiments. The intention is not only to acquire experiences with this kind of technology, e.g. the handling of underwater plugs by an ROV, but also to prepare for event-driven activation of, for example, sediment traps, water sampler, crawler surveys.

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Phase 3 (from 2010) includes the cable connection of HAUSGARTEN observatory to a land base. Koldewey Station, a permanent station of the Alfred Wegener Institute for Polar and Marine Research in Ny Alesund, Spitsbergen, is only about 200 km away from HAUSGARTEN and could be considered to be such a base.

### Regional consortium of users and financing institutions

The observatory is at present predominantly maintained and used by the deep-sea research group of the Alfred Wegener Institute. However, each year scientists from other German and European institutes are participating in either our field work or the later analysis of samples in the laboratory. The planning reliability in access on the station offers good opportunities for other users to share their expertise and infrastructure at HAUSGARTEN. Close cooperation links exist, for example, to the Institute for Polar Ecology (Kiel), the Max-Planck Institute for marine Microbiology (Bremen), the University Ghent (Belgium), Institute of Oceanology in Sopot (Poland), and the PP Shirshov Institute of Oceanology Moscow (Russia). At present the observatory is maintained by institutional funds of the AWI.

### Participants

AWI, IPÖ/Kiel, IOPAR/Sopot, University Ghent, IORAS/Moscow, etc.

### References

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