***IceAGE***
***Icelandic marine Animals: Genetics and Ecology***

Cruise No. POS456
IceAGE2

20.07.2013 – 04.08.2013, Kiel (Germany) – Reykjavik (Iceland)


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## 1 Summary

The IceAGE project (Icelandic marine Animals: Genetics and Ecology) aims to observe the icelandic marine benthos and the benthic fauna of neighboring regions. We aim to combine classical taxonomic methods with modern aspects of biodiversity research, in particular ecological modelling in the climatic sensitive region around Iceland. We want to answer the question which factors are responsible for the distribution of the benthic fauna along the Greenland-Iceland-Scotland Ridge and how high is the genetic variability and why?

**Zusammenfassung**

Das IceAGE Projekt (Icelandic marine Animals: Genetics and Ecology) hat sich zum Ziel gesetzt, die benthische Fauna um Island und angrenzender Meeresgebiete zu beobachten. Bei dem Thema Biodiversität in dieser klimatisch sensitiven Region wird der Fokus auf folgende Fragestellungen gelegt: Welche Faktoren strukturieren die benthische Fauna entlang des Grönland-Island-Schottland Rückens (GIS Rücken) und wie hoch ist die genetische Variabilität und warum?

## 2 Participants

| Name | Discipline | Institution |
|---|---|---|
| Brix, Saskia Dr. | Chief Scientist | DZMB HH |
| Martinez, Pedro, Prof. Dr. | Meiofauna (MUC) | DZMB WHV |
| Svavarsson, Jörundur Prof. Dr. | Epifauna (EBS) | University of Iceland |
| Kenning, Matthes | EBS | Universität Greifswald |
| Jennings, Robert Dr. | EBS | University of Massachussets |
| Holst, Sabine Dr. | Beamtrawl (AGT) | DZMB HH |
| Cannon, Johanna | AGT | Auburn University |
| Henningsen Eilertsen, Mari | AGT | University of Bergen |
| Schnurr, Sarah | CTD | DZMB HH |
| Jeskulke, Karen | Data management | DZMB HH |
| Hoffmann, Sven | Boxcorer (GKG) | DZMB HH |

## 3 Research Program

During the expedition IceGE2 (POS 456) three transects were sampled. The first transect (1–7, fig. 3.1) started in the northern North Sea and ended in the Norwegian Sea sampling the Norwegian Channel in 200m steps in depth between 200 and 1800m. The second transect crossed the Faroe-Scotland Ridge sampling on top of the ridge east of the Faroe islands and south east of the Faroe islands (8–11, fig. 3.1). The third transect crossed the Iceland-Faroe Ridge (12–17, fig. 3.1). Transects over the ridge structures aim to detect potential barriers of species distribution due to the ridge and the hydrographic differences (oceanography) north and south of the ridge. The working area in the Norwegian Channel was characterized by a steep slope decreasing from relatively shallow areas (200–500m) to large depth (1000m) with the steepest part between 600–800m depth. In the Norwegian Channel the aim was to detect were the faunal change from North Sea fauna to artic fauna takes place.

The transect over the Iceland-Faroe Ridge is characterized by a complicated hydrography and fast changing water masses as well as strong currents on a rocky bottom. The mountain chain

under water is not completely mapped and the seafloor charts are incomplete. Most of the depths in the charts were not precise enough to know the precise depth of the station sampled before arriving at the point.

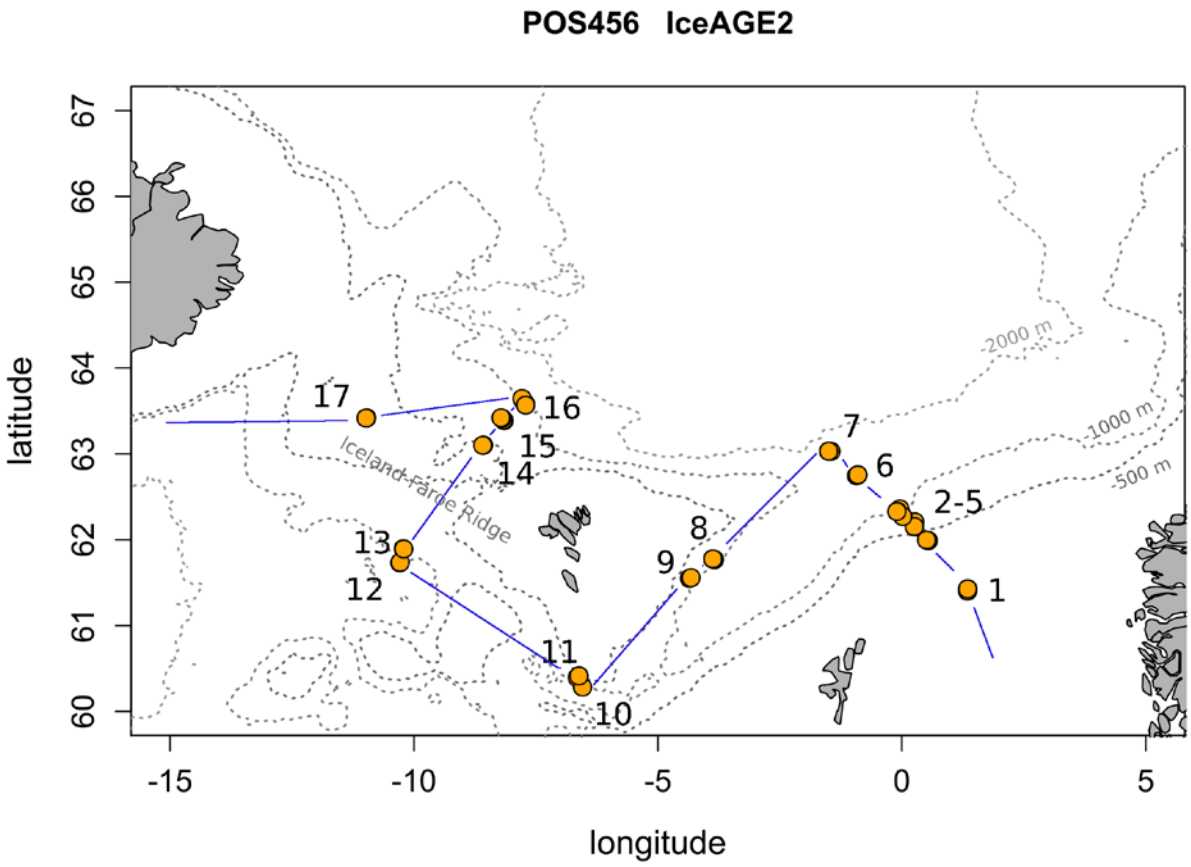



**Fig. 3.1** Track chart of POS456, IceAGE2

## 4 Narrative of the Cruise

RV *Poseidon* left Kiel harbor on July 21st 2013. The weather conditions were sunny and the sea was silent, which made it easy to get used to the life on board. The first 3 days the scientific team used the transit time to equip the laboratories and to get prepared for station work. The decks crew helped preparing the sampling gear. Station work started on the 24th July with a CTD at 06:34 o´clock. At the end of the first week (July 21st to July 27th 2013) of the expedition the first transect was successfully finished in 1800m depth.

During the second week (28th of July to August 3rd 2013) the good weather left and work had to be continued by winds around 7 to 7 bft and foggy conditions outside. Compared to the soft sediments in the Norwegian Channel sampling the Ridge was more difficult. The marine bottom became more and more gravely and stony and strong bottom currents made trawling gear more difficult. Difficult conditions during sampling lead to the loss of the beamtrawl/AGT on the 28h of July in area 10. Thus, during the third transect the triangle dredge was deployed instead of the beamtrawl. End of the week a storm came up and RV Poseidon had to go more north for better working conditions. All transect could be successfully finished before heading to Reykjavik started on 2sd of August leaving station at 7 p.m. early evening. It was possible to add one more working area on the way (area 17) in the Icelandic economic zone before being on transect to Reykjavik. Station work ended in the morning of August 2nd 2013. RV Poseidon arrived in port on the morning of August 4th 2013 at 09:00 o´clock in stormy conditions.

# 5 Preliminary Results

## 5.1 CTD Measurements

(Sarah Schnurr)

The abiotic parameters with the CTD were collected in order to connect the marine fauna of each working area to the physical environment. During POS 456 the RV Poseidon CTD system SBE 5 was used for measuring conductivity, temperature, depth, salinity and oxygen at each station. Additionally we deployed the AANDERAA Seaguard Type 6000. The CTD was deployed 17 times during POS 456 (Figure 5.2) without any problems. Conductivity temperature depth profiles were compiled at each station from the surface until a depth of 10 m above seafloor. The determination of the near bottom water masses will be done after the cruise in Hamburg, in order to connect them to species data.

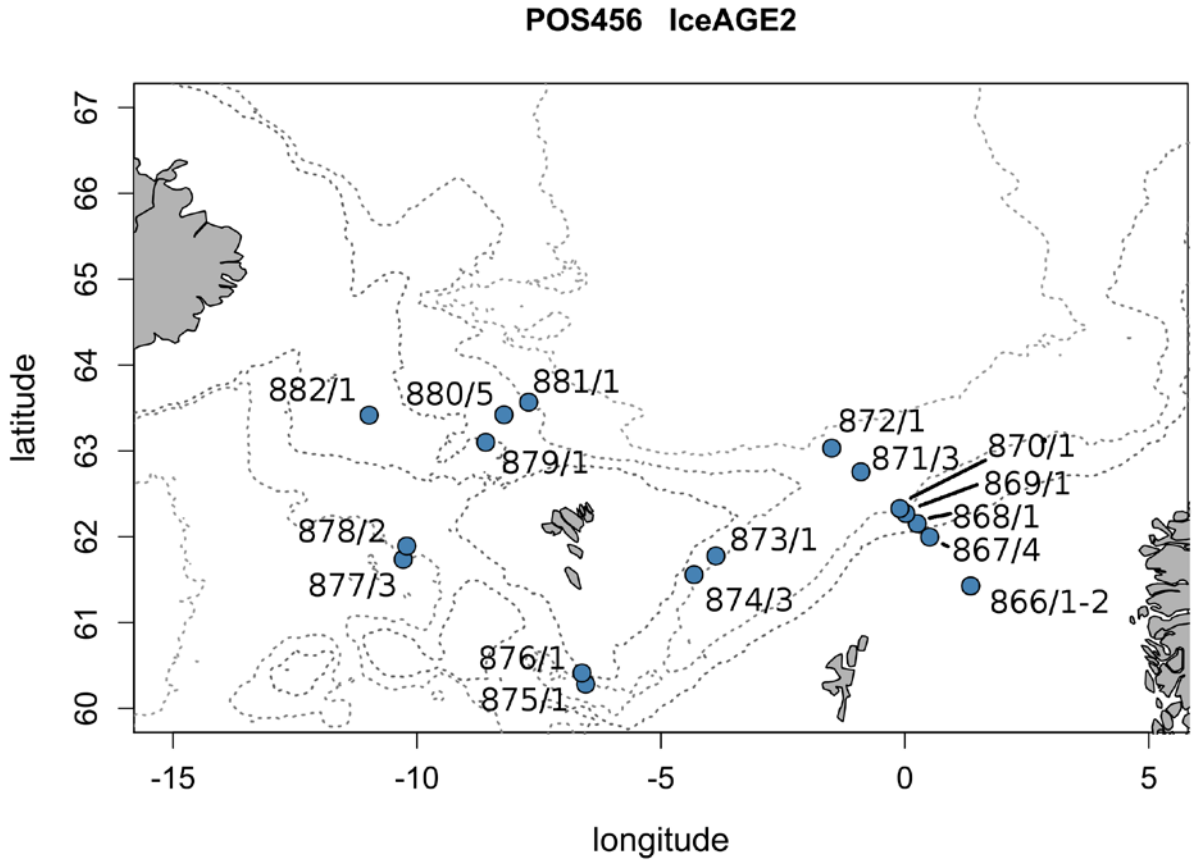



**Fig. 5.2** CTD deployments

## 5.2 Meiofauna

(Pedro Martinez)

Meiofauna refers to a group of organisms of small size-class, passing through a 1mm sieve, but being retained in a 40µm sieve. During this cruise we sampled meiofauna communities with the multiple corer (MUC). This device is equipped with 12 plastic corers having an inner diameter of 9,4 cm. Samples were taken for following main tasks:

Study of metazoan meiofauna community structure and diversity: The top 5cm of sediment of 4 corers were fixed in formaline at a final concentration of 4%. In addition one corer was sliced in 1cm slices (top 5cm) and fixed in formaline, to study the vertical distribution of meiofauna into

the sediment. This samples will be analyzed by Alexandra Ostmann at DZMB in Senckenberg am Meer, Wilhelmshaven.

Genetic studies with meiofauna: The top 3cm of sediment from 4 corers per deployment was fixed in DESS, a fixative which preserves DNA for further studies while preserving the morphology of the organism. This samples will be used to extract and DNA for phylogenetic and population genetic studies with copepods and nematodes. Samples will be analyzed by Sahar Khodami at DZMB in Senckenberg am Meer, Wilhelmshaven.

Abiotic conditions: The top 5cm of one corer per deployment was cut into 1cm slices. The sediment was divided into 3 parts, filled into plastic bags and deep-frozen at -22°C. This samples will be used to determine the granulometry of the sediment, the organic carbon and nitrogen content and the chlorophyl a and phaeopigment content. Samples will be analyzed in Wilhelmshaven by Alexandra Ostmann.

Study of microfossils: One corer was cut into 1cm slices, up to the maximum possible depth (up to 20 cm). Sediment was filled into plastic bags and deep-frozen at -22°C. From these sample the shells of ostracodes and foraminifera will be analyzed, to study past biodiversity of the area. The samples will be analyzed by Moriaki Yasuhara at University of Hong-Kong.

Study of environmental DNA and recent Foraminifera. From one corer, three surface sediment samples (2ml) were collected with sterile spoon and deep-frozen at -22°C. The reminding sediment was preserved into a small jar together with original bottom water, and kept in the fridge. Living foraminifera will be studied by Franck Lejzerowicz at University of Geneva in Switzerland.

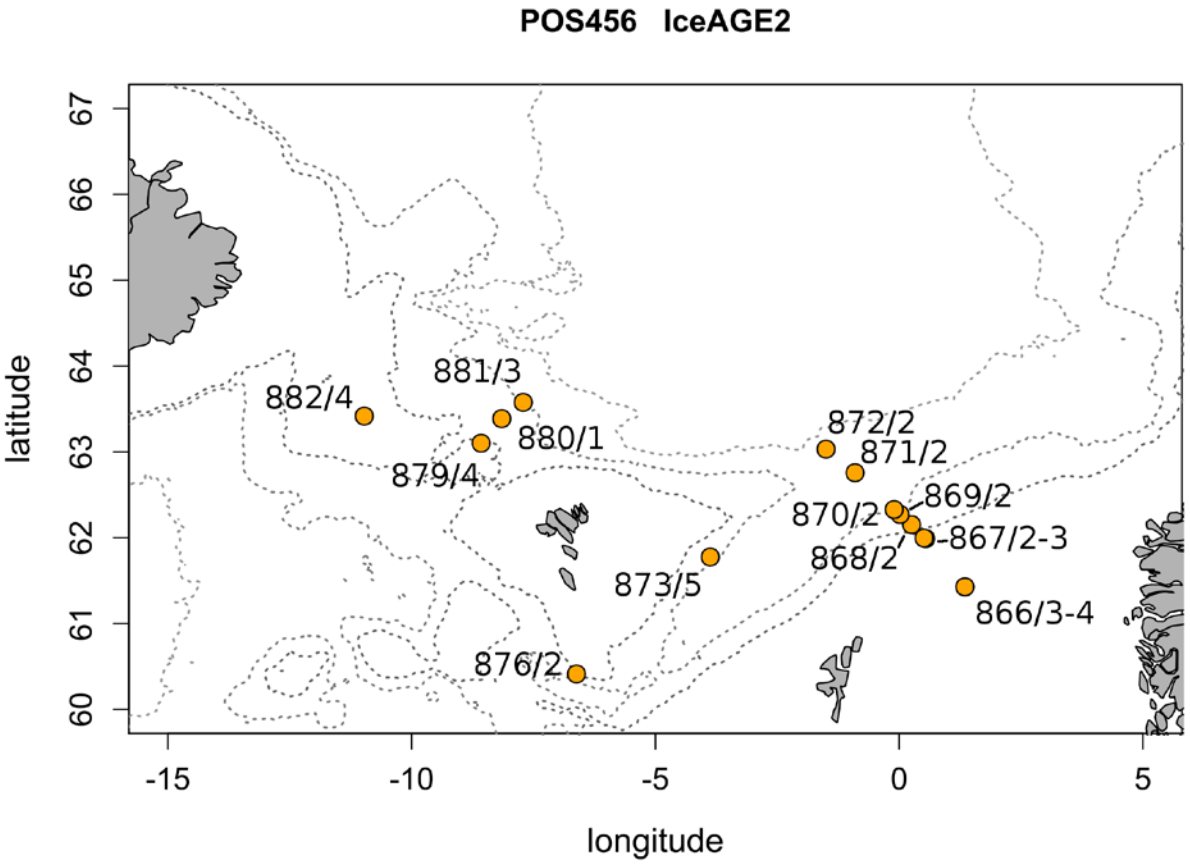



**Fig. 5.3** MUC deployments

## 5.3 Macrofauna

(Jörundur Svavarsson, Saskia Brix, Rob Jennings, Sarah Schnurr, Sven Hoffmann, Matthes Kenning)

### 5.3.1 Epifauna

Samples were taken with epibenthic sleds, i.e. the Brenke sled (Brenke 2005) and the RP sled (Rothlisberg & Pearcy 1977, figure 5.4). The sleds are excellent tools for sampling crustaceans (e.g. isopods, amphipods, tanaids and cumaceans) and other light animals (e.g. foraminifers, small bivalves, small polychaetes) occurring on the bottom (epifaunal) and in the uppermost centimeter of the sediments on the bottom. The sleds induce turbulence in front of them and the benthic organisms are lifted up by this turbulence and subsequently get carried into the large net(s) of the epibenthic samplers. The large nets allow for gentile separation of the organisms from the suspended sediment, and accordingly, fragile species are collected undamaged in the cod-ends with a mesh size of 300µm.

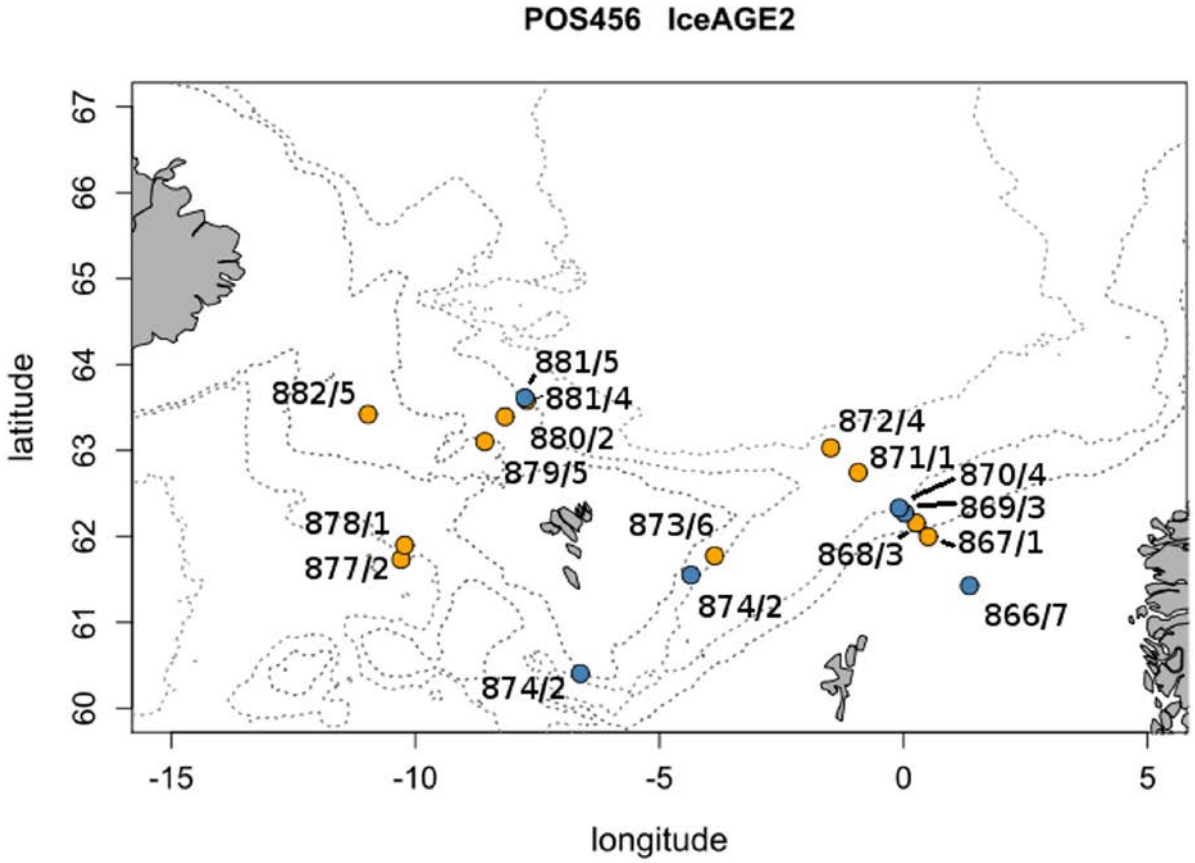



**Fig. 5.4** EBS deployments. Blue (dark) dots: RP sled, Yellow (light) dots: Brenke (2005) EBS.

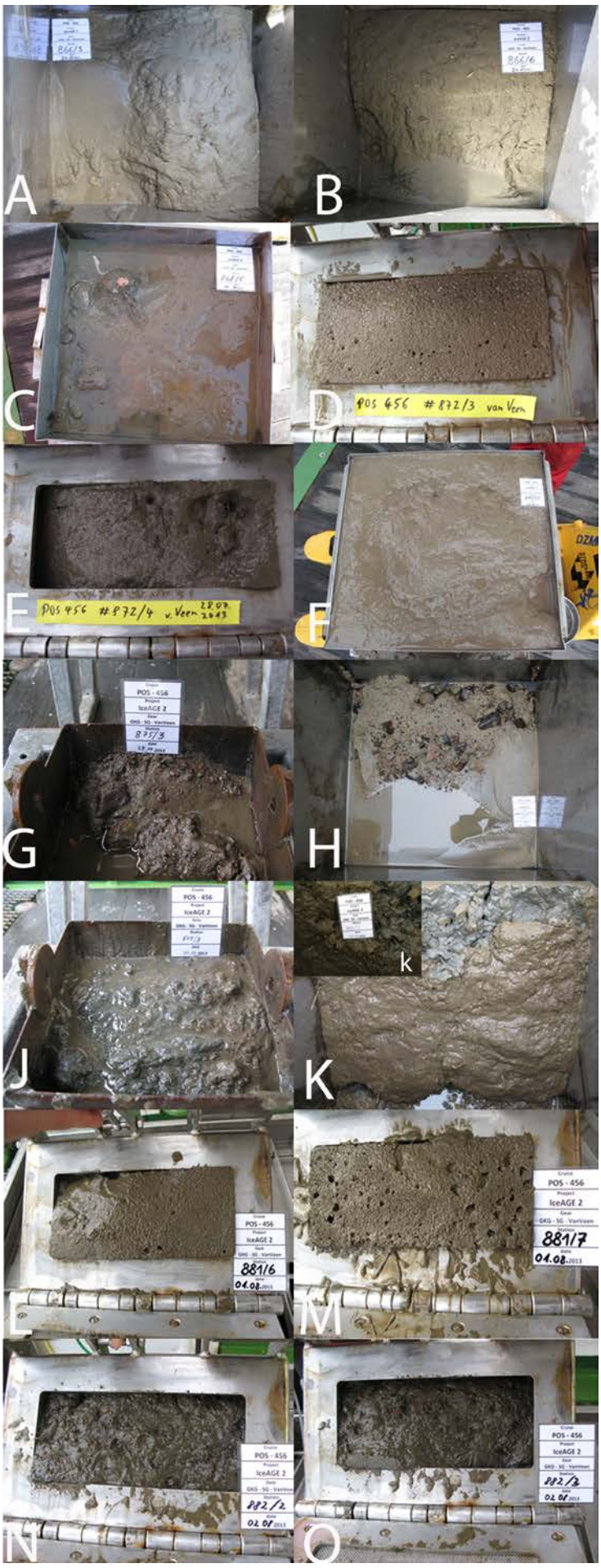
The samples will provide a representative picture of the benthic fauna, both the characteristic arctic deep sea fauna of the region north of the Iceland-Faeroe Ridge and the fauna occurring in the somewhat warmer waters on the Ridge and south of the Ridge, allowing for in-depth comparison of various aspects (e.g. genetics, morphology, taxonomy and ecology) of the warm and cold (temperature low as -0.7°C) water species. Successful samples were taken from the deep channels of the Iceland-Faeroe Ridge, which are very important “routes” for species crossing this Ridge, which is probably among the most remarkable distributional and zoogeographical barriers in the North Atlantic Ocean.

Bivalve collections from the epibenthic sleds contained 88 specimens already picked alive from the samples before preservation. This total includes some 35 protobranch bivalves. Full species identifications require the use of a microscope and must wait until the specimens are on land; however, at best count at least 5 species of protobranchs from 3 genera were collected. Non-protobranch bivalves included many species of thyasirids, several cuspidarids, and at least two species of *Astarte.* Protobranchs seemed most abundant at the last station, but bivalves *en masse* were found rather evenly among all stations. A small number of gastropods were also collected, including one large limpet, a number of small turrid-like specimens, and one murcid-like specimen. Some individuals from each of these groups were preserved in RNAlater, for nucleic acid extraction back on land, and (hopefully for some target groups), RNA extraction for transcriptomics. Since most bivalves (and especially most protobranchs) at these depths are quite small, it is expected that the substantially more specimens will be found during further sample processing in Hamburg. A special focus was given to the taxon Isopoda. The Greenland-Scotland Ridge (GSR) constraining the water exchange between the northernmost North Atlantic and the Nordic Seas.

Within this region several benthic isopods show boundaries in their distributional limits. The epibenthic isopod family Munnopsidae (Crustacea) appears to be very abundant within the area. Moreover, some species, which occur within the research area are putative species complexes. Therefore, specimens of IceAGE2 will be dissected and afterwards sequenced at the Smithsonian in Washington D.C.. Morphological variation can then be evaluated in the light of genetic variation and the resulting morphological species delineations can be then used to reevaluate the *Eurycope inermis* and *Eurycope producta*. Further genetic variation of *Munnopsurus giganteus* and *Munnopsis typica* will be investigated and compared to samples of the IceAGE1 cruise.

**Table 1:** Species picked alive for morphological brain research going to the University of Greifswald

| station | gear | taxon | | | | | N |
|---|---|---|---|---|---|---|---|
| 868 3 | EBS | Crustacea | Isopoda | Munnopsidae | *Munnopsuris* | *giganteus* | 4 |
| 869 3 | EBS | Crustacea | Isopoda | Munnopsidae | *Eurycope* | *inermis* | 10 |
| 870 5 | AGT | Crustacea | Isopoda | Munnopsidae | *Munnopsuris* | *giganteus* | 13 |
| 870 5 | AGT | Chelicerata | Pycnogonida | indet. | | | 10 |
| 870 4 | EBS | Crustacea | Isopoda | Munnopsidae | *Munnopsuris* | *giganteus* | 1 |
| 870 4 | EBS | Crustacea | Isopoda | Munnopsidae | *Eurycope* | *inermis* | 3 |
| 873 6 | EBS | Chelicerata | Pycnogonida | indet. | | | 1 |
| 874 1 | TD | Crustacea | Isopoda | Munnopsidae | *Eurycope* | *inermis* | 4 |
| 874 1 | TD | Crustacea | Isopoda | Munnopsidae | *Ilyarachna* | sp. | 1 |
| 874 2 | EBS | Crustacea | Isopoda | Munnopsidae | *Eurycope* | *inermis* | 3 |
| 874 2 | EBS | Crustacea | Isopoda | Munnopsidae | *Ilyarachna* | sp. | 2 |
| 876 5 | EBS | Chelicerata | Pycnogonida | indet. | | | 1 |
| 876 5 | EBS | Chelicerata | Pycnogonida | indet. | | | 1 |
| 877 1 | TD | Crustacea | Isopoda | Munnopsidae | *Janaeropsis* | sp. | 1 |
| 879 5 | EBS | Crustacea | Isopoda | Munnopsidae | *Munnopsis* | *typica* | 6 |
| 879 5 | EBS | Crustacea | Isopoda | Arcturidae | *Astacilla* | *boreaphilis* | 4 |
| 881 4 | EBS | Crustacea | Isopoda | Munnopsidae | *Ilyarachna* | sp. | 3 |
| 882 5 | EBS | Crustacea | Isopoda | Munnopsidae | *Ilyarachna* | sp. | 9 |
| 882 5 | EBS | Chelicerata | Pycnogonida | indet. | | | 2 |
| | EBS | Crustacea | Isopoda | Munnopsidae | *Ilyarachna* | sp. | 2 |
| | EBS | Crustacea | Isopoda | Munnopsidae | *Munnopsis* | typica | 4 |




During POS 456 isopods were picked alive right after the gear was back on deck. So far specimen belonging to *Eurycope inermis* (n=19), *Munnopsis typica* (n=31) and *Munnopsurus giganteus (*n=20) were fixed for genetic studies from the alive picking. Furthermore, additional specimens of the several species of isopods (partly the same species as used for molecular treatment) and pantopods (Chelicerata) were prepared for morphological analyses of the brain in cooperation with the University of Greifswald (Table 1).

### 5.3.2 Infauna

On our cruise we deployed 27 corers of 3 different types. To use corers is the best way to collect quantitative samples for study the infauna of the seafloor.

Which type of grab was deployed depended on the bottom expected in the working area and the time frame of the sampling because large gear (boxcorer) could be only deployed between 6 a.m. and 6 p.m. during the day. We used the giant boxcorer, the VanVeen grab and the 60kg Shipek grab. The giant boxcorer has a defined sample area of 0.25m², the other grabs are not as precise as the boxcorer.

The boxcorer was deployed 10 times (3 failures), the VanVeen grab 10 times (2 failures) and the Shipek grab 7 times (see station list below). The VanVeen grab is a very light gear and we could not see exactly if it hit the seafloor at stations deeper as 1200m. The tension meter of the winch was not sensitive enough to show us the “impact” of the VanVeen. The most reliable gear was the Shipek grab.

**Fig. 5.5** Sediment pictures of different grab deployments. Transect 1 Norwegian Channel (A-F), transect 2 Faroe-Scotland Ridge (G-H), transect 3 Iceland-Faroe Ridge (J-O): A,866-5. B,866-6. C,868-5. D,872-3. E,872-4. F,872-5. G,875-3. H,876-3. J,879-3. K,880-3; k, detail station label 880-3. L,881-6. M,881-7. N,882-2. O,882-3.

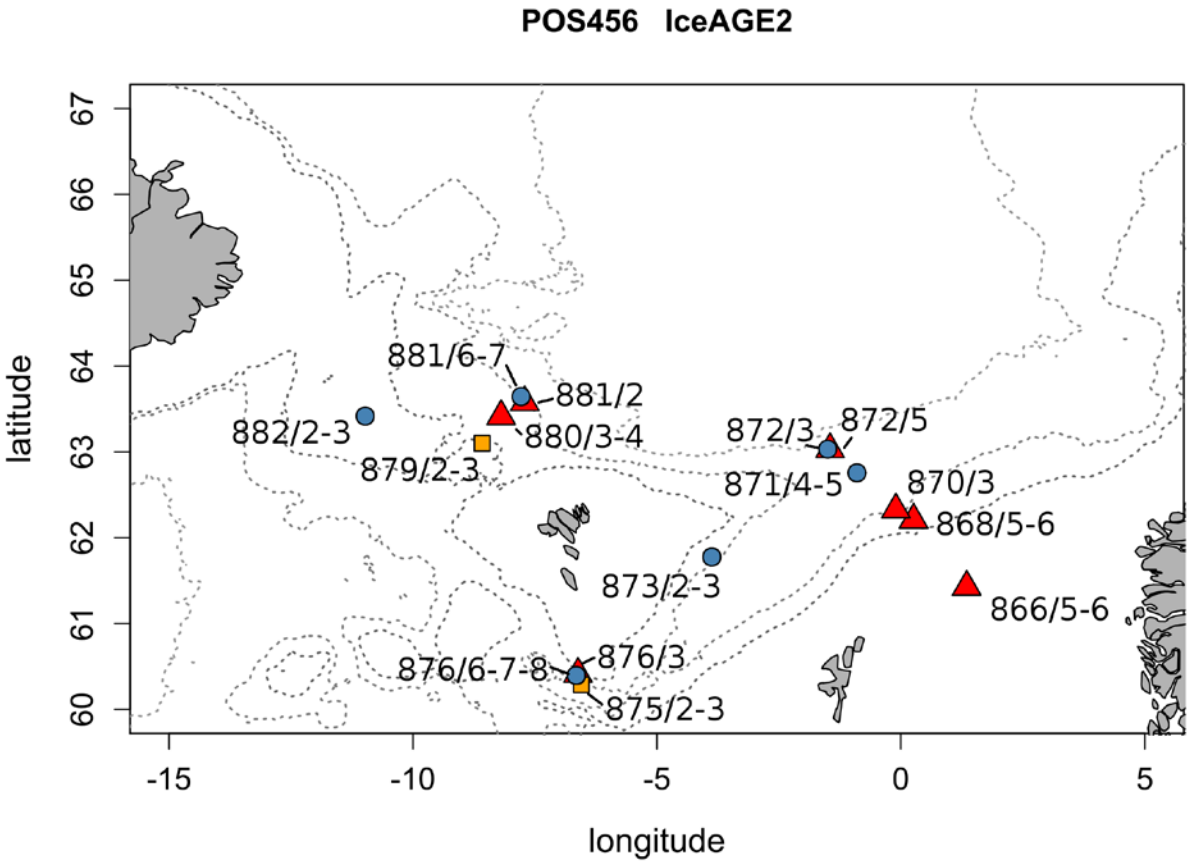



**Fig. 5.6** Grab deployments. Blue dots: VanVeen, red triangle: boxcorer, yellow squares: Shipek grab

## 5.4 Megafauna

(Sabine Holst, Johanna Cannon, Mari Eilertsen, Karen Jeskulke)

Two different gears were used for sampling of megafauna (animals >1mm). The larger Agassiz trawl, 3.5 m in width (Fig.5.6a), was used at 3 stations at depths of 168, 660, and 1079 m. It was trawled for 10 minutes at 2 kn ship speed. The net of the Agassiz trawl was damaged by large stones at station 866/8. At station 873/7 (875m) the gear broke and was lost. Afterwards the smaller triangle dredge, 0.75 m in width (Fig.5.6b) was used at 4 stations at depths of 895, 1088, 535, and 1094 m. At stations 874/1 and 875/4 the triangle dredge was trawled for 5 min at low ship speeds of 0.2 to 0.3 kn resulting in a very small catch. At the latter station more planktonic than benthic animals were collected by the net (see fig. 5.8a) and the data were not included in the biomass analysis (fig. 5.8b). The triangle dredge was trawled at 1 kn ship speed for 5 minutes at stations 876/4 and 877/1, resulting in a sufficient amount of intact animals in the catch. The net was successfully operated at a station with a rocky bottom (station 876/4) where it was not damaged by the catch of large stones. The total catch or a subsample was sieved into two fractions. The larger 7100 µm fraction was sorted into taxonomic groups immediately after sieving in the wet lab on board. The specimens were counted, weighted, and photographed. The abundances and biomasses of the sorted material >7100µm at different stations are shown in figure 5.8 and a photo selection of megafauna found at different AGT and TAD stations is provided in figure 5.9. Most individuals were fixed in 96% non-denatured ethanol. Species which appeared in large amounts were preserved in 96% denatured ethanol. Polychaeta and gelatinous animals (eg. Hydrozoa, Staurozoa) were occasionally preserved in a borax buffered

4% formalin-seawater solution to allow later investigations on their morphology. Fishes were frozen at -20°C after tissue subsamples were taken and fixed in 96% Ethanol. The smaller 1000–7100 µm fraction or a subsample of this material was fixed in 96% denatured or non-denatured ethanol for later sorting.

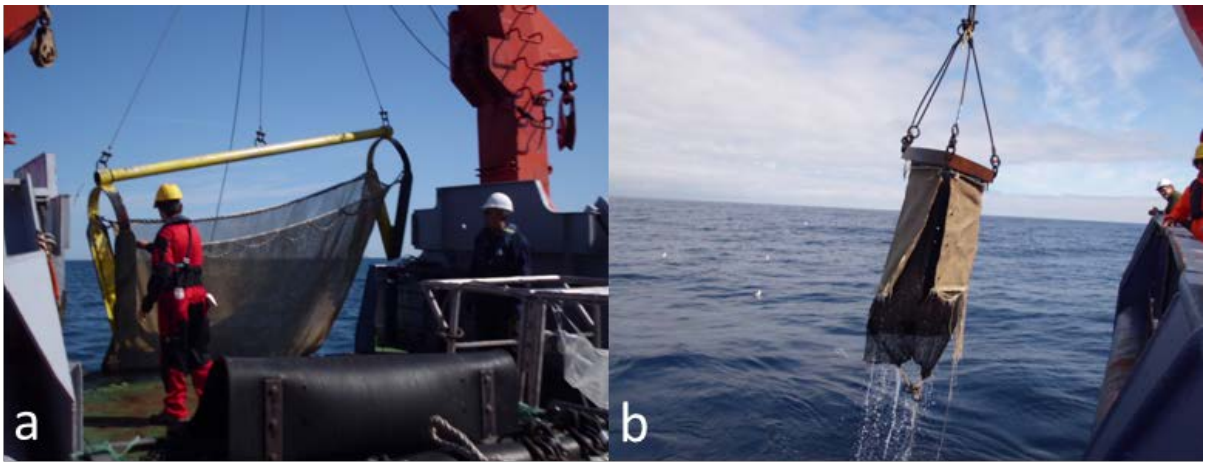



**Fig. 5.6** Gears used for the collection of the megafauna. **a** Agassiz trawl, **b** Triangle dredge.

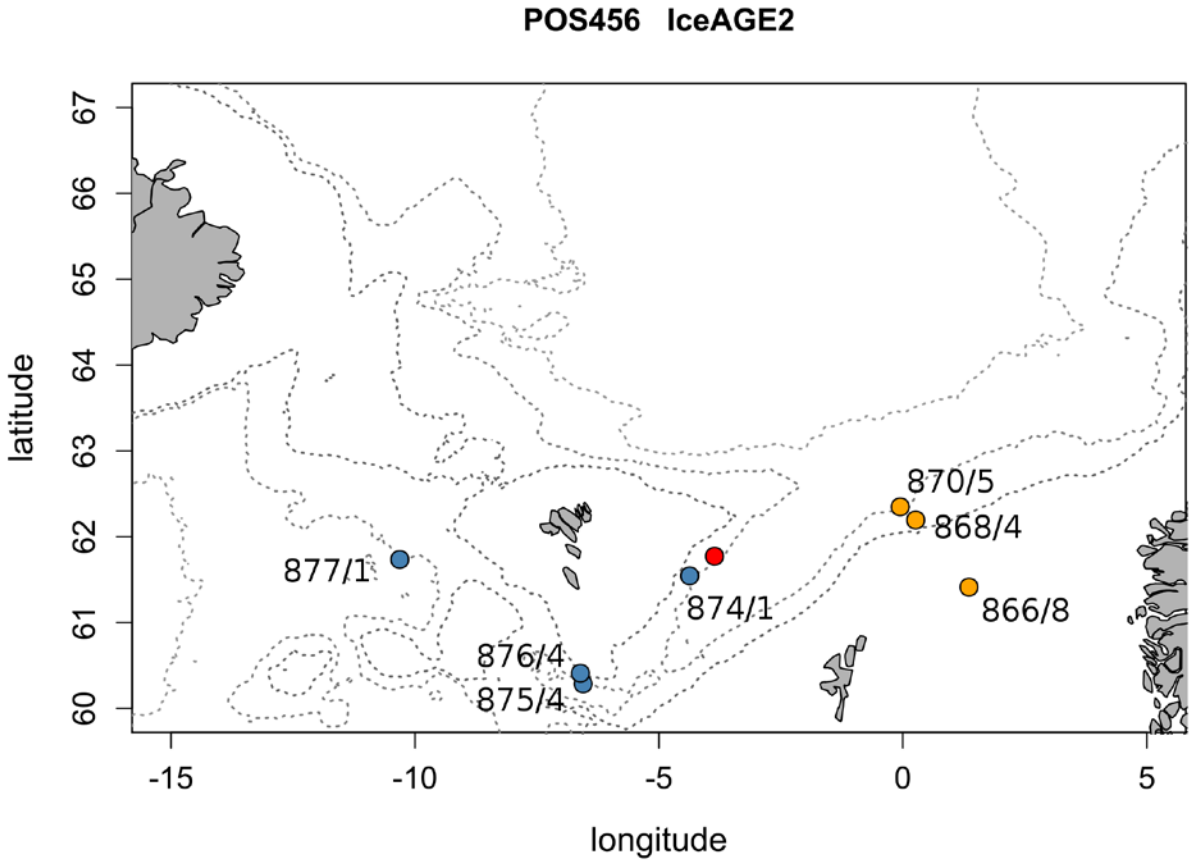



**Fig**. 5.7 Deployments of the beamtrawl (AGT, yellow dots) and the Triangle dredge (blue dots). The red dot indicated the loss of the beamtrawl.

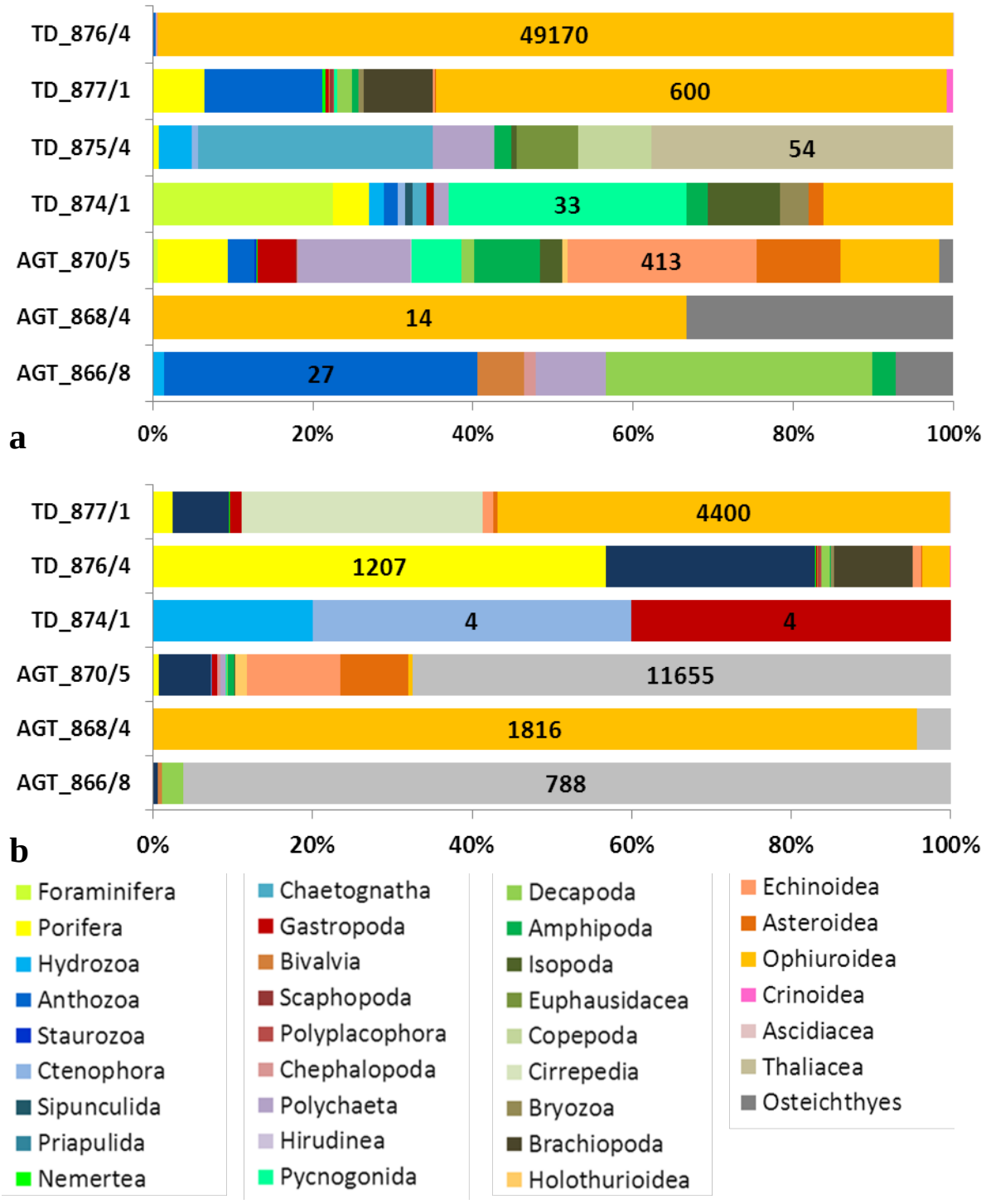



**Fig. 5.8 a** Abundance and **b** Biomass (of taxa present in amounts >1 g) of specimens >7100µm from different Agassiz trawl (AGT) and Triangle dredge (TD) stations, sorted on board Poseidon (POS 456) into 34 taxa. The largest values per station are given in the bars.


**Fig. 5.9** Photo selection of animals >7100 µm from Agassiz trawl and Triangle dredge catches sorted on Board of Poseidon (POS 456). The station number (St.) is given in each photograph. a Osteichthyes, b Asteroidea, c Ophiuroidea, d Echinoidea, e Holothurioidea, f Amphipoda, g Gastropoda, h Polychaeta, i Hexacorallia (Anthozoa), j Octocorallia (Anthozoa), k Porifera with Octocorallia, l Foraminifera.

One more was to collect sponges (phylum Porifera) of all classes for taxonomic studies, and in particular the calcareous sponge *Sycon abyssale* for phylogeographic studies. *Sycon abyssale* is found at bathyal and abyssal depths in the North Atlantic and Norwegian Sea, but the species has also been found in shallower waters in Norwegian fjords. One of the research goals is to test the conspecificity of these populations and the genetic connectivity between them, especially across the Greenland-Iceland-Faroe ridge, which is believed to be a major barrier to dispersal between the North Atlantic and Norwegian Sea. A high number of sponges of different morphotypes were collected, both encrusting and freestanding types. Although the exact number of species has to be determined by experts, it is clear that some of the stations (e.g. station 876) had a very rich sponge fauna. A few specimens that might potentially be *Sycon abyssale* were identified in field, but as these sponges are very small, they are difficult to recognize without use of a dissection microscope, and it is expected that more will be identified when the bulk-fixed samples are

sorted after the cruise. All specimens were fixated on undenatured ethanol, but where there were very many specimens of the same species two to three specimens were fixated on formalin for histological studies.

Further goals for this cruise were to collect specimens for ongoing projects on hemichordate phylogeny, evolution of symbiosis, and polar phylogeography. Specimens fulfilling all three of these goals were obtained, as outlined below.

1) *Hemichordate phylogeny*. Hemichordates have been central to hypotheses of early chordate evolution, but much is unknown about their biology and diversity. Specimens obtained during the first IceAGE cruise form a substantial portion of a recently discovered molecular clade of enteropneust hemichordates, which is likely to represent a new genus. During IceAGE2, small enteropneusts externally resembling these worms were found in MUC sample 881/3These specimens will aid in the description of this newly discovered genus, which includes two new species from Iceland. The specimens collected on this expedition were preserved in ethanol and formalin, allowing morphological species description and molecular characterization for phylogenetic analyses.
In addition, enteropneust hemichordates identified as *Stereobalanus canadensis* were collected at stations 879 and 882, in both the MUC and the EBS samples. This species is found in Maine (USA), along the northeastern coast of Canada, in the Norwegian Sea, North Sea, Greenland Sea. Molecular data are available for *S. canadensis* from Maine, USA, but no comprehensive taxonomic work has been conducted to determine whether this is a valid species throughout this range, or if it may represent cryptic species. The IceAGE2 specimens will be sequenced in order to address this question.
Specimens of the neomenoid genus *Plawenia* (aplacophoran molluscs) were found in EBS station 881/5. These samples, preserved in formalin and RNAlater, will contribute to these ongoing studies. Dr. Kevin Kocot (Auburn University) and Dr. Christiane Todt (University of Bergen) will use these specimens in their continuing collaboration on neomenoid taxonomy and molecular phylogeny.

2) *Evolution of symbiosis.* Tubeworms in polychaete family Siboglinidae lack a true mouth, anus, or functional gut, and instead derive their energy from bacterial symbionts, which are housed in a unique endosymbiotic storage organ, the trophosome. Siboglinidae includes Vestimintifera (well-known vent and seep fauna such as *Riftia*, *Lamellibrachia*, and *Seepiophila*), bone-eating worms such as *Osedax*, and frenulates. One or two specimens of frenulate siboglinids (genus *Siboglinum*) were found in Triangle Dredge station 874/1, and MUC stations 879/4 and 881/3. These specimens were preserved in RNAlater, which will allow extraction of RNA to generate transcriptome data from this species. These transcriptome data will be added to current studies of Vestimentifera and *Osedax*, enabling comparison across Siboglinidae.

3) *Polar phylogeography*. Echinoderm specimens were collected as part of Halanych lab (Auburn University) research on polar phylogeography. This work has primarily focused on Antarctic endemism, and questions of life history as it relates to dispersal ability. Specimens from the North Atlantic may be used either as outgroups for these studies, or for broader questions comparing biogeographic influences in the north and south hemispheres. During IceAGE2, ophiuroid *Gorgonocephalus* sp. tissue samples were taken from specimens collected in Agassiz Trawl Station 868/4 (five individuals), and EBS (Brenke, epi-net) station 880/2 (four individuals). Additionally, echinoid *Strongylocentrotus* c.f. *droebachiensis* specimens (15 individuals) were collected in Triangle Dredge station 877/1.

# 6 Station List POS456, IceAGE2

| Station No. POS456 | Date in 2013 | Gear | Time [UTC] | Latitude | Longitude | Water Depth [m] | Remarks/Recovery |
|---|---|---|---|---|---|---|---|
| 866-4 | 24.07. | MUC | 06:34 | 61° 25.64' N | 001° 20.96' E | 168,5 | successful |
| 866-7 | 24.07. | EBS | 08:44 | 61° 25.63' N | 001° 21.07' E | 169,1 | Successful |
| 866-8 | 24.07. | AGT | 09:49 | 61° 24.87' N | 001° 21.42' E | 168,2 | Successful |
| 866-6 | 24.07. | GKG | 08:14 | 61° 25.62' N | 001° 21.02' E | 168,8 | Successful |
| 866-2 | 24.07. | CTD | 05:15 | 61° 25,62' N | 001° 20,91' E | 167,9 | Successful, oil platform |
| 866-1 | 24.07. | CTD | 05:00 | 61° 25,61' N | 001° 20,95' E | 168,2 | Successful, oil platform |
| 866-5 | 24.07. | GKG | 07:39 | 61° 25.62' N | 001° 21.01' E | 169,1 | Successful, oil platform |
| 866-3 | 24.07. | MUC | 05:57 | 61° 25.64' N | 001° 20.98' E | 168,5 | Successful, oil platform |
| 867-1 | 24.07. | EBS | 15:11 | 61° 59.83' N | 000° 30.40' E | 302,5 | Successful |
| 867-3 | 24.07. | MUC | 17:11 | 61° 59.80' N | 000° 30.65' E | 301,6 | Successful |
| 867-2 | 24.07. | MUC | 16:26 | 61° 59.38' N | 000° 32.73' E | 292,9 | Successful |
| 867-4 | 24.07. | CTD | 17:38 | 61° 59,79' N | 000° 30,44' E | 302,9 | Successful |
| 868-3 | 25.07. | EBS | 05:56 | 62° 09.14' N | 000° 15.51' E | 587,4 | Successful |
| 868-5 | 25.03. | GKG | 09:53 | 62° 12.49' N | 000° 15.67' E | 669,4 | Successful |
| 868-2 | 25.07. | MUC | 05:21 | 62° 09.18' N | 000° 15.36' E | 588,4 | Successful |
| 868-4 | 25.07. | AGT | 07:42 | 62° 10.71' N | 000° 15.93' E | 625,4 | Successful big stones |
| 868-1 | 25.07. | CTD | 04:15 | 62° 09,20' N | 000° 15,19' E | 590,4 | Successful |
| 868-6 | 25.07. | GKG | 11:40 | 62° 12.52' N | 000° 15.72' E | 669,4 | Successful |
| 869-2 | 25.07. | MUC | 14:17 | 62° 16.21' N | 000° 01.21' E | 845,4 | Successful |
| 869-1 | 25.07. | CTD | 13:03 | 62° 16,18' N | 000° 1,22' E | 844,4 | Successful |
| 869-3 | 25.07. | EBS | 14:47 | 62° 16.20' N | 000° 01.21' E | 846,4 | Successful |
| 870-2 | 26.07. | MUC | 05:23 | 62° 19.71' N | 000° 06.13' W | 1056,4 | Successful, full of sediment |
| 870-5 | 26.07. | AGT | 09:38 | 62° 20.37' N | 000° 04.22' W | 1075,4 | Successful, full of sediment |
| 870-4 | 26.07. | EBS | 07:30 | 62° 19.73' N | 000° 06.10' W | 1058,4 | Successful, Crustaceansoup |
| 870-1 | 26.07. | CTD | 04:17 | 62° 19,73' N | 000° 6,12' W | 1059,4 | Successful |
| 870-3 | 26.07. | GKG | 06:21 | 62° 19.71' N | 000° 06.11' W | 1056,4 | Failure |
| 871-2 | 26.07. | MUC | 17:43 | 62° 45.39' N | 000° 54.26' W | 1568,7 | Successful |
| 871-1 | 26.07. | EBS | 14:48 | 62° 44.23' N | 000° 56.78' W | 1577,4 | Successful |
| 871-4 | 26.07. | VV | 20:12 | 62° 45.31' N | 000° 54.09' W | 1562,7 | Successful |
| 871-5 | 26.07. | VV | 21:44 | 62° 45.32' N | 000° 53.94' W | 1571,2 | Successful |
| 871-3 | 26.07. | CTD | 18:19 | 62° 45,35' N | 000° 54,10' W | 1564,5 | Successful |
| 872-4 | 27.07. | EBS | 11:15 | 63° 01.88' N | 001° 29.91' W | 1858,3 | Successful |
| 872-2 | 27.07. | MUC | 08:45 | 63° 01.89' N | 001° 29.96' W | 1868,2 | Successful |
| 872-3 | 27.07. | VV | 10:27 | 63° 01.90' N | 001° 29.95' W | 1859,5 | Successful |
| 872-5 | 27.07. | GKG | 14:58 | 63° 01.80' N | 001° 27.05' W | 1842 | Successful |
| 872-1 | 27.07. | CTD | 07:00 | 63° 01,91' N | 001° 29,98' W | 1858,1 | Successful |
| 873-6 | 28.07. | EBS | 07:24 | 61° 46.52' N | 003° 52.38' W | 833,7 | Gear got stuck during trawl |
| 873-3 | 28.07. | VV | 05:35 | 61° 46.56' N | 003° 52.40' W | 834,3 | Successful |
| 873-4 | 28.07. | VV | 06:23 | 61° 46.52' N | 003° 52.51' W | 833,8 | Successful |
| 873-7 | 28.07. | AGT | 09:13 | 61° 46.58' N | 003° 52.38' W | 834,4 | gear lost |
| 873-2 | 28.07. | VV | 04:30 | 61° 46.63' N | 003° 52.38' W | 835,1 | Successful |
| 873-1 | 28.07. | CTD | 02:58 | 61° 46,56' N | 003° 52,31' W | 842,1 | Successful |

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| 873-5 | 28.07. | MUC | 07:00 | 61° 46.53' N | 003° 52.47' W | 833,6 | Successful |
| 874-3 | 29.07. | CTD | 04:14 | 60° 16,88' N | 006° 32,55' W | 1100,8 | Successful |
| 874-1 | 28.07. | TD | 12:49 | 61° 32.75' N | 004° 22.09' W | 894,2 | Successful |
| 874-2 | 28.07. | EBS | 14:33 | 61° 32.82' N | 004° 21.98' W | 901,8 | full of mud (grey), |
| 875-3 | 29.07. | SG | 06:35 | 60° 17.21' N | 006° 33.09' W | 1084,6 | stones in sample |
| 875-2 | 29.07. | SG | 05:53 | 60° 17.16' N | 006° 32.79' W | 1084,1 | Stones in sample |
| 875-4 | 29.07. | TD | 07:33 | 60° 17.21' N | 006° 33.19' W | 1085,2 | Successful |
| 875-1 | 29.07. | CTD | 16:27 | 61° 33,55' N | 004° 19,16' W | 942,9 | Successful |
| 876-4 | 29.07. | TD | 13:04 | 60° 24.27' N | 006° 36.71' W | 528 | Successful |
| 876-7 | 29.07. | VV | 17:06 | 60° 23.66' N | 006° 38.99' W | 691,4 | only 1 big stone, failure |
| 876-6 | 29.07. | VV | 16:42 | 60° 23.63' N | 006° 38.85' W | 691,8 | Failure |
| 876-5 | 29.07. | EBS | 14:29 | 60° 24.33' N | 006° 36.91' W | 554,3 | Shell fragments |
| 876-2 | 29.07. | MUC | 11:30 | 60° 24.78' N | 006° 37.12' W | 534,1 | gear nearly empty, failure? |
| 876-3 | 29.07. | GKG | 12:14 | 60° 24.78' N | 006° 37.02' W | 534,2 | Successful |
| 876-8 | 29.07. | VV | 17:06 | 60° 23.71' N | 006° 39.25' W | 698,2 | Successful |
| 876-1 | 29.07. | CTD | 10:37 | 60° 24,75' N | 006° 37,11' W | 533,7 | Successful |
| 877-2 | 30.07. | EBS | 11:30 | 61° 44.09' N | 010° 18.04' W | 1087,4 | Gear got stuck during trawl |
| 877-1 | 30.07. | TD | 09:06 | 61° 44.22' N | 010° 19.71' W | 1110 | Successful |
| 877-3 | 30.07. | CTD | 14:32 | 61° 44,11' N | 010° 16,91' W | 1098,5 | Successful |
| 878-1 | 30.07. | EBS | 16:52 | 61° 53.79' N | 010° 13.77' W | 781,4 | Successful |
| 878-2 | 30.07. | CTD | 18:32 | 61° 53,53' N | 010° 12,59' W | 771,3 | Successful |
| 879-6 | 31.07. | TD | 08:31 | 63° 05.60' N | 008° 36.38' W | 499,6 | fishtrawler too close for haul |
| 879-1 | 31.07. | CTD | 04:55 | 63° 06,00' N | 008° 35,53' W | 504,6 | Successful |
| 879-2 | 31.07. | SG | 05:35 | 63° 06.02' N | 008° 35.14' W | 505,9 | Successful |
| 879-4 | 31.07. | MUC | 06:29 | 63° 06.05' N | 008° 34.49' W | 509,5 | Successful |
| 879-5 | 31.07. | EBS | 07:04 | 63° 06.10' N | 008° 34.32' W | 510,9 | Successful |
| 879-3 | 31.07. | SG | 06:00 | 63° 06.02' N | 008° 34.80' W | 508,1 | Successful |
| 880-1 | 31.07. | MUC | 12:29 | 63° 23.23' N | 008° 09.12' W | 683 | Successful |
| 880-4 | 31.07. | GKG | 15:45 | 63° 24.90' N | 008° 11.55' W | 693,2 | failure, bad weather |
| 880-3 | 31.07. | GKG | 14:55 | 63° 24.79' N | 008° 11.63' W | 688,1 | Surface disturbed |
| 880-2 | 31.07. | EBS | 12:55 | 63° 23.36' N | 008° 09.42' W | 686 | Successful |
| 880-5 | 31.07. | CTD | 17:13 | 63° 25,19' N | 008° 12,98' W | 0 | Successful |
| 881-5 | 01.08. | EBS | 11:54 | 63° 36.54' N | 007° 45.21' W | 1056,2 | Successful |
| 881-3 | 01.08. | MUC | 09:10 | 63° 34.64' N | 007° 42.71' W | 1043 | Successful |
| 881-1 | 01.08. | CTD | 04:59 | 63° 33,95' N | 007° 42,90' W | 1028,5 | Successful |
| 881-6 | 01.08. | VV | 13:34 | 63° 38.50' N | 007° 47.03' W | 1073,4 | Successful |
| 881-4 | 01.08. | EBS | 09:43 | 63° 34.66' N | 007° 42.69' W | 1043,6 | Successful |
| 881-2 | 01.08. | GKG | 07:29 | 63° 34.63' N | 007° 42.55' W | 1041 | failure |
| 881-7 | 01.08. | VV | 15:30 | 63° 38.72' N | 007° 47.15' W | 1080,4 | |
| 882-5 | 02.08. | EBS | 07:19 | 63° 25.04' N | 010° 58.20' W | 440,5 | Successful |
| 882-4 | 02.08. | MUC | 06:49 | 63° 25.05' N | 010° 58.36' W | 440 | Successful |
| 882-3 | 02.08. | VV | 06:04 | 63° 25.03' N | 010° 58.73' W | 439,6 | Successful |
| 882-2 | 02.08. | VV | 05:37 | 63° 25.01' N | 010° 58.80' W | 441,4 | Successful |
| 882-1 | 02.08. | CTD | 04:59 | 63° 24,95' N | 010° 58,89' W | 440,9 | |

## 7 Data and Sample Storage and Availability

All benthic samples are sorted at the DZMB (HH and WHV). Most probably the complete sorting of samples will be finished most likely summer 2016. Specimens are available for specialists on request and provided as loan to work with the specimens before they are finally stored in museum collections. The DZMB is the link between the sampling effort on the vessel, the scientists working up the samples and the final storage of specimens in museum collections. After sorting samples are housed in the Meteor archives (http://www.material-archiv.de/en/home.html) from where they can be made available to interested individuals at any time. The IceAGE-project is getting evolved with a modern digital data management system for its diverse data collection efforts. At the core of these efforts stands a database in MS Access 2010 which includes all the data content.

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## 9 References

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