METEOR-Berichte

Overflow, Circulation and Biodiversity

Cruise No. M85/3

August 27 – September 28, 2011
Reykjavik (Iceland) – Cuxhaven (Germany)

IceAGE

Icelandic marine Animals:
Genetics and Ecology

S. Brix, W. Bauernfeind, N. Brenke, M. Blazewicz, V. Borges, K. Buldt, J. Cannon, G. Díaz Agras, D. Fiege, D. Fiorentino, S. Haraldsdóttir, S. Hoffmann, S. Holst, F. Hüttmann, K. Jeskulke, R. Jennings, K. Kocot, S. Khodami, Y. Lucas Rodriguez, P. Martinez Arbizu, K. Meißner, N. Mikkelsen, M. Miller, A. Murray, H. Neumann, A. Ostmann, T. Riehl, S. Schnurr, J. Savavarsson, M. Yasuhara

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1 Summary

We aim to combine classical taxonomic methods with modern aspects of biodiversity research, in particular phylogeography (population genetics and DNA barcoding) and ecological modelling in the climatic sensitive region around Iceland. The sampling area is characterised by several local pecularities like submarine ridges (geographical barriers) and influence of different water masses of different origin. This allows the analysis of factors influencing the distribution and migration of species as well as investigation of the background of biogeographic zonation.

Zusammenfassung

Zentrales übergeordnetes Thema ist die Biodiversität der klimatisch sensitiven Region um Island. Das Projekt beinhaltet zwei Fragestellungen, (a) nach den Faktoren, die die benthische Fauna strukturieren und (b) nach genetischer Variabilität und deren Ursachen. Das Vorhaben soll eine Verbindung klassischer taxonomischer Forschung mit modernen Aspekten der Biodiversitätsforschung, im Besonderen Phylogeographie (Populationsgenetik und DNA Barcoding) und ökologische Modellierung realisieren.

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3 Research Program

(S. Brix)

The main aim of the expedition is to sample the icelandic marine fauna from the shelf down the slope to the deep-sea basins surrounding Iceland. Collecting specimens for genetic analyses and sampling regions not represented in the BIOICE dataset is most important. At the same time, this sampling grit allows to develop a genetic inventory and a diversity baseline study along geographical barriers like the Greenland-Iceland-Faroe Ridge or the bathymetric gradient from shelf to the abyss. For every single specimen we will conserve the voucher specimen along with the DNA extract. Extractions will be done on board, PCR and sequencing in the cooperating laboratories.

Parallel to the sampling of the marine fauna, the abiotic parameters of each station are measured with a CTD and linked with already existing oceanographic data from the sampling area. These information about abiotic parameters combined with station data and occurrence of species will be the basic dataset for ecological modeling. All publicly available information will be added to the dataset. As a result, it will be possible to model the distribution of species based on the knowledge of environmental parameters. More data will be collected at revisited stations during future expeditions in the climatic sensitive area around Iceland and allow the observation of alterations in species distribution related to climate change.

As result, genetic and modelling results will be combined in one dataset. For example, if molecular data can tell more about the occurrence of cryptic species and probably species turnover along gradients like depth, this can be analysed in detail with ecological methods. The sythesis of the results from genetics and ecology will allow the description of distribution patterns of species and give important information for a better understanding of the ecosystem around Iceland.

4 Narrative of the Cruise

(S. Brix)

Starting in Reykjavik on the 27th August 2011 at 08:00 o´clock we went to the Iceland Basin for the first transect from the deep sea to the southern shelf close to the volcano eruptions from 2010 and 2011. After a successful sampling on this first transect we crossed the Reykjanes Ridge. A deviation was made going back to Reykjavik on the September 5th, due to illness of one scientist. Station work continued in the evening of the same day and we finished the second transect from the deep sea of the Irminger Basin to the west Icelandic shelf in the second week. Stormy weather conditions made it necessary to hide in the west Icelandic fjords for two days. The third transect could be started on Tuesday, September 13th and we got good samples as well from both sides of the Denmark Strait comparing the faunal elements of the Icelandic and Greenlandic shelf. The fourth and last transect of the expedition started in the deep sea of the Norwegian Basin and ended on the east Icelandic shelf on September 23rd. Stormy weather conditions made further station work impossible.

In total, we sampled 31 working areas (241 stations) on four transects during M85/3 (Figure 1) representing different faunal communities and habitats.

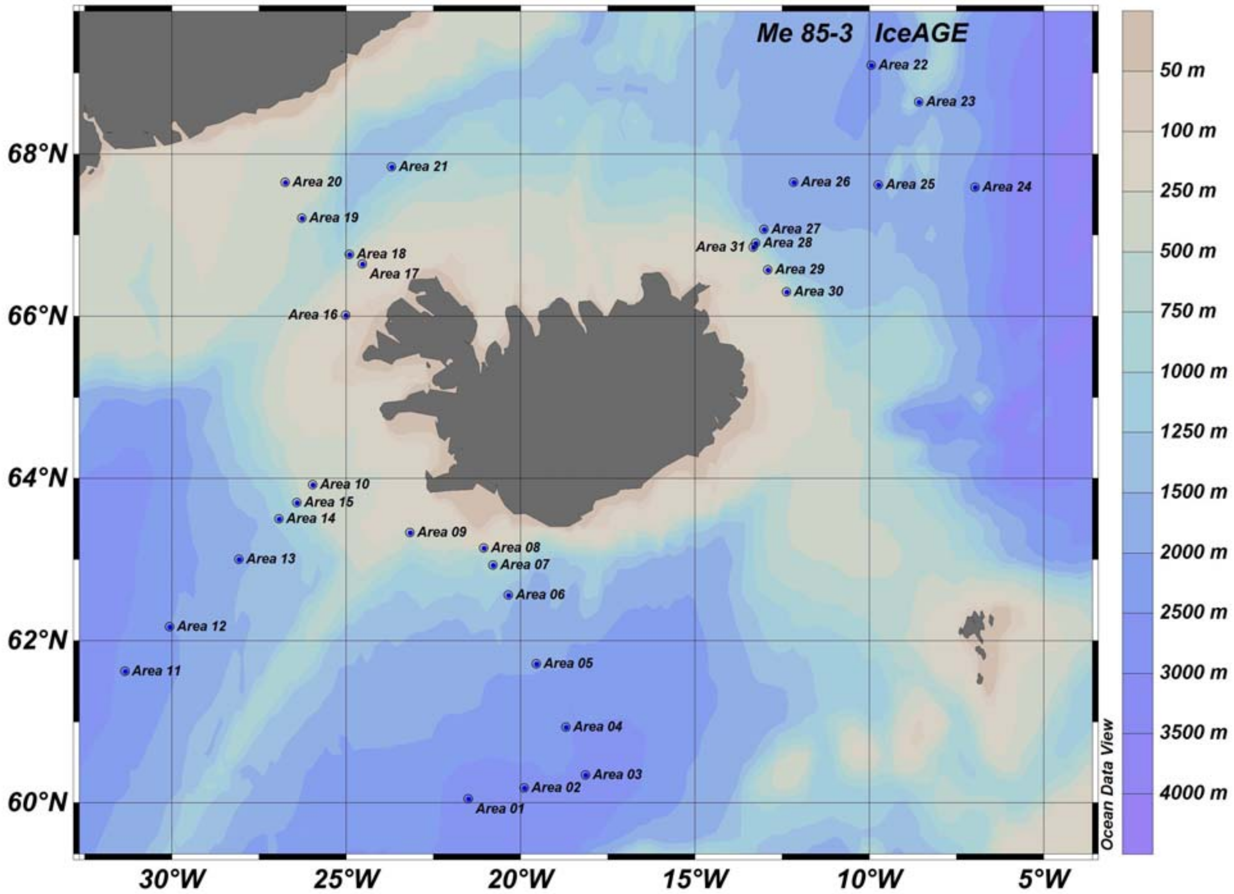


Fig. 1 Track chart of R/V METEOR Cruise M85/3.

Prior to each station PARASOUND and MULTIBEAM (EM 122/710) gave information about the sampling area in a circle of 2–5 sm to pick the best location for the station coordinates (compare chapter 7). At each working area the following gears were deployed: CTD, Multicorer (MUC), a grab (boxcorer: GKG, Van Veen: VV or Shipek grab: SG) and two trawled gears (epibenthic sledge: EBS, Agassiz Trawl: AGT or Triangle Dredge: TAD). If possible in the timeframe, station work replicates were taken. Which type of gear was deployed depended on the conditions we found in the substrate (sediment type, rocks, depth etc.).

The ADCP was switched on when leaving the 12 nm zone and switched off – as well as PARASOUND and MULTIBEAM – entering the 12 nm zone when weather conditions or short ways in between stations made it necessary. The ADCP data were taken on request by the previous leg (M85/2), chief scientist Johannes Karstensen, who will be responsible for the data processing.

The sorting of the samples started on board. Due to the huge amount of material, subsamples were taken from each station for the sorting process on board. The complete sample amount will be sorted in the home laboratories of the DZMB (HH and WHV) in Germany and the UIRCS-TNC in Iceland. All samples and sorted animals will be available in a project database (see chapter 8). For as many specimens as possible we prepared DNA extractions on board. Frozen material was stored in -20, -80 °C or liquid nitrogen. Single specimens were kept alive in tanks for further research to allow taxonomic description of the living animal (see chapter 5.7). The last station work ended on September 23rd, switching off logging of EM122/710 and ADCP on the way to Cuxhaven upon leaving the Icelandic economic zone. On Wednesday morning, Sept. 28th RV METEOR reached Cuxhaven on schedule and was moored alongside the pier at 8:30 o´clock.

5 Preliminary Results

5.1 MULTIBEAM and PARASOUND

(P. Martinez & S. Brix)

The EM 122 logging was switched on during M85/2 when the ship reached 60° north. During M85/3 the logging was switched on reaching the first working area in the Iceland Basin on the 29th August 2011. PARASOUND and MULTIBEAM were used to explore the seafloor in each working area. This allowed us to observe "safe" areas for the deployment of trawled gear, avoiding high depth ranges within the trawling distance or iceberg scars close to the Greenland coast. In between working areas the logging was switched off. Depending on the depth of each working area, EM122 or EM710 was used. The data were viewed during the last days of expedition and put into a readable format for further processing at the home laboratory at the DZMB WHV. In total, we explored 32 working areas and mapped the seafloor previous the deployment of the benthic gear. All 38 MULTIBEAM and PARASOUND stations (MB-PS) are listed in the station list (chapter 7).

5.2 Physical Oceanography

(Schnurr, S., Huettmann, F. & P. Martinez)

Parallel to the sampling of the marine fauna, the abiotic parameters of each station were measured with a CTD and linked with already existing oceanographic data from the sampling area. During M85/3 the RV METEOR CTD system was used for the measurement of conductivity, temperature, density and oxygen data. The following sensors were used for measurements: two temperature sensors (S/N 5272 and S/N 5288), two conductivity sensors (S/N 3732 and S/N 3734), one oxygen sensor (S/N 1812), one fluorometer (S/N 1713), one altimeter (S/N 49762) and one TSG (S/N 0065). Conductivity temperature depth profiles were run from the ocean surface to a depth of 10 m above sea floor. During M85/3 no problems occurred during the deployment of the CTD. For our purposes sea floor measurement of near sea floor conditions received a special emphasis.

The CTD was deployed 31 times during M85/3 (Figure 2). A total of 6 stations was measured in the Irminger Basin, 6 stations in the Denmark Strait, 9 stations in the Iceland Basin, as well as 6 in the Norwegian Basin and 4 stations in the Norwegian Sea. The determination of water masses and the evaluation of CTD measurements will be done back in Germany.

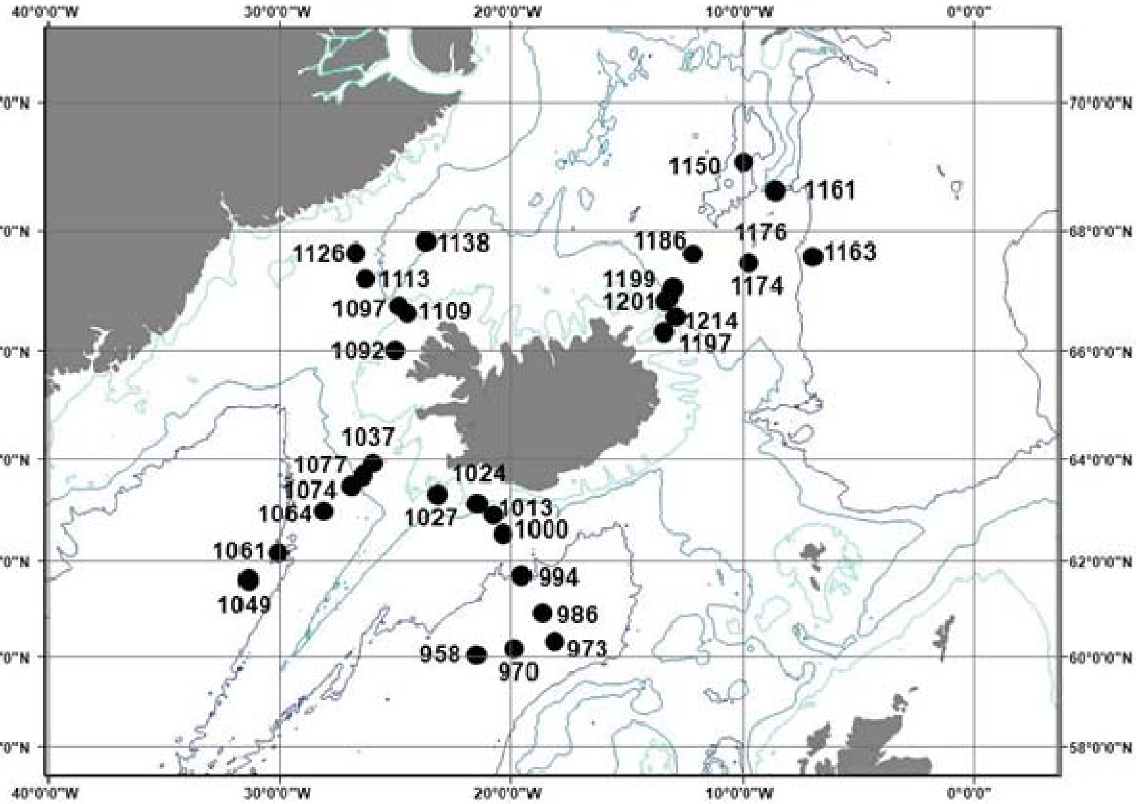


Fig. 2 CTD was deployed 31 times during M85/3.

5.3 Meiofauna communities around Icelandic waters

(Ostmann, A. Kohdami, S., Schnurr, S., Bauernfeid, W., Yasuhara, M. & P. Martinez)

We used a multiple-corer armed with 12 corers with an inner diameter of 9.4 cm (69.4 cm²) to take the sediment samples. If not otherwise stated, the gear was operated with 1 m/s rope speed until 100m over ground. The rope speed was then lowered to 0.4 m/s without stopping the gear until bottom contact. Bottom contact was recognized as an abrupt decrease in rope tension at the tension-recorder.

An additional 4 meters of rope were lowered and the gear remained at the bottom for 3–5 minutes to allow slow penetration of the corers into the sediments. The gear was heaved first with 0.4 m/s, and after leaving the bottom the speed was increased to 1 m/s.

The multicorer was deployed at 38 stations (Figure 3). At 11 shallow water stations (117–742m) corers did not penetrate into the sediment resulting in no samples or qualitative samples only (Figure 3 dark station numbers). The main reason was the hard volcanic sands present at these sites. At three deep deployments (stations 995, 997,1001; 1392–1918m) the gear did not retrieve samples because of sea roughness together with bottom currents. At these stations the gear was lowered with 0.8 m/s until bottom contact. We interpret that this high speed provokes too heavy an impact with the bottom resulting in a spontaneous closing of the corers before the corers actually penetrate the sediments. In total 276 corers were retrieved for meiofauna and DNA studies and 24 for abiotic parameters. Table 1 provides an overview of the number of corers used at each station for each treatment.

1. Metazoan meiofauna communities. The scope of this treatment is to study the abundance of metazoan meiofaunal organisms and the diversity of the meiofaunal communities in bottom sediments. For this the top 5 cm of sediment were sliced altogether and fixed in buffered formalin at a final concentration of about 5%. Top water was filtered through a 40 µm sieve and the contents of the sieve fixed together with the sediment. This fixation allows for the study of nematodes and copepods and other less abundant meiofaunal groups, but is not recommended for preservation of calcareous organisms like foraminifera and ostracods. Five corers of each deployment were dedicated to this treatment. The top 5 cm sediment of one of the corers was sliced in 1 cm profiles that were fixed separately in formalin.

Different focus of our research deserved different treatments of the sediment corers:

2. Molecular characterization of metazoan meiofaunal communities (Ethanol). The top 3 cm of 1 corer were fixed directly in 96% DNA grade ethanol. After fixation the sample was stored at -22°C. One day after fixation the first ethanol was exchanged for new ethanol. Samples were kept at -22°C during whole time.

3. Molecular characterization of metazoan meiofaunal communities (DESS). The top 3 cm of 1 corer were fixed in DESS – a solution containing dimethyl sulphoxide (DMSO), disodium EDTA and saturated with NaCl – and kept at room temperature. One day after fixation the DESS solution was exchange for a new one. Samples were kept at room temperature. DESS fixative is highly recommended for morphologic and genetic studies of nematodes and copepods, but dissolves the calcareous shells of ostracods and foraminifera.

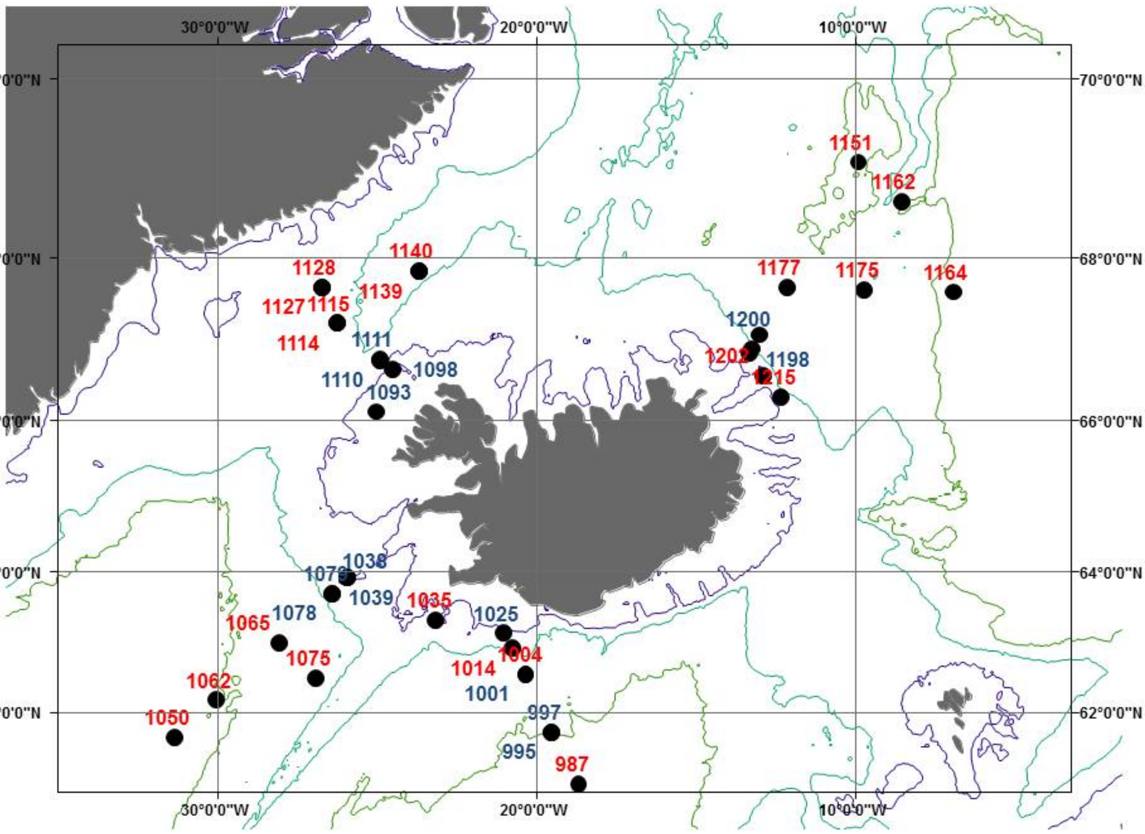


Fig. 3 Map of multicorer sites (red: successful deployments, blue: no sampling success)

Table 1 Treatment of cores

St.	Formalin	Ethanol	DESS	##	aDNA	Ostracods	Abiotics	Depth (m)	Remarks
959	5	1	1	1	2	1	1	2749	
971	5	1	1	1	2	1	1	2670	
974	5	1	1	1	2	1	1	2563	
987	5	1	1	1	2	1	1	2493	
995	0	0	0	0	0	0	0	1918	empty corers
997	0	0	0	0	0	0	0	1915	empty corers
1001	0	0	0	0	0	0	0	1393	
1004	5	1	1	1	2	1	1	1392	
1014	5	1	1	1	2	1	1	911	
1025	0	0	0	0	0	0	0	271	
1035	5	1	1	1	2	1	1	307	
1038	2	2	0	0	0	0	0	215	qualitative samples
1039	5	1	0	0	0	1	0	214	qualitative samples, core 1 in plastic bag
1050	5	1	1	1	2	1	1	2548	
1062	5	1	1	1	2	1	1	1928	
1065	5	1	1	1	2	1	1	1619	
1075	5	1	1	1	2	1	1	1175	
1078	0	0	0	0	0	0	0	742	empty corers
1079	0	0	0	0	0	0	0	742	empty corers
1093	3	1	0	0	0	0	0	117	1 jar with qualitative sample from mixed cores in formalin
1098	0	0	0	0	0	0	0	120	
1110	0	0	0	0	0	0	0	569	mixed samples with ethanol fixation
1111	0	0	0	0	0	0	0	555	
1114	5	1	1	1	2	1	1	684	
1115	5	1	1	1	2	1	1	684	
1127	3	1	1	1	2	1	1	320	corers 1 and 9 were broken
1128	5	1	1	1	2	1	1	320	
1139	5	1	1	1	2	1	1	1238	brittle stars from surface into ethanol
1140	5	1	1	1	2	1	1	1241	brittle stars from surface into ethanol
1151	5	1	1	1	2	1	1	2210	
1162	5	1	1	1	2	1	1	1962	
1164	5	1	1	1	1	1	1	2403	corer 6 was empty
1175	5	1	1	1	2	1	1	1711	
1177	5	1	1	1	2	1	1	1820	
1187	5	1	1	1	2	1	1	1581	
1198	0	0	0	0	0	0	0	283	mixed ethanol sample for qualitative analysis
1200	0	0	0	0	0	0	0	701	mixed ethanol sample for qualitative analysis
1215	5	1	1	1	2	1	1	733	
Sum	128	28	24	24	47	25	24		

4. Environmental genomics of marine sediments. The top 3.6 cm of 1 corer were sliced in three profiles using a petri dish (1.2 cm high). To avoid contamination with DNA fragments, gloves were used and petri dishes and any instruments used were cleaned with a 4% NaOH solution (domestic bleaching solution Domol). Samples were then frozen at -22°C and kept frozen. These samples will be used to extract and amplify DNA fragments from metazoan and protozoan meiofauna from the sediments directly using commercial Soil DNA Extraction Kits. Amplicons will be sequenced using next generation mass sequencing technologies (454 and Illumina).

5. Ancient DNA in marine sediments. Two corers were left untouched (only some 10 cm of top water was removed) and frozen directly after collection at -22°C. These corers will be used to extract ancient DNA from deeper sediment layers covering the post-glacial period.

6. Biodiversity of microfossils in post-glacial period. One corer was totally sliced in 1 cm profiles. The number of slices was dependent on the total length of the corer. Samples were frozen at -20°C. These samples will be used to study microfossils of ostracodes, foraminifera and diatoms. Analysis of tephra will be used to date the age of sediment layers by correlating with known volcanic eruptions.

7. Abiotic parameters. The top 5 cm of 1 corer were sliced in 1 cm profiles for later characterization of granulometry, water content, C/N content and ratio, pigments analysis (chlorophyl, phaeopigments).

The objective of our group is to document the communities of small size class organisms (40µm – 1mm) inhabiting sediments around Iceland at different water depths. Ostracods will be a target group for recent and past (microfossil) biodiversity comparisons. A DNA-Bank of meiofauna organisms will be built for some genes (COI, 18S) and this will allow us to study gene flow of organisms within the area and to make statements about the isolation and range of distribution of benthic species. We aim to genetically characterize some 500 meiofaunal species. Key questions that we want to address with our studies involve:

- How do abundance, standing stocks and diversity of meiofaunal organisms change along depth gradients around Iceland?
- How do these parameters correlate with different environmental conditions at different water masses north, south and west of Iceland?
- Do the communities north, south and west of Iceland belong to different biogeographic groups?
- Are there any barriers to the distribution of meiobenthic species, for instance the Greenland Current or the Reykjanes Ridge?
- How do widely distributed morpho-species differ genetically around Iceland?
- What can microfossils (ostracods, foraminifera) tell us about biodiversity changes of meiofauna during the post-glacial time?
- How does recent ostracode diversity correlate with recent meiofaunal diversity (can ostracod shells be used as a proxy)?

In addition we want to study how well and for how long DNA fragments can be preserved marine sediments at different environmental conditions (temperature, depth, oxygen, etc.).

5.4 Makrofauna (Infauna, Epifauna)

(Svavarsson, J., Meißner, K., Hoffmann, S. Díaz Agras, G., Fiege, D., Fiorentino, D., Murray, A., Riehl, T., Brenke, N., Jennings, R., Mikkelsen, N., Blazewicz, M. Haraldsdóttir, Sigrun & S. Brix)

The aim was to collect samples for studies on the composition and diversity of macrobenthic fauna of the Icelandic shelf and adjacent deep waters. Moreover, material for studies on the taxonomy, genetics, morphology, and histology of different taxa was obtained.

5.4.1 Infauna

Endobenthic macrofauna was sampled in the Iceland Basin, along the Reykjanes Ridge, in the Irminger Basin, along the Denmark Strait, at the East Greenland shelf and in the Norwegian Sea. The water depth at the different stations was between 116 m and 2750 m. The gear used for collection included the boxcorer (GKG), the Van Veen grab (VV) and the Shipek grab (SG). The GKG was a 0.25 m^2 USNEL box corer. Since it is the most suitable of available samplers to obtain quantitative samples it was the most frequently used gear. Altogether it was deployed 39 times (figure 4) of which it failed only two times. When rough sediment or stones were expected to be present in shallower waters of the study area, either the VV or SG was deployed. For the VV only one out of 5 deployments was successful. The SG is a powerful grab of small size (A=400 cm^2). It is suitable for rough sea bottom with stones or rock. This type of grab was successfully deployed 9 times.

Usually two samples were taken in each area. The upper 5–30 cm (depending on how deep the fauna penetrated the sediment) of the sediment from the box corer samples were sieved through stacked 1 mm, 0.5 mm and 0.3 mm screens and preserved either in 4 % formalin or in 96% ethanol. Samples taken by means of both the VV and SG were sieved in total and processed as described for the box corer samples. Where stones were found in the samples they were either preserved whole, or the associated fauna was removed from the surface. Sorting, weighing and taxonomic analysis of samples will be undertaken in the home laboratories.

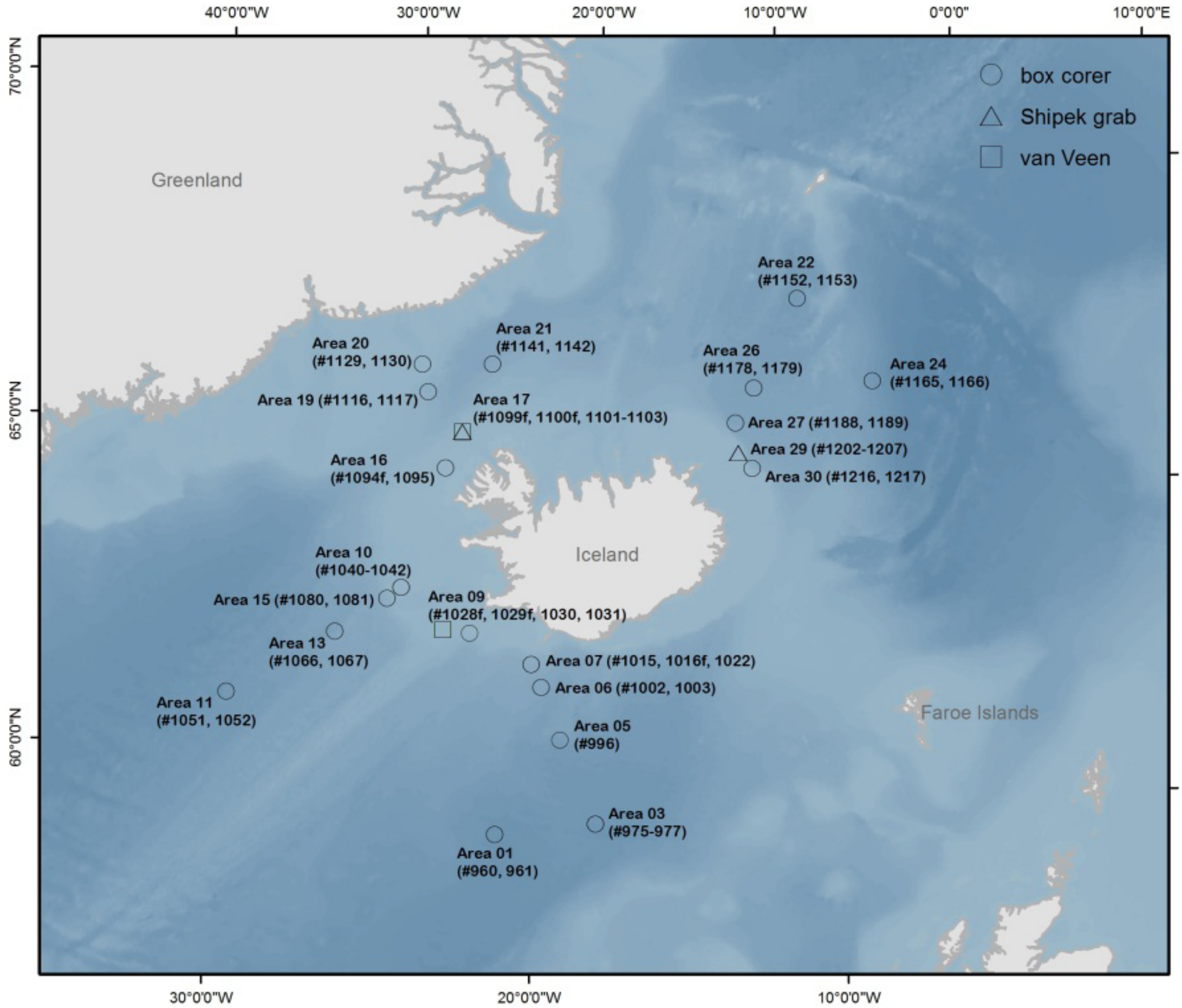


Fig. 4 Areas with grab deployments indicating which grab was used with station numbers.

A sediment sample for granulometric examination and measurements of the organic contents was obtained for infauna samples from each area, except areas 5, 9, and 29. In addition, photos of the sample were taken before sieving (see figure 5). The sediment at the different stations varied considerably. The sediment found can be described as follows: area 1–7 (Iceland Basin): mud, sandy mud, fine sand; area 9 (Reykjanes Ridge): black fine to medium sand; area 10–15 (Irminger Basin): dark brown fine sand; area 16, 17 (Denmark Strait): medium to coarse sand with stones and gravel; area 19–21 (east Greenland shelf): grey and brown mud with some stones, area 22–27 (Iceland Sea and Norwegian Sea): very fine sand; area 29, 30 (east off Iceland, GIF ridge): fine to medium sand with stones. Information on the hydrography was collected in each area where infauna sampling took place.

The deep-water boxcores taken off northeast Iceland had a very high density of numerous foraminiferan species, in particular the calcareous foraminifer *Pyrgo* sp. (probably *Pyrgo sarsi*) and the agglutinating foraminifer *Cribrostomoides subglobosum*/*C. wuellerstorfi*. Although foraminiferan species are generally considered to be part of the meiofauna, these are very large foraminifers. Both agglutinating foraminifers and calcareous ones are very important food for various macrofaunal species, for instance large isopods.

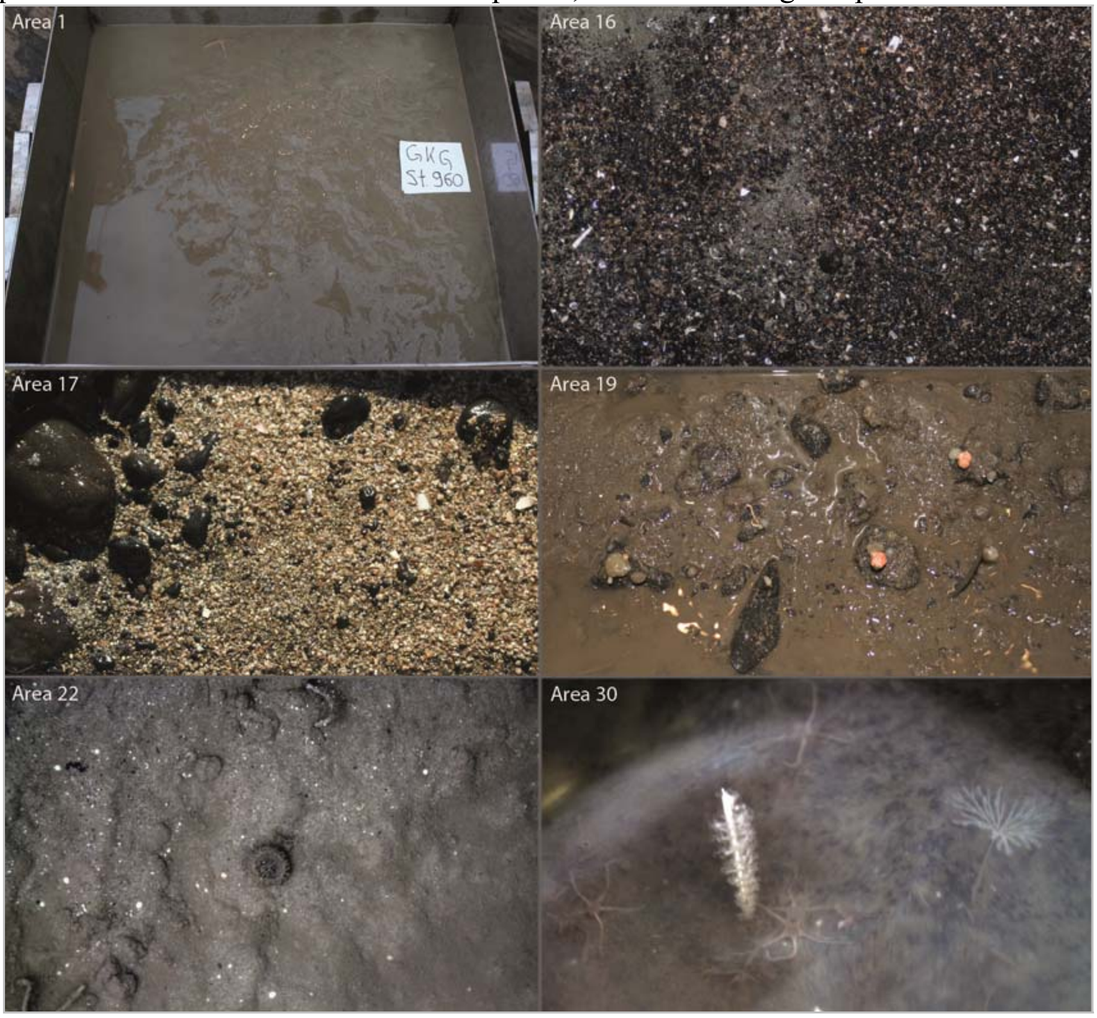


Fig. 5 Photos of different infauna samples taken prior sample processing on deck. ©Senckenberg am Meer/K. Meißner

5.4.2 Epifauna

Three types of epibenthic sledges were used (figure 6), i.e. the CliSAP sledge, the Brenke sledge (Brenke 2005) and the RP sledge (Rothlisberg-Pearcy sledge, Rothlisberg & Pearcy 1977). At every second area (full set of gear) two of the three types were deployed. The objective of deploying different types was to allow a later comparison of the efficiency of the sledges and subsequently, patterns of diversity, as the Brenke sledge has mainly been used in the deep sea of the Southern Ocean, the Pacific and the South Atlantic Ocean, while the RP has mainly been used in the Nordic Seas (Greenland, Iceland and Norwegian Seas). The CliSAP sledge is a modified Brenke sledge with two camera systems.

Table 2 EBS deployments during M85/3, indicating model, depth and time needed.

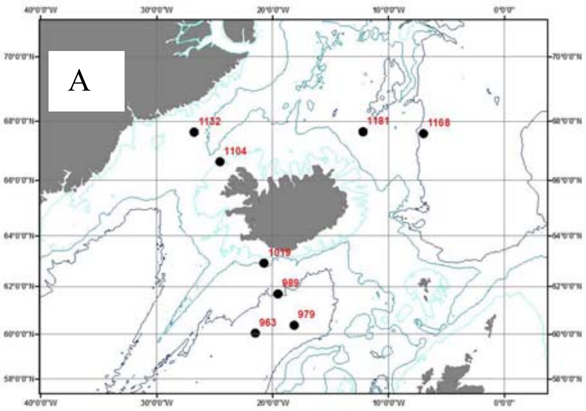
Area	station	~depth (m)	trawled distance (m)	Model/ no. of deployment	time on ground (min)	total time (min)
01	963	2744	2679	Brenke_01	98	251
01	967	2750	2462	RP_01	91	257
03	979	2572	2280	Brenke_02	85	230
03	983	2562	2102	RP_02	91	267
05	989	1916	1183	Brenke_03	58	148
06	1006	1386	1338	CliSAP_01	44	146
06	1010	1384	n.a.	RP_03	39	82
07	1017	909	733	RP_04	34	95
07	1019	906	974	Brenke_04	32	100
09	1032	300	273.5	CliSAP_02	19	41
09	1033	300	365.2	RP_05	22	41
10	1043	200	457.8	CliSAP_03	17	31
10	1045	200	381.5	RP_06	15	33
11	1054	2500	2434.6	CliSAP_04	90	235
11	1057	2500	1982.9	RP_07	75	231
13	1069	1600	1312.5	CliSAP_05	53	151
13	1072	1600	1672.5	RP_08	65	160
15	1082	750	730	CliSAP_06	33	74
15	1086	700	729	RP_09	34	74
16	1090	120	212.6	CliSAP_07	21	27
17	1104	120	152.6	Brenke_05	15	26
19	1119	705	762.13	CliSAP_08	35	77
19	1123	722	669.5	RP_10	32	80
20	1132	316	396.07	Brenke_06	23	45
20	1136	316	366.1	CliSAP_10	22	53
21	1144	1270	1339.9	RP	54	97
21	1148	1246.2	1850.8	CliSAP_11	71	87
22	1155	2176	1581.7	RP_11	62	203
22	1159	2160.7	2041.2	CliSAP_12	77	204
24	1168	2385.3	2254.7	Brenke_07	84	210
24	1172	2455	2280.3	RP_12	85	229
26	1181	1827	1732.5	Brenke_08	67	172
26	1184	1813	1885	RP_13	72	179
27	1191	1580	1795.13	RP_14	69	151
27	1194	1579	1795.13	CliSAP_13	69	151
29	1209	315	304.3	RP_15	19	42
29	1212	314	547.8	CliSAP_14	30	55
30	1219	609	760.4	RP_16	30	70
30	1222	631	542.5	CliSAP_15	25	62

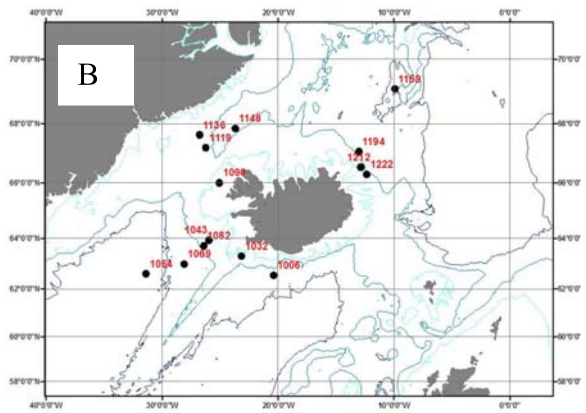
The CliSAP sledge was deployed 14 times, the Brenke sledge 9 times and the RP 16 times (Table 2). All deployments were successful and the sledges provided rich samples, allowing extensive material to be used for genetic analysis and forming a solid basis for modeling distribution of the benthic fauna.

The sampling grid allows a detailed study of the macrofauna in various water masses around Iceland, an area which is among the most special in the world in terms of diversity of water masses. From all 39 EBS deployments (Table 2) specimens were examined and identified on board the vessel. Some of these are common in shallow waters, e.g. the deep-water shrimp *Pandalus borealis* and the shrimps *Sclerocrangon borealis* and *S. ferox*. Most other species must be considered rare, or at least rarely sampled. Among these are many isopod and amphipod crustaceans (Arthropoda).

Determining and dissecting specimens for genetic analysis was a priority task on board. In total, 96 polychaete, 672 isopod and 288 tanaid specimens were prepared for DNA extraction. In case of the isopods, following families were selected: Desmosomatidae, Nannoniscidae, Arcthuridae, Ischnomesidae, Gnathiidae, Macrostylidae, Munnopsidae and Munnidae. One of the most interesting findings was five specimens of the single known species of *Katianira* in these waters. No material has hithero been available for genetic analysis of this rare family, the Katianiridae Svavarsson, 1987, until now.

Members of the family Munnopsidae were among the most common species in EBS samples, both in the areas south and north of the Greenland-Iceland-Faeroe Ridge. However, different species dominated in each area and the difference is probably to the very different environmental conditions north and south of the Ridge.





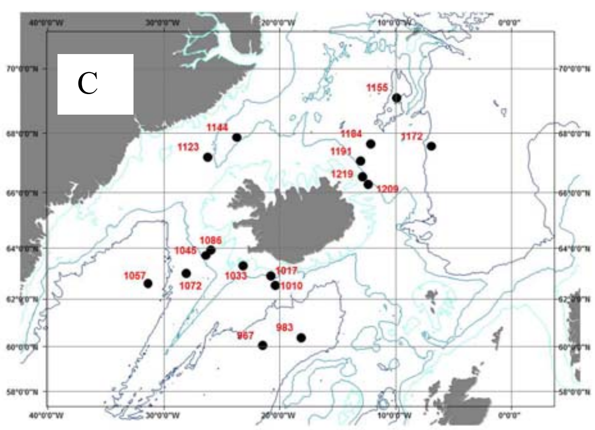


Fig. 6 Map of EBS stations.
A: Brenke sledge, B: CliSAP sledge, C: RP sledge

Among the most common munnopsid species (Isopoda, Munnopsidae) south of the Ridge were *Eurycope producta* and *E. cornuta*, which were replaced by closely related species to the north of the Ridge, i.e. *E. dahli* and *E. hanseni*.

Tanaid crustaceans were represented in every sample. We estimate that at least one third of the known Icelandic fauna was collected during M85/3. Numerous specimens were placed in ethanol for genetic analysis and prepared for DNA extraction. In addition, several specimens were collected of species most probably new to science.

Polychaetes were present in all EBS samples. Altogether, 47 supraspecific taxa of polychaetes have been be identified so far. Among the most common ones were Polynoidae, Spionidae, Ampharetidae, Flabelligeridae, Lumbrineridae, Sabellidae, Paraonidae and Syllidae.

Bivalve collections contained 652 specimens picked from the subsamples sorted on board. The most commonly collected protobranchs were in the genus *Yoldiella,* followed by the genus *Malletia.* For non-protobranchs, common specimens included *Astarte* spp.*, Thyasira* spp.*,* cardiids (possibly *Parvicardium* spp.), and pectinids.

Other conspicuous species sampled were numerous specimens of the deepwater holothurians *Kolga hyalina* and *Elpidia glacialis*, which appear to be very common in deep Arctic waters. These are probably a very important faunal element in deep, Arctic waters, though their ecology is very poorly known.

5.5 Megafauna

(Holst, S., Neumann, H., Kocot, K., Cannon, J., Lucas Rodríguez, Y.)

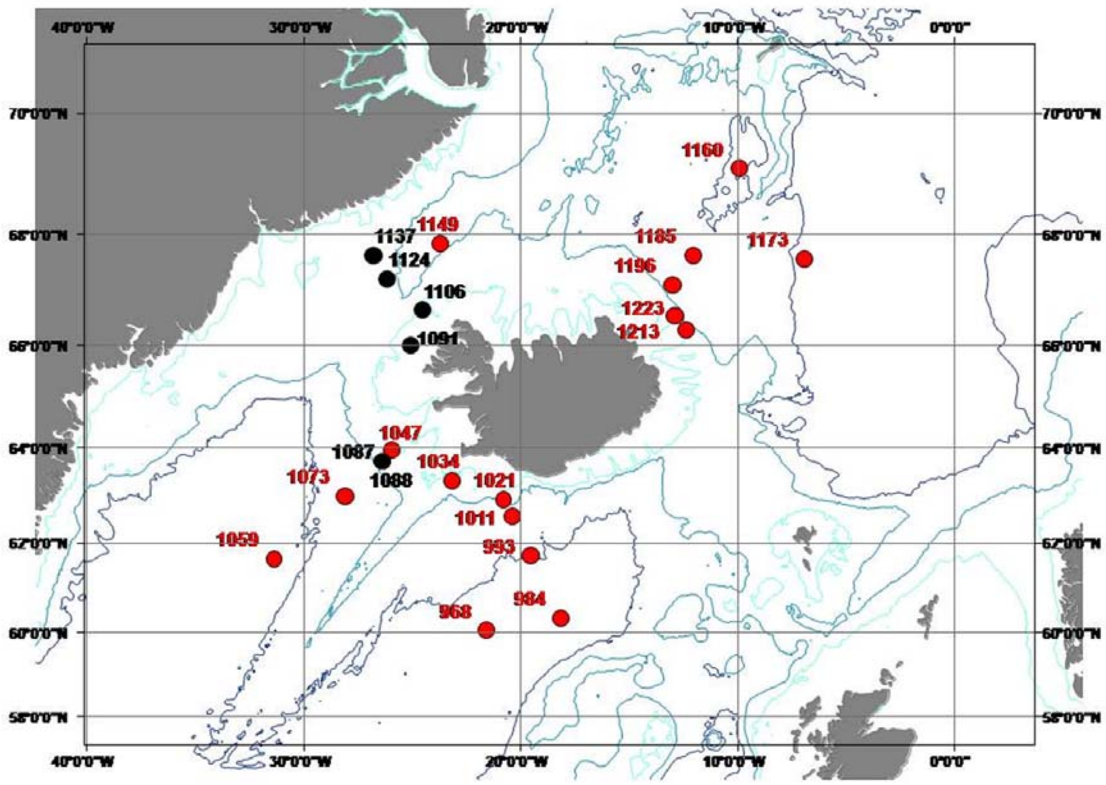


Fig. 7 AGT (red) and TAD (black) station map.

Two different gears were used for sampling of megafauna. The larger Agassiz trawl (3.5 m in width) was used at 16 stations at depths of 209 to 2732 m (Figure 7, Table 3). It was trawled for 5 to 15 minutes at 2 kn ship speed. The nets of the Agassiz trawl were damaged by large stones at 6 stations (1034, 1047, 1059 1073, 1149, 1213). The smaller triangle dredge (0.75 m in width) was used at 6 stations at depths of 117 to 686 m (Figure 7, Table 4). At stations 1087 and 1088 the triangle dredge was trawled at low ship speeds of 0.2 to 0.3 kn resulting in a very small catch (Figures 8 and 9). It was trawled at 1.6 kn ship speed for 3 to 10 minutes at the following stations. The net was useful at stations with rocky bottoms (stations 1091 and 1106) where it was not damaged by the catch of large stones. However, it was less effective at muddy bottoms (stations 1124 and 1137). A selection of megafauna found at different AGT and TAD stations is shown in figure 10.

The total catch or a subsample was sieved into two fractions. The larger 7100 µm fraction was sorted into taxonomic groups immediately after sieving. Most individuals were fixed in 96% non-denatured ethanol, or in a 4% formalin-seawater solution. From large Osteichthyes,

Echinodermata, Crustacea, and Cnidaria a tissue subsample was taken and fixed in 96% ethanol before the rest of the organism was frozen at -20°C or fixed in 4% formalin. The smaller 1000 µm fraction or a subsample of this material was fixed, one half in 96% ethanol and the other half in 4% formalin for later sorting of the material.

The abundances of the sorted taxa at different stations are shown in figures 8 and 9. Only abundances of more than 10 animals were included in the results; colonial species and sponges, which were mostly found in pieces, were excluded. Biomasses larger than 1g were analysed and are shown in figure 2. Brachiopoda were found in very high abundance at station 1047, (figure 8a). Sponges appeared in high masses at several stations (figure 9a). Echinodermata were also high abundant at many stations (figure 8b).

Table 3 Agassiz trawl stations, distances and times

Station	Date (2011)	Time	Latitude (N)	Longitude (W)	Depth [m]	shipping distance [sm]	Shipping distance [m]	Total time [min]	Total time [h]	trawling distance [sm]	trawling distance [m]
968	29.08.	10:12	60° 2.73'	21° 34.61'	2732	3.55	6570.7	310.1	5.2	2.29	4233.7
984	31.08.	04:32	60° 19.57'	18° 8.95'	2572	3.24	5993.3	256.8	4.3	1.74	3218.0
993	01.09.	02:25	61° 41.83'	19° 31.92'	1926	2.57	4758.6	197.8	3.3	1.57	2906.0
1011	02.09.	22:50	62° 33.35'	20° 22.50'	1389	1.98	3662.8	146.1	2.4	1.16	2144.0
1021	03.09.	13:42	62° 55.88'	20° 46.66'	887	1.46	2708.8	100.3	1.7	0.76	1412.0
1034	04.09.	07:07	63° 19.48'	23° 9.83'	297	0.83	1540.8	53.25	0.9	0.63	1166
1047	06.09.	00:28	63° 56.07'	25° 56.53'	209	0.73	1354.3	36.9	0.6	0.59	1100.0
1059	07.09.	16:17	61° 39.24'	31° 20.68'	2539	2.72	5041.6	240.3	4.0	1.58	2933.3
1073	09.09.	03:23	63° 0.04'	28° 4.83'	1614	1.98	3668.0	152.1	2.5	1.04	1928.0
1149	15.09.	15:52	67° 50.57'	23° 41.85'	1246	1.4	2508.9	46.7	0.8	0.2	308.7
1160	17.09.	19:16	69° 6.18'	9° 55.35'	2169	1.4	2508.9	111.7	1.9	0.6	1040.7
1173	19.09.	14:22	67° 34.01'	6° 54.31'	2465.9	2.5	4588.8	214.0	3.6	1.1	2087.3
1185	20.09.	22:01	67° 37.39'	12° 4.06'	1780.5	2.1	3921.4	167.5	2.8	1.0	1859.3
1196	21.09.	17:50	67° 5.79'	13° 0.42'	1611.6	1.8	3344.9	140.1	2.3	0.8	1427.3
1213	22.09.	07:57	66° 33.16'	12° 53.40'	318.2	0.5	857.1	37.4	0.6	0.3	476.7
1223	22.09.	18:10	66° 17.72'	12° 21.76'	662.6	0.9	1717.5	71.9	1.2	0.5	1007.3

Table 4 Triangle dredge stations, distances and times

Station	Date (2011)	Time	Longitude (N)	Latitude (W)	Depth [m]	Shipping distance [sm]	Shipping distance [m]	Total time [min]	Total time [h]	Trawling distance [sm]	Trawling distance [m]
1087	09.09.	23:49	63° 42.62'	26° 22.67'	686	0.02	27.8	54.0	0.9	0.02	27.8
1088	10.09.	01:01	63° 42.64'	26° 22.55'	683.5	0.04	64.8	65.4	1.1	0.04	64.8
1091	10.09.	19:42	66° 0.25'	25° 2.44'	117.5	0.22	405.7	82.0	1.4	0.19	359.2
1106	13.09.	13:48	66° 38.79'	24° 30.90'	117	0.18	326.3	20.8	0.3	0.10	185.2
1124	14.09.	07:07	67° 12.90'	26° 9.81'	737.5	0.67	1243.5	83.6	1.4	0.35	653.2
1137	14.09.	19:00	67° 37.78'	26° 46.81'	311.2	0.30	552.1	40.9	0.7	0.16	291.1

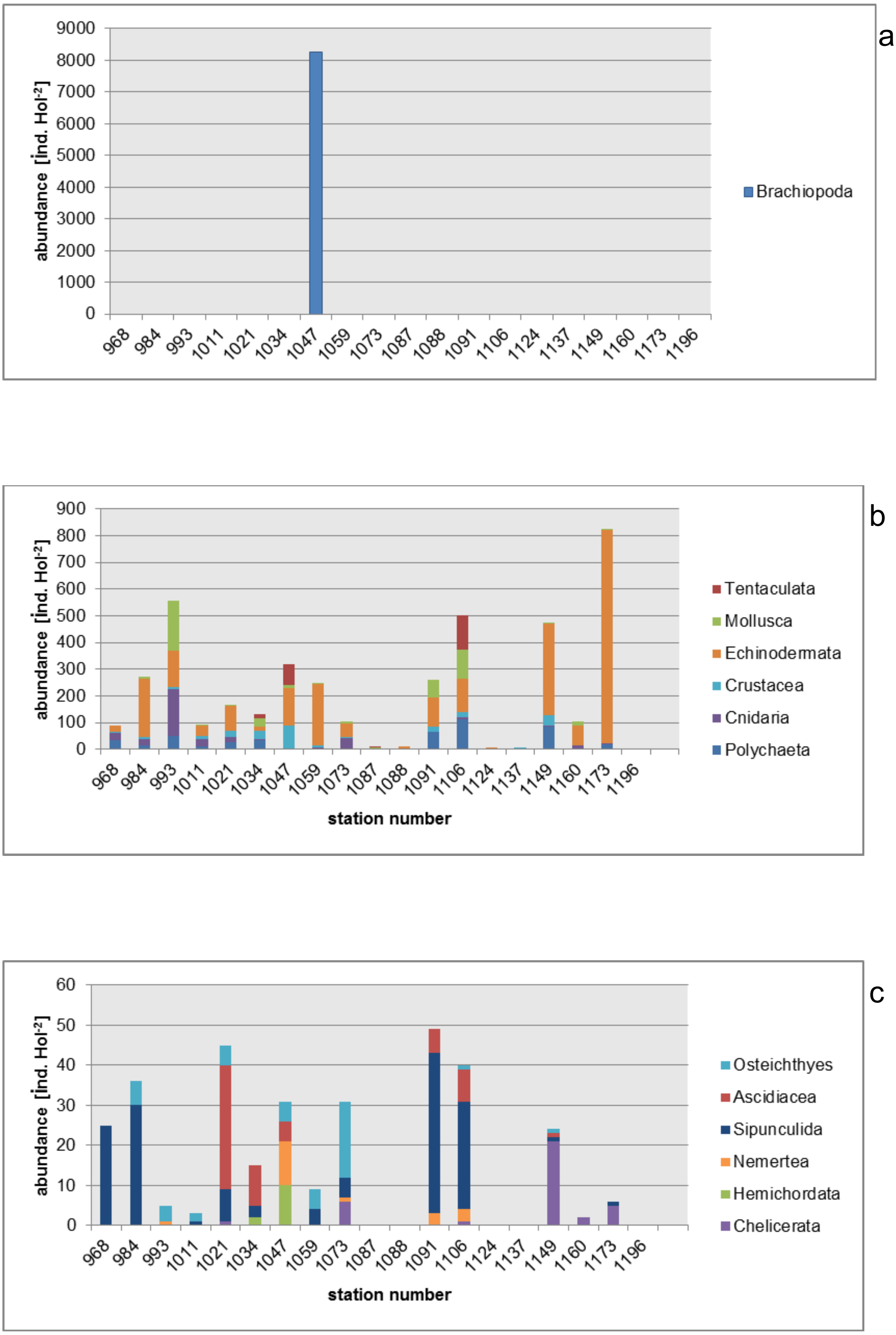
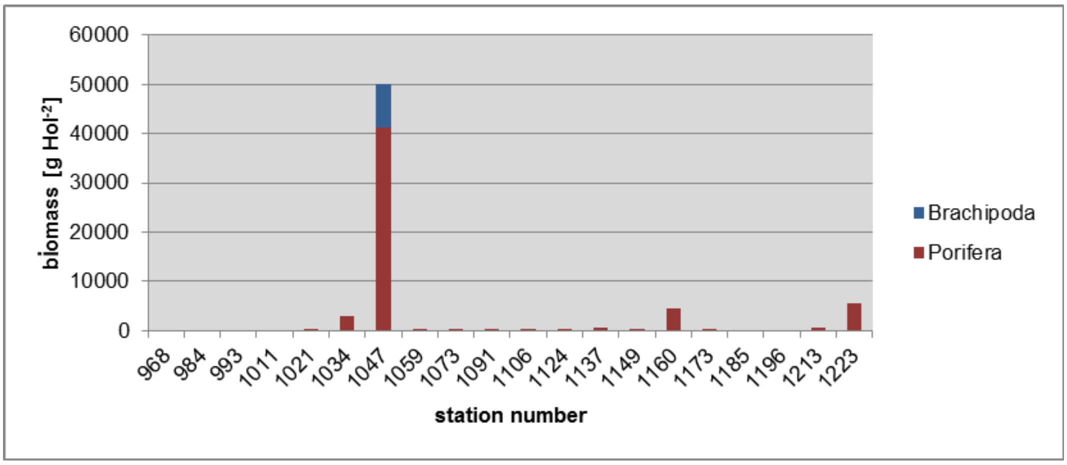
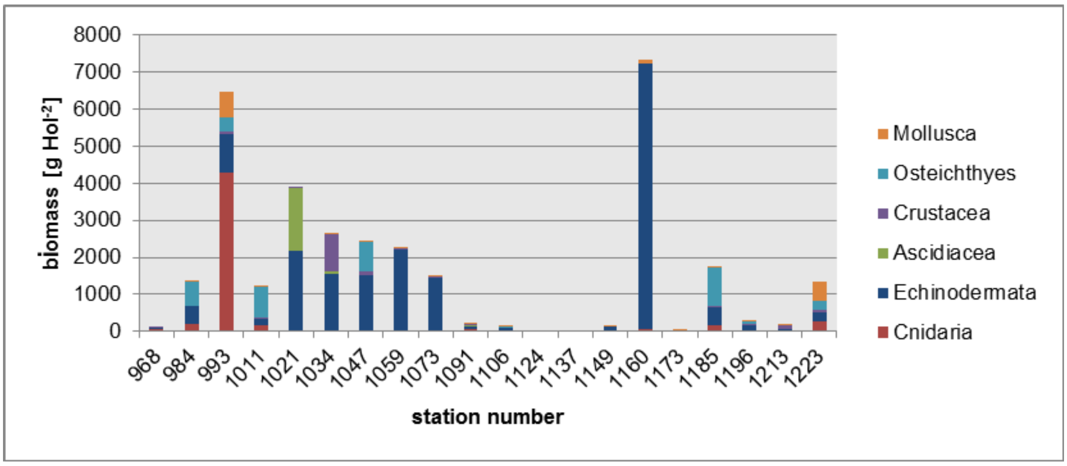


Fig. 8a-c Abundances of dominant megafauna taxa at different IceAGE stations.





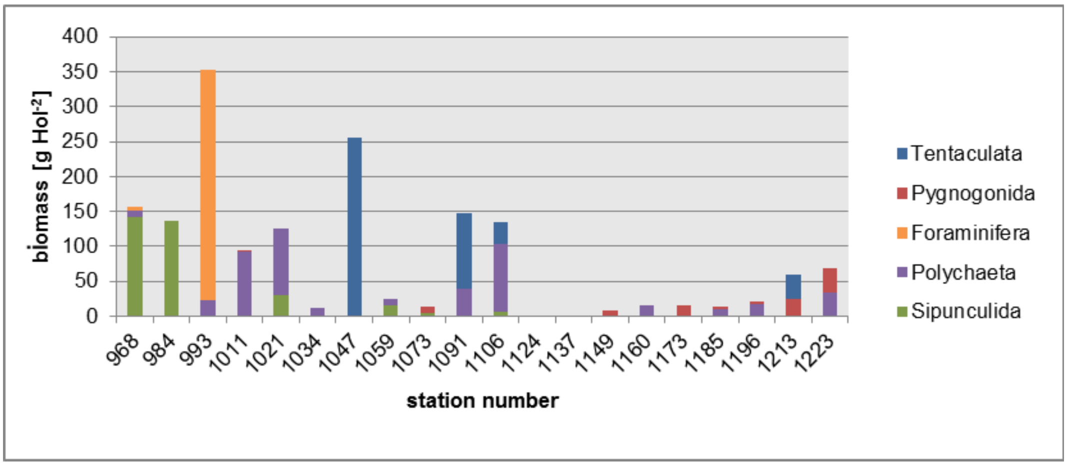


Fig. 9a-c Biomasses of dominant megafauna taxa at different IceAGE stations.

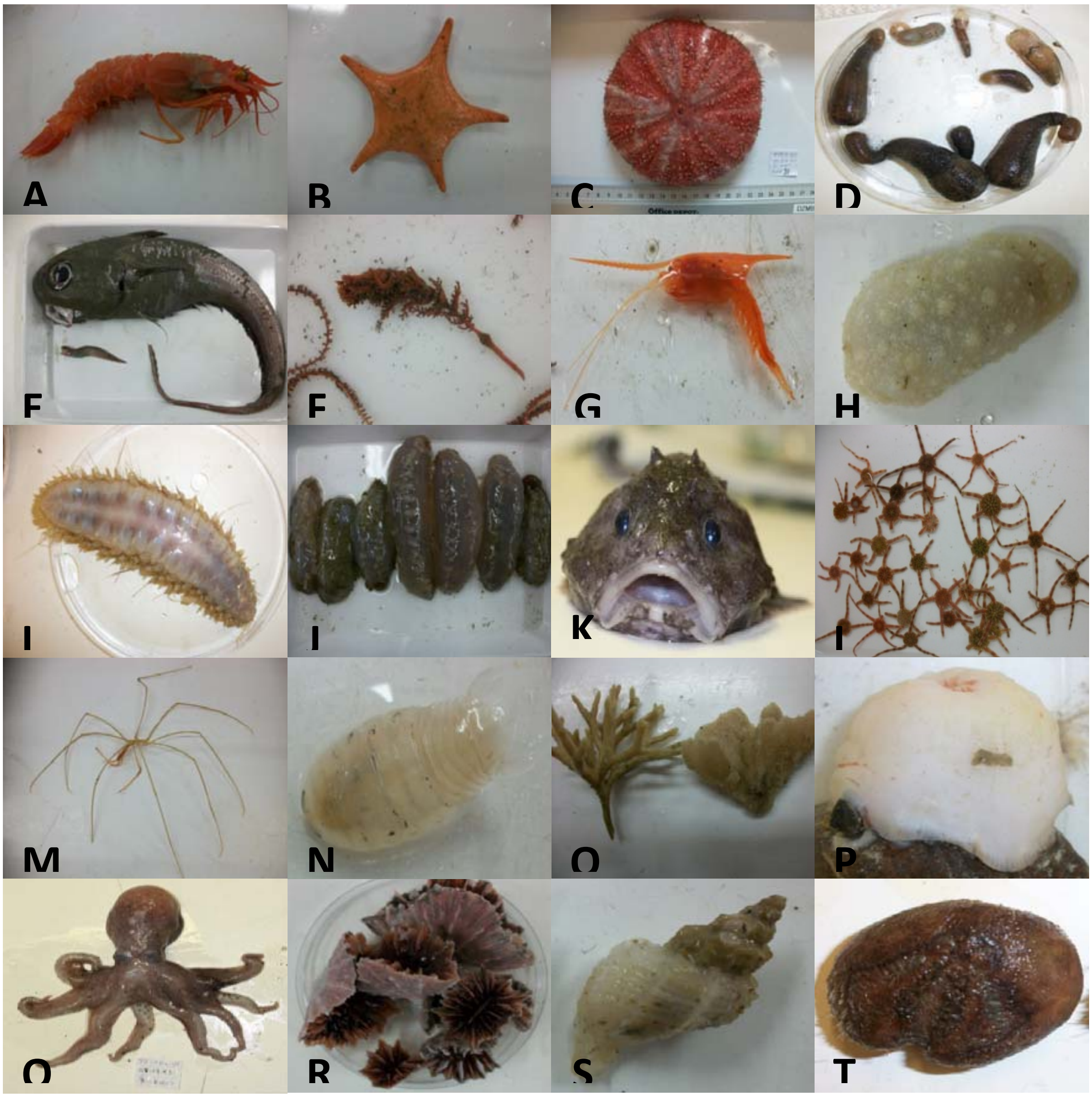


Fig. 10 Megafauna animals from Agassiz trawl (AGT) and triangle dredge (TAD) stations (st). **A** Crustacea AGT st 1073, **B** Asteroidea (Echinodermata) AGT st 993, **C** Echinoidea (Echinodermata) AGT st 1021, **D** Sipunculida AGT st 1021, **E** Lycodes sp. (Osteichythes) AGT st 1011, **F** Octocorallia (Cnidaria) AGT st 1011, **G** Crustacea AGT st 1011, **H** Nudibranchia (Mollusca) AGT st 1047, **I** Polychaeta AGT st 1011, **J** Holothurioidea (Echinodermata) AGT st 1047, **K** Osteichthyes AGT st 1223, **L** Ophiuroidea (Echinodermata) AGT st 1047, **M** Pycnogonida AGT st 1059, **N** Crustacea AGT st 1047, **O** Porifera TAD st 1091, **P** Actiniaria (Cnidaria) AGT st 1059, **Q**, Cephalopoda (Mollusca) AGT st 1223, **R** Cnidaria (Scleractinia) AGT st 1011, **S** Gastropoda (Mollusca) TAD st 1091, **T** Echinoidea (Echinodermata) AGT st 1011. ©Senckenberg am Meer/S. Holst

5.6 Plankton

(Ostmann, A., Borges, V. & R. Jennings)

The term plankton is used for organisms drifting in the water column. Zooplankton is represented mainly by calanoid copepods, chaetognaths, jellyfish, fish larvae, polychaete larvae and small crustaceans. The working group on “Molecular Taxonomy of Marine Organism” based at Senckenberg am Meer (DZMB WHV) is building a comprehensive gene library of the North Sea fauna. More than 200 species of planktonic organism have already been characterized genetically using the barcode gene COI and hypervariable regions of 18S. During this cruise we took opportunistic plankton samples. The aim is to provide material to increase the gene library of North Sea fauna with organisms living in nearby seas. Some plankton was sampled to feed the benthic animals that were kept alive on board.

The samples were taken with a plankton net (figure 11), consisting of a metal ring on which a 300 µm mesh sized net is fixed by a zipper. At the end of the 4 m long net there is a bucket, which is surrounded by a net of same mesh size. The surrounding net is also fixed to the net by a zipper.

The opening of the ring is 1 m, at the end the net has a diameter of 30 cm. Additionally there are ropes fixed on the outside to secure the net during bad conditions. The plankton net was deployed while the EBS was trawling at 1 kn speed over ground. A crane was used to set the net into the water until the whole net was just below the surface. One tow took about 15 minutes before the net was heaved back on deck. There, the sample was poured into two 10 liter buckets and sieved through a 50 µm mesh. With a squeeze bottle, the samples were washed into plastic vials with 96% DNA grade ethanol for fixation.

Fig. 11 Plankton net during deployment (picture: ©Senckenberg am Meer)

Back in Germany, the samples will be sorted under a dissecting microscope. Organisms will be identified and DNA will be extracted using standard protocols.

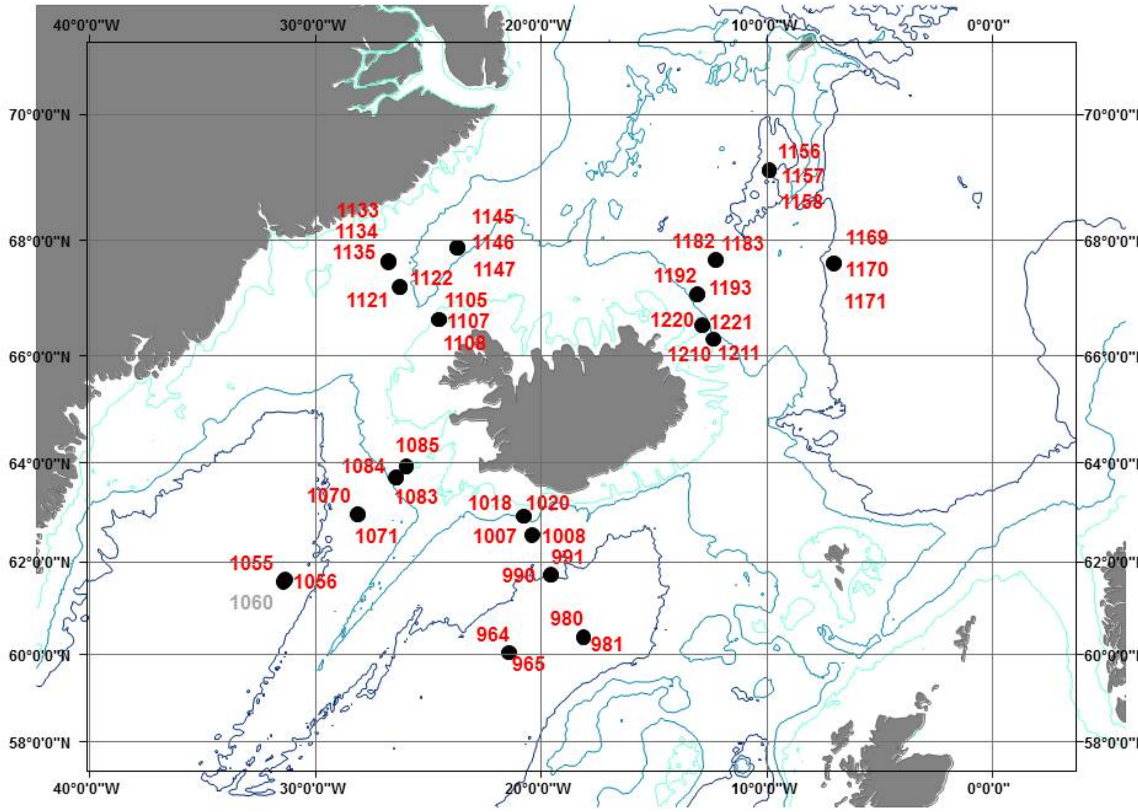


Fig. 12 A total of 47 samples were collected from 19 areas, positioned around Iceland.

5.7 Seabed Images and Videos

(N. Brenke)

Seafloor images were taken as a supplement to the deployment of the benthos gear. The pictures and videos provide a better understanding of the life at the ocean bottom by showing the live forms in their natural conditions. Additionally the information on the seafloor influenced the decision of deploying other towed gear in the working area, like the AGT versus the TAD. Video surface observation is useful to identify geomorphologic structures and the frequency of biological activities.

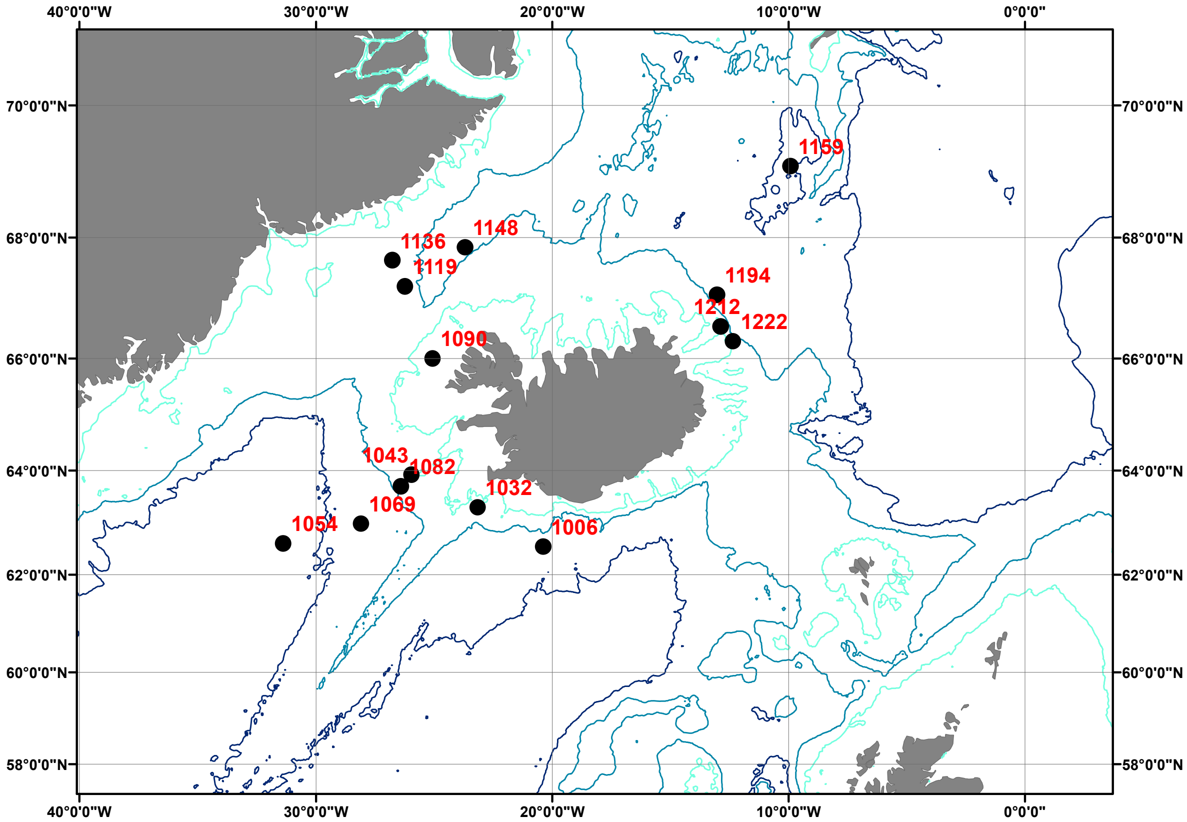


Fig. 13 Map of the CliSAP-Video-EBS deployments.

The "CliSAP-Sledge" (a modified EBS, compare Brenke, 2005) was used to document the sediment surface. The sledge was the carrier for a digital underwater video camcorder, a still camera and a control unit. All parts were installed in an additional frame on both sides of the sledge.

The Camcorder (Sony in pressure chamber Model: "OKTOPUS mari tech") was equipped with two 600 W spotlights. The still camera (KONGSBERG/Canon G5) was equipped with a standard flashlight. The still camera and the camcorder were activated by a control unit. The entire system was powered up using a deep sea battery that provides 24V with 2x14 Ah.

The underwater camcorder filmed to the left side (-30° of the towing direction), in a position 60–80 cm above the sediment surface, a trapezoid area of approximately 2x10m. The "HD" film was saved on an internal hard drive.

The still camera made photos to the right side (+30° of the towing direction), also in a position 60–80 cm above the sediment surface. The trapezoid area is of approximately 2x10m. The time interval between the pictures is 20 seconds. All pictures were saved on an internal memory card.

In total 2708 pictures (4600 MB) and 763 min (92 GB) of videos were taken. General results of the analysis of the video images are summarized in Table 5.

Table 5 Results of the analysis of the video and picture material of deployments of the Video-EBS (CliSAP). Green indicates successful operations (function of camera or camcorder as programmed). Red indicates malfunction of camera or camcorder.

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
area/ station	6# 1006	9# 1032	10# 1043	11# 1054	13# 1069	15# 1082	16# 1090	19# 1119	20# 1136	21# 1148	22# 1159	27# 1194	29# 1212	30# 1222
depth	1386	300	200	2500	1600	750	120	705	316	1246	2160	1579	314	540
run	15:26	04:52	22:35	05:13	19:57	20:08	18:31	03:07	17:05	11:57	13:26	13:15	06:24	16:17
start	16:06	04:54	22:37	06:38	20:29	20:43	18:33	03:27	17:17	12:57	14:36	14:05	06:25	16:25
Still Interval [sec]	20	20	20	20	20	20	20	20	20	20	20	20	20	20
pic #	255	30	105	476	0	128	111	59	117	288	457	363	156	163
MB	403	52	194	811	0	226	191	105	214	472	781	568	276	302
CC[h]	01:48	00:29	00:16	02:39	02:02	00:12	00:17	01:01	00:15			01:55	00:26	00:51
date name	2011 0902-160648	2011 0904-045425	2011 0904-223611	2011 0907-063245	2011 0908-202947	2011 0909-204400	2011 0910-183234	2011 0914-032700	2011 0914-172533	0	0	2011 0921-140402	2011 0922-062538	2011 0922-162838
CC[min]	108	29	16	159	124	12	18	61	16	0	0	115	26	52
GB	13.7	3.7	1.9	19	15.5	1.5	2.2	7.9	1.9	0	0	14.7	3.4	6.6
CC-pic	0	1	1	1	1	0	1	1	0	0	0	1	1	1
KB	0	2	2	2	2	0	3	3	0	0	0	3	3	3

A first analysis of the pictures and video material allowed an approximate specification of the sediment consistency and a simple characterization of the relative abundance of epifauna. The exact analysis of the images will be made in the laboratories of the DZMB, Senckenberg am Meer, Germany. It is planned that all pictures and videos will be placed on a server, to make the material available to all participants of the expedition.

It is important to note that the error rate is high due to the subjective nature of an analysis based on the interpretation of pictures and videos. Consequently, the different specialists should compare the material of the catches with the videos to identify the different animals without errors.

The visual perception of the sea bottom stimulates our thoughts about the processes at the sediment-water interface in a manner that corers, grabs and net catches cannot match. The technology of remote monitoring of the deep-sea floor allows us a better understanding of the complexity of sediment dynamics.

Fig. 14 The „Norwegian lobster“ (*Nephrops norvegicus*) is waiting for prey. (Soft sediments, 300 Meter, Reykjanes ridge). ©Senckenberg am Meer/N.Brenke

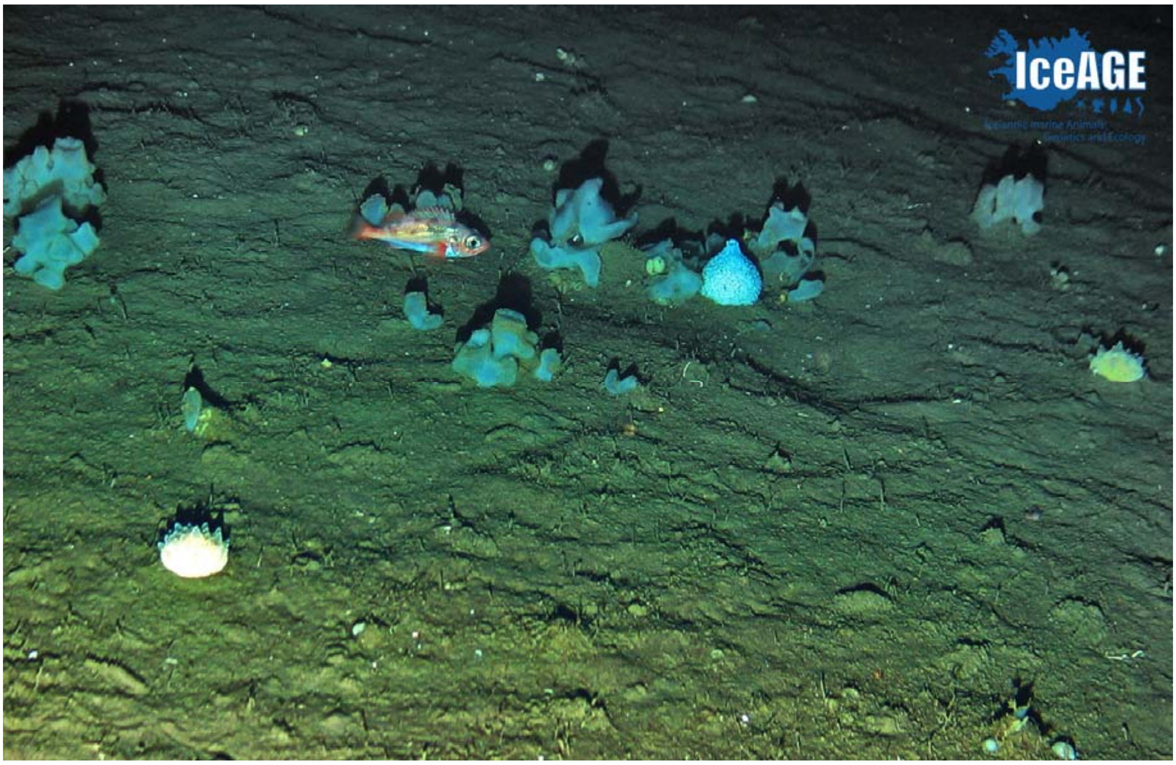


Fig. 15 *Sebastes marinus* is sheltering between sponges (soft sediments, 450 meter, Irminger Basin). ©Senckenberg am Meer/N.Brenke

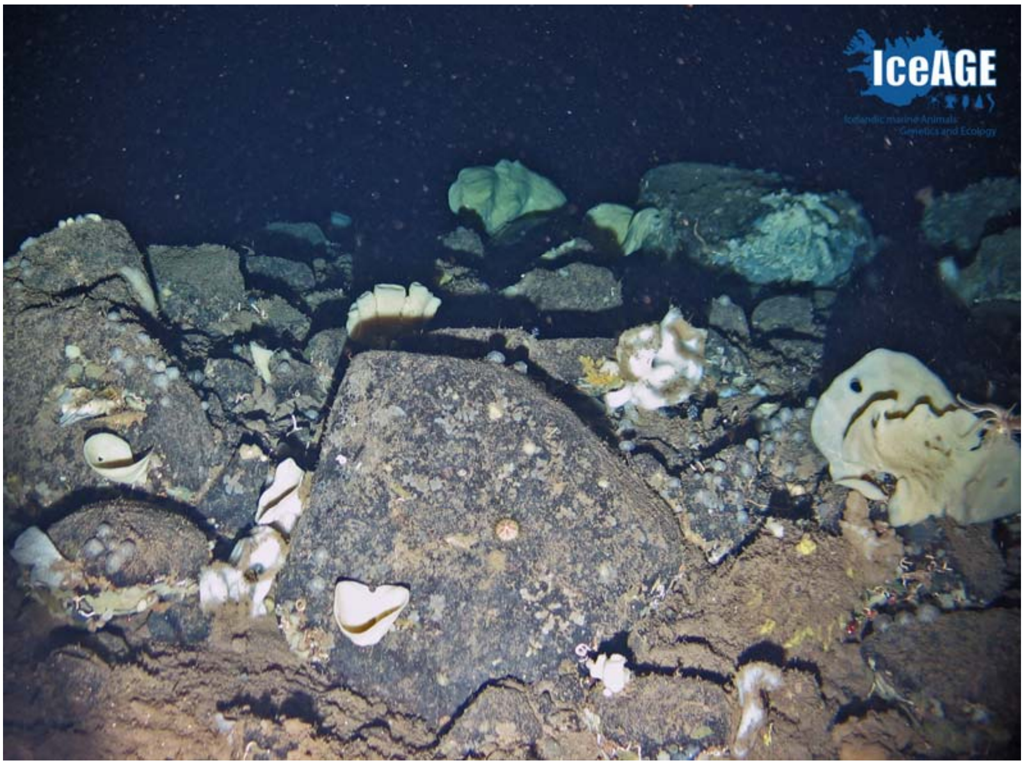


Fig. 16 Sponges, tunicates, sea urchins, crinoids and many more organisms inhabit rocks. These stones allow non-digging, sessile animals to colonize this habitat. Consequently the biodiversity at those stations is much higher than at stations without stones. (Hard substrates, 400 meter Denmark Strait). ©Senckenberg am Meer/N.Brenke

Fig. 17 *Umbellula encrinus* (Penatulacea, about 1,5 m height) is higher than the mud clouds produced by the videosledge (Sandy substrates, 1250 meter Denmark Strait). ©Senckenberg am Meer/N.Brenke

Fig. 18 Sea cucumbers (Holothuroidea) grazing on the deep sea seafloor. Consequently, the input and quantity of nutrients are presumably high in this type of sediment (Soft sediments, 2200 meter, Norwegian Basin) ©Senckenberg am Meer/N.Brenke

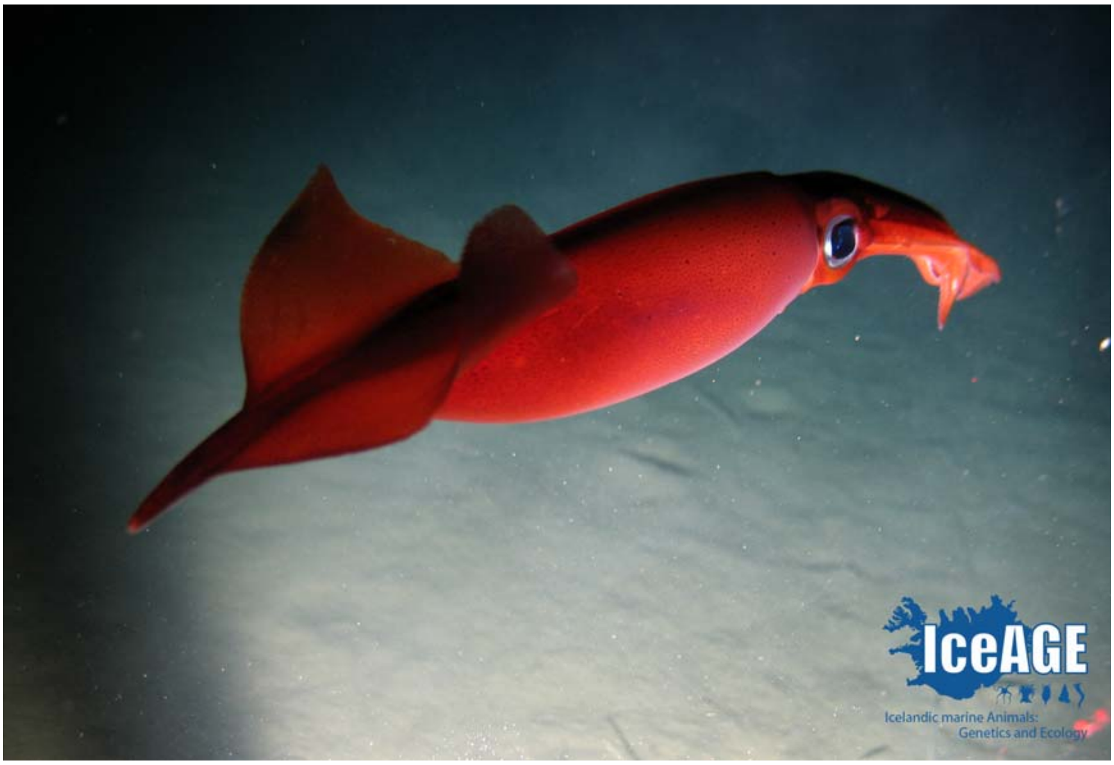


Fig. 19 A huge (app. 50 cm) Calmar (*Loligo* sp.) is swimming smoothly in the deep of the North Atlantic (1600 meter, Norwegian Basin). ©Senckenberg am Meer/N.Brenke

5.8 Photographic Documentation of Living Benthic Fauna

(T. Riehl)

During the IceAGE expedition animals were photographed alive for scientific purposes and public outreach. Important data can get lost when animals are fixed depending on the structure of the animals as well as the method of fixation and preservation. Photographic documentation of living animals can ‘preserve’ these data that include coloration as well as structural features. Most animal groups loose colours in fixation media such as ethanol.

Beyond the scientific documentation of the collected material, photographs showing living animals in natural behavior and coloration patterns serve a public outreach aspect. The Arctic and sub-Arctic marine environments may be less diverse than comparable tropical environments. The fauna of the cold North Atlantic consists of many species, though those are only found in these regions and are as well colorful and attractive to the human eye. Photographs can be used as artwork to gain public and political awareness and support for the project. Furthermore and especially true for megafauna, photographs allocated with taxonomic identifications of the shown taxa can provide good help for identification based on coloration and structural details. Some of the photographed species may have never before been photographed alive or such pictures are hardly available to the public.

Animals were retrieved alive mostly from rather shallow stations between roughly 120 and 700 m water depth, mostly by means of ABS and an AGT, to a lesser extent by means of a plankton net, a multicorer and a GKG. The animals were kept in aquaria in an eight degrees centigrade cooling room for the short term and photographed in photo dishes and/or photo cuvettes of 25 cm x 15 cm x 5 cm (whd) or $25^3 cm^3$ respectively, according to size of the animals. Photographic equipment used included a NIKON D5000 dSLR, a NIKON Speedlight SB-600 flash light, a NIKON NIKKOR AF-S 60 mm Micro lens, and a NIKON NIKKOR 105 mm tele-macro lens as well as diverse light sources (see figure 20).

Pictures taken during the IceAGE expedition will be made available online for the public and associated with the IceAGE database of all collected animals and metadata. They will mostly be made accessible as an open recourse under the Creative Commons License Agreement under the status (BY-NC-SA). This means that pictures are free for use with attribution (BY) of the author and the IceAGE project. The term ‘use’ means that pictures may be copied, distributed, displayed, and remixed. Secondly, pictures are not to be used for commercial purposes (NC). If somebody wants to use a photograph for commercial purposes, this is only possible upon agreement of the author. Finally, derivative works or adaptations of the pictures are only to be used and shared under the same Creative Commons license under which the original work was published (shared alike - SA).

For details visit http://creativecommons.org/licenses/by/3.0/legalcode. Consequently, the pictures can serve educational and scientific purposes - as long as these are non-commercial - without their potentially being hindered by copyright laws.

Fig. 20 Aquaria set up and photographic equipment used during the IceAGE expedition

Fig. 21 The amphipod (Crustacea: Malacostraca: Peracarida) *Paramphithoe hystix*, Ross is one of the most spectacular amphipods of the North Atlantic (Enckell1980).

6 Ship's Meteorological Station

(Miller M., Buldt, K.)

During the first expedition days, high pressure influence was the dominating feature around Iceland with only light to moderate winds. At the same time ex-hurricane "Irene" off the east coast of the United States was integrated into the west wind zone. Therefore on Wednesday, Aug. 31st the south to southeast wind gradually increased. In the evening Bft 6 to 7 was measured. On Thursday morning Bft 8 caused a swell up to 4 m. During the night to Friday, Sept. 2nd "Ex-Irene" moved east. Along with this the wind decreased significantly and veered northeast.

During the following days we operated in Irminger Sea. Due to weak pressure gradient light to moderate winds dominated. The next ex-hurricane "Katia" approached on Saturday, Sept. 10th so the northeast wind increased up to Bft 7 again. As "Ex-Katia" was predicted to cause strong winds up to Bft 9 and a sea state up to 5 m in the operation area decision was taken to shelter from this in one of the fjords of Iceland. During the night to Sunday RV METEOR entered the fjord „Isafjardardjup" located at the northwest coast of Iceland. In this fjord we only measured wind force around Bft 5.

In the early morning of Tuesday, Sept. 13th RV METEOR left the fjord again. In the Denmark Strait the northeast wind already had subsided to Bft 5 and the swell abated down to 2 m. During the following days high pressure influence became the dominant feature in Denmark Strait and also in the area south of Jan Mayen. The light winds veered south so that for the first time during this expedition fog was observed.

On Saturday, Sept. 17th ex-hurricane "Maria" was taken up by a strong low over Labrador Sea. It moved towards Irminger Sea within the next 24 hours. However, as RV METEOR operated northeast of Iceland at this time the southeast wind here only increased up to Bft 6. The next days the storm weakened and moved east. RV METEOR got into the centre of the low with only light and variable winds.

A new low formed on Tuesday, Sept. 20th off Nova Scotia and was expected to reach Iceland on Saturday, Sept. 24th. At this time RV METEOR already had started its transit to Cuxhaven. Only near the Shetlands the south wind increased up to Bft 7 for short times but the swell didn't exceed 2 m.

During the night to Monday, Sept. 26th a secondary low near Ireland moved northeast. Therefore Bft 7 from southwest to west was measured over the northern part of the North Sea only for short times again. At the same time a high over the Ukraine extended towards the North Sea. This caused the wind to decrease soon.

On Wednesday morning, Sept. 28th RV METEOR reached Cuxhaven on schedule at light to moderate southerly winds.

7 Station List M 85/3

Station No.		Date	Gear	Time	Latitude	Longitude	Water Depth	Remarks/ Recovery
Event label	Area	2011		[UTC]	[°N]	[°W]	[m]	
M 85-3/ 957	01	28.08.2011	MB-PS	12:22	60° 02.79'	021° 34.68'	2730	valid
M 85-3/ 958	01	28.08.2011	CTD	12:56	60° 02.72'	021° 30.10'	2745.9	valid
M 85-3/ 959	01	28.08.2011	MUC	15:52	60° 02.73'	021° 30.14'	2749	valid
M 85-3/ 960	01	28.08.2011	GKG	18:02	60° 02.73'	021° 30.14'	2750.4	valid
M 85-3/ 961	01	28.08.2011	GKG	20:10	60° 02.73'	021° 30.14'	2748.3	valid
M 85-3/ 962	01	28.08.2011	MB-PS	21:08	60° 02.73'	021° 30.14'	2747.1	valid
M 85-3/ 963	01	28.08.2011	EBS	23:34	60° 02.73'	021° 28.06'	2749.4	valid
M 85-3/ 964	01	28.08.2011	PLA	22:00	60° 02.76'	021° 25.08'	2741.8	valid
M 85-3/ 965	01	28.08.2011	PLA	22:20	60° 02.74'	021° 25.68'	2743	valid
M 85-3/ 966	01	29.08.2011	MB-PS	02:26	60° 02.78'	021° 29.91'	2747.9	valid
M 85-3/ 967	01	29.08.2011	EBS	04:52	60° 02.77'	021° 28.54'	2750.4	valid
M 85-3/ 968	01	29.08.2011	AGT	10:12	60° 02.73'	021° 34.61'	2732	valid
M 85-3/ 969	02	29.08.2011	MB-PS	20:00	60° 10.36'	019° 54.62'	2652.2	valid
M 85-3/ 970	02	29.08.2011	CTD	20:24	60° 10.99'	019° 53.52'	2674	valid
M 85-3/ 971	02	30.08.2011	MUC	23:52	60° 10.97'	019° 53.55'	2670.1	valid
M 85-3/ 972	03	30.08.2011	MB-PS	05:45	60° 17.97'	018° 09.63'	2564.5	valid
M 85-3/ 973	03	30.08.2011	CTD	06:28	60° 20.53'	018° 08.69'	2564.4	valid
M 85-3/ 974	03	30.08.2011	MUC	09:18	60° 20.54'	018° 08.69'	2562.9	valid
M 85-3/ 975	03	30.08.2011	GKG	11:16	60° 20.54'	018° 08.69'	2571.8	failed
M 85-3/ 976	03	30.08.2011	GKG	13:14	60° 20.54'	018° 08.67'	2568.6	failed
M 85-3/ 977	03	30.08.2011	GKG	15:08	60° 20.54'	018° 08.69'	2571.7	valid
M 85-3/ 978	03	30.08.2011	MB-PS	16:17	60° 20.53'	018° 08.86'	2572	valid
M 85-3/ 979	03	30.08.2011	EBS	18:25	60° 21.48'	018° 08.24'	2567.6	valid
M 85-3/ 980	03	30.08.2011	PLA	16:58	60° 22.95'	018° 07.51'	2568.2	valid
M 85-3/ 981	03	30.08.2011	PLA	17:19	60° 22.59'	018° 07.69'	2563.2	valid
M 85-3/ 982	03	30.09.2011	MB-PS	20:43	60° 29.71'	018° 08.57'	2570.6	valid
M 85-3/ 983	03	30.08.2011	EBS	23:23	60° 21.44'	018° 08.14'	2567.7	valid
M 85-3/ 984	03	31.08.2011	AGT	04:32	60° 19.57'	018° 08.95'	2572	valid
M 85-3/ 985	04	31.08.2011	MB-PS	11:29	60° 55.17'	018° 41.33'	2497.1	valid
M 85-3/ 986	04	31.08.2011	CTD	11:49	60° 55.70'	018° 41.80'	2494.6	valid
M 85-3/ 987	04	31.08.2011	MUC	14:29	60° 55.68'	018° 41.81'	2493.3	valid
M 85-3/ 988	05	31.08.2011	MB-PS	20:09	61° 41.55'	019° 30.77'	1937.3	valid
M 85-3/ 989	05	31.08.2011	EBS	21:50	61° 42.63'	019° 32.96'	1912.3	valid
M 85-3/ 990	05	31.08.2011	PLA	21:04	61° 43.29'	019° 34.18'	1901.1	valid
M 85-3/ 991	05	31.08.2011	PLA	21:25	61° 42.98'	019° 33.63'	1906.6	valid
M 85-3/ 992	05	01.09.2011	MB-PS	00:18	61° 41.39'	019° 31.33'	1940.4	valid
M 85-3/ 993	05	01.09.2011	AGT	02:25	61° 43.83'	019° 31.92'	1926	valid
M 85-3/ 994	05	01.09.2011	CTD	05:34	61° 42.49'	019° 32.78'	1915.5	valid
M 85-3/ 995	05	01.09.2011	MUC	07:52	61° 42.42'	019° 32.78'	1918.2	failed
M 85-3/ 996	05	01.09.2011	GKG	08:31	61° 42.49'	019° 32.78'	1913	valid
M 85-3/ 997	05	01.09.2011	MUC	11:09	61° 42.49'	019° 32.78'	1914.5	valid
M 85-3/ 998	05	01.09.2011	MB-PS	17:47	62° 32.48'	020° 16.47'	1467.8	valid
M 85-3/ 999	06	02.09.2011	MB-PS	18:40	62° 33.68'	020° 21.37'	1391.3	valid
M 85-3/ 1000	06	02.09.2011	CTD	08:22	62° 33.51'	020° 21.29'	1394.7	valid
M 85-3/ 1001	06	02.09.2011	MUC	10:12	62° 33.50'	020° 21.18'	1393	failed
M 85-3/ 1002	06	02.09.2011	GKG	11:28	62° 33.50'	020° 21.18'	1392.4	valid

M 85-3/ 1003	06	02.09.2011	GKG	12:43	62° 33.50'	020° 21.18'	1390	valid
M 85-3/ 1004	06	02.09.2011	MUC	14:02	62° 33.50'	020° 21.18'	1392.2	failed
M 85-3/ 1005	06	02.09.2011	MB-PS	14:38	62° 33.56'	020° 21.09'	1388.9	valid
M 85-3/ 1006	06	02.09.2011	EBS	16:25	62° 33.05'	023° 23.33'	1386.8	valid
M 85-3/ 1007	06	02.09.2011	PLA	15:35	62° 32.74'	020° 25.06'	1377.1	valid
M 85-3/ 1008	06	02.09.2011	PLA	16:00	62° 32.87'	020° 24.18'	1379.9	valid
M 85-3/ 1009	06	02.09.2011	MB-PS	18:22	62° 33.36'	020° 21.90'	1386.7	valid
M 85-3/ 1010	06	02.09.2011	EBS	19:49	62° 33.10'	020° 23.71'	1384.8	valid
M 85-3/ 1011	06	02.09.2011	AGT	22:50	62° 33.35'	020° 22.50'	1389	valid
M 85-3/ 1012	07	03.09.2011	MB-PS	03:37	62° 56.43'	020° 42.68'	902.2	valid
M 85-3/ 1013	07	03.09.2011	CTD	04:37	62° 55.59'	020° 47.39'	908	valid
M 85-3/ 1014	07	03.09.2011	MUC	05:56	62° 55.58'	020° 47.38'	911.8	valid
M 85-3/ 1015	07	03.09.2011	GKG	07:04	62° 55.59'	020° 47.38'	913.2	valid
M 85-3/ 1016	07	03.09.2011	GKG	08:08	62° 55.58'	020° 47.37'	917.5	failed
M 85-3/ 1017	07	03.09.2011	EBS	09:29	62° 55.84'	020° 46.43'	891.7	valid
M 85-3/ 1018	07	03.09.2011	PLA	09:44	62° 55.96'	020° 45.98'	909.5	valid
M 85-3/ 1019	07	03.09.2011	EBS	11:20	62° 56.32'	020° 44.61'	913.6	valid
M 85-3/ 1020	07	03.09.2011	PLA	10:55	62° 56.12'	020° 45.40'	910.9	valid
M 85-3/ 1021	07	03.09.2011	AGT	13:42	62° 55.88'	020° 46.66'	886.6	valid
M 85-3/ 1022	07	03.09.2011	GKG	15:44	62° 55.58'	020° 47.36'	906.8	valid
M 85-3/ 1023	08	03.09.2011	MB-PS	17:38	63° 08.11'	021° 01.75'	290.4	valid
M 85-3/ 1024	08	03.09.2011	CTD	18:01	63° 08.41'	021° 02.85'	270.2	valid
M 85-3/ 1025	08	03.09.2011	MUC	18:40	63° 08.41'	021° 02.85'	270.6	failed
M 85-3/ 1026	08	04.09.2011	MB-PS	00:46	63° 22.12'	023° 09.57'	272.4	valid
M 85-3/ 1027	09	04.09.2011	CTD	01:46	63° 19.96'	023° 10.08'	307.8	valid
M 85-3/ 1028	09	04.09.2011	van Veen	02:20	63° 20.00'	023° 10.00'	305	valid
M 85-3/ 1029	09	04.09.2011	van Veen	02:42	62° 30.00'	023° 10.00'	305.7	failed
M 85-3/ 1030	09	04.09.2011	van Veen	02:58	63° 20.00'	023° 10.00'	305.6	valid
M 85-3/ 1031	09	04.09.2011	GKG	03:34	63° 20.00'	023° 10.00'	305.3	valid
M 85-3/ 1032	09	04.09.2011	EBS	05:08	63° 18.51'	023° 09.46'	289.4	valid
M 85-3/ 1033	09	04.09.2011	EBS	06:10	63° 18.88'	023° 09.61'	288.5	valid
M 85-3/ 1034	09	04.09.2011	AGT	07:07	63° 19.48'	023° 09.83'	297.2	valid
M 85-3/ 1035	09	04.09.2011	MUC	08:32	63° 20.00'	023° 10.01'	306.7	valid
M 85-3/ 1036	10	05.09.2011	MB-PS	18:23	63° 56.90'	025° 54.93'	216.7	valid
M 85-3/ 1037	10	05.09.2011	CTD	18:53	63° 55.36'	025° 57.86'	214.5	valid
M 85-3/ 1038	10	05.09.2011	MUC	19:39	63° 55.36'	025° 57.86'	214.8	failed
M 85-3/ 1039	10	05.09.2011	MUC	20:08	63° 55.36'	025° 57.86'	214.6	valid
M 85-3/ 1040	10	05.09.2011	GKG	20:47	63° 55.36'	025° 57.85'	214.4	failed
M 85-3/ 1041	10	05.09.2011	GKG	21:26	63° 55.36'	025° 57.85'	214.9	failed
M 85-3/ 1042	10	05.09.2011	GKG	21:59	63° 55.37'	025° 57.84'	214.9	failed
M 85-3/ 1043	10	05.09.2011	EBS	22:46	63° 55.46'	025° 57.66'	213.9	valid
M 85-3/ 1044	10	05.09.2011	PLA	22:43	63° 55.41'	025° 57.75'	214.7	valid
M 85-3/ 1045	10	05.09.2011	EBS	23:37	63° 55.70'	025° 57.21'	218.4	valid
M 85-3/ 1046	10	05.09.2011	PLA	23:32	63° 55.63'	025° 57.35'	215.3	valid
M 85-3/ 1047	10	06.09.2011	AGT	00:28	63° 56.07'	025° 56.53'	209.4	valid
M 85-3/ 1048	10	06.09.2011	MB-PS	20:32	61° 39.81'	031° 20.22'	2551.9	valid
M 85-3/ 1049	11	06.09.2011	CTD	21:12	61° 37.41'	031° 21.11'	2542.4	valid
M 85-3/ 1050	11	07.09.2011	MUC	00:01	61° 37.40'	031° 22.11'	2547.5	valid
M 85-3/ 1051	11	07.09.2011	GKG	01:52	61° 37.41'	031° 22.11'	2538.9	valid

M 85-3/ 1052	11	07.09.2011	GKG	03:39	61° 37.41'	031° 22.11'	2539	valid
M 85-3/ 1053	11	07.09.2011	MB-PS	04:42	61° 37.35'	031° 22.10'	2537.8	valid
M 85-3/ 1054	11	07.09.2011	EBS	06:49	61° 36.19'	031° 22.60'	2537.3	valid
M 85-3/ 1055	11	07.09.2011	PLA	05:21	61° 34.83'	031° 23.25'	2547.3	valid
M 85-3/ 1056	11	07.09.2011	PLA	05:41	61° 35.13'	031° 23.13'	2545.2	valid
M 85-3/ 1057	11	07.09.2011	EBS	11:07	61° 38.50'	031° 21.37'	2504.7	valid
M 85-3/ 1058	11	07.09.2011	MB-PS	13:33	61° 39.30'	031° 21.02'	2535.7	valid
M 85-3/ 1059	11	07.09.2011	AGT	16:17	61° 39.24'	031° 20.68'	2539	valid
M 85-3/ 1060	11	07.09.2011	PLA	15:01	61° 37.14'	031° 18.99'	2394.5	valid
M 85-3/ 1061	12	08.09.2011	CTD	00:53	62° 10.47'	030° 03.50'	1924	valid
M 85-3/ 1062	12	08.09.2011	MUC	03:11	62° 10.50'	030° 03.45'	1927.4	valid
M 85-3/ 1063	12	08.09.2011	MB-PS	12:32	62° 57.53'	028° 08.55'	1525.4	valid
M 85-3/ 1064	13	08.09.2011	CTD	13:07	62° 59.93'	028° 04.82'	1621.8	valid
M 85-3/ 1065	13	08.09.2011	MUC	15:03	62° 59.97'	028° 04.79'	1618.9	valid
M 85-3/ 1066	13	08.09.2011	GKG	16:26	62° 59.97'	028° 04.78'	1621.8	valid
M 85-3/ 1067	13	08.09.2011	GKG	17:48	62° 59.97'	028° 04.78'	1624.5	valid
M 85-3/ 1068	13	08.09.2011	MB-PS	18:31	63° 00.01'	028° 04.73'	1620.2	valid
M 85-3/ 1069	13	08.09.2011	EBS	21:00	62° 59.33'	028° 05.70'	1588.2	valid
M 85-3/ 1070	13	08.09.2011	PLA	20:05	62° 58.58'	028° 06.77'	1470.5	valid
M 85-3/ 1071	13	08.09.2011	PLA	20:26	62° 58.88'	028° 06.34'	1534.1	valid
M 85-3/ 1072	13	08.09.2011	EBS	23:47	63° 00.46'	028° 04.09'	1593.8	valid
M 85-3/ 1073	13	09.09.2011	AGT	03:23	63° 00.04'	028° 04.83'	1614	valid
M 85-3/ 1074	14	09.09.2011	CTD	10:17	63° 29.75'	026° 55.90'	1174.7	valid
M 85-3/ 1075	14	09.09.2011	MUC	11:43	62° 29.73'	026° 55.80'	1175.2	valid
M 85-3/ 1076	14	09.09.2011	MB-PS	13:14	63° 34.80'	026° 40.78'	1039.3	valid
M 85-3/ 1077	15	09.09.2011	CTD	15:22	63° 41.90'	026° 24.45'	740.1	valid
M 85-3/ 1078	15	09.09.2011	MUC	16:25	63° 41.90'	026° 24.44'	741.6	failed
M 85-3/ 1079	15	09.09.2011	MUC	17:09	63° 41.90'	026° 24.45'	742.2	failed
M 85-3/ 1080	15	09.09.2011	GKG	18:22	63° 41.90'	026° 24.44'	741	failed
M 85-3/ 1081	15	09.09.2011	GKG	19:11	63° 41.70'	026° 24.43'	741.4	failed
M 85-3/ 1082	15	09.09.2011	EBS	20:33	63° 42.10'	023° 26.98'	724.4	valid
M 85-3/ 1083	15	09.09.2011	PLA	20:17	63° 41.88'	026° 24.41'	737.8	valid
M 85-3/ 1084	15	09.09.2011	PLA	20:36	63° 42.14'	026° 23.90'	722.4	valid
M 85-3/ 1085	15	09.09.2011	PLA	20:52	63° 42.33'	026° 23.51'	705.8	valid
M 85-3/ 1086	15	09.09.2011	EBS	22:06	63° 42.53'	026° 23.05'	698.1	valid
M 85-3/ 1087	15	10.09.2011	TD	23:49	63° 42.62'	026° 22.67'	686	failed
M 85-3/ 1088	15	10.09.2011	TD	01:01	63° 42.64'	026° 22.55'	684	failed
M 85-3/ 1089	16	10.09.2011	MB-PS	17:50	65° 59.93'	025° 03.50'	119.6	valid
M 85-3/ 1090	16	10.09.2011	EBS	18:43	66° 00.03'	025° 03.18'	742.5	valid
M 85-3/ 1091	16	10.09.2011	TD	19:42	66° 00.25'	025° 02.44'	118	valid
M 85-3/ 1092	16	10.09.2011	CTD	20:38	66° 00.59'	025° 01.23'	110.3	valid
M 85-3/ 1093	16	10.09.2011	MUC	21:05	66° 06.61'	025° 01.25'	116.9	valid
M 85-3/ 1094	16	10.09.2011	GKG	21:32	66° 00.62'	025° 01.26'	116.4	failed
M 85-3/ 1095	16	10.09.2011	GKG	21:59	66° 00.62'	025° 01.25'	134.6	valid
M 85-3/ 1096	17	13.09.2011	MB-PS	09:27	66° 39.39'	024° 26.32'	115.7	valid
M 85-3/ 1097	17	13.09.2011	CTD	10:44	66° 38.56'	024° 32.13'	119.7	valid
M 85-3/ 1098	17	13.09.2011	MUC	11:11	66° 38.55'	024° 32.13'	120.3	valid
M 85-3/ 1099	17	13.09.2011	van Veen	11:41	66° 38.55'	024° 32.13'	120	valid
M 85-3/ 1100	17	13.09.2011	van Veen	11:54	66° 38.55'	024° 32.13'	120	failed

M 85-3/ 1101	17	13.09.2011	SG	12:03	66° 38.56'	024° 32.13'	120	valid
M 85-3/ 1102	17	13.09.2011	SG	12:14	66° 38.56'	024° 32.13'	119	valid
M 85-3/ 1103	17	13.09.2011	SG	12:23	66° 38.56'	024° 32.13'	119	valid
M 85-3/ 1104	17	13.09.2011	EBS	12:53	66° 38.60'	024° 31.97'	118.8	valid
M 85-3/ 1105	17	13.09.2011	PLA	12:56	66° 38.62'	024° 31.83'	118.8	valid
M 85-3/ 1106	17	13.09.2011	TD	13:48	66° 38.79'	024° 30.90'	117	valid
M 85-3/ 1107	17	13.09.2011	PLA	13:43	66° 38.74'	024° 31.16'	118.5	valid
M 85-3/ 1108	17	13.09.2011	PLA	14:02	66° 38.82'	024° 30.67'	117.8	valid
M 85-3/ 1109	18	13.09.2011	CTD	15:52	66° 45.89'	024° 54.51'	559	valid
M 85-3/ 1110	18	13.09.2011	MUC	16:47	66° 45.89'	024° 54.51'	558.7	failed
M 85-3/ 1111	18	13.09.2011	MUC	17:29	66° 45.99'	024° 54.26'	554.8	failed
M 85-3/ 1112	19	13.09.2011	MB-PS	21:17	67° 09.52'	026° 06.56'	743.6	valid
M 85-3/ 1113	19	13.09.2011	CTD	22:14	67° 12.82'	026° 16.33'	685.8	valid
M 85-3/ 1114	19	13.09.2011	MUC	23:13	67° 12.82'	026° 16.31'	684.1	valid
M 85-3/ 1115	19	14.09.2011	MUC	00:10	67° 12.82'	026° 16.31'	684.3	valid
M 85-3/ 1116	19	14.09.2011	GKG	01:00	67° 12.82'	026° 16.31'	683.1	valid
M 85-3/ 1117	19	14.09.2011	GKG	01:47	67° 12.82'	026° 16.31'	683.8	valid
M 85-3/ 1118	19	14.09.2011	MB-PS	02:12	67° 12.77'	026° 15.59'	687.1	valid
M 85-3/ 1119	19	14.09.2011	EBS	03:48	67° 12.81'	026° 14.50'	696.9	valid
M 85-3/ 1120	19	14.09.2011	PLA	03:15	67° 12.79'	026° 15.32'	690	valid
M 85-3/ 1121	19	14.09.2011	PLA	03:33	67° 12.81'	026° 14.54'	696.3	valid
M 85-3/ 1122	19	14.09.2011	PLA	03:53	67° 12.83'	026° 13.67'	708.2	valid
M 85-3/ 1123	19	14.09.2011	EBS	05:20	67° 12.83'	026° 12.45'	716.5	valid
M 85-3/ 1124	19	14.09.2011	TD	07:07	67° 12.90'	026° 09.81'	738	valid
M 85-3/ 1125	20	14.09.2011	MB-PS	11:16	67° 38.80'	026° 38.61'	320.2	valid
M 85-3/ 1126	20	15.09.2011	CTD	11:53	67° 38.80'	026° 44.95'	321.5	valid
M 85-3/ 1127	20	14.09.2011	MUC	12:35	67° 38.78'	026° 44.76'	320	valid
M 85-3/ 1128	20	14.09.2011	MUC	13:19	67° 38.77'	026° 44.78'	320.4	valid
M 85-3/ 1129	20	14.09.2011	GKG	13:58	67° 38.77'	026° 44.78'	320.6	valid
M 85-3/ 1130	20	14.09.2011	GKG	14:31	67° 38.76'	026° 44.80'	318.9	valid
M 85-3/ 1131	20	14.09.2011	MB-PS	14:53	67° 38.67'	026° 44.95'	320.5	valid
M 85-3/ 1132	20	14.09.2011	EBS	16:01	67° 38.48'	026° 45.28'	318.1	valid
M 85-3/ 1133	20	14.09.2011	PLA	15:52	67° 38.58'	026° 45.05'	320.1	valid
M 85-3/ 1134	20	14.09.2011	PLA	16:08	67° 38.39'	026° 45.46'	316.6	valid
M 85-3/ 1135	20	14.09.2011	PLA	16:34	67° 38.27'	026° 45.73'	316.9	valid
M 85-3/ 1136	20	14.09.2011	EBS	17:28	67° 38.15'	026° 45.99'	315.9	valid
M 85-3/ 1137	20	14.09.2011	TD	19:00	67° 37.78'	026° 46.81'	311	valid
M 85-3/ 1138	21	17.09.2011	CTD	02:45	67° 50.17'	023° 41.82'	1237	valid
M 85-3/ 1139	21	15.09.2011	MUC	04:19	67° 50.26'	023° 41.78'	1238.2	valid
M 85-3/ 1140	21	15.09.2011	MUC	05:42	67° 50.22'	023° 42.06'	1240.7	valid
M 85-3/ 1141	21	15.09.2011	GKG	06:52	67° 50.22'	023° 42.11'	1241.6	valid
M 85-3/ 1142	21	15.09.2011	GKG	08:05	67° 50.22'	023° 42.12'	1240.9	valid
M 85-3/ 1143	21	15.09.2011	MB-PS	08:49	67° 50.19'	023° 41.85'	1238.4	valid
M 85-3/ 1144	21	15.09.2011	EBS	10:16	67° 52.07'	023° 41.78'	1281	valid
M 85-3/ 1145	21	15.09.2011	PLA	09:33	67° 52.73'	023° 41.81'	1288.1	valid
M 85-3/ 1146	21	15.09.2011	PLA	09:48	67° 52.50'	023° 41.80'	1289.6	valid
M 85-3/ 1147	21	15.09.2011	PLA	10:07	67° 52.20'	023° 41.78'	1281	valid
M 85-3/ 1148	21	15.09.2011	EBS	12:45	67° 50.79'	023° 41.76'	1248.8	valid
M 85-3/ 1149	21	15.09.2011	AGT	15:52	67° 50.57'	023° 41.85'	1246	valid
M 85-3/ 1150	22	18.09.2011	CTD	01:33	69° 05.59'	009° 56.37'	2190.1	valid

M 85-3/ 1151	22	17.09.2011	MUC	04:19	69° 05.61'	009° 56.01'	2219.7	valid
M 85-3/ 1152	22	17.09.2011	GKG	06:19	69° 05.60'	009° 56.01'	2172.6	valid
M 85-3/ 1153	22	17.09.2011	GKG	07:58	69° 05.60'	009° 56.01'	2173.4	valid
M 85-3/ 1154	22	17.09.2011	MB-PS	08:58	69° 05.47'	009° 56.20'	2171	valid
M 85-3/ 1155	22	17.09.2011	EBS	11:03	69° 06.89'	009° 54.72'	2203.8	valid
M 85-3/ 1156	22	17.09.2011	PLA	09:46	69° 08.03'	009° 53.54'	2200.8	valid
M 85-3/ 1157	22	17.09.2011	PLA	10:05	69° 07.75'	009° 53.83'	2195.1	valid
M 85-3/ 1158	22	17.09.2011	PLA	10:25	69° 07.46'	009° 54.13'	2196.2	valid
M 85-3/ 1159	22	17.09.2011	EBS	14:50	69° 06.66'	009° 55.02'	2202.8	valid
M 85-3/ 1160	22	17.09.2011	AGT	19:16	69° 06.18'	009° 55.35'	2169	valid
M 85-3/ 1161	23	18.09.2011	CTD	01:48	68° 38.63'	008° 34.83'	1965.6	valid
M 85-3/ 1162	23	18.09.2011	MUC	04:04	68° 38.66'	008° 34.82'	1962.3	valid
M 85-3/ 1163	24	20.09.2011	CTD	19:52	67° 35.29'	006° 57.47'	2406	valid
M 85-3/ 1164	24	18.09.2011	MUC	22:27	67° 35.28'	006° 57.48'	2403.1	failed
M 85-3/ 1165	24	18.09.2011	GKG	00:18	67° 35.29'	006° 57.48'	2402	valid
M 85-3/ 1166	24	19.09.2011	GKG	01:57	67° 35.28'	006° 57.47'	2401.8	valid
M 85-3/ 1167	24	19.09.2011	MB-PS	03:09	67° 33.35'	006° 52.75'	2482.5	valid
M 85-3/ 1168	24	19.09.2011	EBS	05:43	67° 36.38'	007° 00.08'	2372.6	valid
M 85-3/ 1169	24	19.09.2011	PLA	04:26	67° 37.29'	007° 02.27'	2341.7	valid
M 85-3/ 1170	24	19.09.2011	PLA	04:41	67° 37.13'	007° 01.83'	2342.1	valid
M 85-3/ 1171	24	19.09.2011	PLA	05:05	67° 36.85'	007° 01.17'	2352.2	valid
M 85-3/ 1172	24	19.09.2011	EBS	10:04	67° 34.69'	006° 56.08'	2422.4	valid
M 85-3/ 1173	24	19.09.2011	AGT	14:22	67° 34.01'	006° 54.31'	2466	valid
M 85-3/ 1174	25	21.09.2011	CTD	23:06	67° 37.04'	009° 44.33'	1707.5	valid
M 85-3/ 1175	25	20.09.2011	MUC	00:59	67° 37.02'	009° 44.26'	1710.8	valid
M 85-3/ 1176	26	21.09.2011	CTD	07:00	67° 38.71'	012° 10.10'	1819.6	valid
M 85-3/ 1177	26	20.09.2011	MUC	09:09	67° 38.72'	012° 10.10'	1820	valid
M 85-3/ 1178	26	20.09.2011	GKG	10:42	67° 38.71'	012° 10.10'	1818.8	valid
M 85-3/ 1179	26	20.09.2011	GKG	12:21	67° 38.71'	012° 10.11'	1820.4	valid
M 85-3/ 1180	26	20.09.2011	MB-PS	13:29	67° 37.45'	012° 04.27'	1787	valid
M 85-3/ 1181	26	20.09.2011	EBS	15:29	67° 39.47'	012° 13.59'	1827	valid
M 85-3/ 1182	26	20.09.2011	PLA	14:33	67° 39.94'	012° 15.71'	1828.3	valid
M 85-3/ 1183	26	20.09.2011	PLA	14:48	67° 39.82'	012° 15.15'	1827.4	valid
M 85-3/ 1184	26	20.09.2011	EBS	18:45	67° 38.63'	012° 09.72'	1819.3	valid
M 85-3/ 1185	26	20.09.2011	AGT	22:01	67° 37.39'	012° 04.06'	1781	valid
M 85-3/ 1186	27	21.09.2011	CTD	04:14	67° 04.32'	013° 00.89'	1582.3	valid
M 85-3/ 1187	27	21.09.2011	MUC	06:01	67° 04.32'	013° 00.89'	1581.7	valid
M 85-3/ 1188	27	21.09.2011	GKG	07:27	67° 04.32'	013° 00.89'	1580.6	valid
M 85-3/ 1189	27	21.09.2011	GKG	08:50	67° 04.32'	013° 00.89'	1579.3	valid
M 85-3/ 1190	27	21.09.2011	MB-PS	09:36	67° 04.28'	013° 00.68'	1583.3	valid
M 85-3/ 1191	27	21.09.2011	EBS	11:05	67° 04.72'	013° 03.83'	1574.7	valid
M 85-3/ 1192	27	21.09.2011	PLA	10:12	67° 05.01'	013° 05.90'	1584.6	valid
M 85-3/ 1193	27	21.09.2011	PLA	10:31	67° 04.91'	013° 05.16'	1582.4	valid
M 85-3/ 1194	27	21.09.2011	EBS	14:14	67° 04.66'	013° 03.27'	1573.5	valid
M 85-3/ 1195	27	21.09.2011	MB-PS	16:12	67° 04.48'	013° 01.33'	1581.8	valid
M 85-3/ 1196	27	21.09.2011	AGT	17:50	67° 05.79'	013° 00.42'	1612	valid
M 85-3/ 1197	28 a	21.09.2011	CTD	21:14	66° 50.85'	013° 20.04'	2720	valid
M 85-3/ 1198	28	21.09.2011	MUC	21:50	66° 50.87'	013° 20.03'	283.8	failed
M 85-3/ 1199	28	21.09.2011	CTD	22:48	66° 54.26'	013° 15.03'	703.2	valid
M 85-3/ 1200	28	21.09.2011	MUC	23:44	66° 54.26'	013° 15.03'	702.3	failed

M 85-3/ 1201	29	22.09.2011	CTD	02:24	66° 33.97'	012° 54.81'	323.6	valid
M 85-3/ 1202	29	22.09.2011	SG	03:06	66° 33.97'	012° 54.83'	326	valid
M 85-3/ 1203	29	22.09.2011	SG	03:25	66° 33.97'	012° 54.83'	324	valid
M 85-3/ 1204	29	22.09.2011	SG	03:43	66° 33.97'	012° 54.83'	325	valid
M 85-3/ 1205	29	22.09.2011	SG	04:02	66° 33.97'	012° 54.84'	327	failed
M 85-3/ 1206	29	22.09.2011	SG	04:21	66° 33.97'	012° 54.84'	323	failed
M 85-3/ 1207	29	22.09.2011	SG	04:40	66° 33.97'	012° 54.84'	326	valid
M 85-3/ 1208	29	22.09.2011	MB-PS	04:58	66° 33.92'	012° 54.75'	327.5	valid
M 85-3/ 1209	29	22.09.2011	EBS	05:43	66° 32.29'	012° 51.89'	315.9	valid
M 85-3/ 1210	29	22.09.2011	PLA	05:35	66° 32.18'	012° 51.70'	307.5	valid
M 85-3/ 1211	29	22.09.2011	PLA	05:54	66° 32.43'	012° 52.14'	316.8	valid
M 85-3/ 1212	29	22.09.2011	EBS	06:39	66° 32.63'	012° 52.48'	317.2	valid
M 85-3/ 1213	29	22.09.2011	AGT	07:57	66° 33.16'	012° 53.40'	318.2	valid
M 85-3/ 1214	30	22.09.2011	CTD	10:52	66° 18.06'	012° 22.38'	731.3	valid
M 85-3/ 1215	30	22.09.2011	MUC	11:51	66° 18.06'	012° 22.38'	732.5	valid
M 85-3/ 1216	30	22.09.2011	GKG	12:45	66° 18.06'	012° 22.38'	730.8	valid
M 85-3/ 1217	30	22.09.2011	GKG	13:31	66° 18.06'	012° 22.40'	732.1	valid
M 85-3/ 1218	30	22.09.2011	MB-PS	14:09	66° 18.83'	012° 24.79'	784.4	valid
M 85-3/ 1219	30	22.09.2011	EBS	15:06	66° 17.34'	012° 20.82'	579.1	valid
M 85-3/ 1220	30	22.09.2011	PLA	14:49	66° 17.14'	012° 20.41'	537.5	valid
M 85-3/ 1221	30	22.09.2011	PLA	15:08	66° 17.37'	012° 20.88'	585.1	valid
M 85-3/ 1222	30	22.09.2011	EBS	16:38	66° 17.49'	012° 21.09'	610.8	valid
M 85-3/ 1223	30	22.09.2011	AGT	18:10	66° 17.72'	012° 21.76'	662.6	valid

CTD- values

Area	Region			CTD- values			
				measurement depth	temperature	salinity	Oxygen saturation
				[m]	[°C]	[psu]	[mg/l]
01	South Iceland	Iceland Basin	Deep Sea	2736	2.5253	34.9916	5.85461
02	South Iceland	Iceland Basin	Deep Sea	2655	2.7575	34.9891	255.493
03	South Iceland	Iceland Basin	Deep Sea	2568	2.6581	34.9955	258.389
04	South Iceland	Iceland Basin	Deep Sea	2487	2.2983	34.9864	261.1616
05	South Iceland	Iceland Basin	Deep Sea	1910	2.7443	34.9866	258.5425
06	South Iceland	Iceland Basin	Slope	1386	3.8804	35.02456	254.57
07	South Iceland	Iceland Basin	Shelf	902	5.29	35.08	242.79
08	South Iceland	Iceland Basin	Shelf	265	8.36	35.23	240.43
09	South Iceland	Reykjanes Ridge	Shelf	305	8.01	35.22	241.44
10	South Iceland	Irminger Basin	Shelf	212	7.42	35.19	246.74
11	South Iceland	Irminger Basin	Deep Sea	2530	3.16	34.94	254.17
12	South Iceland	Irminger Basin	Deep Sea	1923	3.27	34.94	253.69
13	South Iceland	Irminger Basin	Deep Sea	1613	4.28	34.99	245.53
14	South Iceland	Irminger Basin	Slope	1168	4.3688	34.998	244.56
15	South Iceland	Irminger Basin	Slope	733	6.19553	35.09964	231.5267
16	West Iceland	Denmark Strait	Shelf	116	7.87818	35.12831	228.812
17	N/W Iceland	Denmark Strait		117	7.32249	35.1535	237.1402
18	East Greenland	Denmark Strait		554	-0.37014	34.90502	284.5959
19	East Greenland	Denmark Strait		685	0.07	34.907	292.966

20	East Greenland	Denmark Strait		313	0.706	34.625	290.9
21	East Greenland	Denmark Strait	Deep Sea	1208	-0.66561	34.91109	278.7728
22	N/E Iceland	Norwegian Basin	Deep Sea	2161	-0.7518	34.91	266.74
23	N/E Iceland	Norwegian Basin	Deep Sea	1920	-0.80024	34.91073	272.5799
24	N/E Iceland	Norwegian Basin	Deep Sea	2367	-0.82	34.91	271.26
25	N/E Iceland	Norwegian Basin	Deep Sea	1669	-0.76303	34.902	267.98
26	Norwegian Sea	Norwegian Basin	Deep Sea	1781	-0.8511	34.91	0
27	N/E Iceland	Norwegian Sea		1546	-0.74403	34.90862	269.2512
28	N/E Iceland	Norwegian Sea		278	4.74634	34.98964	254.3813
28 a	Nordostisland	Norwegian Sea					
29	N/E Iceland	Norwegian Sea		314	1.36103	34.8472	291.8144
30	East Iceland	Norwegian Sea		712	-0.40217	34.90286	283.581

8 Data and Sample Storage and Availability

(F. Hüttmann, S. Brix)

All benthic samples are sorted at the DZMB (HH and WHV) in Germany and the The University of Icelands Research Centre in Iceland. The sample sorting is a shared effort as bilateral cooperation between Germany and Iceland. Most probably the complete sorting of samples will be finished within three years, most likely end o 2014 or early 2015. 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. Shipping of samples already centrally sorted to major taxa at the DZMB saves the specialists a large amount of work and at the same time makes to them available a high amount of additional samples. 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. This service is coordinated through web portals and databases.

The IceAGE-project is getting evolved with a modern digital data management system for its diverse data collection efforts. This is done for ease of inventory, analysis, automated reporting and global compatibility. At the core of these efforts stands the relational IceAGE database in MS Access 2010 which includes all the data content. The 'backend' (ship version M85/3) of the database is currently 4.3 MB in size, and growing. It is widely based on hard copy protocol sheets, with the data provided by the gear operators (various sledges, CTD, box corers, opportunistic sightings, and ship log data). Photos and video material are not included yet but reported and stored externally. It is the goal to include them at a later stage. All taxonomic species names are following the World Registry of Marine Species (WORMS; www.marinespecies.org) and the International Taxonomic Information System (www.itis.org) with taxonomic serial numbers (TSN and Aphia numbers) to provide for a global compatibility and best applicability of the obtained data. These data further allow for documentation and tracking survey and sampling efforts, referenced in space, ocean depth and time (usually collected by minute, and with decimal minutes in WGS84; depth is provided in meters below sea level). The IceAGE database can export data in various formats, e.g. MS Excel,dbf, ASCII, and for GIS mapping software. The data are currently not considered for an online upload, but data can get exported into XML and online serving is considered, e.g. 'in the cloud' and in-time while still at sea.

For a better transparency and compatibility with ongoing research efforts elsewhere, this database got described in high detail with metadata following international ISO standards (19115, 19139), as outlined with the International Polar Year (IPY), ICSU, NASA Global Change Master Directory (GCMD) and other research bodies and monitoring projects (e.g. GEOSS, Pangea). The metadata are reporting on all relevant IceAGE methods and protocols; all columns of the database with over 29 tables are described in XML (available from the chief scientist on request).

This is the first time that a digital database structure was employed with IceAGE, and it represents a pilot study. The database in IceAGE was operated during the field campaign by a data manager and in collaboration with the local programmer and the system manager of RV Meteor. Good working collaborations were formed. The database got placed on the server of the ship, and code updates were provided by DZMB. Research areas were assigned by the Chief Scientist. All subsequent data were keyed in via terminals and laptops by the gear operators and assistants, and then approved by the data manager and further edited for specimens and their identification by the gear operators and sorting staff.

The IceAGE database makes for a 'working' database which is constantly improved; the data are quality-controlled, reviewed, cleaned, and updated. Having 'clean data' was made a priority before completion of the field campaign and when leaving the ship. However, since many specimen identifications are still in progress and international loans are made, data updates are an ongoing task for the coming next years and between all project partners involving collaborators with institutions worldwide.

A first data policy was also formed and the IceAGE database was also put successfully to a test: It provided already an overview, summary and analysis details for cruise reporting, GIS mapping and modeling projects in IceAGE.

9 Acknowledgements

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