The Expeditions ANTARKTIS-XIX/3-4 of the Research Vessel POLARSTERN in 2002

(ANDEEP I and II: Antarctic benthic deep-sea biodiversity – colonization history and recent community patterns)

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1 INTRODUCTION AND SUMMARY

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Leg 3 and Leg 4 of POLARSTERN expedition ANT-XIX were devoted almost exclusively to two extensive biological projects regionally concentrated to the southern edge of Drake Passage at the tip of the Antarctic Peninsula around Elephant Island and the South Shetland Islands (ANT-XIX/3) to the deep basin of the north-western Weddell Sea and to the South Sandwich Trench.

(1) The first main project was conducted by an international group of scientists during Leg ANT-XIX/3 scientifically coordinated by the German Federal Research Institute for Fisheries, Hamburg. This project concentrated on the investigation of the state of fish stocks in the Elephant Island - South Shetland Islands region. This region were exploited commercially by fishing fleets from 1977/78 through 1988/89. Most fishing occurred from 1977 to 1981 when concentrations of mackerel icefish, *Champsocephalus gunnari*, and marble notothenia, *Notothenia rossii*, were fished. Since 1982/83 commercial fishing has only been conducted irregularly and with little success.

The "Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)" which was established in 1982, closed the region for finfishing after the 1989/90 season. From results of the first three monitoring surveys in the region after the closure of the fishery little prospect turned out for re-opening the region for commercial fishing.

Since 1998, the U.S.A. and Germany have conducted a collaborative research programme in order to estimate stock sizes and to collect information on biological features of the abundant species. So far, three surveys were conducted: 1988 and 2001 around Elephant Island and the lower South Shetland Islands, and in 1999 around the South Orkney Islands. They gave little indication that the two formerly abundant species *Champsocephalus gunnari* and *Notothenia rossii,* have recovered from over-exploitation. Other abundant fish species in the South Shetland Islands, such as *Gobionotothenia gibberifrons*, were less abundant in 2001 than in 1998 while stock sizes in most of the icefish species were in the same order or magnitude as in 1998.

During Leg ANT-XIX/3, the fourth survey was carried out around Elephant Island, the South Shetland Islands and additionally, north of d'Urville Island. This survey again was a joint German - U.S.A. contribution to CCAMLR and was used to very successfully sample and assess the stock sizes, population structure and meso-scale distribution of commercially exploitable fish, pollution loads of fish stocks as well as the feeding habits of fish.

The shelf around Elephant Island and north of the South Shetland Islands was covered by 70 hauls, 50 around Elephant Island and 20 around the South Shetland Islands using a commercially-sized bottom trawl. Favoured by good weather conditions five additional hauls were conducted in the shelf area off d'Urville Island at the tip of the Antarctic Peninsula.

Fish density in the lower South Shetland Islands was less than at Elephant Island. Catch composition in terms of size and abundance of adult individuals of most species gives evidence that the fishing ban by CCAMLR has been kept to. However, results from preliminary biomass estimations seem not to support a reopening of the area for finfishing.

(2) The second main project, ANDEEP - standing for ANtarctic benthic DEEP-sea biodiversity: colonization history and recent community pattern - had its first phase (ANDEEP I) jointly with the fisheries project during Leg ANT-XIX/3 but had its main activity, ANDEEP II, during Leg ANT-XIX/4 in the deep-sea of the north-western Weddell Sea and in the tectonically active region of the South Sandwich Trench.

The ANDEEP project conducted the first comprehensive survey of mega-, micro- and meio-faunal deep-water communities in the southern Scotia and Weddell seas. ANDEEP sampled very successfully as planned at 23 stations in all: (a) in the deep-sea of the Drake Passage, specifically along the tectonic ridge structure of the Shackleton Fracture Zone as a potential route for colonisation and exchange of the Antarctic deep-sea fauna (Target Area 1, see Fig. 3-1), and around the South Shetland Islands during Leg ANT-XIX/3 (ANDEEP I; see Fig. 1.1-2 A and B), and (b) east of the Antarctic Peninsula across the deep-sea of the northern Weddell Sea (Target Areas 3 and 4; see Fig. 3-1) and across the South Sandwich Trench east of Montagu Island (Target Area 6; see Fig. 3-1) during Leg ANT-XIX/4 (ANDEEP II; Fig. 1.1-2 A and D).

Additionally to these two main projects complementary research activities were carried out such as (a) Differential Optic Absorption Spectroscopy (DOAS) measurements of atmospheric trace gases for the validation of the SCIAMACHY instrument onboard the ENVISAT satellite during both legs, (b) an educational project of the AURICHER WISSENSCHAFTSTAGE comprising a practical project to introduce advanced students of the Aurich GYMNASIUM ULRICIANUM and BERUFSBILDENDE SCHULEN II into modern topics and methods of marine and polar research during Leg ANT-XIX/3, and (c) microbiological investigations on the abundance and community structure of oligotrophic, low-nutrient bacteria during Leg ANT-XIX/4.

On both legs sampling was carried out generally during day and night. On Leg ANT-XIX/3 fishing activities were concentrated to daylight from 6 a.m. to 10 p.m. in order to take into account the diurnal migration pattern of Antarctic fish. Therefore, sampling for ANDEEP in the deep sea on Leg ANT-XIX/3 was committed to the remaining nighttime only. As a consequence several ANDEEP stations had to be interrupted and completed the next night.

Important difficulties for the German working team developed from very specific and restrictive conditions for scientific work south of 60 degrees latitude south made by the German Federal Office for the Environment very shortly before the start of the cruises. This concerned especially the use of any acoustic devices such as HYDROSWEEP and PARASOUND systems which were planned to be used for the proper identification of sampling sites or bottom finding pingers. Because of the tight time frame it was not possible to organize an appropriate alternative. Therefore, acoustic investigations were only carried out for and in the framework of the projects of the participating Belgian research team.

In summary, the fisheries research and sampling projects during Leg ANT-XIX/3 were extremely successful and completed in full. Sampling for ANDEEP was a success in all as well since sampling was done in international cooperation and a number of sampling locations were situated to the north of 60 degrees latitude south

1.1 Itinerary of Leg ANT-XIX/3 / ANDEEP I

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RV POLARSTERN set sail in the late afternoon of January 23, 2002 and left the Catalina pier of Punta Arenas, Chile. The international team of 42 scientific participants from ten countries, Australia, Belgium, Canada, Germany, Italy, Norway, Spain, Ukrain, United Kingdom and United States of America and 46 crew enjoyed bright sunshine and calm sea when POLARSTERN steamed on an easterly course through Magellan Strait. Outside Magellan Strait the ship performed calibration measurements for a new permanently ship-mounted marine magnetometer system. Sunny weather and calm sea accompanied the ship while passing Le Maire Strait into Drake Passage and the Screaming Fifties (Fig. 1.1-1, inset).

A first station to test the large bottom trawl of the fisheries project was successfully carried out in the morning of January 25. Sampling for the ANDEEP project started early in the morning of January 26 when POLARSTERN reached the large ridge structure of the Shackleton Fracture Zone (Fig. 1.1-2, A). Very soon a sampling routine developed employing Sediment Profile Imaging (SEP), Epibenthos Sledge (EBS), Agassiz trawl (AGT), Large Box Corer (GKG), MultiCorer (MUC), and Amphipod traps at e few seleted sites (ATC). Slowly proceeding to the southeast along the ridge structure this sampling routine - with variable success - lasted up to January 29 when POLARSTERN arrived at the shelf of Elephant Island and started with station work for the fishery project (Fig. 1.1-2, A and C).

Day and night sampling over 24 hours was split up in a way that fishery was carried out during daylight hours when fish are known to concentrate at the bottom. Sampling the deep-sea for the ANDEEP project was carried out predominantly during the remaining night time when distance between fishing and sampling stations was conveniently small. Favoured by still calm but cloudy weather conditions the Elephant Island shelf was covered by 30 hauls up to February 4 (Fig. 2.1.-1a). During the following days up to the evening of February 10 fishery was concentrated to small-scale investigations on fish concentrations in a 8x10 nautical mile box on the western shelf of Elephant Island (Fig. 1.1-2, C; Fig. 2.1.-1a). 20 hauls were conducted facing weather conditions which became more variable than the days before. A gale force wind caused an interruption of the sampling programme for half a day.

In the night of February 10 POLARSTERN moved to a position north of King George Island to sample an extensive ANDEEP station - lasting about some 40 hours - in the deep South Shetland Trench at ~5200 m (Fig. 1.1-1). The fishery programme on the South Shetland Islands shelf was less packed to better enable ANDEEP sampling in and on the flank of the South Shetland Trench where three deep ANDEEP stations were successfully accomplished. During the days following February 13 about 20 hauls were conducted on the shelf of King George Island and Livingstone Island (Fig. 1.1.-2, B). The fishery programme in this area was finished late in the evening of February 19.

During the night of February 19/20 POLARSTERN the area and sailed around Snow Island and Deception Island into Bransfield Strait. During heavy snowfall a compulsory life boat drill was carried out on February 20 off Arctowski Station in Admirality Bay, King George Island. During the following night the ship crossed Bransfield Strait heading for the shelf area north of d'Urville Island which was commercially fished some 20 years ago. The remaining time of one day - available because of the in all calm weather conditions together with the technically smooth fishing process - enabled POLARSTERN to revisit this fishing ground to conduct five additional hauls.

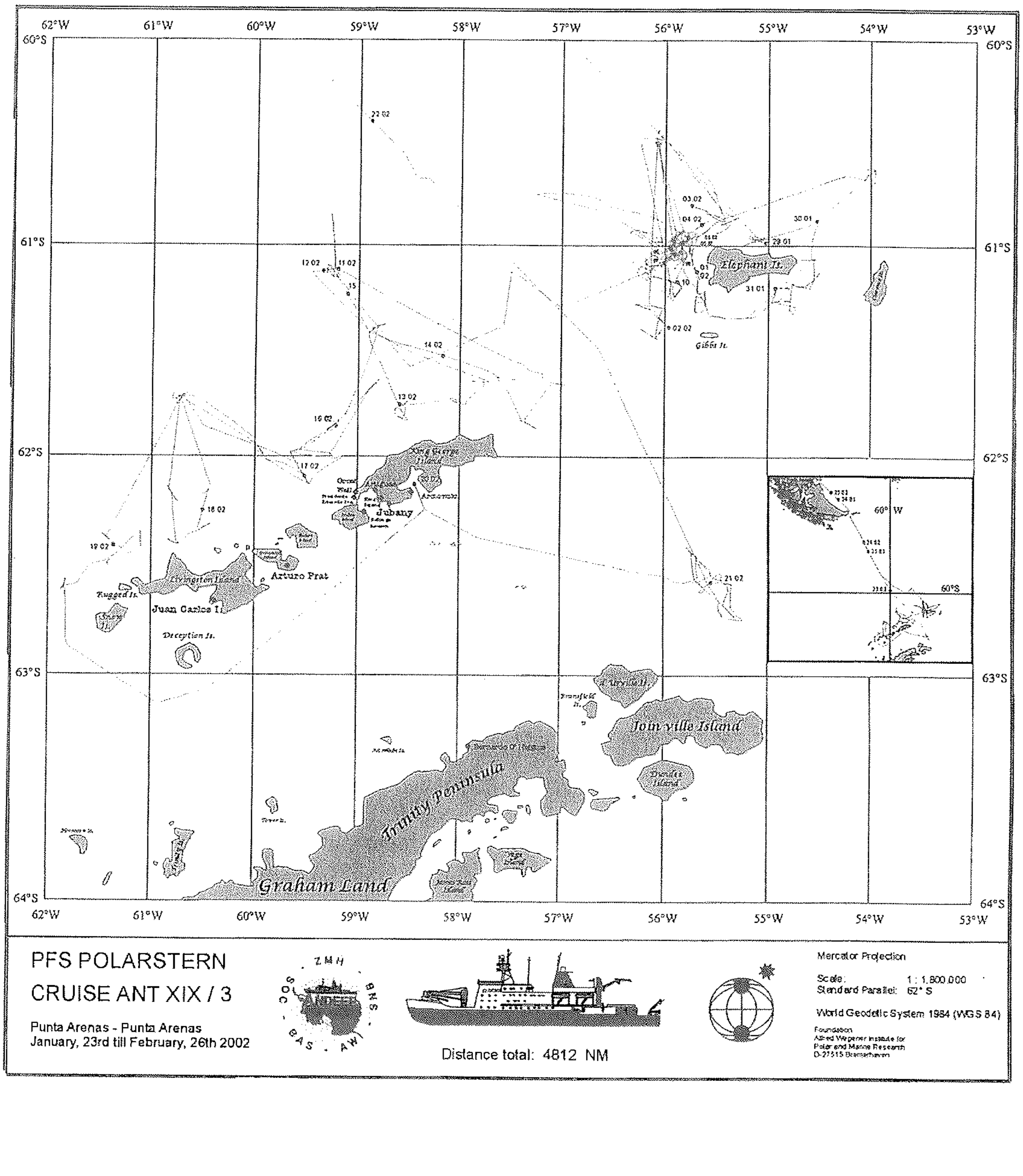

Fig. 1.1-1: Cruise track of RV POLARSTERN during Leg ANT-XIX/3 (ANDEEP I)

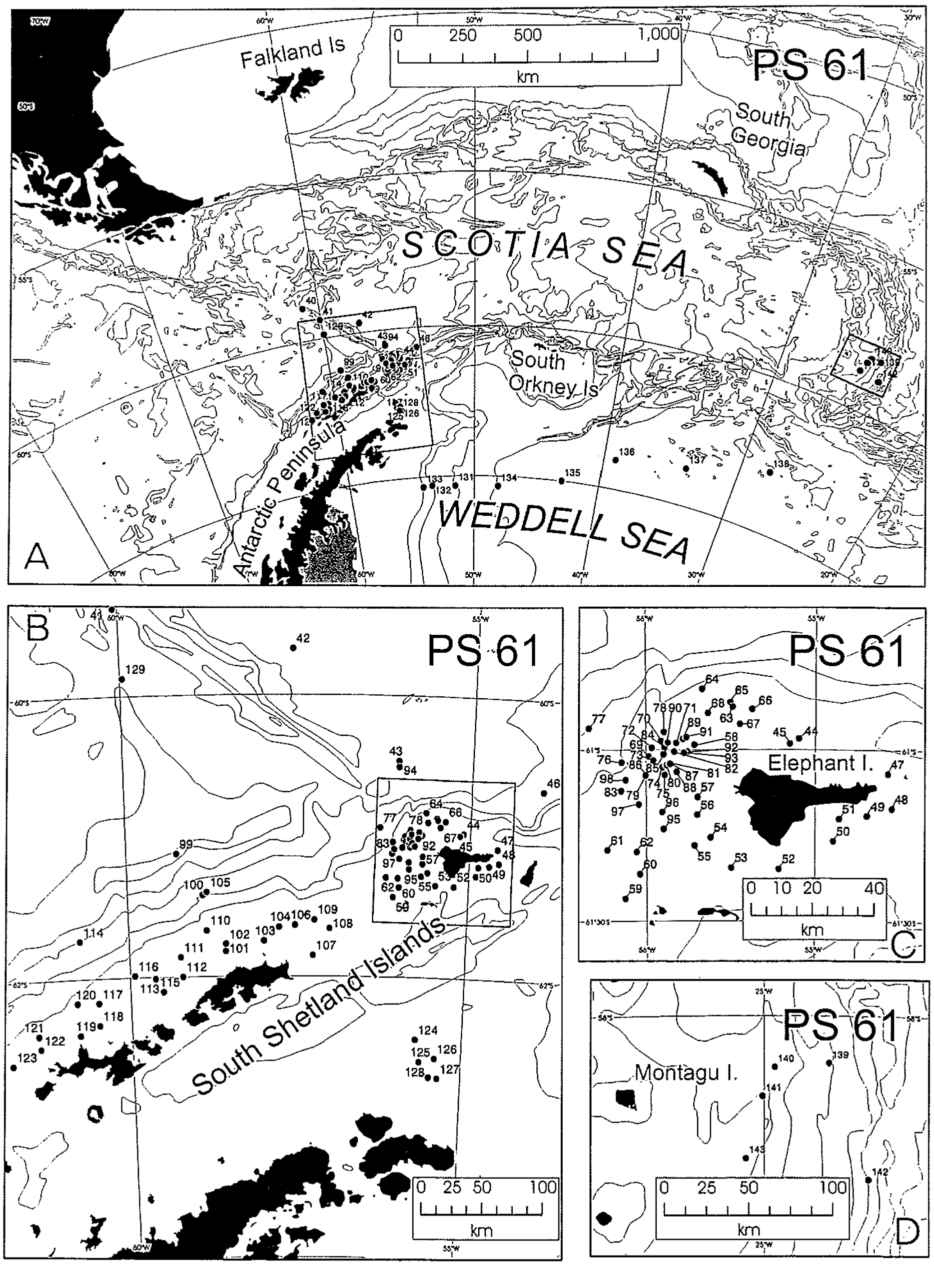

Fig. 1.1-2: Sampling location maps of RV POLARSTERN leg ANT-XIX/3 (ANDEEP I), areas A,B, and C and leg ANT-XIX/4 (ANDEEP II), areas A and C. Complete location identification consists of cruise/expedition number PS61 (for ANT-XIX) and consecutive location numbers, e.g. PS61/40. It can be complemented by a number for gear deployment (see Appendix A). Map by courtesy of Paul Cooper, British Antarctic Survey. For POLARSTERN cruise tracks of ANT-XIX/3 and ANT-XIX/4 see Figures 1.1.-1 and 1.2-1 respectively.

After termination of the fishing programme north of d'Urville Island late in the evening of February 21, POLARSTERN steamed north heading for Punta Arenas. During the night of February 22/23, north of 60 degree latitude south in the deep sea west of the Shackleton Fracture Zone (Fig. 1.1-2, A and B) the remaining time was used to sample a final deep-sea station for the ANDEEP project.

As planned, POLARSTERN terminated Leg ANT-XIX/3 early in the morning of February 26 at Catalina pier of Punta Arenas.

1.1.1 Meteorological conditions during ANT XIX/3

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Leaving Punta Arenas on January 23 RV POLARSTERN encountered calm and sunny weather caused by high pressure over Patagonia which slowly moved east. At Le Maire Strait a first cold front passed being part of a low over the Pacific.

In the northern parts of the Drake Passage the prevailing westerly winds force 7 ceased due to temporary high pressure influence between Patagonia and the Weddell Sea giving way to relatively calm but cloudy weather when Elephant Island was approached. Only on January 31 the clouds dissolved and the island's beauty could be admired. The following days clouds and fog dominated the weather.

On February 5 the spell of calm weather ended when RV POLARSTERN was affected by the frontal system of a gale force low. For some hours the wind reached Bft 9 with wave heights of six meters. A similar situation with slightly less wind occurred on February 7 followed by a period of moderate northwesterly air flow induced by small lows moving from the Pacific to the Weddell Sea.

On February 10 RV POLARSTERN moved to a position north of King George Island. During the next days cold air caused massive convection with showers. On February 15 the frontal systems of a low near Amundsen Sea passed the South Shetland Islands. With a temperature range of 2-4°C rain fell quite often until February 18 but during this time the wind reached forces of Bft 8 only once and for a short time. Later, higher pressure led to calmer but foggy weather.

During the routine life boat exercise on February 20 at Admirality Bay (King George Island) a secondary low caused rain and snow and later winds of force Bft 8. During the next day the weather brightened up just in time for stunning views on marvellous icebergs near d'Urville Island. On the way back to Punta Arenas high pressure prevailed at the beginning. In the northern parts of the Drake Passage, however, another gale force low passed with northerly winds of force Bft 8 to 9.

In summary, the weather during Leg ANT-XIX/3 was quite close to what could be expected from general climate values.

1.2 Itinerary of Leg ANT-XIX/4 / ANDEEP II

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RV POLARSTERN started for Leg ANT-XIX/4 - somewhat later than initially scheduled - in the late evening of February 28 from Catalina pier of Punta Arenas, Chile. An international team of 44 scientific participants from 13 countries Australia, Belgium, Denmark, Germany, Italy, The Netherlands, New Zealand, Norway, Russia, Spain, Switzerland, United Kingdom and United States, some newly embarked, a number continuing from the previous Leg ANT-XIX/3 and 43 crew were looking for new challenges. Leg ANT-XIX/4 had a very focused programme concentrated almost exclusively on sampling for the ANDEEP project in Target Areas 3: the eastern continental margin of the Antarctic Peninsula; Target Area 4: northern Weddell Sea, and Target Area 6: South Sandwich Trench (see Fig. 3-1).

As we approach La Maire Strait we meet the US research vessel LAWRENCE GOULD and a little bit later the NATHANIEL PALMER on their way back from successful cruises to Punta Arenas. Reaching the open sea POLARSTERN set course for a position in the deep-sea of the southern Ona Basin, east of the Shackleton Fracture Zone where on the previous leg a moored baited amphipod trap system of the Belgian team (SNB) could not be recovered (Fig. 1.2-1). Since approaching this position did not need strong deviation from the direct course for the Antarctic Sound it was agreed to have another attempt to recover the trap. Late in the afternoon on March 3 POLARSTERN arrived on site. All attempts to release the system were unsuccessful and since weather condition and visibility got worse the system was given up and the ship headed directly for Antarctic Sound.

The Antarctic Sound was passed on March 4 hiding is beautiful landscape in thick clouds and heavy snow fall. Later the day bathymetric profiling across the continental slope into the northern Weddell Basin (see Target Area 3 in Fig. 3-1) started for the Belgian team of SNB to identify locations suitable to run the Agassiz trawl properly (Fig. 1.2-1). The next days up to March 7 the continental margin was sampled from east to west at depths of 3000 m, 2000 m, and 1000 m respectively using the same devices routinely as during Leg ANT-XIX/3 (ANDEEP I): Sediment Profile Imaging (SEP), Epibenthos Sledge (EBS), Agassiz trawl (AGT), Large Box Corer (GKG), MultiCorer (MUC), and Amphipod traps (ATC) at selected sites.

On March 8 sampling along a west to east transect through the northern Weddell Sea (see Target Area 4 in Fig. 3-1) was started. Sampling was carried out at about 4000 m, 4500 m, 4750 m, 5000 m, and again 4500 m water depth. Station time on each location was about 30 to 40 hours. Sampling along this transect lasted until March 17.

A quick transit to the north led POLARSTERN on March 19 to the tectonically active South Sandwich Islands region, the Target Area 6 of ANDEEP. East of the huge ice-covered volcanic cone of Montagu Island a composite profile transect of five stations between water depths of ~800 m and 6300 m were sampled after extensive bathymetric surveys to identify suitable sampling locations. The volcanically structured sea bottom and the unusual volcanic derived sediment made this area a very unique one. Sampling in this area was finished in the late afternoon of March 25 and without delay POLARSTERN left this remote archipelago on a direct course for Punta Arenas where this successful cruise terminated as scheduled on April 1, 2002.

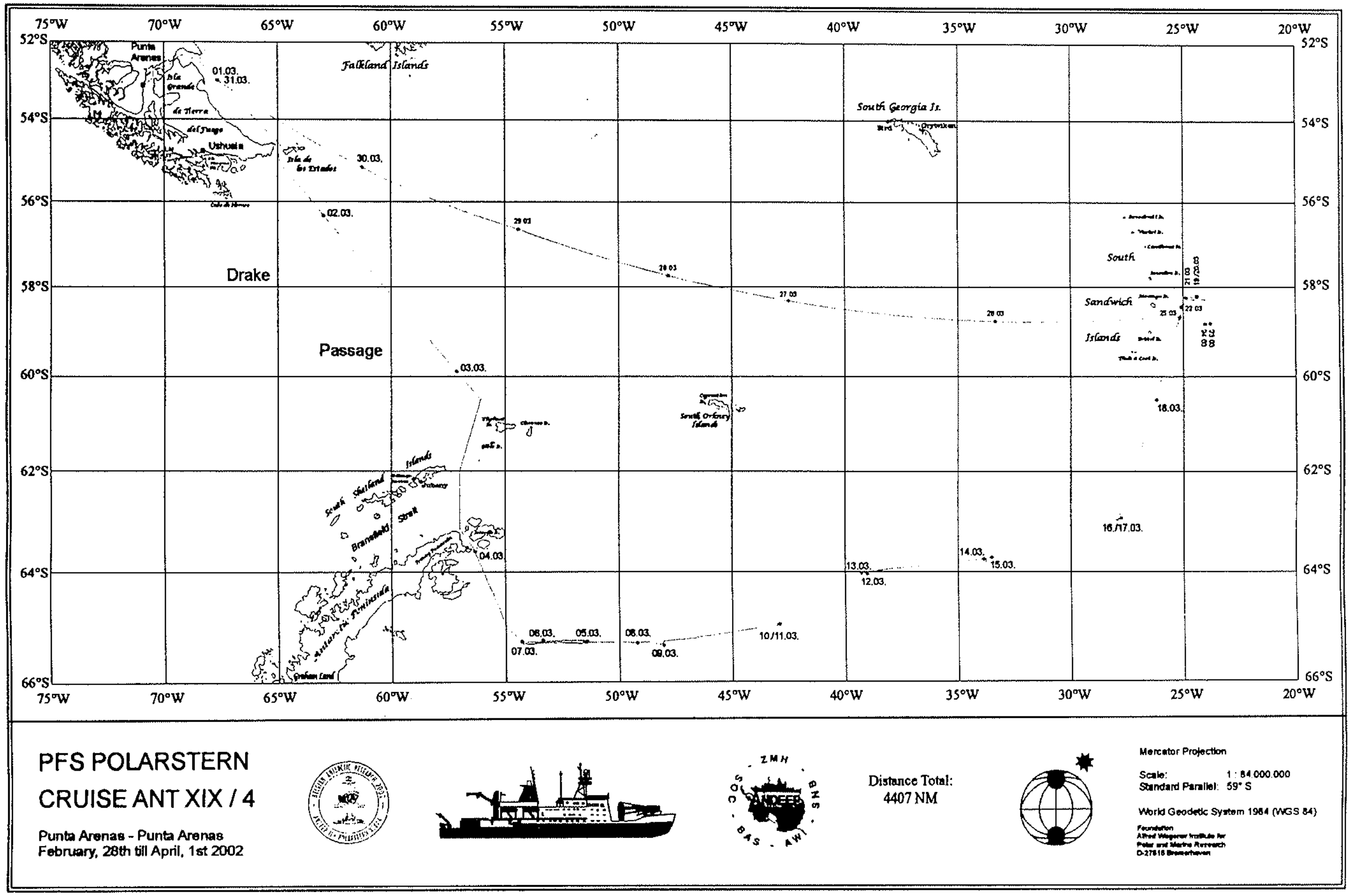

Fig. 1.2-1: Cruise track of RV POLARSTERN during Leg ANT-XIX/4 (ANDEEP II). For sampling locations see Figure 1.1-2 (A and D).

1.2.1 Weather conditions during Leg ANT-XIX/4

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Passing the Drake Passage and the Antarctic Sound on the first days of March, the weather was dominated by a low pressure system over the south-eastern Pacific. Mostly weaken frontal troughs crossed the area with northerly winds of about Bft 6. On March 5 slight high pressure influenced the north-western Weddell Sea. The wind shifted to east and decreased to Bft 5. Some troughs of a new giant low over the southeast Pacific crossed the Drake Passage. Leeward of the Antarctic Peninsula smaller lows developed and moved to southeast.

At the beginning of the 2nd decade of march the pacific low filled but a new gale centre was build up south of the South Orkney Islands. Passing a frontal trough the easterly wind increased - in combination with a sea up to 5 m - to more than 20 m/s in the morning of March 11. Coming close to the centre, the wind decreased very quickly to 12 m/s. Next days the gale moved very slowly to northeast and crossed the Scotia Sea at March 13. A weaken gradient weather situation appeared at the Weddell Sea for some days.

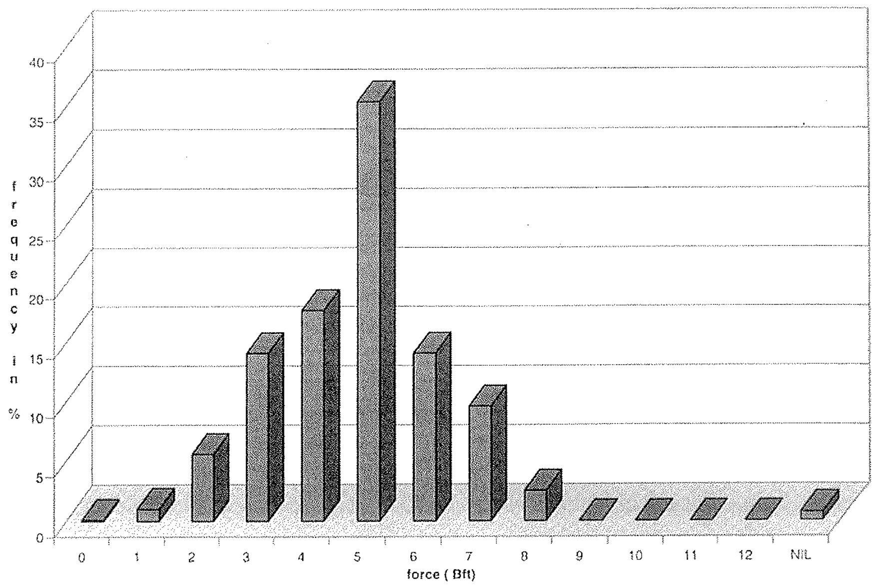
At March 15 a low crossed South America and moved along 50°S to east with subtropical warm air at its front side. In the following days more and more cold air flew on its back. This caused a heavy gale centre at the Scotia Sea at March 18. The formation of the storm was finished the next day but at the research area east of the South Sandwich Islands wind increased only for some hours up to 20 m/s. The low dissipated quickly but a new low formed several hundred miles downstream.

Because of rising pressure over the South Atlantic a meridian high pressure zone reaching from Falkland Island to Dronning Maud Land appeared. It moved to east and influenced the weather at March 21 and March 22 with light to moderate southerly wind. The wind changed to northerly directions after the high pressure zone had passed the position of RV POLARSTERN.

The frontal system of a new low over the Scotia Sea moved to east, but was blocked near the South Sandwich Islands. Because of the great pressure gradient the wind increased up to Bft 8 with a sea state up to 6 m. The low dissipated to several centres and the wind decreased at March 25 down to Bft 5 after the trough had passed.

At the beginning of the transit to Punta Arenas RV POLARSTERN passed the centre of a low that moved across the eastern Scotia Sea to the south. As the result of the intensifying low over the central Weddell Sea and the build up of a subtropical high over the south-western Atlantic a strong zonal air stream set in covering the area from Drake Passage to South Sandwich Islands. RV POLARSTERN passed this zone with westerly gale up to Bft 8. The sea state came up to more than 6 m for a longer period.

At the end of the cruise both pressure forms moved to east and the gradient weakened remarkably so the wind decreased to Bft 5 or 6, but at the morning of 2003-10-21 a small sub synoptic low passed RV POLARSTERN directly. In a few minutes wind speed increased from 5 m/s up to 20 m/s, wind direction changed to south and temperature dropped from plus 3°C to minus 1°C. Later on the weather conditions improved again.



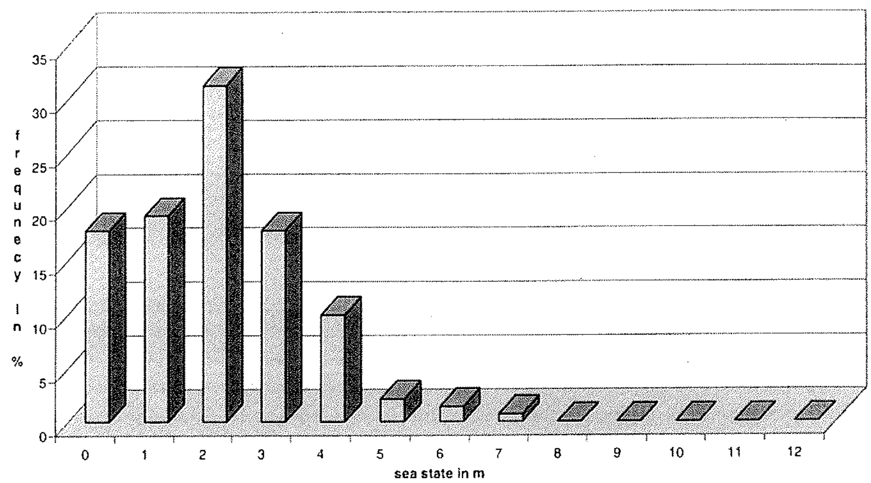


Fig. 1.2.1-1: Relative frequency distribution of wind force (Bft; top) and sea state (m; bottom) during Leg ANT-XIX/4; for cruise track see Fig. 1.2-1.

1.3 Multi-Axis-DOAS measurements of atmospheric trace gases for SCIAMACHY / ENVISAT validation

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In spring 2002, ESA Environmental Research Satellite ENVISAT is to be launched by an ARIANE 5 carrier. Among its instruments the SCIAMACHY spectrograph is designed to measure solar light reflected off the earth's surface and atmosphere in the visible and ultraviolet wavelength range. Employing the viewing geometries of nadir (straight down) as well as limb (through the atmosphere, directed towards the sun) the device will measure stratospheric and tropospheric columns of various trace gases important for the understanding of the atmosphere's chemistry. Among these gases are ozone, NO_2, gaseous H_2O, formaldehyde as well as halogene oxydes. The measurement technique applied is the Differential Optical Absorption Spectroscopy, DOAS, invented by U. Platt (Environmental Physics, Univ. Heidelberg). It uses the molecular absorption features unique to each of the species probed for to detect and gauge their spectral signatures in scattered solar light, and thus to conclude on their atmospheric columns.

During the first months of operation, a variety of instruments in various places will serve to validate SCIAMACHY's findings. Among them is the prototype of a Multi-Axis (MAX)-DOAS instrument installed on the upper fore deck of R/V POLARSTERN. Since ENVISAT will deploy on a polar orbit, its relative geographic position will change and also cover the polar regions. For this reason, the R/V POLARSTERN is a unique platform to perform measurements under comparable and representative conditions. It also provides the opportunity to gain access to areas where ground based data are sparse and/or hard to develop.

Since the sensitivity of measurements with scattered sunlight changes with viewing geometry, the use of multiple viewing directions (multiple axis) allows to increase the temporal and spatial information content. Two different spectrographs are set to measure visible and ultraviolet scattered sunlight. The former is collected by a moving telescope successively changing its elevation. For the latter a second instrument with nine fixed telescopes has been devised which are trained into different directions (elevations as well as azimutal angles).

Calibration, dark current and slit function information is obtained by calibration Hg, Ne and halogen lamps integrated into the telescope unit. Future designs of the instruments are to operate as autonomously as possible over periods from months to years. The task of the maintenance personnel of the MAX instrument is to collect experience with the system and to monitor the hardware and its response to e.g. the specific weather conditions encountered on a research vessel, to develop the control software in order to adapt to e.g. variations in light intensity and to develop concepts to overcome malfunctions with e.g. the moving parts exposed to wind and spray.

On ANT-XIX/3, the software for the VIS instrument was optimized in order to operate under rapidly varying light intensities, and to increase the number of data points per unit time by a factor of 25. Also difficulties with the telescope's moving parts and automatic adjustment were detected and overcome. Overall, the prototype instrument proved to be well hardened and its basic design well suited as basis for further developed apparatuses.

Since the final goal is to derive vertical profiles of the gaseous species measured, radiative transfer modelling has been developed parallel to the measurements. Their path of the light recorded, thus its sensitivity to a given trace gas layer's shape, extension and altitude is a function of a variety of parameters such as The model serves to reconstruct the path of the light entering the telescopes from the various directions through the different altitude layers with the trace gases contained therein, and thus to derive matrix elements to retrieve altitude distributions of the species from the measured data.

2 INVESTIGATIONS ON ANTARCTIC FISH

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ANT-XIX/3

Antarctic fish work during ANT XIX/3 comprised six main parts:
(1) Study of the composition and abundance of demersal fish stocks in the Elephant Island to South Shetland Islands region for stock assessment purposes as part of the Germany's contribution to the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR);
(2) Studies of the age and growth of selected Antarctic fish species;
(3) The mesoscale abundance of fish species and their food and feeding in a limited area ("Box") of 8 x 10 nm from depth of 100 to 300 m west of Elephant Island;
(4) Genetic studies of populations of selected Antarctic fish species;
(5) Electron microscopy and cytochemical analyses of eggs and spermatozoa of Antarctic fish and
(6) Pollutant loads in Antarctic fish of the Elephant Island to South Shetland Islands region.

The following net configuration was used:
A 140' (= 42.67 m) commercially-sized bottom trawl with a 20 mm meshed liner of 20 mm in the codend. The trawl has been the standard gear on all previous surveys since 1981. The dimensions of the trawl were 18-19 m width between the tips of the upper wings and 2.8-3.1 m height. In order to minimize destruction of benthic communities within the path of the trawl without reducing the catchability of the trawl for finfish, the ground tackle and the size of the otter boards were changed. The steel bobbins of the ground tackle were replaced by rubber disks of 60 cm diameter and the size and weight of the doors were reduced from 6.3 m^2 to 4.8 m^2 and from 1750 kg to 1500 kg. Due to these changes the tendency of the net to become hooked on the bottom was greatly reduced and the net suffered only minor damage during trawling. The benthos by-catch around Elephant Island was reduced from 9.76 tonnes in 1996 to 1.60 tonnes in 2002. It is recommended that the modified gear should continue to be used in the future.

2.1 The composition of the demersal fish fauna of the Elephant Island – South Shetland Islands region

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ANT-XIX/3

The Federal Research Centre for Fisheries in Hamburg, Germany has conducted research on the composition, abundance, biology and population dynamics of fish stocks in the southern Scotia Arc since 1975. One of the areas of particular interest has been the Elephant Island to South Shetland Islands region. From 1977/78 to 1989/90, fish stocks in the area have been exploited on a commercial scale by fleets from former Eastern Bloc countries. Target species were mackerel icefish (*Champsocephalus gunnari*) and marbled notothenia (*Notothenia rossii*), while other species, such as green notothenia (*Gobionotothenia gibberifrons*), Scotia Sea icefish (*Chaenocephalus aceratus*) and notothenia (*N. coriiceps*) formed the main by-catch species. Stocks of the target species were fished to very low levels within a few seasons. The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) closed the region for finfishing after the 1989/90 season (KOCK 1992). Since 1998, research was conducted in close cooperation with the Southwest Fisheries Science Centre of the National Marine Fisheries Service (NMFS) in La Jolla (California, USA) in order to follow the potential recovery of stocks closely. Results from these investigations form the basis for management decisions by CCAMLR at its annual meetings in Hobart, Australia as to whether and when the area should be reopened for finfishing.

Fishing was based on the same stratified random survey design utilized in the area since 1981. Sampling was restricted to areas where trawling was known to be suitable. A total of 50 hauls (30 around Elephant Island and 20 in the small-scale Elephant Island box) was conducted between 50 and 500 m depth around Elephant Island from 27 January to 10 February 2002 (30 hauls) and around the South Shetland Islands from 13 February to 19 February (20 hauls). More emphasis was put on the 100-400 m depth range while comparatively few hauls were conducted in the 50-100 m and in the 400-500 m depth range. In addition to the survey a small-scale box of 8x10 nm size west of Elephant Island between 100 and 300 m was sampled by 20 hauls in order to investigate the meso scale distribution of fish species in the area. The location of fishing stations is shown in Figures 2.1-1a and 2.1-1b. In order to take into account the diurnal migration pattern of Antarctic fish, trawling was conducted only during daylight hours when fish are known to concentrate on the bottom. With a few exceptions when rough bottom conditions necessitated earlier hauling, towing time was 30 minutes on the bottom. Hauls of less than 20 minutes duration were considered invalid. A SCANMAR system was used to monitor the ground tackle to ensure that continuous contact with the bottom was maintained.

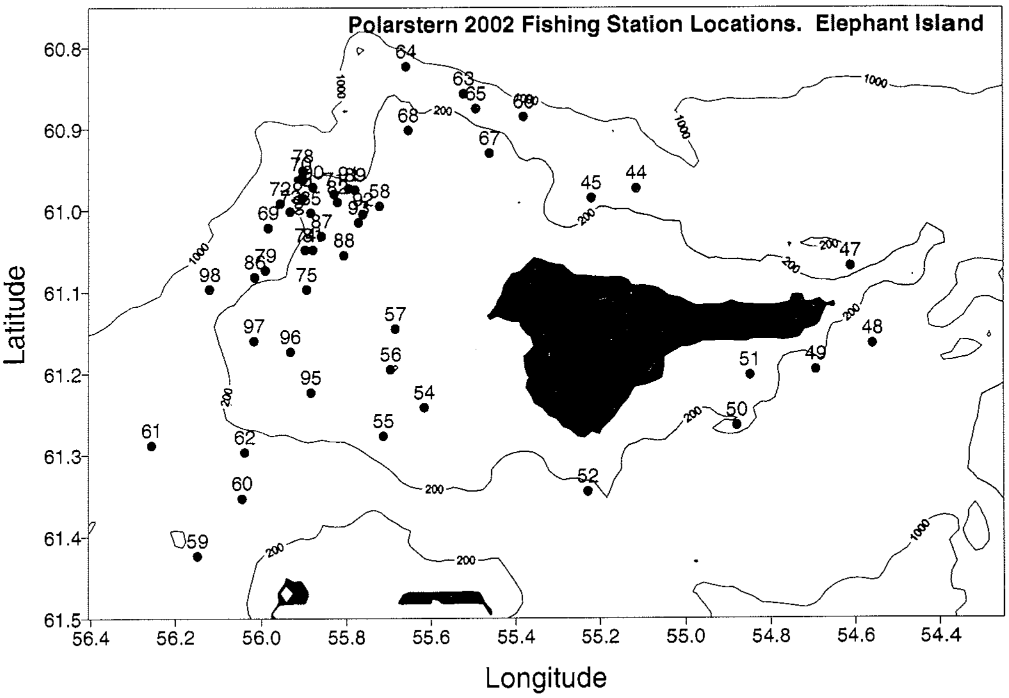

Fig. 2.1-1a: Map of fishing stations around Elephant Island in January - February 2002 (ANT-XIX/3)

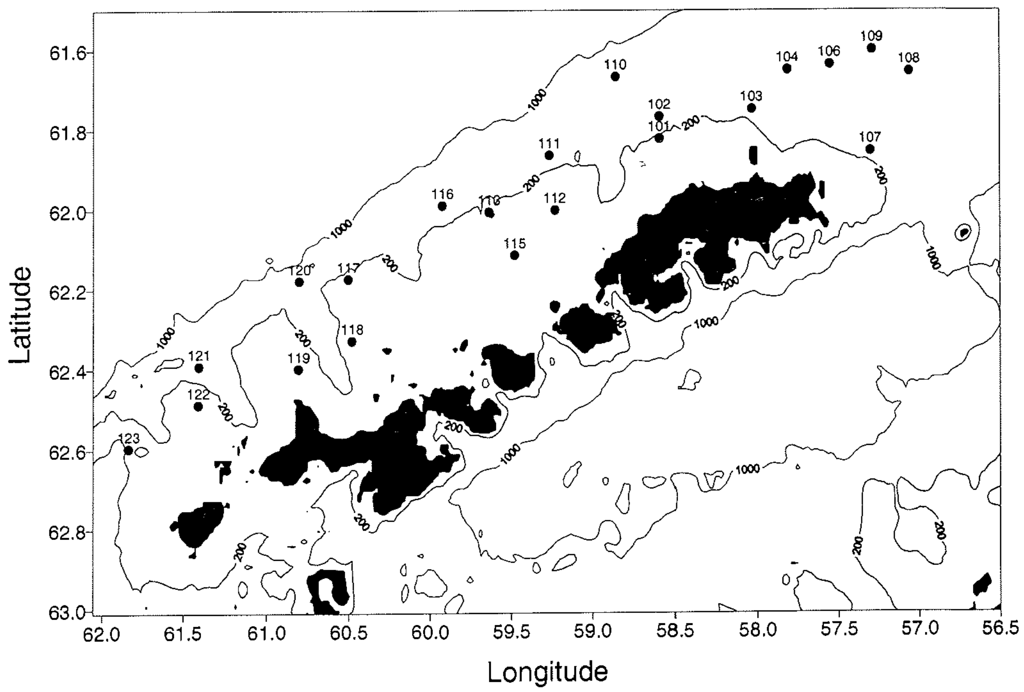

Fig. 2.1-1b: Map of fishing stations around south Shetland Islands in January - February 2002 (ANT-XIX/3)

Family	Species	Elephant Island	S. Shetland Isls
Nototheniidae	*Dissostichus mawsoni*	regular	
	Notothenia rossii	common	common
	N. coriiceps	common	common
	Gobionotothenia gibberifrons	common	common
	Lepidonotothenia larseni	common	common
	L. squamifrons	common >250 m	common >250 m
	L. nudifrons	common, <250 m	common, <250 m
	Trematomus eulepidotus	regular	regular
	T. bernacchii	rare	rare
	T. hansoni	rare	rare
	T. loennbergii	rare	
	T. scotti	rare	
	Pleuragramma antarcticum	rare, >300 m	
Harpagiferidae	*Harpagifer antarcticus*	rare, <100 m	
Artedidraconidae	*Pogonophryne spec.*	rare	rare
Bathydraconidae	*Parachaenichthys charcoti*	regular, <200 m	regular, <200 m
	Gerlachea australis	rare	rare
	Racovitzia glacialis	rare	
Channichthyidae	*Champsocephalus gunnari*	common, <300 m	common
	Chaenocephalus aceratus	common	common
	Chionodraco rastrospinosus	common, >200 m	common
	Pseudochaenichthys georgianus	common	common
	Cryodraco antarcticus	regular	regular
	Chaenodraco wilsoni	rare	
	Pagetopsis macropterus	rare	rare
	Dacodraco hunteri	rare	
Rajidae	*Bathyraja sp. 2*	regular	regular
	B. maccaini	regular	regular
	B. eatonii	rare	rare
Muraenolepidae	*Muraenolepis microps*	regular	regular
Gempylidae	*Paradiplospinus gracilis*	rare	rare
Myctophidae	*Electrona antarctica*	regular, >300 m	regular, >300m
	E. carlsbergi	rare	
	Protomyctophum bolini	rare	
	Gymnoscopelus nicholsi	regular, >300 m	regular, >300 m
Anotopteridae	*Anotopterus pharao*	rare	
Zoarcidae	*Ophthalmolycus amberensis*	regular	regular
	Pachycara brachycephalum	rare, >300 m	rare, >300m
Liparididae	*Paraliparis tribolodon (?)*	rare	

Tab. 2.1-1: List of species caught in the course of the bottom trawl survey around Elephant Island and the South Shetland Islands and their status (common, present on more than 30 % of all hauls, regular, present in 5-30 % of the hauls, rare, present in less than 5 % of the hauls).

Catch composition of each tow was recorded in terms of weight and number of individuals per species. The by-catch of benthos was recorded in terms of weight. The qualitative composition of the benthos was noted

The Elephant Island region was covered by 30 hauls while 19 hauls were done in the South Shetland Islands between King George Island in the east and Livingston Island in the west (Figs. 2.1-1a, 2.1-1b). Catch composition was similar during all surveys since the second half of the

1980's. Totals of 39 species and 27 species were taken around Elephant Island and the South Shetland Islands respectively (Tab. 2.1-1).

Two ichthyo-faunal elements mix in the southern Scotia Arc: the low-Antarctic and the high-Antarctic fauna. The most common species were *G. gibberifrons*, *C. aceratus*, *C. gunnari*, *L. larseni*, *N. rossii*, *N. coriiceps* and *C. rastrospinosus*. With the exception of the latter species, all other species were of low-Antarctic origin. The number of species in the catch usually increased towards deeper waters (>300 m) when the number of high-Antarctic species increased in the catch. Consequently, the stations with the largest number of species in the catch were those in the peripheral parts of the shelf. Below 300 m, the myctophid *Gymnoscopelus nicholsi* was of some importance. Typical shallow water species which hardly occurred below 200 m depth were *Harpagifer antarcticus*, *Parachaenichthys charcoti* and *Lepidonotothenia nudifrons*. Deep-water species which were only found below 200 m were *Lepidonotothenia squamifrons*, whose blood probably lacks antifreeze glycoprotein in their blood, *Chionodraco rastrospinosus* and all high-Antarctic species. *G. gibberifrons*, *C. aceratus*, *N. coriiceps*, *N. rossii* and *L. larseni* were ubiquitous at all depth ranges between 120 and 400 m. Their habitat preference and thus abundance is probably primarily effected by sediment type and structure, bottom topography and benthic communities.

In *N. rossii*, we only detected the recruiting part of the population, i.e. fish of 34-50 cm. The adult stock, which was known to occur in a limited area to the north of Elephant Island at 220-320 m depth in the 1970's, was severely depleted by commercial fishing in 1979/80 (KOCK 1992). The stock should have recovered to some extent in the meantime. It is unknown at present where the adult part of the population occurs. A search for this stock at or close to the previous fishing ground to the north of the island is recommended.

Fish abundance was largest in the area (8x10 nm) selected for a study on the meso scale distribution of fish species. Fish concentrated along the 200 m depth contour (Figs. 2.1-2, 2.1-3). Variability in yield in the small scale area was similar to that on the whole shelf. Fish concentrations consisted either of *C. gunnari* or *G. gibberifrons* but never of both species. The depth distribution of *C. gunnari* was related to size class, with smaller individuals found in shallower water and size increased with increasing depth. *C. gunnari* fed almost entirely on krill while *G. gibberifrons* took a variety of bottom organisms and some krill.

Fish density in the lower South Shetland Islands was less than at Elephant Island. However, the biggest catch was taken to the northeast of King George Island where 3.9 tonnes/30 min were taken. 3.1 tonnes consisted of *N. coriiceps* while the remainder consisted primarily of *G. gibberifrons*, *C. gunnari*, *C. aceratus* and *N. rossii*. This catch was taken on the same position where 1 and 1.5 tonnes/30 min were already caught in 1998 and 2001.

Kock, K.-H. (1992): Antarctic fish and fisheries.- Cambridge University Press, Cambridge, U.K., 359 pp.

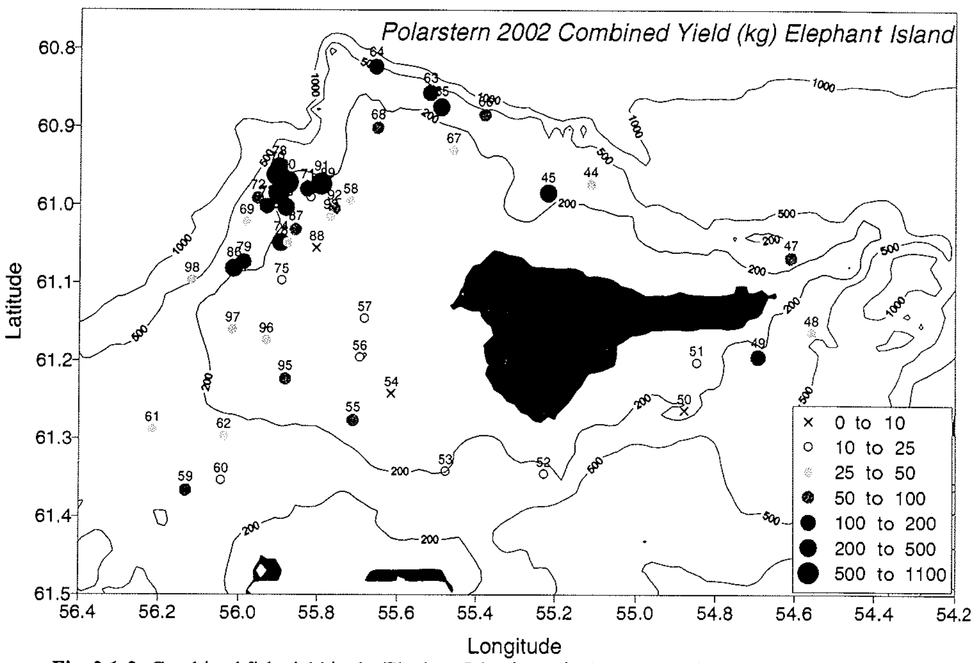

Fig. 2.1-2: Combined fish yield in the Elephant Island area in January – February 2002 (ANT-XIX/3)

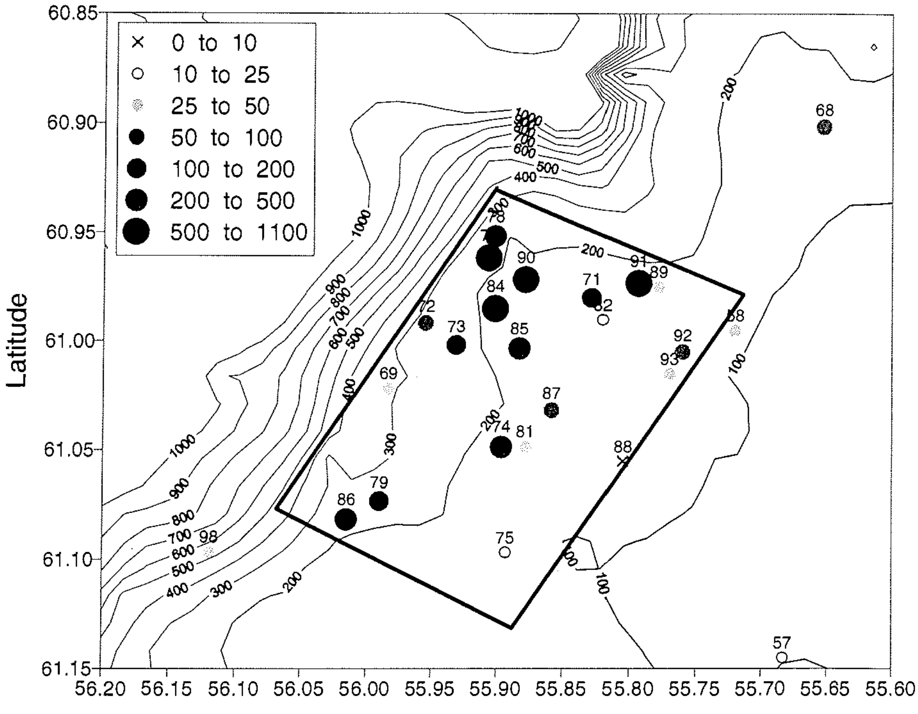

Fig. 2.1-3: Combined fish yield in the Elephant Island Box in February 2002 (ANT-XIX/3)

2.2 Biological characteristics of Antarctic fish species in the Elephant Island – South Shetland Islands region

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ANT-XIX/3

Knowledge of the biological characteristics of Antarctic demersal fish stocks has increased substantially in the last 10-15 years. Basic biological features, such as reproduction and food and feeding (in qualitative terms) are now relatively well understood. Quantitative food studies, however, are still limited to the summer/autumn and early winter period. Age and growth, however, are still poorly understood (KOCK & EVERSON 1997). Investigations were confined to marbled notothenia (*Notothenia rossii*), mackerel icefish (*Champsocephalus gunnari*) and several inshore species (KOCK & EVERSON 1997). Extensive additional collections of otoliths for further age studies have been made in 2001 and during this cruise (see below). A summary of knowledge on biological characteristics of demersal fish in the southern Scotia Arc is currently under review (KOCK & JONES 2002). We present here first results of observations conducted during ANT-XIX/3. Most samples have to be investigated in the lab in Hamburg.

Length were recorded (total length to the nearest cm below in all species except myctophids where standard length in mm was measured), sex, and maturity (five point scale, KOCK & KELLERMANN 1991) for each individual caught and total weight (in g) from 200-400 individuals per species. Gonad weight was collected for individuals in maturity stage 3. Food habits of *C. gunnari* and *C. aceratus* were studied in detail and on a broader scale in other species, such as *C. rastrospinosus* and *N. rossii.* Samples of *Gobionotothenia gibberfrons*, *Champsocephalus gunnari* and *Lepidonotothenia larseni* were collected in a small study area of 8x10 nm to the west of Elephant Island between 100 and 300 m depth in order to study diet composition and its changes on a small geographical scale.

Length compositions of the abundant fish species were consistent with earlier observations obtained during the cruises in 1996, 1998 and 2001 that no or very little illegal fishing has taken place in the region since CCAMLR closed the southern Scotia Arc region (CCAMLR Subareas 48.1 and 48.2) for finfishing after the 1989/90 season. A number of large fish of species of potential commercial importance, such as *G. gibberifrons*, *N. coriiceps*, *C. aceratus* and *C. rastrospinosus*, were found close to their maximum sizes. These individuals would likely not have been present in the catches if the region were fished regularly.

The developmental stage of gonads was investigated in most fish species. In a number of species, such as *G. gibberifrons*, *L. larseni*, *C. gunnari* and *P. georgianus*, gonads were observed to be in resting stage. The size of the gonads did not exceed 2-3 % in females and 1 % in males. It is likely that these species will not spawn before the austral winter. Gonads in other species, such as *N. coriiceps* and *C. aceratus*, exhibited gonado-somatic indices of 4-7 % in females which suggest that they spawn from late April to June. Some species, such as *C. rastrospinosus*, *Trematomus eulepidotus*, *C. antarcticus* and *L. nudifrons*, were further advanced in their developmental stage. Most *C. rastrospinosus* are likely to spawn in March and at the beginning of April. *T. eulepidotus* and *C. antarcticus* are likely to start spawning from mid/late March onwards. *L. nudifrons* begins spawning in April. The developmental stage of *L. squamifrons* indicated that the species had started spawning already. A number of spent females were observed.

Food analyses were mostly confined to several icefish species. *C. gunnari* was mostly concentrated in the box west of Elephant Island, where they fed entirely on krill. Krill was again the primary food item in the South Shetland Islands with a small proportion of the hyperiid *Themisto gaudichaudii*. *C. aceratus* and *C. antarcticus* up to 30-35 cm took mostly krill and to a lesser extent mysids (*Antarctomysis maxima*). Older individuals fed solely on fish entirely. As in previous studies 60-80 % of the stomachs of both species were empty. Regurgitation is a possible explanation. However, in most cases the stomach wall was not extended, which suggested that the stomach was empty and not regurgitated. Other icefish species, such as *P. georgianus* and *C. rastrospinosus*, preyed on krill and fish (both notothenioids and mesopelagic fish) in both areas.

Kock, K.-H. & Kellermann, A. (1991): Reproduction in Antarctic notothenioid fish - a review.- Antarctic Sci. 3: 125-150.

Kock, K.-H. & Everson, I. (1998):Age, growth and maximum size of Antarctic notothenioid fishes – revisited.- In: G. DI PRISCO, E. PISANO & A. CLARKE (eds), Fishes of Antarctica,. A Biological Overview, Springer Verlag, Italia, 29-40.

Kock, K.-H. & Jones, C.J. (2002): What do we know about demersal fish stocks in the southern Scotia Arc region? A Review and Prospects for Future Research.- Reviews in Fisheries Science (in press).

2.3 Fishing off D'Urville Island at the tip of the Antarctic Peninsula

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The area off Joinville and D'Urville Islands at the tip of the Antarctic Peninsula in Bransfield Strait has been fished by commercial vessels from Poland and the ex-Soviet Union at least in 1979/80, when CCAMLR was still being negotiated. CCAMLR entered into force in 1982. More than 4000 tonnes of the icefish *Chaenodraco wilsoni* have been reported to FAO as being taken by Poland in that season. Russian vessels were known to have fished in the area but catches have never been recorded in published statistics. No further information appears to exist from this fishery. This cruise provided us with the first opportunity to revisit this fishing ground. Due to the lack of time we could only fish for one day. Due to time restraints only one day of fishing was possible. It was decided that fishing should be carried out over a limited depth range of 140-250 m in order to save steaming time between stations.

Length (total length to the nearest cm below in all species), sex, and maturity (five point scale, KOCK & KELLERMANN 1991) were recorded for each individual caught and total weight (in g) for a subsample of each species. Gonad weight was taken for individuals in maturity stage 3. Detailed diet analysis was conducted for *Chaenodraco wilsoni* and *C. rastrospinosus*.

The area appears to be a transition zone between the low- and high-Antarctic ichthyofauna. Low-Antarctic species were only represented by five species, all of them members of the family Nototheniidae (Tab. 2.3-1). *G. gibberifrons* and *L. nudifrons* were the most abundant species. Low-Antarctic channichthyids which are still abundant at Elephant Island and the lower South Shetland Islands, were absent. Low-Antarctic species were still dominant in terms of biomass. High-Antarctic species made up the major part of the species inventory (Tab. 2.3-1). Their proportion in terms of biomass was substantially higher than in the southern Scotia Arc. However, *C. rastrospinosus*, *T. eulepidotus* and *T. newnesi* were the only species of equal importance to the low-Antarctic species.

Species	low – Antarctic origin	high - Antarctic origin
Nototheniidae		
Gobionotothenia gibberifrons	common	
Notothenia coriiceps	common	
N. rossii	regular	
L. nudifrons	common	
L. larseni	regular	
Trematomus bernacchii		common
T. hansoni		regular
T. eulepidotus		common
T. newnesi		common
T. centronotus		rare
T. nicolai		rare
Channichthyidae		
Chionodraco rastrospinosis		common
Chaenodraco wilsoni		common
Pagetopsis macropterus		common
Bathydraconidae		
Parachaenichthys charcoti		regular
Gymnodraco acuticeps		common
Artedidraconidae		
Artedidraco skottsbergi		regular
Rajidae		
Bathyraja maccaini		regular
B. eatonii		rare

Tab. 2.3-1: Species composition off Joinville – D'Urville Islands between 140-250 m (classification see KOCK et al., this vol.).

C. wilsoni had either gonads which were spent or had finished the resorption process and were in resting stage. This confirms earlier observations that the species is likely to spawn in the Peninsula region in November to early December. *C. rastrospinosus* had developing gonads similar in size to those which were observed in the Elephant Island – South Shetland Island region. *Artedidraco skottsbergii* was found to be close to spawning. Several ovaries were collected for fecundity studies and the determination of oocyte size. *C. wilsoni* fed entirely on krill. Most stomachs of *C. rastrospinosus* were empty. The few individuals with full stomachs had fed on krill and fish.

2.4 Electron microscopy und cytochemical analyses of eggs and spermatozoa of Antarctic fish

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Studies of the oogenesis and the spermatogenesis of Antarctic fish to date have been conducted only by light microscopy and have focussed on only a few species (BUTSKAYA & FALEEVA 1987, CALVO et al. 1992, SHANDIKOV & FALEEVA 1992). A detailed electron microscopy and cytochemical study has never been conducted. Most specimens collected on a former cruise (ANT-XIV/2 in 1996) were later found to be unsuitable for a study of this kind as the preservation of the material proved to be unsatisfactory. For that reason, new material was collected during ANT-XIX/3.

Work focussed on the following subjects:
(1) The first description of the spermatogenesis of a number of species of the notothenioid families Artedidraconidae, Bathydraconidae, Channichthyidae and Nototheniidae using transmission electron microscopy (TEM). Particular emphasis was placed on the collection of mature spermatozoa, as this is important for phylogenetics as well.
(2) Investigation of the oogenesis from the oogonia to the ova undertaken by TEM on selected species of the families Nototheniidae and Channichthyidae.
(3) The analysis of the zona radiata (egg envelope) by histo- and cytochemical methods. The principal aim of this study was to look for neutral and acid mucopoly - saccharides which attach the eggs to different substrata. The presence or absence of these substances provides evidence as if eggs are benthic or pelagic (compare RIEHL & PATZNER 1998).
(4) The formation of the zona radiata to the bstate of complete differentiation as observed by TEM. Structure and thickness of the zona also provides information on the spawning mode and here by gives an indication as to the hitherto unknown location of spawning grounds.

Tissue from the ovary and testis was collected from 13 species (Tab. 2.4-1) in order to study spermatogenesis, oogenesis and formation of the zona radiata in the egg. Tissues were preserved in different glutaraldehyde solutions with and without sucrose, in formaldehyde and, for special purposes, in 70 % ethanol. For SEM purposes the material was also preserved in buffered glutaraldehyde and formaldehyde solutions. The specimens were treated with Alcian blue and the PAS method to detect mucopolysaccharides in the zona radiata externa. TEM, SEM and cytochemical studies will be carried out at Düsseldorf University following this cruise.

Species for studies on oogenesis, formation of zona radiata and cytochemistry	Species for studies on Spermatogenesis	Species for SEM study
Chaenocephalus aceratus	*Chaenocephalus aceratus*	*Chaenocephalus aceratus*
Chionodraco rastrospinosus	*Champsocephalus gunnari*	*Champsocephalus gunnari*
Cryodraco antarcticus	*Chionodraco rastrospinosus*	*Chionodraco rastrospinosus*
Dissostichus mawsoni	*Cryodraco antarcticus*	*Cryodraco antarcticus*
Gobionotothenia gibberifrons	*Dissostichus mawsoni*	*Notothenia coriiceps*
Lepidonotothenia larseni	*Gobionotothenia gibberifrons*	*Notothenia rossii*
Lepidonotothenia nudifrons	*Lepidonotothenia larseni*	*Paraliparis tribolodon*
Lepidonotothenia squamifrons	*Lepidonotothenia nudifrons*	
Notothenia coriiceps	*Lepidonotothenia squamifrons*	
Notothenia rossii	*Muraenolepis microps*	
Paraliparis tribolodon	*Notothenia coriiceps*	
	Notothenia rossii	

Tab. 2.4-1: List of species collected.

Butskaya, N.A., & Faleeva, T.I. (1987): Seasonal changes in the gonads and fecundity of Antarctic fishes *Trematomus bernacchii, Trematomus hansoni* and *Pagothenia borchgrevinki* (Nototheniidae).- Vopr. Ikhtiol. 14: 114-123.
Calvo, J., Morriconi, E., Rae, G.A. & San Roman, N.A. (1992): Evidence of protandry in a subantarctic notothenid *Eleginops maclovinus* (Cuv. & Val., 1830) from the Beagle Channel, Argentina.- J. Fish Biol. 40: 157-164.
Riehl, R & Patzner, R.A. (1998): Minireview: The modes of attachment in the eggs of teleost fishes.- Ital. J. Zool. 65 (Suppl. 1): 415-420.
Shandikov, G.A. & Faleeva, T.I. (1992): Features of gametogenesis and sexual cycles of six notothenioid fishes from East Antarctica.- Polar Biol. 11: 615-621.

2.5 Age and growth in notothenioid fish around the South Shetland Islands

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ANT-XIX/3

The composition of the coastal fish fauna around Elephant Island and the lower South Shetland Islands is of particular interest for age and growth studies for two main reasons: Firstly, very few data on this topic have been reported to date, except for some species that are (or have been, in the past) heavily exploited, such as *Champsocephalus gunnari*, *Gobionotothenia gibberifrons*, *Notothenia coriiceps* and *Notothenia rossii* (FREYTAG 1980, TOMO & BARRERA-ORO 1986, BARRERA-ORO 1988, KOCK 1990, BARRERA-ORO & CASAUX 1992, BARRERA-ORO & CASAUX 1996). As has been stated previously, the fish are also interesting from a faunistic point of view, as two ichthyofaunal elements overlap in this area, namely the low- and the high-Antarctic ichthyofauna. The latter is only present in small quantities (KOCK & STRANSKI 2000). For this reason, it is important to study longevity and growth rates of species of the two faunal elements in order to compare different life strategies. In addition, age and growth data of some high-Antarctic fish species collected off the South Shetland Islands, such as *Chionodraco rastrospinosus*, *Cryodraco antarcticus*, *Trematomus eulepidotus* and *Dissostichus mawsoni*, will be compared with those of similar or the same species occurring in Terra Nova Bay, Ross Sea. The possibility of comparing growth estimates in species with a wide range of distribution, from low - to high - Antarctic waters, could provide insight into the relationship between growth rates and environmental conditions. In collecting otolith samples, particular emphasis has been placed on the bathydraconids (for example *Parachaenichthys charcoti*), whose ecology is less well studied.

For each fish specimen, a set of standard measurements and biological parameters (total length, total weight, sex, stage of maturity) were recorded and entered into an ACCESS database. After dissection, the pairs of sagittal otoliths were collected, dried and stored in vials.

The study of age and growth by means of otolith readings will be conducted in the laboratory in Italy, following methods described in previous publications (VACCHI et al. 1992, LA MESA et al. 1996) and, if it is deemed necessary, new procedures for preparation will be developed. In addition, the study will be complemented by the addition of analyses of length composition and otolith microstructure of juvenile fish in order to validate age readings from adult fish.

Overall, 1034 otoliths were collected from seven notothenioid species. As previously mentioned, the less common and less studied species were selected for this study, with the aim of sampling as far as possible all the families of notothenioids in the area. Otoliths were therefore collected for the following species: *Parachaenichthys charcoti* (48), *Chaenocephalus aceratus* (358), *Chionodraco rastrospinosus* (285), *Pseudochaenichthys georgianus* (83), *Dissostichus mawsoni* (55), *Notothenia coriiceps* (191) and *Trematomus eulepidotus* (109). For all species, otolith samples were obtained for the whole size range of fish collected. The size range of each species, measured as total length, was as follows: *P. charcoti* (12-50 cm), *C. aceratus* (13-67 cm), *C. rastrospinosus* (26-49 cm), *P. georgianus* (16-55 cm), *D. mawsoni* (11-70 cm), *N. coriiceps* (16-59 cm) and *T. eulepidotus* (9-36 cm). Unfortunately, the length frequency distribution showed that for some species, such as *C. rastrospinosus*, *P. georgianus* and *N. coriiceps*, the smaller length classes (and therefore also the smaller age classes) were absent. On the other hand, *D. mawsoni* was only represented by juvenile or subadult specimens.

Barrera-Oro, E.R. (1988): Age determination of *Notothenia gibberifrons* from the South Shetland Islands, Antarctic Peninsula subarea (Subarea 48.1).- SC-CAMLR, Select. Scient. Pap. 1988: 143-159.

Barrera-Oro, E.R., Casaux, R.J. (1992): Age estimation for juvenile *Notothenia rossii* from Potter Cove, South Shetland Islands.- Antarct. Sci. 4: 131-136.

Barrera-Oro, E.R, Casaux, R.J. (1996): Validation of age determination in *Notothenia coriiceps*, by means of a tag-recapture experiment at Potter Cove, South Shetland Islands.- Arch. Fish. Mar. Res. 43: 205-216.

Freytag, G. (1980): Length, age and growth of *Notothenia rossii marmorata* Fischer 1885 in the West Antarctic waters.- Arch. FischWiss. 30: 39-66.

Kock, K.-H. (1990): Results of the CCAMLR Antarctic fish otoliths/scales/bones exchange system.- SC-CAMLR, Select. Scient. Pap. 1989: 197-227.

Kock, K.-H. & Stransky, C. (2000): The composition of the coastal fish fauna around Elephant Island (South Shetland Islands, Antarctica).- Polar Biol. 23: 825-832.

La Mesa, M., Arneri, E., Giannetti, G., Greco, S. & Vacchi, M. (1996): Age and growth of the nototheniid fish *Trematomus bernacchii* Boulenger from Terra Nova Bay, Antarctica.- Polar Biol. 16: 139-145.

Tomo, A.P. & Barrera-Oro, E. (1986): Age and length growth of *Champsocephalus gunnari*, Lönnberg 1905 (Pisces, Chaenichthyidae), in the area of Elephant Island, west zone, Antarctica.- Inst. Antart. Argent. Contrib. 319: 1-14.

Vacchi, M., Romanelli, M. & La Mesa, M. (1992): Age structure of *Chionodraco hamatus* (Teleostei, Channichthyidae) samples caught in Terra Nova Bay, East Antarctica.- Polar Biol. 12: 735-738.

2.6 Genetic studies of Antarctic fish

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ANT-XIX/3

Ongoing projects on Antarctic fish at the University of Padua (Italy) include studies of the molecular phylogeny of notothenioids and population genetics of *Chionodraco rastrospinosus* and and *Pleuragramma antarcticum.* Population samples from other species have been collected or provided by many scientists in recent years. The ANT-XIX/3 cruise provided a unique opportunity to expand the university's population sample collection and will enable us to begin preliminary genetic analysis of populations of many different Antarctic species.

Tissue samples for DNA extraction were collected from more than 1200 individual fish during ANT-XIX/3. For about 900 of them, information on individual length, weight, sex and gonad size and maturity were recorded. One to ten grams of muscle tissue were collected from each individual. Each muscle sampled has been split into two parts, which have been stored in different ways (frozen or in 96 % ethanol) to maximize the chance of obtaining high quality DNA from at least one of the two samples. DNA extraction and genetic analysis will be carried out in the laboratory in Italy.

Seven species that were not included in our molecular phylogenetic analysis (BARGELLONI et al. 2000) have been collected, namely:

Artedidraco skottsbergi	*Chaenodraco wilsoni*
Dacodraco hunteri	*Gerlachea australis*
Lepidonotothenia larseni	*Pseudochaenichthys georgianus*
Racovitzia glacialis	

Population samples were obtained from the species listed in Table 2.6-1. Six abundant species yielded particularly useful large samples: *Chaenocephalus aceratus, Chionodraco rastrospinosus, Gobionotothenia gibberifrons, Notothenia coriiceps, Notothenia rossii* and *Pleuragramma antarcticum. C. rastrospinosus, G. gibberifrons* and *N. coriiceps* were collected in all three areas (Elephant Island, King George Island and Joinville Island) fished. The samples of these three species will complement samples already stored at Padua University, collected in the same area in 1996 (POLARSTERN cruise ANT-XIV/2) and in 1997 (JAMES CLARK ROSS cruise JCR26).

C. aceratus was collected in high numbers near Elephant Island, and in reasonable numbers near King George Island. The availability of different size classes, and the possibility of working on the same individuals aged by La Mesa (IRPEM-CNR, Ancona, Italy; see previous contribution) may enable genetic analysis of different cohorts to be conducted. A reasonable sample has been obtained for *N. rossii* at Elephant Island. For this species, samples of scales have been taken to investigate the possibility of extracting DNA from this material. Finally, despite the small sample size, *P. antarcticum* will prove useful for the ongoing study on this species. The other population samples will be stored for future use and may be available to scientists from other institutions.

Species	*Number of specimens* Elephant Island	King George Island	Joinville Island
Chaenocephalus aceratus	209	84	1
Chionodraco rastrospinosus	137	134	56
Notothenia coriiceps	59	47	52
Notothenia rossii	94	13	0
Gobionotothenia gibberifrons	55	54	56
Lepidonotothenia larseni	50	0	0
Lepidonotothenia squamifrons	50	0	0
Pleuragramma antarcticum	12	0	1
Pseudochaenichthys georgianus	20	20	0
Trematomus eulepidotus	0	0	50

Tab. 2.6-1: Species collected for genetic analysis.

Bargelloni, L., Marcato, S., Zane, L. & Patarnello, T. (2000): Molecular phylogeny of Antarctic fish.- Systematic Biology.

2.7 Pollution loads in Antarctic fish of the Elephant Island - South Shetland Islands region

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The study area is interesting with respect to our knowledge on the contamination level of Antarctic marine organisms and the comparatively pristine state of the environment. It is necessary to make a clear distinction between pollution by human activities in the Antarctic and global pollution transported into the Antarctic from outside the Southern Ocean.

Elephant Island and the South Shetland Islands are adjacent to the Antarctic Peninsula, from which they are separated only by the Bransfield Strait. The Antarctic Peninsula is relatively close to South America and this may affect the way in which POPs (Persistent Organic Pollutants) are transported into Antarctica and its waters. The presence of many scientific stations may also contribute to the introduction of pollutants to the environment. Data obtained from these surveys will be used to compare the contamination *status* in the sampling area to that of the Ross Sea, where our research group has been working for the last ten years. The study areas are characterized by different geographical features, meteorological conditions and physical-chemical characteristics of seawater that may influence POP transport and accumulation in the biota.

Investigated species were:

Channichthyidae: *Chaenocephalus aceratus*,
Champsocephalus gunnari,
Chionodraco rastrospinosus;
Nototheniidae: *Dissostichus mawsoni*,
Gobionotothenia gibberifrons,

	Lepidonotothenia larseni,
	Lepidonotothenia nudifrons,
	Notothenia coriiceps,
	Notothenia rossii,
	Pleuragramma antarcticum,
	Trematomus eulepidotus;
Muraenolepididae:	*Muraenolepis microps;*
Myctophidae:	*Electrona antartica,*
	Gymnoscopelus nicholsi.

Liver, muscle, gonad, stomach and brain were collected and frozen (-25°C). Fish of less than 10 cm length were preserved whole.

The chemical analysis was carried out in accordance with the methods described by KANNAN et al. (2001) with some modification: 5-10 g of sampled tissue homogenized with sodium sulphate and sohxlet extracted with methylene chloride and exane (3:1, 400 ml) for 16 hours. The extract is rotary-evaporated at 40°C and an aliquot is used for the determination of fat content by gravimetry. The remaining extract is spiked with PCB30 as an internal standard and extraneous substances removed by fractionation with a multi-layer-silica gel-column. PCBs congeners are identified and quantified using a gas chromatograph (Perkin Elmer Autosystem) equipped with 63Ni electron capture detector (GC-ECD). A fused silica capillary column coated with DB-5 (5%-phenil-methylpolysiloxane, 30 m x 0.25 mm i.d.; Supelco) having a film thickness of 0.25 mm is used.

A total of 740 individuals was collected for our analyses, of which 440 were from the Elephant Island area, 260 from the South Shetland Islands and 40 from an area near D'Urville Island. The number of samples for each species was:

C. aceratus:	100	*N. coriiceps*:	103
C. gunnari:	80	*N. rossii*:	53
C. rastrospinosus:	100	*P. antarcticum*:	6
D. mawsoni:	50	*T. eulepidotus*:	35
G. gibberifrons:	80	*M. microps*:	30
L. larseni:	20	*E. antartica*:	12
L. nudifrons:	10	*G. nicholsi*:	60

This selection of species covers shallow-water, deep-water and ubiquitous species. The presence of both males and females sampled in different maturity stages may prove useful in assessing the level of concentration of PCBs. Furthermore, the concentration of bioaccumulation can be related to fish size. Analysis of PCBs in stomach contents may indicate to what extent pollutants are transported by food.

2.8 Cephalopod diversity and ecology

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Although cephalopods have been shown to be very important in the Antarctic food webs, the cephalopod fauna remains poorly known. For example, recent research on octopods nominally assigned to the genus *Pareledone* have revealed diversity much higher than previously expected. Based on results of a previous POLARSTERN cruise, we have shown that cirrate octopods are much more abundant in the vicinity of the South Shetland Islands than was suspected. The other octopods and the squids of the Antarctic have not been investigated as thoroughly but our previous studies have shown that unknown octopod taxa (species, genera and perhaps families) remain to be described once adequate specimens have been collected.

The cruise ANT-XIX/3 provided a unique opportunity to sample cephalopods in a variety of locations around the Antarctic Peninsula. Our work during the cruise focused on distribution and abundance, taxonomy, and diet studies. During the cruise our research team examined all cephalopods from the catches taken with the bottom trawl. Our overall goal was to expand our previous observations for improved understanding of the diversity, ecology, biology, life cycles, distribution and abundance of this important fauna. Freshly caught material was used for:
(1) photo-documentation of subtle taxonomic characters such as colour patterns and skin texture,
(2) recording size and morphometric measurements prior to distorsion in preservatives,
(3) sampling and special fixation of tissues for studies of DNA, and
(4) removal of stomachs for trophic analyses. In the following we present preliminary results of our work on board and a brief outline of further planned studies on the cephalopod collection.

The study area concentrated on the area around Elephant Island, the continental shelf region north and west of the southern South Shetland Islands, and the shelf north of Joinville Island. For descriptions of the collecting gear and information on station data etc. see KOCK et al. (this vol.).

All cephalopods were sorted from the catches, counted and identified to the lowest possible taxon. Dorsal mantle length (ML), total length, sex and maturity stage were recorded for all specimens. Voucher specimens of all cephalopod species were preserved for archival at the National Museums of Scotland and tissue samples were taken for subsequent genetic analysis. Stomachs from representatives of abundant and taxonomically well-known species were removed and opened for examination of food items. Beaks were removed from representative specimens as well to contribute to a reference collection for comparison with stomach contents of predators (e.g., marine mammals, birds, and fishes).

We collected 2414 cephalopod specimens from the bottom trawl samples on this cruise, comprising approximately 15 octopod species and one squid species (Tab. 2.8-1). Squids were represented by three specimens of the glacial squid, *Psychroteuthis glacialis*. Although this number is very low, one specimen was, to our knowledge, the first collection of a fully mature male. This allowed observations and photographs of male reproductive anatomy and of the secondary sexual modifications of the lateral arms in addition to preservation of the specimen for future study.

Next to fishes, octopods were the dominant group of mobile megabenthic predators in the bottom trawl samples. We collected 2411 octopods, adding to the most comprehensive collection of Antarctic octopods to date. Attached is a preliminary key to identification of the common octopods encountered on the shelf and upper slope (Tab.2.8-2).

The most abundant octopods in the Antarctic belong to the endemic genus *Pareledone*. There is much confusion surrounding this genus. Currently seven species of *Pareledone* are considered to be valid. Tissue samples will be analysed using DNA sequence analysis. This will allow calculation of genetic diversity among taxa, using established indices. When genetic distances among the species have been established it should be possible to assess, in part, which morphological characters are important for octopod taxonomy and phylogeny. Many of the descriptions of the species encountered during this cruise are either inaccurate or incomplete and morphometric characters will be used to help rectify this problem. Such characters will also be used in the description of new species.

The three *Pareledone* species previously reported from this area (*P. charcoti*, *P. turqueti*, and *P. polymorpha* – see comments below on genus) were found in large numbers, together with nine putative new species (Tab. 2.8-1), on this cruise. Of the new species, six have papillated skin and closely resemble *P. charcoti* (*Pareledone* spp. 12a and 12b, sp. 15, sp. 19, sp. 26, and genus undetermined sp. 29), one has smooth skin and closely resembles *P. turqueti* (*Pareledone* sp. 14), and one species resembles none of the above (*Megaleledone*? sp. 17); the status of several specimens (*Pareledone* sp. 33, *Megaleledone*? sp. 34) remains unclear. It has previously been suggested that *P. polymorpha*, together with *P. adeliana*, should be removed from the genus *Pareledone* and placed in a new genus. The taxonomic data collected during this cruise support this suggestion.

In addition to further taxonomic studies, abundance and distribution of the octopods sampled during the cruise will be described and compared with results of previous trawling aboard "POLARSTERN". Preliminary results on the geographical distribution and relative abundance are summarized in Table. 2.8-1. They demonstrate that octopods are apparently much more abundant in the vicinity of Elephant Island than in nearby areas. The ranges of the mean depth distributions for the major species based on minimum depths of bottom trawls are shown in Figure 2.8-1. Depth distributions vary considerably among species, even between closely related forms. For some species (e.g., *Cirroctopus glacialis*, *Benthoctopus* cf *levis*, genus undetermined sp. 29), only the upper part of the depth range was sampled. Deeper trawling would expand our knowledge of these unusual octopods.

Among the many octopods collected during the trawling survey were several species that are not closely related to the common pareledonins. All are either poorly known or new to science, so we will describe their morphology and anatomy. We will also use DNA sequencing to investigate relationships among them. The specimens of a *Benthoctopus* species are similar to *B. levis*, but differ from it in arm length, web depth, and details of the hectocotylus. These 46 specimens, together with 39 from ANT-XIV/2, comprise a comparatively large collection for a species in this deep-sea genus. This collection will allow us to describe a new subspecies and to infer patterns in the basic biology of these animals.

Species	Elephant Islands 49 stations		southern South Shetlands 21 stations		Joinville Islands 5 stations		Total	75 stations
	Speci-mens	Stations	Speci-mens	Stations	Speci-mens	Stations	Speci-mens	Stations
Pareledone charcoti	670	34	15	4			685	38
Pareledone sp 12 complex	494	41	186	16	2	1	682	58
"Pareledone" polymorpha	226	28	66	15			292	43
Pareledone sp 19	217	25	9	4			226	29
Pareledone turqueti	156	33	35	10	1	1	192	44
Megaleledone? sp 17	107	18	18	8			125	26
Megaleledon setebos	40	22	6	4	1	1	47	27
Benthoctopus cf *levis*	35	8	11	5			46	13
Pareledone sp 15	22	4	23	6	2	2	47	12
Pareledone sp 33?	14	3	30	5			44	8
Cirroctopus glacialis	7	3	2	2			9	5
Pareledone sp 26	7	3	1	1			8	4
Genus undetermined sp 29	2	1	3	3			5	4
Pareledone sp 14 ?			2	2			2	2
Megaleledone? sp 34			1	1			1	1
Total	1997	49	408	21	6	4	2411	74
Number per station	40.7		19.4		1.5		32.6	

Tab. 2.8-1: Summary of the octopods collected.

Length-weight relationships for *Benthoctopus* cf *levis*, as well as the best-known of the pareledonins, are presented in Figure 2.8-2. These indicate some of the sexual variability in life-history parameters among the species of this fauna. Stomach contents for the same species are summarized in Figure 2.8-3. It is clear that separate feeding niches must exist among these mobile predators. Their roles in the regional food web warrant further study. The results are still preliminary and further analyses still have to be done. Nevertheless, the present collection of cephalopods is extremely valuable for Southern Ocean ecosystem research and in particular for further progress in Antarctic cephalopod science.

1a	Fins and cirri present	*Cirroctopus glacialis*
1b	Fins and cirri absent	2
2a	Suckers clearly biserial, arms very long (>75 % total length)	*Benthoctopus* cf. *levis*
2b	Suckers either uniserial or loosely zigzag, arms <75 % total length	3
3a	Oral surface of web purple, much darker than aboral surface of web, head and mantle, four to five lamellae per outer gill demibranch	*Thaumeledone* sp.
3b	Oral surface of web not darker than rest of animal, 6 or more lamellae per outer gill demibranch	4
4a	Ridges present on dorsal mantle where stylettes would be, chromatophores present in dorsal mantle cavity	*Pareledone*? *polymorpha*
4b	No distinct ridges on stylette area of dorsal mantle, no chromatophores in dorsal mantle cavity	5
5a	Papillae clearly raised and close set on dorsal mantle, head and aboral surface of dorsal arms of relaxed specimens	6
5b	Papillae may be present in live octopods but not as above on relaxed specimens	11
6a	Size of papillae clearly variable, at least 2 compound horns above each eye	*Pareledone* sp. 19
6b	Size of papillae approximately equal (although shape may vary), superocular papillae if present not as above	7
7a	Discrete white spot above each eye, papillae regularly ring-like and flat	*Pareledone* sp. 15
7b	White area above eye if present not a small discrete spot, papillae either uniformly round or irregular in shape	8
8a	Papillae irregular in shape, many flat on top	*Pareledone charcoti*
8b	Papillae uniformly round, very regularly spaced	9
9a	Papillae extremely small, one discrete white marking on proximal half of each arm	*Pareledone* sp. 26
9b	Papillae medium to large, white markings if present not confined to one conspicuous spot on each arm	10
10a	Web shallow (< 30 % arm length), papillae are fingerlike projectionswith dark superocular papillae	*Pareledone* sp. 12b
10b	Web deeper (> 30 % arm lenth), papillae broader and less raised	*Pareledone* sp. 12a
11a	Web shallow (< 30% arm length), 9-11 lamellae per inner gill demibranch	*Pareledone turqueti*
11b	Web deeper (>30% arm length), inner gill lamellae count not as above	12
12a	6-8 lamellae per inner gill demibranch, oral surface of proximal arms white, matures at a small size (ca 50 mm ML)	*Megaleledone*? sp. 17
12b	12-14 lamellae per inner gill demibranch, oral surface of proximal arms pigmented (including sucker bases), matures at a very large size (>200 mm ML)	*Megaleledone setebos*

Tab. 2.8-2: Preliminary key to identification of common octopod species of the shelf and upper slope of the South Shetlands Islands.

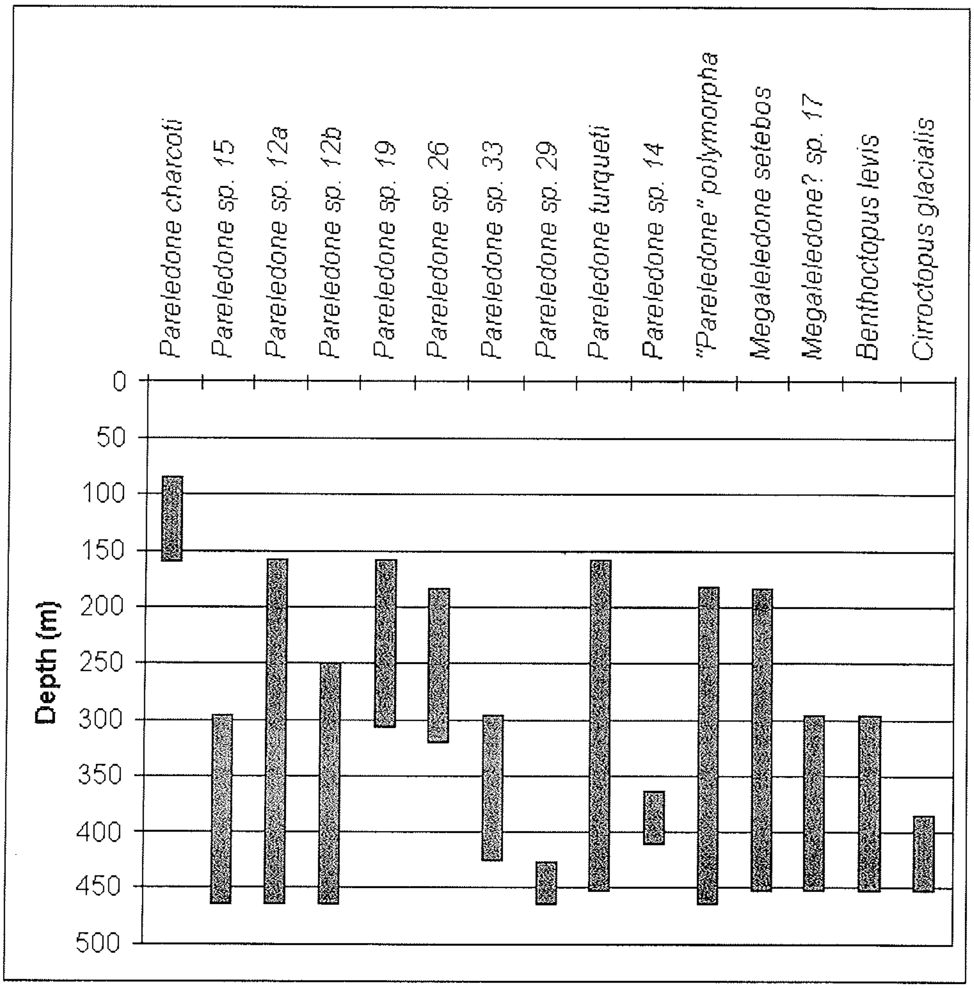

Fig. 2.8-1: Ranges of depths distribution of common octopod species captured during ANT-XIX/3. Captures are plotted for 95 % of individuals of each species to eliminate outliers.

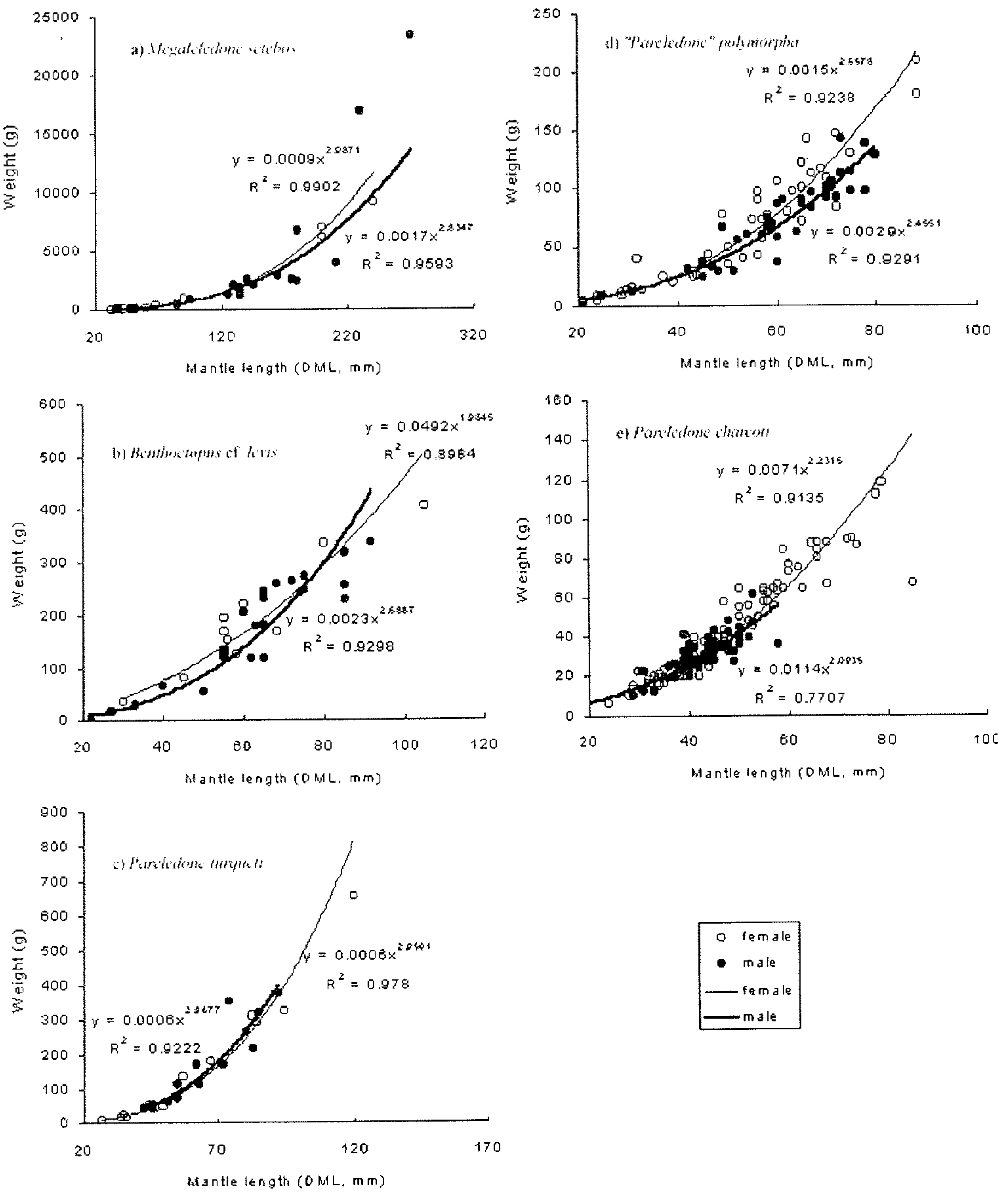

Fig. 2.8-2: Lenght-weight relationships for *Benthoctopus* cf *levis* and the best-known of the pareledonins

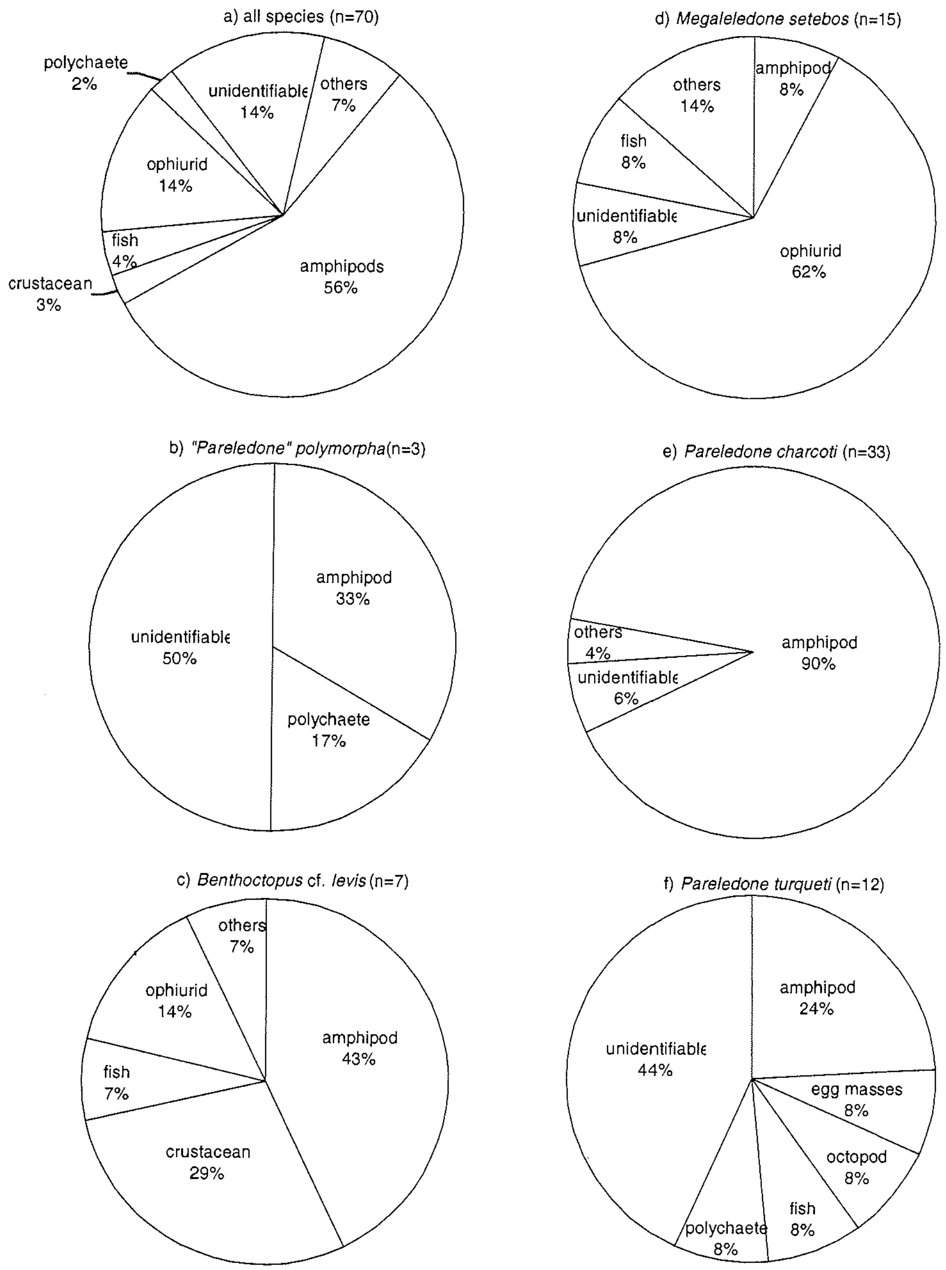

Fig. 2.8-3: Stomach contents for *Benthoctopus* cf *levis* and the best-known of the pareledonins

2.9 CTD measurements, with emphasis on the Elephant Island region

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ANT-XIX/3 / ANDEEP I

Within the framework of the ANDEEP I cruise (24 January-26 February, 2002), 33 deployments were performed in order to characterise water masses for temperature and salinity, using a CTD-probe (Seacat SBE 19-04). The probe was fitted to record one data s^{-1} and was hauled down and up at 1 m s^{-1}. Studied areas include the Shackleton Fracture Zone (Drake Passage), an intensive survey round Elephant Island, the northwestern shelf and deep trench off South Shetland Islands, and the northeastern part of Bransfield Strait (off Joinville Island). For detailed station list see Annex..

Drake Passage

The CTD-profiles performed along the Shackleton Fracture Zone all display the same pattern. Temperature decreases rapidly from about 2.5°C at sea surface to 0.3°C at about 150 m depth (Fig. 1); it then increases up to 2.0°C at about 400 m, and after that decreases progressively down to around 0.5 to 0°C at the sea bottom, depending on station. Salinity increases quickly from 33.9 at surface to about 34.7 at 400-500 m depth, and then stays rather constant down to the sea floor. The T/S diagram clearly shows the occurrence of three distinct water masses (see MANN 1977), i.e. downwards the Sub-Antarctic Surface Water (SASW), the Circumpolar Deep Water (CDW) and the Antarctic Bottom Water (AABW). Approaching the South Shetland Islands, SASW current mixes with the counter Antarctic Surface Water (ASW), with the result that the T and S patterns of the upper layers are altered.

Elephant Island shelf

Seventeen CTD deployments were performed over the continental shelf of Elephant Island, to depths ranging from 95 to 370 m. The obtained temperature profiles can be grouped in five clusters corresponding to distinct areas round the island (Fig. 2.9-2). Northern shelf is covered by a water mass the temperature of which progressively falls down from 1.2 (surface) to -0.2°C (310 m). In the northeastern area, temperature drops rapidly from 1.4 to 0°C at 40 m depth, and then very slowly decreases downwards. Profiles from the southeastern zone are rather similar to those of the northern one, except that reached depths are shallower. In the northwestern area, on the other hand, the temperature vertical distribution pattern is totally different: it is rather constant (1.4°C) from surface down to about 55 m depth where a thermocline is observed; water then cools down to about 0.7°C within 30 m, and after that, from 95 m to bottom, gets progressively warmer, reaching a temperature similar to the sub-surface one. In the southwest are observed the warmer surface waters (1.8 to 2°C); temperature gradually decreases down to about 0.7°C at 95 m depth, and then stays relatively constant or even a bit less colder.

Salinity profiles are similar for northern, southeastern and southwestern areas, with a progressive slight increase from surface (about 34.15) to bottom (about 34.55). In the northeastern region, salinity rise is steeper close to surface and becomes weaker beneath 40 m depth (as for temperature profile). Northwesterly, salinity remains constant (like temperature) from surface to 55 m depth and then gradually increases to 34.6.
The T/S diagrams also show some discrepancies between areas (Fig. 2.9-3). While northerly and southeasterly they look straight, tracing a gradual mixing process between surface and bottom water masses, disturbances can be seen in northeastern area diagram, likely due to turbulent exchanges in sub-surface water layer. Over the northwestern shelf, albeit not deeper, diagrams

are V-shaped evidencing the intrusion of another water mass (likely CDW) beneath the surface layer ([S]ASW). Southwesterly diagrams are intermediate between N-W and S-E ones, the presence of a deep water mass being less obvious.

How could such variations in seawater vertical structure within a so small geographical area (about 80x40 km) be interpreted? Elephant Island is in a somewhat central position of a complex system of currents, wherein the general clockwise surface circulation of the circumpolar Antarctic current meets the counterclockwise currents of the Weddell Sea gyre. Ocean bottom topography round the island, with *e.g.* the deep South Shetland trench, the south end of Shackleton Fracture Zone and of the South Scotia Arc, is also likely to play an important role in water mass distribution. Collected data are moreover limited to a short period of time (two weeks). The understanding of water movements in the area should thus benefit from direct measurements such as those provided by currentmeter moorings or ADCP. The observed variations are however not trivial and should influence the structure of benthic communities, as suggested by bottom pictures (DIAZ et al., this vol., Ch. Jones, unpubl.) or by fish distribution (KOCK et al., this vol.).

South Shetland trench
Three deep CTD deployments (2280, 2900 and 5200 m, respectively) were performed northwest King George Island. The observed profiles look very similar to those of the Shackleton Fracture Zone, only differing by the shallower depth of the cold water mass, between 100 and 200 m. T/S diagrams are also comparable and display the same water mass pattern.

Mann C.R. (1977): Currents and water masses in the vicinity of Drake Passage.- In: M.J. DUNBAR (ed), Polar Oceans, Arctic Inst. North Amer., Calgary, pp. 121-127.

Station	DATE	LATITUDE	LONGITUDE	AREA	DEPTH
40	26.01.02	58°55.06' S	61°1.03' W	DP-SF	2000
41	26.01.02	59°22.07' S	60°4.19' W	DP-SF	2380
42	27.01.02	59°41.23' S	57°35.97' W	DP-SF	3690
43	29.01.02	60°26.98' S	56°4.95' W	DP-SF	3960
44	29.01.02	60°58.22' S	55°4.12' W	ELI	370
45	29.01.02	60°59.03' S	55°9.77' W	ELI	260
46	29.01.02	60°37.91' S	53°57.74' W	ELI	2890
47	30.01.02	61°3,96' S	54°34.04' W	ELI	215
48	30.01.02	61°10.18' S	54°34.08' W	ELI	310
50	31.01.02	61°15.74' S	54°53.83' W	ELI	145
54	01.02.02	61°15.44' S	55°37.01' W	ELI	95
59	02.02.02	61°26.57' S	56°5.27' W	ELI	285
63	03.02.02	60°52.62' S	55°26.82' W	ELI	270
66	04.02.02	60°52.84' S	55°21.70' W	ELI	340
68	04.02.02	60°53.45' S	55°37.37' W	ELI	170
70	05.02.02	60°58.69' S	55°55.30' W	ELI	220
73	06.02.02	61°3.39' S	55°58.62' W	ELI	295
75	06.02.02	61°2.99' S	55°53.59' W	ELI	180
76	07.02.02	61°2.24' S	56°8.55' W	ELI	1080
77	07.02.02	60°56.59' S	56°20.47' W	ELI	2150
79	07.02.02	61°4.64' S	55°59.15' W	ELI	230
85	08.02.02	61°1.01' S	55°54.04' W	ELI	195
91	09.02.02	60°56.77' S	55°43.44' W	ELI	175
96	10.02.02	61°10.92' S	55°52.30' W	ELI	125
99	11.02.02	61°7.05' S	59°16,01' W	KGI-LI	5190
102	13.02.02	61°46.03' S	58°33.89' W	KGI-LI	280
105	14.02.02	61°23.94' S	58°50.92' W	KGI-LI	2280
111	16.02.02	61°51.10' S	59°13.08' W	KGI-LI	265
114	17.02.02	61°43.46' S	60°44.06' W	KGI-LI	2900
116	17.02.02	61°58.94' S	59°57.08' W	KGI-LI	290
120	18.02.02	62°9.97' S	60°49.02' W	KGI-LI	425
125	21.02.02	62°37.27' S	55°39.25' W	JOI	160
129	22.02.02	59°52.25' S	59°5781' W	DP-SF	3590

Tab. 2.9-1: Position of the CTD profiles, ANDEEP 1 cruise. DP-SF: Drake Passage-Shackleton fracture zone; ELI: Elephant Island; KGI-LI: north of King George & Livingstone Islands; JOI: north of Joinville Island.

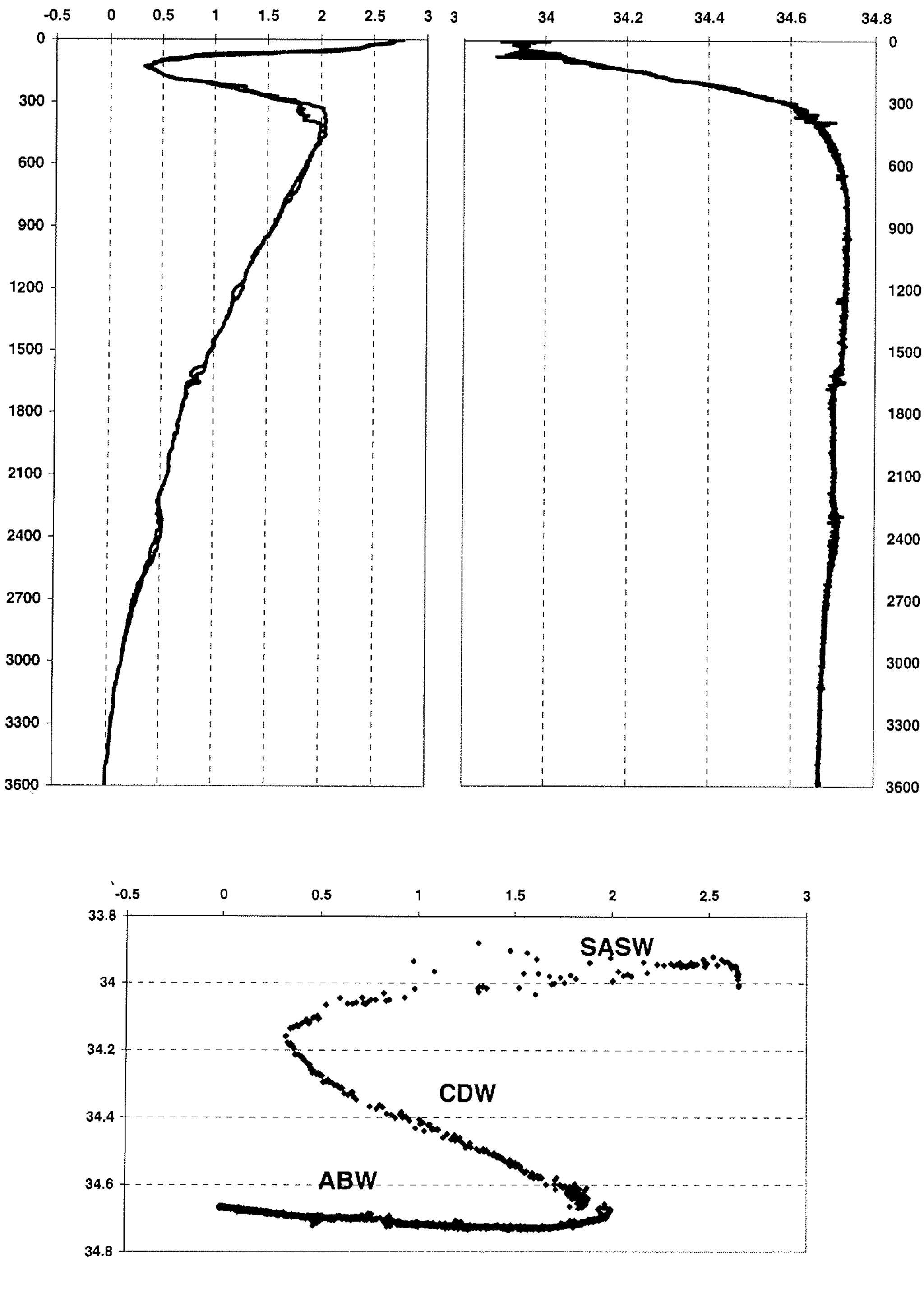

Fig. 2.9-1: Temperature (°C) and salinity profiles, and TS diagram for station 42 (**see Tab. 2.9-1**), Drake Passage.

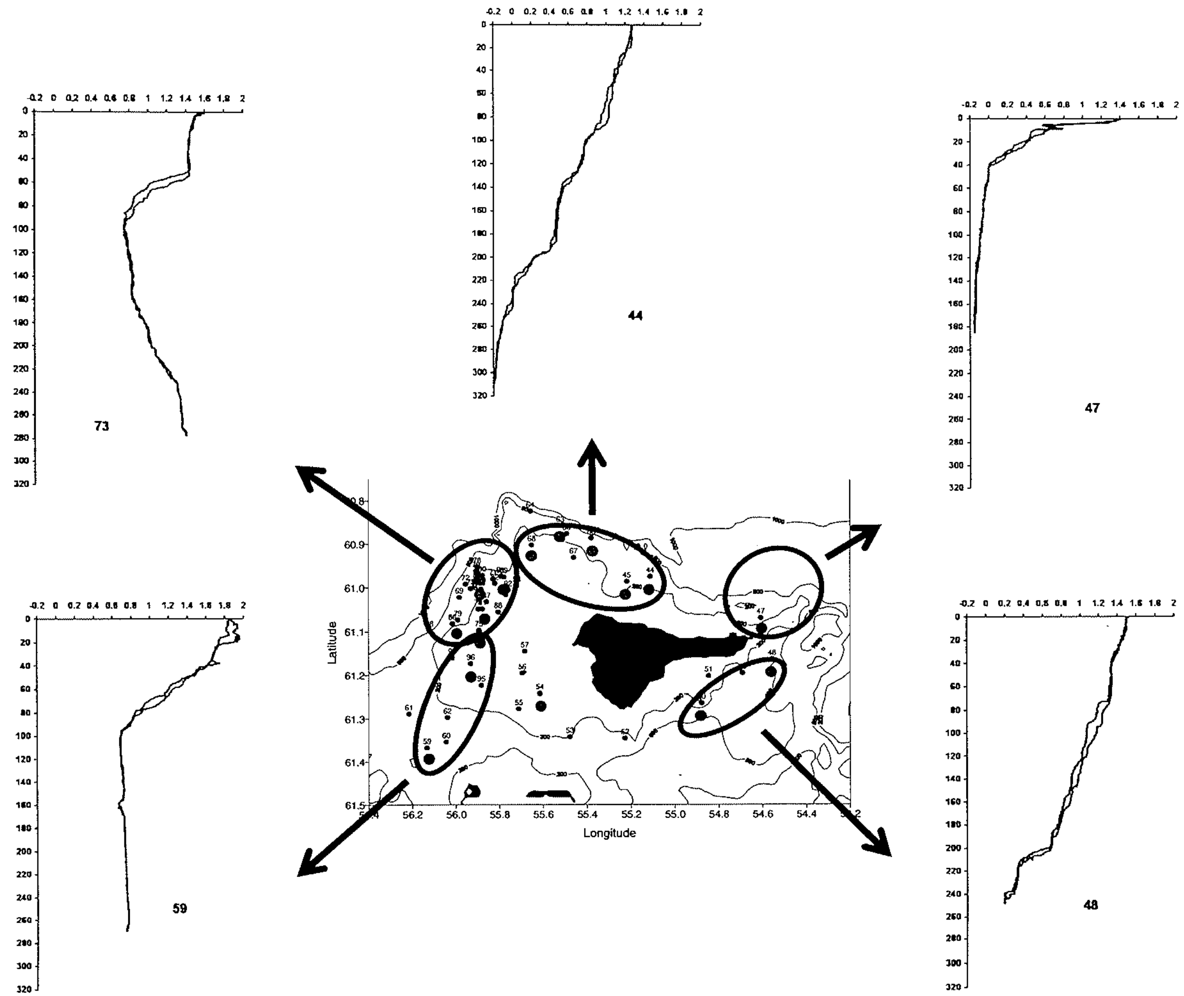

Fig. 2.9-2: Distribution of the temperature profiles round Elephant Island. All plots at the same scale: T° from -0.2 to +2°C; Depth from surface to 320 m.

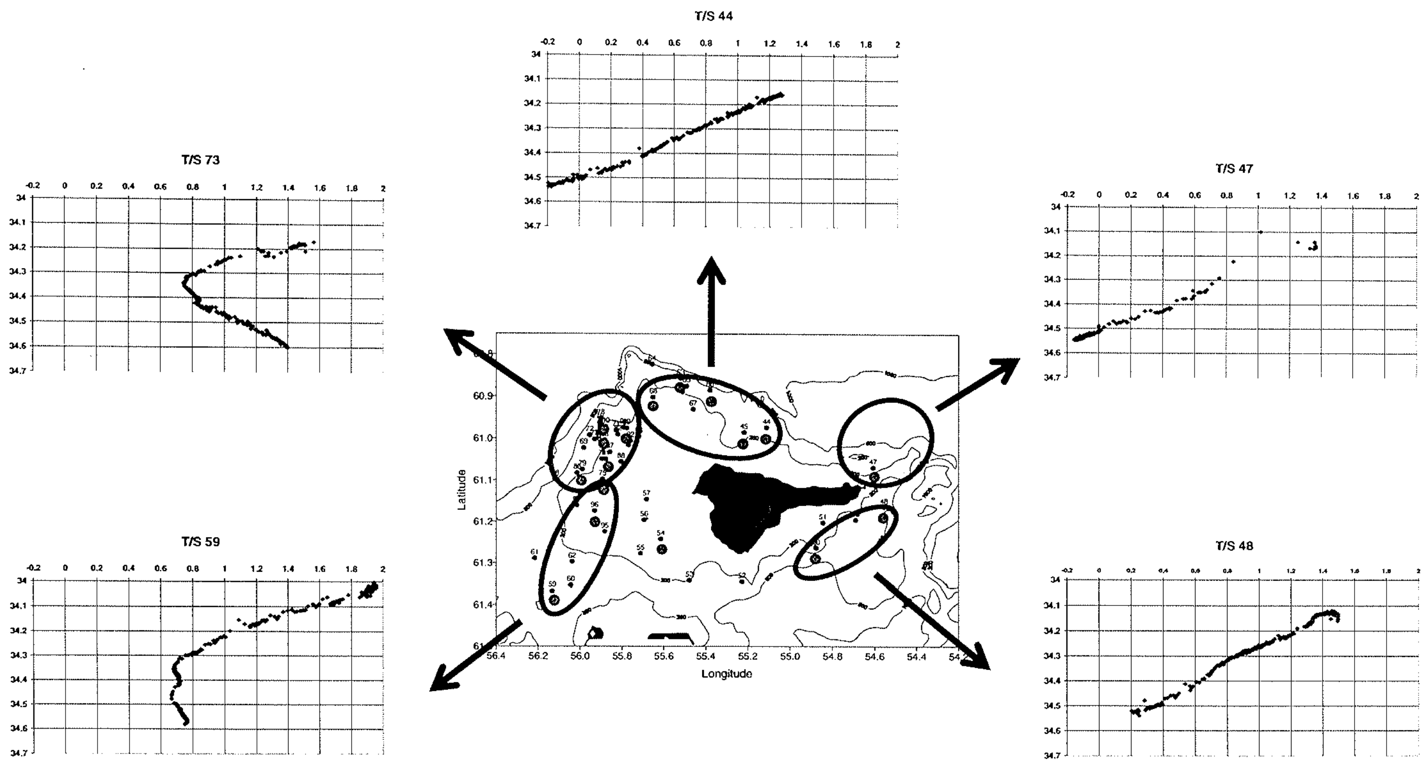

Fig. 2.9-3: Distribution of the T/S diagrams round Elephant Island. All plots at the same scale: T° from -0.2 to +2°C; Salinity from 34.0 to 34.

3 ANDEEP: ANTARCTIC BENTHIC DEEP-SEA BIODIVERSITY-COLONIZATION HISTORY AND RECENT COMMUNITY PATTERNS

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ANT-XIX/3 / ANDEEP I (AB, CB, BH) and ANT-XIX/4 / ANDEEP II (AB, BH, AJG, MRAT).

Biodiversity - defined as the variety and variability of genomes, species and populations, communities and ecosystems in space and time - is a central aspect of modern biology. The assessment of Antarctic biodiversity, the understanding of its role in ecosystem functioning, and requirements for its conservation, are of particular importance in the context of global environmental changes. Biogeography is closely linked to biodiversity. It is concerned with the geographic distribution of species and taxa in our biosphere, tries to explain patterns of distribution, and can help to identify the origin of species in certain areas on the basis of their phylogenetic relationships. Knowledge of biodiversity and biogeography is absolutely central to any attempt to conserve species and their habitats. Without reliable information about species assemblages and communities, we will not be able adequately to protect the environment or its living organisms. When considering marine biodiversity, we must always remember that roughly three quarters of the earth is ocean, less than 10 % of which consists of coastal or shelf areas and more than 90 % is deep sea. The faunas living in this vast area are very poorly known, especially in the Antarctic where there has been a notable lack of intensive biological sampling effort. Without doubt, the Antarctic deep sea harbours many unknown taxa, despite the fact that many nations have intensified their Antarctic research activities during the last 20 years.

Modern deep-sea biological research started in the early 60s when Howard Sanders and co-workers postulated, on the basis of samples collected with a fine-meshed epibenthic sledge, that species richness increased with water depth while faunal densities decreased (e.g., SANDERS et al. 1965, SANDERS & HESSLER 1969). Since then, attempts to describe and explain patterns of species diversity have become a major goal in deep-sea biological research. On regional (e.g., basin-wide) spatial scales, diversity is influenced by environmental factors such as organic matter fluxes, bottom-water oxygen concentrations, current velocity and sediment type (LEVIN et al. 2001). There is also evidence for the existence of patterns in biodiversity at larger (global) scales; in particular, an apparent decrease in species richness among a number of taxa from the equator towards the poles (POORE & WILSON 1993, REX et al. 1993, THOMAS & GOODAY 1996, REX 1997, CULVER & BUZAS 2000). After processing of samples from ANDEEP I and ANDEEP II, it will be possible for the first time to compare data from a single working group on the biodiversity of, for example, peracarid taxa collected with the same gear, an epibenthic sledge (BRANDT & BARTHEL 1995), from high Arctic (BRANDT 1995, 1997, BRANDT et al. 1996) and Antarctic continental slope and deep sea.

Biodiversity research in Antarctica based on evolutionary biology and biogeography has particular significance because the Antarctic ecosystem is of considerable age. Climatic cooling can be dated back at least to the Oligocene, about 35 million years ago (CLARKE & CRAME 1992). Because of the antiquity of this ecosystem, Southern Ocean organisms, especially those living on the continental shelf, have had a long time available in which to evolve. This historical background may explain the adaptive radiation events observed in many benthic or benthopelagic taxa (e.g., Notothenioidei, Amphipoda, Isopoda, Gastropoda). WATLING & THURSTON (1989) memorably characterised the Antarctic as an "evolutionary incubator" for the amphipod family Iphimediidae. These radiation processes, and the long time span available for evolution, probably explain the high degree of endemism, approaching almost 90 % in taxa such as sponges, peracarid crustaceans and some gastropod families, that characterises Antarctic communities. However, these generalisations apply specifically to shelf faunas. We do not know whether the biological characteristics of the Antarctic fauna, such as gigantism, late maturity, decreased number of offspring, long life spans etc., also apply to Antarctic deep-sea organisms. The ANDEEP expeditions were carried out in order to address these basic gaps in our knowledge of Antarctic biology.

The deeper waters of the Scotia and Weddell seas include some of the least explored parts of the world's oceans, and we know almost nothing about the bottom-dwelling animals that inhabit them. In contrast to the isolated shelf, waters deeper than 1000 m have broad connections with the Pacific, South Atlantic and Indian oceans. Hence, the faunas of bathyal and abyssal areas around Antarctica may be similar to those living at comparable depths elsewhere, and the degree of endemism much lower in the deep sea than on the shelf. In addition, the Weddell Sea is potentially an important source for taxa presently living in the Atlantic and other neighbouring parts of the deep oceans. Periodic extensions of the ice sheet possibly enhanced rates of speciation on the continental shelf and slope around Antarctica. Deep bottom water production in the Weddell Sea then may have acted as a larval distribution mechanism, driving Antarctic deep-water faunas northwards into the Atlantic Ocean over evolutionary time-scales.

Another important question concerns the potential faunistic links between South America and Antarctica, and whether faunal exchange is still possible today, either by island hopping or migration through the deep-sea basins. In other words, does the Antarctic deep sea constitute a barrier or a route of faunal migration between South America and the Antarctic Peninsula? The formation of the Weddell Sea began during Jurassic time (165 million years ago), but a continental link between South America and Antarctica persisted until just over 20 million years ago. Geographical and climatic changes, including intermittent periods of global warming and global sea-level rise and fall, are likely to have influenced the movement of species in and out of the Antarctic region.

The considerations outlined above led us to pursue the following specific objectives during the ANDEEP surveys:

- To conduct the first comprehensive survey of megafaunal, macrofaunal and meiofaunal deep-water communities in the Scotia and Weddell seas.

- To investigate the similarity of the Scotia and Weddell Sea faunas at the taxonomic (morphological) and genetic (molecular) levels to the faunas of Atlantic basins, on the one hand, and Antarctic shelf on the other.
- To describe the variety of seafloor habitats in tectonically active ahd inactive regions and to determine the influence of 'habitat diversity' on species and genetic diversity over a variety of spatial scales.
- To determine the importance of life history strategies and larval biology in determining species distributional patterns and geographical ranges.
- To investigate the evolutionary processes that have resulted in the present biodiversity and distributional/zoogeographical patterns in the Antarctic deep sea.
- To investigate the colonisation and exchange processes of the deep-sea fauna, in particular the role of tectonic structures (for example ridges or seamounts).

In a broader sense, ANDEEP may enhance our understanding of some important general issues in deep-sea biology. The project will certainly provide a wealth of new information about the scale and patterns of species diversity in the deep ocean (ETTER & MULLINEAUX 2000, LEVIN et al. 2001), add to our knowledge of deep-sea species ranges and the relationship between local and regional diversity (STUART & REX 1994), and may ultimately lead to a better understanding of the origins of faunas inhabiting these remote regions. It has particular relevance to the controversial issue of global (latitudinal) diversity gradients. As mentioned above, there is evidence that diversity decreases from the tropics to the poles in some deep-sea taxa. Gradients are particularly pronounced in the Northern Hemisphere, a fact that probably reflects the geologically recent origin of the Arctic Ocean. This hypothesis was first published by POORE & WILSON (1993) and also supported by REX et al. (1993) on the basis of epibenthic sledge samples taken down to 4000 m depth. In a response to the publication of REX et al. (1993), BREY et al. (1994) examined diversity gradients in the Southern Hemisphere, using data from the shelf and upper slope of the eastern and southern Weddell Sea. They demonstrated that species richness for bivalves, gastropods, and isopods is comparable to that found in tropical regions around 20°S. However, the conclusions of BREY et al. (1994) are weakened by the fact that they compared Agassiz trawl and box corer data with epibenthic sledge data from REX et al. (1993) and POORE & WILSON (1993). ANDEEP samples will provide a rich source material that can be used to test whether or not a latitudinal diversity gradient really exists in the Southern Hemisphere. A more precise and detailed description of latitudinal diversity trends in the deep ocean may help to promote a better understanding of some fundamental controls on patterns of biodiversity in marine ecosystems over geological and ecological time scales.

Sampling programme

Seven potential target areas were selected for the ANDEEP expeditions (Fig. 3-1). During ANDEEP I (ANT-XIX/3), Target area 1 in the Drake Passage was sampled in addition to stations off Elephant, King-George and Livingston islands. ANDEEP II (ANT-XIX/3) aimed to investigate target areas 2, 3, 4 and 6, with 7 as an alternative to 3. Because target area 2 is believed to resemble stations sampled during ANDEEP I, and target area 3 was not covered with ice, we proceeded to sample areas 3, 4, and 6 during ANDEEP II. Ship time for ANDEEP III has been requested for 2005, when we hope to be able to sample target area 5 and possibly area 2. A number of considerations guided the selection of these sampling areas.

<u>Target area 1</u> on the Shackleton Fracture Zone was choosen in order to investigate whether or not this tectonic feature might provide a submarine bridge for faunal migration between southern South America and the Antarctic Peninsula.

<u>Target areas 2 and 7</u> off the South Orkney Islands and South Georgia were selected because the shelf faunas in those areas are relatively well known. This provides an opportunity to determine

whether shelf species also occur in the deep sea and exhibit a higher than expected degree of eurybathy.

Target area 3. The arguments for this area were similar to those for areas 2 and 7 as it provides a link between the eastern shelf of the Antarctic Peninsula and the Weddell Sea abyssal plain. However, the area is rarely accessible because of the concentrations of pack ice that occur in the northwestern Weddell Sea under the influence of the Weddell gyre,.

Target area 4 was chosen because, unlike areas off the Antarctic Peninsula and in the eastern Weddell Sea, the composition of the deep Weddell Sea fauna is unknown. Information about deep-sea assemblages in this area may help to establish whether or not latitudinal gradients exist in the southern Atlantic Ocean.

Target area 5 is situated off Kapp Norvegia shelf where the benthic fauna is well known. Like areas 2, 3 and 7 it provides an opportunity to investigate possible changes between the shelf and the abyssal plain.

Target area 6 near the South Sandwich Islands was selected because it has previously been sampled only by Russian expeditions. It also provides the opportunity to investigate faunas and habitat topography in a tectonically active deep for comparison with the geologically inactive abyssal plain.

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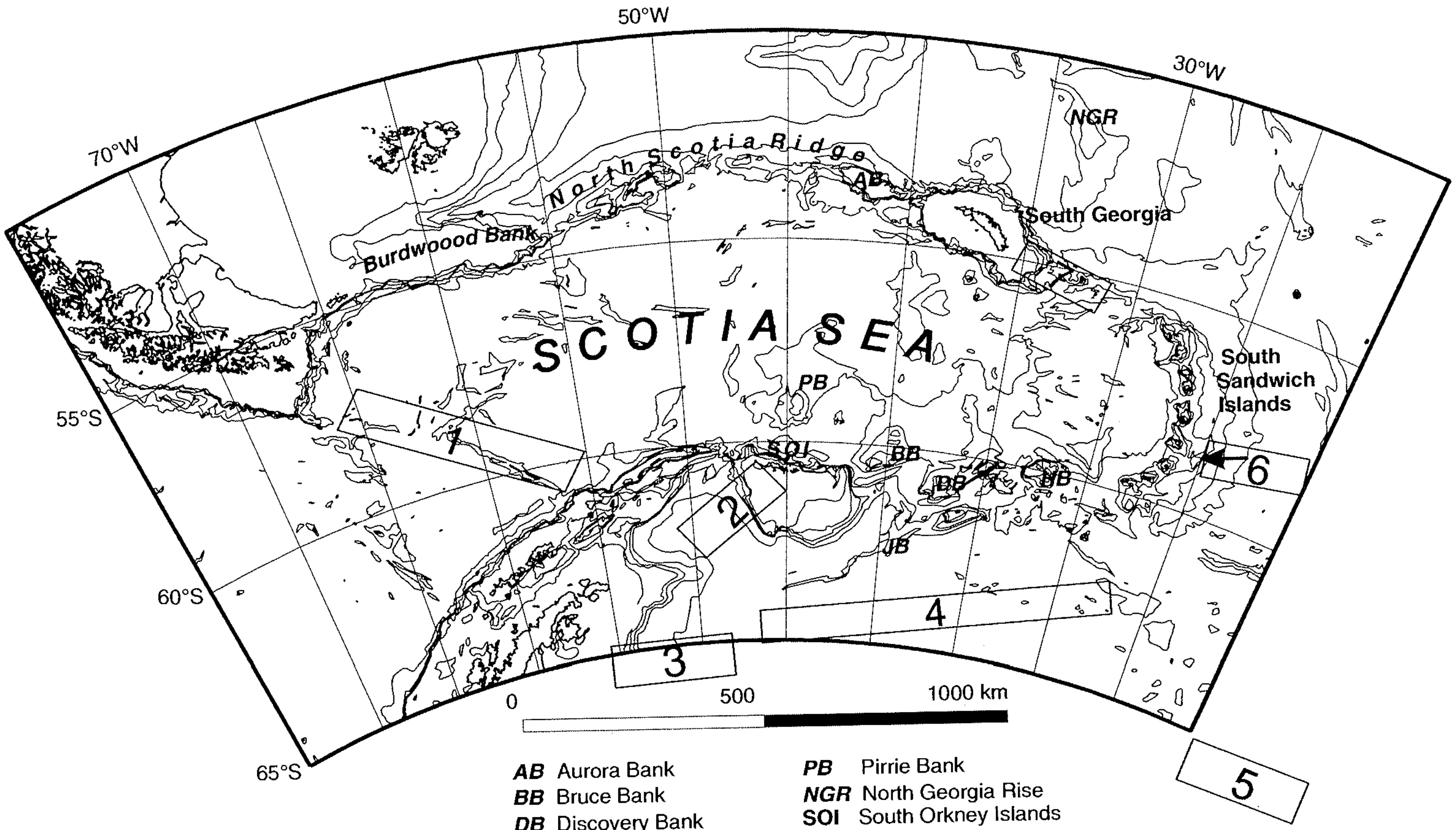

AB Aurora Bank
BB Bruce Bank
DB Discovery Bank
HB Herdman Bank
JB Jane Bank
PB Pirrie Bank
NGR North Georgia Rise
SOI South Orkney Islands
← un-named bank SSI

Fig. 3-1: Regional Target Areas of ANDEEP

3.1 Meiobenthos

3.1.1 Introduction to meiobenthos studies

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ANT-XIX/4 / ANDEEP II

Samples for meiofaunal studies (foraminifera and metazoans) were taken using a Barnett-Watson multiple corer (MUC) equipped with 12 core tubes of 57 mm internal diameter (25.5 cm^2 surface area) (BARNETT et al. 1984). Additional cores were used for extraction of macrofaunal polychaetes (Blake), an investigation of the diversity of resting stages (cysts) in deep-sea sediments (Pirano), and sediment characteristics (Howe). The corer was deployed 35 times during ANDEEP II and recovered a total of 307 cores, an average of 8.8 per deployment. At station 138 on the Weddell Sea Abyssal Plain (4500 m water depth), six cores were taken from each of five deployments in order to study the spatial variability of one meiofaunal taxon (Harpacticoidea). Otherwise, 2-3 replicate deployments were made at each station.

The use of a multiple corer is now widespread in deep-sea meiofaunal research. Unlike the box corer, this device recovers samples in which the sediment-water interface is virtually intact. It therefore recovers a much higher proportion of the meiofauna than box corers as well as retaining loose, surficial deposits of phytodetritus (BETT et al. 1994). On the other hand, the multiple corer does not work so well in sandy sediments where cores are typically short and therefore are often lost during the retrieval of the corer from the seafloor. Indeed, the cores collected during ANDEEP II varied widely in length, reflecting the characteristics of the sediments present in the different study areas. Long cores were obtained on the Peninsula slope transect (usually 32-38 cm) and the abyssal plain (35-43 cm) where the sediments were soft oozes. The sandier sediments of the South Sandwich transect invariably yielded shorter (usually <15 cm) cores while those from the South Sandwich Trench (station 142) were somewhat longer (16-20 cm). The cores were generally devoid of any obvious stratification, although those from one of the South Sandwich Trench deployments (142-5) contained distinctive dark layers. Phytodetritus was visible on the surfaces of cores from a number of stations. It formed a thin green veneer in some samples from the Peninsula slope transect, a thicker fluffy layer of loose material in samples from the 4000 m station (134), some parts of the Abyssal Plain (particularly 137, 138), and the two deeper stations of the South Sandwich transect (139, 140), and a surface mat-like deposit in cores from the 6,300 m-deep trench site (station 142).

Meiofaunal studies within ANDEEP comprise two main strands. One concerns the molecular and morphological diversity of foraminifera and the other the metazoan meiofauna, particularly nematodes and harpacticoid copepods. In both cases, species present in ANDEEP samples will be compared with those occurring in the deep North Atlantic and other regions, in particular a site on the Porcupine Abyssal Plain that has been the focus of an intensive European research effort for more than a decade (BILLETT 2001). It is hoped that a comparison of diversity trends among the nematodes and foraminifera will provide insights into the factors controlling diversity patterns and species ranges in these two very diverse but contrasting taxa. For example, nematode species, which lack a larval stage, might be expected to have smaller ranges than foraminifera that can possibly disperse more easily.

3.1.2 Diversity of deep-sea benthic foraminifera – molecular and morphological aspects

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ANT-XIX/4 / ANDEEP II

Although often a dominant faunal element in deep-sea and high latitude settings (GOODAY 1986b, GOODAY et al. 1996), foraminifera are frequently overlooked in studies of benthic faunas because they are unfamiliar organisms that are difficult to extract from sample residues and to identify. Most information about diversity comes from geological studies of hard-shelled taxa. Soft-shelled species are often abundant but are poorly known and present many taxonomic problems. In particular, they possess few morphological characters, making the recognition of morphospecies difficult and time consuming. As a result, few studies have addressed the diversity of "entire" (i.e. hard and soft-shelled) foraminiferal assemblages in the deep sea.

Recent developments in molecular systematics have opened new avenues for approaching the problems of recognising and defining species and understanding genetic diversity among marine foraminifera. Studies have revealed high genetic diversity among some benthic (HOLZMANN & PAWLOWSKI 1997) and planktonic (DE VARGAS et al. 1999) species, apparently linked with biogeographic patterns (DARLING et al. 2000). A recent molecular study has revealed an unusually high degree of genetic diversity among soft-shelled monothalamous (allogromiid) foraminifera at a shallow-water site in Explorers Cove, Antarctica (PAWLOWSKI et al. 2002). However, these methods have not been applied to deep-water species; indeed, little is known about the genetic diversity of deep-sea organisms in general (CREASEY & ROGERS 1999). To better understand the scale and pattern of foraminiferal diversity and biogeography on the ocean floor, a combination of morphological and molecular approaches is required. Specifically, we need to establish 1) whether foraminiferal morphospecies are distinct entities at the molecular level, 2) whether genetically distinct but morphologically very similar cryptic species exist and 3) the geographical and bathymetric ranges of common morphospecies and the degree of genetic differentiation that exists across these ranges. An additional and intriguing aspect of deep-sea faunas is the presence of a number of enigmatic foraminiferan-like taxa (xenophyophores, komokiaceans), the affinities of which are presently obscure.

With these considerations and the overall objectives of ANDEEP in mind, we will address the following questions and aims on the basis of samples collected during this cruise:

- Determine the diversity of foraminiferans at the genetic and morphological levels.
- Establish whether morphospecies present in ANDEEP samples also occur in the North Atlantic on the one hand and at shallow-water Antarctic sites on the other.
- Investigate links between patterns of morphospecies distribution and diversity and the environmental characteristics of the varied habitats within the ANDEEP study area.
- Determine whether or not morphospecies that are widely distributed bathymetrically and geographically within the ANDEEP area really form a single genetic entity.
- Determine the evolutionary origins of xenophyophores and komokiaceans.
- Describe new foraminiferal taxa, with special emphasis on monothalamous forms (allogromiids).

Multicore samples were taken for foraminiferal studies at all ANDEEP stations (Tab. 3.1.2-1). One core was sliced into 1 cm thick layers to 5 cm depth. In order to provide replication, three to six small subcores (3.45 cm^2) were taken from separate cores. To obtain more substantial volumes of sediment, we took one box-core subcore at each station. These were also sliced to 5 cm depth. Agassiz trawl and epibenthic sledge residues were examined on an opportunistic basis for larger foraminifera. This material was fixed and preserved in 4 % formaldehyde solution buffered with sodium borate. Together, it will form the basis for a detailed study of foraminiferal biodiversity and biogeography. Below, we present some preliminary observations made during the cruise on the distribution of selected foraminiferal species.

	Multicore syringe subsample	Complete multicore	Box core subcore
Surface area	3.5 cm^2	25.5 cm^2	90 cm^2
Number per station	4–9	1–2	1
Size fraction to be examined	>32 μm	>125 μm	>250 μm

Tab. 3.1.2-1: Fixed samples to be used for faunal study.

Epibenthic sledge residues (>500 µm fraction; qualitative samples) from four ANDEEP I stations (41-3, 42-2, 43-8, 99-4) yielded numerous large foraminifera, most of them agglutinated. A total of 128 morphospecies was tentatively recognised among this material. Groups that were particularly rich in species included agglutinated spheres and attached domes (e.g. *Crithionina* spp., *Psammosphaera* sp., *Saccammina spherica*), various tubular forms (e.g. *Bathysiphon, Rhabdammina, Rhizammina, Hyperammina, Saccorhiza*) and hormosinaceans (mainly *Hormosina* spp., *Reophax* spp.). At stn 41-3, calcareous foraminifera were diverse although not very common. Some abundant species present in these residues are listed in Table 3.1.2-2.

At all ANDEEP II stations, sediment was removed from the surfaces of multicore and box core samples, sieved on 125 μm and 500 μm screens, and examined for live foraminifera. In addition to providing specimens for molecular analysis (see below), this material gave us a general overview of foraminiferal species composition in the study areas. On the basis this preliminary analysis, the stations could be divided into three main groups: the Peninsula slope (stations 131-133), the Abyssal Plain (135-138) and the South Sandwich slope (stations 140-141), with stations 134 and 139 having a transitional character (Tab. 3.1.2-3).

Attached agglutinated foraminifera, e.g. *Webbinella* and *Tolypammina*, free-living agglutinated species such as *Glomospira* sp., *Psammosphaera* spp., *Crithionina hispida,* a variety of small white *Bathysiphon* spp., *Subreophax distans, Ammobaculites filiformis*, and several calcareous species including *Alabaminella weddellensis, Epistominella exigua* and *Pyrgo* spp., were common on the Peninsula slope. At the deepest (4000 m) station on this transect (station 134), a number of other species appear, among them an elongate, tubular "saccaminid"-like form that probably represents a new genus. The dead assemblage at this station included a number of large hormosinaceans (*Hormosina normani, H. globulifera, Nodosinum gaussicum*).

Species	stn 41-3 2374 m	stn 42-2 3680 m	stn 43-8	stn 99-4 5194 m
Saccorhiza spherica	C	P		
Pilulina argentea		C		
[A]*Webbinella* sp.	C			
Rhabd. aff. *neglecta*		A		
Saccorhiza ramosa		A	A	
Rhizammina algaeformis		A	A	A
Hyperammina subnodosa				A
[A]*Ammolagena clavata*	C			
[A]*Tolypammina* sp.	C			
[A]Branched tube	C			
Yellow *Rhabdammina*				A
Hormosina sp.		A	A	
Hormosina normani				A
Subreophax distans		C	C	
Cribro. subglobosa		C	C	
C. crassimargo			C	
Recurvoides contortus			C	

Tab. 3.1.2-2: Selection of species that were abundant in epibenthic sledge residues form ANDEEP I. A = Abundant, C = Common, P = Present. [A] Attached species

The abyssal plain assemblage was characterised by delicate komokiaceans, notably *Edgertonia argillispherula, Ipoa fragilis, Lana* spp., *Normanina* sp. and *Septuma* sp. The best komokiacean material was obtained from residues carefully elutriated by J. Blake. Some specimens of *Edgertonia argillispherula* and *Normanina* sp. possessed very long tubules which extended out from the main body of the organism. These individuals apeared to be in much better condition than any previously collected kmokiaceans. Possibly related to komokiaceans were a number of delicate chain-like forms. Tubular fragments of *Rhizammina* sp. and *Saccorhiza* sp. were abundant in some of the Abyssal Plain samples. A few specimens of a very elongate, needle-shaped *Nodellum*-like species also occurred. Delicate komokiaceans remained abundant at Station 139. Some additional distinctive species were also present here, among them several saccamminids and a short stick-like tube with a silvery reflection enclosed within a muddy envelope. These probably represent undescribed taxa.

The South Sandwich transect was characterised by large agglutinated foraminifera, some of which had been encountered previously in the Drake Passage samples collected during ANDEEP I. They included *Bathysiphon rusticus, B. flavidus, Hyperammina crassatina, Astrorhiza angulosa, Cyclammina cancellata, Ammolagena clavata, Nodosinum gaussicum, Saccammina sphaerica and Clavulina communis.* In many cases, these large tests were empty. Particularly notable were several live specimens of the xenophyophore *Aschemonella ramuliformis* (station 140) and numerous individuals of the organic-walled *Nodellum membranacea* (station 139). A very large individual of *Pelosina* was obtained in a multicore from station 139.The deep station (142) in the South Sandwich Trench (not included in Tab. 3.1.2-3) yielded a number of foraminiferal taxa not found at shallower sites. Among these was a distinctive white saccamminid, very delicate chains of elongate, spindle-shaped chambers, and a variety

Species (>125 μm)	Peninsula Slope	Transition (stn 134)	Abyssal Plain	Transition (stn 139)	South Sandwich slope
Webinella sp.	L				
Tholosina vesicularis	Y				
Tolypammina sp.	D				D
Crithionina hispida	Y				
Reophax distans	L				
Glomospira sp.	**L**				L
Ammobaculites filiformis	L	L			
Psammosphaera sp.	D	D			
Komoki mudballs	L				
Cyclammina cancellata	D			D	**D**
Alabaminella weddelensis	L				
Epistominella exigua	L	L	L	L	L
Small white *Bathysiphon*	L	L	L		
Spherical *Allogromia* sp.	L	L	L	L	L
Vanhoffenella spp.	L	L	L	L	L
Trifarina angulosa	D				
Hyperammina (arcuate)	L	L	L		
'*Waschmaxia*'		L	L		
silver saccamminid (>1 sp.)	L	L	L	L	L
Hormosina normani		D			
Nodosinum gaussicum		D			D
Hormosina globulifera		D	D		
Delicate chains			L		
Saccorhiza ramose			**L**		
Rhizammina sp.			**L**		
Needle *Nodellum*			L		L
Adercotryma sp.			L		
Aschemonella scabra			D		
Ellipsolagena sp.			L	L	
Delicate komoki (*Septuma, Ipoa, Normanina, Lana*)			**L**	**L**	
Delicate komoki (*Komokia sp., ?Septuma*)				**L**	
Large grey sacamminid				L	
Silver stick		D		L	
Hyperammina crassatina				L	L
Ammologena clavate					D
Bathysiphon rusticus					D
Bathysiphon flavidus					**L**
Clavulina communis					L
Pelosina sp.					L
Nodellum membranacea					L
Astrorhiza angulosa					L
Aschemonella ramuliforrmis					L
Saccammina spherica					L

Tab. 3.1.2-3: Provisional list of important species in ANDEEP II samples. L = live, D = dead; bold underline = abundant.

of komokiacean mudballs. The Trench samples also provided the best xenophyophore material collected during the ANDEEP campaign. This comprised fragments, some of them alive, of two species, *Psammina* sp. and *Homogammina* sp. The Trench fauna was not entirely unique. It included species found at other stations; e.g. the widely distributed *Allogromia* sp. nov., *Ammobaculites filiformis,* and a small arcuate *Hyperammina* with an organic proloculus.

A few foraminiferal morphospecies or morphotypes were present in all samples and appear to be ubiquitous across the ANDEEP study area. These included a spherical species of *Allogromia*, *Vanhoeffenella* spp. and a variety of silver saccamminids probably representing more than one species. Slender, white *Bathysiphon* species occurred in many of the samples and the calcareous species *Epistominella exigua* was also widely distributed. Some of the species present in the ANDEEP samples appear to be undescribed, but a large proportion of them are known from the North Atlantic. Particularly striking is the similarity between the large agglutinated forms present in the Drake Passage and South Sandwich areas and species occurring under the upwelling area off NW Africa. Many of the smaller foraminifera, including soft-shelled species, have been observed in the Porcupine Seabight (NE Atlantic). Our preliminary observations suggest that deep-water foraminiferal faunas off Antarctica contain few relatively endemic elements and are generally similar to those occurring in other parts of the deep ocean.

The molecular part of this project consisted on DNA preservation or extraction of the foraminiferans collected during the cruise. At each station, the surface sediment samples were taken from box-cores and multicores. The samples were transferred rapidly to the cooling container (4°C) and sieved through 1 mm, 0.5 mm, 0.125 mm, 0.063 mm and 0.032 mm size-mesh sieves. The fractions >0.125 mm were stored at 2°C room, while the smaller fractions were frozen in liquid nitrogen. The living specimens of foraminifera >0.125 mm were hand-picked under stereoscopic microscope. The small calcareous and agglutinated specimens were dried at room temperature, while the larger specimens and the soft-walled allogromiids were either frozen in liquid nitrogen or their DNA was directly extracted by using guanidine buffer (TKACH & PAWLOWSKI 1999). Each specimen destinated for DNA extraction was described and photographed before being destroyed. In total, 314 guanidine extractions were performed on 691 specimens representing 65 different morphospecies and 36 undetermined forms. About 300 specimens were dried and 250 were frozen in liquid nitrogen. Additionally, 84 samples, including sieved fractions 0.063 and 0.032 mm and unsieved sediment samples were frozen.

The further molecular procedure will be carried out in the Molecular Systematics Laboratory at University of Geneva. Its aim is to obtain partial or complete small subunit ribosomal DNA sequences for each morphospecies identified in our samples. In case of ubiquitous morphospecies such as *Epistominella exigua*, *Allogromia* sp. and *Vanhoeffenella gaussi*, the sequences of specimens collected at different depths and localities will be obtained searching for cryptic species. All specimens of common deep-sea genus *Bathysiphon* will be also examined to evaluate its genetic variability and to revise the morphological criteria of species distinction. Particular importance will be given to different komokiaceans and related forms (chains, mudballs), as well as to few xenophyophoreans (*Aschemonella*, *Psammina*) found in the South Sandwich Islands transect samples, in order to establish the phylogenetic position of these enigmatic groups. Finally, the frozen samples of phytodetritus and surface sediment will be examined to identify deep-sea protists communities by using molecular probes specific for different groups.

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3.1.3 Species diversity of benthic copepods and loriciferans in the Southern Ocean

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ANT-XIX/3 / ANDEEP I

Meiofaunal organisms are important components of deep sea benthic communities in terms of both abundance and diversity. After the Nematoda, the Harpacticoida (Copepoda) and the Loricifera are the most species-rich metazoans in the deep sea. We expect more than 90 % of the Harpacticoida and 100 % of the Loriciferans collected during this expedition will be new

Station	Date	Coordinates		Depth (m)	Meio-fauna	Poly-chaetes	Sediment
PS61/042-5	28.01.02	59° 40.39' S	57° 35.74' W	3695	9	2	1
PS61/042-7	28.01.02	59° 39.49' S	57° 34.51' W	3650	6	2	0
PS61/043-4	03.02.02	60° 27.05' S	56° 4.77' W	3958	9	2	1
PS61/043-6	03.02.02	60° 27.00' S	56° 4.24' W	3954	10	2	0
PS61/046-4	30.01.02	60° 38.12' S	53° 57.67' W	2893	9	2	1
PS61/046-6	30.01.02	60° 38.64' S	53° 57.27' W	2893	10	2	0
PS61/099-5	12.02.02	61° 7.09' S	59° 16.50' W	5191	7	2	1
PS61/099-7	12.02.02	61° 7.06' S	59° 15.53' W	5194	10	2	0
PS61/105-2	14.02.02	61° 24.14' S	58° 51.15' W	2290	8	2	1
PS61/105-4	14.02.02	61° 23.81' S	58° 50.24' W	2274	10	2	0
PS61/105-6	14.02.02	61° 23.73' S	58° 50.26' W	2274	10	2	0
PS61/114-5	18.02.02	61° 43.52' S	60° 44.13' W	2917	9	2	1
PS61/114-7	18.02.02	61° 43.48' S	60° 43.50' W	2900	8	1	0
PS61/114-9	19.02.02	61° 43.58' S	60° 43.22' W	2875	6	1	0
PS61/129-5	23.02.02	59° 52.39' S	59° 57.78' W	3597	5	1	1
PS61/129-7	23.02.02	59° 52.30' S	59° 57.63' W	3614	5	1	0
Totals					131	28	7

Tab. 3.1.3-1: Stations sampled with the multicorer during ANDEEP 1, showing oordinates, water depth and the number of corers used for each treatment.

to science, and of great phylogenetic importance. Other meiofaunal taxa will be studied by interested colleagues. The Nematoda will be the subject of a detailed investigation by experts at the University of Ghent. The material sampled during ANDEEP I and ANDEEP II will be of major importance for comparing meiofaunal diversity in the Antarctic deep-sea diversity with diversity in other deep-sea regions, describing and understanding latitudinal diversity patterns, and for investigating the major factors structuring deep sea meiofauna communities.

During ANDEEP I samples were taken with the AWI-multicorer equipped with 62 mm diameter tubes in depths between 2274 m and 5194 m. For meiofaunal analysis the top 10 cm sediment of each core (together with the supernatant water) was fixed with buffered formalin at a final concentration of about 4 %. Sorting of organism will be performed at our home institutes. From each multicorer deployment, one or two corers were used for the extraction of living polychaetes using an elutruation method (J. Blake). From each station one corer was deep frozen for future grainsize and pigments analyses.

The multicorer was been used at seven Station with 2-3 replicate drops per station. A total of 16 deployments yielded 166 useable sediments corers. Table 3.1.3-1 summarises these data.

3.1.4 Biogeography and biodiversity patterns of the metazoan meiobenthos in deep Antarctic waters with special emphasis on free-living marine nematodes

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ANT-XIX/4 / ANDEEP II

This project will focus on the nematodes, which are the main component of the meiobenthos in the deep-sea, and the most abundant metazoan group in bathyal and abyssal sediments. We defined the meiobenthos as all metazoans retained on a 32 μm sieve and passing through a 1 mm sieve. The meiofauna of shallow Antarctic waters, has been studied in the past by different research groups. However, the deep-sea meiofauna from the Southern Ocean is much less known. Data on Nematoda from deeper waters are restricted to the shelf break and upper slope areas up to 2000 m water depth off Kapp Norvegia and off Halley Bay (VANHOVE et al. 1995). Therefore, the ANDEEP sampling programme offered a unique opportunity to extend our knowledge of the biodiversity and biogeography of the Antarctic deep-sea fauna. In order to identify our main objectives for future research in the framework of the ANDEEP programme, we have made a comparison of the nematode community from the deepest stations (2000 m) from the Halley Bay and Kapp Norvegia transects with data from other, geographically distinct sites from similar water depths all over the world, including the Central Arctic ocean, the NE Atlantic, the West Indian ocean and the East Pacific. This comparison has revealed some obvious trends, which will be summarized below.

The Weddell Sea samples were characterized by the highest nematode densities, probably in relation to the higher primary production and its most nearshore location of the five sites. In addition the mean individual biomass was also higher in the Antarctic stations resulting in even more elevated biomass values compared to the other sites. By comparing the dominant genera it was found that in each area about 50 % of the nematode communities is made up by the same five to six dominant genera, with *Acantholaimus* and *Monhystera* being most abundant. In the Antarctic, *Dichromadora* is also abundant while *Microlaimus* replaces *Acantholaimus* as the dominant genus. It is mainly nematodes with larger buccal cavities preferentially with teeth that are responsibe for increased densities at the Weddell Sea stations, compared to other deep-sea sites.

Our comparison thus far did not consider the species level. Very few studies on the deep sea considered species, since very little taxonomical work has been done at this level. Nematodes are characterized in the deep-sea by a very high local biodiversity which can reach values up to three times higher than those of shallow water communities The genus *Acantholaimus*, that only occurs below 500 m depth and slightly increases in importance going deeper along the slope, is known as a very species rich genus. Within one deep-sea sample in the West Indina ocean, for instance, up to more than 15 *Acantholaimus* species living together are not exceptiona[l] However, we know nothing of the geographical ranges of the species, although there is evidence for high species turnover suggesting a high local radiation at deep-sea sites.

In this context, we identified several aims in the study of the Antarctic deep-sea communities:
(1) to obtain an idea on local species richness (alpha diversity) at different depths in the Southern Ocean and to relate gradients in biodiversity to changes in environmental characteristics including water depth, distance offshore, sediment composition and food supply;
(2) to estimate the species turn over (beta diversity) on different spatial scales by comparing the communities present at the different target sites from ANDEEP I and II;
(3) to recognize geographical patterns in community composition within the deep-sea;
(4) to compare Antarctic deep-sea meiofauna diversity with other bathyal and abyssal areas; (5) to perform molecular analysis on some of the dominant taxa in order to get a preliminar idea on the genetic radiation and to compare between different sites.

Results
Samples were taken with the multiple corer along a depth gradient reaching from 1000 m to 4000 m in the western Weddell Sea and the Scotia Sea and from 2000 m to 6300 m east of the South Sandwich Islands, and on the abyssal plain in the Weddell Sea at a depth of approximately 4500 to 5000 m. From every station at least three complete cores were sliced (0-1 cm, 1-3 cm, 3-5 cm and 5-10 cm) and preserved on formaldehyde (see Tab. 3.1.4-1) for meiofauna analysis. In the laboratory, the taxonomic composition of the meiofauna, and at the specific level the nematode community, will be studied. Our sampling method enables us not only to compare different regions but also to study the vertical distribution profile of the meiobenthos in the sediment. Subsamples (with cut off syringes of 1 ml per 1 cm sediment layer) were taken for organic carbon, grain size and pigment analysis along the Peninsula transect and at the Weddell Abyssal Plain. At the Sandwich Trench transect, each time one to two cores per station were sliced, each slice subdivided over two petridishes and stored at -30°C for further analysis of organic carbon, pigments and granulometry. Along this transect 2 ml subsamples were also taken for bacterial analysis from the surface layer (AWI, Dr Tan)

Clear differences in sediment composition between stations were observed. All samples from the Weddell Sea consisted of silt. Many small stones on top of the silty sediments were found along the Penninsula transect, whereas the abyssal plain sediments consisted of more homogeneous soft silty material. The sediment in the Scotia Sea was much coarser and many basalt grit and sand grains could be found mixed with the silt. As grain size is one of the most important factors influencing the nematode composition, these observations already suggest the presence of differences in the nematode community from the different areas.

On the surfaces of abyssal plain sediments, a distinct greenish fluff layer was present on most cores, and sometimes even lumps of phytodetritus were found. This phytodetritus layer was very patchy as it was not found with the same intensity on each core. A brief examination of some of the fluff layers did not reveal high densities of nematodes. Previous research has showed that nematodes are one of the last components of the benthos to react to phytodetritus deposition. A green fluff layer was also found at the 2000 m station on the Peninsula transect. In the Scotia Sea lumps of phytodetritus were found at the 3000 m and 4000 m station, but green fluff was lacking at the 6300 m station. Only some remains of faecal pellets were observed on top of these cores. The following table gives a description of the cores obtained and details of further processing.

Station	Depth	Core	Destination cores	Subcores of 1ml/1cm layer	Remarks
		A	meio (VP, form)	Sediment	
131-7	3053 m	B	meio (VP, form)	Organic C	
		C	meio (VP, form)	Pigments	
131-9	3064 m	A	meio (VP, form)	Organic C	
		A	meio (VP, form)	Organic C	
131-11	3038 m	B	meio (VP, form)	Sediment	
		C	meio (molecular, ac)		
		A	meio (VP, form)	Organic C	
132-5	1978 m	B	meio (VP, form)	Sediment	Green fluff
		C	meio (VP, form)	Pigments	
		D	meio (molecular, ac)		
		A	meio (VP, form)	Sediment	
132-7	2076 m	B	meio (VP, form)	Organic C	Green fluff
		C	meio (VP, form)	Pigments	
		D	meio (molecular, ac)		
132-8	2074 m	A	meio (VP, form)		Green fluff
		B	env. (– 10°C)		
133-6	1085 m	A	meio (VP, form)	Sediment	
		A	meio (VP, form)	Organic C	
133-8	1107 m	B	meio (VP, form)	Sediment	
		C	meio (VP, form)	Pigments	
		D	meio (molecular, ac)		
		A	meio (VP, form)	Organic C	
133-10	1109 m	B	meio (VP, form)	Sediment	
		C	env. (– 10°C)		
		A	meio (VP, form)	Organic C	
134-6	4068 m	B	meio (VP, form)	Sediment	A lot of green fluff
		C	meio (VP, form)	Pigments	
		D	meio (molecular, ac)		
		A	meio (VP, form)	Organic C	
134-8	4063 m	B	meio (VP, form)	Sediment	A lot of green fluff
		C	meio (VP, form)	Pigments	
		A	meio (VP, form)	Organic C	
135-6	4679 m	B	meio (VP, form)	Sediment	Few fluff
		C	meio (VP, form)	Pigments	
		D	meio (molecular, ac)		
135-8	4677 m	A	meio (VP, form)	Organic C	
		B	meio (VP, form)	Pigments	
136-6	4732 m	A	meio (VP, form)	Organic C	
		B	meio (VP, form)	Sediment	
		A	meio (VP, form)	Organic C	
136-8	4737 m	B	meio (VP, form)	Sediment	Thin green fluff layer
		C	meio (VP, form)	Pigments	
137-6	4975 m	A	meio (VP, form)	Organic C	A lot of fluff
		B	meio (VP, form)	Sediment	
		A	meio (VP, form)	Organic C	
137-8	4975 m	B	meio (VP, form)	Sediment	Few fluff
		C	meio (VP, forml	Pigments	
138 (3-5-7 -9-11)	4538 m	A	Meio (form)	Bulk samples processed for P. Martinez (University Oldenburg)	A lot of fluff (not green)
		B	Meio (form)		
		C	Meio (form)		
		D	Meio (form)		
		E	Meio (form)		
		F	Meio (form)		

Station	Depth	Core	Destination cores	Subcores of 1ml/1cm layer	Remarks
138-7	4539 m	A	meio (VP, form)	Organic C	Lumps of degraded phytodetritus
		B	meio (VP, form)	Sediment	
138-9	4540 m	A	meio (VP, form)	Organic C	no obvious phytoplankton but some fluff
		B	meio (VP, form)	Sediment	
		C	meio (VP, form)	Pigments	
		D	meio (molecular, ac)		
138-11	4541 m	A	meio (VP, form)	Organic C	lumps of phytodetritus
		B	meio (VP, form)	Sediment	
139-4	3933 m	A	meio (VP, form)		Silt, many stones and coarse bazalt grit
		B	meio (VP, form)		
		C	env. (– 10°C)		
		D	meio (molecular, ac)	Bacteria	
139-8	3933 m	A	meio (VP, form)	Bacteria	Phytodetritus lumps
139-9	3981 m	A	meio (VP, form)		Phytodetritus lumps
140-3	2950 m	A	meio (VP, form)		Many lumps of phytodetritus
		B	meio (VP, form)		
		C	env. (– 10°C)		
		D	meio (molecular, ac)	Bacteria	
140-5	2949 m	A	meio (VP, form)		Many phytodetritus lumps
141-4	2293 m	A	meio (VP, form)		
141-6	2276 m	A	meio (VP, form)		
		B	meio (VP, form)		
		C	meio (molecular, ac)		
141-8	2285 m	A	env. (– 10°C)		
142-4	6319 m	A	meio (VP, form)		
		B	meio (VP, form)		
		C	meio (molecular, ac)		
		D	env. (– 10°C)	Bacteria	
142-5	6315 m	A	meio (VP, form)		
		B	meio (VP, form)		
		C	meio (molecular, ac)		
		D	env. (– 10°C)	Bacteria	

Tab. 3.1.4-1: Overview of the samples (VP: Vertical Profile; meio: meiofauna; env: environmental characteristics; form: fixation to 4 % final concentration neutralized formaldehyde; ac: pure acetone fixation).

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3.1.5 Diversity of resting stages in deep-sea sediments

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ANT-XIX/4 / ANDEEP II

Resting stages are merobenthic stages in the life cycles of many planktonic taxa and they can reach densities up to 100 million/m^2 in shallow sediments ("seed banks"). The ecological importance of resting stages in neritic areas has been widely investigated and the presence of dinoflagellate cysts and resting eggs of Calanoida, Cladocera and Rotifera in marine shelf sediments is inversely related to distance from coastline and/or depth. On the contrary, the importance of cysts in deep waters is mostly neglected. In marine ecological systems, resting stages constitute a "potential biodiversity" allowing a structural continuity in the life cycle against the functional discontinuity given by the disappearance of species from the water column (BOERO et al. 1996). Resting stages may also represent an important food source for meiofaunal and macrobenthic taxa: keystone or diffuse predation on resting stages may act as a benthic key control on the pelagic system (ALBERTSSON & LEONARDSSON 2000, 2001). MARCUS & BOERO (1998) suggested that resting stages should be a fundamental biological link, via submarine canyons, in shelf-slope and shallow-deep sea coupling. During up-welling events, significant quantities of water and sediment coming from the deep bottom are pumped out of canyons toward the coasts. If the canyon lies sufficiently close to the coast, the canyon-up-welled water might be further up-welled into the euphotic zone where it would become readily available to the biota (HICKEY 1995). In particular, up-welled waters might affect coastal planktonic populations by not only supplying dissolved nutrients, but also recruiting propagules (resting stages) for their life cycle dynamics. If so, the functioning of coastal Antarctic waters would be intimately linked with that of offshore ones, via canyon-driven circulation of propagules. Many authors invoked the necessity to work out a complete model to better understand the functioning of marine systems (DENMAN & POWELL 1984). On the other hand, BOERO et al. (1996), and MARCUS & BOERO (1998) proposed biological cycles as a necessary complement to biogeochemical cycles. The EASIZ III cruise offered the first opportunity to start our investigations on dinoflagellate and metazoan cyst diversity (abundance, taxon richness, morphological adaptation) in sediments from Weddell Sea and South Shetland Islands. Collection of deep-sea resting stages within the framework of ANDEEP cruises will offer additional knowledge on a cryptic, but ecologically important component of the Antarctic marine system.

A total number of 35 sediment samples (first 3 cm layer) were taken by 5.3 cm^2 subcores from MUC (multicorer) and GKG (giant box corer) cores at 12 stations. Samples were fixed shortly after sampling in 4 %, borate-buffered formaldahyde solution in seawater. Further laboratory work at home (sonication, centrifugation in saccarose gradient) will allow isolation of cysts and morphometric analysis by using light and confocal microscope.

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3.2 Macrobenthos

3.2.1 Introduction to work at sea

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ANT-XIX/3 / ANDEEP I (AB, BH, JB, KE) and ANT-XIX/4 / ANDEEP II (AB, BH, JB, BEN)

The biodiversity of benthic macroinvertebrates in the Southern Ocean deep sea was investigated during ANDEEP I and ANDEEP II on the basis of 22 samples taken with the epibenthic sledge (EBS) (stations PS 61-40-3; -41-3; -42-2; -46-7; -43-8; -99-4; -105-7; -114-4; -129-2; -131-3; 132-2; -133-3; -134-4; -135-4; -136-4; -137-4; -138-6; -139-6; -140-8; -141-10; -142-6; -143-1) and 35 samples taken with the 0.25 m^2-box corer (GKG; Tab. 3.2.1-1).

On most of these stations the following additional gears were employed: CTD, a sediment profile imaging system (SEP), Agassiz trawl (AGT), and the multicorer (MUC). Systematic sampling of the scavenger component of these communities by baited traps, performed for the first time in the Weddell Sea during EASIZ expeditions, has been continued and extended to the deep sea at seven additional stations.

The epibenthic sledge was successfully employed at all 22 stations. It is equipped with an epibenthic (500 µm mesh size) and a suprabenthic net (300 µm mesh size) both bearing a cod end of 300 µm mesh size and of 1 m width, was trawled at every station with 1.5 times wire length to depth for 10 minutes over the ground with a mean velocity of about one knot. The haul distances will be calculated on the basis of the GPS derived positions of the ship at start

alternate	alternate	alternate	alternate	alternate
larvae (Blake)	macrofauna	macrofauna	macrofauna	alternate
larvae (Blake)	macrofauna	macrofauna	macrofauna	macrofauna
sediment (Howe)	macrofauna	macrofauna	macrofauna	sediment (Blake)
live animals	live animals	live animals	live animals	live animals

Fig. 3.2.1-1: Distribution scheme of box corer subsamples.

Station	Area	Box	Success/ Failure	Remarks
040-4	Shackleton Fracture Zone	undivided	f	foraminiferal ooze with stones
041-5	"	"	f	few cobbles
042-4	Ona Basin	divided	s	
042-6	"	"	s	
043-2	"	undivided	s	
043-5	"	"	f	pretrip in the water column
043-7	"	divided	s	
046-3	off Elephant Island	"	s	
046-5	"	undivided	s	
099-2	South Shetland Trench	divided	f	pretrip in the water column
099-6	"	"	(s)	qualitative sample, 5 subcores
099-8	"	"	f	sediment too soft
099-10	"	undivided	f	
105-3	off King George Island	divided	s	overpenetrated
105-5	"	"	s	"
114-6	"	"	s	
114-8	"	"	s	
129-4	west of Shackleton Fracture Zone	"	s	
129-6	"	"	f	pretrip in the water column
131-6	east of Peninsula	"	s	overpenetrated
131-8	"	"	s	
132-4	"	"	s	
132-6	"	"	s	
133-5	"	"	s	
133-7	"	"	s	
134-5	"	"	s	
134-7	"	"	s	
135-5	Weddell Sea Abyssal Plain	"	f	did not trip
135-7	"	"	s	
135-9	"	"	s	
136-5	"	"	f	pretrip in the water column
136-7	"	"	s	
136-9	"	"	s	
137-5	"	"	s	
137-7	"	"	s	
138-8	S of South Sandwich Islands	"	s	
138-10	"	"	s	
139-7	South Sandwich Islands	"	s	
139-10	"	"	s	
140-2	"	"	s	
140-4	"	"	s	
141-2	"	"	(s)	qualitative sample, low penetration
141-5	"	undivided	s	very sandy
141-7	"	"	s	"
142-2	South Sandwich Trench	divided	f	pretrip in the water column
142-3	"	undivided	f	"
142-7	"	n.a.	(s)	MUC, 7 subcores only
142-8	"	"	f	MUC, failure due to sea state

Tab. 3.2.1-1: List of box core stations and remarks on samples and processing. s = success, (s) = partial success, f = failure, n.a. = not applicable

and end of the haul according to BRANDT & BARTHEL (1995). The sample volume will then be calculated by multiplying the haul distance with the area of the box opening. As the sample distances will vary, numbers of individuals will later be calculated for a standardised 1000 m haul for reasons of comparison of both abundance and diversity values of Peracarida. As the EBS-material will also serve genetic studies, the complete samples were fixed in precooled 80 % ethanol for 48 hours. First extractions of DNA have already been done on board.

The box corer was successfully, or at least partly successfully, deployed at 17 stations, covering a depth range from roughly 1800 to 4500 m. In nearly all cases, boxes were used that were divided into 25 10x10-cm subcores. Only at stations with many drop stones or very sandy sediment an undivided box was used. The subcores were used for different analyses, with the inner nine and one additional outer subcore usually processed for macroinfauna (Fig. 3.2.1-1, box core plan). The upper 10 cm were sliced off the subcore and washed through 300 μm-mesh screens. At stations with a soft and fluffy surface layer, this layer was transferred directly to a sample container without sieving to ensure gentle treatment of infauna. Samples were fixed in 4 % buffered formalin and, if possible, transferred into 70 % ethanol after a few days. At stations with very sandy sediment, the upper 10 cm from a surface area of 0.1 m^2 were removed with a small shovel and processed in the same way as the soft-bottom samples.

3.2.2 Spatial patterns of Antarctic deep-sea soft-sediment biodiversity

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ANT-XIX/3 / ANDEEP I

In terrestrial systems a marked decline in the species richness of many animals and plants from the tropics to the poles is the general rule (ROSENZWEIG 1995, GASTON 1996). It has long been assumed that a similar trend is also found in the sea. There is no convincing evidence for a latitudinal cline across all taxa in the sea compared to that seen on land (CLARKE 1992, CLARKE & CRAME 1997). In the Southern Hemisphere the evidence for a latitudinal gradient of increasing richness from Antarctica to the tropics is less convincing than in the Northern Hemisphere (CLARKE 1992, POORE & WILSON 1993, CRAME 2000).

The idea that coastal diversity is low compared with that of the deep sea has been firmly accepted (e.g. HUSTON 1994, GRASSLE & MACIOLEK 1992). However, GRAY (1994) and GRAY et al. 1997) showed high species richness in soft sediments in coastal areas and thus questioned whether there is a decline of species diversity from shallow water to the deep sea.

One principal question is how marine biodiversity should be measured in a given latitudinal area. The number of species (species richness) has been the traditional measure of biodiversity in ecological and conservation studies, but the abstract concept of biodiversity as the "variety of life" cannot be encapsulated by a single measure. Distributions of species and community differences should be taken into account in addition to species richness. The partitioning of species diversity into alpha (α), beta (β) and gamma (γ) components to characterise different aspects or levels of diversity was first proposed by WHITTAKER (1960). One sample or site is typically, as in this study, used to describe α diversity, whereas γ diversity is computed by merging a number of samples over larger spatial scale. Most marine studies of species richness have been done on small scales, that of α diversity, and there are few studies of diversity at different spatial scales in the marine environment. Compared with the knowledge of α diversity, β diversity has been far less studied in marine systems (GRAY 2000). β diversity may be based on ratios of species richness of areas of different sizes, or differences in faunal composition between sites or areas, and is not a spatial scale of diversity, in contrast to α and γ diversity. Various measures of biodiversity may be expected to vary with different levels of environmental variability.

The ANT-XIX/3 and ANT-XIX/4 POLARSTERN cruises provided a unique possibility to sample macrobenthos data in order to address a variety of questions concerning Antarctic deep-sea soft-sediment biodiversity.

Samples from the Scotia Sea and the Weddell Sea were taken with a Sandia box corer (GKG giant box corer; surface 50 × 50 cm, divided into 25 subcores), washed through a 0.3 mm sieve, and the retained macrobenthos were fixed in 4 % formalin for later identification. At each site one additional sample was collected with a multicorer for analyses of sediment variables.

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Crame, J.A. (2000): Evolution of taxonomic diversity gradients in the marine realm: evidence from the composition of Recent bivalve faunas.- Paleobiology 26: 188-241.
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3.2.3 Patterns in diversity and controls on macrobenthic community structure, particularly Polychaeta

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ANT-XIX/4 / ANDEEP II

As the planned sampling strategy in the Powell Basin did not occur, the initially proposed project has been modified slightly. This project will concentrate mainly on the polychaetes as they tend to be the dominant macrofaunal group in the deep-sea. Although some previous sampling of macrofauna has been undertaken in the Southern Ocean, this has been confined to the shelf and upper slope of the Southeast Weddell Sea. The ANDEEP project thus allowed an opportunity to investigate the diversity and composition of the deep-sea polychaetes from the Northwest Weddell Slope to the South Sandwich Trench.

The objectives were:
(1) to look primarily at macrofaunal polychaete species diversity and composition;
(2) to compare macrofaunal polychaete diversity and composition from the Antarctic as well as to explore the links between Antarctic macrofaunal polychaetes with those from other deep-sea basins e.g. the Northeast Atlantic; and
(3) to determine which factors, such as water depth, sediment granulometry and organic carbon, influence the polychaete macrofaunal community.
Methods are described by BRANDT et al. (this vol.). Additional subcores were also collected, between 1 and 5 per station, from the Abyssal Plain and South Sandwich Trench. The overlying water was poured through a 300 μm sieve and any fauna were preserved immediately in 4 % buffered formalin. Each subcore that was taken was sliced at a depth of 5 cm, the surface layer was gently washed into a container and preserved. The remaining sediment was "puddled" using a 300 μm mesh sieve and then the remaining residue was preserved in 4 % buffered formalin. These samples will be sorted, the fauna counted and identified to the lowest possible taxonomic level and the results then combined with those of J. Blake (see Blake & Evans, this vol.).

It is hoped that these results will help answer the objectives put forward in this project and that the data will help determine the relationships between the Antarctic deep-sea fauna and those from other deep-sea areas.

3.2.4 Biodiversity and zoogeography of Crustacea Peracarida and Polychaeta

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ANT-XIX/3 / ANDEEP I (AB, WB, BH, MR, GS, GW); ANT-XIX/4 / ANDEEP II (AB, WB, BH, MR, GS, GW, UM-S)

During this study, the zoogeography, and biodiversity of peracarid crustaceans, and polychaetes were investigated using an epibenthic sledge. The results will be compared with existing data on the peracaridan fauna of the Magellan area, European northern seas, and the polychaete fauna of deep-sea regions in the Atlantic and northeastern Pacific oceans. Quantitative and qualitative samples were taken at 22 stations between 750 m and 6348 m in environments with different topographical and sedimentary conditions.

Peracarida

Peracarida (Amphipoda, Cumacea, Isopoda, Mysidacea, Tanaidacea) is the most successful taxon of Crustacea in the Southern Ocean, with a high percentage of endemic species (~90 %) on the Antarctic continental shelf and slope. However, it is not known whether this also applies for the Antarctic deep sea. Knowledge on the composition of Antarctic deep-sea isopods is generally scarce. A comparison of the biodiversity of Antarctic deep-sea Isopoda with that of the high European northern seas and with the deep sea of the Angola Basin will later contribute to discussions concerning latitudinal biodiversity gradients. As the epibenthic sledge (construction and deployment described in BRANDT & BARTHEL 1995), was always used in a standardised manner at all areas of investigation, the faunal composition of Isopoda of the more ancient Antarctic ecosystem can be compared with that of the Quaternary, Neogene Arctic one on the basis of material sampled with the same gear. Preliminary results from sorting some EBS-stations are summarised in Table 3.2.4-1.

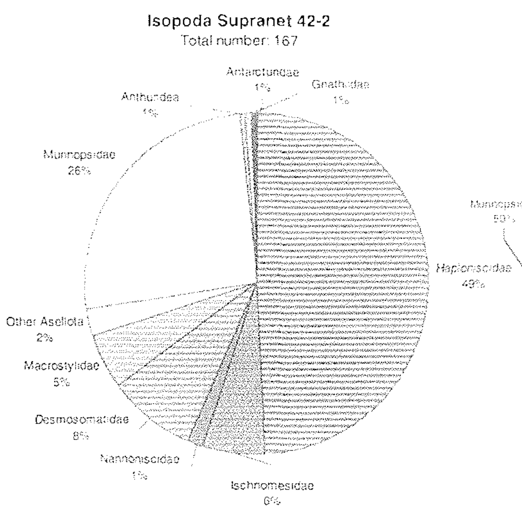
In the following figures we present the differences in isopod composition of supranet and epinet of the epibenthic sledge at family level for two stations. The first illustrations shows the isopod composition at station PS 61-42-2 in 3680 m depth.

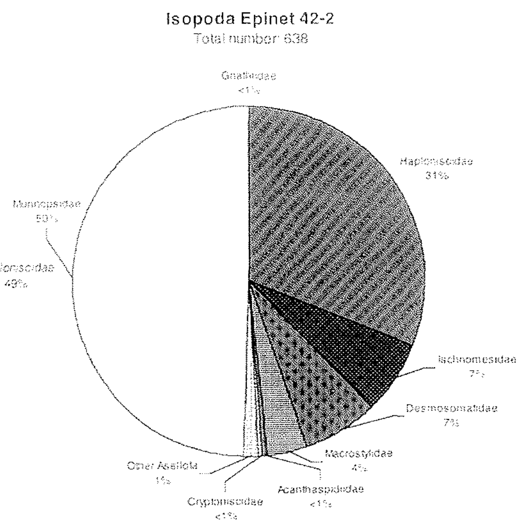
There are clear differences between the ocurrence of isopod species attributed to different families in both supra-, and epinet samples. While in the supranet the Haploniscidae clearly

Station	Depth	Amphipoda	Cumacea	Isopoda	Mysidacea	Tanaidacea	total
Supranet							
40-3 S	1756	0	0	0	0	0	0
41-3 S	2370	90	14	60	2	90	169
42-2 S	3680	152	127	167	7	12	465
43-8 S	2894	89	25	51	1	4	170
46-7 S	3962	927	684	390	94	23	2118
99-4 S	5190	3	0	10	0	2	15
105-7 S	2308	11	5	3	2	1	22
114-4 S	2920	63	60	209	10	9	351
129-2 S	3622	20	5	14	0	5	44
131-3 S	3050	64	3	42	3	3	115
132-2 S	2086	16	0	6	6	0	28

Station	Depth	Amphipoda	Cumacea	Isopoda	Mysidacea	Tanaidacea	total
Epinet							
40-3 E	1756	0	0	0	0	0	0
41-3 E	2370	120	21	136	9	7	293
42-2 E	3680	392	348	721	11	94	1566
43-8 E	2894	151	57	169	1	32	410
46-7 E	3962	1145	1120	572	14	115	2966
99-4 E	5190	9	1	22	0	4	36
105-7 E	2308	15	5	4	0	0	24
114-4 E	2920	31	26	203	2	8	270
129-2 E	3622	72	36	74	5	20	207
Total (both nets)							9269

Tab. 3.2.4-1: Peracarid individuals sorted from ANDEEP Stations taken with the EBS (S = Supranet: E = Epinet)

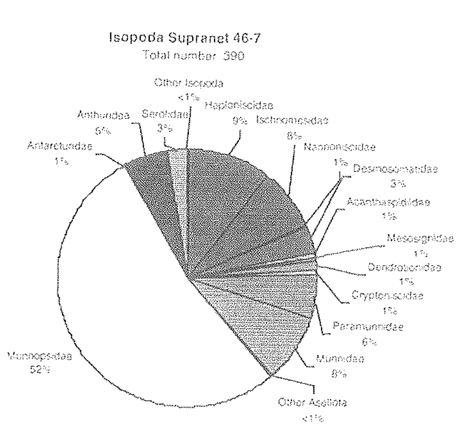


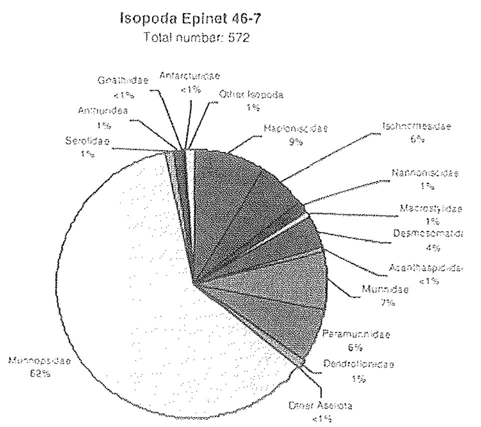


dominated with 49 % of the species, the Munnopsididae were the most abundant family in the epinet with 50 %, the Haploniscidae were only represented with 31 % in the epinet. Ischnomesidae, Desmosomatidae and Macrostylidae were sampled in both nets in very similar numbers. It is unknown whether this result might be an artifact or whether it illustrates that the highly motile Munnopsididae, which are capable of swimming feed closer to the bottom.

Isopod composition at station PS 61-46-7 in 3962 m depth shows a different picture. At this station Munnopsididae dominated with more than 50 % in both nets, however, they also occurred in higher numbers in the epinet. The fact that the Anthuridea were found more frequently in the supranet than in the epinet is certainly an artifact, the species of this taxon catch prey on the seafloor.

Composition of both stations show that Munnopsididae are the most abundant deep-sea isopod family.





Typical deep-sea asellote isopods sorted so far belong to the families Munnopsididae (primarily Ilyarachninae, Eurycopinae), Haploniscidae, Ischnomesidae, Desmosomatidae, Munnidae, Acanthaspidiidae, Nannoniscidae, and Macrostylidae. Antarcturidae, Serolidae and Gnathiidae were much rarer.

Evidence for high biodiversity is not only the number of species, but also the degree to which species differ genetically. For this reason DNA from specimens of *Haploniscus* (Haploniscidae) was isolated for further investigation of population genetics of five stations in the Drake Passage area and around Elephant Island.

Polychaeta

First indications on the diversity and composition of polychaete communities in the Antarctic deep sea emerged from preliminary analyses of several samples taken during ANDEEP I with the epibenthic sledge. Two statements can be made about the polychaete fauna based on six examined samples:

• there seems to be a depth related distributional pattern of polychaetes along downslope transects between about 1000 and 4000 m (Fig. 3.2.4-1);

• the sampled study areas differ from each other considerably, for example, in sediment characteristics, and they consequently support regionally different polychaete communities (Figs. 3.2.1-2, -3).

For example, the Maldanidae and Onuphidae are most abundant and predominant at shallower depths around 2300 m, whereas the Pholoidae and Sphaerodoridae dominate the community around 3000 m, and the Spionidae, which are very abundant and species rich in other deep-sea areas, are of minor importance except for greater depths around 3700 m. However, most of these "depth-related" differences may be related much more to local conditions of the seabed. The high dominance of onuphids observed at the Shackleton Fracture Zone was also found during ANT-XV/3 off King George Island, but not in the Weddell Sea, and may be restricted to the Drake Passage and the waters west of the Peninsula. It is also likely that the high dominance of spionids is a local rather than a depth-related phenomenon as the species richness known so far from deeper waters below 1000 m

is low, which may indicate that this otherwise ubiquitous family has not been able to colonise wider areas of the Antarctic deep sea.

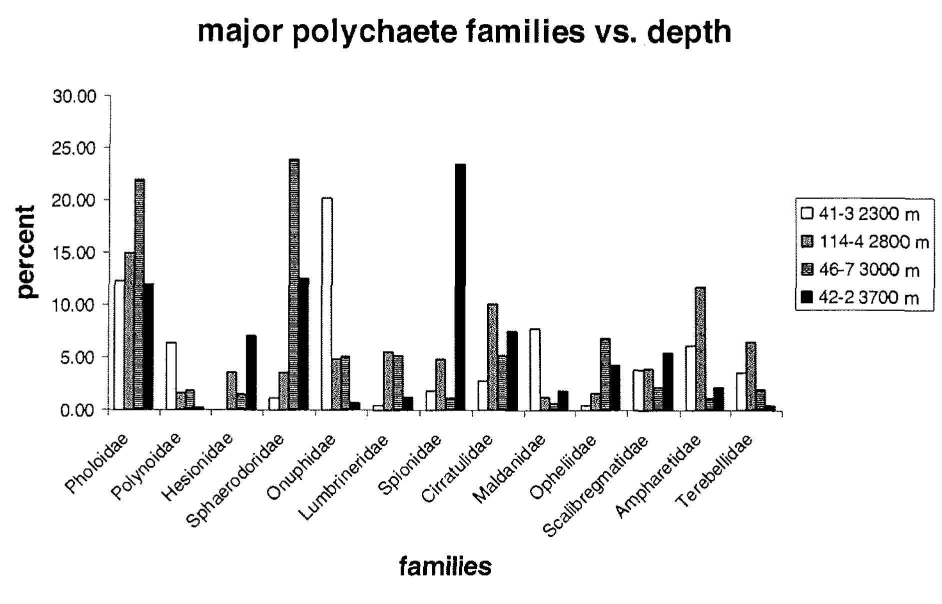


Fig. 3.2.4-1: Depth distribution of selected abundant polychaete families in the Drake Passage, Ona Basin, off Elephant Island, and off King George Island.

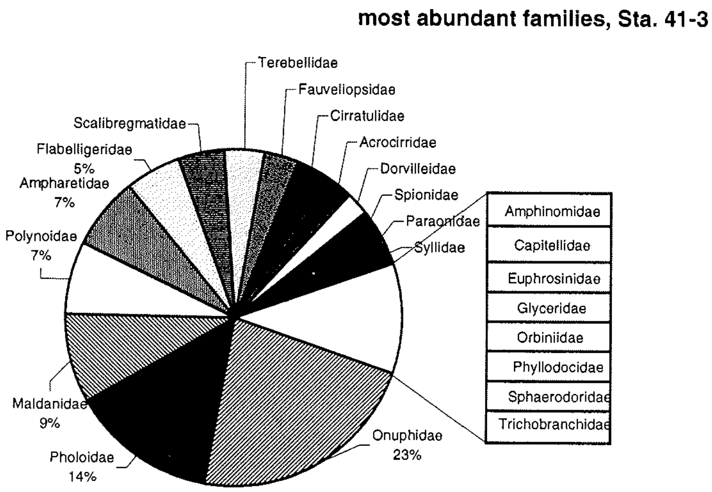


Fig. 3.2.4-2: Polychaete families contributing more than 1% to the total polychaete fauna, Shackleton Fracture Zone.

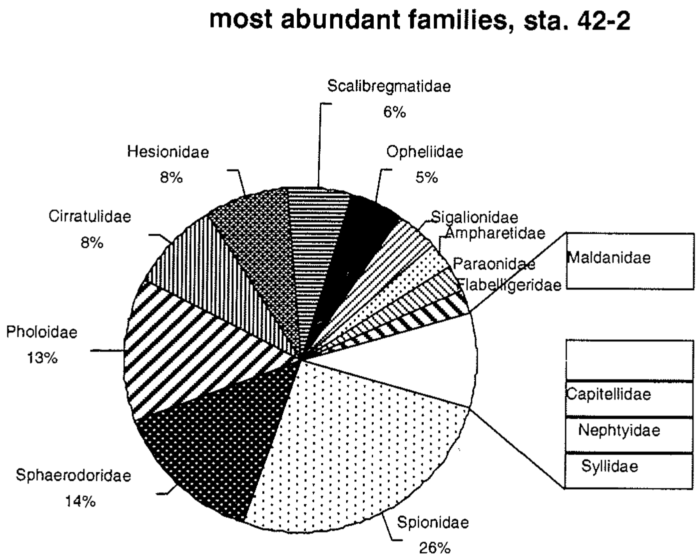


Fig. 3.2.4-3: Polychaete families contributing more than 1% to the total polychaete fauna, Ona Basin.

Cumacea

Cumaceans are subdominant after Amphipoda and Isopoda among the peracarids. They were sorted and counted to family level on board. Five out of nine known families are abundant in the epibenthic sledge samples: Lampropidae, Bodotriidae, Leuconidae, Nannastacidae, and Diastylidae. Members of the Nannastacidae live from coastal waters to the deep sea and from polar to tropical regions. The Diastylidae and Leuconidae prefer the cooler waters of the boreal and polar oceans. The dominance (in %) of certain families is depth dependant (Fig. 3.2.4-4).

Results are based on the pooled data from epi- and supranet of the samples already sorted. No significant defferences exist between supra and epinat in concern of family composition. At the "shallow" stations up to 3500 m depth the family Nannastacidae dominates while at the deeper stations (more than 3500 m up to 5110 m) the families Diastylidae and Leuconidae do so. Mysidacea are more rare in the epinet but regularly distributed in the supranet samples.

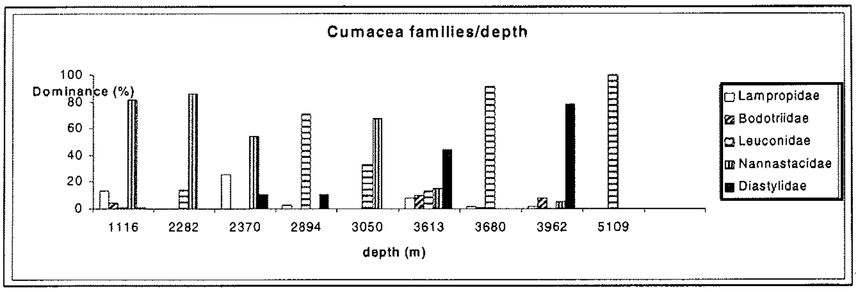


Fig. 3.2.4-4: Dominance of the Cumacea families versus depth

3.2.5 Ecology, life cycle variability and reproductive biology of deep-sea polychaetes (Aphroditidae, Polynoidae, Sabellidae)

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ANT-XIX/4 / ANDEEP II

Polychaetes are known in the Antarctica with about 800 species. The life cycle and the reproductive biology is known for less than 4 % of them. Many species of deep sea polychaetes show reduced larval phase (demersal larvae *sensu* MILEIKOWSKY 1977), or embryos brooding, which is a feature often observed also in cold, polar waters (DUCHENE 1985, BHAUD & DUCHENE 1987). This pattern has been recently recorded also in species belonging to a family which show strong phylogenetic contraints in larval development, such as Polynoidae. In some members of this family, species belonging to *Harmothoe*, and *Hermadion* have been observed to brood their eggs and embryos below the dorsal elitrae (GAMBI et al. in press, PIRAINO & MONTIEL-SAN MARTIN in press), a features never reported for this group, also in Antarctic waters (STILLER 1996), where lecitotrophic development of a pelagic larva seems to be a synapomorphy (GAMBI et al. in press). Interestingly, at least in some cases, an unknown case of complex epibiosis may occur. In fact, during the EASIZ III cruise masses of early embryos were found below the elitrae of one *Hermadion* sp. specimen which developed into Acoela flatworms. Members of Sabellidae have been observed as brooders, too, despite their relatively large sizes (GAMBI et al. 2000, in press). Brooding specimens of Polynoidae and Sabellidae have been collected in the Weddell Sea shelf during the EAȘIZ cruises in 1996 (ANT-XIII/3), 1998 (ANT-XV/3) (GAMBI 1997, 1999), and 2000 (ANT-XVII/3) (PIRAINO & MONTIEL-SAN MARTIN 2001).

On the other hand, many polychaetes colonising both deep sea and the cold polar waters are represented by small-sized forms, with short life span and belonging to families generally showing many r-strategy traits in their life history (e.g., Cirratulidae, Paraonidae, Capitellidae) (OLIVER 1984, OLIVER & SLATTERY 1985).

Participation to the ANDEEP programme aimed to increase the knowledge on ecology, life history and reproductive biology of deep sea antarctic polychaetes, with particular attention to some families and forms that can be found also in the shelf areas and that can be compared in their adaptation. In particular, polynoids and sabellids are investigated in order to search for other incubating species and to gather new data, by rearings on board, on developmental times and modes within these families in the deep-sea environment. Similar observations were successfully carried out during the EASIZ-III cruise in 2000 (PIRAINO & MONTIEL-SAN MARTIN 2001).

Scale worms were collected by Agassiz trawls only in 5 out of 12 stations (132, 139, 140, 141, 143), with three species of Polynoidae (total of 29 individuals) and two species Aphroditidae (total of 22 individuals). Due to the needs of ongoing molecular research projects, no ANDEEP II samples from EBS (epibenthos sledge) could be examined on board. However, samples taken from 4 out of 9 ANDEEP I stations (41-3, 42-3, 43-8, 46-7) were already available for the searching of scale worms. Some young polynoid specimens (most of them fragmented), belonging to three different species, were found in four out of the eight available samples (four stations, epi- and supra- net samples). According to this observation, the EBS seems the most promising gear in terms of polynoid catches, and we are looking forward to obtain all the available material as soon as the main sorting process for molecular and taxonomic purposes of other taxa will be completed by specialists in Hamburg. Collaborative work with scientists interested in other invertebrate groups has also been carried out on board to sort out all remaining metazoan taxa from ANDEEP I -EBS samples, after the main sorting for crustaceans and polychaetes already made by the Hamburg research groups. Unfortunately, only few specimens or fragments of very small polynoids were recorded in those pre-sorted samples.

All collected specimens obtained by AGT trawls were sorted under the stereomicroscope and fixed either in borate-buffered 4 % formaldheyde solution in seawater, or for genetic analysis. EBS samples were immediately transferred into 80 % alcohol as soon as the gear was on the deck. Identification of polynoids was preliminary carried out at the genus level, mainly using HARTMAN's (1964, 1974) monographs, followed by separation of morphotypes. Proper classification will be completed at the Stazione Zoologica of Naples.

None of the collected polynoids was found brooding egg masses under the dorsal elitrae. At home, the reproductive state of collected specimens will be investigated by histological analysis and electron microscopy. Unfortunately, most animals arrived dead or in poor conditions on the deck and it was impossible to start rearing experiments even to allow recovery of animals before fixation.

During the ANDEEP II cruise, 21 specimens of the aphroditid Laetmonice producta were collected by the AGT at station 143-2 (nearly 800 m maximum depth) on March 25th. The reproductive state of all specimens was checked by sectioning the body cavity and a rough estimate of the body proportion with visible gonads was given for each worm. Egg counting and measurements will be made at home under appropriate microscopes. By courtesy of J. Blake, ten specimens from a bottom trawl during the ANDEEP I at station 45-1 on 29 January (from 196 to 269 m depth) were also analysed and compared to the ANDEEP II specimens and to previous data from EASIZ II and III expeditions. At station 45-1, only 2 out of 10 specimens showed mature and extended gonads on the ventral side. Nearly two months later, 16 out of 21 specimens collected at station 143-2 showed visible gonads on the ventral side with mature gametes in at least one third of the whole body length. However, these data may be only merely indicative of the time of gonad maturation since the two sampled populations within the ANDEEP framework came not only from different stations (even though roughly at same latitude), but also from different depths.

During the EASIZ cruises, measurements of body size on large numbers of *L. producta* specimens showed that large individuals (body length >6 cm)were more abundant at shallow stations. On the other hand, small mature females were more abundant at the deepest sampled station (850 m depth), and this was interpreted as a possible paedomorphic effect with reduction of somatic growth and age or ripeness (MICALETTO et al. 2001a). Nevertheless, body size measurements of *L. producta* from ANDEEP II station 143-2 showed that the mean body length for ripe females is about 10.8 cm.

The polychaete *Veneriserva pygoclava* (Dorvilleidae) is a parasite living into the coelomic cavity of *L. producta* (MICALETTO et al 2001b). Three *L. producta* specimens, two males and one female, were infected each by a single parasite worm. This may reach a length of nearly three times the host length, i.e. up to 30 cm. For the first time we had the opportunity to put one parasite specimen in alcohol 96 %; this will give the opportunity to investigate by standard molecular tools the phylogenetic relationship of the parasite within the Dorvilleidae family. The other two specimens were relaxed with menthol and fixed in borate-buffered 4 % formaldheyde solution in seawater for further morphological analysis.

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3.2.6 The origin and evolution of Antarctic and deep-sea macro-infauna: systematics and reproductive patterns of polychaetes

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ANT-XIX/3 / ANDEEP I and ANT-XIX/4 / ANDEEP II

There are very few data that address the origin of polychaetes in the Southern Ocean. The ANDEEP program provides an opportunity to
(1) address the origins of deep-sea benthic polychaetes in relation to the fauna of the Antarctic shelf,
(2) explore linkages of Antarctic deep-sea faunas with the Atlantic and Pacific Oceans,
(3) test hypotheses to explain high biodiversity in the deep sea,
(4) assess deep-sea benthic community structure in the Southern Ocean, and
(5) develop data on the reproduction and larval development of benthic polychaetes.

From a systematic standpoint, the following seven polychaete families are targeted for detailed analysis: Orbiniidae*, Oweniidae, Paraonidae, Spionidae, Cirratulidae*, Scalibregmatidae, and Opheliidae*. Monographs on three of these families (*), based on collections from numerous expeditions, have recently been completed. New observations of living animals of these families provide an opportunity to test keys and species concepts, refine descriptions based on living specimens, and to expand the data on their distribution.

Additional observations were made on a variety of other polychaete families as well as other invertebrates. A somewhat more extensive benthic community analysis is thus possible based on the combined box core and multicore samples.

The field work was focused on developing new data on transient larval and post-larval polychaetes from surficial sediments of undisturbed multicore and box core subsamples. A meiofaunal extraction method was used to carefully separate the organisms from the sediment. Field tests of these methods in the Weddell Sea in May 2000 proved that small polychaetes could be obtained from the mud, cultured in the laboratory, and observed while still alive. In ANDEEP I, in January and February 2002, polychaetes from sediments in excess of 3000 m were successfully observed in the laboratory while still alive. These results have provided the first opportunity to examine the morphology of juveniles and postlarvae of rarely observed polychaetes. Similar observations were made on specimens from ANDEEP II from many stations exceeding 4000 m.

The field work also establishes quantitative data on the density and richness of polychaete populations, thus providing a framework that can be used to calculate species diversity and other benthic community parameters. The present report includes methods used to collect and study polychaetes in the laboratory, preliminary faunistic results, and results of the larval and postlarval investigations.

Sample collection

Samples were collected from the multicore equipped with 62 mm diameter cylinders and the 0.25 m^2 box core equipped with a vegematic box divided into the 25 10x10x50 cm subcores. Two multicore tubes and two box core subcores were collected with each deployment. The samples were extruded to a depth of 4 cm, cut, and placed into sample carriers. Water overlying each core was filtered through a 250 μm sieve. The samples were refrigerated until elutriation.

Sample elutriation and handling

Each sample was elutriated using a 500 ml distillation flask. Elutriated water flowed over a 250 μm sieve. After the elutriation was completed, the contents on sieve were gently washed into a sample container and refrigerated until sorting. Wet ice was used to keep standing samples cold during this procedure.

Sample sorting, handling, and observation

In the laboratory, the specimens retained on the sieve were examined using a Wild M-5 Stereomicroscope equipped with fibre optics. Polychaetes and other invertebrates were picked out and recorded on a datasheet. All polychaetes were examined for the presence of eggs or sperm. Following sorting, the specimens were kept in refrigerator running at -2°C. As time permitted, these animals were further separated into taxa and identified to the lowest possible identified level as permitted in the shipboard laboratory. The data was entered into a notebook. Specimens intended for further observation were set aside, others were immediately preserved in either 10 % formalin or cold 100 % ethanol, the latter used for specimens planned for DNA extraction. Specimens intended for detailed analysis were placed into hanging drop preparations and observed on the compound microscope. The stage of the microscope was a Brook Cooling Stage that was calibrated to cool to c. 2-4°C. In this manner, small, fragile specimens could be observed for extended periods while still alive. After observation, the specimens were preserved as above.

Photomicroscopy

Photomicrographs were taken with an older model Pentax Spotmatic II camera that could be conveniently mounted on either the compound microscope (Fisher brand equipped with Zeiss objectives of 2.5, 4, 10, and 40x), or the Wild M-5. The film used was Kodak Ektachrome Professional film, EPJ 135-36 with an ASA of 320. This film is colour corrected for tungsten filaments. For the compound microscope, light intensity was adjusted to a slight over exposure to allow for E-6 processing being done on the ship for other types of Ektachrome film. All exposures on the compound microscope were at either 1/125 or 1/250 second. For the Wild M-5, where a fibre optics illuminator was used, exposures ranged from 1/4 to 1/15 second and were usually bracketed to ensure at least one good exposure. Vibration was not a problem up to 100x magnifications. However, it was difficult to make observation at 400x and there were no attempts to use higher magnifications. The images were developed using E-6 Processing. The resulting images were cut into 6-exposure strips and scanned using a Polaroid film scanner. These digital images were then edited in Photoshop Business Edition 1.1 or in some instances Corel Presentations.

Database development
Excel spreadsheets were created from the datasheets. Raw data were kept separate for each sample for each station whether box core or multicore. Manipulations of the data included some pooling because of the low density and species richness at many of the stations. Larger station-wide estimates were then possible using combined samples to increase the surface area sampled. This sometimes resulted in an uneven sample size, but was the only way to obtain sufficient data to generate diversity indices.

Results
Of nine stations sampled as part of ANDEEP I, only seven yielded fully useable samples from the boxcore and multicore. Two stations on the Shackleton Fracture Zone were sandy and scoured by currents, nevertheless, some sandy sediment retained on the spade of the box core was elutriated and yielded several polychaetes. Of the seven stations sampled normally with the corers, a total of 25 subcores from the box core and 30 from the multicore were elutriated and processed for macrofauna.

For ANDEEP I, a total of 253 specimens of benthic invertebrates were obtained, of which, Annelids accounted for 74 %, Peracarids 16 %, and Molluscs 4 %. Of the annelids, there were 29 families of polychaetes in the samples in addition to oligochaetes. The dominant polychaete families included: Cirratulidae (22 %), Spionidae (16 %), Paraonidae (8 %), and Scalibregmatidae (7 %); Oligochaeta accounted for 7 % of the total annelid fauna.

The samples yielded several new species of polychaetes including two species of *Ophryotrocha* (Family Dorvilleidae), one species of *Scoloplos* (Family Orbiniidae), two species of *Aricidea* (Family Paraonidae), species of *Spiophanes* and *Prionospio* (Family Spionidae), and several species of *Aphelochaeta, Chaetozone*, and *Monticellina* (Family Cirratulidae). The species of *Monticellina* occurs in mudballs and is similar to *M. luticastellus*, described by Jumars from the San Diego Trough off California in the 1970's. It is likely that other new taxa will be revealed once more careful study of the preserved collections is undertaken.

Juveniles accounted for approximately 50 % of the specimens examined. Juveniles or postlarvae were present in most of the families examined. Of particular note were small specimens of scalibregmatids where the prostomium was rounded on the anterior end instead of having frontal or lateral horns. The latent development of the typical adult prostomium may have implications for understanding the systematic interrelationships of species and genera within the family as well as of scalibregmatids with other polychaetes. A growth sequence of *Sphaerodorpsis parva* (Family Sphaerodoridae) indicates that all adult characters are established by the 7-setiger stage.

Twelve stations were sampled for benthic infauna in ANDEEP II. Eight stations were in the Weddell Sea and a total of 54 subcores were obtained from the box core and 50 from the multicore. Four stations were sampled from the South Sandwich transect and a total of 18 subcores were obtained from the box core and 16 from the multicore. There were no usable box core samples from either station 141 or 142 on the South Sandwich transect. The higher number of samples per station reflects a desire to obtain more individuals in a sparsely populated area. For ANDEEP II, a total of 353 specimens of benthic infauna were obtained.

Dominant taxa in the Weddell Sea were: Annelids (66 %), Peracarida (21 %), and Echinodermata (5 %). There were 25 families of polychaetes as well as oligochaetes among the annelids. Dominant taxa were: Spionidae (16 %), Cirratulidae (14 %), Paraonidae (11 %), Oligochaeta (7 %), and another four families with 5 % each.

Dominant taxa along the South Sandwich Island transect were: Annelids (73 %), Peracarida (10 %), and Ostracoda (6 %). Of the annelids, there were 19 families represented of which Cirratulidae (13 %), Terebellidae (12 %), Maldanidae (9 %), and Spionidae (9 %) were the most abundant.

Numerous new taxa were observed in the ANDEEP II samples. A third species of *Ophryotrocha* was observed at station 133 on the slope of the Weddell Sea. This species was considered an adult because the jaws were fully developed, but the specimen was small and had polytrochal ciliary bands over all body segments, suggesting it may be a neotenous species. New taxa of Orbiniidae (*Leitoscoloplos* and *Orbiniella*), Paraonidae (*Aricidea* and *Cirrophorus*), Cirratulidae (*Aphelochaeta, Caulleriella, Chaetozone*, and *Tharyx*), Spionidae (*Prionospio*, unknown genus), and Acrocirridae (*Flabelligella*) were observed.

As in ANDEEP I, approximately 50 % of the specimens were juveniles or postlarvae. These were present in most of the families investigated. One juvenile of a species of *Euchone* (Family Sabellidae) exhibited an unusual growth pattern of the branchial crown, where some filaments were several times longer than others. Juveniles of *Travisia* (Family Opheliidae) exhibited similarities in habitus to scalibregmatids, with which they are often considered related. These similarities included development of a large expanded region in the anterior half of the body. Developmental sequences were evident in new species of *Prionospio, Aricidea*, and *Chaetozone* observed along the deep Weddell Sea stations. For the *Aricidea*, all specimens had a greenish cast and very distinctive conical shaped prostomium. The youngest specimens observed lacked both a medial antenna and branchiae. The medial antenna eventually developed, but branchiae were never observed. The *Prionospio* species only developed two pair of branchiae as an adult. Juveniles with no, one or two branchial pairs were observed.

Conclusions

In summary, the study of infaunal benthic polychaetes from the two ANDEEP surveys was highly successful in terms of finding new species and in obtaining living juveniles. Of special interest is that all of the seven families of polychaetes targeted for detailed analysis were present and yielded new taxa in addition to known ones. Some specimens were preserved for molecular analysis.

The results will provide valuable data to evaluate the relationships of the Antarctic deep-sea fauna to that of other ocean basins and to the Antarctic shelves. The community assemblage data, when compiled will permit a comparison of the Antarctic benthos to that of other deep-sea habitats and permit a test of hypotheses that the deep-sea is a reservoir of high species diversity.

The study of juvenile and post-larval forms has provided new characters to evaluate phylogentic relationships between and within families. Observations of developmental patterns among other polychaetes yielded interesting results as well and these will be compiled and expanded upon with further study.

3.2.7 Antarctic deep-sea amphipods

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ANT-XIX/4 / ANDEEP II

Amphipod crustaceans are often the dominant macrofaunal element within marine benthic and epibenthic communities, e.g. in the Southern Ocean (DE BROYER & JAZDZEWSKI 1993), and are widely used in environmental impact surveys and biodiversity assessments. They occupy the full range of both marine and freshwater habitats, from the depths of the deep-sea to interstitial and intertidal habitats, as well as freshwater, subterranean and even semi-terrestrial habitats. Furthermore, amphipod lifestyles include the entire range from benthic (endo- and epi-) to pelagic, as well as commensal and even semi-parasitic associations. In 1993 (GRUNER 1993), there were about 6300 described species, placed in approximately 150 families and 4 suborders, but the figure at the species level has increased significantly since then. In the Antarctic deep-sea, however, there had previously only been reported 21 species below 2000 m.

Due to limited time for sorting the various EBS-samples onboard, this report is mainly based upon those EBS-samples collected during ANDEEP I. From the ANDEEP II expedition, only station 133-3 has been available.

Main objectives
The main objective of the present project is to study the bio-diversity of the Antarctic deep-sea amphipod fauna. Further more, in connection with an ongoing project on amphipod phylogeny, we want to collect fresh material of a representative selection of families, suitable for morphological and molecular studies.

Secondary objectives
Study the fauna of associated amphipods in the Antarctic deep sea, and provide additional material of the amphipod family Stegocephalidae.

Amphipod biodiversity
In Table 3.2.7-1 all amphipods collected with the EBS during ANDEEP I (Drake Passage) and on station 133-3 (Weddell Sea) during ANDEEP II, are listed. For some of the families, especially the lysianassoids, phoxocephalids and oedicerotids, identifications were only to family level, although they were sorted to different species within each sample. For most other groups, identifications were to the genus level. Thus, comparing the number of species between the different stations is in many cases not possible. However, counting the minimum_number of species present in all the listed stations combined, there were at least 74 different species, from 28 different families of amphipods.

Table 3.2.7-1 lists the total numbers of species and individuals collected in the EBS-samples during ANDEEP I (and station 133-3 of ANDEEP II). The results, preliminary as they are, make clear that the biodiversity of the Amphipoda in the Antarctic deep sea is much higher than previously reported. In fact, the number of families (27) found below 2000 m during ANDEEP I is higher than the number of species reported earlier from that area. It is also worth noting that the diversity of amphipods at most stations is quite high, as is typical for deep sea biotopes: the average number of individuals per species varies from c. 4 to 10, with the exception of the aberrant station 46-7 with its clearly very rich epifauna, where the number is 19. The species-composition of this station, however, was very different from any of the other stations. Some of the main characteristics of station 46-7 were the many corophi

Station	41-3 (2300 m)		42-2 (3600 m)		43-8 (3900 m)		46-7 (2800 m)	
FAMILY	Species	#	Species	#	Species	#	Species	#
Ampeliscidae			2	10	2	13	2	31
Amphilochidae	1	2						
Astyridae	1	5					1	6
Caprellidae							1	35
Ceradocus-group							1	4
Corophioidea	1	20	3	54	4	34	4	335
Dexaminidae	1	1	1	1	1	1	1	15
Eusiridae	2	4	3	26	3	11	3	26
Epimeriidae								
Hyperiopsidae	1	3					1	2
Iphimediidae	1	2						
Ischyroceridae	1	3						
Leucothoidae								
Liljeborgiidae	1	5	1	22	1	13	1	34
Lysianassoidea	2	3	7	90	8	50	5	55
Melphidippidae							2	5
Oedicerotidae	3	8	5	8			3	11
Pardaliscidae	4	18	1	2			1	2
Phoxocephalidae	3	4	5	176	3	38	3	8
Pleustidae							1	24
Podoceridae			2	56	2	12	3	119
Sebidae	1	2						
Stegocephalidae	1	3	1	8	1	2	2	19
Stenothoidae			2	2			1	1
Stilipedidae								
Synopiidae	3	3	2	3			2	11
Urothoidae	2	15	1	1			1	1
Vitjazianidae								
Families: 28	29	101	36	459	25	174	39	744

Tab. 3.2.7-1: List of species collected with the EBS during ANDEEP I (Drake Passage) and station 133-3 during ANDEEP II (Weddell Sea).

oids (mostly *Gammaropsis*), podocerids and caprellids. In fact, caprellids were not recorded from any other station.

Comparing with the amphipod checklist for the Antarctic area, recently published by the Ant'poda network (Debroyer, *unpublished*), the following genera, present in the ANDEEP collections, have not earlier been recorded from Antarctic waters: *Halicoides* (Pardaliscidae), *Haploops* (Ampeliscidae), *Pseudo* (Stegocephalidae), *Pseudotiron* (Synopiidae), *Vitjaziana* (Vitjazianidae), and *Xenodice* (Podoceridae). For at least two of these (*Pseudo* and *Vitjaziana*), these are the first records from the southern hemisphere.

Material of 27 species (from 17 families) was collected for later DNA-analysis.

Associated amphipods in the Antarctic deep sea

Although there are no truly parasitic amphipods, a rapidly increasing number of species has been found living in association with other invertebrates or marine vertebrates. Several such associations have also been discovered in the Antarctic: sponge associates have recently been the subject of extensive studies, while the reports on amphipods in Antarctic tunicates are scattered in the literature. In the deep-sea the presence of associated amphipods has hitherto been virtually unreported, but this may have its main cause in the collecting methods used. In the present investigation, the megafauna has been primarily collected by Agassiz trawl; during ANDEEP II the trawl usually came up filled with sediment, necessitating extensive sieving of the contents. Nevertheless, a clear case of association was discovered: on many sea urchins of one of two cidarid spècies (probably *Aporocidaris milleri*) present in sample 140-8 (3000 m) east of the South Sandwich Islands from one to four lysianassoid amphipods were found firmly clinging to the oral field of several sea urchins; the amphipods have not yet been identified, but belong to or are closely related to the genus *Lepidepecreella* Schellenberg.

During ANDEEP I amphipod associates were found on two occasions: in both cases the hosts were cidarid sea urchins, and the associates were Corophiidae s.l.. In sample 43-8 (3953 m) three specimens were found on the surface of the sea urchin *Aporocidaris milleri*, while the many animals in sample 44-1 (330 m) lived in self-constructed tubes attached to the spines of the sea urchin *Rhynchocidaris triplopora.* In addition to this, a number of amphipods (*Andaniotes linearis* (50 specimens in one sponge), *Orchomenella* sp) were found on or in sponges, and more may turn up when the collected sponge material is examined in more detail.

The family Stegocephalidae in the Antarctic deep-sea

The family Stegocephalidae was recently revised by BERGE & VADER (2002), and especially the Southern Ocean proved to contain many previously undescribed taxa (see also BERGE et al. 2000). Until now, 18 species are recorded in the area, eight of these have been reported from the deep-sea (see below). In addition to the taxa that were treated in these papers, several still undescribed taxa have been reported (e.g. DE BROYER & RAUSCHERT 1999: 286).

Stegocephalid species on the Southern Ocean shelf:
Andaniella integripes, Andaniotes linearis, A. pooh, A. pseudolinearis, Austrophippsia unihamata, Schellenbergia vanhoeffeni, Stegocephalina pacis, Stegocephalus kergueleni, S. rostrata, Stegosoladidus antarcticus, S. debroyeri, S. ingens, Tetradeion crassum.

Stegocephalid species in the Southern Ocean deep-sea: *Andaniexis ollii, Andaniotes linearis, A. pooh, Parandania gigantea, P. boecki, Parandaniexis dewitti, Stegomorphia watlingi, Stegosoladidus ingens.*

From the samples made available during ANDEEP II, six stegocephalid species were discovered, four of which had previously been reported from the Southern Ocean (Tab. 3.2.7-2). Of these six species, *Andaniotes abyssorum* and *Pseudo* n.sp. had not been recorded from the Southern Ocean before, thus ten out of a total of 20 Southern Ocean species are found in the deep-sea. Furthermore, three species (*Andaniotes linearis, A. pooh* and *Stegosoladidus ingens*) have been found both on the shelf and in the deep sea.

Andaniexis ollii	Drake Passage, abundant (EBS)
Andaniotes abyssorum	station 46-7, Drake Passage (EBS)
Andaniotes linearis	Collected from sponges on station 68-1 (Bottom Trawl)
Parandania boecki	station 132-3, Weddell sea (EBS)
Parandaniexis dewitti	station 134-3, Weddell Sea (Agassiz Trawl)
Pseudo n. sp.	station 133-3, Weddell Sea (EBS)

Tab. 3.2.7-2: Stegocephalid species discovered during ANDEEP II.

Examining the sister group relationships (as hypothesised in BERGE & VADER 2001) of these 20 species, it is evident that the stegocephalid species found either strictly on the shelf or both on the shelf and in the deep-sea, have closest affinities to shelf species in Australia. Similarly, the deep-sea component of stegocephalid species is most closely related to deep-sea species in other basins, again mostly off Australia). There does not, therefore, seem to have been a flux of species between the two zones, except for the three species that have been recorded both on shelf and in the deep-sea. These three species are all closely related to other shelf species, which seems to suggest that they have invaded the deep-sea from the shelf, and not vice versa.

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3.2.8 Biodiversity, molecular phylogeny and trophodynamics of amphipod crustaceans in the Antarctic deep-sea

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In the Antarctic coastal and shelf communities, the peracarid crustaceans, and in particular the amphipods with more than 500 species, were shown to be by far the most speciose animal group and one of the most diverse in terms of life styles, trophic types, habitats and size spectra (De Broyer & Jazdzewski 1996, Chapelle & Peck 1999, Dauby et al. 2001a, De Broyer et al. 2001). Amphipods thus appear to be a particularly suitable model group for biodiversity studies.

In the Southern Ocean deeps, the very scarce investigations have revealed so far the presence of 82 benthic amphipod species below 500 m and only 21 ones below 2000 m, all belonging to relatively primitive families characterised by free-swimming males. These numbers are to be compared with the 405 and 262 species found below 1000 and 2000 m, respectively, in the other oceans of the world.

The project first aims at discovering and characterizing the biodiversity of the poorly known Antarctic deep-sea amphipod fauna and at comparing it with the Antarctic shelf and deep World Ocean faunas. The Antarctic deep-sea colonisation processes as hopefully revealed by the amphipod phylogeny and biogeography will be investigated as well as the potential causes of deep-sea amphipod diversity.

A second objective is to investigate the ecofunctional role of the deep sea amphipod taxocoenosis and in particular its trophodynamic aspects. However, the project includes several complementary approaches.

Taxonomic studies

The species compositions of the Antarctic deep-sea amphipod taxocoenoses are to be documented in a first step and new taxa to be described. These results will be integrated in the ongoing revision of the Antarctic fauna undertaken by the "Antarctic Amphipodologist

Network". Data and material will contribute to the ANT'PHIPODA biodiversity reference centre developed at I.R.Sc.N.B., Brussels (DE BROYER et al. 2001b) and to the preparation of new identification handbooks and interactive keys.

Phylogeny and biogeography

Pioneering molecular studies (using 16s and 18s rRNA and CO1 gene data,) on polar submergence serolid and arcturid isopods indicated several invasions into the deep-sea from the Antarctic shelf, all of which having occurred independently (HELD 2000). Calibrating the local molecular clock by using the opening of the Drake Passage (23 My) as a reference time suggested that submergence within these isopod families could be closely related to the glaciations history in Antarctica.

Do the amphipods exhibit similar trends? Can we establish phylogenetic links between shelf and deep-sea amphipod faunas and trace the origin of some World Ocean deep taxa in the Antarctic? Can we establish a gradient of apomorphy since distance (elapsed time) from the Antarctic place of origin increases? The deep-sea colonisation and the "polar submergence and Antarctic biodiversity pump" hypotheses are to be investigated within selected amphipod families through parallel molecular and morphological approaches. Among families widely distributed in both Antarctic shelf and deep-sea waters, lysianassoid amphipods probably constitute one of the most appropriate taxon for such kind of molecular and phylogeographic study. They are indeed the most speciose group on the Antarctic shelf bottoms and are susceptible to represent an important fraction of the deep fauna where they can be caught in baited traps.

Ecofunctional diversity

Previous studies carried out in the Weddell Sea have stressed out the large diversity of niche occupations (DE BROYER et al. 2001) as well as feeding habits (DAUBY et al. 2001a, GRAEVE et al. 2001) of benthic amphipods. The characterization of the general and trophic behaviour is to be pursued on deep-sea species. Most of them are supposed to scavenge on sinking organic matter, but many specialised inquiline associations (with e.g. sponges or tunicates) can be suspected.

The role played by amphipods as predators in the Antarctic ecosystems was also estimated for the Weddell Sea area, using either stomach content data (DAUBY et al. 2001b), lipid classes (GRAEVE et al. 2001) or stable isotope analyses (NYSSEN et al. 2001, 2002). Both the lipid and stable isotope techniques will be performed on deep-sea material. Not only amphipods, but also the other major zoological groups (in co-operation with the other benthologists onboard), would be sampled and analysed in order to delineate the position of the different amphipod groups in the deep Antarctic trophic webs.

Amphipoda (Gammarida and Caprellida) were collected from benthic and suprabenthic samples taken at the 9 and 12 stations devoted to deep benthos during ANDEEP I and II cruises, respectively. The following gears were used: Agassiz trawl (AGT), epibenthic sledge (EBS), large box corer (GKG) and multicorer (MUC). In addition, shelf specimens were collected from the benthos by-catch of the 72 bottom trawls (BT) performed by the Fish investigation team headed by K.H. Kock. Material from EBS was fixed immediately in cooled ethanol for further DNA analyses.

Seven (5 and 2) operations were carried out with a baited trap system. This system is composed of a cubic metal buoyed frame on which are fixed at different levels (bottom, 1 and 4 m high) several traps baited with icefish (*Champsocephalus gunnari*). The frame is sunk to the sea bottom by a single use ballast hooked to an acoustic release device which allows the system to come up. The prospected depths were respectively 2913, 3953, 349, 2280 and 2754 m during ANDEEP I, and 3070 and 3739 m deep during ANDEEP II. The second operation did not allow to recover a trap set.

Living specimens of more than 20 amphipod species (among which deep-sea ones) were kept in a dark container the temperature of which was maintained at -1°C (±1°C). Animals were grown in different aquaria (of 6 to 30 l) permanently fed with fresh sub-surface seawater and provided with various biological or inorganic substrates. Ethological observations of all species were performed in these tanks as well as feeding experiments on some selected species. The latter are the herbivorous eusirid Djerboa furcipes and the scavenger lysianassids *Pseudorchomene coatsi, Abyssorchomene plebs, Eurythenes gryllus* and *Waldeckia obesa.* Given food is of two types, depending on whether feeding rates (natural food, i.e. red algae and pieces of squid meat, respectively) or assimilation rates (isotopically labelled food, i.e. soy beans and pieces of cod meat) have to be estimated.

Specimens that survive at the end of the ANDEEP II cruise will be brought north to I.R.Sc.N.B., Brussels, in order to pursue behaviour observations and feeding experiments. Some non-amphipod taxa (pycnogonids, isopods) were kept in the same conditions.

Samples from different phyla representative for the deep-sea and the shelf benthic communities, and especially from groups which are known or suspected to be preys or predators of amphipods, were collected and frozen for further lipid and stable isotope analyses. Some amphipods from the stomach content of demersal fish (L. Pshenichnov, Ukraine) and octopuses (U. Piatkowski, Kiel) were also collected to implement the "predator database" (DAUBY et al. 2002).

Preliminary results of faunistic survey

Epibenthic sledge

Due to time schedule, only the samples from ANDEEP I could be partly examined. It clearly appears that amphipod biodiversity in the deep Antarctic is much higher than previously recorded. A preliminary sorting out of amphipod material (this work and VADER & BERGE, this vol.) revealed the occurrence of more than 70 species belonging to more than 25 families (see details in VADER & BERGE, this vol.). On the other hand, the relative abundance of amphipods in total deep-sea peracarid fauna looked much more important than usually thought for deep ecosystems (see BRANDT et al., this vol.).

Agassiz trawls

Very few amphipod specimens were collected with this gear. They mainly belong to Ampeliscidae, Ischyroceridae and Podoceridae; some lysianassoids (*Waldeckia* sp.) were also present in some samples.

Baited traps.

The seven trap deployements allowed to collect about 10,000 amphipod specimens (Tab. 3.2.8-1) belonging to 22 lysianassid species, 5 from the shelf area and 17 from deep-sea (Tab. 3.2.8-2). The deepest station (T7) provided about 1000 specimens of the cosmopolitan abyssal species *Eurythenes gryllus*. Moreover, the deep stations also provided more than ten species of lysianassoids which are likely to be new for science.

Station	Location	Depth (m)	Time h	Amphipod No. spp.	Amphipod No. ind.	Isopoda Nos spp. (ind.)	Fish Nos spp. (ind.)
O46-1 (T1)	60°39'S 53°59'W	2926	14	3	44	-	1(1)
043-3 (T2)	60°30'S 56°05'W	3953	etern al	?	?	?	?
083-1 (T3)	61°07'S 56°09'W	349	·72	5	~8500	2(97)	-
100-1 (T4)	61°25'S 58°54'W	2280	57	12	165	1(4)	2(2)
114-1 (T5)	61°46'S 60°45'W	2754	54	4	36	-	-
131-1 (T6)	65°19'S 51°35'W	3070	71	5-6	129	-	-
139-1 (T7)	58°18'S 24°29'W	3739	70.5	2	~1000	-	-
Totals					**~10,000**	**3(101)**	**3(3)**

Tab. 3.2.8-1: Summary of the trap samples.

Abyssorchomene plebs	083
Abyssorchomene sp.1 (humped1)	083
Abyssorchomene sp. 2 (ommatidian eye)	046
Abyssorchomene sp. 3 (humped2)	100, 114, 131
Abyssorchomene sp. 4 (humped3)	100, 131
Abyssorchomene sp. 5	114
Alicella n. sp.	100
Eurythenes gryllus	046, 100, 114, 131, 139
Hirondellea sp. 1	100
Orchomenid sp. 1 (humped1)	083
Orchomenid sp. 2	100
Orchomenid sp. 3	100
Paralicella sp. 1	100, 114
Paralicella sp. 2	100
Pseudorchomene coatsi	083
Pseudorchomene sp.1	100
Scopelocheirid gen. sp.	100, 114
Tryphosella sp. 2	083
Tryphosella sp. 3	100
Tryphosella sp. 4	100
Tryphosella sp. 5	100
Waldeckia obesa	083

Tab. 3.2.8-2: List of amphipod species collected in the baited traps.

Bottom trawls by-catch

Sorting out the invertebrate benthos by-catched by fish otter-trawl provided several amphipod species, many of which could be kept alive in aquarium such as: *Paraceradocus gibber, Eusirus perdentatus, Djerboa furcipes, Epimeria georgiana, E. similis, E. robusta, E. oxycarinata, Waldeckia obesa* or *Gnathiphimedia mandibularis*. Many other non-living specimens were collected, mainly from families Lysianassidae, Epimeriidae, Iphimediidae, Ischyroceridae, Ampeliscidae, Leucothoidae (in sponges) and caprellids.

Predator stomach contents
The analysis of octopus stomach contents revealed that amphipods constituted 53 % on the average of the total prey items. They formed up to 90 % of the items in octopus species such as *Pareledone charcoti*. The identified amphipods families were: Caprellidae, Podoceridae, Ischyroceridae, Lysianassidae, Pontogeneidae, Eusiridae. The identified amphipod species were: *Tryphosella* sp., *Parschiturella* cf. *simplex*, *Epimeria georgiana, Hippomedon kergueleni, Orchomenopsis pinguides, Paraceradocus gibber.*

A rapid survey of stomach contents of some rockcods, *Gobionotothen gibberifrons*, revealed the presence of numerous amphipods; main families were: Lysianassidae, Oedicerotidae, Podoceridae, Ischyroceridae, Liljeborgiidae, Eusiridae and Phoxocephalidae.

Molecular phylogeny and phylogeography of selected deep sea amphipod taxa
Specimens destinated for molecular analyses were put in ethanol 96 % the soonest as possible after sampling, preferably live when possible, or dead, according to the gear used for sampling, in order to avoid possible DNA degradation by enzymatic activity. As a rule, and when possible, a very little part of each specimen destinated for molecular analyses was taken, the pereopod 6 as a whole or a part of it, depending of the size of the animal. The amputated animals were preserved in ethanol 96 %, or 70 %, as voucher specimens and for future morphological studies. More than seventy DNA extractions and purifications were carried out by means of QIAamp DNA Mini Kit (Qiagen), from specimens of a total of 9 families, 29 genera and possibly 70 different species. The biological material was mostly representative of the super family Lysianassoidea, of which at least 19 genera and 47 species were obtained during Andeep I and II cruises. The remaining material consisted of a few specimens of related amphipod families, and was processed for the sake of outgroup use in future molecular phylogenetic reconstructions. All this material will be processed in the laboratory, in order to obtain DNA fragment sequences of at least 18S, CO1 and possibly ITS2 genes. These genes have proven to be useful for different phylogenetic levels and to give complementary information.

Feeding eco-ethology
Several experiments have been initiated on living amphipod species maintained in cooled aquaria, in order to estimate both ingestion and assimilation rates. These experiments will be pursued during the following cruise and further in Brussels. Results, which need stable isotope mass spectrometry measurements, cannot be acquired onboard.

Stomach content analyses, especially on deep species, have also been carried out in order to extend the existing database on Antarctic amphipod feeding habits.

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3.2.9 Investigations on the systematics, zoogeography, and evolution of Antarctic deep-sea isopods (Crustacea, Malacostraca)

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It is supposed that in the Pliocene and Pleistocene the Antarctic ice shelf never completely eradicated the Antarctic benthic shelf fauna. In the recent geological past Gondwana broke up and Antarctica subsequently isolated. This accompanied by climatic changes involving intermittent periods of global warming and global sea-level changes might have determined faunal zoogeographic ranges, migration processes in and out of the Antarctic, and limits. Extensions of the ice sheet may have enhanced speciation (as demonstrated for the Serolidae and Antarcturidae) on the Antarctic continental shelf, suitably named the Antarctic "diversity pump."

The Circumpolar Current isolates the Antarctic shelf, whose colonisation by the peracarid taxon Isopoda is relatively well documented. 88 % of shelf species are endemic. However, it is unclear whether this high degree of endemicity also proves true for the Antarctic deep sea, and how this faunal component communicates with other deep-sea species of the world's oceans via the continental slope and Antarctic deep-sea in space and time. Therefore, results from the deep-sea stations taken during this expedition will be compared with data on the biogeography and biodiversity of Isopoda from the Magellan area and the Antarctic. Against a background of phylogenetic analyses the new finds might help to elucidate the origin of taxa in Antarctica. How many species do we find in the Southern Ocean deep sea? Was the Antarctic shelf colonised by invaders from the deep sea or via the islands of the Scotia Arc?

The Isopoda are one of the most important elements of the bathyal and abyssal crustacean fauna occurring in every hitherto studied region of the deep-sea. However, Antarctic deep-sea isopods are little known. On the Antarctic shelf the isopod suborder Asellota dominates, usually increasing in species number with increasing depth. Therefore, we expect an increase of species numbers for Antarctic Isopoda with increasing sampling efforts in the deep-sea of the Southern Ocean. This Antarctic fauna might have a high proportion of species that evolved from shelf regions, since submergence has been observed for several taxa on the continental slope of Antarctica. It is therefore expected that while some species belong to the more ancient deep-sea fauna, others are derived from the more recently evolved polar shelf fauna. Investigation of the composition of the Southern Ocean isopod fauna and phylogenetic analyses of taxa will help to identify submergence or emergence phenomena. It is not known if local radiations occurred in the Antarctic deep-sea parallel to the radiations observed on the Antarctic shelf. With the help of molecular-clock models we intend to date the divergence of deep-sea species compared to those of shelf species collected during previous expeditions. We are also interested in the relationships of the more ancient faunal elements (mainly Asellota) with the deep-sea fauna of the more northern parts of the Atlantic (recently sampled during the expedition "Diva 1"). Unpublished results imply that specialisation of populations to certain depths leads to speciation in Antarctica. It is therefore important to compare superficially similar specimens collected in different depths to determine the degree of genetic divergence between populations. DNA from specimens of apparently the same species from different stations was extracted.

For example, the Asellote family *Haploniscidae* was found in almost all EBS-samples sorted on board. It consists of seven genera of which five were found in the samples: *Haploniscus*, *Antennuloniscus*, *Mastigoniscus*, *Chauliodoniscus* and probably *Hydroniscus*. *Haploniscus* is represented by at least three species, which can not be identified so far. The most abundunt *Haploniscus* species has a characteristic rostrum that shows allometric variability obviously not linked to sex or age. This might prove to be two or more closely related species. Numerous tissues were taken for DNA-extraction (see below).

The genus *Mastigoniscus* is recorded for the first time from the Southern Ocean. It was previously known only from the Pacific Ocean with a proposed centre of radiation in the southern Pacific. Two similar species differing in the size of the posterolateral processes of the pleotelson were found in the EBS-samples. Until now only male specimens have been seen.

Besides the Haploniscidae, deep sea isopods sorted so far belonged to the families Munnopsididae (several subfamilies represented, mainly Ilyarachninae and Eurycopinae), Ischnomesidae, Desmosomatidae, Munnidae, Acanthaspidiidae, Nannoniscidae, and Macrostylidae. As the size of the animals usually ranges between 1-3 mm, dissections and species identification will have to be done later in the laboratory in Hamburg.

In addition to traditional morphological studies, molecular methods have become more and more useful and important tools in modern systematics. Sequence data from nuclear and mitochondrial genes can help determine the population genetics, phylogeny and biogeography of deep-sea isopods of the Southern Ocean. Genetic distances will be used as a proxy for biodiversity. On the basis of these data we aim to develop a method for comparison of these data with species numbers identified by morphologists. The extraction of DNA of selected species was the first and most important step for further molecular studies and has been successful on board. For this treatment it was necessary that the specimen were fixed as soon as possible in cooled ethanol to prevent digestion of DNA. It is intended to use sequence data from nuclear and mitochondrial genes to analyse the phylogeny and biogeography of deep-sea isopods from the Southern Ocean. While systematics and phylogenetic work will be done in Hamburg using traditional methods, molecular systematics will be applied at the Ruhr-University of Bochum.

DNA extractions were taken from more than 140 specimens representing several taxa of the Asellota, the most dominant deep-sea isopod group, including genera like *Haploniscus*, *Acathaspidia*, *Mastigoniscus*, *Munna*, *Antennuloniscus*, *Mesosignum* and *Ischnomesus*.

For population genetics of *Haploniscus* spp. specimens from five stations and depths were fixed in order to study the gene flow between populations (Tab. 3.2.9-1).

Station	Depth [m]	Number of specimens
ANDEEP-I 41	2368	1
ANDEEP-I 42	3685	9
ANDEEP-I 43	3962	3
ANDEEP-I 46	2893	8
ANDEEP-II 133	1121	15

Tab. 3.2.9-1: Stations from which DNA of *Haploniscus* spp. was extracted during ANDEEP-I and ANDEEP-II

3.2.10 Comparative evolutionary histories of Antarcturidae and related families (Crustacea Isopoda) of southern continents

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During ANDEEP the origins and history of Antarctic benthic deepwater fauna will be investigated. Important questions for the Antarcturidae and related families are:
(1) Are any hypotheses generated for the Weddell Sea generally applicable for other regions of Antarctica?
(2) Are the processes that might be elucidated to explain the relationships between shelf, slope and deep-sea faunas of Antarctica the same as those applicable in other continents, namely Australia?

The crustacean order Isopoda is one of the characteristic taxa of cold waters with greatest diversity in polar seas, the deep-sea, and in much of the cool-temperate Southern Hemisphere. The isopod fauna of Antarctica has long received attention with 427 species described (BRANDT 1992). With one or two exceptions, no species are in common between Antarctica, Australia, New Zealand, South America and South Africa but common ancestors are suspected for many species.

The continental slope of southeastern Australia is one of the few deep-sea areas whose isopod crustacean fauna (365 species, most undescribed) has been catalogued in detail (POORE et al. 1994). This count of species was much higher than any comparable survey and was remarkable for the number of apparent local species radiations within genera and families. Apparent, because phylogenetic relationships have not been established in detail. The most important question remains: do the different faunas in Antarctica and southern Australia reflect ancient or recent (or both) periods of independent radiation?

New material of Antarcturidae and other Valvifera from ANT XIX-3 and -4 samples in the Weddell Sea will become part of a rigorous phylogenetic analysis of genera building on the family treatment of POORE (2001). Only in this way will these specific questions be answered:
(1) Is the apparent emergence from the deep sea to the southeastern Australian slope, and radiation there, of these species groups paralleled in Antarctica?
(2) If not, does this suggest periods of extinction in Antarctica of a once more widespread cold-water fauna?
(3) Are common ancestors for Weddell Sea and Australian slope species groups to be found in the deep-sea or elsewhere in Antarctica?

Sampling has been successful during ANDEEP I and II and valviferan isopods have been obtained from 26 otter trawl, EBS and Agassiz trawl samples sorted on board RV POLARSTERN. Many more samples remain to be sorted in the laboratory on land.

Biodiversity
Four families, at least eight genera, and 23 species have been recorded. Preliminary identifications have been made and all except two of the species from depths less than 1000 m can now be attributed to known species. Only one of these was found at greater depths. *Pseudidothea scutata* Stephensen, 1947 was previously known from the Antarctic Peninsula and South Shetland Islands at 342-600 m. New records are from 2900 and 3600 m but further investigation is needed to confirm this broad distribution. Half of the species appear to be

undescribed, and all of these are from depths greater than 1000 m. Only three species may belong to already described deep-water species but this is unclear. As a general rule the Antarctic shelf and slope faunas are distinct, as is the case for other continents, in spite of the absence of a significant temperature gradient.

Evolutionary radiation
There is no evidence among the few specimens identified so far of local speciation on the slope and shelf as occurs in the Australia region. Most species belong to genera widespread in Antarctican and the world's deep oceans.

Relationship to Australian taxa
The austrarcturellid genus *Dolichiscus* comprises 19 described species, 15 from Antarctica shelf and two each from the South Atlantic and South Pacific. All 17 other species of this family Austrarcturellidae belong to four genera found exclusively in Australia and New Zealand (POORE & BARDSLEY 1992). *Dolichiscus* is the sister taxon of this locally radiated group of species. One specimen of a new species of *Dolichiscus* collected at 2900 m during ANDEEP is morphologically similar to species of *Austrarcturella* and may help in timing events in the radiation of this southern hemisphere family. The new species will be described and all other species of *Dolichiscus* re-examined to construct a more detailed phylogeny of the family.

Species determined so far from depths less than 1000 metres:
Family Antarcturidae
Antarcturus hodgsoni Richardson, 1913; *Antarcturus spinacoronatus* Schultz, 1978; *Antarcturus strasseni* Brandt, 1990; *Antarcturus* sp.; *Chaetarcturus bovinus* (BRANDT & WÄGELE 1988); *Chaetarcturus longispinosus* Brandt, 1990; *Chaetarcturus* sp.; *Litarcturus antarcticus* (Bouvier, 1911).
Family Austrarcturellidae
Dolichiscus mirabilis Brandt, 1990; *Dolichiscus pfefferi* Richardson, 1913.
Family Pseudidotheidae
Pseudidothea scutata Stephensen, 1947 (also from >2000 m).
Family Idoteidae
Edotia pulchra Brandt, 1990.

Species determined so far from depths greater than 1000 metres:
Family Antarcturidae. *Antarcturus* cf. *princeps* Kussakin and Vasina, 1998; *Cylindrarcturus* cf. *elongatus* Schultz, 1981; *Cylindrarcturus* sp.; *Fissarcturus* – 4 spp.; *Litarcturus* sp.; *Oxyarcturus* cf. *beliaevi* (Kussakin, 1967); 2 genera undetermined.
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3.2.11 Ultrastructure of isopod sensillae (Crustacea, Malacostraca)

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The functioning of peracarid sensory organs is scarcely known. Within the Isopoda a special contact-chemoreceptor named "sensory spine" was described by BRANDT (1998) for *Sphaeroma hookeri* from boreal regions. This organ occurs in a rather similar shape frequently within several taxa, e.g. Valvifera, Sphaeromatidea, but its homology could not be shown until now. Boreal and Antarctic Isopoda face different environmental conditions. Besides the temperature differences Antarctic Isopoda are strongly affected by the changing light regime in winter (compared to their boreal relatives) and have to cope with a strongly pulsed seasonal food supply, whereas for boreal species changes in food availability does not change as much between summer and winter. The question is, whether the chaetotaxy of Antarctic species is different and whether morphologically similar organs, which are characterised by a strong seta equipped with a sensory sensilla, are homologous.

In order to test the potential homology of other organs with the known receptor, selected animals for transmission-electron-microscopy were prepared. A variety of appendages (antennae, antennulae, pereopods and uropods) of ten isopod species from different shelf and deep-sea localities were dissected and embedded for electron microscopy. Detritivorous or omnivorous species were *Storthyngura* sp. (Munnopsididae) and the passive filter feeding isopods *Antarcturus* cf. *hodgsoni*, *A.* cf. *polaris*, *A.* cf. *furcatus*, *A.* cf. *hempeli*, *A.* cf. *Spinacoronatus* (Antarcturidae), and *Pseudidothea scutata* (Pseudidotheidae). Predators fixed belonged to the isopod family Serolidae (Seroloidea), namely *Ceratoserolis trilobitoides*, and *Spinoserolis beddardi*. The dissected appendages were fixed in 6 % buffered glutaraldehyde, washed in phosphate or cacodylate buffer, postfixed in 2 % OsO_4 and after another washing procedure samples were dehydrated in ethanol (40-100 %) before they were transferred into propylene oxide and finally after 24 hours into Spurr resin. The samples were then polymerised at 60°C for three days. Later at home, selected blocs will be cut with an ultramicrotome, the ultrathin sections (~30 nm) will be picked up with fine-meshed grids and finally stained with lead citrate and uranyl acetate. Finally, the cellular structure of the sensory organs will be investigated in the transmission electron microscope at home after preparation of the ultrathin sections. Specimens of the above mentioned species were also fixed in formalin, washed and later transferred into ethanol. Some of these will serve to investigate the morphology and distribution of the sensory organs on the appendages of different species in the scanning electron microscope.

Brandt, A. (1988): Morphology and ultrastructure of the sensory spine, a presumed mechanoreceptor of *Sphaeroma hookeri* (Crustacea, Isopoda), and remarks on similar spines in other peracarids.- J. Morphol. 198: 219-230.

3.3 Megabenthos

3.3.1 Introduction to work at sea

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ANDEEP I (LA, SL, KE, RM, CdB); ANDEEP II (LA, SL)

A small AGT (1.5 m width) with a cod end mesh size of 10 mm was deployed on 10 occasions during ANDEEP I and on 13 occasions during ANDEEP II. The deployment protocol varied between catches during ANDEEP I but was standardised during ANDEEP II. The cable length put out was 1.8 times the water depth and the net was then trawled at ~1 knot for 30 minutes and hauled at 0.7 m s^{-1} with the ship stationary. Only 7800 m of cable were available and at stations deeper than 4300 m the entire cable was deployed although this was less than 1.8 times the water depth. The Agassiz was not trawled at the 6000 metre station as there was little chance of it reaching the bottom.

The Agassiz was judged to have fished successfully on all but four occasions although the small size of the trawl coupled with the relatively large mesh size meant that catches were often small. The catches adjudged to have failed were 43-9 (which was repeated as station 94-1), 114-2 (repeated as 114-10), 129-3 and 136-3 (neither of which were repeated). At station 133-4 the net suffered a large rip, however the cod end was full and the trawl was therefore considered successful. Station 136-3 was considered a failure despite the presence of a few ophuiroids and small pebbles. It was fished in heavy swell with less than 1.8 times the water depth of cable and it is likely that it was only on the bottom intermittently.

To determine the relative abundance of major taxonomic groups, the catches from the AGT were subjected to a visual check and major taxa were classified according to a four point scheme: 0 = absent, - =s carce, + = regular to fairly common, ++ = very common, dominant. The presence or absence of sediment (with comment on sediment type) is noted in the resulting Table 3.3.1-1 as this is likely to have biased the data. Many catches (especially during ANDEEP II) were filled with large volumes of soft mud and/or small pieces of pumice (from the volcanic activity around the South Sandwich Islands). To varying degrees these sediments entrapped smaller animals that would otherwise pass through the cod end mesh.

Station no.			PS-61/41-4	PS-61/42-3	PS-61/43-9	PS-61/46-8	PS-61/94-1	PS-61/99-3	PS-61/105-8
Date			27.01.02	28.01.02	05.02.02	02.02.02	10.02.02	12.02.02	15.02.02
Depth (m)			2201-2213	3720-3740	3971-3974	2895-2896	3966-3974	5192-5195	2228-2219
Sediment			clean	clean	failed	mud	clean	clean	clean
Porifera	Hexactinellida		0	0	0	0	0	0	0
	Other sponges		-	0	0	-	0	-	0
Cnidaria	Hydroidea		-	0	0	-	0	0	0
	Actiniaria		0	0	0	-	0	0	-
	Gorgonaria		-	0	0	-	0	0	0
	Pennatularia		-	-	0	-	0	0	0
	Alcyonaria		0	0	0	0	-	0	0
	Scleractinia		0	0	0	0	0	0	0
Nemertini			0	0	0	-	0	0	0
Mollusca	Bivalvia		0	0	0	-	0	0	0
	Aplacophora		0	0	0	0	0	0	0
	Gastropoda	Prosobranchia	-	-	0	-	0	0	0
		Ophistobranchia	0	0	0	0	0	0	0
	Polyplacophora		0	0	0	0	0	0	0
	Octopoda		0	0	0	-	0	0	0
	Scaphopoda		0	0	0	0	0	0	0
Polychaeta	Sedentaria		0	-	0	-	0	-	-
	Errantia		-	-	0	-	0	0	0
Priapulida			0	0	0	0	0	0	-
Sipunculida			0	0	0	0	-	0	-
Echiurida			0	0	0	0	0	0	-
Crustacea	Cirripedia		0	0	0	0	0	-	0
	Amphipoda		-	-	0	-	0	-	0
	Isopoda		-	-	0	-	-	0	0
	Cumacea		0	0	0	0	0	0	0
	Mysidacea		-	0	0	-	0	0	0
	Decapoda	Natantia	-	0	0	-	0	0	0
Pycnogonida			+	0	-	-	-	0	0
Bryozoa			-	0	0	-	-	0	0
Brachiopoda			-	0	0	-	0	0	0
Pterobranchia			0	0	0	0	0	0	0
Echinodermata	Ophiuroidea		+	+	-	+	-	+	-
	Asteroidea		+	+	-	+	-	+	-
	Echinoidea	Regularia	-	-	0	-	0	0	0
		Irregularia	0	0	0	-	-	0	0
	Crinoidea		+	0	0	0	-	0	0
	Holothuroidea		-	-	0	+	0	-	0
Ascidiacea			+	-	0	-	0	-	-
Pisces			-	-	0	0	0	-	-

Tab. 3.3.1-1: Relative abundance of major taxonomic groups in AGT catches. 0 = absent, - = scarce, + = regular to fairly common, ++ = very common (dominant)

Station no.			PS-61/114-2	PS-61/114-10	PS-61/131-4	PS-61/132-3	PS-61/133-4	PS-61/134-3	PS-61/135-3
Date			17.02.02	19.02.02	05.03.02	06.03.02	07.03.02	08.03.02	10.03.02
Depth (m)			2849-2889	2856-2852	3049-3052	2087-2084	1113-1120	4061-4065	4680-4680
Sediment			failed	clean	mud	mud	rocks / torn	mud	mud
Porifera	Hexactinellida		0	0	0	+	-	+	0
	Other sponges		0	0	0	+	+	+	++
Cnidaria	Hydroidea		0	0	-	-	-	-	-
	Actiniaria		-	+	0	-	0	-	0
	Gorgonaria		0	0	0	-	-	0	0
	Pennatularia		-	0	0	0	0	0	0
	Alcyonaria		0	0	0	-	0	0	0
	Scleractinia		0	0	0	0	-	0	0
	Schyphozoa		0	0	+	+	0	0	+
Nemertini			0	0	0	0	0	0	0
Mollusca	Bivalvia		0	0	0	0	0	-	-
	Aplacophora		-	-	0	0	0	0	0
	Gastropoda	Prosobranchia	0	0	0	-	0	-	-
		Ophistobranchia	0	0	0	-	0	0	0
	Polyplacophora		0	0	0	0	0	0	0
	Octopoda		0	-	0	0	0	0	0
	Scaphopoda		-	-	0	-	-	0	-
Polychaeta	Sedentaria		0	0	-	-	-	0	-
	Errantia		0	0	0	-	-	0	0
Priapulida			0	-	0	0	0	0	0
Sipunculida			0	0	0	0	0	0	0
Echiurida			0	0	0	0	0	0	0
Crustacea	Cirripedia		0	-	0	-	0	-	0
	Amphipoda		0	-	0	-	-	-	-
	Isopoda		0	0	0	-	-	-	-
	Cumacea		0	0	0	0	0	0	0
	Mysidacea		0	0	0	0	0	0	0
	Decapoda	Natantia	-	-	-	+	0	0	-
Pycnogonida			0	0	0	-	0	0	0
Bryozoa			0	0	-	-	+	-	-
Brachiopoda			0	0	0	0	0	0	0
Pterobranchia			-	-	0	0	0	0	0
Echinodermata	Ophiuroidea		-	+	0	+	++	+	-
	Asteroidea		0	0	0	-	0	0	-
	Echinoidea	Regularia	-	-	0	-	-	-	0
		Irregularia	0	0	0	0	0	-	-
	Crinoidea		0	-	-	0	-	-	0
	Holothuroidea		0	0	0	-	0	-	0
Ascidiacea			0	-	0	-	-	-	0
Pisces					0	0	0	0	0

Tab. 3.3.1-1: Relative abundance of major taxonomic groups in AGT catches (continued.). 0 = absent, - = scarce, + = regular to fairly common, ++ = very common (dominant)

Station no.			PS-61/136-3	PS-61/137-3	PS-61/138-4	PS-61/139-5	PS-61/140-7	PS-61/141-9	PS-61/143-2
Date			12.03.02	14.03.02	16.03.02	19.03.02	21.03.02	23.03.02	25.03.02
Depth (m)			4741-4736	4975-4973	4543-4545	3948-3926	2945-2958	2276-2292	753-795
			failed	clean	mud	rocks	pumice	pumice	pumice
Porifera	Hexactinellida		0	-	-	0	-	0	0
	Other sponges		0	-	-	-	-	-	+
Cnidaria	Hydroidea		0	-	-	0	-	-	-
	Actiniaria		0	-	-	-	-	-	-
	Gorgonaria		0	0	0	0	0	-	0
	Pennatularia		0	0	-	0	0	0	-
	Alcyonaria		0	0	0	0	0	0	0
	Scleractinia		0	-	0	0	0	0	0
	Scyphozoa		+	-	0	-	0	-	0
Nemertini			0	0	0	0	0	0	-
Mollusca	Bivalvia		0	-	-	-	-	+	+
	Aplacophora		0	0	0	0	0	0	0
	Gastropoda	Prosobranchia	0	0	0	-	-	+	-
		Ophistobranchia	0	0	-	0	0	0	0
	Polyplacophora		0	0	0	0	0	0	-
	Octopoda		0	0	0	0	0	0	0
	Scaphopoda		0	0	0	0	-	0	0
Polychaeta	Sedentaria		-	++	+	-	-	-	-
	Errantia		0	-	0	-	-	-	-
Priapulida			0	0	0	0	0	0	0
Sipunculida			-	-	0	0	+	-	-
Echiurida			0	0	0	0	0	-	0
Crustacea	Cirripedia		0	-	-	0	-	-	0
	Amphipoda		0	0	0	0	-	-	-
	Isopoda		0	-	0	0	-	-	-
	Cumacea		0	0	0	0	0	0	0
	Mysidacea		0	0	0	0	0	0	0
	Decapoda	Natantia	0	0	0	0	0	-	-
Pycnogonida			0	0	0	0	-	-	0
Bryozoa			0	-	0	-	-	0	-
Brachiopoda			0	0	0	0	-	+	+
Pterobranchia			0	0	0	0	0	0	0
Echinodermata	Ophiuroidea		+	++	+	-	++	-	++
	Asteroidea		0	+	+	+	-	-	-
	Echinoidea	Regularia	0	0	0	0	+	-	-
		Irregularia	0	0	0	0	-	-	-
	Crinoidea		0	0	-	0	0	-	-
	Holothuroidea		-	-	+	-	-	+	-
Ascidiacea			0	-	0	-	0	-	-
Pisces			0	0	0	-	0	0	-

Tab. 3.3.1-1: Relative abundance of major taxonomic groups in AGT catches (continued.). 0 = absent, - = scarce, + = regular to fairly common, ++ = very common (dominant)

3.3.2 Mollusca in the Antarctic deep sea - preliminary notes on their taxonomy, biogeography and diversity

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ANT-XIX/3 / ANDEEP I (KL, LA) and ANT-XIX/4 / ANDEEP II (KL, MS, CRMC, LA)

The break-up of the continental bridge between South America and the Antarctic Peninsula was a major event that influenced the evolution of the Antarctic marine benthic fauna. A better understanding of the mollusc distribution in the Antarctic deep sea of the Peninsula and Scotia Sea region will throw further light on the evolution and radiation of the present fauna. ANDEEP provided the ideal opportunity to study the missing faunal link between the temperate South America, the South Atlantic deep-sea and the Antarctic shelf fauna.

The material collected will be the basis for species descriptions, critical taxonomic revisions and zoogeographic analyses. The biodiversity of different molluscan classes will be assessed and latitudinal species diversity gradients will be studied. Studies on the phylogeny and population dynamics of selected taxa using traditional and modern methods may elucidate the role of the Southern Ocean as a center of radiation for Atlantic taxa and possibly as a continuing portal for colonization from the Indo-Pacific. These studies may also explain the origin of the recent Antarctic molluscan fauna.

We sorted and pre-identified Mollusca from nine EBS stations of ANDEEP I (2300-5200 m) as well as from the 20 AGT stations (1120-5200 m) of both legs. The material collected by the EBS on ANDEEP II has still to be sorted and identified. To date we have found 119 species and 1787 specimens in the samples from both gears.

The epibenthic sledge with a mesh-size of 300 μm in the cod ends was very efficient in collecting macrobenthic molluscs. To date we have identified 86 species belonging to five molluscan classes and have collected 1405 specimens (Table 3.3.2-1). With 41 species, gastropods are the dominant group in terms of species numbers followed by bivalves with 30 species. Aplacophoran species were quite common with five morphotypes of Caudofoveata and seven morphotypes of Solenogastres. Three species of scaphopods were found. The ratio of 1.37 gastropod to bivalve species is quite interesting bearing in mind that three times more gastropod species are known from the Southern Ocean than bivalve species. Further studies on the EBS samples from ANDEEP II will show whether this ratio is consistent for the Antarctic deep-sea. HAIN (1990), POWELL (1958) and EGOROVA (1982) reported ratios for gastropods and bivalves in the range of 1.94–2.94 in their studies on the Antarctic shelf (93 G: 39 B - Weddell Sea, 97 G: 33 B – Enderby Land to Ross Sea, 98 G: 50 B - Davis Sea).

The species populations seem to be small and very patchy in distribution. Almost two-thirds of all species found are represented in the material by specimens only found at one or two locations or by single specimens. High numbers of specimens were observed only for *Solenogaster* sp. 3, *Genaxius* sp., *Kingiella* sp., *Yoldiella* cf. *valettei*, *Philine* sp. 1, and *Siphonodentalium* sp.

There seems to be no relation between increasing water depth and species numbers (Fig. 3.3.2-1). Species numbers per station are more or less consistent over the depth range from 2300 m to 5200 m. Only station 46-7 shows increased species numbers, as well as increased

Class	Species	41-3	42-2	43-8	46-7	99-4	105-7	114-4	129-2	Σ
Caudofo-veata	*Chaetoderma* sp.							1		1
	Falcidens sp. 1		1			2				3
	Falcidens sp. 2		6				1	1		8
	Falcidens sp. 3				2					2
	Limifossor sp.		1							1
Solenogas-tres	*Neomenia* sp.							1	1	2
	Solenogaster sp. 1		1		4	1		1		7
	Solenogaster sp. 2	5		1	39			8		53
	Solenogaster sp. 3	6	17	7	137		6	44	4	221
	Solenogaster sp. 4	3			1			2		6
	Solenogaster sp. 5	3	4		1			2		10
	Solenogaster sp. 6		2	1						3
Gastropoda	?*Toledonia* sp.			1						1
	Aeolidacea sp.				1					1
	Anatoma cf *timora*	2			3					5
	Brookula sp.	4	2	2	2					10
	Buccinidae sp. 1				1		1		1	3
	Buccinidae sp. 2	2								2
	Cheritiella sp.		1							1
	Chlanidota cf *lamyi*				1	1		2		4
	Cylichna sp. 1							1		1
	Diaphana cf *inflata*	1			4					5
	Gastropoda eggs		1	1	4					6
	Lamellaria sp.	1								1
	Littorinidae sp.	2								2
	Melanella sp.		1		3	5				9
	Mesogastropda sp. 5				1					1
	Mesogastropoda sp. 2	3								3
	Mesogastropoda sp. 3	1			1					2
	Mesogastropoda sp. 4				1					1
	Mesogastropoda sp. 6				2					2
	Mesogastropoda sp. 7							1		1
	Mesogastropoda sp.1				1					1
	Naticidae sp.	2		1						3
	Newnesia sp.				1					1
	Notoadmete sp.			6	2					8
	Opisthobranchia sp.				1					1
	Parabucciunum sp.			4	1					5
	Pareuthria sp.		1							1
	Philine sp. 1	2	15		50	4		10		81
	Philine sp. 2					1	1			2
	Philine sp. 3				3					3
	Probuccinum cf *costatum*								1	1
	Prosipho sp.	1								1
	Seguenzia antarctica	6				12	1	1		20
	Sinuber sp.		1							1
	Skeneidae sp. 1								2	2
	Stilapex sp.			1						1

Class	Species	41-3	42-2	43-8	46-7	99-4	105-7	114-4	129-2	Σ
	Tomthompsonia sp.	1			1					2
	Trochidae sp.	1								1
	Trophon drygalski						1			1
	Volutomitra sp.						1			1
	Zerotulanidae sp.				1	33		6		40
Bivalvia	Bivalvia indet				5	4				9
	Cardiomya sp.		1			2				3
	Cuspidaria cf *tenella*	3			13		1	1	4	22
	Cuspidaria sp. 1		2			2				4
	Cuspidaria sp. 2	7	1							8
	Cyamiocardium sp.	24			14		1			39
	Cyclopecten sp. 1							3		3
	Cyclopecten sp. 2	3			1			1	1	6
	Dacrydium sp.	9			21	6			3	39
	Genaxius cf *bongraini*		12	3	66	4		4		89
	Genaxius sp.	6	28	3	35	4	3	50	1	130
	Kingiella sp.	1	4	4		85	2	11	4	111
	Limatula (Antarctolima) sp.	1			5	4		2		12
	Limatula (*Limatula*) sp.	1	4	6	3					14
	Limopsis marionensis	3						4	1	8
	Limopsis tenella							1		1
	Mysella sp.				1			1		2
	Nucula sp. 1							3		3
	Nucula sp. 2		12	1						13
	Silicula sp.				3	1				4
	Solecardia sp.		2					1		3
	Subcuspidaria cf *kerguelensis*								1	1
	Thyasira sp.				1					1
	Tindaria sp.		2	1	3	2		1	1	10
	Yoldia sp.		4							4
	Yoldiella cf *vallettei*	5	10	15	50	2	1	10		93
	Yoldiella cf. *ecaudata*	1	14		3	2			1	21
	Yoldiella sabrina			9		5	1			15
	Yoldiella sp. 2			10		1		1		12
	Yoldiella sp.1		36		1	3	2			42
Scaphopoda	*Cadulus dalli antarcticus*	1								1
	Pulsellum sp.		29		1	1			2	33
	Siphonodentalium sp.		49		45					94
		111	215	77	495	187	23	175	28	1405

Tab. 3.3.2-1: Mollusca collected by the EBS on ANDEEP I.

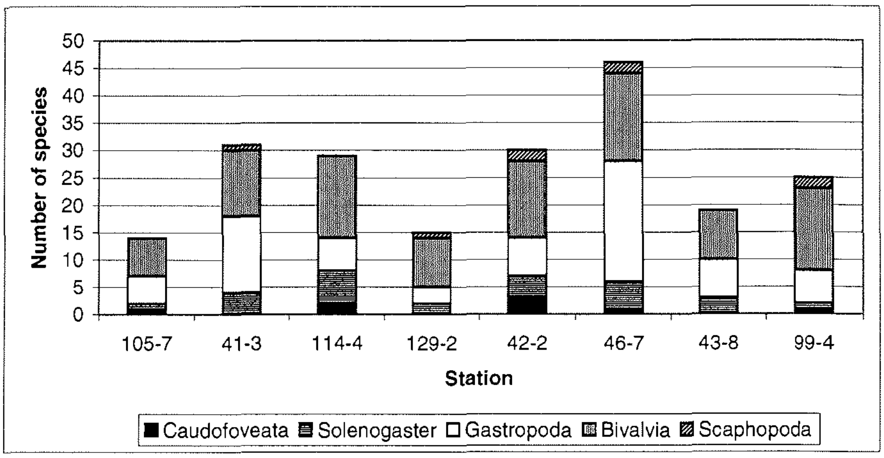

Fig. 3.3.2-1: Species – station distribution. Stations are ordered by increasing depth.

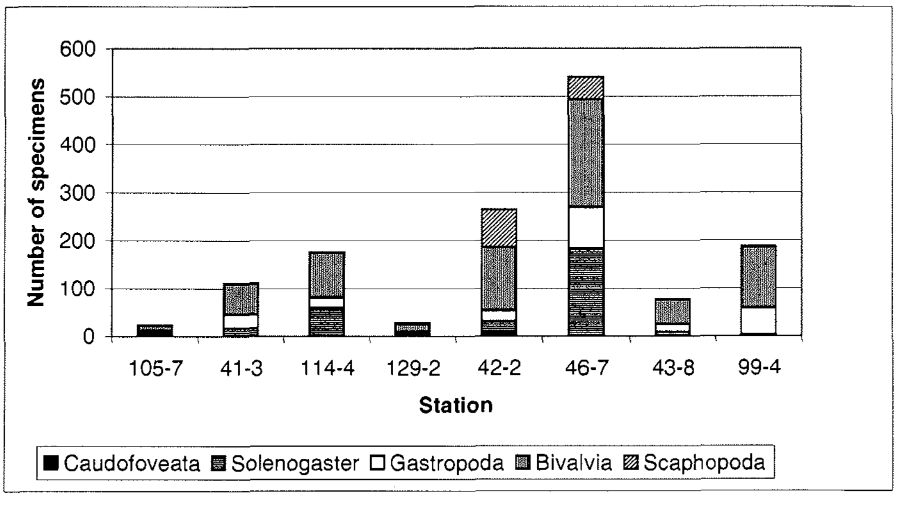

Fig. 3.3.2-2: Specimen – station distribution. Stations are ordered by increasing depth.

specimen numbers (Fig. 3.3.2-2). The location of the station in a depression may explain this.

A principal components analysis was conducted on the covariance/variance matrix of the station by species matrix of ANDEEP I. Four significant axes determined by the broken-stick method were obtained and cummulatively accounted for 98.2 % of the variance in the data set. Two stations, 99-4 and 46-7, plot independently from the other stations (Figs. 3 and 4). Station 99-4 separates from the others by increased abundances of a bivalve *Kingiella* sp. The seguenziid gastropod *Seguenzia antarctica* and a unidentified gastropod species possibly in the family Zerotulanidae also exhibits an influence on the faunal makeup of the station. These three species account for 69.5 % of individuals at this station (45.5, 6.4, and 17.6 % respectively). Station 46-7 is also dissimilar from the other stations. The faunal distinctness is attributed to the greatly increased dominance of an aplacophoran *Solengaster* sp. 3 and the bivalve *Genaxius* cf *bongraini*. *Solengastor* sp. 3 is represented by 132 individuals at this station but never reaches an abundance of over 26 individuals at any of the others. In addition, *Genaxius* cf *bongraini* represents 61 individuals at this station but never more than 10 at any other.

A cluster analysis shows stations 105-7,129-2,43-8,41-3 contain a very similar molluscan fauna (83.6 %, Fig. 3.3.2-4). Stations 114-4 and 42-2 cluster with the previous stations at 61.83 %. Quite discrete from the others, stations 46-7 and 99-4 are only 13.36-23.06 % and 49.05-52.05 % similar in taxonomic makeup to the others.

The AGT catches of ANDEEP were not as rich as the EBS ones but still 45 molluscan species and 385 specimens were collected (Table 3.3.2-2). The catches from ANDEEP I and II were quite distinct from each other. Again, with 31 collected species, gastropods were the species richest group, followed by bivalves with 14 species. Polyplacophorans (1 sp), scaphopods (3 spp.) and octopods (2 spp.) were scarce and often occurred on one station only. On ANDEEP I the catches were clean and sediment free (exception 46-8), while the

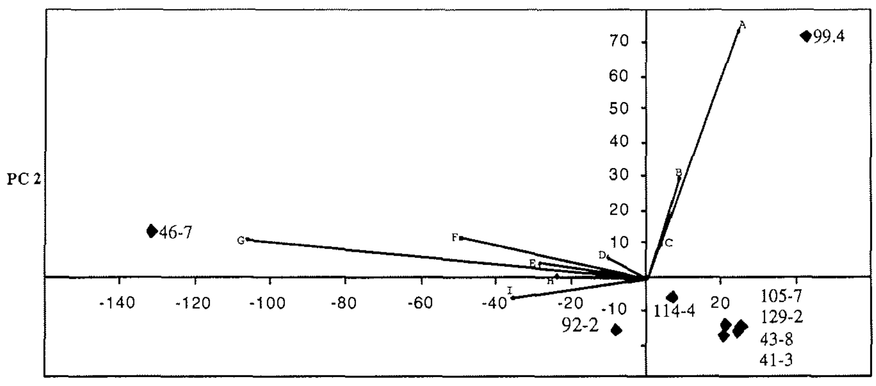

Fig. 3.3.2-3: Principal components analysis plot of ANDEEP I stations with species weightings. A. *Kingiella* sp., B. *Solecardia* sp., C. *Seguenzia antarctica*, D. *Dacrydium* sp., E. *Genaxius cf bongraini*, F. *Solenogaster* sp. 2, G. *Solenogaster* sp. 3, H. *Genaxius* sp., I. *Siphonodentalium* sp.

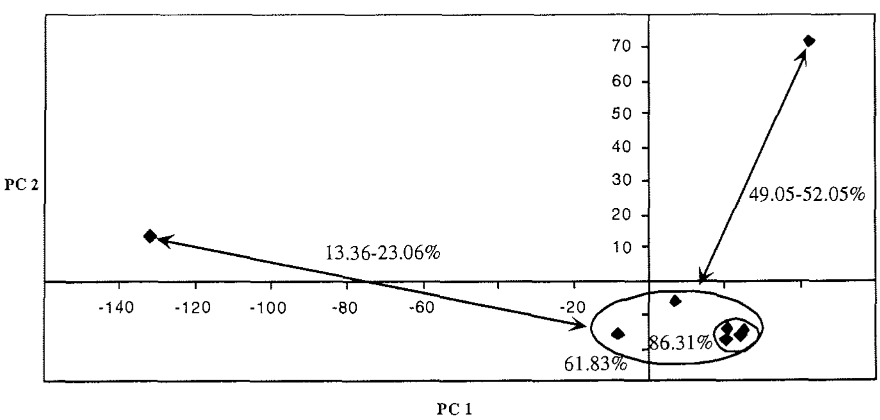

Fig. 3.3.2-4: Principal components analysis plot of ANDEEP I stations with a superimposed cluster analysis conducted on Euclidean distances.

catches on ANDEEP II consisted in varying volumes of mud and coarse sediment. This might explain why small macrobenthic molluscs were absent the former samples. Although the AGT catches are small they are of great scientific value because rare species were collected for further taxonomic work, e.g. see below paragraph on Octopodidae. For example further specimens of three rare species of deep water Trochidae (*Calliotropis* (*Solaricida*) *antarctica* Dell, 1990, *Falsimargarita benthicola* Dell, 1990 and *F. georgiana* Dell, 1990) were collected which were described by DELL (1990) on material collected with RV *Eltanin* in the deep sea off the Antarctic Peninsula, off the South Orkneys and South Georgia.

Species	41 -4	42 -3	43 -9	46 -8	94 -1	99 -4	10 5-8	114 -10	12 9-3	13 2-2	13 3-3	13 4-4	13 5-3	13 6-x	13 7-3	13 8-4	13 9-5	14 0-7	141 -8	14 3-2	Σ
Polyplacophora sp.																				5	5
?Bathyberthella sp.										1											1
?Ponthiothauma sp.												1									1
Anatoma cf *amoena*																		2	5		7
Anatoma cf *timora*										1											1
Antarctoneptunea sp.																		1			1
Buccinidae sp. 1								2													2
Buccinidae sp. 2								1													1
Buccinidae sp. 3								1													1
Calliotropis cf *antarctica*										1									17	2	20
Chlanidota sp. 2																			1		1
Chlanidota sp.1												1									1
Eatoniella sp.													1								1
Falsimargarita cf *benthicola*																			1		1
Falsimargarita cf *georgiana*										1											1
Gastropod eggs										1			1							8	10
Harpovoluta sp.																				2	2
Iothia sp.																			1		1
Marginella sp.																	3				3
Melanella sp.																			2		2
Mesogastropoda sp. 1																			1		1
Mesogastropoda sp. 2																			1		1
Milomelon turnerae				1				10													11
Naticidae sp.					1													1	3		5
Newnesia sp.				3																	3
Rissoidae sp																			2	1	3
Tracolira sp. 1																		2			2
Turridae sp. 1																		1			1
Turridae sp. 2																		2	2		4
Turridae sp.3																				1	1
Turridae sp.4																			1		1
Turritellidae sp.																			1		1
Amussium sp.												2			1	1					4
Cuspidaria cf *tenella*															1						1
Cyamiocardium sp.																		18	28		46
Cyclopecten sp.																			1		1
Dacrydium sp.													2					2		1	5
Genaxius cf *bongraini*																				2	2
Kingiella sp.																			42		42
Limatula (*A*) sp.																		8	1		9
Limopsis marionensis																	1	16	66	50	133

Species	41-4	42-3	43-9	46-8	94-1	99-4	105-8	114-10	129-3	132-2	133-3	134-4	135-3	136-x	137-3	138-4	139-5	140-7	141-8	143-2	Σ
Nucula sp.																		7			7
Yoldia sp.												1									1
Yoldiella cf *vallettei*													1								1
Yoldiella sp. 1																		5	3		8
Yoldiella sp. 2													1		1			4			6
Dentalium megathyris										15											15
Pulsellum sp.											2		1								3
Scaphopoda sp.								1													1
Thaumeledone sp.				2																	2
Bentheledone sp.				1																	1
SUM	0	0	0	4	1	0	0	15	0	20	2	5	7	0	3	1	4	69	179	72	385

Tab. 3.3.2-2: Mollusca collected by the AGT on ANDEEP I (41-4 to 129-3) and ANDEEP II (132-2 to 143-2)

3.3.3 *Philobrya* - Tracer for the possible Antarctic colonisation routes

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ANT-XIX-4 / ANDEEP II

The bivalve genus *Philobrya* (Fam. Phylobryidae: order Arcoidea) seems to be suited for studies on the potential origin of Antarctic marine taxa. The Philobryidae have a rich fossil history since the Eocene (c. 58-36 my) and *Philobrya* itself since the Miocene (22 my) from marine sediments in New Zealand. The recent distribution of the 45 described species of *Philobrya* is almost entirely restricted to the Southern Hemisphere, mostly to the southern tips of the America, Africa, Australia, and New Zealand and to Antarctica. The majority of species are recorded from Antarctic and sub-Antarctic waters (15 spp.), New Zealand (7 spp.), and from the Magellan region (6 spp.). The origin of the genus and Antarctic species is still unknown. Species of *Philobrya* occur from intertidal areas to a depth of 1000 m; deeper records are unknown. During ANDEEP the aim was to collect and prepare more deep-water material of *Philobrya* and related genera such as *Adacnarca*, *Lissarca* and *Limopsis* for further analysis (SEM, PCR).

During ANDEEP no specimens of *Philobrya* were captured, strengthening the hypothesis that *Philobrya* is a shelf species. Fourteen specimens of a new species of *Adacnarca* were collected at station 133-4 (1120 m) and fixed for molecular and morphological studies. Specimens of two species of *Limopsis* (*L. marionensis* and *L. tenella*) were collected to serve as the arcoid outgroups in the molecular analysis. The taxonomic and molecular studies on these specimens will be carried out at the British Antarctic Survey in Cambridge/U.K.

Additionally brachiopods were collected from seven locations (41-3, 101-1, 129-1, 133-4, 140-7, 141-8, and 143-2) for molecular analysis and phylogenetics.

3.3.4 Biodiversity and systematics of Antarctic deep water Opisthobranchia

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ANT-XIX/3 / ANT-XIX/4 / ANDEEP I (LA); ANDEEP II (MS, LA)

The opisthobranch fauna of the Antarctic shelf and the Magellan region has been investigated quite extensively recently (see e.g. WÄGELE 1993, WÄGELE & WILLAN 1994, SCHRÖDL 1999, 2000, SIRENKO & SCHRÖDL 2001). In contrast, few data exist for the Scotia Arc, and virtually nothing is known about opisthobranchs of southern deep waters. Thus, the principal objective during ANDEEP was to achieve a first bioinventory of these latter areas. Material was obtained for taxonomic work involving morphological and histological methods, as well as for molecular studies. Phylogenies of selected groups, i.e. basal Nudipleura of which many taxa are only present in Antarctic or adjacent deep waters, will be developed and used to explain recent distributional patterns by historic distributional and evolutionary mechanisms.

As is evident from Table 3.3.2-1, only some opisthobranch species were sampled by the EBS catches during ANDEEP I. Most are cephalaspideans with external (*Toledonia*? sp., *Diaphana cf. inflata* (Strebel, 1908), *Newnesia antarctica* Smith, 1902) or internal shell (*Philine* spp.). The pleurobranchoid *Tomthompsonia antarctica* (Thiele, 1912) is highly aberrant due to its large helicoid internal shell with umbilicus. The single nudibranch obtained is an as yet unidentified aeolid specimen. Most species were represented by just a single or a few specimens, while *Philine* sp. 1 occurred in high numbers at station 46-7.

The EBS samples taken during ANDEEP II are not yet fully sorted. Up to now, just an additional doridoidean nudibranch species, *Prodoridunculus gaussianus* Thiele 1912, was obtained from 1120 m depth. Using bottom trawls during ANDEEP I, some specimens of the doridoidean *Austrodoris kerguelenensis* (Bergh 1884) and one *Bathyberthella antarctica* Willan & Bertsch 1987 (Pleurobranchida) were obtained from shallow waters down to 300 m depth. The Agassiz trawl during ANDEEP II gathered at least two further cephalaspidean species (Scaphandridae sp.) from 4550 to over 5000 m depth, a *Bathyberthella antarctica* from 2080 m depth, and cf. *Clione antarctica* Smith, 1902, a pelagic Gymnosomata.

Despite the relatively low number of opisthobranch species and specimens obtained, this ANDEEP-material is of considerable interest.
(1) Several species may be undescribed, e.g. the two Scaphandridae spp.;
(2) Some rare and enigmatic species have been found such as the aberrant nudibranch *Prodoridunculus gaussianus* which has never been reported since its brief original description by THIELE (1912). It is a small, phanerobranch dorid-shaped species, with the notum covered with long, spiculate papillae. As already suspected by THIELE (1912), it does not possess the otherwise characteristic medio-dorsal doridoidean gills, neither it has any other type of special, gill-like outgrowths. Although the two newly obtained specimens are in good condition, differentiated rhinophores could not be detected. Anatomical and histological examinations will prove if rhinophores are really absent in *Prodoridunculus gaussianus* (which would be unique for nudibranchs) or if rhinophores are present but just do not differ externally from the spiculate notal papillae. The systematic position of this enigmatic species is unclear but may be resolved through histological and molecular analysis.
(3) Geographical and bathymetrical ranges are significantly extended for several species, e.g. for *Prodoridunculus gaussianus*. It was formerly known from the shelf at Gauss Station, Davis Sea, and is now known from the western Weddell Sea down at 1120 m depth. *Newnesia antarctica* and *Tomthompsonia antarctica* are reported from abyssal depths for the first time, and *Philine*

sp. occurs down to nearly 5000 m. The unidentified aeolid from 3680 m depth is certainly one of the deepest aeolids ever found.
(4) Giantism. While most Antarctic gastropods are micro-molluscs, some of the recently caught shallow and deep water opisthobranchs are of considerable size. A preserved *Bathyberthella antarctica* from 204-294 m depth measured 18 cm in length after fixation and is the largest individual known so far. One *Newnesia antarctica* specimen from 2893 m reached over 5 cm in size, while specimens from the shelf known so far usually reach about 1.5 cm.
(5) Quality of material. Using trawls, it is always problematic to obtain soft-bodied animals such as nudibranchs in good condition. Small species are either not sampled or get smashed and amorphic. In contrast, the EBS provided some small opisthobranch specimens in excellent condition. Due to the immediate preservation of the complete sample in pre-cooled ethanol, the rare material obtained should be appropriate for molecular analyses and, thus, is especially valuable.

The fact that some ubiquitous and large deep water species such as the nudibranchs *Bathydoris clavigera* Thiele, 1912 and *Bathydoris hodgsoni* Eliot, 1907 were obviously not found during ANDEEP I-II indicates that more sampling is needed and that our knowledge on Antarctic deep-water opisthobranchs is still far from satisfactory.

Taxonomy of the family Octopodidae

The taxonomy of the family Octopodidae is in a very confused state and recent phylogenetic work has shown that all four subfamilies are probably polyphyletic (ALLCOCK & PIERTNEY 2002, CARLINI et al. 2001). The deep-sea fauna is poorly known with some species known only from the holotype, nonetheless the presence of a clade containing the deep-sea groups *Graneledone, Bentheledone* and *Thaumeledone* (the subfamily Graneledoninae of VOSS 1988) and the endemic Antarctic shelf genera *Megaleledone* and *Pareledone* is supported by these phylogenetic studies. Antarctica appears to be the only place where the deep-sea and shelf fauna are closely related and is therefore particularly pertinent for studies of octopodid evolution.

Octopods were caught at just one Agassiz station (PS61/46-8) which yielded two specimens of a *Thaumeledone* species and one specimen of a *Bentheledone* species. Freshly caught material was photographed to document subtle taxonomic characters such as colour patterns and skin texture, size and morphometric measurements were taken prior to distortion in preservatives, and tissue samples were fixed in ethanol for an ongoing phylogeny project. Further morphometric work including SEM analysis of radulae will be carried out at the National Museums of Scotland.

Initial examination suggests that the *Thaumeledone* specimens are closely allied to *Thaumeledone brevis* Hoyle, 1885, the type locality of which is off the coast of Uruguay, however the poor condition of the type material and the lack of alternative material from the type locality make a conclusion of conspecificity difficult. Only two *Bentheledone* species have been described. The specimen of *Bentheledone* captured during ANDEEP is most closely allied to *Bentheledone albida* Robson, 1930 (known only from the other side of Antarctica) but differs in some morphometric measurements. The *Thaumeledone* specimens comprised a mature male and a mature female whilst the *Bentheledone* was a mature male. The capture of mature male specimens is extremely useful as it provides us with additional characters (hectocotylus morphology, spermatophore structure etc) for elucidating phylogeny.

One cirrate octopod was captured on video at station PS61/134-1. It was tentatively identified as *Cirroctopus glacialis* Robson, 1930. If this identification proves correct then it considerably extends the depth range of this species, which is captured in waters as shallow as 400 m depth.

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3.3.5 First report on the deep sea Porifera from the Northern Weddell Sea and the slope of South Sandwich Trench

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ANT-XIX/4 / ANDEEP II

Over the years, many poriferan genera and species collected from Antarctic and circumantarctic areas have been described by different authors (e.g. BURTON 1929, DENDY 1918, KOLTUN 1966, 1976, TOPSENT 1901, 1908, 1913). About 352 Antarctic species of the Demospongiae (SARÁ et al. 1992) and c. 25 species of the Hexactinellida (BARTHEL & TENDAL 1994) have been recorded, mostly from the shelf areas well above 1000 m. Very little is known about the poriferan fauna of the Antarctic deep-sea (as it is generally the case for deep sea sponges).

According to a pilot study by BARTHEL & TENDAL (1989, 1992) in the eastern Weddell Sea, the major part of the abyssal sponge fauna down to 2000 m is known only from Antarctic and subantarctic regions. However, this apparently high degree of endemism may not hold true for the true deep-sea fauna because at least in the Weddell Sea the upper limit of the abyssal zone seems to be rather deep (2000 m or more). Because of the incompleteness of our present knowledge of the taxonomic composition of the Antarctic deep-sea Porifera, the first scientific task was the documentation and taxonomic evaluation of the sponges collected during this expedition. As a next step, the Antarctic deep-sea Porifera will be compared with the taxonomic data published from neighbouring deep-sea areas, e.g. the South Atlantic. Further purposes of the sponge project were the fixation of samples from a representative selection of species for ultrastructural and histological studies, e.g. to look for reproductive stages and endobionts, and also the collection and fixation of samples for genetic studies that are planned to elucidate the phylogenetical relations within the class Hexactinellida, the least known class of sponges.

Underwater photography which has proven especially useful for the investigation of Weddell Sea sponge associations at shallower depths down to 1200 m (BARTHEL & GUTT 1995, BARTHEL et al. 1991) were of little help for the evaluation of deep-sea sponge distribution during this expedition. The underwater video recordings were mostly unclear due to dense clouds of suspended sediment and most of the deep-sea sponges too small to say anything more precisely than "It's probably a sponge!" (at best). The main gear for the collection of sponges from the deep-sea is the Agassiz trawl (AGT) but the epibenthic sledge (EBS) is also important. One larger hexactinellid sponge was even collected by the multicorer from a depth of c. 1120 m. Especially when trawling on very muddy soft sediments many larger sponges together with sticky clay may be trapped by the EBS and accumulate in front of the epinet where they are preserved in good condition. Also the sponges smaller than 0.5 cm are unlikely to be collected by AGT. These are mostly juveniles but some of them belong to the smaller species, e.g., of a group rare in the Antarctic: Calcarea. From the epinet of EBS-sample no. 133-3 from c. 1120 m, two calcareous sponges of 1-2 mm were identified, which would otherwise not have been collected. Many more tiny sponges are expected to be found, once all the EBS samples of this expedition have been sorted.

Onboard "Polarstern" sponges were photographed and their external morphology described. Then the sponges must be fixed for different purposes as quickly as possible: tissue samples from some larger hexactinellids were partly frozen (-30°C) for genetic sequencing and partly fixed in 2.5 % glutaraldehyde for later electron microscopy. The major part of the sponge material was fixed in 4 % formol with PBS-buffer for histology. Of those specimens big enough, small parts were cut out and fixed separately in 96 % ETOH for spicule preparations and later molecular analyses.

Table 3.3.5-1 gives an overview of the distribution of the major sponge taxa collected at stations where the AGT was successful. The species numbers estimated here are conservative since spicule preparations onbord ship could be made for only 50 of a total of c. 175 specimens collected mainly by the AGT. Further, not all preparations were successful and not all contained diagnostic spicules. Detailed investigations of the sponge material obtained, including histology and SEM are most likely to reveal details which will increase the number of species, some of which may be new. Further, the EBS samples, once they get sorted, will probably provide further species. For these reasons, and because further literature studies are necessary, the species identifications made onboard are still only cf. determinations. Preliminary results are briefly discussed for each class of the Porifera.

Station	Depth m	Hexactinellida		Demospongiae		Calcarea	
		Spp.	#	Spp.	#	Spp.	#
131-3 aps	3055			1	1		
132-3 aps	2085	3	6	c. 10	c. 22		
133-3 aps	1120	4	12	4	4	2	2
133-4/5 ap	1120	3	3	3	3		
134-4 tr	4065	3	13	2	2	1	1
135-3 ap	4680	1 (2?)	1 (2?)	1 (2?)	c. 21		
137-3 ap	4975	2	2	1 (2?)	2		
138-4 ap	4550	1	1	2	2		
139-5 ssi	3940			2	2		
140-7 ssi	2950	1	1	1	2		
141-9 ssi	2285			3	4		
143-2 ssi	800	2	2 (3?)	7 (8?)	c. 70		

Tab. 3.3.5-1: Sponges from ANDEEP II stations (fragments only included if they could be properly identified), aps = Antarctic Peninsula slope, tr = transitional zone, ap = abyssal plain, ssi = South Sandwich Islands transect.

Hexactinellida

Sponges of this group are commonly found on the Antarctic Peninsula slope, including the transitional zone. But abundance and diversity decreased towards the South Sandwich Islands and only few mostly fragmentized hexactinellids were collected from the abyssal plain. There is a strong species turnover between the different stations that have hardly any species in common. *Caulophacus* for instance is a true deep-sea genus which we would expect to be common at the abyssal plain but was found only at station 134-4 in 4060 m where six complete specimens and several fragments were collected. Dictyonine hexactinellids were abundant only at station 133-3 at relatively shallow water depth of 1120 m. Here we collected three specimens of *Farrea* cf. *occa* and several fragments of *Heterochone* cf. *lamella* along with eight lyssacine specimens so far unidentified. All hexactinellids from this station were collected alive with the soft body intact. At station 132-3 from 2085 m water depth several specimens of *Bathyxiphus* sp. and *Heterochone* sp. were collected, but these were all macerated and mudfilled skeletons of dead specimens that had probably been transported down the slope. The Antarctic "Dictyonina" thus should be considered as primarily shelf species with only few representatives (*Heterochone* spp.) reported as having been found alive in depths below 2000 m. The Euplectellidae, which have been reported from many circumantarctic localities, were missing at this cruise altogether, except for one fragment of *Malacosaccus* cf. *pendunculatus* from station 138-4 (4550 m).

Demospongiae

Similar to Hexactinellida, Demospongiae are found in highest diversity east of the Antarctic Peninsula, particularly at station 132-3 in 2085 m water depth where about ten species were collected including the one representative of the Geodiidae, the first one recorded from the Antarctic deep-sea so far. Here we also collected two specimens of *Polymastia* sp., probably a new species closely related to the widely distributed shelf demosponge *P. invaginata*, but interestingly this new species appears to be the same as one collected in the Mediterranean deep-sea (unpubl. data). At station 131-3 in 3055 m, only one demosponge was caught in the front of the EBS: A large fragmented specimen (the biggest fragment measuring c. 12 x 6 cm, which is an unusual size for sponges beyond 3000 m water depth) of the very common shelf species, the "slimy sponge" *Mycale* cf. *acerata*. Otherwise, the 3000 m stations (131-4 and 140-7) were poor with respect to sponges. The abyssal plain and also the deep slope off the South Sandwich Islands reveal a highly specialised deep-sea demosponge community of low diversity. The only really deep place, where a high number of individuals could be collected, was station 135-5 at 4680 m water depth. Here, 22 specimens of one single demospongid species, still undetermined but possibly another *Polymastia* species, were caught by AGT. Elsewhere on the way to the South Sandwich Islands, we gathered only one or two demosponges at each station, and these were mostly of the predatorous sponge family Cladorhizidae, to which also the well known *Asbestopluma* belong. This is not surprising, since the Cladorhizidae are typically deep-sea sponges adapted to life in waters poor in suspended nutritions. However, apparently most of the true deep-sea demosponges collected during this cruise do not belong to *Asbestopluma*, the genus described from the Antarctic deep-sea, but some of these species may be new and maybe attributed to *Cladorhiza* or *Chondrocladia*. Station 143-2 just east of South Sandwich Islands showed again a high diversity, but this locality with its c. 800 m water depth was not a deep-sea station, and the sponge fauna there showed a shelf composition.

Calcarea

For the first time, calcarean sponges are reported from the Antarctic deep-sea: three specimens from stations 133-3 and 134-3. Calcarea are generally rare in the Antarctic Ocean and their deepest occurrence published so far was at 500 m (TOPSENT 1901). The few deeper water species of the Calcarea known worldwide were mainly collected from the deep shelf, e.g., in the Atlantic

Ocean, but one report of calcareous sponges in the Norwegian Sea was from depths down to more than 3000 m (Tendal pers. comm.). The calcarean sponge collected at the Weddell Sea station 134-3 at 4065 m water depth may be the deepest record of this group. The two species from station 133-3 were collected at 1120 m, this occurrence is about 600 m deeper than the deepest report of Antarctic calcareans so far. The two sponges are preliminarily identified as *Leucosolenia* cf. *botryoides* and *Sycon* cf. *antarcticum* but determinations of the calcarean sponges will only be definite after histological sections have been made for observation of soft body organisation and aquiferous system.

Main conclusions from these preliminary results on the Porifera of the deep Weddell Sea are following:
(1) A significant divergence seems to exist between the western and the eastern Weddell Sea in the sense that sponge abundancy and species diversity are generally higher towards the Antarctic Peninsula. This is true for both the Demospongiae and the Hexactinellida; the only Calcarea specimens obtained were also collected in the western part of the Weddell Sea. This tendency seems to be independent of water depth, but it might be related with the suspended nutrition supply, or with the nature of the mostly basaltic substrates from the volcanic Sandwich Islands. An exception was the 800 m station 143-2 just east of South Sandwich Islands but this can be considered a shallow water station with true shelf faunal associations.
(2) The upper limit of the true deep-sea sponge fauna in the Weddell Sea is very deep. At 2000 m water depth many shelf species are present and around 3000 m there seems to be a general impoverishment in species numbers and individuals, before the true deep-sea sponge association comes in. It is not yet clear at exactly which depth this happens but it must be somewhere between 3000 and 4000 m. We are now only beginning to understand the nature of these peculiar specialized deep-sea poriferan communities, mainly consisting of Demospongiae of the family Cladorhizidae, few deep-sea Calcarea and some equally specialized Hexactinellida, such as *Bathydorus spinosus* and *Caulophacus* spp.
(3) When the detailed taxonomical work is completed, the next task will be a thorough comparison with other known deep-sea sponge faunas from the neighbouring oceans, especially of the South Atlantic. And it is necessary to look at the other more remote deep-sea areas as well. However, because of the patchy occurrence of the Antarctic sponge associations, species turnover between the stations investigated is high and thus comparisons on the basis of our very limited data are extremely difficult. For well-founded conclusions concerning the biogeographic distribution of the deep-sea sponges and the phylogenetic and ecological parameters controlling this pattern, further investigations of the deep-sea benthic life are absolutely necessary in the Weddell Sea and in the entire Antarctic ocean.

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3.3.6 Biodiversity, life cycles, and reproductive biology of deep-sea cnidarians

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Cnidarians are an important part of Antarctic benthos. In the past, the study of the hydrozoan class diversity was mostly oriented to the morphological analysis of hydrozoan esoskeletons of the biggest species, and few papers dealt with hydrozoans with polyp stages of small size, which in most cases do not have distinctive chitinous hydrothecae. These species may produce long-living medusae which are common components of planktonic communities, but only in a few cases the life cycles of Antarctic jellyfish have been fully described. Moreover, due to the paucity of hard substrata, the polyp stage of several species developed epibiotic, species-specific relationships with several invertebrate taxa. These symbiotic associations are somehow cryptic and may remain unobserved without appropriate laboratory rearings and cannot be easily detected after fixation of host organisms. Many species belonging to the Hydractiniidae family are well known for their strict symbiotic relationship with molluscs and ophiuroids, but preliminary molecular work has recently shown that this group may be represented by several sibling species. On the other hand, the Anthozoa class is one of the major components, in terms of biomass and diversity, in many benthic communities. In spite of its abundance, nearly 50 % of the anthozoan fauna from the Southern ocean is still unknown. Participation to the ANDEEP cruises aims to increase the knowledge on the diversity of the cnidarian fauna and record new data on its spatial and depth distribution in Antarctic and sub-Antarctic areas. The quantification of the invested reproductive effort will give a further contribution to the knowledge of pattern of cnidarian population dynamics and to the understanding of seasonal changes in benthic community composition. The ANDEEP cruises also offer the opportunity to gather new information on the paleo- and biogeographical mechanisms shaping the extant Antarctic anthozoan fauna. Furthermore, deep-sea anthozoans (especially gorgonians) with bi-polar distribution, or hydrozoans such as those belonging to the hydractiniidae family, need clarification of their phylogenetic status and relationships by an integrated approach of traditional and molecular taxonomy.

Cnidarians have been collected mainly by bottom trawls during the ANDEEP I cruise (Tab. 3.3.6-1) and Agassiz trawls during the ANDEEP II (Tab. 3.3.6-2). Quite interesting small species were also found in some available EBS samples from the ANDEEP I cruise (Tab. 3.3.6-3). Due to the needs of parallel research projects, EBS samples from ANDEEP II were not available on board, and we are looking forward to share all the available material as soon as the main sorting process for molecular and morphological analysis of other taxa will be completed. All collected cnidarians were kept in running seawater during a preliminary sorting into main taxonomic groups. All anthozoans and some sensitive hydrozoans (medusae and tiny epibiotic polyps) were placed into small aquaria at 0°C with menthol crystals for five hours to let them relax before fixation in 4 % borate-buffered formaldehyde solution in sea water or in 96 % ethanol for further genetic analysis.

ANDEEP I: A total of 50 bottom trawl hauls were carried out between 50 and 500 m depth around Elephant Island (30 hauls), and around King George and Livingstone islands (20 hauls). A total of 28 anthozoan species were collected (Tab. 3.3.6-1). Seventheen species belong to the Octocorallia, and eleven to the Hexacorallia. Within the octocoral species there were three Pennatulacea, five Alcyonacea and nine Gorgonacea. The hexacoral species can be divided in eight Actiniaria, two Scleractiniaria and one Zoantharia.
ANDEEP II: Twelve Agassiz trawls were hauled between 795 m and 4975 m depth along three transects near the Antarctic Peninsula, the abyssal plane of the Weddell Sea, and east of South Sandwich Islands shelf. To date, 50 species and 180 specimens of cnidarians were found in the processed samples. In detail we found 19 hydrozoans (58 specimens), two scyphozoans (14 specimens), 29 anthozoan species (108 specimens). Among the Anthozoa, 21 species belong to Hexacorallia (18 actiniarians, two scleractinians, one zoantharian colony) and eight species to Octocorallia (two gorgonians, two stoloniferans, three pennatulaceans, and one alcyonarian colony).

In spite of the limited number of samples that we could sort on board during the ANDEEP II, the deep-sea cnidarians show an unexpected, relatively high species richness. In fact, GUTT et al (2000) listed 39 species of hydrozoans and 50 anthozoans in the Weddell Sea, which were collected from 47 stations both in shelf areas and down to 2315 m depth during the EASIZ I expedition. EASIZ II and III expeditions increased the number of known cnidarians species from the Antarctic shelf in the Weddell Sea and the Peninsula, but we believe that more extensive and diversified sampling with different gears (including the TV grab) in the deep-sea will contribute to increase the number of present findings. Apparently, the typology of the substrate influenced the anthozoan distribution among the stations. In the transect 3, close to the Antarctic Peninsula, the bottom showed a fine sediment component less suitable for settlement of actiniarians, usually the dominant anthozoan taxon in deep stations from other transects. Stations closer to South Sandwich Islands, for instance, where the seafloor was rich in small stones, provided the best substrate for sea anemones, leading to higher diversity and abundance of the overall cnidarian assemblage. The remaining anthozoan groups were poorly represented in the samples, with almost no differences among stations.

The deepest samples were richer in actiniarians than shelf samples, with a total of 18 species out of 12 ANDEEP II stations, against eight species out of the 50 ANDEEP I stations. However, the remaining anthozan taxa were more represented in shallow stations, with a nearly balanced contribution in terms of species numbers.

With the exceptions of a single, large plumulariid colony recorded at station 134, some medusae, a siphonophore, and some large burrowing hydropolyps, records of most hydrozoans were linked to the presence of other macroinvertebrate taxa. Indeed, the discontinuity of hard substrata on the sea floor led to habitat diversification for small hydroid colonies unable to live in the sediment: at least eight different species were found in close symbiotic relationships to a wide range of macroinvertebrates (larger hydroid species with chitinous erect stem, gastropods, bivalves, polychaetes, sea urchins, ophiuroids, bryozoans). One hydroid colony (*Pandaeidae* sp.) was found living on the lower surface of the arms of a still unidentified ophiuroid species, showing to prey on benthic meiofaunal organisms: (one polyp was observed at the microscope while still ingesting the abdominal part of an harpacticoid copepod). This might be interpreted as a adaptive switch from a generalised filter feeding strategy (realised by the hydrozoan polyp bauplan) to a deposit-feeder habit of whole colonies, leading also to predation on meiofauna, related to deep-sea trophic constrains. Most of the collected hydrozoans were undergoing sexual reproduction: the morphology of the adult stage will be extremely useful for systematics accounts and phylogenetic analysis, especially within the Hydractiniidae family. At last, two ANDEEP hydrozoans (a jellyfish and a burrowing hydroid with capitate tentacles) are probably new to science. Further analysis at home will clarify their taxonomic position.

	Station number
GORGONACEA	
Fam. Isididae	
Primnoisis	47-49, 101-104, 108, 109, 128
Fam. Primnoidae	
Ainigmaptilon	44, 103, 111, 125, 127, 128
Thourella sp. 1	44, 45, 47-49, 52, 53, 59, 64-67
Thourella sp. 2	48, 49, 51-54, 57-69, 71-73, 85, 86, 88-93, 101, 102, 104, 106-111, 113, 117, 118, 121, 124-128
Callozostron	44, 51-54, 58, 59, 92, 101, 103, 126, 127
Fannyella	48, 85, 101-104, 107, 109, 110, 125, 127
Ascolepsis	53, 59, 60
Primnoella	53-61, 92, 101, 103, 104, 125-128
Armadillogorgia	107
PENNATULACEA	
Umbelulla	48, 51, 61, 62, 79, 86, 107, 110, 111, 113, 117, 118, 120-122
Anthoptillum	60, 61
Anthomasthus	61, 86, 101, 120
ALCYONACEA	
Alcyonium sp. 1	47, 98, 101, 121
Alcyonium sp. 2	47, 92, 98
Anthomastus	61, 64, 69, 72, 73, 98
Alcyonacea sp. 1	97, 107, 119, 121, 122
Alcyonacea sp. 2	97
SCLERACTINIARIA	
Flabellum	49, 51, 66, 70, 101, 103, 104, 108, 109, 120, 121, 124
Gardenia	98, 101, 103, 104, 107
ACTINIARIA	
Glyphoperidium	45, 66, 67, 79, 102, 124
Isosicyonis	45, 58, 59, 63, 65, 67, 68, 70-73, 78-80, 82, 84, 85, 87-93, 96, 103, 121, 123-125
Actiniaria sp. 1	64, 78, 98
Actiniaria sp. 2	60, 64, 72, 86, 89-91, 93, 98, 109, 111, 120, 125
Actiniaria sp. 3	59-62, 64, 66-69, 73-74, 79, 89-91, 93, 98, 101-103, 107-112, 116, 120, 121, 124-126, 128
Epiactis	48, 49, 51-53, 60-65, 68-73, 75, 79, 89-91, 93, 102-103, 107-109
Hormathidae	47, 52, 59, 61, 64, 67-74, 89-93, 101, 103, 107-110, 117, 121, 124, 126
Dactylantus	48, 51-53
ZOANTHARIA	
Parazoanthus sp.	59, 117, 128

Tab. 3.3.6-1: Anthozoans collected by bottom trawls during ANDEEP I.

	131-4		132-3		133-4		134-3		135-3		136-3	
	sp	#	sp	#	sp	#	sp	#	sp	#	sp	#
Hydrozoa	-	-	-	-	-	-	-	-	-	-	-	-
Athecata/Anthomedusae	1	1	2	4	1	1	1	1	-	-	-	-
Thecata/Leptomedusae	1	1	-	-	3	3	3	3	-	-	-	-
Stylasterina	-	-	-	-	-	-	-	-	-	-	-	-
Scyphozoa	-	-	-	-	-	-	-	-	-	-	-	-
Coronata	1	3	2	3	-	-	-	-	1	6	1	11
Anthozoa	-	-	-	-	-	-	-	-	-	-	-	-
Actiniaria	-	-	1	1	-	-	2	20	-	-	-	-
Zoantharia	-	-	-	-	-	-	-	-	-	-	-	-
Scleractinia	-	-	-	-	-	-	-	-	-	-	-	-
Pennatulacea	-	-	-	-	-	-	-	-	-	-	-	-
Gorgonacea	-	-	1	1	1	1	1	1	-	-	-	-
Alcyonacea	-	-	1	1	-	-	-	-	-	-	-	-
Stolonifera	-	-	-	-	-	-	-	-	-	-	-	-
	137-3		138-4		139-5		140-7		141-9		143-2	
	sp	#	sp	#	sp	#	sp	#	sp	#	sp	#
Hydrozoa	-	-	-	-	-	-	-	-	-	-	-	-
Athecata/Anthomedusae	-	-	1	1	-	-	1	7	-	-	-	-
Thecata/Leptomedusae	-	-	-	-	-	-	-	-	1	1	1	1
Stylasterina	-	-	-	-	-	-	-	-	-	-	-	-
Scyphozoa	-	-	-	-	-	-	-	-	-	-	-	-
Coronata	-	-	-	-	1	5	-	-	-	-	-	-
Anthozoa	-	-	-	-	-	-	-	-	-	-	-	-
Actiniaria	6	30	6	8	4	5	3	3	3	3	3	3
Zoantharia	-	-	-	-	1	1	-	-	-	-	-	-
Scleractinia	1	8	-	-	-	-	-	-	-	-	-	-
Pennatulacea	-	-	1	1	-	-	-	-	-	-	-	-
Gorgonacea	-	-	-	-	-	-	-	-	1	1	1	1
Alcyonacea	-	-	-	-	-	-	-	-	-	-	-	-
Stolonifera	-	-	-	-	-	-	-	-	-	-	-	-

Tab. 3.3.6-2: Cnidarians collected by Agassiz trawls during ANDEEP II (numbers of species and individuals).

	41-3		42-2		43-8		44-1		45-1		46-7		47-1	
	sp	#	sp	#	sp	#	sp	#	sp	#	sp	#	sp	#
Hydrozoa	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Athecata/Anthomedusae	-	-	1	2	4	11	-	-	2	5	1	5	-	-
Thecata/Leptomedusae	1	1	-	-	-	-	1	2	1	1	-	-	1	1
Stylasterina	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scyphozoa	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coronata	-	-	-	-	1	8	-	-	1	1	-	-	-	-
Anthozoa	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Actiniaria	-	-	1	1	1	1	1	1	1	1	3	4	-	-
Zoantharia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scleractiniaria	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pennatulacea	-	-	1	1	-	-	-	-	-	-	-	-	-	-
Gorgonacea	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Alcyonacea	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stolonifera	-	-	-	-	-	-	-	-	-	-	-	-	1	1

	59-1		99-4		114-4		123-2		125-1		129-2	
	sp	#	sp	#	sp	#	sp	#	sp	#	sp	#
Hydrozoa	-	-	-	-	-	-	-	-	-	-	-	-
Athecata/Anthomedusae	-	-	-	-	1	2	-	-	1	1	-	-
Thecata/Leptomedusae	-	-	-	-	2	2	-	-	-	-	-	-
Stylasterina	-	-	-	-	-	-	-	-	-	-	1	1
Scyphozoa	-	-	-	-	-	-	-	-	-	-	-	-
Coronata	-	-	-	-	-	-	-	-	-	-	-	-
Anthozoa	-	-	-	-	-	-	-	-	-	-	-	-
Actiniaria	-	-	2	2	1	1	1	1	2	2	2	2
Zoantharia	-	-	-	-	-	-	-	-	-	-	-	-
Scleractiniaria	-	-	-	-	-	-	-	-	-	-	-	-
Pennatulacea	-	-	-	-	-	-	-	-	-	-	-	-
Gorgonacea	-	-	-	-	-	-	-	-	-	-	-	-
Alcyonacea	-	-	-	-	-	-	-	-	-	-	-	-
Stolonifera	1	1	-	-	-	-	-	-	-	-	-	-

Tab. 3.3.6-3: Cnidarians collected by EBS during ANDEEP I (preliminary list of numbers of species and individuals).

3.3.7 Phylogeny, reproductive mode, and parasitism in Antarctic cidaroid sea urchins

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Sea urchins in the order Cidaroidea are a well defined group with one of the best fossil records among echinoderms. Two of the extinct families occurred in the Paleozoic, one of which extended into the Mesozoic. Of the four families in the Mesozoic, two survived into the Cenozoic and have living representatives: Psychocidaridae, with a single species, and Cidaridae, with about 130 species. While the fossil record for cidarids in the Mesozoic is mainly in the Tethys Sea of Europe, for the Cenozoic, after the closure of the Tethys Sea, both the fossil record and the present distribution is mainly Indo - west Pacific and Antarctic. At least four clades have invaded the deep-sea, including in the Antarctic.

Antarctic cidarids appear to represent one clade of about 19 species in the subfamily Ctenocidarinae. It is likely that its sister clade is, or is within, a western Pacific subfamily, Goniocidarinae, with many species in Australian and New Zealand waters, including the deep sea. If that is true, the two clades probably split after Australia/New Zealand separated from Antarctica about 40 million years ago. Almost all ctenocidarines are restricted to Antarctic waters, but two additional species occur only on the Patagonian shelf, and one of the Antarctic species descends from the shelf into the deep sea and extends into the eastern Pacific as far north as Alaska and Kamchatka. Whether it is one genetic species or not is open to question.

From what is known about the history and distribution of cidarids, they make an ideal group to examine the relationship between Antarctic shelf species and those of the deep-sea. A molecular clock can probably be calibrated by the separation of the Antarctic from Australia and New Zealand (and perhaps South America), and the phylogenetic relationships within the Antarctic species determined with a good timeline. Moreover, such an analysis would determine whether the deep sea or shelf species are basal, and therefore whether the deep sea was invaded by shelf species, or vice versa.

The collections of cidaroids made during ANT-XIX/3 (ANDEEP I) and -XIX/4 (ANDEEP II) will be extremely useful for developing a phylogenetic hypothesis of the group that can then address questions of their origin and radiation. A total of 450 specimens were collected during the two cruises. Most individuals were collected from relatively shallow water in collaboration with the CCAMLR team trawling for fishes during ANT-XIX/3, but 115 specimens were collected from deeper water using the Agassiz trawl (and in one case the box core) of the ANDEEP program (Fig. 3.3.7-1). Species from all four Antarctic genera were included in the samples, and although the species have not yet been identified, all but two of the known Antarctic species occur above 500 m depth, so the large number of specimens from less than 500 m is encouraging. Moreover, only four species are known to occur deeper than 2000 m, making our 114 specimens collected below that depth very valuable.

In addition to using the phylogenetic analysis for understanding the history of Antarctic cidaroids, we wish to use it to examine their unusual mode of reproduction. With the exception of one species of goniocidarine in New Zealand and the two species of ctenocidarines in Patagonia, many Antarctic ctenocidarines, if not all, are the only cidaroids known to provide parental care for their young by holding the embryos among the spines around the mouth or anus. This behavior avoids development in the plankton, and provided evidence for the hypothesis (called "Thorson's rule") that hazardous conditions in polar seas select against pelagic development. Although it is now known that there is an abundance of pelagic larvae of many taxa in both Arctic and Antarctic waters, discrediting this hypothesis in general, parental care by ctenocidarines in the Antarctic is very unusual for cidaroids and demands an explanation.

Of the 19 currently recognized species of Antarctic cidaroids, ten have been reported to protect their young, or brood. We found brooding specimens of one of those species, *Rhynchocidaris triplopora*, in our collections. In addition, we found a brooding specimen of *Notocidaris mortenseni*, for which there has been no previously published report of brooding. Consequently, the known number of brooders is now eleven out of 19.

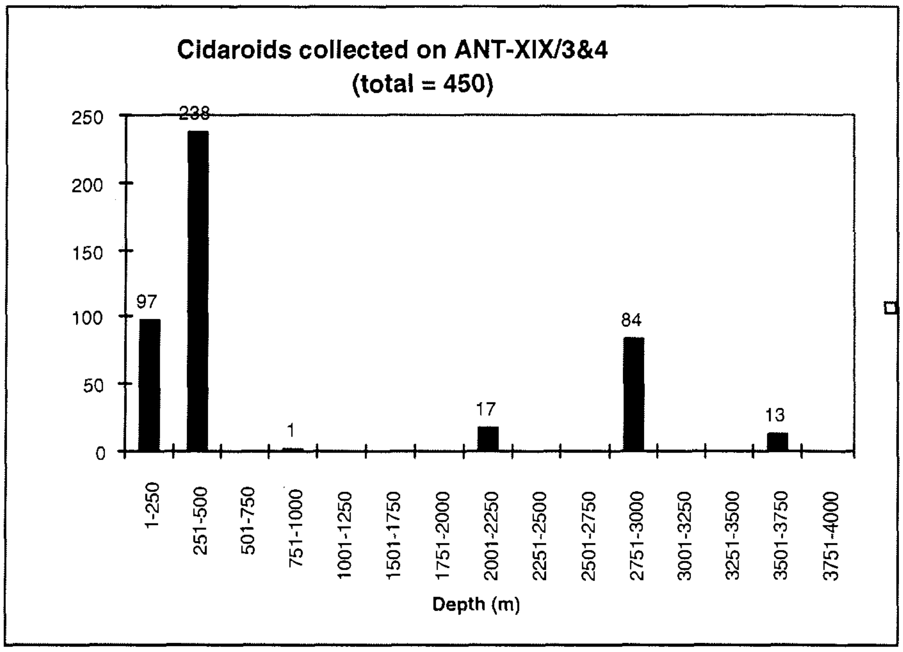

Fig. 3.3.7-1: Number of collected cidaroids during legs ANT-XIX/3 (ANDEEP I) and ANT-XIX/4 (ANDEEP II) according to depth intervals.

We plan to use the phylogenetic analysis we develop to determine whether brooding is basal or derived within the Antarctic cidaroids. If basal, it could have evolved before the harsh polar conditions developed in the Antarctic, and have little to do with them. And regardless of what led to the brooding behavior, by localizing populations and limiting gene flow, once established it could have lead to the relatively high number of cidaroid species now seen in the Antarctic.

Finally, it has long been known that an unusual fungal-like parasite, *Echinophyces mirabilis* infects some species of Antarctic cidaroids and causes dramatic changes in their morphology. In particular, the female gonoducts are connected to gonopores near the mouth in infected animals rather than the usual location in sea urchins around the anus. How this is achieved is unknown. The first step is "simply" to find out what kind of organism it is. We found 37 infected specimens of *Rhynchocidaris triplopora* in our collections, confirmed the parasite's unusual effect on the host, and fixed them for suitable histological and genetic analyses. Their collection and proper preservation makes the whole cruise especially worthwhile for us.

Collections of and observations on non-cidaroid echinoderms

While this project focused on cidaroid sea urchins, we also took specimens of other echinoderms in the trawls to add to the collections held by the California Academy of Sciences. Over 1700 specimens were retained from the more than 70 fish trawls (on ANT-XIX/3 only) and 18 Agassiz trawls, representing five of the six extant classes of echinoderms. Nearly 70 % of the specimens were ophiuroids, clearly a major feature of the Antarctic bottom fauna. However, there were also about 275 specimens of asteroids, 100 specimens of holothuroids (ANT-XIX/3 only), and 125 specimens of echinoids. But of particular interest, were a few specimens of a small, stalked crinoid (possible in the genus *Rhizocrinus*) collected from two deep stations (PS61/41-4, 2215 m and PS61/94-1, 3974 m). There are few records of xenomorphic stalked crinoids in Antarctica, and these specimens could be significant in advancing our understanding of the evolution in the deep sea. Indeed, they could represent a "living fossil" of an otherwise extinct Paleozoic clade.

Most of the non-cidaroid sea urchins collected were irregular echinoids, most of which, like Antarctic cidaroids, are unusual because they brood their young. Schizasterid spatangoids, in particular, retain their young in pouches formed by depressions on the aboral surface of the test. More than 75 specimens of schizasterids were collected, belonging mainly to the genera *Abatus, Amphipneuses,* and *Brachysernaster.* In addition, 15 specimens of the holasteroid irregular echinoid *Antrechinus mortenseni* were collected from around Elephant Island and the South Shetland Islands, half of which were females. This species is known to protect the young inside the test, and MOOI & DAVID (1993) postulated from preserved material that ciliary currents within the brood pouches irrigate the otherwise completely enclosed embryos. Observations on a broken specimen confirmed this suggestion when bands of cilia along the spines within the brood pouches were seen to waft small particles in distinct currents through the brood pouch.

3.3.8 Antarctic deep-sea holothurians

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ANT-XIX/4 / ANDEEP II

Deep-sea holothurians are known to dominate megafauna in many areas of the deep ocean and in modern oceanographic studies they are often used as an "indicator taxon". As a group highly specialised to the deep-sea environment, holothurians deserve a special attention in the discussions about the history of deep-sea fauna.

Two taxa of holothurians are especially abundant in the deep-sea: the order Elsipodida and the family Synallactidae (Aspidochirotida). During leg ANT-XIX/4 (ANDEEP II) the elasipodid holothurians were the primary objects of two research projects: by A. Gebruk and B. Wigham. A third research project, by JMB, focused on the apodid holothurians, a common deep-sea infaunal group.

The following problems were indicated as objectives of studies of Antarctic elasipodid holthurians:
(1) composition of Antarctic deep-sea holothurian fauna;
(2) links between the Antarctic abyssal, bathyal and shelf faunas;
(3) links between the Antarctic and low-latitude deep-sea faunas;
(4) links between the Antarctic and high latitude faunas;
(5) level of morphological specialisation of the Antarctic deep-sea fauna.

During ANDEEP II holothurians were collected using the Ebibenthic sledge (EBS) and Agassiz trawl (AGT). Following is a brief account on holothurians sampled with the AGT.

Elasipodid holothurians

The elasipodid holothurians were found at seven trawl stations out of twelve (Fig. 3.3.8-1). They were missing at two stations shallower than 2000 m, in the depth range where they are in general more rare. The elasipodids were also absent at three deeper stations (131, 135 and 141), although traces of their activity were seen on the seafloor images.

Three families of elasipodid holothurians were found in the trawl samples: Elpidiidae, Psychropotidae and Deimatidae (Tab. 3.3.8-1). The highest diversity was shown by elpidiids: four genera and at least eight species. The psychropotids were represented by two genera and four
species, the deimatids by one genus and species, *Oneirophanta mutabilis*. The highest species number was in the genus *Peniagone*: five species, followed by *Psychropotes*: three species. Both *Peniagone* and *Psychropotes* were also observed on the seafloor images.

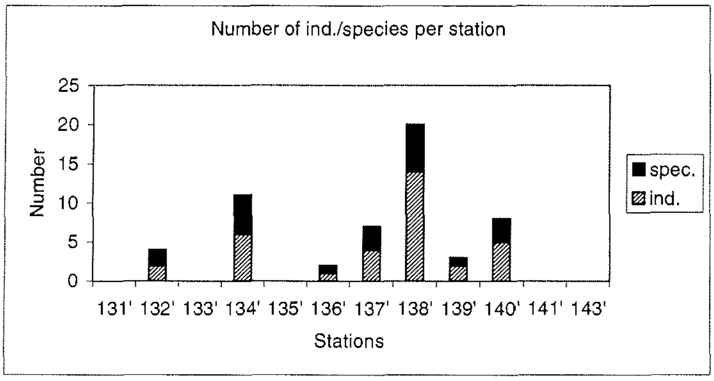

Fig. 3.3.8-1: Number of individuals and species of elasipodids per station.

Family	Genus	Number of species
Elpidiidae	*Peniagone*	5
	Elpidia	1
	Rhipidothuria	1
	Scotoplanes	1
Psychropotidae	*Psychropotes*	3
	Benthodytes	2
Deimatidae	*Oneirophanta*	1

Tab. 3.3.8-1: Diversity of elasipodid fauna sampled during the ANDEEP II.

The highest diversity of elasipodids was recorded at station 138 (4552 m): six species and 14 individuals. Five species were found at station 134 (4066 m), three species at stations 137 (4977 m) and 140 (2965m).

We accumulated all records of elasipodids over the depth, with an increment of 500 m (Fig. 3.3.8-2); values on the diagram indicate the number of species and individuals found in the 500 m depth interval above the given depth. The highest number and diversity of elasipodids appeared in the depth layer 4500-5000 m.

The elasipodids holothurians are among classical deep-sea groups showing features of Antarctic origin. There is every reason to believe that the elasipodid fauna was widely distributed in the ancient Tethys Sea basin, and was split into at least three parts, following the break up of the Tethys Sea into the Indo-Malayan, the Mediterranean and the West Indian Sections. The subsequent invasion of the Antarctic occurred most probably along the South American continental slope in the bathyal zone (presumably in Miocene), and a new stage, the penetration of abyssal depths and world wide distribution, started in the Antarctic. Thus, the Antarctic can be considered as one of the centres of origin of modern deep-sea elasipodid fauna.

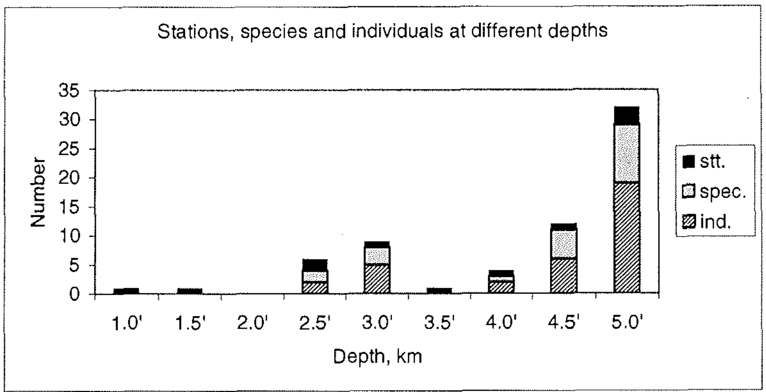

Fig. 3.3.8-2: Number of individuals, species and stations in the 500 m depth layer above the indicated depth.

Primitive elasipodid genera, showing connections between the Antarctic and low-latitude faunas, are of a special interest for studies of the history of this group. Among such genera is Rhipidothuria, sampled at station 138 (4066 m). Further studies of this genus will be undertaken for better understanding of the history of colonisation of the Antarctic by deep-sea holothurians.

Variability of a "shared" holothurian fauna from the abyssal Weddell Sea and NE Atlantic Ocean: a molecular approach

Deep-Sea holothurians, particularly those of the order Elasipodida, dominate the invertebrate megafauna in many areas of the deep sea and can be found in exceptionally high numbers, both in the Weddell Sea and the NE Atlantic (GUTT & PIEPENBURG 1991, BILLETT et al. 2001).

Large numbers of elasipodid holothurians have regularly been sampled from the Porcupine Abyssal Plain (PAP) in the NE Atlantic (48° 50'N 16° 30'W, 4850 m depth), of which several species are widely distributed in the world oceans. Two species in particular, *Psychropotes longicauda* and *Oneirophanta mutabilis*, are a major component of the holothurian megafauna on the PAP and have also been reported from the abyssal Weddell Sea (HANSEN 1975).

For such widely distributed species, neither *P. longicauda* nor *O. mutabilis* exhibit reproductive patterns conducive to wide-scale dispersal. P. longicauda possesses the largest measured egg of any deep-sea invertebrate at 4.4 mm. With eggs of this size direct development of the larvae is inferred (HANSEN 1975, TYLER & BILLETT 1987), however juveniles have been taken in rectangular mid-water trawls at distances of 17 to 1000m off the seabed. This suggests the possibility of a pelagic juvenile capable of dispersal by deep-ocean currents and may account for the cosmopolitan distribution of many of these species (TYLER & BILLETT 1987, GEBRUK et al. 1997). O. mutabilis also produces large eggs (c. 0.9 mm) indicative of direct larval development, but is a curious species in that for the majority of samples examined there is an apparent lack of functional males.

Aims

To firstly assess whether the populations of *P. longicauda* and *O. mutabilis* sampled from the NE Atlantic are the same species as those sampled from the deep Weddell Sea. It is already believed, based on morphological data, that specimens of *P. longicauda* taken from the Pacific Ocean may be a separate species to those found in the NE Atlantic. Secondly, to assess the genetic variation between populations, of these two species, separated geographically on a basin scale, and to investigate whether any gene flow is evident between the two populations. Thirdly, if they are separated reproductively how long ago did these two populations diverge.

DNA has already been extracted and sequenced from NE Atlantic samples and primers have been developed for both the 16S and CO1 (Cytochrome oxidase) regions of the mitochondrial DNA.

Results
Unfortunately, the number of specimens recovered by the Agassiz trawl, during ANDEEP II, were too low to be of use in a comparative study with those specimens from the NE Atlantic. Muscle tissue was taken from three individuals of *Psychropotes longicauda* (two just partial specimens) and one individual of *Oneirophanta mutabilis* for a purely qualitative comparison with NE Atlantic samples in an attempt to complement morphological work undertaken as part of objective (4).

Muscle tissue was also taken from individuals of *Peniagone* sp. to compare 16S sequences with samples of *Peniagone* sp. collected from the West Antarctic peninsula shelf, again to complement ongoing morphological work as part of objective (2).

Apodid holothurians
The Apodida are a group of mainly infaunal holothurians with a worldwide distribution from shallow areas down to hadal depths. All three families are known to occur in Antarctic waters (Myriotrochidae: four genera, eight species; Chiridotidae: three genera, four species; Synaptidae: one genus, one species).

The ANDEEP legs I and II together with the LAMPOS expedition to the deep-sea and the shallow areas of the Scotia Arc for the first time offer the opportunity to answer such questions as:
(1) What is the composition of the Apodida fauna of this area.
(2) What are the relationships of the Antarctic, the South American and the Scotia Arc shelf fauna to the surrounding deep-sea?
(3) Are there links between the Antarctic deep-sea fauna and the deep-sea fauna of other areas (e.g. South Atlantic)?

During ANDEEP more than 100 specimens of at least seven different genera of all three Apodida families have been collected using the EBS and the AGT (Tab. 3.3.8-2). The majority of the specimens collected came from the EBS (seven stations), due to the small size of most Apodida, and only few specimens were collected with the AGT (three stations). Because of the time consuming sorting of the EBS samples on board, only Apodida of the ANDEEP I are represented in this report.

Family	Genus	41-3 EBS 2375	42-2 EBS 3683	43-8 EBS 3961	46-7 EBS 2893	99-4 EBS 5190	114-4 EBS 2914	132-3 AGT 2084	141-9 AGT 2292	143-1 EBS 773	143-2 AGT 725
	Apodida cf.		18	2			1				
Myriotrochidae		1		1		6	1		2		
	Acanthotrochus						1				
	Prototrochus	1	8	17	8	3	6				
	Myriotrochus		6		2	1	1	1			
Chiridotidae	*Paradota*									1	2
	Taeniogyrus				1					2	
	Trochodota	2	3	1							
Synaptidae	*Labidoplax*		1		2		4				

Tab. 3.3.8-2: Stations where Apodida have been collected during ANDEEP I and II; EBS =pibenthic sledge, AGT = Agassiz trawl, depths in metres.

Myriotrochidae

All three genera (*Prototrochus*, *Myriotrochus*, *Acanthotrochus*) represented in this collection were known from the Antarctic deep-sea (BELYAEV & MIRONOV 1982). *Prototrochus* and *Myriotrochus* are the most common representatives of the Myriotrochidae in the deep-sea, which often have a wide distributional range. On the other hand, the finding of a specimen of *Acanthotrochus* (station 114-4) is of great interest with regard to zoogeography. Until now only three species are known from few localities from Arctic waters, the Central Pacific and East Antarctica. This is the first record of a representative of this genus in the South Atlantic.

Chiridotidae

Specimen of three genera (*Paradota*, *Taeniogyrus*, *Trochodota*) have been collected during the expedition, all of which have been reported earlier from Antarctic waters (EKMAN 1925, EKMAN 1927, PAWSON 1969). *Taeniogyrus* and *Trochodota* species thought to be restricted to Antarctic shelf areas (down to 800 m in Antarctic waters) have been collected for the fist time from abyssal depths (down to 4000 m).

Synaptidae

Up to now only one species of the family Synaptidae has been reported from Antarctic waters, but EKMAN (1925) regarded its identity as a doubtful. Off the Antarctic Peninsula seven specimen belonging to the genus *Labidoplax* have been collected at three EBS stations (Tab. 2). *Labidoplax* is a small genus with five species, four of which have a northern Atlantic distribution in shallow and bathyal depths (GAGE 1985; own data) and one species which is known from off New Caledonia (SMIRNOV 1997). The new record of this genus from abyssal depths in the Drake Passage may reveal a possible connection via the deep-sea between these two isolated distributional areas.

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3.4 Depositional environments

3.4.1 Benthic habitat characterization of physical and biological processes influencing surface sediment structure in the southern Scotia and northern Weddell seas: ANDEEP I and II.

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ANT-XIX/3 / ANDEEP I (RJD) and ANT-XIX/4 / ANDEEP II (LWC)

The factors structuring surface sediments, down to 20-30 cm from the sediment-water-interface (SWI), in the deep-sea are a combination of physical and biological processes. While physical processes deliver sediment to the sea-floor it is the activities of benthic organisms, or bioturbation, that alter primary physical sedimentary structures and produces secondary structures such as graded beds below the SWI and mounds or pits at the SWI. Surface and near-surface sedimentary structures are then a time-integrated record of recent biological and physical processes, which can be used to evaluate the importance of biology versus physics in structuring the benthic boundary layer.

In order to characterize the benthic boundary layer sediment-surface and profile film cameras and video were used. Surface and video cameras have been routinely used in the deep-sea to characterize benthic fauna and geological features of the sea bed. The use of a sediment profile camera in the deep-sea is relatively recent, see DIAZ et al. (1995). RHOADS & CANDE (1971) initially developed sediment profiling as a means of obtaining *in situ* data to investigate processes structuring the SWI. The technology of remote ecological monitoring of the sea floor (REMOTS) or sediment profile imaging (SPI) has allowed for the development of a better understanding of the complexity of sediment dynamics, from both a biological and physical point of view (for shallow water examples see: RHOADS & GERMANO (1982, 1986), DIAZ & SCHAFFNER (1988), VALENTE et al. (1992), BONSDORFF et al. (1996), NILSSON & ROSENBERG (2000), and ROSENBERG et al. (2001)). This approach to evaluating the SWI and benthic boundary layer can be combined with geochemical and benthic community data to give a holistic view of processes structuring deep-sea surface sediments.

The primary objective of this project is to document and characterize sediment structures and fabric form of the SWI to a depth of 20-30 cm using a combination of surface and sediment-profile cameras. Information will be generated on the processes influencing the structure of surfical sediments at stations in the Scotia and Weddell Seas that can be linked to biological fauna and geochemical data collected by multicores and box-corer. Specific questions to be addressed are:

(1) what is the relative importance of biological and physical processes in structuring bottom sediments?
(2) how far into the sediments does bioturbation extend and can mixed layer depth be estimated?
(3) what faunal components are responsible for major biogenic structures? and
(4) is small scale variation (within a station) in sediments, forming both biological and physical factors, of the same magnitude as large scale variation?

In addition to the primary objective, collaborations will be developed with the other investigators to assist in interpreting patterns on biodiversity and geochemistry. The surface and profile images will provide data on *in situ* sedimentary and benthic conditions.

Materials and methods
The sediment profile camera used was a Benthos model 3137, which can photograph a 15 by 24 cm cross-section of the sediment. A Benthos model 371 utility camera and strobe were attached to the profile camera frame and photographed a 0.7 to 0.8 m^2 area in front of the sediment profile prism. A Sony DCR-TRV10 digital camcorder was placed into a housing and attached to the frame at an oblique angle to image the seabed from 0.4 to 1.5 m away from the edge of the frame (an area of approximately 1-2 m^2). Illumination was provided by 120 white LEDs. At each station the camera system was lowered to the seabed and 10 to 18 replicates collected. 100 kg of lead were attached to the frame to improve prism penetration. The profile camera was set to take two pictures, using Ektachrome 100 ASA slide film, on each deployment at 1 and 15 seconds after bottom contact. The surface camera used 400 ASA Ektachrome. Film was developed onboard R/V Polarstern and results made available to other investigators.

ANDEEP I results
A total of 18 stations was sampled from 26 January to 22 February 2002 (Tab. 3.4.1-1). Six of the stations (PS61/073, 075, 102, 116, 120, and 125) were made to support fisheries activities on the continental shelf around Elephant and King George Islands, at depths from 160 to 422 m, and were not part of the ANDEEP programme. The other twelve stations ranged in depth from 1086 m at station PS61/076 to 5197 m at station PS61/099. Station 099 was sampled twice, first on 11 February and again on 15 February, because the sediment profile camera did not work the first time. Sediment profile images were successfully collected at all station, except 099-1. Surface images were not obtained at two stations due to problems with the camera's wire harness (PS61/041, 042 and 077). At two stations there was a dense nepheloid layer about 2-3 m above the bottom that obscured all bottom detail (PS61/073 and 075). The video camera did not function properly until station 073.

All film Ektachromes were digitized and transferred to CD, and will be available on the PANGAEA Data System maintained by the Alfred Wegener Institut for Polar- und Marine Research (AWI), Bremerhaven, Germany. Images were labelled with the cruise number, station number, gear code, and film number. For example, PS61-040-2 SPI-10 is the tenth sediment profile image (SPI) from station PS61/040, and PS61-040-2 SUR-09 is the ninth surface or plane view image from station PS61/040.

The video camera recorded the entire time the camera frame was collecting profile and surface images. Upon return to the surface the video tape was removed and reviewed in order to determine the sedimentary characteristics of the bottom and suitability for sampling with the box-corer and multi-cores. The quality of the recorded video was good from station 075 to station 129. As the camera frame drifted between replicates details on biogenic activities and physical aspects of bed roughness could be seen on the video tape and were useful for classifying bottom type over scales of approximately tens of metres. Video clips from each station were compiled onto a single mini-DV tape that will be archived at the Alfred-Wegener-Institut für Polar- und Meeresforschung.

The surface camera produced high resolution images of the bottom over an area of approximately 0.7-0.8 m^2 with resolution of about 1 mm. The living position of many invertebrate species were determined from the surface images. For example, a very delicate octacoral was photographed at 5198 m (image PS61/099-9 SUR-07). At all stations, except 040, that was on top of the Shackleton Fracture Zone (image PS61/040-2 SPI-14 and PS61/040-2 SUR-22), and 129, that was in an area with a high concentration of iceberg drop-stones (image PS/61-129-1 SPI-18 and PS61/129-1 SUR-29), surface sediments were dominated by biogenic structures such as pits, mounds, and sedentary megafauna.

Sediment-profile images provided details on SWI structure and subsurface sediments down to about 20 cm. Shallowest prism penetration was at station 040 on the Shackleton Fracture Zone and deepest penetration at 099 in the South Shetland Trench. Sediment type ranged from cobble at station 040 to clay at 099. At three stations (042, 105 and 099) sediments were laminated and appeared to be related to changes in source sediments.

STATION	DEPTH(m)	SPI	SURFACE	VIDEO
040	1768	YES	YES	NO
041	2373	YES	NO	NO
042	3694	YES	NO	YES
043	3958	YES	YES	NO
046	2886	YES	YES	NO
073	295	YES	NO	YES
075	178	YES	NO	YES
076	1087	YES	YES	YES
077	2154	YES	NO	YES
099-1	5192	NO	YES	YES
102	282	YES	YES	YES
105	2288	YES	YES	YES
099-9	5197	YES	YES	YES
114	2905	YES	YES	YES
116	294	YES	YES	YES
120	422	YES	YES	YES
125	161	YES	YES	YES
129	3595	YES	YES	YES

Tab. 3.4.1-1: Summary of sediment profile camera, surface camera, and video images collected on ANDEEP I.

ANDEEP II results
A total of 13 stations was sampled from 5 to 25 March 2002 (Tab. 3.4.1-2). Three of the stations (PS61/131-10, 133-9 and 134-9) were successfully repeated to collect additional data following equipment failure (Tab. 3.4.1-2). The 13 stations ranged in depth from 767 m at station PS61/143-3 to 6336 m at station PS61/142-1. Sediment profile images were collected successfully at all stations except 142-1 where the equipment could not be deployed because of insufficient pressure ratings. Surface images were obtained at all stations, and video images at all stations, except at PS61/135-1 and 138-2 where excessive power loss was experienced.

The video camera recorded images the entire time the camera frame was collecting profile and surface images. Upon return to the surface the video tape was removed and reviewed in order to determine the sedimentary characteristics of the bottom and suitability for box-cores and multicore sampling. The quality of the recorded video was good at all stations. As the camera frame moved between replicates, details of biogenic activities and sediment characteristics were visible. Video clips from each station were compiled onto a single mini-DV tape that will be archived at the Alfred Wegener Institute (AWI).

Sediment profile images provided detail on SWI structure and subsurface sediments down to about 20 cm. The shallowest prism penetration (746 m), occurred at station PS61/143-3 at 746 m, east of Montagu Island and South Sandwich Islands. Some of the deepest penetrations occurred between stations 131-2 and 139-3. A detailed description of sediment types can be found in HOWE (this vol.). Sediment characterization was only carried out on ANDEEP II. Completion of image and sedimentological analyses will occur upon return to respective home institutions.

STATION	DEPTH (m)	SPI	SURFACE	VIDEO
131-2	3055	NO	YES	YES
131-10*	3070	YES	NO	YES
132-1	2090	YES	YES	YES
133-1*	1120	YES	YES	NO
133-9	1111	NO**	NO**	YES
134-1	4062	YES	NO	YES
134-9*	4066	YES	YES	NO
135-1	4678	YES	YES	NO
136-1	4749	YES	YES	YES
137-1	4994	YES	YES	YES
138-2	4540	YES	YES	NO
139-3	3848	YES	YES	YES
140-1	2956	YES	YES	YES
141-3	2302	YES	YES	YES
142-1	6336	NO†	YES	YES
143-3	767	YES	YES	YES

Tab. 3.4.1-2: Summary of sediment profile camera, surface camera, and video images collected on ANDEEP II. Notes: * These stations were repeated to collect lost data due to equipment failure; ** Intentional non-deployment of SPI and Surface cameras. † The SPI camera was removed, as the anticipated depth was outside the recommended 'working pressure'.

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3.4.2 Recent depositional environments of the north western Weddell Sea and South Sandwich Trench

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Sediment deposition within the Scotia and northern Weddell seas is controlled by Neogene basement topography producing regions of erosion and deposition in response to bottom-current, hemipelagic and downslope activity (DIECKMANN et al. 2000, PUDSEY & HOWE 1998, PETSCHICK et al. 1996). Extensive studies in the Scotia Sea, have revealed the influence of the geographically constrained Antarctic Circumpolar Current (ACC) dominating sediment deposition and redistribution with both contourite drifts and regions of erosion common (HOWE et al. 1997, DIECKMANN et al. 2000, ZIELINSKI & GERSONDE 1997). Deposition occurs as mounded drifts and moats or as zones of flatter more hemipelagic drape, locally occurring in the lees of the rough basement topography (HOWE & PUDSEY 1999). Downslope debris flows and turbidites are most dominant in the deep-water areas adjacent to continental blocks (e.g. South Georgia).

A core transect across the Scotia Sea indicates decreasing bottom-current influence towards the south away from the main axis of the ACC with a corresponding decrease in biogenic content towards the influence of the Weddell Gyre. The main zone of productivity is controlled by the position of the Polar Front and spring sea-ice edges. Sedimentation rates vary across this region from 17 to 3 cm per 1000 years and current speeds increase from 7 cm/s in the south to 17 cm/s in the north with an associated increase in benthic storm frequency towards to the axis of ACC flow (PUDSEY & HOWE 1998). Towards the south in the northwestern Powell Basin, northern Weddell Sea, an area of mudwave development has been identified. The active wave-field is located near the base of the continental slope in water depths of 2800-3100 m, and may reveal a pathway of Antarctic Bottom Water (AABW) flow from the Weddell Sea to the Scotia Sea. The original construction of the waves may have been via downslope turbidity currents predominantly supplied from the basin floor channels. Present day deposition appears to be maintained by fine-grained sediment supply as a result of the lateral transfer of distal turbidites from the basin floor channels by bottom currents. The initiation of current-influenced sedimentation appears closely linked to the onset of AABW flow during the Early Miocene, following the separation of the South Orkney Microcontinent and the opening of Powell Basin during the Late Oligocene, 20-25 million years ago (HOWE et al. 1998).

Sampling

During the ANDEEP II cruise, the sampling stations focussed on the northwestern Weddell Slope and the South Sandwich Trench. Geologically these two vast areas are interesting in that they allow a comparison between a passive margin (Weddell) and a tectonically active (South Sandwich) forearc-trench system. Depth transects at both regions also allow the sampling of sediments from different "slices" of the water column. In the Weddell Sea these ran across the axis of AABW to the abyssal plain, and in the South Sandwich area from the slope into the very deep water of the trench floor. Samples were taken using both the box corer (GKG) and the multicorer (MUC; Tab. 3.4.2-1). The box corer provided an undisturbed sample enabling later study of sedimentary structures, particle size analysis and magnetic susceptibility. The multicorer provided sediment slices that will form the basis of further geochemical, volcanic ash (tephra) and radiocarbon work. Sediment descriptions were made using the box corer, multicorer and from the video and camera equipment (see DIAZ & CARPENTER this vol.).

Station no.	Sample type	Length mbsf	Comments
131	Box core	0.40 m	
	Multicore	0.38 m	
132	Box core	0.40 m (first drop) 0.48 m (second drop)	First drop disturbed core
	Multicore	0.33 m	
133	Box core	0.23 m (first drop) 0.41 m (second drop)	
	Multicore	0.16 m	
134	Box core	0.50 m	
	Multicore	0.40 m	
135	Box core	0.42 m	Core top disturbed
	Multicore	0.40 m	
136	Box core	0.37 m	
	Multicore	0.46 m	
137	Box core	0.42 m	
	Multicore	0.43 m	
138	Box core	0.42 m	
	Multicore	0.43 m	
139	Box core	0.22 m	
	Multicore	0.18 m	
140	Box core	0.18 m	
	Multicore	0.13 m	
141	Box core	0.22 m 0.27 m	
	Multicore	0.06 m	
142	Box core	No Deployment	
	Multicore	0.19 m Sliced core 0.19 m Intact sample	

Tab. 3.4.2-1: Sediment Samples.

Box corer

Initially, once the box corer was secured inboard, the visible sediment surface was described. Visual descriptions of the sediment colour, type, texture, structure, level of biotubation and appearance of any drop-stones were taken. The box core was then subsampled using a 10 cm diameter, 60 cm long polyurethene core tube. The core tube was pushed into the sediment, capped and stored in the 4°C cold store onboard RV POLARSTERN.

Multicorer

Multicores were distributed amongst interested workers once the corer was secured inboard. For the sediment work, a longer core was needed to allow the longest geological record to be studied. Working in the main geology laboratory, the multicore was extruded and 2 cm slices taken to a depth of 10 cm below the sediment-water interface. Below 10 cm, 5-cm slices were taken to the end of the core. The core slice samples were stored in the 4°C cold store onboard RV

POLARSTERN. Smear slides were made of the five 2-cm slices, by mixing a small amount of sediment with water on a slide and drying on a hotplate. A small amount of Canada balsam was added as a mounting medium and a coverslip placed over the slide. By examining these slides under the microscope an estimate of sediment composition, sorting and biogenic content was made using the procedure adopted by the Ocean Drilling Program (ODP) and based on a *pro forma* previously used by the Antarctic Cape Roberts Project.

Interpretation of Depositional Environments

The interpretation of the depositional environments is based on a number of criteria, all from shipboard examination of the seabed camera, video, sediment profiler, multicore and box core sediment samples (Tab. 3.4.2-2). The criteria used are: sediment sorting, levels of bioturbation, sand/silt/clay content and any bedforms/structures visible. The sediment was classified according to depositional process, e.g. a sediment deposited by a turbidity current is classed as a turbidite, contour currents deposit contourites, etc.

Hemipelagite – low energy settling of suspended material, under 30 % biogenic. High levels of bioturbation.
Contourite – moderate-high energy alongslope deposition and reworking of sediment by persistant thermohaline flow. High levels of bioturbation, types are muddy-silty and sandy depending on current strength (increasing grainsize reflects increasing current velocity).
Pelagite – low energy settling of suspended material, over 30 % biogenic. High levels of bioturbation.
Turbidite – high energy downslope reworking of sediments, possible erosive base with graded structure coarsest in lower units to fine grain size in the upper units.

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Howe, J.A. & Pudsey, C.J. (1999): Antarctic Circumpolar Deepwater: a Quaternary palaeoflow record from the northern Scotia Sea, south Atlantic Ocean.- J. Sed. Res. 64 (4): 847-862.
Petschick, R., Kuhn, G. & Gingele, F. (1996): Clay mineral distribution in surface sediments of the South Atlantic: sources, transport and relation to oceanography.- Mar. Geol. 130: 203-229.
Pudsey, C.J. & Howe, J.A. (1998): Quaternary history of the Antarctic Circumpolar Current: evidence from the Scotia Sea.- Mar. Geol. 148: 83-112.
Zielinski, U & Gersonde, R. (1997): Diatom distribution in Southern Ocean surface sediments (Atlantic sector): implications paleoenvironmental reconstructions.- Palaeogeogr. Palaeoclimatol. Palaeoecol. 129: 213-250.

Stn. No.	Position (box core)	Water Depth (m)	General Area	Interpretation and depositional environment	Overall estimate sand	silt	clay	Comments
131	65°19.35'S 51°32.26'W	3055	lower cont. slope NW Weddell Sea	muddy-silty contourite	10	40	50	Moderate current, fine-grained seabed
132	65°17.72'S 53°22.65'W	2090	lower cont. slope NW Weddell Sea	glacigenic hemipelagite	35	55	10	Sluggish current, fine-grained seabed.
133	65°20.23'S 54°12.65'W	1166	middle cont. slope NW Weddell Sea	sandy-silty contourite	70	15	15	Mn coated drop stones; glacial clays below 6 cm anaero bic conditions.
134	65°19.90'S 48°05.55'W	4060	Weddell Abyssal Plain	hemipelagite	5	30	65	Phytodetrius on sediment surface,
135	64°59.00'S 43°00.65'W	4680	Weddell Abyssal Plain	hemipelagite	5	30	65	Core surface possibly disturbed
136	64°01.67'S 39°07.68'W	4760	N. Weddell Abyssal Plain, S. Endurance Ridge	hemipelagite	5	40	55	
137	63°45.00'S 33°47.81'W	4975	N. Weddell Abyssal Plain - near fracture zone	hemipelagite - low energy	5	75	20	Core top contained much phytodetritus / polychaete covers.
138	62°57.98'S 27°53.83'W	4542	N. Weddell Kosminski Fracture Zone deep	pelagite - low energy	1	70	19	Biogenic siliceous material and volcanic glass.
139	58°14.71'S 24°20.48'W	3936	South Sandwich Trench, east of Montagu Island	contourite - moderate energy	25	50	25	Winnowed sands much siliceous biogenic material and volcanic glass
140	58°16.14'S 24°53.74'W	2964	South Sandwich Trench, east of Montagu Island	Hemipelagite- poss. some contourite reworking	15	60	25	Diatom Chaetoceros spp. layer below 0.20 m
141	58°24.96'S 25°00.94'W	2292	South Sandwich Trench, east of Montagu Island	Hemipelagite - ?? some contour. reworking	30	60	10	
142	58°50.81'S 23°58.55'W (multicore postion only)	6326	Floor of the South Sandwich Trench, east of Montagu Island	Hemipelagite and pelagite (?? fine-grained turbidite layer?)	5	95		Biogenic-rich, poss. turbidite in second multicore drop

Tab. 3.4.2-2: Sediment data.

3.4.3 Drop-stones

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Ice flowing outward from the centre of the Antarctic ice-sheets reaches the land edge as ice-sheet fronts or by being channelled into faster-flowing glaciers and ice streams. As the ice flows over the bedrock, it may pick up loose pieces of rock and also pluck ice from the rock base. Rock incorporated into the base of the ice then acts as an abrasive, scouring and polishing the bedrock surface, and locally leaving scratches parallel to ice movement direction. Glaciers flowing from rocky uplands (e.g. Antarctic Peninsula glaciers) or flowing past mountain ranges (e.g. Slessor and Recovery glaciers) also receive material on their surfaces which has fallen down from rock exposures.

As the ice mass flows outward, at some location it will reach a point (grounding line) where it begins to float off into the sea and may then extend outwards from the coast in huge ice shelves, hundreds of metres thick and thousands of square kilometres in extent. Eventually, fragments break off from the seaward margins of the ice shelves to form tabular bergs, sometimes tens of km in length. Through melting, and erosion caused by wave action, rock fragments incorporated into bergs are released and fall to the seabed as drop-stones.

Ice flowing into the Weddell Sea crosses three major geological provinces:

Province 1
- basement area of Dronning Maud and Coats lands - mainly Precambrian gneisses (typically 1000 Ma old or older) with local areas of Precambrian and Palaeozoic sedimentary rock (>245 Ma), and areas of Permian sediments intruded by dolerite sheets (e.g. Theron Mountains).

Province 2
- Palaeozoic sedimentary rocks of Pensacola and Ellsworth mountains – Cambrian to Permian (550-245 Ma); in Pensacola Mountains there is also a large intrusion of layered gabbro (Dufek Intrusion).

Province 3
- Volcanic arc of Antarctic Peninsula - volcanic and associated plutonic rocks (mainly 240 to 20 Ma) plus terrestrial and marine sedimentary rocks from flanking basins. There are also very young basaltic rocks (10 Ma) along the north-eastern coast, and a small area of 1000 Ma gneisses at Haag Nunataks, southernmost Antarctic Peninsula.

Whilst it is difficult to distinguish in a hand specimen between, say, mudstones of widely differing ages from different provinces, certain rocks are diagnostic or at least known primarily from only one province. However, it must be borne in mind that the only knowledge of rock types and their distribution comes from what we can see in outcrop, which is about 1 % of the surface of Antarctica. The extent to which the rocks we see in the mountains may extend under the ice is a matter for speculation, and there may even be hidden rock units we do not see at the surface.

Bergs containing material derived from the Weddell Sea hinterland will drift around under the influence of the clockwise current known as the Weddell gyre. This means that drop-stones dredged from north-western Weddell Sea could have come from anywhere between western Dronning Maud Land and the Antarctic Peninsula. By contrast, bergs which reach the northwestern area then drift out into the open ocean, and thus one would not expect to find rocks from the Ronne-Filchner Ice Shelf hinterland or from the Antarctic Peninsula, off the coast of Dronning Maud Land.

Once a piece of rock is incorporated into a body of glacial ice it unlikely to experience much in way of rounding. Thus we can expect drop-stones to be very angular (especially pieces plucked off the bedrock at the base of the ice sheet or which fell directly onto a glacier) to sub-angular. Well-rounded stones are likely to have come from pre-glacial beaches or rivers (overridden by ice) or from pre-existing conglomerate strata.

The drop-stones of ANDEEP II

Northern Weddell Sea transect

A previous study of Weddell Sea drop-stones (OSKIERSKI 1988) concentrated on collections from the shelf of eastern Dronning Maud Land to Filchner Ice Shelf and sampled stones close to their delivery points. Those collections are likely to have been representative of the adjacent source area. Collections of stones made on ANDEEP II, however, were from sites far from their points of probable origin. Each probably sampled the fall-out from several bergs and may thus be expected of mixed provenance.

Given the random processes by which drop-stones arrive at their final resting places on the sea-bed, the collections brought up in the Agassiz trawls were typically unsorted and composed of different rock assemblages. As would also be expected, most of the stones were angular to subangular. Well-rounded pebbles and cobbles were found, but the collection of at least one stone consisting of a cobble with lithified gravelly matrix attached, indicates that a pre-existing conglomerate deposit constitutes one of the source rocks.

With few exceptions, stones were coated with a dark mahogany or even black coating, presumed to be a mixture of manganese and iron oxides, with typically less than one quarter of the stone (that part buried in the sediment) showing a clean rock face. A few pebble-sized stones had a manganiferous coating on all surfaces, suggesting that they had been rolled at some stage. Evidence from manganese nodules suggests growth rates of approximately 3 mm per million years (BROEKER & PENG 1982). Whilst the coatings seen on the drop-stones from the Weddell Sea can only be fractions of a millimetre thick, they nevertheless are likely to have taken hundreds or even thousands of years to build up. It thus seems that the stones have been exposed for a very long time and that present-day sedimentation rates are extremely low. Video footage of the sea-bed typically showed low or moderate levels of current activity, suggesting that drop-stone fields are swept bare of sediment continually.

Many stones serve as substrates for a variety of animals, such as foraminifers, corals and anemones, sponges, bryozoans, inarticulate brachiopods, and stalked barnacles. Given that the sea-bed consists typically of extremely soft mud, it is a moot point whether such animals could inhabit the deep waters of the Weddell Sea at all, without the presence of drop-stones. Hence, it may be argued that drop-stone accumulations play a significant role in enhancing the diversity of benthic animals in the circum-Antarctic deep sea.

South Sandwich trench transect

The curved volcanic chain of the South Sandwich Islands acts as a barrier for the capture of many ice flows and bergs drifting out of the Weddell Sea. In the early to mid part of the Austral summer, there is often a heavy concentration of Weddell Sea ice and bergs in the South Sandwich Islands area and one might therefore expect to find a significant concentration of drop stones. However, the greater proportion is likely to occur on the '"catchment" or western side with less on the eastern side of the islands. Agassiz trawls from sites PS61/139, 140, 141 and 143 contained fragments of scoria as the dominant constituent, together with angular basaltic to andesitic material, all probably locally derived. Most of such material could have been transported by normal volcanic (as ejecta) or current-transport processes. A few highly angular stones of granitic and metasedimentary rocks are foreign and therefore likely to be true drop-stones. The most remarkable occurrence, however, was that of well-rounded pebbles and cobbles of presumed local volcanic rocks and which apparently came from beaches. Given that station PS61/139, which contained some of the largest cobbles, was located in nearly 4000 m of water depth and some 60 NM from the nearest island (Montagu), some special mechanism, such as a debris flow, has to be invoked for their emplacement.

Broeker, W.S. & Peng, T.-H. (1982): Tracers in the sea.- Palisades, New York: Lamont Doherty Geological Observatory, Columbia University. 690 pp.

Oskierski, W. (1988): Verteilung und Herkunft glazial-mariner Gerölle am Antarktischen Kontinentalrand des östlichen Weddellmeeres.- Ber. Polarforsch. 47: 1-167.

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Windstrength [m/s]	Course [°]	Speed [kn]	Gear	Gear Abbreviation	Action	Comment
PS61/040-1	26.01.02	02:25	58° 55,06' S	61° 1,03' W	1942,0	W 9	299,0	0,2	CTD - Seabird	CTD-R	surface	
PS61/040-1	26.01.02	03:03	58° 54,91' S	61° 1,20' W	2005,0	W 10	135,5	0,9	CTD - Seabird	CTD-R	at depth	1900 m
PS61/040-1	26.01.02	03:29	58° 54,90' S	61° 1,19' W	2012,0	W 10	4,3	0,7	CTD - Seabird	CTD-R	on deck	
PS61/040-2	26.01.02	04:07	58° 55,70' S	60° 59,52' W	1754,0	WSW 11	291,4	0,6	Sediment Profile Imaging	SEP	into water	
PS61/040-2	26.01.02	04:58	58° 55,54' S	61° 0,22' W	1768,0	W 11	112,4	0,8	Sediment Profile Imaging	SEP	into deep	1742 m ausgesteckt
PS61/040-2	26.01.02	05:27	58° 55,52' S	61° 0,08' W	1756,0	W 10	51,5	0,7	Sediment Profile Imaging	SEP	start rising	Fotoserie abgeschlossen Beginnen zu Hieven
PS61/040-2	26.01.02	06:01	58° 55,30' S	61° 0,29' W	1799,0	W 10	316,5	1,6	Sediment Profile Imaging	SEP	on deck	
PS61/040-3	26.01.02	06:24	58° 55,22' S	61° 0,42' W	1825,0	WSW 10	355,5	0,1	Epibenthos sledge	EBS	surface	
PS61/040-3	26.01.02	07:35	58° 55,35' S	61° 0,63' W	1825,0	SW 10	115,8	1,0	Epibenthos sledge	EBS	on ground	
PS61/040-3	26.01.02	07:38	58° 55,39' S	61° 0,63' W	1826,0	WSW 10	136,4	1,5	Epibenthos sledge	EBS	start trawling winch stop	
PS61/040-3	26.01.02	08:10	58° 55,59' S	61° 0,11' W	1763,0	SW 8	127,6	0,8	Epibenthos sledge	EBS	end trawling start hoisting	
PS61/040-3	26.01.02	09:05	58° 55,56' S	60° 59,86' W	1754,0	SW 6	328,1	0,9	Epibenthos sledge	EBS	from the bottom	
PS61/040-3	26.01.02	10:24	58° 55,12' S	61° 0,57' W	1891,0	WSW 5	63,2	0,5	Epibenthos sledge	EBS	on deck	
PS61/040-4	26.01.02	12:12	58° 55,49' S	60° 59,54' W	1852,0	WSW 4	93,1	0,3	Large Box Corer	GKG	surface	
PS61/040-4	26.01.02	12:52	58° 55,27' S	61° 0,02' W	1838,0	SW 4	50,3	0,4	Large Box Corer	GKG	at sea bottom	
PS61/040-4	26.01.02	13:30	58° 55,11' S	61° 0,20' W	1922,0	WSW 3	301,4	0,9	Large Box Corer	GKG	on deck	
PS61/041-1	26.01.02	18:28	59° 22,07' S	60° 4,19' W	2382,0	S 2	277,7	0,9	CTD - Seabird	CTD-R	surface	
PS61/041-1	26.01.02	19:12	59° 22,20' S	60° 4,28' W	2373,0	N 0	126,4	0,6	CTD - Seabird	CTD-R	at depth	
PS61/041-1	26.01.02	19:43	59° 22,26' S	60° 4,04' W	2371,0	ESE 2	129,4	0,2	CTD - Seabird	CTD-R	on deck	
PS61/041-2	26.01.02	19:45	59° 22,26' S	60° 4,03' W	2372,0	E 2	76,8	0,9	Sediment Profile Imaging	SEP	into water	
PS61/041-2	26.01.02	20:42	59° 22,43' S	60° 3,82' W	2373,0	NE 2	229,7	0,6	Sediment Profile Imaging	SEP	into deep	
PS61/041-2	26.01.02	21:05	59° 22,51' S	60° 3,79' W	2364,0	ENE 3	305,4	0,3	Sediment Profile Imaging	SEP	start rising	
PS61/041-2	26.01.02	21:35	59° 22,60' S	60° 3,78' W	2357,0	ENE 4	231,6	0,5	Sediment Profile Imaging	SEP	on deck	
PS61/041-3	26.01.02	21:56	59° 21,69' S	60° 5,18' W	2333,0	NE 4	61,3	1,7	Epibenthos sledge	EBS	surface	
PS61/041-3	26.01.02	22:58	59° 21,97' S	60° 4,27' W	2380,0	NE 5	186,0	0,9	Epibenthos sledge	EBS	on ground	
PS61/041-3	26.01.02	23:22	59° 22,24' S	60° 4,06' W	2375,0	NE 6	90,9	0,9	Epibenthos sledge	EBS	start trawling winch stop	
PS61/041-3	26.01.02	23:32	59° 22,40' S	60° 3,99' W	2372,0	NE 5	182,7	1,4	Epibenthos sledge	EBS	end trawling start hoisting	
PS61/041-3	27.01.02	00:05	59° 22,55' S	60° 4,01' W	2359,0	NE 7	237,9	0,7	Epibenthos sledge	EBS	from the bottom	
PS61/041-4	27.01.02	02:20	59° 25,38' S	60° 1,89' W	2574,0	NE 8	114,7	1,0	Agassiz trawl	AGT	surface	
PS61/041-4	27.01.02	03:29	59° 24,25' S	60° 3,15' W	2253,0	ENE 8	0,0	1,5	Agassiz trawl	AGT	AGT on ground	
PS61/041-4	27.01.02	04:01	59° 23,48' S	60° 3,54' W	2201,0	ENE 9	332,7	1,0	Agassiz trawl	AGT	start trawl	3800 m Seil ausgesteckt
PS61/041-4	27.01.02	04:12	59° 23,32' S	60° 3,65' W	2213,0	ENE 8	2,7	0,9	Agassiz trawl	AGT	Stop Trawl	Schiff wird aufgestoppt
PS61/041-4	27.01.02	04:54	59° 23,36' S	60° 3,90' W	2211,0	ENE 10	15,5	0,4	Agassiz trawl	AGT	AGT off ground	
PS61/041-4	27.01.02	05:52	59° 23,27' S	60° 4,52' W	2249,0	ENE 11	164,7	0,2	Agassiz trawl	AGT	on deck	
PS61/041-5	27.01.02	06:19	59° 22,23' S	60° 3,76' W	2374,0	NE 11	115,2	0,8	Large Box Corer	GKG	surface	
PS61/041-5	27.01.02	07:06	59° 22,26' S	60° 3,34' W	2369,0	ENE 10	30,1	0,6	Large Box Corer	GKG	at sea bottom	
PS61/041-5	27.01.02	07:50	59° 21,95' S	60° 2,84' W	2336,0	ENE 10	298,0	0,7	Large Box Corer	GKG	on deck	
PS61/042-1	27.01.02	18:16	59° 41,23' S	57° 35,97' W	3723,0	NE 8	27,3	0,4	Sediment Profile Imaging	SEP	into water	mit CTD - R
PS61/042-1	27.01.02	19:20	59° 40,39' S	57° 35,72' W	3694,0	ENE 8	357,9	0,8	Sediment Profile Imaging	SEP	into deep	
PS61/042-1	27.01.02	19:45	59° 40,18' S	57° 35,95' W	3689,0	ENE 8	321,1	0,8	Sediment Profile Imaging	SEP	start rising	

PS61/042-1	27.01.02	20:20	59° 39,99' S	57° 36,61' W	3691,0	ENE 9	3,6	0,7	Sediment Profile Imaging	SEP	on deck	
PS61/042-2	27.01.02	20:45	59° 39,54' S	57° 36,49' W	3678,0	ENE 9	292,9	0,4	Epibenthos sledge	EBS	surface	
PS61/042-2	27.01.02	21:52	59° 39,88' S	57° 35,94' W	3681,0	ENE 8	203,2	0,6	Epibenthos sledge	EBS	on ground	
PS61/042-2	27.01.02	22:26	59° 40,29' S	57° 35,43' W	3683,0	ENE 8	151,9	1,0	Epibenthos sledge	EBS	start trawling winch stop	
PS61/042-2	27.01.02	22:36	59° 40,42' S	57° 35,27' W	3680,0	ENE 8	171,0	1,1	Epibenthos sledge	EBS	end trawling start hoisting	
PS61/042-2	27.01.02	23:43	59° 40,32' S	57° 35,64' W	3690,0	ENE 8	139,6	0,3	Epibenthos sledge	EBS	from the bottom	
PS61/042-3	28.01.02	02:16	59° 40,37' S	57° 35,73' W	3693,0	E 6	84,1	2,2	Agassiz trawl	AGT	surface	
PS61/042-3	28.01.02	03:27	59° 40,76' S	57° 35,22' W	3692,0	E 6	202,4	0,8	Agassiz trawl	AGT	AGT on ground	
PS61/042-3	28.01.02	04:03	59° 41,26' S	57° 35,94' W	3720,0	E 5	237,2	1,0	Agassiz trawl	AGT	start trawl	6000 m ausgesteckt
PS61/042-3	28.01.02	04:33	59° 41,57' S	57° 36,46' W	3740,0	E 6	280,5	0,5	Agassiz trawl	AGT	Stop Trawl	Beginnen zu Hieven
PS61/042-3	28.01.02	05:32	59° 41,30' S	57° 36,93' W	3735,0	ESE 6	296,1	0,4	Agassiz trawl	AGT	AGT off ground	
PS61/042-3	28.01.02	07:08	59° 40,84' S	57° 36,04' W	3713,0	SE 6	315,6	0,5	Agassiz trawl	AGT	on deck	
PS61/042-4	28.01.02	08:01	59° 40,41' S	57° 35,46' W	3685,0	ESE 6	131,7	0,0	Large Box Corer	GKG	surface	
PS61/042-4	28.01.02	09:13	59° 40,26' S	57° 35,36' W	3682,0	SE 7	38,4	0,1	Large Box Corer	GKG	at sea bottom	
PS61/042-4	28.01.02	10:15	59° 40,02' S	57° 35,18' W	3668,0	SE 7	11,2	0,6	Large Box Corer	GKG	on deck	
PS61/042-5	28.01.02	10:44	59° 40,54' S	57° 35,87' W	3702,0	SSE 7	351,0	0,4	MultiCorer	MUC	surface	
PS61/042-5	28.01.02	12:01	59° 40,39' S	57° 35,74' W	3695,0	SSE 7	77,9	0,3	MultiCorer	MUC	at sea bottom	
PS61/042-5	28.01.02	13:14	59° 39,63' S	57° 35,86' W	3670,0	SSE 8	351,7	1,2	MultiCorer	MUC	on deck	
PS61/042-6	28.01.02	13:40	59° 40,39' S	57° 35,76' W	3697,0	SSE 9	280,6	0,3	Large Box Corer	GKG	surface	
PS61/042-6	28.01.02	14:49	59° 40,42' S	57° 35,75' W	3692,0	S 8	56,6	0,2	Large Box Corer	GKG	at sea bottom	3663 m
PS61/042-6	28.01.02	15:51	59° 40,32' S	57° 35,74' W	3691,0	S 8	256,7	0,4	Large Box Corer	GKG	on deck	
PS61/042-7	28.01.02	16:25	59° 40,31' S	57° 35,70' W	3692,0	S 9	68,8	0,8	MultiCorer	MUC	surface	
PS61/042-7	28.01.02	17:32	59° 39,49' S	57° 34,51' W	3650,0	S 8	297,7	0,4	MultiCorer	MUC	at sea bottom	3650 m ausgesteckt
PS61/042-7	28.01.02	18:20	59° 38,92' S	57° 34,16' W	3637,0	S 10	58,1	1,3	MultiCorer	MUC	on deck	
PS61/043-1	29.01.02	00:38	60° 26,98' S	56° 4,95' W	3958,0	S 12	340,3	0,5	Sediment Profile Imaging	SEP	into water	Mit CTD-R
PS61/043-1	29.01.02	01:42	60° 27,00' S	56° 4,99' W	3958,0	SSE 14	290,1	0,8	Sediment Profile Imaging	SEP	into deep	Mit CTD-R Seabird 3938 m
PS61/043-1	29.01.02	02:15	60° 27,04' S	56° 4,96' W	3958,0	SSE 14	107,9	0,3	Sediment Profile Imaging	SEP	start rising	Mit CTD-R Seabird
PS61/043-1	29.01.02	03:03	60° 27,01' S	56° 4,99' W	3958,0	SSE 14	155,9	0,2	Sediment Profile Imaging	SEP	on deck	Mit CTD-R Seabird
PS61/043-2	29.01.02	03:17	60° 26,99' S	56° 5,00' W	3958,8	SSE 15	91,2	0,3	Large Box Corer	GKG	surface	
PS61/043-2	29.01.02	04:31	60° 26,95' S	56° 4,96' W	3957,6	S 14	26,7	0,5	Large Box Corer	GKG	at sea bottom	3928 ausgesteckt
PS61/043-2	29.01.02	05:30	60° 26,81' S	56° 5,00' W	3960,4	S 14	341,7	0,6	Large Box Corer	GKG	on deck	
PS61/044-1	29.01.02	10:09	60° 57,61' S	55° 11,30' W	330,8	S 10	146,8	2,2	Bottom trawl	BT	cod end to surface	
PS61/044-1	29.01.02	10:19	60° 58,21' S	55° 10,58' W	219,6	S 6	161,3	2,0	Bottom trawl	BT	turn	
PS61/044-1	29.01.02	10:24	60° 58,33' S	55° 9,82' W	251,2	S 6	83,8	6,1	Bottom trawl	BT	otter boards to surface	
PS61/044-1	29.01.02	10:42	60° 58,08' S	55° 6,85' W	308,0	S 6	81,5	2,9	Bottom trawl	BT	start trawling	
PS61/044-1	29.01.02	11:12	60° 58,09' S	55° 4,05' W	398,8	S 8	105,6	2,8	Bottom trawl	BT	stop trawling	
PS61/044-1	29.01.02	11:40	60° 58,08' S	55° 2,72' W	496,4	S 10	47,9	1,5	Bottom trawl	BT	otter boards on deck	
PS61/044-1	29.01.02	11:54	60° 57,69' S	55° 1,97' W	528,0	S 6	27,7	2,8	Bottom trawl	BT	cod end on deck	
PS61/044-2	29.01.02	12:27	60° 58,22' S	55° 4,12' W	368,8	S 10	300,1	0,5	CTD - Seabird	CTD-R	surface	
PS61/044-2	29.01.02	12:34	60° 58,26' S	55° 4,07' W	366,8	SSE 9	127,0	0,7	CTD - Seabird	CTD-R	at depth	350 m

PS61/044-2	29.01.02	12:43	60° 58,22' S	55° 4,14' W	366,8	S 10	0,2	0,3	CTD - Seabird	CTD-R	on deck	
PS61/045-1	29.01.02	13:17	60° 57,59' S	55° 9,67' W	0,0	S 7	198,0	1,9	Bottom trawl	BT	cod end to surface	
PS61/045-1	29.01.02	13:25	60° 58,07' S	55° 9,58' W	250,0	SSW 6	177,5	2,7	Bottom trawl	BT	otter boards to surface	
PS61/045-1	29.01.02	13:30	60° 58,35' S	55° 9,22' W	270,8	SSE 4	101,0	4,9	Bottom trawl	BT	turn	
PS61/045-1	29.01.02	14:34	60° 59,30' S	55° 3,24' W	325,6	S 12	86,2	2,2	Bottom trawl	BT	otter boards on deck	
PS61/045-1	29.01.02	14:47	60° 59,19' S	55° 2,23' W	408,4	S 13	84,0	1,7	Bottom trawl	BT	cod end on deck	
PS61/045-1	29.01.02	15:58	61° 0,38' S	55° 15,73' W	309,6	S 8	57,3	3,5	Bottom trawl	BT	cod end to surface	
PS61/045-1	29.01.02	16:11	60° 59,84' S	55° 14,18' W	294,0	S 8	62,2	5,1	Bottom trawl	BT	otter boards to surface	
PS61/045-1	29.01.02	16:36	60° 59,14' S	55° 11,38' W	196,4	S 6	55,6	1,6	Bottom trawl	BT	start trawling	
PS61/045-1	29.01.02	17:06	60° 58,78' S	55° 9,17' W	269,2	S 6	76,6	2,6	Bottom trawl	BT	stop trawling	
PS61/045-1	29.01.02	17:31	60° 58,67' S	55° 7,81' W	292,4	S 7	74,7	1,9	Bottom trawl	BT	otter boards on deck	
PS61/045-1	29.01.02	17:44	60° 58,51' S	55° 6,83' W	305,6	S 10	57,2	2,2	Bottom trawl	BT	cod end on deck	
PS61/045-2	29.01.02	18:18	60° 59,03' S	55° 9,77' W	256,8	S 3	355,5	0,7	CTD - Seabird	CTD-R	surface	
PS61/045-2	29.01.02	18:26	60° 59,10' S	55° 9,65' W	257,2	S 4	118,4	0,4	CTD - Seabird	CTD-R	at depth	240 m ausgesteckt
PS61/045-2	29.01.02	18:31	60° 59,13' S	55° 9,57' W	257,6	S 3	151,7	0,8	CTD - Seabird	CTD-R	on deck	
PS61/046-1	29.01.02	21:28	60° 39,46' S	54° 0,71' W	2926,0	SSW 6	10,9	2,3	Amphipod trap	ATC	to water	
PS61/046-2	29.01.02	21:59	60° 37,91' S	53° 57,74' W	2892,0	S 8	124,6	1,3	Sediment Profile Imaging	SEP	into water	mit CTD-R
PS61/046-2	29.01.02	22:58	60° 37,93' S	53° 56,85' W	2886,4	S 9	321,2	0,3	Sediment Profile Imaging	SEP	into deep	
PS61/046-2	29.01.02	23:23	60° 37,93' S	53° 56,81' W	2885,6	SSW 7	222,4	0,4	Sediment Profile Imaging	SEP	start rising	
PS61/046-2	29.01.02	23:57	60° 38,07' S	53° 57,00' W	2889,2	S 7	89,5	0,3	Sediment Profile Imaging	SEP	on deck	Mit CTD-R
PS61/046-3	30.01.02	00:09	60° 38,05' S	53° 57,07' W	2889,6	S 9	260,7	0,6	Large Box Corer	GKG	surface	
PS61/046-3	30.01.02	01:01	60° 37,92' S	53° 57,17' W	2888,0	S 6	85,8	0,6	Large Box Corer	GKG	at sea bottom	
PS61/046-3	30.01.02	01:41	60° 38,03' S	53° 57,22' W	2890,0	SSW 6	285,7	0,9	Large Box Corer	GKG	on deck	
PS61/046-4	30.01.02	01:56	60° 38,00' S	53° 57,25' W	2889,6	SSW 7	103,0	0,6	MultiCorer	MUC	surface	
PS61/046-4	30.01.02	02:51	60° 38,12' S	53° 57,67' W	2893,2	SSW 4	257,7	0,7	MultiCorer	MUC	at sea bottom	
PS61/046-4	30.01.02	03:31	60° 38,26' S	53° 57,91' W	2896,0	SSW 7	199,0	0,7	MultiCorer	MUC	on deck	
PS61/046-5	30.01.02	03:51	60° 38,03' S	53° 57,94' W	2894,8	SSW 8	72,6	0,6	Large Box Corer	GKG	surface	
PS61/046-5	30.01.02	04:45	60° 38,13' S	53° 57,68' W	2893,6	SSW 7	111,4	0,6	Large Box Corer	GKG	at sea bottom	2852 m ausgesteckt
PS61/046-5	30.01.02	05:26	60° 38,24' S	53° 57,38' W	2891,6	S 8	172,7	0,9	Large Box Corer	GKG	on deck	
PS61/046-6	30.01.02	05:40	60° 38,36' S	53° 57,32' W	2891,6	S 6	222,2	0,8	MultiCorer	MUC	surface	
PS61/046-6	30.01.02	06:34	60° 38,64' S	53° 57,27' W	2893,2	S 4	174,1	0,9	MultiCorer	MUC	at sea bottom	2857 m ausgesteckt
PS61/046-6	30.01.02	07:13	60° 39,02' S	53° 56,69' W	2889,2	S 5	125,8	1,5	MultiCorer	MUC	on deck	
PS61/046-7	30.01.02	07:35	60° 39,53' S	53° 56,93' W	2888,8	NE 5	345,8	0,4	Epibenthos sledge	EBS	surface	
PS61/046-7	30.01.02	08:26	60° 39,19' S	53° 56,85' W	2889,2	NE 4	341,5	0,8	Epibenthos sledge	EBS	on ground	
PS61/046-7	30.01.02	08:54	60° 38,35' S	53° 57,36' W	2893,6	ENE 3	347,9	1,5	Epibenthos sledge	EBS	start trawling winch stop	
PS61/046-7	30.01.02	09:08	60° 38,12' S	53° 57,49' W	2893,2	ENE 3	260,2	0,4	Epibenthos sledge	EBS	end trawling start hoisting	
PS61/046-7	30.01.02	10:08	60° 38,06' S	53° 57,51' W	2892,8	NE 3	174,5	0,4	Epibenthos sledge	EBS	from the bottom	
PS61/046-7	30.01.02	11:32	60° 37,93' S	53° 56,86' W	2886,0	NE 3	148,1	0,1	Epibenthos sledge	EBS	on deck	
PS61/046-1	30.01.02	12:05	60° 39,38' S	54° 0,22' W	2920,8	S 2	83,4	1,1	Amphipod trap	ATC	released	
PS61/046-1	30.01.02	13:16	60° 39,70' S	54° 0,06' W	2908,4	SW 3	353,4	2,4	Amphipod trap	ATC	surfaced	

PS61/046-1	30.01.02	13:30	60° 39,41' S	54° 1,84' W	2926,0	SSW 3	354,9	0,2	Amphipod trap	ATC	on deck	
PS61/047-1	30.01.02	16:34	61° 4,01' S	54° 41,05' W	160,0	WSW 2	104,6	2,6	Bottom trawl	BT	cod end to surface	
PS61/047-1	30.01.02	16:43	61° 4,11' S	54° 40,18' W	182,0	SSW 0	101,1	3,8	Bottom trawl	BT	otter boards to surface	
PS61/047-1	30.01.02	17:03	61° 4,18' S	54° 36,81' W	189,6	ESE 1	93,1	2,7	Bottom trawl	BT	start trawling	
PS61/047-1	30.01.02	17:33	61° 4,15' S	54° 33,82' W	0,0	SSW 1	90,3	3,0	Bottom trawl	BT	stop trawling	
PS61/047-1	30.01.02	17:58	61° 4,25' S	54° 32,40' W	190,0	WNW 1	83,2	3,7	Bottom trawl	BT	otter boards on deck	
PS61/047-1	30.01.02	18:09	61° 4,24' S	54° 31,46' W	171,6	WSW 1	80,5	2,0	Bottom trawl	BT	cod end on deck	
PS61/047-2	30.01.02	18:27	61° 3,96' S	54° 34,04' W	215,6	WNW 1	88,2	0,7	CTD - Seabird	CTD-R	surface	
PS61/047-2	30.01.02	18:36	61° 3,93' S	54° 34,03' W	218,0	W 1	122,5	0,8	CTD - Seabird	CTD-R	at depth	200 m ausgesteckt
PS61/047-2	30.01.02	18:40	61° 3,99' S	54° 33,88' W	210,4	WNW 1	122,8	1,1	CTD - Seabird	CTD-R	on deck	
PS61/048-1	30.01.02	19:53	61° 7,33' S	54° 29,54' W	262,8	WSW 5	210,7	1,1	Bottom trawl	BT	cod end to surface	
PS61/048-1	30.01.02	20:02	61° 7,70' S	54° 30,01' W	356,8	SW 5	202,0	3,3	Bottom trawl	BT	otter boards to surface	
PS61/048-1	30.01.02	20:31	61° 9,82' S	54° 33,40' W	343,2	WSW 7	217,5	2,8	Bottom trawl	BT	start trawling	
PS61/048-1	30.01.02	21:01	61° 11,16' S	54° 35,45' W	277,6	WSW 5	212,8	3,5	Bottom trawl	BT	stop trawling	
PS61/048-1	30.01.02	21:35	61° 12,21' S	54° 36,24' W	311,2	WSW 5	200,3	1,0	Bottom trawl	BT	otter boards on deck	
PS61/048-1	30.01.02	21:45	61° 12,52' S	54° 36,28' W	310,0	WSW 6	185,4	1,6	Bottom trawl	BT	cod end on deck	
PS61/048-2	30.01.02	22:16	61° 10,18' S	54° 34,08' W	322,8	WSW 7	21,3	1,2	CTD - Seabird	CTD-R	surface	
PS61/048-2	30.01.02	22:27	61° 10,10' S	54° 34,19' W	301,2	WSW 6	359,8	0,7	CTD - Seabird	CTD-R	at depth	
PS61/048-2	30.01.02	22:35	61° 10,02' S	54° 34,22' W	299,2	SW 7	284,4	0,4	CTD - Seabird	CTD-R	on deck	
PS61/049-1	30.01.02	23:51	61° 11,94' S	54° 37,37' W	302,8	WSW 7	260,0	3,5	Bottom trawl	BT	cod end to surface	
PS61/049-1	30.01.02	23:58	61° 11,81' S	54° 38,34' W	292,0	WSW 8	285,6	3,2	Bottom trawl	BT	otter boards to surface	
PS61/049-1	31.01.02	00:18	61° 11,73' S	54° 41,45' W	272,0	WSW 8	264,9	3,3	Bottom trawl	BT	start trawling	
PS61/049-1	31.01.02	00:48	61° 11,42' S	54° 44,54' W	306,4	WSW 8	279,1	3,0	Bottom trawl	BT	stop trawling	
PS61/049-1	31.01.02	01:10	61° 11,10' S	54° 45,36' W	308,0	SW 8	342,1	2,0	Bottom trawl	BT	otter boards on deck	
PS61/049-1	31.01.02	01:23	61° 10,73' S	54° 45,71' W	224,8	WSW 7	313,5	1,5	Bottom trawl	BT	cod end on deck	
PS61/050-1	31.01.02	09:13	61° 15,81' S	54° 48,75' W	239,6	SW 6	263,6	3,6	Bottom trawl	BT	cod end to surface	
PS61/050-1	31.01.02	09:21	61° 15,85' S	54° 49,84' W	217,6	SW 6	268,8	3,1	Bottom trawl	BT	otter boards to surface	
PS61/050-1	31.01.02	09:37	61° 15,88' S	54° 52,63' W	145,2	SW 5	268,4	4,5	Bottom trawl	BT	start trawling	
PS61/050-1	31.01.02	10:07	61° 15,99' S	54° 56,06' W	181,2	SW 6	250,6	3,2	Bottom trawl	BT	stop trawling	
PS61/050-1	31.01.02	10:23	61° 16,13' S	54° 57,22' W	208,8	SW 6	270,4	1,4	Bottom trawl	BT	otter boards on deck	
PS61/050-1	31.01.02	10:35	61° 16,08' S	54° 58,11' W	221,6	SW 7	282,7	2,3	Bottom trawl	BT	cod end on deck	
PS61/050-2	31.01.02	11:06	61° 15,74' S	54° 53,83' W	146,8	SW 6	37,6	1,4	CTD - Seabird	CTD-R	surface	
PS61/050-2	31.01.02	11:12	61° 15,63' S	54° 53,70' W	144,8	SW 6	30,8	0,7	CTD - Seabird	CTD-R	at depth	
PS61/050-2	31.01.02	11:17	61° 15,63' S	54° 53,71' W	145,2	SSW 5	214,6	0,0	CTD - Seabird	CTD-R	on deck	120 m ausgesteckt
PS61/051-1	31.01.02	12:52	61° 12,02' S	54° 47,46' W	172,8	SW 5	280,7	3,6	Bottom trawl	BT	cod end to surface	
PS61/051-1	31.01.02	13:01	61° 12,00' S	54° 48,57' W	124,0	SW 5	270,0	4,9	Bottom trawl	BT	otter boards to surface	

PS61/051-1	31.01.02	13:13	61° 12,01' S	54° 50,50' W	94,4	SW 4	272,3	2,9	Bottom trawl	BT	start trawling	
PS61/051-1	31.01.02	13:43	61° 11,97' S	54° 53,79' W	62,4	SSW 4	271,0	2,6	Bottom trawl	BT	stop trawling	
PS61/051-1	31.01.02	13:56	61° 11,98' S	54° 54,73' W	48,3	SSW 4	267,8	2,2	Bottom trawl	BT	otter boards on deck	
PS61/051-1	31.01.02	14:05	61° 11,98' S	54° 55,42' W	41,6	SSW 4	248,5	2,2	Bottom trawl	BT	cod end on deck	
PS61/052-1	31.01.02	15:41	61° 20,90' S	55° 18,27' W	276,8	SW 4	82,3	4,3	Bottom trawl	BT	cod end to surface	
PS61/052-1	31.01.02	15:48	61° 20,89' S	55° 17,34' W	275,6	SW 5	96,4	3,6	Bottom trawl	BT	otter boards to surface	
PS61/052-1	31.01.02	16:09	61° 20,76' S	55° 13,80' W	264,0	SW 5	87,4	3,2	Bottom trawl	BT	start trawling	
PS61/052-1	31.01.02	16:39	61° 20,60' S	55° 10,57' W	270,0	SW 5	81,6	2,0	Bottom trawl	BT	stop trawling	1000 m ausgesteckt
PS61/052-1	31.01.02	17:03	61° 20,45' S	55° 9,36' W	287,2	SSW 4	84,0	2,2	Bottom trawl	BT	otter boards on deck	
PS61/052-1	31.01.02	17:13	61° 20,39' S	55° 8,63' W	308,4	SSW 4	83,5	2,4	Bottom trawl	BT	cod end on deck	
PS61/053-1	31.01.02	18:34	61° 20,83' S	55° 25,43' W	354,0	S 2	299,8	4,2	Bottom trawl	BT	cod end to surface	
PS61/053-1	31.01.02	18:43	61° 20,77' S	55° 26,27' W	334,4	SSW 1	279,8	1,6	Bottom trawl	BT	otter boards to surface	
PS61/053-1	31.01.02	19:00	61° 20,51' S	55° 28,66' W	159,2	SW 4	275,5	2,2	Bottom trawl	BT	start trawling	
PS61/053-1	31.01.02	19:30	61° 20,22' S	55° 32,15' W	117,6	SW 3	272,9	3,8	Bottom trawl	BT	stop trawling	
PS61/053-1	31.01.02	19:43	61° 20,24' S	55° 33,16' W	126,4	SW 3	253,1	0,9	Bottom trawl	BT	otter boards on deck	
PS61/053-1	31.01.02	19:59	61° 20,30' S	55° 33,73' W	93,2	SW 3	261,3	1,1	Bottom trawl	BT	cod end on deck	
PS61/054-1	01.02.02	09:08	61° 13,08' S	55° 37,59' W	83,2	NNE 7	166,7	1,9	Bottom trawl	BT	cod end to surface	
PS61/054-1	01.02.02	09:18	61° 13,59' S	55° 37,32' W	84,0	NNE 7	169,0	3,3	Bottom trawl	BT	otter boards to surface	
PS61/054-1	01.02.02	09:28	61° 14,50' S	55° 36,99' W	90,8	NNE 6	173,2	4,2	Bottom trawl	BT	start trawling	
PS61/054-1	01.02.02	09:58	61° 16,21' S	55° 36,92' W	110,4	NNE 6	184,6	3,1	Bottom trawl	BT	stop trawling	
PS61/054-1	01.02.02	10:08	61° 16,57' S	55° 36,92' W	110,4	NNE 7	170,3	1,8	Bottom trawl	BT	otter boards on deck	
PS61/054-1	01.02.02	10:18	61° 16,90' S	55° 36,92' W	120,4	N 7	193,1	3,1	Bottom trawl	BT	cod end on deck	
PS61/054-2	01.02.02	10:33	61° 15,44' S	55° 37,01' W	94,0	NNE 8	35,6	0,3	CTD - Seabird	CTD-R	surface	
PS61/054-2	01.02.02	10:37	61° 15,39' S	55° 37,06' W	91,6	NNE 8	320,5	0,3	CTD - Seabird	CTD-R	at depth	
PS61/054-2	01.02.02	10:39	61° 15,38' S	55° 37,06' W	91,2	NNE 8	144,3	0,1	CTD - Seabird	CTD-R	on deck	
PS61/055-1	01.02.02	11:06	61° 14,76' S	55° 42,66' W	120,0	NNE 8	175,8	1,7	Bottom trawl	BT	cod end to surface	
PS61/055-1	01.02.02	11:16	61° 15,25' S	55° 42,66' W	122,8	NNE 8	186,4	2,6	Bottom trawl	BT	otter boards to surface	
PS61/055-1	01.02.02	11:34	61° 16,59' S	55° 42,72' W	135,6	NNE 8	177,2	3,2	Bottom trawl	BT	start trawling	
PS61/055-1	01.02.02	12:04	61° 18,04' S	55° 42,80' W	171,6	N 8	180,4	3,2	Bottom trawl	BT	stop trawling	700 m ausgesteckt
PS61/055-1	01.02.02	12:22	61° 18,63' S	55° 42,81' W	202,0	NNE 9	170,1	1,9	Bottom trawl	BT	cod end on deck	
PS61/056-1	01.02.02	13:20	61° 13,38' S	55° 41,83' W	105,6	NNE 9	353,1	4,7	Bottom trawl	BT	cod end to surface	
PS61/056-1	01.02.02	13:26	61° 12,80' S	55° 41,86' W	102,4	NNE 9	359,3	4,2	Bottom trawl	BT	otter boards to surface	
PS61/056-1	01.02.02	13:39	61° 11,76' S	55° 41,78' W	97,2	NNE 9	357,1	3,9	Bottom trawl	BT	start trawling	
PS61/056-1	01.02.02	14:09	61° 10,28' S	55° 41,57' W	91,6	NNE 9	10,4	3,2	Bottom trawl	BT	stop trawling	

PS61/056-1	01.02.02	14:20	61° 9,97' S	55° 41,63' W	89,6	NNE 9	354,5	2,0	Bottom trawl	BT	otter boards on deck	
PS61/056-1	01.02.02	14:29	61° 9,67' S	55° 41,70' W	90,4	NNE 9	350,5	1,7	Bottom trawl	BT	cod end on deck	
PS61/057-1	01.02.02	15:30	61° 10,20' S	55° 39,83' W	85,2	NNE 10	331,2	9,5	Bottom trawl	BT	cod end to surface	
PS61/057-1	01.02.02	15:42	61° 9,45' S	55° 40,43' W	84,8	NNE 9	341,7	3,3	Bottom trawl	BT	otter boards to surface	
PS61/057-1	01.02.02	15:52	61° 8,75' S	55° 40,97' W	84,8	NE 10	335,6	2,8	Bottom trawl	BT	start trawling	350 m ausgesteckt
PS61/057-1	01.02.02	16:22	61° 7,30' S	55° 42,22' W	62,8	NE 10	335,9	2,9	Bottom trawl	BT	stop trawling	
PS61/057-1	01.02.02	16:36	61° 6,91' S	55° 42,76' W	60,0	NE 10	320,9	2,3	Bottom trawl	BT	otter boards on deck	
PS61/057-1	01.02.02	16:47	61° 6,70' S	55° 43,52' W	64,8	NE 10	284,7	2,1	Bottom trawl	BT	cod end on deck	
PS61/058-1	01.02.02	17:22	61° 1,20' S	55° 44,29' W	152,0	NE 8	23,7	3,1	Bottom trawl	BT	cod end to surface	
PS61/058-1	01.02.02	17:31	61° 0,72' S	55° 43,83' W	149,2	NE 8	20,3	2,5	Bottom trawl	BT	otter boards to surface	
PS61/058-1	01.02.02	17:46	60° 59,76' S	55° 43,16' W	106,4	ENE 7	20,5	2,8	Bottom trawl	BT	start trawling	
PS61/058-1	01.02.02	18:16	60° 58,16' S	55° 41,90' W	113,2	ENE 6	23,4	3,2	Bottom trawl	BT	stop trawling	351 m ausgesteckt, Hieven
PS61/058-1	01.02.02	18:27	60° 57,81' S	55° 41,62' W	115,2	ENE 6	21,7	2,0	Bottom trawl	BT	otter boards on deck	
PS61/058-1	01.02.02	18:38	60° 57,44' S	55° 41,43' W	122,8	NE 6	8,4	2,1	Bottom trawl	BT	cod end on deck	
PS61/046-8	01.02.02	22:31	60° 41,66' S	53° 57,48' W	2819,6	NNE 8	358,4	1,6	Agassiz trawl	AGT	surface	
PS61/046-8	01.02.02	23:28	60° 39,75' S	53° 57,44' W	2886,0	NNE 8	359,4	0,7	Agassiz trawl	AGT	AGT on ground	
PS61/046-8	02.02.02	00:08	60° 38,79' S	53° 57,42' W	2896,4	NNE 10	10,2	0,5	Agassiz trawl	AGT	start trawl	5000 m coiled down
PS61/046-8	02.02.02	00:38	60° 38,39' S	53° 57,55' W	2895,6	NNE 11	315,3	0,6	Agassiz trawl	AGT	Stop Trawl	
PS61/046-8	02.02.02	01:34	60° 38,46' S	53° 57,23' W	2893,2	NNE 12	319,0	0,2	Agassiz trawl	AGT	AGT off ground	2893 m
PS61/046-8	02.02.02	02:36	60° 38,22' S	53° 57,32' W	2892,4	NNE 11	11,3	0,3	Agassiz trawl	AGT	on deck	
PS61/059-1	02.02.02	10:01	61° 23,78' S	56° 13,95' W	249,2	WNW 8	116,9	4,6	Bottom trawl	BT	cod end to surface	
PS61/059-1	02.02.02	10:09	61° 23,96' S	56° 13,01' W	211,2	WNW 7	111,0	2,9	Bottom trawl	BT	otter boards to surface	
PS61/059-1	02.02.02	10:38	61° 25,42' S	56° 8,90' W	298,4	WNW 8	121,8	3,1	Bottom trawl	BT	start trawling	
PS61/059-1	02.02.02	11:07	61° 26,30' S	56° 6,21' W	326,4	WNW 7	126,6	2,8	Bottom trawl	BT	stop trawling	
PS61/059-1	02.02.02	11:34	61° 26,71' S	56° 4,57' W	265,2	WNW 6	91,3	1,7	Bottom trawl	BT	otter boards on deck	
PS61/059-1	02.02.02	11:45	61° 26,65' S	56° 3,69' W	275,2	WNW 6	60,6	3,3	Bottom trawl	BT	cod end on deck	
PS61/059-2	02.02.02	12:14	61° 26,57' S	56° 5,27' W	294,8	WNW 7	324,4	0,0	CTD - Seabird	CTD-R	surface	
PS61/059-2	02.02.02	12:21	61° 26,50' S	56° 5,25' W	285,6	WNW 6	2,6	0,7	CTD - Seabird	CTD-R	at depth	275 m
PS61/059-2	02.02.02	12:27	61° 26,43' S	56° 5,20' W	279,6	WNW 6	37,5	0,7	CTD - Seabird	CTD-R	on deck	
PS61/060-1	02.02.02	13:23	61° 19,70' S	56° 6,22' W	343,6	WNW 7	130,1	3,0	Bottom trawl	BT	cod end to surface	
PS61/060-1	02.02.02	13:31	61° 19,99' S	56° 5,52' W	348,4	NW 7	133,6	3,3	Bottom trawl	BT	otter boards to surface	
PS61/060-1	02.02.02	13:55	61° 21,34' S	56° 2,65' W	355,2	NW 7	130,1	3,2	Bottom trawl	BT	start trawling	
PS61/060-1	02.02.02	14:25	61° 22,37' S	56° 0,47' W	352,8	WNW 8	133,3	3,1	Bottom trawl	BT	stop trawling	1300 m

PS61/060-1	02.02.02	14:55	61° 22,91' S	55° 58,95' W	163,6	WNW	8	127,8	1,9	Bottom trawl	BT	otter boards on deck	
PS61/060-1	02.02.02	15:05	61° 23,16' S	55° 58,20' W	174,0	WNW	8	122,7	2,5	Bottom trawl	BT	cod end on deck	
PS61/061-1	02.02.02	16:32	61° 18,14' S	56° 8,27' W	326,4	WNW	7	292,5	3,4	Bottom trawl	BT	cod end to surface	
PS61/061-1	02.02.02	16:40	61° 17,99' S	56° 9,25' W	328,4	WNW	8	291,6	3,2	Bottom trawl	BT	otter boards to surface	
PS61/061-1	02.02.02	17:02	61° 17,38' S	56° 12,98' W	327,2	WNW	8	288,6	4,0	Bottom trawl	BT	start trawling	1100 m ausgesteckt
PS61/061-1	02.02.02	17:32	61° 16,90' S	56° 16,12' W	317,2	WNW	8	281,3	2,3	Bottom trawl	BT	stop trawling	
PS61/061-1	02.02.02	17:59	61° 16,89' S	56° 17,69' W	323,2	WNW	9	268,9	2,1	Bottom trawl	BT	otter boards on deck	
PS61/061-1	02.02.02	18:10	61° 16,94' S	56° 18,36' W	312,0	W	8	260,0	1,4	Bottom trawl	BT	cod end on deck	
PS61/062-1	02.02.02	19:03	61° 18,33' S	55° 57,98' W	296,8	W	8	272,4	3,6	Bottom trawl	BT	cod end to surface	
PS61/062-1	02.02.02	19:09	61° 18,32' S	55° 58,57' W	301,2	W	9	273,4	3,4	Bottom trawl	BT	otter boards to surface	
PS61/062-1	02.02.02	19:33	61° 17,87' S	56° 2,29' W	304,8	W	9	281,9	2,5	Bottom trawl	BT	start trawling	
PS61/062-1	02.02.02	20:03	61° 17,46' S	56° 5,50' W	317,6	W	9	284,2	3,5	Bottom trawl	BT	stop trawling	
PS61/062-1	02.02.02	20:32	61° 17,21' S	56° 7,12' W	320,0	WSW	8	286,2	2,2	Bottom trawl	BT	otter boards on deck	
PS61/062-1	02.02.02	20:45	61° 17,06' S	56° 7,68' W	318,0	W	9	309,2	1,0	Bottom trawl	BT	cod end on deck	
PS61/043-3	03.02.02	00:57	60° 30,21' S	56° 5,09' W	3962,0	W	8	102,5	0,5	Amphipod trap	ATC	to water	
PS61/043-4	03.02.02	01:29	60° 27,08' S	56° 4,86' W	3958,8	W	8	296,8	0,5	MultiCorer	MUC	surface	
PS61/043-4	03.02.02	02:44	60° 27,05' S	56° 4,77' W	3958,4	W	7	298,3	0,5	MultiCorer	MUC	at sea bottom	3955 m ausgesteckt
PS61/043-4	03.02.02	03:39	60° 27,26' S	56° 4,88' W	3959,6	W	8	223,2	0,3	MultiCorer	MUC	on deck	
PS61/043-5	03.02.02	04:00	60° 27,25' S	56° 4,67' W	3958,0	WNW	7	321,0	0,8	Large Box Corer	GKG	surface	
PS61/043-5	03.02.02	05:13	60° 27,07' S	56° 4,20' W	3954,4	W	10	249,5	0,7	Large Box Corer	GKG	at sea bottom	3926 m ausgesteckt
PS61/043-5	03.02.02	06:09	60° 27,00' S	56° 4,12' W	3954,0	W	6	162,1	0,5	Large Box Corer	GKG	on deck	
PS61/043-6	03.02.02	06:28	60° 27,06' S	56° 4,65' W	3956,0	WNW	6	90,9	0,5	MultiCorer	MUC	surface	
PS61/043-6	03.02.02	07:40	60° 27,00' S	56° 4,24' W	3954,4	W	7	334,0	0,3	MultiCorer	MUC	at sea bottom	
PS61/043-6	03.02.02	08:33	60° 26,84' S	56° 4,11' W	3953,6	WNW	6	279,8	0,0	MultiCorer	MUC	on deck	
PS61/063-1	03.02.02	11:27	60° 50,92' S	55° 34,88' W	270,4	NW	5	272,4	6,4	Bottom trawl	BT	cod end to surface	
PS61/063-1	03.02.02	11:37	60° 50,94' S	55° 36,02' W	265,6	NW	4	272,8	4,6	Bottom trawl	BT	turn	
PS61/063-1	03.02.02	11:51	60° 50,67' S	55° 35,16' W	302,0	NW	5	115,0	2,7	Bottom trawl	BT	otter boards to surface	
PS61/063-1	03.02.02	12:20	60° 51,39' S	55° 31,35' W	278,8	NW	4	110,0	3,1	Bottom trawl	BT	start trawling	
PS61/063-1	03.02.02	12:50	60° 51,85' S	55° 28,87' W	291,6	NW	5	115,3	2,8	Bottom trawl	BT	stop trawling	
PS61/063-1	03.02.02	13:16	60° 52,17' S	55° 27,50' W	288,8	NW	5	120,8	2,3	Bottom trawl	BT	otter boards on deck	
PS61/063-1	03.02.02	13:25	60° 52,41' S	55° 26,80' W	288,4	NW	5	124,6	3,2	Bottom trawl	BT	cod end on deck	
PS61/063-2	03.02.02	13:35	60° 52,62' S	55° 26,82' W	269,6	NW	5	169,8	0,6	CTD - Seabird	CTD-R	surface	
PS61/063-2	03.02.02	13:43	60° 52,62' S	55° 26,76' W	268,0	NW	5	298,7	1,0	CTD - Seabird	CTD-R	at depth	
PS61/063-2	03.02.02	13:47	60° 52,61' S	55° 26,69' W	270,4	NNW	4	91,2	0,4	CTD - Seabird	CTD-R	on deck	
PS61/064-1	03.02.02	15:02	60° 49,00' S	55° 43,91' W	474,4	NNW	6	266,9	3,4	Bottom trawl	BT	cod end to surface	
PS61/064-1	03.02.02	15:09	60° 49,01' S	55° 44,74' W	465,6	NNW	6	282,3	1,8	Bottom trawl	BT	turn	

PS61/064-1	03.02.02	15:22	60° 48,71' S	55° 44,16' W	500,4	NNW 6	118,3	5,2	Bottom trawl	BT	otter boards to surface	
PS61/064-1	03.02.02	15:55	60° 49,42' S	55° 39,56' W	453,6	NNW 4	111,9	2,4	Bottom trawl	BT	start trawling	1500 m ausgesteckt
PS61/064-1	03.02.02	16:25	60° 49,87' S	55° 37,26' W	455,6	NNW 4	110,9	2,3	Bottom trawl	BT	stop trawling	
PS61/064-1	03.02.02	17:01	60° 50,25' S	55° 35,38' W	412,0	N 4	106,1	3,7	Bottom trawl	BT	otter boards on deck	
PS61/064-1	03.02.02	17:13	60° 50,42' S	55° 34,24' W	386,8	NNW 4	103,1	2,4	Bottom trawl	BT	cod end on deck	
PS61/065-1	03.02.02	17:41	60° 51,42' S	55° 34,22' W	261,2	NNW 3	126,2	2,6	Bottom trawl	BT	cod end to surface	
PS61/065-1	03.02.02	17:50	60° 51,66' S	55° 33,29' W	251,6	N 4	114,2	3,0	Bottom trawl	BT	otter boards to surface	
PS61/065-1	03.02.02	18:18	60° 52,51' S	55° 29,65' W	242,0	NNE 2	119,2	2,6	Bottom trawl	BT	start trawling	1000 m ausgesteckt
PS61/065-1	03.02.02	18:48	60° 53,06' S	55° 27,36' W	250,4	NNE 2	116,5	1,5	Bottom trawl	BT	stop trawling	
PS61/065-1	03.02.02	19:12	60° 53,26' S	55° 26,15' W	264,4	NNE 2	111,2	4,1	Bottom trawl	BT	otter boards on deck	
PS61/065-1	03.02.02	19:24	60° 53,42' S	55° 25,16' W	265,2	NE 2	118,6	2,8	Bottom trawl	BT	cod end on deck	
PS61/043-7	03.02.02	22:56	60° 26,86' S	56° 4,20' W	3954,4	E 6	333,7	0,7	Large Box Corer	GKG	surface	
PS61/043-7	04.02.02	00:09	60° 26,59' S	56° 3,95' W	3952,8	E 6	90,9	1,0	Large Box Corer	GKG	at sea bottom	3961 m
PS61/043-7	04.02.02	01:10	60° 26,38' S	56° 3,37' W	3950,0	E 6	102,7	0,5	Large Box Corer	GKG	on deck	
PS61/043-8	04.02.02	01:36	60° 26,79' S	56° 4,09' W	3955,2	E 4	4,2	0,6	Epibenthos sledge	EBS	surface	
PS61/043-8	04.02.02	02:50	60° 26,48' S	56° 4,00' W	3953,6	ESE 4	326,2	0,2	Epibenthos sledge	EBS	on ground	
PS61/043-8	04.02.02	03:25	60° 27,12' S	56° 5,10' W	3961,2	ESE 4	210,5	1,6	Epibenthos sledge	EBS	start trawling winch stop	6000 m ausgesteckt
PS61/043-8	04.02.02	03:35	60° 27,24' S	56° 5,25' W	3962,4	ESE 3	184,6	0,8	Epibenthos sledge	EBS	end trawling	
PS61/043-8	04.02.02	04:45	60° 27,18' S	56° 4,80' W	3958,8	ESE 2	103,7	0,3	Epibenthos sledge	EBS	start hoisting from the bottom	
PS61/043-8	04.02.02	06:30	60° 27,46' S	56° 3,84' W	3954,4	S 2	84,0	0,7	Epibenthos sledge	EBS	on deck	
PS61/066-1	04.02.02	09:27	60° 54,17' S	55° 28,58' W	169,6	SW 4	47,6	1,5	Bottom trawl	BT	cod end to surface	
PS61/066-1	04.02.02	09:37	60° 53,97' S	55° 27,40' W	203,2	SW 5	69,3	5,2	Bottom trawl	BT	otter boards to surface	
PS61/066-1	04.02.02	10:02	60° 53,13' S	55° 22,96' W	301,2	SW 6	64,1	3,5	Bottom trawl	BT	start trawling	
PS61/066-1	04.02.02	10:24	60° 52,65' S	55° 20,76' W	439,6	SW 7	62,3	3,1	Bottom trawl	BT	stop trawling	
PS61/066-1	04.02.02	10:50	60° 52,30' S	55° 19,05' W	874,0	SW 5	67,6	3,1	Bottom trawl	BT	otter boards on deck	
PS61/066-1	04.02.02	11:02	60° 52,11' S	55° 17,83' W	1196,8	WSW 6	74,5	3,1	Bottom trawl	BT	cod end on deck	
PS61/066-2	04.02.02	11:23	60° 52,84' S	55° 21,70' W	336,0	SW 6	313,9	0,3	CTD - Seabird	CTD-R	surface	
PS61/066-2	04.02.02	11:32	60° 52,82' S	55° 21,72' W	340,4	SW 6	324,0	0,3	CTD - Seabird	CTD-R	at depth	320 m
PS61/066-2	04.02.02	11:38	60° 52,86' S	55° 21,70' W	335,6	SW 6	145,7	0,6	CTD - Seabird	CTD-R	on deck	
PS61/067-1	04.02.02	12:29	60° 56,47' S	55° 30,17' W	102,8	WSW 4	51,1	2,7	Bottom trawl	BT	cod end to surface	
PS61/067-1	04.02.02	12:36	60° 56,27' S	55° 29,35' W	102,4	WSW 5	67,2	3,3	Bottom trawl	BT	otter boards to surface	
PS61/067-1	04.02.02	12:48	60° 55,89' S	55° 27,63' W	114,8	SW 4	63,7	3,6	Bottom trawl	BT	start trawling	
PS61/067-1	04.02.02	13:18	60° 55,15' S	55° 24,84' W	181,6	SW 5	44,0	2,0	Bottom trawl	BT	stop trawling	
PS61/067-1	04.02.02	13:29	60° 54,94' S	55° 24,24' W	229,6	WSW 6	48,3	2,8	Bottom trawl	BT	otter boards on deck	
PS61/067-1	04.02.02	13:39	60° 54,67' S	55° 23,76' W	242,4	WSW 6	25,2	2,1	Bottom trawl	BT	cod end on deck	

PS61/068-1	04.02.02	14:37	60° 55,11' S	55° 41,68' W	161,6	WSW 5	59,1	4,5	Bottom trawl	BT	cod end to surface	
PS61/068-1	04.02.02	14:43	60° 54,86' S	55° 41,10' W	152,8	WSW 4	47,0	3,9	Bottom trawl	BT	otter boards to surface	
PS61/068-1	04.02.02	14:58	60° 54,14' S	55° 39,16' W	164,0	WSW 5	59,8	3,2	Bottom trawl	BT	start trawling	
PS61/068-1	04.02.02	15:28	60° 53,16' S	55° 36,27' W	164,0	WSW 5	53,9	3,1	Bottom trawl	BT	stop trawling	
PS61/068-1	04.02.02	15:46	60° 52,86' S	55° 35,25' W	192,4	WSW 4	62,6	2,7	Bottom trawl	BT	otter boards on deck	
PS61/068-1	04.02.02	15:52	60° 52,76' S	55° 34,89' W	193,6	WSW 4	68,4	2,0	Bottom trawl	BT	cod end on deck	
PS61/068-2	04.02.02	16:08	60° 53,45' S	55° 37,37' W	167,2	WSW 5	276,1	0,2	CTD - Seabird	CTD-R	surface	
PS61/068-2	04.02.02	16:12	60° 53,45' S	55° 37,42' W	166,4	WSW 5	256,8	0,5	CTD - Seabird	CTD-R	at depth	155 m ausgesteckt
PS61/068-2	04.02.02	16:16	60° 53,47' S	55° 37,49' W	169,2	WSW 5	204,8	0,6	CTD - Seabird	CTD-R	on deck	
PS61/069-1	04.02.02	17:33	61° 3,33' S	56° 1,90' W	564,8	WSW 7	23,8	3,2	Bottom trawl	BT	cod end to surface	
PS61/069-1	04.02.02	17:41	61° 2,90' S	56° 1,26' W	481,2	SW 7	36,9	4,2	Bottom trawl	BT	otter boards to surface	
PS61/069-1	04.02.02	18:05	61° 1,41' S	55° 58,98' W	338,0	SW 8	38,3	3,7	Bottom trawl	BT	start trawling	1050 m ausgesteckt
PS61/069-1	04.02.02	18:30	61° 0,27' S	55° 57,48' W	272,4	WSW 9	28,2	2,7	Bottom trawl	BT	stop trawling	
PS61/069-1	04.02.02	18:56	60° 59,70' S	55° 56,43' W	285,2	WSW 10	32,0	2,1	Bottom trawl	BT	otter boards on deck	
PS61/069-1	04.02.02	19:06	60° 59,46' S	55° 55,89' W	270,4	WSW 9	50,5	1,6	Bottom trawl	BT	cod end on deck	
PS61/043-3	04.02.02	21:23	60° 30,03' S	56° 4,36' W	3953,6	SW 11	59,5	1,1	Amphipod trap	ATC	released	05.02.2002 01:30 utc : trap not possible to recover in spite of extensive search
											possible to recover in spite of extensive search	
PS61/043-9	05.02.02	01:44	60° 29,23' S	56° 5,03' W	3970,0	WSW 7	55,9	1,6	Agassiz trawl	AGT	surface	
PS61/043-9	05.02.02	03:16	60° 29,13' S	56° 4,36' W	3962,8	W 6	238,5	2,8	Agassiz trawl	AGT	AGT on ground	
PS61/043-9	05.02.02	03:52	60° 29,76' S	56° 5,48' W	3971,2	W 7	215,7	1,5	Agassiz trawl	AGT	start trawl	6500 m ausgesteckt
PS61/043-9	05.02.02	04:22	60° 30,09' S	56° 6,00' W	3974,0	WNW 7	190,7	0,9	Agassiz trawl	AGT	Stop Trawl	
PS61/043-9	05.02.02	05:27	60° 30,22' S	56° 5,11' W	3961,6	WNW 8	180,6	0,5	Agassiz trawl	AGT	AGT off ground	
PS61/043-9	05.02.02	07:11	60° 31,19' S	56° 3,92' W	3932,8	NW 9	179,5	1,0	Agassiz trawl	AGT	on deck	
PS61/070-1	05.02.02	09:55	60° 55,95' S	55° 51,88' W	249,2	W 15	283,1	1,8	Bottom trawl	BT	cod end to surface	
PS61/070-1	05.02.02	10:08	60° 56,00' S	55° 53,40' W	224,4	WNW 15	194,9	5,4	Bottom trawl	BT	otter boards to surface	
PS61/070-1	05.02.02	10:28	60° 57,76' S	55° 54,43' W	212,4	W 16	183,6	3,3	Bottom trawl	BT	start trawling	
PS61/070-1	05.02.02	10:58	60° 59,47' S	55° 54,91' W	205,6	W 15	197,7	3,2	Bottom trawl	BT	stop trawling	
PS61/070-1	05.02.02	11:32	61° 0,67' S	55° 54,08' W	190,0	W 16	281,6	1,6	Bottom trawl	BT	otter boards on deck	
PS61/070-1	05.02.02	11:42	61° 0,61' S	55° 54,94' W	232,0	W 17	278,8	1,2	Bottom trawl	BT	cod end on deck	
PS61/070-2	05.02.02	12:13	60° 58,69' S	55° 55,30' W	218,8	W 18	63,5	0,4	CTD - Seabird	CTD-R	surface	
PS61/070-2	05.02.02	12:17	60° 58,68' S	55° 55,23' W	220,4	W 19	75,9	0,8	CTD - Seabird	CTD-R	at depth	210 m

PS61/070-2	05.02.02	12:22	60° 58,66' S	55° 55,27' W	219,6	W 19	350,7	0,2	CTD - Seabird	CTD-R	on deck	
PS61/071-1	05.02.02	13:44	60° 59,93' S	55° 51,05' W	158,8	W 18	276,5	2,7	Bottom trawl	BT	cod end to surface	
PS61/071-1	05.02.02	13:52	60° 59,95' S	55° 51,81' W	166,4	WSW 18	264,1	3,6	Bottom trawl	BT	turn	
PS61/071-1	05.02.02	14:05	60° 59,39' S	55° 51,87' W	171,2	WSW 17	67,1	4,6	Bottom trawl	BT	otter boards to surface	
PS61/071-1	05.02.02	14:20	60° 58,83' S	55° 49,74' W	160,0	W 17	56,7	3,0	Bottom trawl	BT	start trawling	
PS61/071-1	05.02.02	14:50	60° 58,13' S	55° 46,85' W	187,2	W 21	71,4	3,5	Bottom trawl	BT	stop trawling	
PS61/071-1	05.02.02	15:07	60° 57,90' S	55° 45,40' W	194,8	W 16	70,0	4,9	Bottom trawl	BT	otter boards on deck	
PS61/071-1	05.02.02	15:32	60° 57,72' S	55° 46,75' W	208,0	W 18	298,6	3,1	Bottom trawl	BT	cod end on deck	
PS61/072-1	06.02.02	11:28	60° 57,61' S	55° 54,56' W	223,2	WNW 4	270,5	3,4	Bottom trawl	BT	cod end to surface	
PS61/072-1	06.02.02	11:36	60° 57,61' S	55° 55,53' W	228,8	WNW 4	275,6	3,5	Bottom trawl	BT	turn	
PS61/072-1	06.02.02	11:47	60° 58,29' S	55° 56,53' W	297,6	WNW 4	196,7	4,6	Bottom trawl	BT	otter boards to surface	
PS61/072-1	06.02.02	12:04	60° 59,53' S	55° 57,37' W	289,2	WNW 5	208,3	3,4	Bottom trawl	BT	start trawling	
PS61/072-1	06.02.02	12:29	61° 0,66' S	55° 58,39' W	306,0	NW 5	195,5	3,2	Bottom trawl	BT	stop trawling	
PS61/072-1	06.02.02	13:01	61° 1,93' S	55° 59,68' W	343,6	NW 6	257,8	4,8	Bottom trawl	BT	otter boards on deck	
PS61/072-1	06.02.02	13:15	61° 2,23' S	56° 0,91' W	407,2	NW 6	224,5	7,8	Bottom trawl	BT	cod end on deck	
PS61/073-1	06.02.02	13:58	60° 58,00' S	55° 53,87' W	186,0	WNW 4	263,5	3,9	Bottom trawl	BT	cod end to surface	
PS61/073-1	06.02.02	14:06	60° 58,02' S	55° 54,85' W	218,4	WNW 4	270,8	5,0	Bottom trawl	BT	turn	
PS61/073-1	06.02.02	14:13	60° 58,52' S	55° 55,42' W	225,2	WNW 4	179,3	4,4	Bottom trawl	BT	otter boards to surface	
PS61/073-1	06.02.02	14:34	61° 0,10' S	55° 55,96' W	276,8	WNW 5	173,7	2,8	Bottom trawl	BT	start trawling	
PS61/073-1	06.02.02	15:04	61° 1,68' S	55° 56,49' W	297,6	WNW 5	187,3	2,3	Bottom trawl	BT	stop trawling	
PS61/073-1	06.02.02	15:26	61° 2,46' S	55° 56,60' W	275,2	WNW 4	172,4	3,7	Bottom trawl	BT	turn	
PS61/073-1	06.02.02	15:34	61° 2,89' S	55° 57,25' W	277,2	WNW 3	243,2	3,2	Bottom trawl	BT	otter boards on deck	
PS61/073-1	06.02.02	15:44	61° 3,07' S	55° 57,76' W	292,0	WNW 4	240,3	1,7	Bottom trawl	BT	cod end on deck	
PS61/073-2	06.02.02	16:02	61° 3,20' S	55° 58,03' W	294,8	WNW 3	201,3	0,8	Sediment Profile Imaging	SEP	into water	
PS61/073-2	06.02.02	16:11	61° 3,24' S	55° 58,13' W	294,8	W 3	75,4	0,4	Sediment Profile Imaging	SEP	into deep	285 m ausgesteckt
PS61/073-2	06.02.02	16:26	61° 3,29' S	55° 58,33' W	292,8	W 3	238,2	1,1	Sediment Profile Imaging	SEP	start rising	
PS61/073-2	06.02.02	16:32	61° 3,32' S	55° 58,42' W	296,0	W 3	245,5	1,6	Sediment Profile Imaging	SEP	on deck	
PS61/073-3	06.02.02	16:36	61° 3,34' S	55° 58,49' W	297,2	W 3	203,6	0,3	CTD - Seabird	CTD-R	surface	
PS61/073-3	06.02.02	16:44	61° 3,37' S	55° 58,61' W	296,8	WSW 3	199,1	0,3	CTD - Seabird	CTD-R	at depth	280 m ausgesteckt
PS61/073-3	06.02.02	16:50	61° 3,39' S	55° 58,62' W	294,0	W 2	251,7	1,2	CTD - Seabird	CTD-R	on deck	
PS61/074-1	06.02.02	17:59	61° 1,68' S	55° 51,46' W	145,2	W 1	212,7	2,4	Bottom trawl	BT	cod end to surface	
PS61/074-1	06.02.02	18:07	61° 1,96' S	55° 52,00' W	157,2	NW 1	225,6	3,9	Bottom trawl	BT	otter boards to surface	
PS61/074-1	06.02.02	18:23	61° 2,91' S	55° 53,76' W	187,6	NNW 2	229,6	2,6	Bottom trawl	BT	start trawling	600 m ausgesteckt
PS61/074-1	06.02.02	18:45	61° 3,74' S	55° 55,46' W	190,8	NNW 3	225,9	0,3	Bottom trawl	BT		
PS61/074-1	06.02.02	19:15	61° 3,64' S	55° 55,24' W	185,6	NNW 4	205,3	2,0	Bottom trawl	BT	otter boards on deck	
PS61/074-1	06.02.02	19:31	61° 4,36' S	55° 55,84' W	206,0	NNW 4	184,5	2,1	Bottom trawl	BT	cod end on deck	

PS61/075-1	06.02.02	20:19	61° 6,86' S	55° 54,36' W	133,2	NW 5	270,9	2,3	Bottom trawl	BT	cod end to surface	
PS61/075-1	06.02.02	20:25	61° 6,84' S	55° 55,03' W	135,2	WNW 6	275,7	4,0	Bottom trawl	BT	turn	
PS61/075-1	06.02.02	20:30	61° 6,57' S	55° 55,36' W	140,8	WNW 7	54,1	7,5	Bottom trawl	BT	otter boards to surface	
PS61/075-1	06.02.02	20:44	61° 5,78' S	55° 53,61' W	139,2	W 9	44,8	3,4	Bottom trawl	BT	start trawling	
PS61/075-1	06.02.02	21:14	61° 4,61' S	55° 50,94' W	126,8	W 9	30,7	2,3	Bottom trawl	BT	stop trawling	
PS61/075-1	06.02.02	21:28	61° 4,31' S	55° 50,09' W	126,0	W 9	47,6	5,9	Bottom trawl	BT	turn	
PS61/075-1	06.02.02	21:34	61° 3,93' S	55° 50,04' W	128,4	WNW 11	280,8	5,2	Bottom trawl	BT	otter boards on deck	
PS61/075-1	06.02.02	21:45	61° 4,09' S	55° 50,94' W	131,6	W 11	245,0	2,5	Bottom trawl	BT	cod end on deck	
PS61/075-2	06.02.02	22:07	61° 2,99' S	55° 53,59' W	183,2	W 11	150,2	0,5	CTD - Seabird	CTD-R	surface	
PS61/075-2	06.02.02	22:12	61° 3,02' S	55° 53,57' W	183,2	W 11	91,7	2,3	CTD - Seabird	CTD-R	at depth	
PS61/075-2	06.02.02	22:15	61° 3,05' S	55° 53,56' W	178,8	W 11	163,9	0,3	CTD - Seabird	CTD-R	on deck	
PS61/075-3	06.02.02	22:29	61° 3,18' S	55° 53,91' W	178,8	W 12	255,6	2,2	Sediment Profile Imaging	SEP	into water	
PS61/075-3	06.02.02	22:39	61° 3,27' S	55° 53,95' W	178,4	W 11	195,7	0,9	Sediment Profile Imaging	SEP	into deep	
PS61/075-3	06.02.02	23:01	61° 3,46' S	55° 54,15' W	174,8	W 12	237,4	1,9	Sediment Profile Imaging	SEP	start rising	
PS61/075-3	06.02.02	23:09	61° 3,54' S	55° 54,38' W	174,8	W 11	236,4	1,4	Sediment Profile Imaging	SEP	on deck	
PS61/076-1	07.02.02	00:23	61° 2,24' S	56° 8,55' W	1090,0	W 14	166,4	0,5	Sediment Profile Imaging	SEP	into water	mit CTD-R
PS61/076-1	07.02.02	00:56	61° 2,16' S	56° 8,35' W	1086,8	W 13	282,1	1,8	Sediment Profile Imaging	SEP	into deep	mit CTD-R
PS61/076-1	07.02.02	01:18	61° 2,16' S	56° 8,28' W	1072,0	WSW 14	234,5	0,2	Sediment Profile Imaging	SEP	start rising	
PS61/076-1	07.02.02	01:43	61° 2,24' S	56° 8,40' W	1072,0	WSW 14	216,9	0,9	Sediment Profile Imaging	SEP	on deck	
PS61/077-1	07.02.02	03:06	60° 56,59' S	56° 20,47' W	2155,0	WSW 16	82,5	2,1	Sediment Profile Imaging	SEP	into water	mit CTD-R
PS61/077-1	07.02.02	03:50	60° 56,32' S	56° 19,74' W	2154,0	WSW 15	133,2	0,5	Sediment Profile Imaging	SEP	into deep	2125 m ausgesteckt
PS61/077-1	07.02.02	04:12	60° 56,21' S	56° 19,69' W	2154,0	WSW 18	31,7	1,3	Sediment Profile Imaging	SEP	start rising	
PS61/077-1	07.02.02	04:44	60° 55,85' S	56° 19,32' W	2149,0	WSW 19	46,5	1,0	Sediment Profile Imaging	SEP	on deck	
PS61/078-1	07.02.02	09:15	60° 58,14' S	55° 56,25' W	0,0	WSW 17	233,1	2,3	Bottom trawl	BT	cod end to surface	
PS61/078-1	07.02.02	09:24	60° 58,35' S	55° 57,35' W	0,0	WSW 16	252,6	7,8	Bottom trawl	BT	turn	
PS61/078-1	07.02.02	09:29	60° 58,01' S	55° 57,43' W	350,0	WSW 16	57,3	6,8	Bottom trawl	BT	otter boards to surface	
PS61/078-1	07.02.02	09:49	60° 57,07' S	55° 54,15' W	222,0	WSW 17	56,3	3,6	Bottom trawl	BT	start trawling	
PS61/078-1	07.02.02	10:14	60° 56,43' S	55° 51,39' W	251,2	WSW 16	54,8	2,8	Bottom trawl	BT	stop trawling	
PS61/078-1	07.02.02	10:35	60° 55,90' S	55° 49,27' W	368,4	WSW 16	70,7	8,7	Bottom trawl	BT	turn	
PS61/078-1	07.02.02	10:41	60° 55,72' S	55° 49,81' W	447,6	SW 20	251,9	3,8	Bottom trawl	BT	otter boards on deck	
PS61/078-1	07.02.02	10:52	60° 55,99' S	55° 50,93' W	287,2	SW 15	241,7	2,6	Bottom trawl	BT	cod end on deck	
PS61/079-1	07.02.02	12:26	61° 4,82' S	56° 2,36' W	264,8	WSW 14	249,6	3,5	Bottom trawl	BT	cod end to surface	
PS61/079-1	07.02.02	12:35	61° 5,09' S	56° 3,52' W	417,2	WSW 14	229,7	4,2	Bottom trawl	BT	turn	
PS61/079-1	07.02.02	12:46	61° 5,24' S	56° 2,49' W	256,0	WSW 14	48,7	4,7	Bottom trawl	BT	otter boards to surface	
PS61/079-1	07.02.02	13:08	61° 4,36' S	55° 59,47' W	252,0	WSW 12	81,2	4,1	Bottom trawl	BT	start trawling	3,4 kt über Grund
PS61/079-1	07.02.02	13:26	61° 4,05' S	55° 57,85' W	252,7	WSW 15	232,9	0,3	Bottom trawl	BT		
PS61/079-1	07.02.02	14:07	61° 3,99' S	55° 58,08' W	263,8	WSW 14	239,0	2,8	Bottom trawl	BT	otter boards on deck	
PS61/079-1	07.02.02	14:17	61° 4,24' S	55° 58,66' W	255,2	WSW 13	231,0	2,5	Bottom trawl	BT	cod end on deck	
PS61/079-2	07.02.02	14:49	61° 4,64' S	55° 59,15' W	231,2	WSW 10	158,4	1,0	CTD - Seabird	CTD-R	surface	
PS61/079-2	07.02.02	14:54	61° 4,69' S	55° 59,16' W	229,7	WSW 9	128,3	1,1	CTD - Seabird	CTD-R	at depth	

PS61/079-2	07.02.02	15:00	61° 4,74' S	55° 59,15' W	226,1	WSW 9	100,4	0,8	CTD - Seabird	CTD-R	on deck	
PS61/080-1	07.02.02	15:39	61° 2,84' S	55° 54,25' W	197,9	W 11	242,5	3,6	Bottom trawl	BT	cod end to surface	
PS61/080-1	07.02.02	15:47	61° 3,09' S	55° 55,17' W	200,4	W 11	244,1	6,2	Bottom trawl	BT	turn	
PS61/080-1	07.02.02	15:54	61° 3,39' S	55° 54,58' W	179,4	W 11	53,1	5,3	Bottom trawl	BT	otter boards to surface	
PS61/080-1	07.02.02	16:07	61° 2,91' S	55° 52,57' W	169,1	W 14	63,7	4,3	Bottom trawl	BT	start trawling	550 m ausgesteckt
PS61/080-1	07.02.02	16:19	61° 2,57' S	55° 51,32' W	145,8	W 12	69,5	1,3	Bottom trawl	BT		
PS61/080-1	07.02.02	16:38	61° 2,62' S	55° 50,40' W	137,2	WNW 12	81,7	7,3	Bottom trawl	BT	turn	
PS61/080-1	07.02.02	16:45	61° 2,23' S	55° 50,30' W	132,1	WNW 10	337,1	1,5	Bottom trawl	BT	otter boards on deck	
PS61/080-1	07.02.02	16:59	61° 1,93' S	55° 51,29' W	140,9	WNW 10	302,0	2,4	Bottom trawl	BT	cod end on deck	
PS61/081-1	07.02.02	17:54	61° 2,72' S	55° 54,52' W	204,7	WNW 13	231,2	2,8	Bottom trawl	BT	cod end to surface	
PS61/081-1	07.02.02	18:02	61° 3,05' S	55° 55,39' W	206,9	WNW 13	223,6	4,6	Bottom trawl	BT	turn	
PS61/081-1	07.02.02	18:11	61° 3,39' S	55° 54,51' W	178,9	WNW 14	67,4	5,4	Bottom trawl	BT	otter boards to surface	
PS61/081-1	07.02.02	18:24	61° 2,91' S	55° 52,78' W	171,0	WNW 12	71,8	2,7	Bottom trawl	BT	start trawling	500 m ausgesteckt
PS61/081-1	07.02.02	18:54	61° 2,03' S	55° 49,26' W	127,5	WNW 12	59,5	3,0	Bottom trawl	BT	stop trawling	
PS61/081-1	07.02.02	19:07	61° 1,96' S	55° 48,09' W	138,2	WNW 12	80,0	7,0	Bottom trawl	BT	turn	
PS61/081-1	07.02.02	19:14	61° 1,57' S	55° 48,13' W	131,8	WNW 12	288,8	2,7	Bottom trawl	BT	otter boards on deck	
PS61/081-1	07.02.02	19:25	61° 1,41' S	55° 49,02' W	125,4	WNW 12	294,2	1,7	Bottom trawl	BT	cod end on deck	
PS61/082-1	07.02.02	19:56	60° 58,20' S	55° 47,18' W	201,9	WNW 12	271,9	3,8	Bottom trawl	BT	cod end to surface	
PS61/082-1	07.02.02	20:03	60° 58,07' S	55° 47,80' W	208,2	WNW 12	287,9	3,6	Bottom trawl	BT	turn	
PS61/082-1	07.02.02	20:21	60° 59,33' S	55° 49,12' W	160,0	WNW 13	206,9	3,9	Bottom trawl	BT	start trawling	
PS61/082-1	07.02.02	20:51	61° 0,92' S	55° 50,40' W	145,6	NW 11	198,0	3,0	Bottom trawl	BT	stop trawling	
PS61/082-1	07.02.02	21:05	61° 1,50' S	55° 50,31' W	138,8	WNW 11	171,8	2,8	Bottom trawl	BT	otter boards on deck	
PS61/082-1	07.02.02	21:07	61° 1,62' S	55° 50,30' W	138,3	NW 11	178,2	5,7	Bottom trawl	BT	turn	
PS61/082-1	07.02.02	21:15	61° 1,75' S	55° 51,17' W	136,6	WNW 11	298,4	2,9	Bottom trawl	BT	otter boards on deck	
PS61/082-1	07.02.02	21:24	61° 1,51' S	55° 51,82' W	147,8	WNW 12	301,3	1,7	Bottom trawl	BT	cod end on deck	
PS61/083-1	07.02.02	22:23	61° 7,18' S	56° 8,84' W	349,5	WNW 12	90,6	1,4	Amphipod trap	ATC	to water	
PS61/084-1	08.02.02	11:23	60° 58,90' S	55° 56,12' W	258,5	NW 14	298,5	3,4	Bottom trawl	BT	cod end to surface	
PS61/084-1	08.02.02	11:31	60° 58,68' S	55° 56,90' W	346,5	NW 14	296,5	5,9	Bottom trawl	BT	turn	
PS61/084-1	08.02.02	11:42	60° 58,48' S	55° 55,87' W	242,3	NW 13	129,3	4,6	Bottom trawl	BT	otter boards to surface	
PS61/084-1	08.02.02	11:56	60° 59,08' S	55° 54,16' W	189,2	NW 14	119,8	2,8	Bottom trawl	BT	start trawling	
PS61/084-1	08.02.02	12:26	61° 0,02' S	55° 51,25' W	161,4	NW 11	114,0	3,2	Bottom trawl	BT	stop trawling	
PS61/084-1	08.02.02	12:45	61° 0,54' S	55° 49,75' W	145,8	NW 10	139,0	5,3	Bottom trawl	BT	turn	
PS61/084-1	08.02.02	12:56	61° 0,80' S	55° 50,59' W	147,6	NW 11	343,2	2,1	Bottom trawl	BT	otter boards on deck	
PS61/084-1	08.02.02	13:09	61° 0,54' S	55° 51,07' W	153,0	NW 12	341,5	1,8	Bottom trawl	BT	cod end on deck	
PS61/085-1	08.02.02	13:38	60° 59,07' S	55° 51,17' W	173,4	NW 11	299,0	3,5	Bottom trawl	BT	cod end to surface	
PS61/085-1	08.02.02	13:45	60° 58,87' S	55° 51,79' W	176,0	NNW 12	303,8	5,2	Bottom trawl	BT	turn	

PS61/085-1	08.02.02	13:50	60° 59,08' S	55° 52,31' W	176,9	NNW 11	203,1	4,4	Bottom trawl	BT	otter boards to surface	
PS61/085-1	08.02.02	14:06	61° 0,22' S	55° 53,00' W	167,1	NNW 12	200,6	3,1	Bottom trawl	BT	start trawling	
PS61/085-1	08.02.02	14:36	61° 1,76' S	55° 53,93' W	210,6	NNW 11	211,6	3,2	Bottom trawl	BT	stop trawling	
PS61/085-1	08.02.02	14:52	61° 2,31' S	55° 54,09' W	211,0	NNW 10	200,9	5,4	Bottom trawl	BT	turn	
PS61/085-1	08.02.02	14:59	61° 2,32' S	55° 54,89' W	229,0	NNW 9	318,4	1,9	Bottom trawl	BT	otter boards on deck	
PS61/085-1	08.02.02	15:08	61° 2,14' S	55° 55,47' W	246,7	NNW 10	300,5	1,8	Bottom trawl	BT	cod end on deck	
PS61/085-2	08.02.02	15:25	61° 1,01' S	55° 54,04' W	193,0	NNW 10	357,3	0,8	CTD - Seabird	CTD-R	surface	
PS61/085-2	08.02.02	15:31	61° 0,98' S	55° 54,03' W	195,4	NNW 10	215,4	0,6	CTD - Seabird	CTD-R	at depth	190 m ausgesteckt
PS61/085-2	08.02.02	15:35	61° 1,00' S	55° 53,98' W	195,6	NNW 10	93,5	1,6	CTD - Seabird	CTD-R	on deck	
PS61/086-1	08.02.02	16:19	61° 6,51' S	56° 1,76' W	172,5	N 10	307,0	4,3	Bottom trawl	BT	cod end to surface	
PS61/086-1	08.02.02	16:27	61° 6,20' S	56° 2,59' W	201,4	N 11	310,9	4,2	Bottom trawl	BT	turn	
PS61/086-1	08.02.02	16:32	61° 5,90' S	56° 2,41' W	212,3	N 12	70,4	4,7	Bottom trawl	BT	otter boards to surface	
PS61/086-1	08.02.02	16:49	61° 4,87' S	56° 0,89' W	229,1	N 13	30,3	4,3	Bottom trawl	BT	start trawling	
PS61/086-1	08.02.02	17:19	61° 3,30' S	55° 59,24' W	306,5	N 14	19,4	3,3	Bottom trawl	BT	stop trawling	820 m ausgesteckt
PS61/086-1	08.02.02	17:42	61° 3,16' S	55° 57,66' W	286,3	NNW 14	101,3	3,2	Bottom trawl	BT	turn	
PS61/086-1	08.02.02	17:48	61° 2,91' S	55° 57,16' W	279,4	N 15	5,1	1,7	Bottom trawl	BT	otter boards on deck	
PS61/086-1	08.02.02	18:01	61° 2,59' S	55° 56,83' W	277,2	N 16	72,1	1,7	Bottom trawl	BT	cod end on deck	
PS61/087-1	08.02.02	19:46	61° 0,58' S	55° 49,25' W	137,4	N 15	343,5	4,5	Bottom trawl	BT	cod end to surface	
PS61/087-1	08.02.02	19:56	61° 0,04' S	55° 49,78' W	148,0	N 16	334,4	5,7	Bottom trawl	BT	turn	
PS61/087-1	08.02.02	20:01	61° 0,21' S	55° 50,48' W	155,3	N 15	199,2	7,8	Bottom trawl	BT	otter boards to surface	
PS61/087-1	08.02.02	20:25	61° 1,93' S	55° 51,47' W	148,5	N 15	171,0	3,0	Bottom trawl	BT	start trawling	
PS61/087-1	08.02.02	20:55	61° 3,61' S	55° 52,02' W	149,5	NNW 16	199,0	2,9	Bottom trawl	BT	stop trawling	
PS61/087-1	08.02.02	21:14	61° 4,36' S	55° 51,72' W	131,2	NNW 16	184,5	5,7	Bottom trawl	BT	turn	
PS61/087-1	08.02.02	21:21	61° 4,47' S	55° 52,42' W	137,3	NNW 15	321,0	4,0	Bottom trawl	BT	otter boards on deck	
PS61/087-1	08.02.02	21:32	61° 4,24' S	55° 53,14' W	152,2	NNW 15	216,7	0,4	Bottom trawl	BT	cod end on deck	
PS61/088-1	08.02.02	22:15	61° 2,28' S	55° 47,91' W	119,8	NNW 16	357,6	2,6	Bottom trawl	BT	cod end to surface	
PS61/088-1	08.02.02	22:22	61° 2,01' S	55° 48,33' W	131,0	NNW 14	328,5	5,3	Bottom trawl	BT	turn	
PS61/088-1	08.02.02	22:29	61° 2,05' S	55° 47,67' W	121,7	NNW 15	193,7	5,3	Bottom trawl	BT	otter boards to surface	
PS61/088-1	08.02.02	22:45	61° 3,31' S	55° 48,31' W	117,0	NNW 15	203,2	3,7	Bottom trawl	BT	start trawling	
PS61/088-1	08.02.02	23:15	61° 4,96' S	55° 49,45' W	114,0	NNW 14	186,8	3,0	Bottom trawl	BT	stop trawling	
PS61/088-1	08.02.02	23:30	61° 5,56' S	55° 49,39' W	107,9	NNW 13	191,0	5,5	Bottom trawl	BT	turn	
PS61/088-1	08.02.02	23:39	61° 5,55' S	55° 50,10' W	107,6	NNW 14	355,6	1,2	Bottom trawl	BT	otter boards on deck	
PS61/088-1	08.02.02	23:48	61° 5,27' S	55° 50,16' W	114,2	NNW 13	330,3	0,8	Bottom trawl	BT	cod end on deck	
PS61/089-1	09.02.02	09:19	60° 59,40' S	55° 50,55' W	164,4	WNW 14	284,5	1,1	Bottom trawl	BT	cod end to surface	
PS61/089-1	09.02.02	09:28	60° 59,33' S	55° 51,66' W	170,0	WNW 13	267,7	6,2	Bottom trawl	BT	turn	
PS61/089-1	09.02.02	09:33	60° 59,54' S	55° 51,19' W	166,8	WNW 16	51,8	8,4	Bottom trawl	BT	otter boards to surface	

PS61/089-1	09.02.02	10:02	60° 58,52' S	55° 46,75' W	189,3	WNW	13	54,6	2,2	Bottom trawl	BT	start trawling	
PS61/089-1	09.02.02	10:32	60° 57,55' S	55° 43,79' W	158,4	WNW	11	58,1	3,4	Bottom trawl	BT	stop trawling	
PS61/089-1	09.02.02	10:49	60° 57,25' S	55° 42,60' W	134,7	WNW	11	59,8	6,4	Bottom trawl	BT	turn	
PS61/089-1	09.02.02	10:53	60° 56,98' S	55° 42,97' W	143,1	WNW	11	282,1	5,0	Bottom trawl	BT	otter boards on deck	
PS61/089-1	09.02.02	11:03	60° 56,89' S	55° 43,71' W	179,3	WNW	11	268,7	2,6	Bottom trawl	BT	cod end on deck	
PS61/090-1	09.02.02	12:14	60° 57,75' S	55° 54,63' W	223,6	WNW	12	323,1	4,2	Bottom trawl	BT	cod end to surface	
PS61/090-1	09.02.02	12:18	60° 57,56' S	55° 55,07' W	230,3	WNW	13	314,7	3,7	Bottom trawl	BT	turn	
PS61/090-1	09.02.02	12:31	60° 57,26' S	55° 54,83' W	231,8	WNW	12	138,2	5,2	Bottom trawl	BT	otter boards to surface	
PS61/090-1	09.02.02	12:49	60° 58,29' S	55° 52,78' W	193,4	WNW	10	124,2	4,2	Bottom trawl	BT	start trawling	
PS61/090-1	09.02.02	13:19	60° 59,46' S	55° 50,20' W	161,2	WNW	10	124,0	3,9	Bottom trawl	BT	stop trawling	
PS61/090-1	09.02.02	13:39	60° 60,00' S	55° 49,05' W	146,8	WNW	11	147,7	5,7	Bottom trawl	BT	turn	
PS61/090-1	09.02.02	13:47	61° 0,18' S	55° 49,63' W	144,8	WNW	12	309,2	1,9	Bottom trawl	BT	otter boards on deck	
PS61/090-1	09.02.02	13:55	60° 59,89' S	55° 49,83' W	153,2	WNW	12	12,6	1,4	Bottom trawl	BT	cod end on deck	
PS61/091-1	09.02.02	14:35	60° 59,79' S	55° 48,83' W	152,4	WNW	12	272,3	4,8	Bottom trawl	BT	cod end to surface	
PS61/091-1	09.02.02	14:46	60° 59,58' S	55° 50,15' W	156,4	WNW	13	285,2	5,5	Bottom trawl	BT	turn	
PS61/091-1	09.02.02	14:54	60° 59,05' S	55° 50,25' W	0,0	WNW	13	74,7	4,4	Bottom trawl	BT	otter boards to surface	
PS61/091-1	09.02.02	15:12	60° 58,45' S	55° 47,65' W	200,0	WNW	13	62,8	4,2	Bottom trawl	BT	start trawling	
PS61/091-1	09.02.02	15:42	60° 57,66' S	55° 44,47' W	201,2	WNW	12	62,4	3,1	Bottom trawl	BT	stop trawling	700 m ausgesteckt
PS61/091-1	09.02.02	16:01	60° 57,64' S	55° 43,03' W	139,2	WNW	12	95,2	2,7	Bottom trawl	BT	turn	
PS61/091-1	09.02.02	16:10	60° 57,26' S	55° 42,72' W	141,6	WNW	13	340,0	0,9	Bottom trawl	BT	otter boards on deck	
PS61/091-1	09.02.02	16:20	60° 57,02' S	55° 43,08' W	145,2	WNW	10	349,8	1,6	Bottom trawl	BT	cod end on deck	
PS61/091-2	09.02.02	16:39	60° 56,77' S	55° 43,44' W	176,0	WNW	12	236,2	0,4	CTD - Seabird	CTD-R	surface	
PS61/091-2	09.02.02	16:47	60° 56,76' S	55° 43,39' W	207,6	WNW	11	284,4	0,0	CTD - Seabird	CTD-R	at depth	165 m ausgesteckt
PS61/091-2	09.02.02	16:52	60° 56,75' S	55° 43,38' W	171,2	WNW	10	283,6	0,3	CTD - Seabird	CTD-R	on deck	
PS61/092-1	09.02.02	17:19	60° 58,14' S	55° 43,56' W	135,2	WNW	11	302,9	4,2	Bottom trawl	BT	cod end to surface	
PS61/092-1	09.02.02	17:27	60° 57,94' S	55° 44,34' W	181,2	WNW	10	285,0	3,9	Bottom trawl	BT	turn	
PS61/092-1	09.02.02	17:31	60° 58,17' S	55° 44,75' W	194,0	NW	10	194,6	4,9	Bottom trawl	BT	otter boards to surface	
PS61/092-1	09.02.02	18:03	61° 0,33' S	55° 45,63' W	158,6	NW	11	188,1	3,8	Bottom trawl	BT	start trawling	
PS61/092-1	09.02.02	18:30	61° 1,81' S	55° 45,63' W	122,7	WNW	12	176,7	4,1	Bottom trawl	BT	stop trawling	550 m ausgesteckt
PS61/092-1	09.02.02	18:42	61° 2,20' S	55° 45,15' W	118,3	WNW	10	150,3	4,3	Bottom trawl	BT	turn	
PS61/092-1	09.02.02	18:49	61° 2,38' S	55° 45,69' W	115,4	WNW	10	320,8	2,8	Bottom trawl	BT	otter boards on deck	
PS61/092-1	09.02.02	19:01	61° 2,08' S	55° 46,25' W	125,9	WNW	10	298,7	2,2	Bottom trawl	BT	cod end on deck	
PS61/093-1	09.02.02	19:58	61° 3,29' S	55° 44,52' W	103,8	WNW	10	309,9	3,8	Bottom trawl	BT	cod end to surface	
PS61/093-1	09.02.02	20:08	61° 2,87' S	55° 45,41' W	113,2	WNW	10	316,1	5,4	Bottom trawl	BT	turn	
PS61/093-1	09.02.02	20:11	61° 2,59' S	55° 45,58' W	114,2	WNW	11	349,7	6,4	Bottom trawl	BT	otter boards to surface	
PS61/093-1	09.02.02	20:31	61° 0,97' S	55° 46,16' W	153,0	WNW	10	340,8	2,7	Bottom trawl	BT	start trawling	

PS61/093-1	09.02.02	21:01	60° 59,32' S	55° 46,70' W	184,2	WNW 10	337,7	3,3	Bottom trawl	BT	stop trawling	
PS61/093-1	09.02.02	21:18	60° 58,62' S	55° 46,66' W	188,1	WNW 10	333,6	5,6	Bottom trawl	BT	turn	
PS61/093-1	09.02.02	21:24	60° 58,40' S	55° 47,30' W	208,4	WNW 10	270,9	1,4	Bottom trawl	BT	otter boards on deck	
PS61/093-1	09.02.02	21:31	60° 58,24' S	55° 47,88' W	202,3	WNW 11	310,1	4,0	Bottom trawl	BT	cod end on deck	
PS61/094-1	10.02.02	00:03	60° 30,33' S	56° 5,06' W	3968,0	WNW 13	77,5	0,7	Agassiz trawl	AGT	surface	
PS61/094-1	10.02.02	01:46	60° 30,52' S	56° 3,14' W	3932,0	WNW 12	250,0	0,3	Agassiz trawl	AGT	AGT on ground	
PS61/094-1	10.02.02	03:02	60° 30,71' S	56° 5,23' W	3966,0	WNW 12	277,1	1,1	Agassiz trawl	AGT	start trawl	7000 m cable down
PS61/094-1	10.02.02	03:32	60° 30,36' S	56° 5,39' W	3974,0	WNW 12	264,1	0,3	Agassiz trawl	AGT	Stop Trawl	Start Hieven
PS61/094-1	10.02.02	04:46	60° 29,75' S	56° 3,93' W	3963,0	WNW 11	6,9	0,9	Agassiz trawl	AGT	AGT off ground	
PS61/094-1	10.02.02	06:12	60° 29,22' S	56° 3,20' W	3957,0	NW 13	53,5	1,2	Agassiz trawl	AGT	on deck	
PS61/095-1	10.02.02	11:08	61° 11,95' S	55° 50,36' W	120,8	NNW 11	320,8	0,7	Bottom trawl	BT	cod end to surface	
PS61/095-1	10.02.02	11:12	61° 11,92' S	55° 50,38' W	122,3	NNW 11	33,7	1,1	Bottom trawl	BT	turn	
PS61/095-1	10.02.02	11:44	61° 12,55' S	55° 51,85' W	134,2	NNW 11	212,7	4,7	Bottom trawl	BT	otter boards to surface	
PS61/095-1	10.02.02	11:57	61° 13,38' S	55° 52,94' W	144,6	NNW 10	207,7	2,7	Bottom trawl	BT	start trawling	
PS61/095-1	10.02.02	12:27	61° 14,87' S	55° 54,74' W	163,2	NNW 12	204,0	3,0	Bottom trawl	BT	stop trawling	
PS61/095-1	10.02.02	12:40	61° 15,26' S	55° 55,06' W	173,8	NNW 13	183,5	3,7	Bottom trawl	BT	turn	
PS61/095-1	10.02.02	12:49	61° 15,27' S	55° 56,25' W	167,9	NNW 14	309,2	2,7	Bottom trawl	BT	otter boards on deck	
PS61/095-1	10.02.02	12:58	61° 14,94' S	55° 56,78' W	157,1	NW 12	340,1	3,4	Bottom trawl	BT	cod end on deck	
PS61/096-1	10.02.02	13:25	61° 10,68' S	55° 57,56' W	129,5	NW 11	294,6	2,8	Bottom trawl	BT	cod end to surface	
PS61/096-1	10.02.02	13:33	61° 10,43' S	55° 58,37' W	131,3	NW 10	310,4	4,0	Bottom trawl	BT	turn	
PS61/096-1	10.02.02	13:44	61° 10,05' S	55° 57,60' W	127,0	NW 9	125,8	5,6	Bottom trawl	BT	otter boards to surface	
PS61/096-1	10.02.02	13:55	61° 10,38' S	55° 56,01' W	127,4	NW 9	129,2	3,3	Bottom trawl	BT	start trawling	
PS61/096-1	10.02.02	14:25	61° 11,17' S	55° 52,69' W	125,6	NW 8	110,5	3,8	Bottom trawl	BT	stop trawling	
PS61/096-1	10.02.02	14:38	61° 11,43' S	55° 51,83' W	124,8	NW 9	109,2	4,8	Bottom trawl	BT	turn	
PS61/096-1	10.02.02	14:46	61° 11,07' S	55° 51,49' W	120,4	NW 10	317,4	2,3	Bottom trawl	BT	otter boards on deck	
PS61/096-1	10.02.02	14:54	61° 10,85' S	55° 51,92' W	121,5	NW 9	309,5	1,2	Bottom trawl	BT	cod end on deck	
PS61/096-2	10.02.02	15:15	61° 10,92' S	55° 52,30' W	124,6	NW 10	213,8	0,4	CTD - Seabird	CTD-R	surface	
PS61/096-2	10.02.02	15:20	61° 10,95' S	55° 52,34' W	121,2	NW 10	227,5	0,7	CTD - Seabird	CTD-R	at depth	118 m ausgesteckt
PS61/096-2	10.02.02	15:24	61° 10,97' S	55° 52,35' W	122,1	NW 11	13,8	0,4	CTD - Seabird	CTD-R	on deck	
PS61/097-1	10.02.02	16:07	61° 9,96' S	55° 58,38' W	130,9	WNW 12	277,5	3,6	Bottom trawl	BT	cod end to surface	
PS61/097-1	10.02.02	16:15	61° 9,93' S	55° 59,23' W	140,9	WNW 11	282,6	4,5	Bottom trawl	BT	otter boards to surface	
PS61/097-1	10.02.02	16:27	61° 9,62' S	56° 0,97' W	153,4	WNW 12	282,8	3,6	Bottom trawl	BT	start trawling	
PS61/097-1	10.02.02	16:57	61° 9,09' S	56° 4,46' W	171,5	WNW 11	275,1	3,1	Bottom trawl	BT	stop trawling	500 m ausgesteckt
PS61/097-1	10.02.02	17:09	61° 9,06' S	56° 5,19' W	181,6	WNW 11	278,3	1,7	Bottom trawl	BT	otter boards on deck	
PS61/097-1	10.02.02	17:19	61° 9,01' S	56° 5,93' W	193,0	WNW 11	277,0	2,0	Bottom trawl	BT	cod end on deck	
PS61/098-1	10.02.02	19:52	61° 5,51' S	56° 0,44' W	380,5	WNW 12	295,5	5,6	Bottom trawl	BT	cod end to surface	

PS61/098-1	10.02.02	20:04	61° 5,35' S	56° 2,01' W	473,2	WNW 11	256,7	4,7	Bottom trawl	BT	otter boards to surface	
PS61/098-1	10.02.02	20:32	61° 5,79' S	56° 7,11' W	458,2	WNW 10	258,3	2,8	Bottom trawl	BT	start trawling	
PS61/098-1	10.02.02	21:02	61° 5,42' S	56° 10,32' W	442,4	WNW 9	326,2	2,9	Bottom trawl	BT	stop trawling	
PS61/098-1	10.02.02	21:25	61° 4,93' S	56° 10,85' W	0,0	WNW 11	319,9	3,6	Bottom trawl	BT	otter boards on deck	
PS61/098-1	10.02.02	21:34	61° 4,45' S	56° 11,27' W	875,2	WNW 10	341,9	2,0	Bottom trawl	BT	cod end on deck	
PS61/083-1	10.02.02	22:15	61° 7,09' S	56° 8,41' W	339,4	WNW 7	1,0	0,3	Amphipod trap	ATC	released	
PS61/083-1	10.02.02	22:22	61° 7,09' S	56° 8,36' W	339,6	WNW 7	285,0	0,0	Amphipod trap	ATC	surfaced	
PS61/083-1	10.02.02	22:49	61° 7,12' S	56° 8,98' W	354,3	NW 7	188,3	0,7	Amphipod trap	ATC	on deck	
PS61/099-1	11.02.02	11:47	61° 7,05' S	59° 16,01' W	5203,0	N 0	321,5	0,5	Sediment Profile Imaging	SEP	into water	mit CTD-R
PS61/099-1	11.02.02	13:18	61° 7,05' S	59° 15,83' W	5192,0	N 16	254,8	1,0	Sediment Profile Imaging	SEP	into deep	5201 m cable coiled down
PS61/099-1	11.02.02	13:55	61° 7,10' S	59° 15,93' W	5193,4	N 16	93,9	0,2	Sediment Profile Imaging	SEP	start rising	mit CTD-R
PS61/099-1	11.02.02	15:03	61° 7,11' S	59° 15,75' W	5191,8	NNW 16	170,3	0,2	Sediment Profile Imaging	SEP	on deck	
PS61/099-2	11.02.02	15:13	61° 7,14' S	59° 15,70' W	5191,9	N 16	10,5	0,1	Large Box Corer	GKG	surface	
PS61/099-2	11.02.02	16:49	61° 7,04' S	59° 15,36' W	5195,1	NNW 16	77,7	0,8	Large Box Corer	GKG	at sea bottom	5202 m ausgesteckt
PS61/099-2	11.02.02	18:06	61° 6,93' S	59° 14,32' W	5195,1	NNW 18	44,7	1,2	Large Box Corer	GKG	on deck	
PS61/099-3	12.02.02	00:25	61° 9,49' S	59° 12,72' W	4715,6	NW 12	207,3	2,0	Agassiz trawl	AGT	surface	
PS61/099-3	12.02.02	02:45	61° 9,30' S	59° 14,80' W	5101,6	W 12	161,5	0,5	Agassiz trawl	AGT	AGT on ground	
PS61/099-3	12.02.02	03:45	61° 8,61' S	59° 17,35' W	5194,8	W 9	300,5	0,9	Agassiz trawl	AGT	start trawl	7500 m ausgesteckt
PS61/099-3	12.02.02	04:45	61° 8,27' S	59° 18,69' W	5191,6	WNW 9	289,5	1,0	Agassiz trawl	AGT	Stop Trawl	Beginnen zu Hieven
PS61/099-3	12.02.02	05:46	61° 8,22' S	59° 19,02' W	5189,2	W 10	317,6	0,2	Agassiz trawl	AGT	AGT off ground	
PS61/099-3	12.02.02	08:04	61° 7,69' S	59° 18,93' W	5189,2	W 8	314,1	2,9	Agassiz trawl	AGT	on deck	
PS61/099-4	12.02.02	09:07	61° 9,36' S	59° 15,41' W	5109,2	WNW 7	70,2	1,2	Epibenthos sledge	EBS	surface	
PS61/099-4	12.02.02	10:57	61° 7,44' S	59° 15,40' W	5194,0	WNW 7	18,5	0,6	Epibenthos sledge	EBS	on ground	
PS61/099-4	12.02.02	11:49	61° 6,41' S	59° 16,55' W	5190,4	WNW 8	320,2	2,3	Epibenthos sledge	EBS	start trawling winch stop	
PS61/099-4	12.02.02	11:59	61° 6,24' S	59° 16,79' W	5190,4	WNW 7	358,4	0,4	Epibenthos sledge	EBS	end trawling start hoisting	7600 m ausgesteckt
PS61/099-4	12.02.02	13:26	61° 6,41' S	59° 17,63' W	5181,6	WNW 9	162,3	1,4	Epibenthos sledge	EBS	from the bottom	
PS61/099-4	12.02.02	15:19	61° 7,66' S	59° 18,75' W	5188,4	W 13	232,0	0,6	Epibenthos sledge	EBS	on deck	
PS61/099-5	12.02.02	15:52	61° 7,01' S	59° 16,16' W	5191,6	WSW 11	236,0	0,6	MultiCorer	MUC	surface	
PS61/099-5	12.02.02	17:30	61° 7,09' S	59° 16,50' W	5190,8	W 12	56,1	0,4	MultiCorer	MUC	at sea bottom	5213 m ausgesteckt
PS61/099-5	12.02.02	18:39	61° 6,94' S	59° 16,82' W	5190,4	W 12	59,9	0,5	MultiCorer	MUC	on deck	
PS61/099-6	12.02.02	18:50	61° 6,92' S	59° 15,91' W	5192,4	W 12	202,2	0,3	Large Box Corer	GKG	surface	
PS61/099-6	12.02.02	20:24	61° 6,89' S	59° 15,69' W	5194,0	W 9	271,3	0,0	Large Box Corer	GKG	at sea bottom	5200 m ausgesteckt
PS61/099-6	12.02.02	21:38	61° 6,94' S	59° 15,82' W	5193,2	W 14	2,9	0,2	Large Box Corer	GKG	on deck	
PS61/099-7	12.02.02	22:06	61° 6,95' S	59° 15,59' W	5194,0	W 14	159,3	0,2	MultiCorer	MUC	surface	
PS61/099-7	12.02.02	23:30	61° 7,06' S	59° 15,53' W	5194,3	WNW 13	121,4	0,7	MultiCorer	MUC	at sea bottom	
PS61/099-7	13.02.02	00:33	61° 7,14' S	59° 15,67' W	5193,5	WNW 13	197,2	1,7	MultiCorer	MUC	on deck	
PS61/099-8	13.02.02	00:46	61° 7,27' S	59° 15,97' W	5194,5	WNW 13	57,8	0,3	Large Box Corer	GKG	surface	
PS61/099-8	13.02.02	02:19	61° 7,26' S	59° 16,02' W	5193,4	NW 15	256,7	0,6	Large Box Corer	GKG	at sea bottom	5224 m
PS61/099-8	13.02.02	03:28	61° 7,39' S	59° 16,46' W	5200,0	NW 16	317,9	1,4	Large Box Corer	GKG	on deck	

PS61/100-1	13.02.02	06:17	61° 25,01' S	58° 53,90' W	2225,0	NW 15	145,3	1,2	Amphipod trap	ATC	to water	
PS61/101-1	13.02.02	09:14	61° 48,21' S	58° 37,49' W	504,5	WNW 11	309,8	3,5	Bottom trawl	BT	cod end to surface	
PS61/101-1	13.02.02	09:23	61° 47,82' S	58° 38,45' W	529,8	WNW 12	302,7	6,2	Bottom trawl	BT	turn	
PS61/101-1	13.02.02	09:33	61° 48,62' S	58° 38,30' W	490,4	WNW 10	102,9	6,8	Bottom trawl	BT	otter boards to surface	
PS61/101-1	13.02.02	09:52	61° 49,35' S	58° 35,12' W	398,5	WNW 11	123,0	3,8	Bottom trawl	BT	start trawling	
PS61/101-1	13.02.02	10:22	61° 49,90' S	58° 31,59' W	321,4	WNW 13	77,5	3,6	Bottom trawl	BT	stop trawling	
PS61/101-1	13.02.02	10:37	61° 49,99' S	58° 30,58' W	323,1	WNW 12	82,3	5,3	Bottom trawl	BT	turn	
PS61/101-1	13.02.02	10:42	61° 49,71' S	58° 30,55' W	333,3	WNW 12	288,0	3,8	Bottom trawl	BT	otter boards on deck	
PS61/101-1	13.02.02	10:52	61° 49,61' S	58° 31,24' W	323,9	WNW 12	22,3	1,2	Bottom trawl	BT	cod end on deck	
PS61/102-1	13.02.02	11:36	61° 47,43' S	58° 38,08' W	266,3	WNW 13	292,6	3,7	Bottom trawl	BT	cod end to surface	
PS61/102-1	13.02.02	11:43	61° 47,31' S	58° 38,89' W	274,2	WNW 11	290,1	5,5	Bottom trawl	BT	turn	
PS61/102-1	13.02.02	11:49	61° 46,94' S	58° 38,66' W	277,4	WNW 12	60,4	6,0	Bottom trawl	BT	otter boards to surface	
PS61/102-1	13.02.02	12:16	61° 46,00' S	58° 35,17' W	281,9	WNW 10	58,5	3,5	Bottom trawl	BT	start trawling	
PS61/102-1	13.02.02	12:46	61° 45,23' S	58° 31,97' W	284,7	WNW 10	64,8	3,2	Bottom trawl	BT	stop trawling	
PS61/102-1	13.02.02	13:08	61° 45,06' S	58° 30,85' W	286,7	WNW 10	64,0	5,4	Bottom trawl	BT	turn	
PS61/102-1	13.02.02	13:14	61° 44,77' S	58° 31,01' W	288,7	WNW 11	274,3	1,8	Bottom trawl	BT	otter boards on deck	
PS61/102-1	13.02.02	13:31	61° 44,94' S	58° 32,19' W	283,6	NW 10	230,0	1,5	Bottom trawl	BT	cod end on deck	
PS61/102-2	13.02.02	14:05	61° 45,81' S	58° 33,18' W	278,2	WNW 10	235,8	1,0	Sediment Profile Imaging	SEP	into water	
PS61/102-2	13.02.02	14:12	61° 45,83' S	58° 33,28' W	282,4	WNW 9	139,7	0,6	Sediment Profile Imaging	SEP	into deep	271 m cable
PS61/102-2	13.02.02	14:28	61° 45,89' S	58° 33,42' W	282,3	WNW 11	173,7	0,8	Sediment Profile Imaging	SEP	start rising	
PS61/102-2	13.02.02	14:36	61° 45,94' S	58° 33,43' W	277,7	WNW 12	244,0	0,6	Sediment Profile Imaging	SEP	on deck	
PS61/102-3	13.02.02	14:46	61° 45,98' S	58° 33,57' W	282,5	WNW 10	99,5	0,4	CTD - Seabird	CTD-R	surface	
PS61/102-3	13.02.02	14:54	61° 45,99' S	58° 33,76' W	277,3	WNW 11	273,4	1,0	CTD - Seabird	CTD-R	at depth	
PS61/102-3	13.02.02	15:02	61° 46,03' S	58° 33,89' W	281,1	WNW 9	207,4	0,2	CTD - Seabird	CTD-R	on deck	
PS61/103-1	13.02.02	16:46	61° 43,77' S	58° 4,20' W	291,9	WNW 13	287,9	5,7	Bottom trawl	BT	cod end to surface	
PS61/103-1	13.02.02	16:56	61° 43,57' S	58° 5,52' W	299,5	WNW 12	285,1	5,5	Bottom trawl	BT	turn	
PS61/103-1	13.02.02	17:04	61° 44,06' S	58° 5,58' W	292,4	W 13	116,3	5,9	Bottom trawl	BT	otter boards to surface	
PS61/103-1	13.02.02	17:33	61° 44,88' S	58° 1,54' W	256,5	W 13	106,9	3,6	Bottom trawl	BT	start trawling	900 m ausgesteckt
PS61/103-1	13.02.02	18:03	61° 45,54' S	57° 58,15' W	295,7	W 12	111,2	3,7	Bottom trawl	BT	stop trawling	
PS61/103-1	13.02.02	18:22	61° 45,67' S	57° 56,76' W	290,7	W 10	102,8	2,9	Bottom trawl	BT	turn	
PS61/103-1	13.02.02	18:32	61° 45,49' S	57° 56,23' W	295,0	W 13	260,0	1,6	Bottom trawl	BT	otter boards on deck	
PS61/103-1	13.02.02	18:42	61° 45,53' S	57° 56,97' W	294,7	W 11	251,9	2,6	Bottom trawl	BT	cod end on deck	
PS61/104-1	13.02.02	19:47	61° 38,74' S	57° 52,31' W	336,3	W 11	272,5	5,1	Bottom trawl	BT	cod end to surface	
PS61/104-1	13.02.02	19:55	61° 38,68' S	57° 53,16' W	337,5	W 10	276,9	3,8	Bottom trawl	BT	turn	
PS61/104-1	13.02.02	20:01	61° 39,03' S	57° 52,90' W	339,9	WNW 9	83,3	6,2	Bottom trawl	BT	otter boards to surface	
PS61/104-1	13.02.02	20:25	61° 39,01' S	57° 48,36' W	338,7	WNW 10	98,7	3,6	Bottom trawl	BT	start trawling	
PS61/104-1	13.02.02	20:55	61° 39,05' S	57° 44,39' W	384,3	W 8	93,8	3,6	Bottom trawl	BT	stop trawling	
PS61/104-1	13.02.02	21:17	61° 39,07' S	57° 42,99' W	400,8	WNW 7	91,8	4,9	Bottom trawl	BT	turn	
PS61/104-1	13.02.02	21:24	61° 38,73' S	57° 42,84' W	414,1	WNW 8	279,0	2,3	Bottom trawl	BT	otter boards on deck	

PS61/104-1	13.02.02	21:33	61° 38,74' S	57° 43,47' W	408,2	WNW 9	270,9	1,1	Bottom trawl	BT	cod end on deck	
PS61/105-1	14.02.02	01:03	61° 23,94' S	58° 50,92' W	2288,0	W 11	137,0	0,7	Sediment Profile Imaging	SEP	into water	mit CTD-R
PS61/105-1	14.02.02	01:43	61° 24,00' S	58° 50,83' W	2287,8	W 8	142,4	0,7	Sediment Profile Imaging	SEP	into deep	
PS61/105-1	14.02.02	02:09	61° 24,02' S	58° 51,07' W	2287,5	W 10	242,5	0,3	Sediment Profile Imaging	SEP	start rising	
PS61/105-1	14.02.02	02:40	61° 24,06' S	58° 50,95' W	2286,4	WSW 11	267,1	0,8	Sediment Profile Imaging	SEP	on deck	
PS61/105-2	14.02.02	02:51	61° 24,06' S	58° 50,96' W	2286,5	WSW 10	21,8	0,4	MultiCorer	MUC	surface	
PS61/105-2	14.02.02	03:33	61° 24,14' S	58° 51,15' W	2289,9	W 10	109,7	0,6	MultiCorer	MUC	at sea bottom	2256 m ausgesteckt
PS61/105-2	14.02.02	04:03	61° 24,21' S	58° 50,82' W	2281,7	W 10	10,3	0,4	MultiCorer	MUC	on deck	
PS61/105-3	14.02.02	04:17	61° 24,14' S	58° 50,64' W	2275,7	W 10	43,5	0,3	Large Box Corer	GKG	surface	
PS61/105-3	14.02.02	04:58	61° 24,07' S	58° 50,45' W	2273,2	W 10	358,3	0,2	Large Box Corer	GKG	at sea bottom	2242 m ausgesteckt
PS61/105-3	14.02.02	05:32	61° 23,97' S	58° 50,15' W	2272,6	W 11	30,4	1,1	Large Box Corer	GKG	on deck	
PS61/105-4	14.02.02	05:52	61° 23,89' S	58° 50,44' W	2279,2	W 11	79,6	1,0	MultiCorer	MUC	surface	
PS61/105-4	14.02.02	06:28	61° 23,81' S	58° 50,24' W	2274,0	W 11	170,1	0,8	MultiCorer	MUC	at sea bottom	2235 m ausgesteckt
PS61/105-4	14.02.02	06:57	61° 23,80' S	58° 50,09' W	2270,1	W 9	321,3	0,7	MultiCorer	MUC	on deck	
PS61/105-5	14.02.02	07:15	61° 23,76' S	58° 50,11' W	2268,3	WSW 9	299,9	0,4	Large Box Corer	GKG	surface	
PS61/105-5	14.02.02	07:58	61° 23,72' S	58° 50,04' W	2265,7	WSW 10	117,8	0,9	Large Box Corer	GKG	at sea bottom	2224 m
PS61/105-5	14.02.02	08:30	61° 23,80' S	58° 50,09' W	2269,4	WSW 10	4,4	0,3	Large Box Corer	GKG	on deck	
PS61/105-6	14.02.02	08:47	61° 23,80' S	58° 50,21' W	2272,5	WSW 10	119,3	0,1	MultiCorer	MUC	surface	
PS61/105-6	14.02.02	09:29	61° 23,73' S	58° 50,26' W	2274,0	WSW 11	233,8	0,5	MultiCorer	MUC	at sea bottom	2232 m
PS61/105-6	14.02.02	09:59	61° 23,67' S	58° 50,26' W	2269,4	WSW 9	340,9	0,9	MultiCorer	MUC	on deck	
PS61/105-7	14.02.02	10:32	61° 23,89' S	58° 50,61' W	2282,0	WSW 10	318,1	0,3	Epibenthos sledge	EBS	surface	
PS61/105-7	14.02.02	10:58	61° 23,85' S	58° 50,60' W	2280,8	WSW 10	338,1	0,1	Epibenthos sledge	EBS	on ground	
PS61/105-7	14.02.02	11:34	61° 24,16' S	58° 51,55' W	2297,9	WSW 9	228,2	1,7	Epibenthos sledge	EBS	start trawling	
PS61/105-7	14.02.02	11:44	61° 24,26' S	58° 51,83' W	2307,5	WSW 13	256,0	1,1	Epibenthos sledge	EBS	winch stop end trawling start hoisting geschleppt mit 0,9-1,1 kt über Grund	
PS61/105-7	14.02.02	12:20	61° 24,24' S	58° 51,55' W	2296,9	SW 11	115,1	0,9	Epibenthos sledge	EBS	from the bottom	
PS61/105-7	14.02.02	13:12	61° 24,56' S	58° 51,58' W	2282,7	WSW 11	127,4	0,5	Epibenthos sledge	EBS	on deck	
PS61/106-1	14.02.02	16:48	61° 38,35' S	57° 26,85' W	420,1	WSW 9	258,1	3,4	Bottom trawl	BT	cod end to surface	
PS61/106-1	14.02.02	16:55	61° 38,39' S	57° 27,71' W	420,2	WSW 11	278,2	2,4	Bottom trawl	BT	otter boards to surface	
PS61/106-1	14.02.02	17:28	61° 38,17' S	57° 32,66' W	424,0	SW 8	275,3	4,4	Bottom trawl	BT	start trawling	1300 m ausgesteckt
PS61/106-1	14.02.02	17:58	61° 38,05' S	57° 36,39' W	427,1	WSW 9	276,8	3,8	Bottom trawl	BT	stop trawling	
PS61/106-1	14.02.02	18:24	61° 37,82' S	57° 37,94' W	433,2	WSW 10	297,2	2,0	Bottom trawl	BT	otter boards on deck	
PS61/106-1	14.02.02	18:40	61° 37,60' S	57° 39,04' W	429,8	WSW 9	286,3	3,9	Bottom trawl	BT	cod end on deck	
PS61/107-1	14.02.02	20:15	61° 51,77' S	57° 14,01' W	262,0	SW 8	202,0	3,5	Bottom trawl	BT	cod end to surface	
PS61/107-1	14.02.02	20:23	61° 52,17' S	57° 14,37' W	231,4	SW 8	203,7	3,6	Bottom trawl	BT	turn	
PS61/107-1	14.02.02	20:26	61° 52,15' S	57° 14,86' W	226,4	SW 10	305,3	6,8	Bottom trawl	BT	otter boards to surface	
PS61/107-1	14.02.02	20:45	61° 51,25' S	57° 17,56' W	256,4	SW 9	302,1	3,2	Bottom trawl	BT	start trawling	
PS61/107-1	14.02.02	21:15	61° 50,36' S	57° 20,91' W	277,4	SW 9	300,3	3,0	Bottom trawl	BT	stop trawling	

PS61/107-1	14.02.02	21:31	61° 49,97' S	57° 21,09' W	281,2	SW 10	343,5	4,1	Bottom trawl	BT	otter boards on deck	
PS61/107-1	14.02.02	21:40	61° 49,60' S	57° 21,21' W	282,6	SW 9	332,0	2,6	Bottom trawl	BT	cod end on deck	
PS61/108-1	14.02.02	22:58	61° 39,60' S	56° 57,15' W	479,3	SW 11	239,1	2,7	Bottom trawl	BT	cod end to surface	
PS61/108-1	14.02.02	23:04	61° 39,76' S	56° 57,57' W	492,3	SW 11	228,6	2,2	Bottom trawl	BT	turn	
PS61/108-1	14.02.02	23:10	61° 39,76' S	56° 58,49' W	493,1	SW 10	291,7	4,4	Bottom trawl	BT	otter boards to surface	
PS61/108-1	14.02.02	23:36	61° 39,33' S	57° 2,85' W	470,1	SW 8	276,9	3,2	Bottom trawl	BT	start trawling	
PS61/108-1	15.02.02	00:06	61° 39,11' S	57° 6,68' W	465,3	SW 6	279,6	3,8	Bottom trawl	BT	stop trawling	
PS61/108-1	15.02.02	00:33	61° 38,87' S	57° 8,20' W	457,1	SW 4	278,5	2,7	Bottom trawl	BT	otter boards on deck	
PS61/108-1	15.02.02	00:42	61° 38,86' S	57° 8,90' W	457,4	SW 3	264,7	0,5	Bottom trawl	BT	cod end on deck	
PS61/109-1	15.02.02	01:07	61° 36,63' S	57° 10,98' W	459,1	WSW 8	285,8	4,3	Bottom trawl	BT	cod end to surface	
PS61/109-1	15.02.02	01:15	61° 36,51' S	57° 11,78' W	459,7	WSW 7	279,8	4,9	Bottom trawl	BT	otter boards to surface	
PS61/109-1	15.02.02	01:48	61° 36,01' S	57° 16,84' W	427,2	WSW 10	284,1	3,3	Bottom trawl	BT	start trawling	
PS61/109-1	15.02.02	02:08	61° 35,70' S	57° 19,16' W	435,2	WSW 9	289,3	2,7	Bottom trawl	BT	stop trawling	
PS61/109-1	15.02.02	02:31	61° 35,22' S	57° 19,95' W	425,9	WSW 9	320,4	2,5	Bottom trawl	BT	otter boards on deck	
PS61/109-1	15.02.02	02:42	61° 34,74' S	57° 20,16' W	439,0	WSW 11	345,5	2,4	Bottom trawl	BT	cod end on deck	
PS61/099-9	15.02.02	08:25	61° 6,96' S	59° 14,52' W	5195,0	WSW 9	273,8	0,6	Sediment Profile Imaging	SEP	into water	
PS61/099-9	15.02.02	09:35	61° 7,09' S	59° 14,36' W	5197,4	WSW 12	163,2	0,3	Sediment Profile Imaging	SEP	into deep	5201 m
PS61/099-9	15.02.02	10:07	61° 7,14' S	59° 14,50' W	5196,5	W 10	273,0	0,4	Sediment Profile Imaging	SEP	start rising	
PS61/099-9	15.02.02	11:09	61° 7,10' S	59° 14,22' W	5196,7	WSW 11	152,3	0,3	Sediment Profile Imaging	SEP	on deck	
PS61/099-10	15.02.02	11:23	61° 7,12' S	59° 14,31' W	5198,4	WSW 9	192,9	0,2	Large Box Corer	GKG	surface	
PS61/099-10	15.02.02	12:55	61° 7,05' S	59° 14,75' W	5196,8	WSW 9	284,5	0,3	Large Box Corer	GKG	at sea bottom	
PS61/099-10	15.02.02	14:02	61° 7,01' S	59° 15,05' W	5197,0	WSW 10	257,8	0,6	Large Box Corer	GKG	on deck	
PS61/100-1	15.02.02	15:57	61° 24,90' S	58° 53,42' W	2279,6	W 12	88,8	1,4	Amphipod trap	ATC	released	
PS61/100-1	15.02.02	16:44	61° 25,03' S	58° 53,45' W	2226,8	W 13	91,6	2,3	Amphipod trap	ATC	surfaced	
PS61/100-1	15.02.02	17:03	61° 24,80' S	58° 52,79' W	2279,2	W 12	70,2	1,7	Amphipod trap	ATC	on deck	
PS61/105-8	15.02.02	17:41	61° 22,80' S	58° 44,27' W	2246,3	W 13	221,7	1,9	Agassiz trawl	AGT	surface	
PS61/105-8	15.02.02	18:22	61° 23,10' S	58° 46,22' W	2270,0	WNW 11	258,6	2,1	Agassiz trawl	AGT	AGT on ground	
PS61/105-8	15.02.02	18:49	61° 23,16' S	58° 47,49' W	2228,2	WNW 12	261,6	1,4	Agassiz trawl	AGT	start trawl	3800 m ausgesteckt
PS61/105-8	15.02.02	19:19	61° 23,20' S	58° 47,92' W	2219,6	WNW 10	278,7	0,4	Agassiz trawl	AGT	Stop Trawl	
PS61/105-8	15.02.02	20:00	61° 23,16' S	58° 47,98' W	2217,2	WNW 13	272,2	0,8	Agassiz trawl	AGT	AGT off ground	
PS61/105-8	15.02.02	20:56	61° 23,19' S	58° 48,40' W	2225,7	WNW 12	221,8	0,4	Agassiz trawl	AGT	on deck	
PS61/110-1	16.02.02	09:13	61° 42,02' S	58° 53,12' W	355,2	WSW 15	250,2	8,5	Bottom trawl	BT	cod end to surface	
PS61/110-1	16.02.02	09:21	61° 42,24' S	58° 54,36' W	353,7	WSW 15	248,0	4,7	Bottom trawl	BT	turn	
PS61/110-1	16.02.02	09:26	61° 41,92' S	58° 54,65' W	361,9	WSW 12	48,6	7,0	Bottom trawl	BT	otter boards to surface	
PS61/110-1	16.02.02	09:51	61° 40,30' S	58° 51,28' W	371,7	WSW 15	44,4	3,2	Bottom trawl	BT	start trawling	
PS61/110-1	16.02.02	10:21	61° 39,14' S	58° 48,55' W	408,4	WSW 16	52,7	4,0	Bottom trawl	BT	stop trawling	1050 m
PS61/110-1	16.02.02	10:41	61° 38,71' S	58° 47,07' W	401,3	W 16	50,4	3,4	Bottom trawl	BT	turn	
PS61/110-1	16.02.02	10:47	61° 38,47' S	58° 47,45' W	413,0	W 15	253,9	3,6	Bottom trawl	BT	otter boards on deck	

PS61/110-1	16.02.02	10:56	61° 38,55' S	58° 48,10' W	421,2	WSW 15	268,0	1,5	Bottom trawl	BT	cod end on deck	
PS61/111-1	16.02.02	12:39	61° 53,24' S	59° 16,78' W	232,7	W 13	285,0	4,0	Bottom trawl	BT	cod end to surface	
PS61/111-1	16.02.02	12:47	61° 53,26' S	59° 17,76' W	240,7	W 13	263,6	5,3	Bottom trawl	BT	turn	
PS61/111-1	16.02.02	12:55	61° 52,77' S	59° 17,92' W	252,3	W 14	42,1	4,6	Bottom trawl	BT	otter boards to surface	
PS61/111-1	16.02.02	13:13	61° 51,83' S	59° 15,71' W	262,5	W 14	37,7	3,1	Bottom trawl	BT	start trawling	
PS61/111-1	16.02.02	13:43	61° 50,75' S	59° 12,64' W	269,9	W 14	47,3	3,2	Bottom trawl	BT	stop trawling	
PS61/111-1	16.02.02	14:02	61° 50,36' S	59° 11,30' W	271,1	W 12	58,4	3,2	Bottom trawl	BT	turn	
PS61/111-1	16.02.02	14:10	61° 49,95' S	59° 11,33' W	284,8	W 14	272,3	1,7	Bottom trawl	BT	otter boards on deck	
PS61/111-1	16.02.02	14:19	61° 49,96' S	59° 11,95' W	276,9	W 15	359,7	1,6	Bottom trawl	BT	cod end on deck	
PS61/111-2	16.02.02	14:43	61° 51,10' S	59° 13,08' W	265,2	W 14	283,0	1,0	CTD - Seabird	CTD-R	surface	
PS61/111-2	16.02.02	14:49	61° 51,07' S	59° 13,05' W	266,6	WSW 15	48,3	0,6	CTD - Seabird	CTD-R	at depth	
PS61/111-2	16.02.02	14:56	61° 51,05' S	59° 13,00' W	265,7	WSW 14	67,7	0,8	CTD - Seabird	CTD-R	on deck	250 m coiled down
PS61/112-1	16.02.02	17:23	61° 59,46' S	59° 15,32' W	128,4	W 16	263,5	4,4	Bottom trawl	BT	cod end to surface	
PS61/112-1	16.02.02	17:28	61° 59,46' S	59° 15,95' W	128,6	W 17	272,4	4,0	Bottom trawl	BT	turn	
PS61/112-1	16.02.02	17:36	61° 59,93' S	59° 15,80' W	126,3	W 15	90,9	5,7	Bottom trawl	BT	otter boards to surface	
PS61/112-1	16.02.02	17:47	61° 60,00' S	59° 13,95' W	133,9	WSW 13	95,6	2,8	Bottom trawl	BT	start trawling	
PS61/112-1	16.02.02	18:17	62° 0,02' S	59° 9,91' W	139,3	WSW 13	91,1	3,7	Bottom trawl	BT	stop trawling	450 m ausgesteckt
PS61/112-1	16.02.02	18:28	62° 0,04' S	59° 9,01' W	144,3	WSW 12	93,3	5,6	Bottom trawl	BT	turn	
PS61/112-1	16.02.02	18:36	62° 0,44' S	59° 8,99' W	136,6	WSW 12	259,1	3,0	Bottom trawl	BT	otter boards on deck	
PS61/112-1	16.02.02	18:45	62° 0,47' S	59° 9,79' W	137,2	WSW 11	267,0	3,4	Bottom trawl	BT	cod end on deck	
PS61/113-1	16.02.02	20:13	61° 58,51' S	59° 38,61' W	211,2	WSW 18	264,5	4,6	Bottom trawl	BT	cod end to surface	
PS61/113-1	16.02.02	20:19	61° 58,55' S	59° 39,37' W	215,0	WSW 17	255,4	3,8	Bottom trawl	BT	turn	
PS61/113-1	16.02.02	20:22	61° 58,81' S	59° 39,44' W	199,5	W 17	163,0	6,9	Bottom trawl	BT	otter boards to surface	
PS61/113-1	16.02.02	20:40	62° 0,24' S	59° 38,09' W	178,1	W 15	148,4	2,7	Bottom trawl	BT	start trawling	
PS61/113-1	16.02.02	21:07	62° 1,57' S	59° 35,95' W	174,1	W 13	133,9	2,8	Bottom trawl	BT	stop trawling	
PS61/113-1	16.02.02	21:21	62° 1,69' S	59° 34,92' W	173,9	WSW 12	113,4	3,5	Bottom trawl	BT	turn	
PS61/113-1	16.02.02	21:30	62° 2,22' S	59° 34,69' W	169,0	WSW 13	250,7	3,9	Bottom trawl	BT	otter boards on deck	
PS61/113-1	16.02.02	21:40	62° 2,30' S	59° 35,43' W	168,5	WSW 13	346,8	3,0	Bottom trawl	BT	cod end on deck	
PS61/114-1	17.02.02	02:44	61° 45,72' S	60° 45,47' W	2754,0	WSW 13	246,7	0,0	Amphipod trap	ATC	to water	
PS61/114-2	17.02.02	03:23	61° 42,56' S	60° 39,80' W	2869,0	WSW 14	245,5	2,6	Agassiz trawl	AGT	surface	
PS61/114-2	17.02.02	04:24	61° 43,40' S	60° 43,49' W	2916,0	WSW 13	233,9	2,4	Agassiz trawl	AGT	AGT on ground	
PS61/114-2	17.02.02	04:58	61° 44,11' S	60° 45,31' W	2849,0	WSW 16	229,8	0,4	Agassiz trawl	AGT	start trawl	5000 m ausgesteckt
PS61/114-2	17.02.02	05:28	61° 44,16' S	60° 46,00' W	2889,0	WSW 15	289,0	0,5	Agassiz trawl	AGT	Stop Trawl	Start Hieven
PS61/114-2	17.02.02	06:23	61° 44,13' S	60° 45,76' W	2879,0	WSW 17	259,3	1,0	Agassiz trawl	AGT	AGT off ground	
PS61/114-2	17.02.02	07:39	61° 44,09' S	60° 46,48' W	2917,0	WSW 17	241,2	0,0	Agassiz trawl	AGT	on deck	
PS61/114-3	17.02.02	08:10	61° 43,46' S	60° 44,06' W	2924,0	SW 17	173,5	0,4	Sediment Profile Imaging	SEP	into water	mit CTD-R
PS61/114-3	17.02.02	09:01	61° 43,54' S	60° 43,72' W	2905,0	SW 16	78,7	0,6	Sediment Profile Imaging	SEP	into deep	2882 m

PS61/114-3	17.02.02	09:27	61° 43,68' S	60° 43,85' W	2879,0	SW 16	281,8	0,3	Sediment Profile Imaging	SEP	start rising	
PS61/114-3	17.02.02	10:19	61° 43,71' S	60° 43,91' W	2879,0	SW 14	357,7	0,5	Sediment Profile Imaging	SEP	on deck	
PS61/115-1	17.02.02	14:19	62° 7,80' S	59° 27,37' W	78,9	WSW 8	265,9	4,1	Bottom trawl	BT	cod end to surface	
PS61/115-1	17.02.02	14:27	62° 7,74' S	59° 28,42' W	77,8	WSW 6	277,3	6,2	Bottom trawl	BT	turn	
PS61/115-1	17.02.02	14:32	62° 7,44' S	59° 29,02' W	80,2	WSW 9	324,4	6,2	Bottom trawl	BT	otter boards to surface	
PS61/115-1	17.02.02	14:40	62° 6,87' S	59° 29,65' W	91,6	WSW 11	322,3	3,4	Bottom trawl	BT	start trawling	
PS61/115-1	17.02.02	15:10	62° 5,20' S	59° 31,18' W	111,5	WSW 9	343,0	3,6	Bottom trawl	BT	stop trawling	
PS61/115-1	17.02.02	15:19	62° 4,86' S	59° 31,24' W	114,2	WSW 9	347,2	4,2	Bottom trawl	BT	turn	
PS61/115-1	17.02.02	15:23	62° 4,71' S	59° 31,75' W	115,0	WSW 9	257,8	3,4	Bottom trawl	BT	otter boards on deck	
PS61/115-1	17.02.02	15:34	62° 4,87' S	59° 32,58' W	110,5	WSW 11	247,2	2,9	Bottom trawl	BT	cod end on deck	
PS61/116-1	17.02.02	16:34	62° 1,20' S	59° 51,88' W	215,0	W 9	256,2	4,3	Bottom trawl	BT	cod end to surface	
PS61/116-1	17.02.02	16:42	62° 1,23' S	59° 52,95' W	224,4	W 10	279,2	4,5	Bottom trawl	BT	turn	
PS61/116-1	17.02.02	16:45	62° 1,02' S	59° 53,27' W	230,8	W 9	346,8	5,5	Bottom trawl	BT	otter boards to surface	
PS61/116-1	17.02.02	17:10	61° 59,35' S	59° 55,27' W	282,2	WSW 10	336,1	3,6	Bottom trawl	BT	start trawling	
PS61/116-1	17.02.02	17:33	61° 58,15' S	59° 56,79' W	311,0	W 10	334,8	2,9	Bottom trawl	BT	stop trawling	907 m ausgesteckt
PS61/116-1	17.02.02	17:55	61° 57,47' S	59° 57,15' W	316,1	W 10	335,8	4,9	Bottom trawl	BT	turn	
PS61/116-1	17.02.02	18:00	61° 57,32' S	59° 57,80' W	314,1	W 9	256,5	2,8	Bottom trawl	BT	otter boards on deck	
PS61/116-2	17.02.02	18:32	61° 58,69' S	59° 56,26' W	293,6	W 9	259,8	0,8	Sediment Profile Imaging	SEP	into water	
PS61/116-2	17.02.02	18:40	61° 58,72' S	59° 56,38' W	293,7	W 7	267,0	1,1	Sediment Profile Imaging	SEP	into deep	273 m ausgesteckt
PS61/116-2	17.02.02	18:59	61° 58,82' S	59° 56,66' W	293,2	W 6	236,5	0,6	Sediment Profile Imaging	SEP	start rising	
PS61/116-2	17.02.02	19:04	61° 58,84' S	59° 56,75' W	293,6	W 5	257,8	1,4	Sediment Profile Imaging	SEP	on deck	
PS61/116-3	17.02.02	19:16	61° 58,87' S	59° 57,02' W	293,6	WNW 4	228,6	0,5	CTD - Seabird	CTD-R	surface	
PS61/116-3	17.02.02	19:24	61° 58,91' S	59° 57,03' W	292,0	WNW 4	209,8	0,7	CTD - Seabird	CTD-R	at depth	280 m
PS61/116-3	17.02.02	19:31	61° 58,94' S	59° 57,08' W	288,2	WNW 4	268,5	0,9	CTD - Seabird	CTD-R	on deck	
PS61/114-4	17.02.02	22:19	61° 43,63' S	60° 42,33' W	2855,0	N 9	317,0	1,1	Epibenthos sledge	EBS	surface	
PS61/114-4	17.02.02	23:26	61° 43,59' S	60° 42,52' W	2858,0	N 10	254,4	0,3	Epibenthos sledge	EBS	on ground	
PS61/114-4	18.02.02	00:01	61° 43,54' S	60° 44,20' W	2914,0	NNW 9	264,7	1,5	Epibenthos sledge	EBS	start trawling winch stop	
PS61/114-4	18.02.02	00:11	61° 43,54' S	60° 44,55' W	2920,0	NNW 9	265,9	1,6	Epibenthos sledge	EBS	end trawling	
PS61/114-4	18.02.02	01:01	61° 43,51' S	60° 44,44' W	2921,0	WNW 9	289,0	0,1	Epibenthos sledge	EBS	start hoisting from the bottom	
PS61/114-4	18.02.02	02:08	61° 43,28' S	60° 44,39' W	2937,0	WNW 10	74,1	1,9	Epibenthos sledge	EBS	on deck	
PS61/114-5	18.02.02	02:38	61° 43,51' S	60° 43,61' W	2903,0	WNW 10	107,8	0,6	MultiCorer	MUC	surface	
PS61/114-5	18.02.02	03:29	61° 43,52' S	60° 44,13' W	2917,0	WNW 10	264,5	0,7	MultiCorer	MUC	at sea bottom	2878 m ausgesteckt
PS61/114-5	18.02.02	04:05	61° 43,49' S	60° 44,33' W	2923,0	WNW 9	298,3	0,4	MultiCorer	MUC	on deck	
PS61/114-6	18.02.02	04:25	61° 43,45' S	60° 43,66' W	2920,0	WNW 10	243,9	0,5	Large Box Corer	GKG	surface	
PS61/114-6	18.02.02	05:20	61° 43,55' S	60° 43,87' W	2905,0	WNW 10	29,2	0,3	Large Box Corer	GKG	at sea bottom	2873 m ausgesteckt
PS61/114-6	18.02.02	06:04	61° 43,57' S	60° 43,97' W	2903,0	WNW 11	82,5	0,8	Large Box Corer	GKG	on deck	
PS61/114-7	18.02.02	06:31	61° 43,52' S	60° 43,71' W	2906,0	WNW 11	76,1	0,2	MultiCorer	MUC	surface	
PS61/114-7	18.02.02	07:13	61° 43,48' S	60° 43,50' W	2900,0	WNW 10	98,8	0,6	MultiCorer	MUC	at sea bottom	2843 m
PS61/114-7	18.02.02	07:49	61° 43,39' S	60° 43,49' W	2913,0	WNW 10	57,4	0,6	MultiCorer	MUC	on deck	
PS61/114-8	18.02.02	08:09	61° 43,34' S	60° 43,49' W	2917,0	WNW 11	53,2	0,4	Large Box Corer	GKG	surface	

PS61/114-8	18.02.02	09:03	61° 43,46' S	60° 43,39' W	2896,0	WNW 10	293,7	0,3	Large Box Corer	GKG	at sea bottom	2847 m
PS61/114-8	18.02.02	09:50	61° 43,51' S	60° 43,29' W	2881,0	WNW 11	119,5	0,2	Large Box Corer	GKG	on deck	
PS61/117-1	18.02.02	12:38	62° 11,64' S	60° 30,94' W	189,7	W 12	285,0	2,5	Bottom trawl	BT	cod end to surface	
PS61/117-1	18.02.02	12:45	62° 11,54' S	60° 31,70' W	190,4	W 12	283,9	5,4	Bottom trawl	BT	turn	
PS61/117-1	18.02.02	12:51	62° 11,12' S	60° 31,75' W	196,4	W 12	37,5	4,5	Bottom trawl	BT	otter boards to surface	
PS61/117-1	18.02.02	13:05	62° 10,45' S	60° 30,09' W	198,9	WNW 11	63,3	3,4	Bottom trawl	BT	start trawling	
PS61/117-1	18.02.02	13:35	62° 9,66' S	60° 26,50' W	180,3	WNW 12	190,0	0,7	Bottom trawl	BT		
PS61/117-1	18.02.02	13:59	62° 9,81' S	60° 26,69' W	176,3	W 12	82,9	3,5	Bottom trawl	BT	turn	
PS61/117-1	18.02.02	14:07	62° 9,47' S	60° 26,56' W	184,3	W 12	285,0	2,7	Bottom trawl	BT	otter boards on deck	
PS61/117-1	18.02.02	14:22	62° 9,38' S	60° 27,47' W	199,8	W 12	308,8	2,6	Bottom trawl	BT	cod end on deck	
PS61/118-1	18.02.02	15:57	62° 18,90' S	60° 26,01' W	108,4	W 11	123,0	10,5	Bottom trawl	BT	cod end to surface	
PS61/118-1	18.02.02	16:10	62° 18,79' S	60° 26,33' W	112,2	W 11	255,5	3,7	Bottom trawl	BT	turn	
PS61/118-1	18.02.02	16:13	62° 18,89' S	60° 26,79' W	110,6	W 10	219,6	5,6	Bottom trawl	BT	otter boards to surface	
PS61/118-1	18.02.02	16:30	62° 19,57' S	60° 28,62' W	119,1	W 11	244,6	3,4	Bottom trawl	BT	start trawling	370 m ausgesteckt
PS61/118-1	18.02.02	17:00	62° 20,56' S	60° 32,01' W	136,6	W 12	230,5	2,5	Bottom trawl	BT	stop trawling	
PS61/118-1	18.02.02	17:15	62° 20,99' S	60° 32,88' W	149,0	W 12	263,9	3,1	Bottom trawl	BT	otter boards on deck	
PS61/118-1	18.02.02	17:23	62° 21,08' S	60° 33,38' W	179,6	W 12	242,6	2,2	Bottom trawl	BT	cod end on deck	
PS61/119-1	18.02.02	18:31	62° 23,29' S	60° 48,62' W	92,0	W 12	260,9	3,6	Bottom trawl	BT	cod end to surface	
PS61/119-1	18.02.02	18:41	62° 23,22' S	60° 49,83' W	90,8	W 12	282,0	3,7	Bottom trawl	BT	turn	
PS61/119-1	18.02.02	18:49	62° 23,59' S	60° 49,97' W	91,0	W 10	105,5	5,0	Bottom trawl	BT	otter boards to surface	
PS61/119-1	18.02.02	18:58	62° 23,84' S	60° 48,50' W	88,7	W 11	114,8	3,2	Bottom trawl	BT	start trawling	
PS61/119-1	18.02.02	19:28	62° 24,30' S	60° 44,68' W	92,8	W 14	107,4	3,5	Bottom trawl	BT	stop trawling	
PS61/119-1	18.02.02	19:37	62° 24,39' S	60° 43,91' W	99,1	W 13	98,5	2,4	Bottom trawl	BT	turn	
PS61/119-1	18.02.02	19:46	62° 24,05' S	60° 44,03' W	97,8	WSW 14	255,1	3,8	Bottom trawl	BT	otter boards on deck	
PS61/119-1	18.02.02	19:55	62° 24,24' S	60° 44,81' W	92,4	WSW 14	228,4	2,5	Bottom trawl	BT	cod end on deck	
PS61/120-1	18.02.02	21:31	62° 12,76' S	60° 44,44' W	495,5	WSW 10	219,5	1,1	Bottom trawl	BT	cod end to surface	
PS61/120-1	18.02.02	21:38	62° 12,81' S	60° 45,25' W	448,3	WSW 11	271,8	4,7	Bottom trawl	BT	turn	
PS61/120-1	18.02.02	21:40	62° 12,71' S	60° 45,57' W	444,1	WSW 11	331,2	6,4	Bottom trawl	BT	otter boards to surface	
PS61/120-1	18.02.02	22:06	62° 10,73' S	60° 48,05' W	412,6	WSW 12	317,1	4,1	Bottom trawl	BT	start trawling	1200 m
PS61/120-1	18.02.02	22:27	62° 9,63' S	60° 49,55' W	472,0	WSW 13	327,0	4,1	Bottom trawl	BT	stop trawling	
PS61/120-1	18.02.02	22:51	62° 8,63' S	60° 49,43' W	704,6	WSW 12	22,1	3,5	Bottom trawl	BT	turn	
PS61/120-1	18.02.02	22:57	62° 8,36' S	60° 49,97' W	220,3	WSW 12	263,3	2,9	Bottom trawl	BT	otter boards on deck	
PS61/120-1	18.02.02	23:05	62° 8,44' S	60° 50,47' W	268,4	WSW 11	265,2	1,8	Bottom trawl	BT	cod end on deck	
PS61/120-2	18.02.02	23:28	62° 9,97' S	60° 49,02' W	425,9	WSW 10	169,8	0,5	CTD - Seabird	CTD-R	surface	
PS61/120-2	18.02.02	23:37	62° 9,96' S	60° 48,98' W	426,0	WSW 13	176,1	0,3	CTD - Seabird	CTD-R	at depth	
PS61/120-2	18.02.02	23:46	62° 10,00' S	60° 48,97' W	421,9	WSW 12	291,4	0,3	CTD - Seabird	CTD-R	on deck	415 m
PS61/120-3	18.02.02	23:52	62° 10,00' S	60° 48,94' W	421,6	WSW 12	105,4	0,2	Sediment Profile Imaging	SEP	into water	
PS61/120-3	18.02.02	23:59	62° 10,01' S	60° 48,95' W	422,5	SW 12	94,0	0,3	Sediment Profile Imaging	SEP	into deep	

PS61/120-3	19.02.02	00:32	62° 10,02' S	60° 48,87' W	419,2	SW 10	263,0	1,2	Sediment Profile Imaging	SEP	start rising	
PS61/120-3	19.02.02	00:42	62° 10,07' S	60° 48,93' W	422,3	SW 11	240,8	0,6	Sediment Profile Imaging	SEP	on deck	
PS61/114-9	19.02.02	02:53	61° 43,56' S	60° 43,51' W	2877,1	SW 13	60,6	0,7	MultiCorer	MUC	surface	
PS61/114-9	19.02.02	03:39	61° 43,58' S	60° 43,22' W	2875,3	SW 11	66,7	0,6	MultiCorer	MUC	at sea bottom	2833 m ausgesteckt
PS61/114-9	19.02.02	04:19	61° 43,59' S	60° 43,06' W	2872,3	SW 10	252,0	0,2	MultiCorer	MUC	on deck	
PS61/114-10	19.02.02	04:52	61° 42,25' S	60° 38,92' W	2865,9	SW 10	184,4	1,9	Agassiz trawl	AGT	surface	
PS61/114-10	19.02.02	05:52	61° 43,08' S	60° 41,18' W	2830,9	WSW 10	208,7	1,1	Agassiz trawl	AGT	AGT on ground	
PS61/114-10	19.02.02	06:29	61° 43,70' S	60° 42,62' W	2856,2	WSW 10	238,8	1,1	Agassiz trawl	AGT	start trawl	5000 m ausgesteckt
PS61/114-10	19.02.02	06:59	61° 43,81' S	60° 43,15' W	2852,9	SW 9	258,8	1,5	Agassiz trawl	AGT	Stop Trawl	
PS61/114-10	19.02.02	07:52	61° 43,76' S	60° 43,20' W	2862,8	SW 9	126,3	0,2	Agassiz trawl	AGT	AGT off ground	
PS61/114-10	19.02.02	09:04	61° 44,10' S	60° 43,72' W	2826,6	WSW 8	137,1	0,7	Agassiz trawl	AGT	on deck	
PS61/114-1	19.02.02	09:40	61° 45,54' S	60° 45,13' W	2743,4	WSW 10	296,4	0,1	Amphipod trap	ATC	released	
PS61/114-1	19.02.02	10:52	61° 45,65' S	60° 45,34' W	2742,3	W 8	64,3	1,2	Amphipod trap	ATC	surfaced	
PS61/114-1	19.02.02	11:09	61° 45,06' S	60° 45,55' W	2775,7	WSW 7	45,5	2,1	Amphipod trap	ATC	on deck	
PS61/121-1	19.02.02	14:47	62° 25,58' S	61° 20,17' W	284,8	NNW 7	317,1	4,1	Bottom trawl	BT	cod end to surface	
PS61/121-1	19.02.02	14:54	62° 25,30' S	61° 20,74' W	291,9	NNW 6	325,1	3,3	Bottom trawl	BT	otter boards to surface	
PS61/121-1	19.02.02	15:23	62° 23,55' S	61° 24,20' W	363,0	NNW 8	312,7	3,6	Bottom trawl	BT	start trawling	
PS61/121-1	19.02.02	15:49	62° 22,50' S	61° 26,58' W	297,6	N 7	307,3	3,1	Bottom trawl	BT	stop trawling	1050 m ausgesteckt
PS61/121-1	19.02.02	16:08	62° 22,12' S	61° 27,66' W	272,1	N 8	312,7	1,4	Bottom trawl	BT	otter boards on deck	
PS61/121-1	19.02.02	16:16	62° 21,96' S	61° 28,16' W	264,8	N 8	317,2	1,7	Bottom trawl	BT	cod end on deck	
PS61/122-1	19.02.02	18:52	62° 30,62' S	61° 25,09' W	110,2	NW 12	329,9	5,3	Bottom trawl	BT	cod end to surface	
PS61/122-1	19.02.02	19:00	62° 30,18' S	61° 25,64' W	112,1	NW 12	327,7	4,2	Bottom trawl	BT	turn	
PS61/122-1	19.02.02	19:03	62° 29,99' S	61° 25,64' W	114,7	NW 11	39,9	4,7	Bottom trawl	BT	otter boards to surface	
PS61/122-1	19.02.02	19:14	62° 29,30' S	61° 24,66' W	122,0	NW 11	31,5	3,1	Bottom trawl	BT	start trawling	350 m
PS61/122-1	19.02.02	19:43	62° 27,98' S	61° 22,00' W	147,7	WNW 10	45,9	3,8	Bottom trawl	BT	stop trawling	
PS61/122-1	19.02.02	19:51	62° 27,70' S	61° 21,42' W	154,6	WNW 9	30,2	3,1	Bottom trawl	BT	otter boards on deck	
PS61/122-1	19.02.02	20:00	62° 27,46' S	61° 20,75' W	177,0	WNW 9	52,6	3,2	Bottom trawl	BT	cod end on deck	
PS61/123-1	19.02.02	22:01	62° 34,20' S	61° 48,76' W	165,4	WNW 9	281,1	3,0	Bottom trawl	BT	cod end to surface	
PS61/123-1	19.02.02	22:07	62° 34,15' S	61° 49,39' W	169,5	WNW 9	281,3	4,3	Bottom trawl	BT	turn	
PS61/123-1	19.02.02	22:11	62° 34,35' S	61° 49,85' W	171,0	WNW 9	176,8	6,6	Bottom trawl	BT	otter boards to surface	
PS61/123-1	19.02.02	22:28	62° 35,74' S	61° 50,11' W	178,4	WNW 8	183,0	4,0	Bottom trawl	BT	start trawling	
PS61/123-1	19.02.02	22:44	62° 36,82' S	61° 50,76' W	183,4	WNW 10	194,6	3,2	Bottom trawl	BT		
PS61/123-1	19.02.02	23:07	62° 36,76' S	61° 50,18' W	175,0	WNW 9	150,7	2,7	Bottom trawl	BT	otter boards on deck	
PS61/123-1	19.02.02	23:20	62° 37,26' S	61° 49,43' W	164,4	WNW 9	173,3	3,8	Bottom trawl	BT	cod end on deck	
PS61/124-1	21.02.02	09:20	62° 24,87' S	55° 46,05' W	226,0	W 18	278,4	1,7	Bottom trawl	BT	cod end to surface	
PS61/124-1	21.02.02	09:29	62° 24,91' S	55° 46,91' W	244,7	W 15	262,4	5,0	Bottom trawl	BT	turn	
PS61/124-1	21.02.02	09:35	62° 25,37' S	55° 46,64' W	231,9	W 14	140,0	7,5	Bottom trawl	BT	otter boards on deck	
PS61/124-1	21.02.02	09:52	62° 26,28' S	55° 44,36' W	220,6	W 14	121,6	4,3	Bottom trawl	BT	start trawling	600 m

PS61/124-1	21.02.02	10:22	62° 27,43' S	55° 41,36' W	217,4	W 16	151,5	3,5	Bottom trawl	BT	stop trawling	
PS61/124-1	21.02.02	10:35	62° 27,57' S	55° 40,20' W	218,1	W 13	76,8	3,7	Bottom trawl	BT	turn	
PS61/124-1	21.02.02	10:42	62° 27,84' S	55° 40,11' W	218,7	W 13	270,4	3,1	Bottom trawl	BT	otter boards on deck	
PS61/124-1	21.02.02	10:51	62° 27,85' S	55° 40,81' W	211,6	W 14	264,4	2,1	Bottom trawl	BT	cod end on deck	
PS61/125-1	21.02.02	11:34	62° 33,23' S	55° 40,97' W	160,7	W 12	265,3	2,7	Bottom trawl	BT	cod end to surface	
PS61/125-1	21.02.02	11:42	62° 33,15' S	55° 42,02' W	166,3	W 11	277,8	5,7	Bottom trawl	BT	turn	
PS61/125-1	21.02.02	11:49	62° 33,56' S	55° 42,27' W	159,7	WNW 13	135,7	4,4	Bottom trawl	BT	otter boards to surface	
PS61/125-1	21.02.02	12:09	62° 34,63' S	55° 39,96' W	157,6	WNW 12	136,6	3,7	Bottom trawl	BT	start trawling	
PS61/125-1	21.02.02	12:39	62° 35,98' S	55° 36,97' W	167,2	WNW 11	127,2	3,6	Bottom trawl	BT	stop trawling	
PS61/125-1	21.02.02	12:51	62° 36,19' S	55° 36,34' W	167,4	WNW 12	128,9	3,7	Bottom trawl	BT	turn	
PS61/125-1	21.02.02	13:12	62° 37,14' S	55° 37,36' W	159,6	WNW 14	192,0	2,6	Bottom trawl	BT	cod end on deck	
PS61/125-2	21.02.02	13:33	62° 37,19' S	55° 38,67' W	159,1	W 10	248,6	0,9	Sediment Profile Imaging	SEP	into water	
PS61/125-2	21.02.02	13:40	62° 37,19' S	55° 38,76' W	160,8	W 9	191,0	0,4	Sediment Profile Imaging	SEP	into deep	150 m
PS61/125-2	21.02.02	14:12	62° 37,22' S	55° 38,85' W	157,9	WNW 13	293,1	0,7	Sediment Profile Imaging	SEP	start rising	153 m
PS61/125-2	21.02.02	14:16	62° 37,22' S	55° 38,97' W	157,7	WNW 14	260,1	1,2	Sediment Profile Imaging	SEP	on deck	
PS61/125-3	21.02.02	14:23	62° 37,25' S	55° 39,17' W	160,9	W 14	209,7	0,8	CTD - Seabird	CTD-R	surface	
PS61/125-3	21.02.02	14:30	62° 37,27' S	55° 39,19' W	162,1	W 14	209,9	0,4	CTD - Seabird	CTD-R	at depth	150 m
PS61/125-3	21.02.02	14:34	62° 37,27' S	55° 39,25' W	160,0	W 14	304,8	0,9	CTD - Seabird	CTD-R	on deck	
PS61/126-1	21.02.02	15:31	62° 32,89' S	55° 26,38' W	152,1	WNW 12	281,2	3,3	Bottom trawl	BT	cod end to surface	
PS61/126-1	21.02.02	15:38	62° 32,89' S	55° 27,29' W	166,9	WNW 13	255,3	5,6	Bottom trawl	BT	turn	
PS61/126-1	21.02.02	15:43	62° 33,25' S	55° 27,59' W	162,5	WNW 11	148,8	5,1	Bottom trawl	BT	otter boards to surface	
PS61/126-1	21.02.02	15:57	62° 34,24' S	55° 26,67' W	160,1	WNW 11	141,0	3,4	Bottom trawl	BT	start trawling	500 m ausgesteckt
PS61/126-1	21.02.02	16:27	62° 35,48' S	55° 23,61' W	151,3	WNW 11	129,8	4,0	Bottom trawl	BT	stop trawling	
PS61/126-1	21.02.02	16:40	62° 35,78' S	55° 22,74' W	150,2	WNW 9	129,1	4,3	Bottom trawl	BT	turn	
PS61/126-1	21.02.02	16:49	62° 35,47' S	55° 22,61' W	145,3	WNW 10	296,3	3,3	Bottom trawl	BT	otter boards on deck	
PS61/126-1	21.02.02	16:57	62° 35,36' S	55° 23,07' W	149,8	WNW 10	302,5	3,2	Bottom trawl	BT	cod end on deck	
PS61/127-1	21.02.02	17:40	62° 41,87' S	55° 22,81' W	302,7	NW 8	326,7	6,7	Bottom trawl	BT	cod end to surface	
PS61/127-1	21.02.02	17:46	62° 41,59' S	55° 23,48' W	282,9	WNW 8	305,3	3,0	Bottom trawl	BT	turn	
PS61/127-1	21.02.02	17:53	62° 41,76' S	55° 24,17' W	212,1	NW 6	146,7	4,7	Bottom trawl	BT	otter boards to surface	
PS61/127-1	21.02.02	18:10	62° 42,74' S	55° 22,18' W	204,2	NW 5	137,4	3,9	Bottom trawl	BT	start trawling	
PS61/127-1	21.02.02	18:32	62° 43,78' S	55° 20,09' W	294,9	NW 6	138,6	3,8	Bottom trawl	BT	stop trawling	620 m ausgesteckt
PS61/127-1	21.02.02	18:45	62° 44,13' S	55° 19,47' W	280,9	WNW 7	140,4	2,5	Bottom trawl	BT	otter boards on deck	
PS61/127-1	21.02.02	18:54	62° 44,39' S	55° 18,94' W	283,4	NW 7	135,3	2,6	Bottom trawl	BT	cod end on deck	
PS61/128-1	21.02.02	20:21	62° 44,53' S	55° 28,04' W	160,1	WNW 9	270,2	2,4	Bottom trawl	BT	cod end to surface	
PS61/128-1	21.02.02	20:27	62° 44,30' S	55° 28,65' W	166,8	WNW 10	321,2	3,3	Bottom trawl	BT	otter boards to surface	
PS61/128-1	21.02.02	20:42	62° 43,31' S	55° 30,25' W	183,2	WNW 10	336,3	3,7	Bottom trawl	BT	start trawling	
PS61/128-1	21.02.02	21:12	62° 41,37' S	55° 30,62' W	205,3	WNW 11	5,0	3,9	Bottom trawl	BT	stop trawling	500 m ausgesteckt

PS61/128-1	21.02.02	21:22	62° 41,01' S	55° 30,54' W	244,5	W 12	7,0	3,3	Bottom trawl	BT	otter boards on deck	
PS61/128-1	21.02.02	21:33	62° 40,55' S	55° 29,92' W	272,9	WNW 12	31,1	2,4	Bottom trawl	BT	cod end on deck	
PS61/129-1	22.02.02	20:52	59° 52,25' S	59° 57,81' W	3608,0	WSW 8	94,4	0,6	Sediment Profile Imaging	SEP	into water	mit CTD-R
PS61/129-1	22.02.02	22:06	59° 52,39' S	59° 57,84' W	3595,0	WSW 8	237,8	0,8	Sediment Profile Imaging	SEP	into deep	
PS61/129-1	22.02.02	22:34	59° 52,44' S	59° 57,81' W	3590,0	WSW 11	255,6	0,8	Sediment Profile Imaging	SEP	start rising	
PS61/129-1	22.02.02	23:32	59° 52,48' S	59° 58,03' W	3594,0	WSW 9	249,3	0,7	Sediment Profile Imaging	SEP	on deck	mit CTD - R
PS61/129-2	22.02.02	23:54	59° 52,53' S	59° 57,08' W	3613,0	WSW 10	168,8	0,3	Epibenthos sledge	EBS	surface	
PS61/129-2	23.02.02	01:01	59° 52,55' S	59° 57,26' W	3631,0	WSW 8	129,6	0,1	Epibenthos sledge	EBS	on ground	
PS61/129-2	23.02.02	01:32	59° 52,21' S	59° 58,75' W	3643,0	WSW 9	326,4	0,3	Epibenthos sledge	EBS	start trawling	
PS61/129-2	23.02.02	01:42	59° 52,15' S	59° 59,03' W	3622,0	WSW 9	312,0	1,2	Epibenthos sledge	EBS	winch stop end trawling	5300 m
PS61/129-2	23.02.02	02:39	59° 52,20' S	59° 58,63' W	3637,0	WSW 9	127,2	0,6	Epibenthos sledge	EBS	start hoisting from the bottom	
PS61/129-2	23.02.02	04:01	59° 51,99' S	59° 58,28' W	3592,0	WSW 6	28,0	0,6	Epibenthos sledge	EBS	on deck	
PS61/129-3	23.02.02	04:36	59° 53,17' S	59° 52,81' W	3997,0	WSW 7	293,2	1,4	Agassiz trawl	AGT	surface	
PS61/129-3	23.02.02	05:45	59° 52,50' S	59° 56,59' W	3688,0	SSW 6	295,3	2,2	Agassiz trawl	AGT	AGT on ground	
PS61/129-3	23.02.02	06:26	59° 52,36' S	59° 58,75' W	3644,0	SSW 9	272,2	1,5	Agassiz trawl	AGT	start trawl	6000 m ausgesteckt
PS61/129-3	23.02.02	06:56	59° 52,18' S	59° 59,21' W	3619,0	SSW 11	344,3	0,8	Agassiz trawl	AGT	Stop Trawl	Start Hieven
PS61/129-3	23.02.02	07:55	59° 51,56' S	59° 59,08' W	3562,0	S 12	15,3	0,7	Agassiz trawl	AGT	AGT off ground	
PS61/129-3	23.02.02	09:33	59° 51,52' S	59° 57,58' W	3510,0	SSW 10	189,9	3,1	Agassiz trawl	AGT	on deck	
PS61/129-4	23.02.02	09:46	59° 52,31' S	59° 58,10' W	3614,0	SSW 11	221,5	0,3	Large Box Corer	GKG	surface	
PS61/129-4	23.02.02	10:57	59° 52,40' S	59° 57,88' W	3598,0	SSW 11	239,9	0,3	Large Box Corer	GKG	at sea bottom	
PS61/129-4	23.02.02	11:52	59° 52,34' S	59° 57,79' W	3607,0	SSW 14	288,9	0,8	Large Box Corer	GKG	on deck	
PS61/129-5	23.02.02	12:11	59° 52,40' S	59° 57,86' W	3595,0	SSW 12	283,0	0,6	MultiCorer	MUC	surface	
PS61/129-5	23.02.02	13:07	59° 52,39' S	59° 57,78' W	3597,0	SSW 14	178,9	0,7	MultiCorer	MUC	at sea bottom	3555 m
PS61/129-5	23.02.02	13:54	59° 52,47' S	59° 57,47' W	3615,0	SSW 13	112,6	0,8	MultiCorer	MUC	on deck	
PS61/129-6	23.02.02	14:11	59° 52,39' S	59° 57,90' W	3599,0	SSW 13	272,2	0,5	Large Box Corer	GKG	surface	
PS61/129-6	23.02.02	15:15	59° 52,41' S	59° 57,69' W	3601,0	SSW 14	202,2	0,2	Large Box Corer	GKG	at sea bottom	3562 m ausgesteckt
PS61/129-6	23.02.02	16:12	59° 52,49' S	59° 57,32' W	3617,0	SSW 14	258,3	0,2	Large Box Corer	GKG	on deck	
PS61/129-7	23.02.02	16:30	59° 52,32' S	59° 57,86' W	3605,0	SSW 12	10,3	0,3	MultiCorer	MUC	surface	
PS61/129-7	23.02.02	17:29	59° 52,30' S	59° 57,63' W	3614,0	SSW 11	167,6	0,6	MultiCorer	MUC	at sea bottom	3551 m ausgesteckt
PS61/129-7	23.02.02	18:15	59° 52,45' S	59° 57,22' W	3591,0	SSW 11	99,0	1,0	MultiCorer	MUC	on deck	
PS61/130-1	03.03.02	19:22	60° 30,25' S	56° 4,55' W	3953,7	N 12	123,1	1,6	Amphipod trap	ATC	released	Ex 43-3
PS61/130-2	03.03.02	19:38	60° 30,25' S	56° 5,02' W	3960,2	NNW 12	30,2	0,9	CTD/rosette water sampler	CTD/RO	surface	
PS61/130-2	03.03.02	19:47	60° 30,20' S	56° 4,88' W	3958,8	NNW 11	72,3	0,6	CTD/rosette water sampler	CTD/RO	at depth	
PS61/130-2	03.03.02	19:53	60° 30,16' S	56° 4,78' W	3958,1	NNW 11	81,0	0,9	CTD/rosette water sampler	CTD/RO	on deck	
PS61/130-1	03.03.02	20:12	60° 30,26' S	56° 4,94' W	3958,2	N 9	280,8	0,6	Amphipod trap	ATC	Trap not sighted	
PS61/131-1	05.03.02	09:28	65° 17,84' S	51° 35,21' W	3076,0	E 5	300,0	0,6	Amphipod trap	ATC	to water	Radarreflektor, Gelbe Flagge
PS61/131-2	05.03.02	09:59	65° 19,49' S	51° 32,28' W	3054,0	ENE 6	54,5	0,9	Sediment Profile Imaging	SEP	into water	
PS61/131-2	05.03.02	10:15	65° 19,45' S	51° 32,10' W	3053,0	ENE 5	235,8	0,2	Sediment Profile Imaging	SEP	50 m CTD Seabird	
PS61/131-2	05.03.02	10:57	65° 19,44' S	51° 32,40' W	3054,0	E 5	290,6	0,2	Sediment Profile Imaging	SEP	into deep	
PS61/131-2	05.03.02	11:32	65° 19,40' S	51° 32,60' W	3055,0	E 5	282,3	0,3	Sediment Profile Imaging	SEP	start rising	
PS61/131-2	05.03.02	12:08	65° 19,39' S	51° 33,49' W	3051,0	ENE 6	286,0	0,4	Sediment Profile Imaging	SEP	CTD on deck	
PS61/131-2	05.03.02	12:16	65° 19,30' S	51° 33,43' W	3051,0	ENE 6	24,5	0,8	Sediment Profile Imaging	SEP	on deck	

PS61/131-3	05.03.02	12:32	65° 19,20' S	51° 32,37' W	3055,0	ENE 6	282,6	0,2	Epibenthos sledge	EBS	surface	
PS61/131-3	05.03.02	13:42	65° 19,19' S	51° 32,54' W	3055,0	ENE 6	172,1	0,3	Epibenthos sledge	EBS	on ground	
PS61/131-3	05.03.02	14:16	65° 19,83' S	51° 31,62' W	3049,0	ENE 5	143,5	1,4	Epibenthos sledge	EBS	start trawling	
PS61/131-3	05.03.02	14:26	65° 19,95' S	51° 31,41' W	3050,0	ENE 5	145,1	1,1	Epibenthos sledge	EBS	winch stop end trawling	
PS61/131-3	05.03.02	15:19	65° 19,99' S	51° 31,23' W	3050,0	E 6	110,8	0,0	Epibenthos sledge	EBS	start hoisting from the bottom	
PS61/131-3	05.03.02	16:30	65° 20,10' S	51° 30,73' W	3053,0	E 5	110,9	0,4	Epibenthos sledge	EBS	on deck	
PS61/131-4	05.03.02	17:06	65° 17,88' S	51° 38,20' W	3053,0	ENE 5	129,1	2,0	Agassiz trawl	AGT	surface	
PS61/131-4	05.03.02	18:00	65° 18,75' S	51° 35,05' W	3048,0	ENE 5	107,0	2,2	Agassiz trawl	AGT	AGT on ground	
PS61/131-4	05.03.02	18:39	65° 19,47' S	51° 32,55' W	3049,0	ENE 4	118,0	1,3	Agassiz trawl	AGT	start trawl	
PS61/131-4	05.03.02	19:11	65° 19,78' S	51° 31,41' W	3052,0	ENE 3	123,6	0,6	Agassiz trawl	AGT	Stop Trawl	
PS61/131-4	05.03.02	20:09	65° 19,81' S	51° 31,47' W	3054,0	ENE 2	88,5	0,5	Agassiz trawl	AGT	AGT off ground	
PS61/131-4	05.03.02	21:30	65° 19,77' S	51° 31,21' W	3054,0	ENE 3	170,2	0,1	Agassiz trawl	AGT	on deck	
PS61/131-5	05.03.02	21:55	65° 19,69' S	51° 31,45' W	3053,0	ENE 3	26,7	0,5	CTD/rosette water sampler	CTD/RO	surface	
PS61/131-5	05.03.02	22:07	65° 19,60' S	51° 31,35' W	3058,0	ENE 3	41,5	0,7	CTD/rosette water sampler	CTD/RO	at depth	EL32.1 400 m
PS61/131-5	05.03.02	22:14	65° 19,54' S	51° 31,28' W	3059,0	ENE 4	313,1	0,2	CTD/rosette water sampler	CTD/RO	on deck	
PS61/131-6	05.03.02	22:38	65° 19,52' S	51° 32,26' W	3054,0	ENE 3	277,7	0,3	Box corer	BC	surface	
PS61/131-6	05.03.02	23:35	65° 19,37' S	51° 32,26' W	3051,7	ENE 3	8,1	0,2	Box corer	BC	at sea bottom	
PS61/131-6	06.03.02	00:20	65° 19,24' S	51° 32,24' W	3053,6	ENE 3	25,5	0,5	Box corer	BC	on deck	
PS61/131-7	06.03.02	00:52	65° 19,68' S	51° 30,92' W	3053,2	ENE 3	353,5	0,1	MultiCorer	MUC	surface	
PS61/131-7	06.03.02	01:49	65° 19,45' S	51° 30,97' W	3057,2	NE 4	221,2	0,4	MultiCorer	MUC	at sea bottom	
PS61/131-7	06.03.02	02:36	65° 19,23' S	51° 30,88' W	3059,6	ENE 3	20,2	1,2	MultiCorer	MUC	on deck	
PS61/131-8	06.03.02	03:08	65° 18,80' S	51° 31,06' W	3065,3	ENE 4	26,2	1,0	Large Box Corer	GKG	surface	
PS61/131-8	06.03.02	04:00	65° 18,65' S	51° 30,91' W	3068,3	ENE 4	259,2	0,2	Large Box Corer	GKG	at sea bottom	3013 m ausgesteckt
PS61/131-8	06.03.02	04:47	65° 18,68' S	51° 31,48' W	3065,2	NE 3	295,2	0,4	Large Box Corer	GKG	on deck	
PS61/131-9	06.03.02	05:12	65° 18,68' S	51° 31,85' W	3062,8	ENE 3	259,1	0,4	MultiCorer	MUC	surface	
PS61/131-9	06.03.02	06:08	65° 18,55' S	51° 31,95' W	3064,8	NE 3	62,9	0,0	MultiCorer	MUC	at sea bottom	3006 m ausgesteckt
PS61/131-9	06.03.02	06:53	65° 18,45' S	51° 32,29' W	3064,5	NNE 4	63,2	0,0	MultiCorer	MUC	on deck	
PS61/131-10	06.03.02	07:07	65° 18,44' S	51° 32,40' W	3064,1	NNE 3	269,1	0,2	Sediment Profile Imaging	SEP	into water	
PS61/131-10	06.03.02	07:59	65° 18,22' S	51° 32,33' W	3068,4	NE 2	273,1	0,3	Sediment Profile Imaging	SEP	into deep	EL32.1 3032
PS61/131-10	06.03.02	08:39	65° 18,11' S	51° 32,48' W	3069,5	NE 4	321,8	0,2	Sediment Profile Imaging	SEP	start rising	
PS61/131-10	06.03.02	09:16	65° 18,00' S	51° 32,69' W	3071,0	NE 3	3,7	0,3	Sediment Profile Imaging	SEP	on deck	
PS61/132-1	06.03.02	13:26	65° 17,75' S	53° 23,12' W	2081,0	NE 3	43,2	0,2	Sediment Profile Imaging	SEP	into water	
PS61/132-1	06.03.02	13:34	65° 17,79' S	53° 23,08' W	2081,0	NNE 3	192,6	0,2	Sediment Profile Imaging	SEP	50 m CTD Seabird	
PS61/132-1	06.03.02	14:08	65° 17,71' S	53° 22,79' W	2085,0	NNE 3	193,3	0,3	Sediment Profile Imaging	SEP	into deep	
PS61/132-1	06.03.02	14:54	65° 17,81' S	53° 22,67' W	2090,0	NNE 4	4,1	0,0	Sediment Profile Imaging	SEP	start rising	
PS61/132-1	06.03.02	15:20	65° 17,65' S	53° 22,61' W	2087,0	NNE 4	9,1	0,3	Sediment Profile Imaging	SEP	CTD on deck	
PS61/132-1	06.03.02	15:23	65° 17,63' S	53° 22,62' W	2090,0	NNE 4	347,1	0,9	Sediment Profile Imaging	SEP	on deck	
PS61/132-2	06.03.02	15:46	65° 18,43' S	53° 22,76' W	2085,0	NNE 4	336,6	1,6	Epibenthos sledge	EBS	surface	
PS61/132-2	06.03.02	16:33	65° 18,25' S	53° 22,79' W	2082,0	N 4	183,3	0,5	Epibenthos sledge	EBS	on ground	
PS61/132-2	06.03.02	16:55	65° 17,74' S	53° 22,82' W	2086,0	NNE 4	0,5	1,4	Epibenthos sledge	EBS	start trawling	3050 m ausgesteckt
PS61/132-2	06.03.02	17:05	65° 17,56' S	53° 22,83' W	2086,0	NNE 3	0,7	0,8	Epibenthos sledge	EBS	winch stop end trawling	
PS61/132-2	06.03.02	17:39	65° 17,62' S	53° 22,86' W	2084,0	N 4	6,0	0,2	Epibenthos sledge	EBS	start hoisting from the bottom	
PS61/132-2	06.03.02	18:28	65° 17,52' S	53° 22,87' W	2084,0	N 4	327,3	0,2	Epibenthos sledge	EBS	on deck	
PS61/132-3	06.03.02	18:56	65° 19,99' S	53° 22,68' W	2079,0	N 4	7,4	2,8	Agassiz trawl	AGT	surface	

PS61/132-3	06.03.02	19:40	65° 18,55' S	53° 22,73' W	2086,0	NNE 4	354,9	2,1	Agassiz trawl	AGT	AGT on ground	
PS61/132-3	06.03.02	20:02	65° 17,88' S	53° 22,88' W	2087,0	NE 4	350,3	1,6	Agassiz trawl	AGT	start trawl	
PS61/132-3	06.03.02	20:33	65° 17,35' S	53° 22,89' W	2084,0	NNE 5	356,7	0,8	Agassiz trawl	AGT	Start hoisting	
PS61/132-3	06.03.02	21:12	65° 17,30' S	53° 23,20' W	2081,0	NNE 4	262,7	0,3	Agassiz trawl	AGT	AGT off ground	
PS61/132-3	06.03.02	22:04	65° 17,43' S	53° 23,86' W	2069,0	NNE 3	286,9	0,3	Agassiz trawl	AGT	on deck	
PS61/132-4	06.03.02	22:39	65° 17,72' S	53° 22,60' W	2091,0	N 5	327,0	0,1	Large Box Corer	GKG	surface	
PS61/132-4	06.03.02	23:20	65° 17,75' S	53° 22,92' W	2085,0	N 6	202,7	0,3	Large Box Corer	GKG	at sea bottom	
PS61/132-4	06.03.02	23:50	65° 17,73' S	53° 23,13' W	2081,0	NNE 6	191,2	0,5	Large Box Corer	GKG	on deck	
PS61/132-5	07.03.02	00:19	65° 17,73' S	53° 22,75' W	2088,0	NNE 6	291,2	0,2	MultiCorer	MUC	surface	
PS61/132-5	07.03.02	00:59	65° 17,68' S	53° 23,00' W	2084,0	N 7	297,6	0,2	MultiCorer	MUC	at sea bottom	
PS61/132-5	07.03.02	01:28	65° 17,74' S	53° 23,13' W	2083,0	N 7	177,1	0,4	MultiCorer	MUC	on deck	
PS61/132-6	07.03.02	01:49	65° 17,74' S	53° 22,67' W	2089,0	N 5	206,2	0,4	Large Box Corer	GKG	surface	
PS61/132-6	07.03.02	02:29	65° 17,77' S	54° 0,00' W	2086,0	N 7	309,7	0,4	Large Box Corer	GKG	at sea bottom	2038 m ausgesteckt
PS61/132-6	07.03.02	02:29	65° 17,77' S	54° 0,00' E	2086,0	N 7	309,7	0,4	Large Box Corer	GKG	at sea bottom	
PS61/132-6	07.03.02	03:09	65° 17,70' S	53° 23,40' W	2076,0	N 6	285,0	0,3	Large Box Corer	GKG	on deck	
PS61/132-6	07.03.02	03:09	65° 17,70' N	53° 23,40' E	2076,0	N 6	285,0	0,3	Large Box Corer	GKG	on deck	
PS61/132-7	07.03.02	03:36	65° 17,70' S	53° 23,60' W	2072,0	NNE 6	272,7	0,3	MultiCorer	MUC	surface	
PS61/132-7	07.03.02	04:19	65° 17,60' S	53° 23,50' W	2076,0	N 6	4,3	0,1	MultiCorer	MUC	at sea bottom	2023 m ausgesteckt
PS61/132-7	07.03.02	04:50	65° 17,50' S	53° 23,50' W	2075,0	N 7	33,5	0,5	MultiCorer	MUC	on deck	
PS61/132-8	07.03.02	05:30	65° 17,50' S	53° 23,60' W	2074,0	N 8	12,3	0,2	MultiCorer	MUC	surface	
PS61/132-8	07.03.02	06:12	65° 17,50' S	53° 23,60' W	2074,0	N 8	207,1	0,5	MultiCorer	MUC	at sea bottom	2021 m ausgesteckt
PS61/132-8	07.03.02	06:44	65° 17,40' S	53° 23,50' W	2075,0	N 7	236,1	0,2	MultiCorer	MUC	on deck	
PS61/133-1	07.03.02	09:04	65° 20,10' S	54° 14,50' W	1116,0	N 7	165,7	0,5	Sediment Profile Imaging	SEP	into water	
PS61/133-1	07.03.02	09:09	65° 20,00' S	54° 14,50' W	1115,0	N 9	39,3	0,2	Sediment Profile Imaging	SEP	50 m CTD Seabird	
PS61/133-1	07.03.02	09:30	65° 20,07' S	54° 14,37' W	1120,0	N 8	359,2	0,0	Sediment Profile Imaging	SEP	into deep	
PS61/133-1	07.03.02	10:15	65° 20,07' S	54° 14,34' W	1120,0	N 10	0,3	0,0	Sediment Profile Imaging	SEP	start rising	
PS61/133-1	07.03.02	10:27	65° 20,02' S	54° 14,30' W	1121,0	N 9	31,2	0,3	Sediment Profile Imaging	SEP	CTD on deck	
PS61/133-1	07.03.02	10:31	65° 20,07' S	54° 14,34' W	1123,0	N 10	59,9	0,2	Sediment Profile Imaging	SEP	on deck	
PS61/133-2	07.03.02	10:45	65° 20,03' S	54° 14,17' W	1125,0	N 9	105,0	0,2	CTD/rosette water sampler	CTD/RO	surface	
PS61/133-2	07.03.02	10:58	65° 20,30' S	54° 14,10' W	1127,0	N 9	52,1	0,2	CTD/rosette water sampler	CTD/RO	at depth	
PS61/133-2	07.03.02	11:06	65° 20,02' S	54° 14,09' W	1128,0	N 8	357,0	0,2	CTD/rosette water sampler	CTD/RO	on deck	
PS61/133-3	07.03.02	11:30	65° 20,44' S	54° 14,28' W	1116,0	N 7	17,0	0,9	Epibenthos sledge	EBS	surface	
PS61/133-3	07.03.02	11:55	65° 20,40' S	54° 14,11' E	1123,0	N 8	345,6	1,1	Epibenthos sledge	EBS	on ground	
PS61/133-3	07.03.02	12:06	65° 20,15' S	54° 14,35' W	1122,0	N 9	332,0	1,3	Epibenthos sledge	EBS	start trawling	
PS61/133-3	07.03.02	12:16	65° 20,06' S	54° 14,51' E	1119,0	N 8	337,0	0,8	Epibenthos sledge	EBS	winch stop end trawling	
PS61/133-3	07.03.02	12:36	65° 20,09' S	54° 14,36' W	1123,0	N 8	152,9	0,7	Epibenthos sledge	EBS	start hoisting from the bottom	
PS61/133-4	07.03.02	13:58	65° 21,00' S	54° 14,33' W	1110,0	N 6	357,9	1,8	Agassiz trawl	AGT	surface	
PS61/133-4	07.03.02	14:23	65° 20,35' S	54° 14,42' W	1114,0	N 7	356,9	1,3	Agassiz trawl	AGT	AGT on ground	
PS61/133-4	07.03.02	14:36	65° 19,98' S	54° 14,51' W	1120,0	N 7	354,2	1,8	Agassiz trawl	AGT	start trawl	
PS61/133-4	07.03.02	15:06	65° 19,71' S	54° 14,50' W	1113,0	NNW 6	359,3	0,8	Agassiz trawl	AGT	Stop Trawl	2030 m ausgesteckt
PS61/133-4	07.03.02	15:28	65° 19,64' S	54° 14,35' W	1115,0	NNW 5	142,4	0,5	Agassiz trawl	AGT	AGT off ground	
PS61/133-4	07.03.02	15:59	65° 19,70' S	54° 13,98' W	1129,0	WNW 4	123,0	0,5	Agassiz trawl	AGT	on deck	
PS61/133-5	07.03.02	17:35	65° 20,22' S	54° 12,63' W	1167,0	SW 5	230,4	0,9	Large Box Corer	GKG	surface	
PS61/133-5	07.03.02	17:58	65° 20,27' S	54° 12,54' W	1166,0	SW 7	59,9	0,6	Large Box Corer	GKG	at sea bottom	1135 m ausgesteckt

PS61/133-5	07.03.02	18:17	65° 20,33' S	54° 12,31' W	1170,0	SW 7	150,6	0,5	Large Box Corer	GKG	on deck	
PS61/133-5	07.03.02	18:40	65° 20,22' S	54° 14,53' W	1113,0	SW 9	228,4	0,2	MultiCorer	MUC	surface	
PS61/133-5	07.03.02	19:03	65° 20,18' S	54° 14,36' W	1120,0	SW 7	55,9	0,7	MultiCorer	MUC	at sea bottom	
PS61/133-5	07.03.02	19:22	65° 20,18' S	54° 14,34' W	1120,0	SW 10	228,8	0,0	MultiCorer	MUC	on deck	
PS61/133-5	07.03.02	19:40	65° 20,14' S	54° 14,86' W	1103,0	SW 11	10,1	0,1	Large Box Corer	GKG	surface	
PS61/133-5	07.03.02	20:02	65° 20,10' S	54° 14,87' W	1110,0	SW 11	237,3	0,3	Large Box Corer	GKG	at sea bottom	
PS61/133-5	07.03.02	20:23	65° 20,11' S	54° 14,90' W	1107,0	SW 11	30,2	0,1	Large Box Corer	GKG	on deck	
PS61/133-8	07.03.02	20:45	65° 20,15' S	54° 15,01' W	1103,0	SW 10	42,7	0,1	MultiCorer	MUC	surface	
PS61/133-8	07.03.02	21:11	65° 20,09' S	54° 14,72' W	1107,6	SSW 10	88,9	0,2	MultiCorer	MUC	at sea bottom	1088 m
PS61/133-8	07.03.02	21:28	65° 20,23' S	54° 14,64' W	1105,2	SSW 10	160,1	0,6	MultiCorer	MUC	on deck	
PS61/133-9	07.03.02	21:34	65° 20,27' S	54° 14,59' W	1108,0	SW 10	142,0	0,5	Sediment Profile Imaging	SEP	into water	
PS61/133-9	07.03.02	22:06	65° 20,35' S	54° 14,56' W	1110,3	SW 9	219,9	0,0	Sediment Profile Imaging	SEP	into deep	
PS61/133-9	07.03.02	22:21	65° 20,34' S	54° 14,60' W	1110,7	SW 10	335,7	0,1	Sediment Profile Imaging	SEP	start rising	
PS61/133-9	07.03.02	22:42	65° 20,31' S	54° 14,62' W	1110,4	SW 9	219,6	0,0	Sediment Profile Imaging	SEP	on deck	
PS61/133-10	07.03.02	22:53	65° 20,29' S	54° 14,65' W	1107,2	SW 9	342,9	0,1	MultiCorer	MUC	surface	
PS61/133-10	07.03.02	23:17	65° 20,30' S	54° 14,67' W	1109,6	SSW 8	211,5	0,0	MultiCorer	MUC	at sea bottom	
PS61/133-10	07.03.02	23:39	65° 20,33' S	54° 14,66' W	1110,8	WSW 7	179,4	0,4	MultiCorer	MUC	on deck	
PS61/131-11	08.03.02	05:54	65° 19,55' S	51° 33,64' W	3042,0	W 4	253,7	0,4	MultiCorer	MUC	surface	
PS61/131-11	08.03.02	06:49	65° 19,55' S	51° 34,28' W	3038,0	WSW 4	262,9	0,3	MultiCorer	MUC	at sea bottom	2985 m ausgesteckt
PS61/131-11	08.03.02	07:32	65° 19,46' S	51° 34,04' W	3040,8	WSW 5	32,7	0,2	MultiCorer	MUC	on deck	
PS61/131-1	08.03.02	08:21	65° 17,88' S	51° 35,29' W	3069,2	WNW 3	26,1	0,6	Amphipod trap	ATC	released	
PS61/133-1	08.03.02	09:24	65° 17,66' S	51° 35,00' W	3070,8	SW 4	351,2	0,2	Amphipod trap	ATC	surfaced	
PS61/133-1	08.03.02	09:49	65° 17,52' S	51° 35,60' W	3068,0	SW 4	40,2	0,4	Amphipod trap	ATC	on deck	
PS61/134-1	08.03.02	17:40	65° 19,99' S	48° 5,98' W	4073,0	WNW 2	89,8	0,6	Sediment Profile Imaging	SEP	into water	17:55 CTD zu Wasser
PS61/134-1	08.03.02	18:55	65° 19,72' S	48° 5,57' W	4061,6	NNW 2	332,8	0,8	Sediment Profile Imaging	SEP	into deep	4001 m ausgesteckt
PS61/134-1	08.03.02	19:48	65° 19,55' S	48° 5,47' W	4061,6	NW 2	342,4	0,5	Sediment Profile Imaging	SEP	start rising	
PS61/134-1	08.03.02	20:37	65° 19,32' S	48° 5,66' W	4060,8	N 2	342,5	0,3	Sediment Profile Imaging	SEP	CTD on deck	
PS61/134-1	08.03.02	20:47	65° 19,29' S	48° 5,71' W	4060,8	NNE 2	315,6	0,2	Sediment Profile Imaging	SEP	on deck	
PS61/134-2	08.03.02	20:55	65° 19,28' S	48° 5,73' W	4060,7	NNE 2	318,4	0,0	CTD/rosette water sampler	CTD/RO	surface	
PS61/134-2	08.03.02	21:08	65° 19,27' S	48° 5,72' W	4060,8	NNE 2	28,3	0,2	CTD/rosette water sampler	CTD/RO	at depth	395 m
PS61/134-2	08.03.02	21:15	65° 19,27' S	48° 5,72' W	4060,8	NNE 3	318,1	0,0	CTD/rosette water sampler	CTD/RO	on deck	
PS61/134-3	08.03.02	21:55	65° 21,55' S	48° 15,55' W	4029,1	N 3	77,7	0,7	Agassiz trawl	AGT	surface	
PS61/134-3	08.03.02	23:28	65° 19,96' S	48° 8,57' W	4053,3	NE 2	48,6	1,8	Agassiz trawl	AGT	AGT on ground	
PS61/134-3	09.03.02	00:10	65° 19,54' S	48° 5,47' W	4060,8	ENE 2	78,9	2,0	Agassiz trawl	AGT	start trawl	
PS61/134-3	09.03.02	00:40	65° 19,47' S	48° 4,27' W	4065,1	ENE 2	85,4	1,1	Agassiz trawl	AGT	Stop Trawl	
PS61/134-3	09.03.02	02:03	65° 19,51' S	48° 3,60' W	4066,4	ENE 4	62,8	0,3	Agassiz trawl	AGT	AGT off ground	
PS61/134-3	09.03.02	03:48	65° 19,47' S	48° 2,05' W	4075,3	ENE 5	70,8	0,3	Agassiz trawl	AGT	on deck	
PS61/134-4	09.03.02	04:26	65° 20,05' S	48° 6,88' W	4058,8	ENE 6	54,4	1,4	Epibenthos sledge	EBS	surface	
PS61/134-4	09.03.02	05:57	65° 19,71' S	48° 6,27' W	4059,4	ENE 5	45,9	0,4	Epibenthos sledge	EBS	on ground	
PS61/134-4	09.03.02	06:42	65° 19,20' S	48° 3,81' W	4065,6	ENE 6	69,7	1,5	Epibenthos sledge	EBS	start trawling winch stop	6030 m ausgesteckt
PS61/134-4	09.03.02	06:52	65° 19,15' S	48° 3,34' W	4066,8	ENE 6	77,7	1,2	Epibenthos sledge	EBS	end trawling	
PS61/134-4	09.03.02	08:01	65° 19,05' S	48° 2,92' W	4068,7	ENE 9	257,9	0,2	Epibenthos sledge	EBS	start hoisting from the bottom	
PS61/134-4	09.03.02	09:30	65° 19,13' S	48° 2,56' W	4069,5	ENE 8	256,5	0,3	Epibenthos sledge	EBS	on deck	
PS61/134-5	09.03.02	10:00	65° 19,88' S	48° 5,58' W	4060,1	ENE 8	166,4	0,3	Large Box Corer	GKG	surface	
PS61/134-5	09.03.02	11:20	65° 20,10' S	48° 5,33' W	4062,2	NE 6	123,0	0,2	Large Box Corer	GKG	at sea bottom	
PS61/134-5	09.03.02	12:19	65° 20,25' S	48° 4,99' W	4063,3	ENE 6	175,2	0,9	Large Box Corer	GKG	on deck	
PS61/134-6	09.03.02	12:40	65° 20,64' S	48° 4,46' W	4067,1	ENE 7	69,8	0,2	MultiCorer	MUC	surface	

PS61/134-6	09.03.02	13:53	65° 20,82' S	48° 4,15' W	4068,7	NE 8	102,0	0,7	MultiCorer	MUC	at sea bottom	
PS61/134-6	09.03.02	14:53	65° 21,09' S	48° 3,41' W	4072,4	NE 8	124,2	1,5	MultiCorer	MUC	on deck	
PS61/134-7	09.03.02	15:23	65° 19,65' S	48° 6,02' W	4058,4	N 5	39,9	0,8	Large Box Corer	GKG	surface	
PS61/134-7	09.03.02	16:32	65° 19,79' S	48° 5,43' W	4060,4	NW 6	65,8	0,3	Large Box Corer	GKG	at sea bottom	4010 m ausgesteckt
PS61/134-7	09.03.02	17:29	65° 19,72' S	48° 4,94' W	4064,0	NW 5	118,1	0,4	Large Box Corer	GKG	on deck	
PS61/134-8	09.03.02	17:49	65° 19,72' S	48° 5,41' W	4060,8	NW 4	328,8	0,5	MultiCorer	MUC	surface	
PS61/134-8	09.03.02	19:00	65° 19,50' S	48° 4,83' W	4063,9	NNW 6	355,0	0,5	MultiCorer	MUC	at sea bottom	
PS61/134-8	09.03.02	19:58	65° 19,37' S	48° 4,51' W	4064,4	NNW 6	64,5	0,1	MultiCorer	MUC	on deck	
PS61/134-9	09.03.02	20:07	65° 19,34' S	48° 4,51' W	4064,4	NNW 6	352,2	0,4	Sediment Profile Imaging	SEP	into water	
PS61/134-9	09.03.02	21:14	65° 19,21' S	48° 4,32' W	4065,2	N 5	326,8	0,4	Sediment Profile Imaging	SEP	into deep	4019 m
PS61/134-9	09.03.02	21:54	65° 19,21' S	48° 4,23' W	4065,6	N 6	118,5	0,2	Sediment Profile Imaging	SEP	start rising	
PS61/134-9	09.03.02	22:47	65° 19,15' S	48° 4,29' W	4064,8	NNW 5	311,0	0,8	Sediment Profile Imaging	SEP	on deck	
PS61/134-9	09.03.02	22:48	65° 19,14' S	48° 4,31' W	4064,7	NNW 5	317,7	0,7	Sediment Profile Imaging	SEP	on deck	
PS61/135-1	10.03.02	11:26	64° 59,91' S	43° 0,27' W	4685,0	N 6	350,5	0,5	Sediment Profile Imaging	SEP	into water	
PS61/135-1	10.03.02	11:31	64° 59,91' S	43° 0,30' W	4687,0	N 6	187,8	0,2	Sediment Profile Imaging	SEP	50 m CTD Seabird	
PS61/135-1	10.03.02	12:46	64° 59,81' S	43° 0,59' W	4678,0	NNE 7	11,1	0,0	Sediment Profile Imaging	SEP	into deep	
PS61/135-1	10.03.02	13:53	64° 59,79' S	43° 0,87' W	4677,6	NNE 9	2,1	0,0	Sediment Profile Imaging	SEP	start rising	
PS61/135-1	10.03.02	15:00	64° 59,89' S	43° 1,24' W	4677,2	NNE 8	206,9	0,4	Sediment Profile Imaging	SEP	on deck	
PS61/135-2	10.03.02	15:12	64° 59,89' S	43° 1,28' W	4677,1	NNE 9	172,5	0,1	CTD/rosette water sampler	CTD/RO	surface	
PS61/135-2	10.03.02	15:25	64° 59,89' S	43° 1,31' W	4677,1	NNE 8	66,4	0,2	CTD/rosette water sampler	CTD/RO	at depth	397 m ausgesteckt
PS61/135-2	10.03.02	15:32	64° 59,86' S	43° 1,31' W	4677,5	NNE 9	349,7	0,2	CTD/rosette water sampler	CTD/RO	on deck	
PS61/135-3	10.03.02	16:10	65° 3,54' S	43° 1,55' W	4668,8	NNE 7	24,0	4,0	Agassiz trawl	AGT	surface	
PS61/135-3	10.03.02	17:49	65° 0,51' S	43° 0,76' W	4676,7	NNE 10	7,0	1,8	Agassiz trawl	AGT	AGT on ground	
PS61/135-3	10.03.02	18:34	64° 59,12' S	43° 0,43' W	4679,5	NNE 9	18,2	1,4	Agassiz trawl	AGT	start trawl	7800 m ausgesteckt
PS61/135-3	10.03.02	19:04	64° 58,68' S	42° 59,97' W	4680,1	NE 9	32,2	0,8	Agassiz trawl	AGT	Stop Trawl	
PS61/135-3	10.03.02	20:21	64° 58,69' S	42° 59,66' W	4682,3	NE 10	356,3	0,4	Agassiz trawl	AGT	AGT off ground	
PS61/135-3	10.03.02	22:24	64° 58,37' S	42° 59,87' W	4682,0	NE 10	227,3	1,0	Agassiz trawl	AGT	on deck	
PS61/135-4	10.03.02	22:53	65° 0,80' S	43° 3,12' W	4675,8	NE 11	27,5	0,3	Epibenthos sledge	EBS	surface	
PS61/135-4	11.03.02	00:33	65° 0,83' S	43° 3,03' W	4676,0	NE 12	96,6	0,2	Epibenthos sledge	EBS	on ground	
PS61/135-4	11.03.02	01:24	65° 0,06' S	43° 1,19' W	4677,6	NE 12	50,6	1,3	Epibenthos sledge	EBS	start trawling	
PS61/135-4	11.03.02	01:34	64° 59,97' S	43° 0,91' W	4678,2	NE 10	52,8	1,2	Epibenthos sledge	EBS	winch stop end trawling	
PS61/135-4	11.03.02	02:54	64° 59,97' S	43° 0,83' W	4678,1	NE 12	29,1	0,2	Epibenthos sledge	EBS	start hoisting from the bottom	
PS61/135-4	11.03.02	04:38	64° 59,87' S	43° 0,58' W	4678,2	NE 13	271,4	0,3	Epibenthos sledge	EBS	on deck	
PS61/135-5	11.03.02	05:00	64° 59,88' S	43° 0,67' W	4678,9	ENE 13	315,8	0,3	Large Box Corer	GKG	surface	
PS61/135-5	11.03.02	06:24	64° 59,91' S	43° 0,44' W	4679,5	ENE 14	58,7	0,3	Large Box Corer	GKG	at sea bottom	4648 m ausgesteckt
PS61/135-5	11.03.02	07:32	64° 59,86' S	43° 0,80' W	4678,7	ENE 16	171,4	1,0	Large Box Corer	GKG	on deck	nicht ausgelöst
PS61/135-6	11.03.02	07:47	65° 0,02' S	43° 0,48' W	4678,1	ENE 16	135,8	0,5	MultiCorer	MUC	surface	
PS61/135-6	11.03.02	09:13	64° 59,95' S	43° 0,69' W	4679,2	ENE 15	319,2	0,4	MultiCorer	MUC	at sea bottom	
PS61/135-6	11.03.02	10:23	65° 0,02' S	43° 0,76' W	4677,1	E 19	134,4	0,8	MultiCorer	MUC	on deck	
PS61/135-7	11.03.02	11:53	64° 59,67' S	43° 0,22' W	4679,0	ENE 18	321,8	0,5	Large Box Corer	GKG	surface	
PS61/135-7	11.03.02	13:17	64° 58,99' S	43° 0,64' W	4678,8	NE 15	17,7	1,6	Large Box Corer	GKG	at sea bottom	4662 m ausgesteckt
PS61/135-7	11.03.02	14:26	64° 58,50' S	43° 1,63' W	4679,4	NE 14	237,7	1,2	Large Box Corer	GKG	on deck	
PS61/135-8	11.03.02	15:15	65° 0,12' S	42° 59,92' W	4675,8	NE 12	90,3	0,2	MultiCorer	MUC	surface	
PS61/135-8	11.03.02	16:38	65° 0,02' S	42° 59,92' W	4677,9	NE 11	141,3	0,5	MultiCorer	MUC	at sea bottom	4636 m ausgesteckt

PS61/135-8	11.03.02	17:48	64° 59,92' S	43° 0,08' W	4677,2	ENE 13	272,5	0,4	MultiCorer	MUC	on deck	
PS61/135-9	11.03.02	18:05	64° 59,89' S	42° 59,81' W	4678,8	ENE 12	53,0	1,1	Large Box Corer	GKG	surface	
PS61/135-9	11.03.02	19:26	64° 59,82' S	42° 59,17' W	4679,5	ENE 11	149,8	0,2	Large Box Corer	GKG	at sea bottom	4649 m
PS61/135-9	11.03.02	19:30	64° 59,82' S	42° 59,17' W	4681,1	ENE 11	323,9	0,4	Large Box Corer	GKG	at sea bottom	2. Versuch
PS61/135-9	11.03.02	20:36	64° 59,53' S	42° 58,95' W	4686,0	E 12	264,4	0,6	Large Box Corer	GKG	on deck	
PS61/136-1	12.03.02	09:27	64° 1,81' S	39° 6,81' W	4764,0	E 14	265,6	1,3	Sediment Profile Imaging	SEP	into water	
PS61/136-1	12.03.02	09:37	64° 1,84' S	39° 7,11' W	4769,0	E 13	232,2	0,8	Sediment Profile Imaging	SEP	50 m CTD Seabird	
PS61/136-1	12.03.02	10:58	64° 1,60' S	39° 6,92' W	4746,7	ENE 7	117,6	0,5	Sediment Profile Imaging	SEP	into deep	4725 m
PS61/136-1	12.03.02	11:49	64° 1,59' S	39° 7,01' W	4748,9	E 15	193,8	0,2	Sediment Profile Imaging	SEP	start rising	
PS61/136-1	12.03.02	12:57	64° 1,68' S	39° 7,16' W	4752,4	E 13	247,3	0,7	Sediment Profile Imaging	SEP	on deck	
PS61/136-2	12.03.02	13:04	64° 1,72' S	39° 7,31' W	4755,6	E 13	295,7	0,2	CTD/rosette water sampler	CTD/RO	surface	
PS61/136-2	12.03.02	13:15	64° 1,77' S	39° 7,28' W	4756,6	E 14	55,3	0,5	CTD/rosette water sampler	CTD/RO	at depth	
PS61/136-2	12.03.02	13:23	64° 1,83' S	39° 7,26' W	4758,6	E 14	127,1	0,5	CTD/rosette water sampler	CTD/RO	on deck	
PS61/136-3	12.03.02	14:18	64° 1,64' S	39° 16,92' W	4860,1	E 14	97,8	1,7	Agassiz trawl	AGT	surface	
PS61/136-3	12.03.02	15:57	64° 1,62' S	39° 9,14' W	4780,0	E 12	99,7	1,9	Agassiz trawl	AGT	AGT on ground	
PS61/136-3	12.03.02	16:38	64° 1,57' S	39° 5,88' W	4741,1	ENE 8	73,0	1,8	Agassiz trawl	AGT	start trawl	7800 m ausgesteckt
PS61/136-3	12.03.02	17:08	64° 1,49' S	39° 4,85' W	4736,4	ENE 10	137,8	0,5	Agassiz trawl	AGT	Stop Trawl	Start Hieven
PS61/136-3	12.03.02	18:26	64° 1,50' S	39° 4,13' W	4734,4	ENE 10	74,5	0,8	Agassiz trawl	AGT	AGT off ground	
PS61/136-3	12.03.02	20:29	64° 1,18' S	39° 3,39' W	4723,8	E 9	286,1	1,0	Agassiz trawl	AGT	on deck	
PS61/136-4	12.03.02	21:22	64° 1,44' S	39° 10,00' W	4784,2	E 11	15,9	0,3	Epibenthos sledge	EBS	surface	
PS61/136-4	12.03.02	23:13	64° 1,46' S	39° 9,86' W	4782,5	ESE 10	100,3	1,8	Epibenthos sledge	EBS	on ground	
PS61/136-4	13.03.02	00:06	64° 1,54' S	39° 6,88' W	4747,5	E 8	66,8	1,3	Epibenthos sledge	EBS	start trawling	7100 m Draht
PS61/136-4	13.03.02	00:15	64° 1,45' S	39° 6,66' W	4742,5	E 11	43,7	1,3	Epibenthos sledge	EBS	winch stop end trawling	
PS61/136-4	13.03.02	01:38	64° 1,51' S	39° 6,88' W	4745,1	E 11	308,8	0,2	Epibenthos sledge	EBS	start hoisting from the bottom	
PS61/136-4	13.03.02	03:23	64° 1,83' S	39° 7,14' W	4757,3	ESE 11	104,4	0,4	Epibenthos sledge	EBS	on deck	
PS61/136-5	13.03.02	03:38	64° 1,46' S	39° 6,99' W	4744,8	ESE 12	3,3	0,3	Large Box Corer	GKG	surface	
PS61/136-5	13.03.02	05:02	64° 1,54' S	39° 6,41' W	4741,4	E 9	64,1	0,4	Large Box Corer	GKG	at sea bottom	4720 m ausgesteckt
PS61/136-5	13.03.02	06:17	64° 1,29' S	39° 5,49' W	4736,9	ESE 9	256,5	1,5	Large Box Corer	GKG	on deck	
PS61/136-6	13.03.02	06:34	64° 1,36' S	39° 6,72' W	4742,1	ESE 10	47,6	0,6	MultiCorer	MUC	surface	
PS61/136-6	13.03.02	08:00	64° 0,94' S	39° 6,31' W	4732,0	ESE 7	358,7	0,0	MultiCorer	MUC	at sea bottom	
PS61/136-6	13.03.02	09:12	64° 0,43' S	39° 5,97' W	4714,4	E 8	17,3	0,2	MultiCorer	MUC	on deck	
PS61/136-7	13.03.02	09:32	64° 1,63' S	39° 7,48' W	4757,2	ESE 7	155,3	0,4	Large Box Corer	GKG	surface	
PS61/136-7	13.03.02	11:01	64° 1,73' S	39° 7,80' W	4763,0	ESE 8	158,7	0,2	Large Box Corer	GKG	at sea bottom	
PS61/136-7	13.03.02	12:11	64° 1,61' S	39° 8,10' W	4763,8	ENE 8	292,0	1,3	Large Box Corer	GKG	on deck	
PS61/136-8	13.03.02	12:34	64° 1,55' S	39° 4,89' W	4736,2	E 6	40,0	0,3	MultiCorer	MUC	surface	
PS61/136-8	13.03.02	14:02	64° 1,64' S	39° 5,15' W	4737,3	E 7	294,0	0,2	MultiCorer	MUC	at sea bottom	
PS61/136-8	13.03.02	15:08	64° 1,94' S	39° 5,47' W	4738,8	E 7	225,2	0,3	MultiCorer	MUC	on deck	
PS61/136-9	13.03.02	15:27	64° 1,70' S	39° 6,76' W	4748,1	ENE 7	135,9	0,8	Large Box Corer	GKG	surface	
PS61/136-9	13.03.02	16:53	64° 2,02' S	39° 6,12' W	4747,9	ENE 3	132,2	0,9	Large Box Corer	GKG	at sea bottom	4731 m ausgesteckt
PS61/136-9	13.03.02	18:06	64° 2,05' S	39° 5,04' W	4739,4	ENE 2	78,4	1,1	Large Box Corer	GKG	on deck	
PS61/137-1	14.03.02	07:41	63° 44,83' S	33° 46,61' W	4989,0	NW 5	299,9	1,0	Sediment Profile Imaging	SEP	into water	
PS61/137-1	14.03.02	08:04	63° 44,90' S	33° 46,86' W	4992,0	NW 4	150,5	0,4	Sediment Profile Imaging	SEP	50 m CTD Seabird	
PS61/137-1	14.03.02	09:20	63° 45,07' S	33° 47,48' W	4992,0	NNW 4	330,0	0,2	Sediment Profile Imaging	SEP	into deep	
PS61/137-1	14.03.02	10:20	63° 45,04' S	33° 47,69' W	4994,0	NNW 6	231,2	0,4	Sediment Profile Imaging	SEP	start rising	
PS61/137-1	14.03.02	11:49	63° 45,08' S	33° 47,50' W	4973,4	NNW 6	53,1	0,2	Sediment Profile Imaging	SEP	on deck	

PS61/137-2	14.03.02	11:57	63° 45,09' S	33° 47,44' W	4974,3	NNW 6	99,7	0,4	CTD/rosette water sampler	CTD/RO	surface	
PS61/137-2	14.03.02	12:07	63° 45,09' S	33° 47,39' W	4974,6	NNW 6	263,1	0,3	CTD/rosette water sampler	CTD/RO	at depth	
PS61/137-2	14.03.02	12:15	63° 45,09' S	33° 47,39' W	4975,1	NW 7	148,8	0,2	CTD/rosette water sampler	CTD/RO	on deck	
PS61/137-3	14.03.02	13:08	63° 49,20' S	33° 44,27' W	4990,0	NNW 9	355,1	2,2	Agassiz trawl	AGT	surface	
PS61/137-3	14.03.02	14:40	63° 46,29' S	33° 46,54' W	4995,0	NW 9	349,0	1,7	Agassiz trawl	AGT	AGT on ground	
PS61/137-3	14.03.02	15:23	63° 45,00' S	33° 47,82' W	4975,4	NNW 8	331,4	2,4	Agassiz trawl	AGT	start trawl	7800 m ausgesteckt
PS61/137-3	14.03.02	15:53	63° 44,56' S	33° 48,38' W	4973,4	NNW 10	301,7	0,9	Agassiz trawl	AGT	Stop Trawl	Start Hieven
PS61/137-3	14.03.02	17:06	63° 44,35' S	33° 49,01' W	4973,4	NNW 10	260,6	0,5	Agassiz trawl	AGT	AGT off ground	
PS61/137-3	14.03.02	19:12	63° 43,86' S	33° 51,04' W	4973,9	N 11	215,5	0,5	Agassiz trawl	AGT	on deck	
PS61/137-4	14.03.02	19:46	63° 46,62' S	33° 47,54' W	4978,1	N 10	358,2	0,9	Epibenthos sledge	EBS	surface	
PS61/137-4	14.03.02	21:37	63° 46,33' S	33° 47,16' W	4977,6	WSW 7	16,5	0,4	Epibenthos sledge	EBS	on ground	
PS61/137-4	14.03.02	22:32	63° 44,99' S	33° 47,74' W	4975,7	W 5	341,4	1,4	Epibenthos sledge	EBS	start trawling	
PS61/137-4	14.03.02	22:45	63° 44,78' S	33° 47,81' W	4975,1	W 5	14,8	1,0	Epibenthos sledge	EBS	winch stop end trawling	
PS61/137-4	15.03.02	00:08	63° 44,74' S	33° 48,22' W	4975,3	NW 4	221,1	0,3	Epibenthos sledge	EBS	start hoisting from the bottom	
PS61/137-4	15.03.02	01:54	63° 44,45' S	33° 48,60' W	4975,3	S 3	314,4	1,0	Epibenthos sledge	EBS	on deck	
PS61/137-5	15.03.02	02:10	63° 44,97' S	33° 47,59' W	4974,9	SSW 3	211,4	1,7	Large Box Corer	GKG	surface	
PS61/137-5	15.03.02	03:40	63° 45,21' S	33° 47,51' W	4976,4	SSE 4	353,2	0,2	Large Box Corer	GKG	at sea bottom	4940 m ausgesteckt
PS61/137-5	15.03.02	04:52	63° 45,28' S	33° 47,84' W	4975,3	SE 5	252,3	0,4	Large Box Corer	GKG	on deck	
PS61/137-6	15.03.02	05:16	63° 44,93' S	33° 47,85' W	4975,0	SE 6	227,5	0,5	MultiCorer	MUC	surface	
PS61/137-6	15.03.02	06:48	63° 45,00' S	33° 47,81' W	4975,3	SE 6	22,3	0,4	MultiCorer	MUC	at sea bottom	4937 m ausgesteckt
PS61/137-6	15.03.02	07:59	63° 45,02' S	33° 47,99' W	4975,5	SE 8	265,0	0,2	MultiCorer	MUC	on deck	
PS61/137-7	15.03.02	08:23	63° 45,10' S	33° 47,72' W	4976,9	SE 9	158,6	0,4	Large Box Corer	GKG	surface	
PS61/137-7	15.03.02	09:58	63° 45,16' S	33° 47,72' W	4975,3	SSE 10	162,9	0,4	Large Box Corer	GKG	at sea bottom	
PS61/137-7	15.03.02	11:10	63° 45,07' S	33° 47,75' W	4976,0	SSE 10	233,4	0,9	Large Box Corer	GKG	on deck	
PS61/137-8	15.03.02	11:39	63° 45,05' S	33° 47,76' W	4974,9	SSE 9	271,8	0,5	MultiCorer	MUC	surface	
PS61/137-8	15.03.02	13:06	63° 45,03' S	33° 47,95' W	4974,6	NNE 6	312,3	0,1	MultiCorer	MUC	at sea bottom	
PS61/137-8	15.03.02	14:20	63° 45,21' S	33° 47,82' W	4973,4	N 7	117,2	0,7	MultiCorer	MUC	on deck	
PS61/138-1	16.03.02	09:14	62° 58,07' S	27° 54,09' W	4556,0	ENE 10	137,2	0,5	CTD/rosette water sampler	CTD/RO	surface	
PS61/138-1	16.03.02	09:28	62° 58,09' S	27° 54,01' W	4556,0	ENE 9	356,3	0,2	CTD/rosette water sampler	CTD/RO	at depth	398 m
PS61/138-1	16.03.02	09:37	62° 58,06' S	27° 53,92' W	4556,0	ENE 10	73,6	0,7	CTD/rosette water sampler	CTD/RO	on deck	
PS61/138-2	16.03.02	09:54	62° 58,04' S	27° 53,93' W	4553,0	ENE 11	130,4	0,1	Sediment Profile Imaging	SEP	into water	
PS61/138-2	16.03.02	10:09	62° 58,04' S	27° 53,96' W	4557,0	ENE 10	261,6	0,3	Sediment Profile Imaging	SEP	50 m CTD Seabird	
PS61/138-2	16.03.02	11:24	62° 57,99' S	27° 53,98' W	4541,4	ENE 10	317,5	0,3	Sediment Profile Imaging	SEP	into deep	
PS61/138-2	16.03.02	12:40	62° 57,85' S	27° 54,08' W	4540,2	ENE 9	227,6	0,2	Sediment Profile Imaging	SEP	start rising	
PS61/138-2	16.03.02	13:51	62° 57,64' S	27° 54,30' W	4537,9	E 8	172,3	0,2	Sediment Profile Imaging	SEP	on deck	
PS61/138-3	16.03.02	14:10	62° 57,96' S	27° 53,98' W	4540,9	E 9	89,8	0,6	MultiCorer	MUC	surface	
PS61/138-3	16.03.02	15:30	62° 57,70' S	27° 53,63' W	4538,0	ENE 7	59,2	0,8	MultiCorer	MUC	at sea bottom	4496 m ausgesteckt
PS61/138-3	16.03.02	16:37	62° 57,48' S	27° 53,06' W	4537,4	ENE 9	318,0	0,3	MultiCorer	MUC	on deck	
PS61/138-4	16.03.02	17:26	62° 59,09' S	28° 0,85' W	4685,8	ENE 7	73,0	3,1	Agassiz trawl	AGT	surface	
PS61/138-4	16.03.02	18:51	62° 58,26' S	27° 55,53' W	4552,6	ENE 8	74,7	1,6	Agassiz trawl	AGT	AGT on ground	
PS61/138-4	16.03.02	19:43	62° 57,80' S	27° 52,14' W	4543,5	ENE 8	61,9	1,0	Agassiz trawl	AGT	start trawl	
PS61/138-4	16.03.02	20:14	62° 57,77' S	27° 51,10' W	4545,1	ENE 7	92,8	0,7	Agassiz trawl	AGT	Stop Trawl	
PS61/138-4	16.03.02	21:32	62° 57,83' S	27° 50,70' W	4547,6	ENE 6	50,1	0,3	Agassiz trawl	AGT	AGT off ground	
PS61/138-4	16.03.02	23:24	62° 57,91' S	27° 49,81' W	4559,2	ENE 7	49,9	0,3	Agassiz trawl	AGT	on deck	
PS61/138-5	17.03.02	00:00	62° 57,98' S	27° 54,12' W	4542,1	ENE 8	136,4	0,8	MultiCorer	MUC	surface	

PS61/138-5	17.03.02	01:22	62° 57,82' S	27° 54,01' W	4539,9	ENE 9	67,3	0,4	MultiCorer	MUC	at sea bottom	4439 m Draht
PS61/138-5	17.03.02	02:26	62° 57,61' S	27° 53,77' W	4538,5	ENE 9	358,9	0,4	MultiCorer	MUC	on deck	
PS61/138-6	17.03.02	03:06	62° 58,59' S	27° 56,84' W	4555,1	ENE 9	66,2	0,6	Epibenthos sledge	EBS	surface	
PS61/138-6	17.03.02	04:45	62° 58,63' S	27° 57,04' W	4555,9	ENE 8	266,9	0,1	Epibenthos sledge	EBS	on ground	
PS61/138-6	17.03.02	05:34	62° 58,09' S	27° 54,54' W	4542,5	ENE 7	69,5	1,6	Epibenthos sledge	EBS	start trawling	6750 m ausgesteckt
PS61/138-6	17.03.02	05:44	62° 58,02' S	27° 54,25' W	4541,1	ENE 8	49,9	0,7	Epibenthos sledge	EBS	winch stop end trawling	
PS61/138-6	17.03.02	06:56	62° 57,99' S	27° 54,28' W	4541,4	ENE 7	65,8	0,0	Epibenthos sledge	EBS	start hoisting from the bottom	
PS61/138-6	17.03.02	08:57	62° 57,97' S	27° 53,88' W	4541,9	E 7	145,7	0,2	Epibenthos sledge	EBS	on deck	
PS61/138-7	17.03.02	09:23	62° 58,00' S	27° 53,78' W	4542,0	ENE 6	59,1	0,0	MultiCorer	MUC	surface	
PS61/138-7	17.03.02	10:47	62° 58,01' S	27° 53,87' W	4541,2	E 6	151,8	0,1	MultiCorer	MUC	at sea bottom	
PS61/138-7	17.03.02	11:54	62° 58,09' S	27° 54,07' W	4539,1	E 6	57,0	0,0	MultiCorer	MUC	on deck	
PS61/138-8	17.03.02	14:24	62° 57,98' S	27° 53,96' W	4540,7	ENE 6	115,7	0,5	Large Box Corer	GKG	surface	
PS61/138-8	17.03.02	15:44	62° 57,72' S	27° 53,70' W	4538,5	ENE 6	82,5	0,0	Large Box Corer	GKG	at sea bottom	4490 m ausgesteckt
PS61/138-8	17.03.02	16:47	62° 57,56' S	27° 53,23' W	4539,0	E 6	40,8	0,3	Large Box Corer	GKG	on deck	
PS61/138-9	17.03.02	17:08	62° 57,94' S	27° 54,21' W	4540,6	E 5	65,6	0,6	MultiCorer	MUC	surface	
PS61/138-9	17.03.02	18:25	62° 57,90' S	27° 54,13' W	4540,8	ESE 6	257,8	0,4	MultiCorer	MUC	at sea bottom	4495 m ausgesteckt
PS61/138-9	17.03.02	19:29	62° 58,01' S	27° 54,33' W	4542,3	E 6	100,6	0,0	MultiCorer	MUC	on deck	
PS61/138-10	17.03.02	19:45	62° 58,06' S	27° 54,27' W	4541,8	E 5	121,6	0,3	Large Box Corer	GKG	surface	
PS61/138-10	17.03.02	21:10	62° 58,15' S	27° 54,20' W	4536,9	ESE 5	310,9	0,1	Large Box Corer	GKG	at sea bottom	4494 m
PS61/138-10	17.03.02	22:12	62° 58,17' S	27° 54,49' W	4539,1	ESE 7	44,6	0,3	Large Box Corer	GKG	on deck	nicht ausgelöst
PS61/138-11	17.03.02	22:39	62° 58,13' S	27° 54,45' W	4540,7	ESE 8	20,2	0,3	MultiCorer	MUC	surface	
PS61/138-11	18.03.02	00:01	62° 58,03' S	27° 54,08' W	4541,3	E 6	104,0	0,3	MultiCorer	MUC	at sea bottom	4493 m Draht ausgesteckt
PS61/138-11	18.03.02	01:07	62° 58,07' S	27° 53,93' W	4539,6	ESE 6	119,1	0,9	MultiCorer	MUC	on deck	
PS61/139-1	19.03.02	09:13	58° 17,69' S	24° 29,16' W	3739,0	E 15	264,9	0,7	Amphipod trap	ATC	to water	
PS61/139-2	19.03.02	10:20	58° 14,47' S	24° 20,97' W	3941,0	E 16	247,4	0,3	CTD/rosette water sampler	CTD/RO	surface	
PS61/139-2	19.03.02	10:31	58° 14,50' S	24° 20,93' W	3951,0	E 16	303,1	0,7	CTD/rosette water sampler	CTD/RO	at depth	400 m
PS61/139-2	19.03.02	10:40	58° 14,48' S	24° 20,90' W	3942,0	ESE 17	345,4	0,2	CTD/rosette water sampler	CTD/RO	on deck	
PS61/139-3	19.03.02	10:48	58° 14,53' S	24° 20,89' W	3945,0	ESE 16	109,1	1,0	Sediment Profile Imaging	SEP	into water	
PS61/139-3	19.03.02	11:00	58° 14,52' S	24° 20,84' W	3948,0	E 17	97,3	0,0	Sediment Profile Imaging	SEP	50 m CTD Seabird	
PS61/139-3	19.03.02	12:03	58° 14,26' S	24° 20,79' W	3926,1	E 16	30,4	0,6	Sediment Profile Imaging	SEP	into deep	3911 m Draht ausgesteckt
PS61/139-3	19.03.02	13:12	58° 13,88' S	24° 20,63' W	3848,1	E 16	63,0	1,1	Sediment Profile Imaging	SEP	start rising	
PS61/139-3	19.03.02	14:03	58° 13,63' S	24° 20,52' W	3987,2	ESE 18	66,3	0,5	Sediment Profile Imaging	SEP	on deck	
PS61/139-3	19.03.02	14:06	58° 13,65' S	24° 20,51' W	3985,1	ESE 16	86,6	1,1	Sediment Profile Imaging	SEP	CTD on deck	
PS61/139-4	19.03.02	15:20	58° 14,74' S	24° 20,56' W	3947,7	ESE 19	244,0	2,0	MultiCorer	MUC	surface	
PS61/139-4	19.03.02	16:36	58° 14,75' S	24° 20,22' W	3933,3	ESE 18	131,4	0,7	MultiCorer	MUC	at sea bottom	3891 m ausgesteckt
PS61/139-4	19.03.02	17:39	58° 14,88' S	24° 20,26' W	3934,4	ESE 18	238,6	1,1	MultiCorer	MUC	on deck	
PS61/139-5	19.03.02	18:30	58° 13,64' S	24° 29,50' W	3947,4	ESE 18	159,9	2,3	Agassiz trawl	AGT	surface	
PS61/139-5	19.03.02	19:46	58° 14,56' S	24° 24,81' W	3946,2	ESE 20	82,4	2,5	Agassiz trawl	AGT	AGT on ground	
PS61/139-5	19.03.02	20:35	58° 15,07' S	24° 22,03' W	3947,9	ESE 18	114,4	1,8	Agassiz trawl	AGT	start trawl	
PS61/139-5	19.03.02	21:04	58° 15,31' S	24° 21,20' W	3931,4	ESE 18	134,1	1,5	Agassiz trawl	AGT	Stop Trawl	
PS61/139-5	19.03.02	22:22	58° 15,92' S	24° 20,95' W	3925,5	ESE 17	211,7	2,3	Agassiz trawl	AGT	AGT off ground	
PS61/139-5	19.03.02	23:59	58° 16,86' S	24° 20,85' W	3863,3	ESE 17	103,0	1,3	Agassiz trawl	AGT	on deck	
PS61/139-6	20.03.02	11:09	58° 13,23' S	24° 22,75' W	4014,0	SE 14	343,1	0,5	Epibenthos sledge	EBS	surface	
PS61/139-6	20.03.02	12:40	58° 13,45' S	24° 23,04' W	3991,1	SE 14	185,0	0,3	Epibenthos sledge	EBS	on ground	

PS61/139-6	20.03.02	13:25	58° 14,10' S	24° 21,22' W	3941,7	SSE 14	115,2	2,0	Epibenthos sledge	EBS	start trawling winch stop	6000 m Kabel ausgesteckt
PS61/139-6	20.03.02	13:35	58° 14,18' S	24° 20,94' W	3926,8	SSE 13	118,7	1,4	Epibenthos sledge	EBS	end trawling	
PS61/139-6	20.03.02	14:46	58° 14,15' S	24° 21,21' W	3947,2	SSE 13	256,5	0,2	Epibenthos sledge	EBS	start hoisting from the bottom	
PS61/139-6	20.03.02	16:17	58° 14,11' S	24° 21,63' W	3965,8	SE 13	301,3	0,7	Epibenthos sledge	EBS	on deck	
PS61/139-7	20.03.02	16:51	58° 14,18' S	24° 20,47' W	3939,2	SSE 13	230,0	0,2	Large Box Corer	GKG	surface	
PS61/139-7	20.03.02	18:03	58° 14,10' S	24° 20,73' W	3935,1	SSE 13	317,8	1,0	Large Box Corer	GKG	at sea bottom	3914 m ausgesteckt
PS61/139-7	20.03.02	19:03	58° 14,09' S	24° 20,53' W	3973,4	SSE 11	164,2	0,5	Large Box Corer	GKG	on deck	
PS61/139-8	20.03.02	19:15	58° 14,15' S	24° 20,43' W	3974,0	SE 11	105,1	0,1	MultiCorer	MUC	surface	
PS61/139-8	20.03.02	20:41	58° 14,26' S	24° 20,62' W	3933,1	SSE 11	291,0	0,2	MultiCorer	MUC	at sea bottom	
PS61/139-8	20.03.02	21:37	58° 14,08' S	24° 20,78' W	3940,9	SE 10	244,0	0,3	MultiCorer	MUC	on deck	
PS61/139-9	20.03.02	21:47	58° 14,10' S	24° 20,75' W	3938,0	SE 11	56,3	0,3	MultiCorer	MUC	surface	
PS61/139-9	20.03.02	23:07	58° 14,14' S	24° 20,51' W	3981,7	SE 11	328,0	0,7	MultiCorer	MUC	at sea bottom	3926 m Draht ausgesteckt
PS61/139-9	21.03.02	00:07	58° 14,04' S	24° 20,49' W	3974,2	SE 9	283,2	0,3	MultiCorer	MUC	on deck	
PS61/139-10	21.03.02	00:20	58° 14,27' S	24° 20,91' W	3925,9	SSE 9	245,2	0,4	Large Box Corer	GKG	surface	
PS61/139-10	21.03.02	01:29	58° 14,18' S	24° 20,62' W	3965,0	SSE 8	86,3	1,1	Large Box Corer	GKG	at sea bottom	3918 m Kabel ausgesteckt
PS61/139-10	21.03.02	02:27	58° 14,06' S	24° 20,33' W	3981,0	SSE 7	233,4	0,6	Large Box Corer	GKG	on deck	
PS61/140-1	21.03.02	04:53	58° 15,83' S	24° 53,93' W	2934,0	S 8	183,7	0,6	Sediment Profile Imaging	SEP	into water	
PS61/140-1	21.03.02	05:10	58° 15,95' S	24° 54,00' W	2942,0	SSE 7	231,9	1,3	Sediment Profile Imaging	SEP	50 m CTD Seabird	
PS61/140-1	21.03.02	05:59	58° 15,99' S	24° 53,76' W	2951,0	S 9	153,4	0,9	Sediment Profile Imaging	SEP	into deep	2935 m ausgesteckt
PS61/140-1	21.03.02	07:02	58° 16,06' S	24° 53,89' W	2956,0	SSW 8	278,6	1,0	Sediment Profile Imaging	SEP	start rising	
PS61/140-1	21.03.02	07:37	58° 16,18' S	24° 53,84' W	2972,0	S 8	169,9	0,2	Sediment Profile Imaging	SEP	CTD on deck	
PS61/140-1	21.03.02	07:51	58° 16,10' S	24° 53,95' W	2959,0	S 8	313,9	0,7	Sediment Profile Imaging	SEP	on deck	
PS61/140-2	21.03.02	08:02	58° 15,98' S	24° 54,08' W	2945,0	S 8	259,7	0,6	Large Box Corer	GKG	surface	
PS61/140-2	21.03.02	08:53	58° 16,09' S	24° 54,26' W	2944,0	S 7	121,8	0,3	Large Box Corer	GKG	at sea bottom	
PS61/140-2	21.03.02	09:38	58° 16,13' S	24° 54,26' W	2943,0	SSW 7	97,6	0,4	Large Box Corer	GKG	on deck	
PS61/140-3	21.03.02	09:57	58° 15,94' S	24° 53,66' W	2947,0	S 7	19,1	0,3	MultiCorer	MUC	surface	
PS61/140-3	21.03.02	10:49	58° 15,99' S	24° 53,62' W	2950,0	S 8	278,8	0,5	MultiCorer	MUC	at sea bottom	
PS61/140-3	21.03.02	11:35	58° 16,14' S	24° 53,83' W	2964,1	S 6	332,0	1,1	MultiCorer	MUC	on deck	
PS61/140-4	21.03.02	11:57	58° 16,00' S	24° 54,03' W	2943,4	S 8	52,7	0,8	Large Box Corer	GKG	surface	
PS61/140-4	21.03.02	12:47	58° 16,00' S	24° 54,19' W	2935,1	S 7	59,1	0,7	Large Box Corer	GKG	at sea bottom	2891 m Kabel ausgesteckt
PS61/140-4	21.03.02	13:30	58° 16,14' S	24° 54,10' W	2944,9	S 8	359,4	0,5	Large Box Corer	GKG	on deck	
PS61/140-5	21.03.02	13:49	58° 15,95' S	24° 53,61' W	2943,7	S 9	84,3	0,4	MultiCorer	MUC	surface	
PS61/140-5	21.03.02	14:41	58° 16,02' S	24° 53,75' W	2949,0	SSW 8	259,6	1,2	MultiCorer	MUC	at sea bottom	2898 m Draht ausgesteckt
PS61/140-5	21.03.02	15:28	58° 16,04' S	24° 53,93' W	2950,7	SSW 7	198,6	0,8	MultiCorer	MUC	on deck	
PS61/140-6	21.03.02	16:40	58° 15,99' S	24° 54,15' W	2935,4	SSW 7	258,8	0,4	MultiCorer	MUC	surface	
PS61/140-6	21.03.02	17:32	58° 16,07' S	24° 54,12' W	2941,9	SSW 7	169,3	0,5	MultiCorer	MUC	at sea bottom	2889 m ausgesteckt
PS61/140-6	21.03.02	18:17	58° 16,15' S	24° 54,16' W	2943,8	SSW 6	313,5	0,9	MultiCorer	MUC	on deck	
PS61/140-7	21.03.02	19:30	58° 13,40' S	24° 50,59' W	3035,0	SSW 7	213,7	2,8	Agassiz trawl	AGT	surface	
PS61/140-7	21.03.02	20:29	58° 15,11' S	24° 52,60' W	2962,1	SSW 6	215,6	1,7	Agassiz trawl	AGT	AGT on ground	
PS61/140-7	21.03.02	21:02	58° 16,00' S	24° 53,78' W	2945,4	SW 6	226,6	1,8	Agassiz trawl	AGT	start trawl	
PS61/140-7	21.03.02	21:33	58° 16,40' S	24° 54,41' W	2957,6	SW 5	244,1	1,7	Agassiz trawl	AGT	Stop Trawl	
PS61/140-7	21.03.02	22:30	58° 16,39' S	24° 54,85' W	2940,9	SSW 4	282,6	0,3	Agassiz trawl	AGT	AGT off ground	
PS61/140-7	21.03.02	23:46	58° 16,65' S	24° 55,11' W	2950,1	WSW 5	125,1	0,4	Agassiz trawl	AGT	on deck	

PS61/140-8	22.03.02	00:27	58° 15,21' S	24° 52,21' W	3005,0	SW 4	236,0	1,0	Epibenthos sledge	EBS	surface	
PS61/140-8	22.03.02	01:31	58° 15,21' S	24° 52,90' W	2965,0	SSW 7	310,0	0,4	Epibenthos sledge	EBS	on ground	
PS61/140-8	22.03.02	02:05	58° 15,98' S	24° 53,72' W	2947,0	SSW 5	206,8	1,3	Epibenthos sledge	EBS	start trawling	4500 m Kabel ausgesteckt
PS61/140-8	22.03.02	02:15	58° 16,13' S	24° 53,87' W	2970,0	SSW 5	209,8	0,9	Epibenthos sledge	EBS	winch stop end trawling	
PS61/140-8	22.03.02	03:10	58° 16,29' S	24° 54,10' W	2962,0	SSW 4	286,7	0,4	Epibenthos sledge	EBS	start hoisting from the bottom	
PS61/140-8	22.03.02	04:20	58° 16,60' S	24° 54,52' W	2975,0	SW 5	17,9	0,2	Epibenthos sledge	EBS	on deck	
PS61/139-1	22.03.02	07:30	58° 17,63' S	24° 29,26' W	3729,0	WSW 4	349,6	0,2	Amphipod trap	ATC	released	
PS61/139-1	22.03.02	08:43	58° 17,59' S	24° 29,07' W	3735,0	SW 7	58,5	0,5	Amphipod trap	ATC	surfaced	
PS61/139-1	22.03.02	08:54	58° 17,74' S	24° 29,32' W	3724,0	SSW 7	250,7	0,9	Amphipod trap	ATC	on deck	
PS61/141-1	22.03.02	11:35	58° 25,02' S	25° 1,03' W	2292,6	WSW 5	276,2	0,8	CTD/rosette water sampler	CTD/RO	surface	
PS61/141-1	22.03.02	11:47	58° 25,01' S	25° 1,29' W	2285,0	WSW 5	332,0	0,6	CTD/rosette water sampler	CTD/RO	at depth	400 m Kabel ausgesteckt
PS61/141-1	22.03.02	11:56	58° 24,98' S	25° 1,42' W	2271,0	WSW 5	293,4	0,6	CTD/rosette water sampler	CTD/RO	on deck	
PS61/141-2	22.03.02	12:02	58° 24,96' S	25° 1,36' W	2271,0	WSW 5	24,7	0,2	Large Box Corer	GKG	surface	
PS61/141-2	22.03.02	12:41	58° 24,94' S	25° 1,79' W	2213,0	W 4	17,4	0,1	Large Box Corer	GKG	at sea bottom	2173 m Kabel ausgesteckt
PS61/141-2	22.03.02	13:13	58° 24,96' S	25° 1,97' W	2203,0	WNW 5	123,8	0,1	Large Box Corer	GKG	on deck	
PS61/141-3	22.03.02	14:32	58° 24,81' S	25° 0,82' W	2277,0	W 7	269,4	0,7	Sediment Profile Imaging	SEP	into water	
PS61/141-3	22.03.02	15:18	58° 25,03' S	25° 0,88' W	2305,0	WNW 7	270,7	0,0	Sediment Profile Imaging	SEP	into deep	2252 m ausgesteckt
PS61/141-3	22.03.02	15:58	58° 25,01' S	25° 0,99' W	2302,0	WNW 8	71,7	0,4	Sediment Profile Imaging	SEP	start rising	
PS61/141-3	22.03.02	16:28	58° 24,96' S	25° 1,16' W	2289,0	WNW 7	306,4	0,2	Sediment Profile Imaging	SEP	CTD on deck	
PS61/141-3	22.03.02	16:39	58° 24,98' S	25° 1,00' W	2296,0	WNW 7	97,3	1,2	Sediment Profile Imaging	SEP	on deck	
PS61/141-4	22.03.02	16:56	58° 25,00' S	25° 0,76' W	2302,0	WNW 7	142,8	0,4	MultiCorer	MUC	surface	
PS61/141-4	22.03.02	17:39	58° 24,96' S	25° 0,84' W	2293,0	WNW 7	208,1	0,1	MultiCorer	MUC	at sea bottom	2243 m ausgesteckt
PS61/141-4	22.03.02	18:16	58° 24,94' S	25° 0,85' W	2287,0	WNW 7	113,1	0,8	MultiCorer	MUC	on deck	
PS61/141-5	22.03.02	18:32	58° 24,92' S	25° 0,79' W	2279,8	WNW 6	268,0	0,0	Large Box Corer	GKG	surface	
PS61/141-5	22.03.02	19:12	58° 24,85' S	25° 0,96' W	2264,0	NW 6	267,7	0,4	Large Box Corer	GKG	at sea bottom	2225 m ausgesteckt
PS61/141-5	22.03.02	19:44	58° 24,83' S	25° 1,02' W	2255,3	NW 6	24,6	0,3	Large Box Corer	GKG	on deck	
PS61/141-6	22.03.02	19:57	58° 24,97' S	25° 1,01' W	2284,0	NW 6	264,6	0,3	MultiCorer	MUC	surface	
PS61/141-6	22.03.02	20:41	58° 24,96' S	25° 1,07' W	2276,9	NW 6	241,1	0,2	MultiCorer	MUC	at sea bottom	2235 m Draht
PS61/141-6	22.03.02	21:14	58° 24,94' S	25° 1,10' W	2267,8	NW 6	342,3	0,2	MultiCorer	MUC	on deck	
PS61/141-7	22.03.02	21:29	58° 24,95' S	25° 1,16' W	2277,3	NW 6	119,8	0,1	Large Box Corer	GKG	surface	
PS61/141-7	22.03.02	22:08	58° 24,91' S	25° 1,24' W	2257,9	NNW 5	261,5	0,4	Large Box Corer	GKG	at sea bottom	2217 m Draht
PS61/141-7	22.03.02	22:43	58° 24,94' S	25° 1,16' W	2270,2	NNW 6	51,7	0,6	Large Box Corer	GKG	on deck	
PS61/141-8	22.03.02	22:59	58° 24,93' S	25° 1,14' W	2266,8	NNW 6	123,1	0,3	MultiCorer	MUC	surface	
PS61/141-8	22.03.02	23:44	58° 24,98' S	25° 1,00' W	2285,5	NNW 6	166,8	0,6	MultiCorer	MUC	at sea bottom	2236 m Kabel ausgesteck
PS61/141-8	23.03.02	00:19	58° 25,12' S	25° 0,89' W	2310,4	NNW 5	71,9	0,6	MultiCorer	MUC	on deck	
PS61/141-9	23.03.02	00:45	58° 27,06' S	25° 2,59' W	2074,0	NNW 6	26,8	1,8	Agassiz trawl	AGT	surface	
PS61/141-9	23.03.02	01:31	58° 25,68' S	25° 1,47' W	2314,0	N 8	6,0	2,1	Agassiz trawl	AGT	AGT on ground	
PS61/141-9	23.03.02	01:58	58° 24,82' S	25° 0,82' W	2276,0	N 8	29,2	2,0	Agassiz trawl	AGT	start trawl	4100 m Kabel ausgesteckt
PS61/141-9	23.03.02	02:28	58° 24,38' S	25° 0,21' W	2292,0	NW 6	21,5	1,1	Agassiz trawl	AGT	Stop Trawl	
PS61/141-9	23.03.02	02:29	58° 24,36' S	25° 0,20' W	2289,0	NNW 7	31,0	1,1	Agassiz trawl	AGT	Start hoisting	
PS61/141-9	23.03.02	03:15	58° 24,29' S	24° 59,48' W	2304,0	NNW 8	111,7	0,6	Agassiz trawl	AGT	AGT off ground	
PS61/141-9	23.03.02	04:13	58° 24,41' S	24° 59,14' W	2331,0	NW 9	25,8	0,5	Agassiz trawl	AGT	on deck	
PS61/141-10	23.03.02	04:51	58° 25,75' S	25° 0,10' W	2388,0	NNW 9	324,4	1,0	Epibenthos sledge	EBS	surface	
PS61/141-10	23.03.02	05:42	58° 25,55' S	25° 0,22' W	2369,0	NNW 9	126,5	0,2	Epibenthos sledge	EBS	on ground	

PS61/141-10	23.03.02	06:04	58° 25,08' S	25° 0,77' W	2313,0	NNW 9	335,3	1,7	Epibenthos sledge	EBS	start trawling	3404 m ausgesteckt
PS61/141-10	23.03.02	06:14	58° 24,93' S	25° 0,95' W	2281,0	N 9	322,0	1,0	Epibenthos sledge	EBS	winch stop end trawling	
PS61/141-10	23.03.02	06:57	58° 24,63' S	25° 0,74' W	2258,0	N 10	103,3	0,2	Epibenthos sledge	EBS	start hoisting from the bottom	
PS61/141-10	23.03.02	07:50	58° 24,40' S	25° 0,91' W	2199,0	N 11	82,8	0,3	Epibenthos sledge	EBS	on deck	
PS61/142-1	23.03.02	16:41	58° 50,75' S	23° 58,01' W	6342,0	N 15	145,6	1,0	Sediment Profile Imaging	SEP	into water	
PS61/142-1	23.03.02	17:01	58° 50,85' S	23° 57,72' W	6349,0	N 13	191,3	0,6	Sediment Profile Imaging	SEP	50 m CTD Seabird	CTD bei 350 m befestigt
PS61/142-1	23.03.02	18:35	58° 50,80' S	23° 58,27' W	6333,0	NNE 14	95,2	0,2	Sediment Profile Imaging	SEP	into deep	6345 m ausgesteckt
PS61/142-1	23.03.02	19:10	58° 50,81' S	23° 58,20' W	6336,0	NNE 14	163,6	0,7	Sediment Profile Imaging	SEP	start rising	
PS61/142-1	23.03.02	23:11	58° 50,84' S	23° 58,07' W	6335,0	NNE 14	67,5	1,2	Sediment Profile Imaging	SEP	on deck	
PS61/142-2	23.03.02	23:25	58° 50,86' S	23° 58,04' W	6331,0	NNE 13	286,9	0,8	Large Box Corer	GKG	surface	
PS61/142-2	24.03.02	01:19	58° 50,82' S	23° 58,22' W	6322,3	NNE 12	330,3	0,4	Large Box Corer	GKG	at sea bottom	6325 m Kabel ausgesteckt
PS61/142-2	24.03.02	02:54	58° 50,88' S	23° 58,28' W	6318,8	NNE 16	264,2	0,5	Large Box Corer	GKG	on deck	
PS61/142-3	24.03.02	03:51	58° 50,97' S	23° 58,09' W	6301,5	NNE 17	80,5	0,6	Large Box Corer	GKG	surface	
PS61/142-3	24.03.02	05:34	58° 50,78' S	23° 58,14' W	6327,1	NNE 15	92,9	0,6	Large Box Corer	GKG	at sea bottom	6344 m ausgesteckt
PS61/142-3	24.03.02	07:17	58° 50,78' S	23° 58,15' W	6325,6	NNE 16	12,6	0,5	Large Box Corer	GKG	on deck	
PS61/142-4	24.03.02	08:15	58° 50,88' S	23° 58,10' W	6324,3	NNE 17	38,0	1,5	MultiCorer	MUC	surface	
PS61/142-4	24.03.02	10:01	58° 50,85' S	23° 58,26' W	6319,3	NNE 15	151,8	0,9	MultiCorer	MUC	at sea bottom	
PS61/142-4	24.03.02	11:36	58° 50,85' S	23° 58,09' W	6323,7	NNE 19	73,2	1,0	MultiCorer	MUC	on deck	
PS61/142-5	24.03.02	12:13	58° 50,88' S	23° 58,42' W	6317,6	NNE 18	220,8	0,6	MultiCorer	MUC	surface	
PS61/142-5	24.03.02	14:02	58° 50,83' S	23° 58,61' W	6315,7	NNE 16	344,3	1,1	MultiCorer	MUC	at sea bottom	6337 m Kabel ausgesteckt
PS61/142-5	24.03.02	15:42	58° 50,73' S	23° 58,79' W	6331,1	NNE 18	214,3	2,6	MultiCorer	MUC	on deck	
PS61/142-6	24.03.02	16:07	58° 52,01' S	24° 0,05' W	5966,2	NNE 15	357,6	0,5	Epibenthos sledge	EBS	surface	
PS61/142-6	24.03.02	18:42	58° 51,58' S	23° 59,25' W	6224,5	NE 17	301,6	0,7	Epibenthos sledge	EBS	on ground	
PS61/142-6	24.03.02	19:31	58° 50,80' S	23° 58,11' W	6323,1	NE 16	114,9	1,8	Epibenthos sledge	EBS	start trawling	
PS61/142-6	24.03.02	20:04	58° 50,57' S	23° 57,71' W	6333,2	NE 16	39,4	1,3	Epibenthos sledge	EBS	winch stop end trawling	
PS61/142-6	24.03.02	21:27	58° 50,44' S	23° 57,61' W	6339,7	NE 15	103,1	0,9	Epibenthos sledge	EBS	start hoisting from the bottom	
PS61/142-6	24.03.02	23:36	58° 50,56' S	23° 56,91' W	6479,6	NE 16	105,0	1,4	Epibenthos sledge	EBS	on deck	
PS61/142-7	25.03.02	00:32	58° 50,70' S	23° 58,12' W	6335,4	NE 16	247,1	0,5	MultiCorer	MUC	surface	
PS61/142-7	25.03.02	02:25	58° 50,58' S	23° 58,74' W	6334,0	NE 15	292,9	0,8	MultiCorer	MUC	at sea bottom	6325 m Kabel ausgesteckt
PS61/142-7	25.03.02	03:58	58° 50,51' S	23° 58,31' W	6313,1	NE 13	145,3	1,3	MultiCorer	MUC	on deck	
PS61/142-8	25.03.02	04:23	58° 50,82' S	23° 58,32' W	6322,0	NNE 11	58,0	1,1	MultiCorer	MUC	surface	
PS61/142-8	25.03.02	06:16	58° 50,70' S	23° 58,34' W	6331,0	NNW 9	9,8	2,1	MultiCorer	MUC	at sea bottom	6344 m ausgesteckt
PS61/142-8	25.03.02	07:52	58° 50,62' S	23° 58,35' W	6340,0	N 9	20,3	1,0	MultiCorer	MUC	on deck	
PS61/143-1	25.03.02	12:20	58° 44,98' S	25° 9,79' W	799,5	N 10	45,7	0,6	Epibenthos sledge	EBS	surface	
PS61/143-1	25.03.02	12:39	58° 44,91' S	25° 10,11' W	801,2	N 9	249,4	1,2	Epibenthos sledge	EBS	on ground	
PS61/143-1	25.03.02	12:48	58° 44,69' S	25° 10,27' W	773,9	N 9	316,8	1,7	Epibenthos sledge	EBS	start trawling	1200 m Kabel ausgesteckt
PS61/143-1	25.03.02	12:59	58° 44,49' S	25° 10,47' W	755,6	N 10	333,6	1,3	Epibenthos sledge	EBS	winch stop end trawling	
PS61/143-1	25.03.02	13:15	58° 44,45' S	25° 10,66' W	752,6	N 10	227,2	1,0	Epibenthos sledge	EBS	start hoisting from the bottom	
PS61/143-1	25.03.02	13:33	58° 44,42' S	25° 10,93' W	754,9	N 10	319,6	1,2	Epibenthos sledge	EBS	on deck	

PS61/143-2	25.03.02	14:00	58° 45,30' S	25° 9,74' W	833,5	N 10	342,6	3,2	Agassiz trawl	AGT	surface	
PS61/143-2	25.03.02	14:19	58° 44,64' S	25° 10,26' W	771,2	N 12	348,2	2,4	Agassiz trawl	AGT	AGT on ground	
PS61/143-2	25.03.02	14:27	58° 44,35' S	25° 10,48' W	752,7	N 10	344,1	2,4	Agassiz trawl	AGT	start trawl	1400 m Kabel ausgesteckt
PS61/143-2	25.03.02	14:57	58° 43,76' S	25° 11,09' W	795,0	N 9	316,7	1,4	Agassiz trawl	AGT	Stop Trawl	
PS61/143-2	25.03.02	15:13	58° 43,65' S	25° 11,34' W	814,7	NNW 10	304,9	1,2	Agassiz trawl	AGT	AGT off ground	
PS61/143-2	25.03.02	15:37	58° 43,55' S	25° 11,76' W	839,6	N 10	302,2	0,5	Agassiz trawl	AGT	on deck	
PS61/143-3	25.03.02	16:04	58° 44,43' S	25° 10,60' W	755,8	N 11	307,1	0,6	Sediment Profile Imaging	SEP	into water	
PS61/143-3	25.03.02	16:21	58° 44,25' S	25° 10,80' W	764,2	N 12	211,1	0,4	Sediment Profile Imaging	SEP	into deep	740 m ausgesteckt
PS61/143-3	25.03.02	16:58	58° 44,11' S	25° 10,94' W	766,5	NNW 10	244,9	0,7	Sediment Profile Imaging	SEP	start rising	
PS61/143-3	25.03.02	17:11	58° 44,10' S	25° 11,09' W	773,8	NNW 10	347,7	0,7	Sediment Profile Imaging	SEP	on deck	

4.B Participating institutions

Address	Abbreviation
CCAMLR P.O. Box 213 North Hobart Tasmania 7002, Australia	CCAMLR
Gary Charles Beresford Museum Victoria P.O. Box 666E Melbourne Vic 3001, Australia	MOV
Institut Royal des Sciences Naturelles de Belgique Rue Vautier 29 B-1000 Bruxelles, Belgium	SNB
Dept. Oceanology University of Liège Sart Tilman 36 B-4000 Liège	OULg
University of Gent Zoological Institute K.L. Ledeganckstraat 35 B-9000 Gent, Belgium	RUG
Deutscher Wetterdienst Geschäftsfeld Seeschiffahrt Jenfelder Allee 70 A D-22043 Hamburg	DWD
Universität Hamburg Zoologisches Institut und Museum Martin-Luther-King-Platz 3 D-20146 Hamburg	ZIM
Forschungsinstitut Senckenberg Senckenberganlage 25 D-60325 Frankfurt am Main	FIS
Ruhr-Universität-Bochum LS Spezielle Zoologie Universitätsstraße 150 D-44780 Bochum	RUB
Alfred-Wegener-Institut für Polar- und Meeresforschung Columbusstraße D-27568 Bremerhaven	AWI

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Institut für Umweltphysik
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Institut für Meereskunde — IFM
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Universitätsstr. 1
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FB Biologie, Geo- und Umweltwissenschaften
Postfach 25 03
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Karlstr. 23 - 25
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Zoologische Staatssammlung München — ZSM
Münchhausenstr. 21
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Southern Scientific Research Institute — Yug NIRO
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2 Sverdlov str.
Kerch 98300, Ukraine

British Antarctic Survey — BAS
High Cross
Madingley Road
Cambridge CB3 0ET, U.K.

Southampton Oceanographic Centre
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European Way
Southampton SO14 3HZ, U.K
SOC

National Museums of Scotland
Chambers Street
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NMS

Scottish Association for Marine Science
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Dunbeg, Oban PA34 4AD
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DML

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Via Per Monteroni
I-73100 Lecce, Italy
UNILE

Instituto di Ricerche Pesca Martittima del CNR
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I-60125 AnconaI, Italy
IRPEM

University of Padua
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via G. Colombo 3
I-35100 Padova, Italy
UNIPD

Department of Environmental Sciences
Siena University
Via delle Cerchia 3
I-53100 Siena, Italy
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Universitetet i Oslo
Biologisk Institut
P.B. 1064 Blindern
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UIO

Department of Zoology
Tromsø University
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SIO

Universidad de Sevilla Facultad de Biologia Reina Mercedes 6 E-41012 Sevilla, Spain	UDS
Universidad de Cadiz Fakultad de Ciencias de Mar Poligono del rio San Pedro, s/n E-11510 Puerto Real, Cádiz, Spain	CASEM
University of Geneva Station de Zoologie 154, Route de Malagnou CH-1224 Chene-Bougeries, Switzerland	UNIGE
ENSR Marine and Coastal Center 89 Water Street Woods Hole, Massachusetts 02543, U.S.A.	ENSR
California Academy of Sciences Dept. of Invertebrate Zoology & Geology Golden Gate Park San Francisco, CA 94118-4599, U.S.A.	CAS
University of California Long Marine Laboratory 100 Shaffer Road Santa Cruz, CA 95060, U.S.A.	UCSC
Virginia Institute of Marine Science Route 1208 Greate Road Gloucester Point, VA 23062, U.S.A.	VIMS
Ohio University Dept. of Biomedical Sciences Irvine Hall Athens, OH 45701-2979, U.S.A.	OHIOU
Southwest Fisheries Center 8604 La Jolla Shores Dr. La Jolla, California 92037, U.S.A.	UCSD
Smithsonian Institution NMFS National Systematics Laboratory National Museum of Natural History Washington DC 20560, U.S.A.	NMNH
University of Massachusetts Dept. of Biology 100 Morissey Blvd. Boston, Massachusetts 02125, U.S.A.	UMB

4.C Scientific Party

Name	Vorname	Institut	ANT-XIX/3	ANT-XIX/4
Aden	Mareike	GY Aurich	x	
Allcock	Louise	NMS Edinburgh	x	x
Berge	Joergen	ZTU Tromsø		x
Bertouch, von	Gillian	CCAMLR Hobart	x	
Blake	James A.	ENSR Woods Hole	x	x
Bohn	Jens Michael	ZILMU München		x
Brandt	Angelika	ZIM Hamburg	x	x
Broekeland	Wiebke	RUB Bochum	x	x
Broyer, de	Claude	SNB Brüssel	x	
Buldt	Klaus	DWD Hamburg	x	x
Carpenter	Lawrence	VIMS Gloucester Pt.		x
Conradi	Mercedes	UDS Sevilla	x	
Cornelius	Nils	SOC Southampton		x
Danulat	EVA	Journalist		x
Dauby	Patrick	OULg Liège	x	x
Diaz	Robert	VIMS Gloucester Pt.	x	
Doolittle	Daniel	VIMS Gloucester Pt.	x	
Eastman	Joseph	OHIOU Athens	x	
Ellingsen	Kari Elsa	UIO Oslo	x	
Evans	Marie	ENSR Woods Hole		x
Friedeburg, von	Christoph	IUP Heidelberg	x	
Fütterer	Dieter, K.	AWI Bremerhaven	x	x
Gebruk	Andrey	SIO Moskau		x
Germer	Christian	AWI Bremerhaven		x
Gooday	Andrew J.	SOC Southampton		x
Heumann	Holger	IUP Heidelberg		x
Hilbig	Brigitte	ZIM Hamburg	x	x
Howe	John A.	DML Argyll		x
Janussen	Dorte	FIS Frankfurt		x
Jones	Christopher	UCSD La Jolla	x	
Kock	Karl-Hermann	BFA Hamburg	x	
La Mesa	Mario	IRPEM Ancona	x	
Linse	Katrin	BAS Cambridge		x
Lockhart	Susanne	UCSC Santa Cruz	x	x
Martin	Patrick	SNB Brüssel		x
Martinez Arbizu	Pedro	DZMB Oldenburg	x	
McClain	Craig R.	UMB Boston		x
Megina	Cesar	CASEM Cadiz		x
Mesel, de	Ilse	RUG Gent		x
Möller	Hans-Joachim	DWD Hamburg		x
Mooi	Richard	CAS San Francisco	x	
Mühlenhardt-Siegel	Ute	ZIM Hamburg		x
Narayanaswamy	Bhavani Emma	DML Argyll		x
Nyssen	Fabienne	SNB Brüssel	x	x
Pawlowski	Jan	UNIGE Genf		x
Pearse	John	USC Santa Cruz		x
Piatkowski	Uwe	IFM Kiel	x	

Name	Vorname	Institut	ANT-XIX/3	ANT-XIX/4
Piraino	Stefano	UNILE Lecce		x
Poore	Gary C.B.	MOV Melbourne		x
Pshenichnov	Leonid	YugNIRO Kerch	x	
Ramadan	Fadi	GY Aurich	x	
Raupach	Michael	RUB Bochum	x	x
Riehl	Rüdiger	IZUD Düsseldorf	x	
Romeo	Teresa	ESSU Siena	x	
Scherf	Regina	GY Aurich	x	
Schöling	Susanne	BFA Hamburg	x	
Schrödl	Michael	ZSM München		x
Seemann	Markus	GY Aurich	x	
Siegert	Christine	AWI Potsdam		
Spahic	Susanne	AWI Bremerhaven		x
Stracke	Alexander	GY Aurich	x	
Strieso	Gabriela	RUB Bochum	x	x
Strüfing	Reinhard	DWD Hamburg	x	
Tan	Tjhing Lok	AWI Bremerhaven		x
Thomson	Michael	BAS Cambridge		x
Vader	Vim	ZTU Tromsø		x
Vanreusel	Ann	UNIGE Gent		x
Vecchione	Michael	NMNH Washington	x	
Voigt	Katharina	GY Aurich	x	
Wegener	Gisela	ZIM Hamburg	x	x
Wigham	Benjamin	SOC Southampton		x
Zane	Lorenzo	UNIPD Padua	x	
Zittlosen	Gert Johann	AWI Bremerhaven	x	

4.D Ship's Crew

Name	Vorname	Rank	ANT-XIX/3	ANT-XIX/4
Keil	Jürgen	Master	x	x
Domke	Udo	Ch. Offc.	x	
Grundmann	Uwe	1. Offc.	x	x
Pluder	Andreas	Ch.Eng.	x	x
Peine	Lutz G.	2. Offc.	x	x
Spielke	Steffen	2. Offc.	x	x
Hartun	René	3. Offc.		x
Kohlberg	Eberhard	Doctor	x	x
Koch	Georg	R. Offc.	x	x
Delff	Wolfgang	1. Eng.	x	x
Ziemann	Olaf	2. Eng.	x	x
Zornow	Martin	3. Eng.	x	x
Bretfeld	Holger	Electron.	x	x
Greitemann-Hackl	A.	Electron.	x	x
Muhle	Heido	Electric.	x	x
Muhle	Helmut	Electron.	x	x
Roschinsky	Jörg	Electron.	x	x
Clasen	Burkhard	Boatsw.	x	x
Reise	Lutz G.	Carpenter	x	x
Burzan	Gerd-Ekkeh.	A.B.	x	x
Gil Iglesias	Luis	A.B.	x	x
Guse	Hartmut	A.B.	x	
Hagemann	Manfred	A.B.	x	
Hartwig	Andreas	A.B.		x
Kreis	Reinhard	A.B.		x
Moser	Siegfried	A.B.	x	x
Pousada Martinez	S.	A.B.	x	x
Schmidt	Uwe	A.B.	x	
Schulz	Ottomar	A.B.		x
Winkler	Michael	A.B.	x	
Preußner	Jörg	Storek.	x	x
Elsner	Klaus	Mot-man	x	x
Grafe	Jens	Mot-man	x	x
Hartmann	Ernst-Uwe	Mot-man	x	x
Ipsen	Michael	Mot-man	x	x
Voy	Bernd	Mot-man	x	x
Haubold	Bernd	Cook	x	x
Möller	Wolfgang	Cooksmate	x	
Silinsky	Frank	Cooksmate	x	x
Völske	Thomas	Cooksmate	x	x
Jürgens	Monika	1. Stwdess	x	x
Wöckener	Martina	Stwdess/Kr.	x	x
Czyborra	Bärbel	2. Stwdess	x	x
Gaude	Hans-Jürgen	2. Steward	x	x
Huang	Wu-Mei	2. Steward	x	x
Silinsky	Carmen	2. Stwdess	x	x

Name	**Vorname**	**Rank**	**ANT-XIX/3**	**ANT-XIX/4**
Yu	Kwok Yuen	Laundrym.	x	x
Morley	Kieran	Trainee/E	x	x
Rumler	Etienne	Trainee/D		x
Kruse	Lars	Apprent.	x	
Wanke	Steffen	Apprent.	x	