The Expedition ANTARKTIS XIII/3 (EASIZ I) of "Polarstern" to the eastern Weddell Sea in 1996

Edited by Wolf Arntz and Julian Gutt
with contributions of the participants

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1. Introduction

1.1 Objectives of the Cruise (W. Arntz)

"Polarstern" cruise ANT XIII/3, as the first cruise of the EASIZ (Ecology of the Sea Ice Zone) programme adopted by the Scientific Council of Antarctic Research (SCAR) during its XXIII meeting in Rome, was planned to make a contribution to the ecological study of the high Antarctic shelf of the Weddell Sea. This area best reflects typical polar conditions such as distinct seasonality, a short primary production phase, extremely low water temperatures and the impact of ice in its different ways. It also houses some of the most interesting benthic assemblages in the Southern Ocean with an overwhelming dominance of suspension-feeding epifauna, a three-dimensional structure, and great faunal richness (biodiversity). Due to former work in the area culminating in the European "Polarstern" Study (EPOS), many of the faunal components and large-scale structures are fairly well known, and in a first trophic interaction model an attempt has been made to account for the energy fluxes among the major faunal groups. In contrast to former expeditions, this first EASIZ cruise aimed at a higher resolution of factors and processes, both abiotic and biotic, that shape the faunal structures and dynamics under high Antarctic conditions. For this purpose the investigations were planned to concentrate on a few localities ("box concept") rather than applying large-scale measuring and sampling. However, the combination of different gears and methodological approaches, which had turned out useful in former expeditions, was to be continued including, for the first time, the use of hydrosweep-parasound techniques for ecological purposes. Also, international cooperation was to be strengthened both as a consequence of positive German experience in the past and as one of the columns of the EASIZ programme.

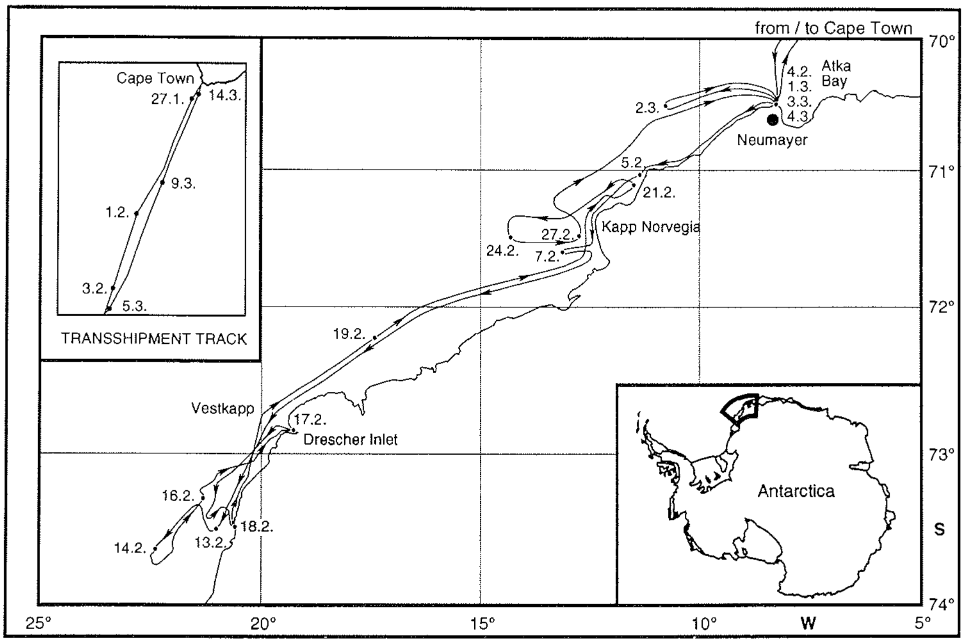

Fig. 1: Cruise track of RV "Polarstern" during the EASIZ cruise ANT XIII/3.

The cruise schedule (Fig. 1) was to concentrate work with a broad variety of gears in the Kapp Norvegia area (ca. 72°S, 12°W, Fig. 2) and to visit an additional area south-west of Vestkapp

(73°S, 19°W, Fig 3) mainly for fishing purposes, as fisheries biologists had experienced difficulties in using trawled gear in the former region due to its huge biomasses of sponges.
From the proposals of the participants several focal research themes emerged, all of them within the EASIZ framework:

- Resilience of Antarctic benthic communities following disturbance by iceberg scouring. This involves studies of iceberg impact as well as the identification of successional stages, and ageing of those organisms that dominate them.
- Pelago-benthic coupling and the role of suspension feeders. Of interest in this context are the size, quantity and quality of particles from the pelagial arriving at the seafloor and those available by resuspension or in the sediment (all of them together representing the food offer for suspension feeders), the size, quality and quantity of food ingested by, and the biology of the suspension feeders (condition, reproductive stage, etc.).
- Population dynamics, reproductive biology and ecophysiology of benthic and fish key species, including special conservation techniques for the application of new methods (isotopes, molecular genetics, etc.).
- Biodiversity within high Antarctic benthic communities from ROV sequences and trawl samples.
- Occurrence and characteristics of meiobenthic drift fauna.
- Food availability and characteristics of pelagic food offer for Weddell seals and Emperor penguins in the Drescher Inlet area.

Furthermore, the cruise offered the opportunity to complement the species inventory for various groups and to collect material for other purposes, taking care, however, that "collecting" did not become a primary objective for station planning.

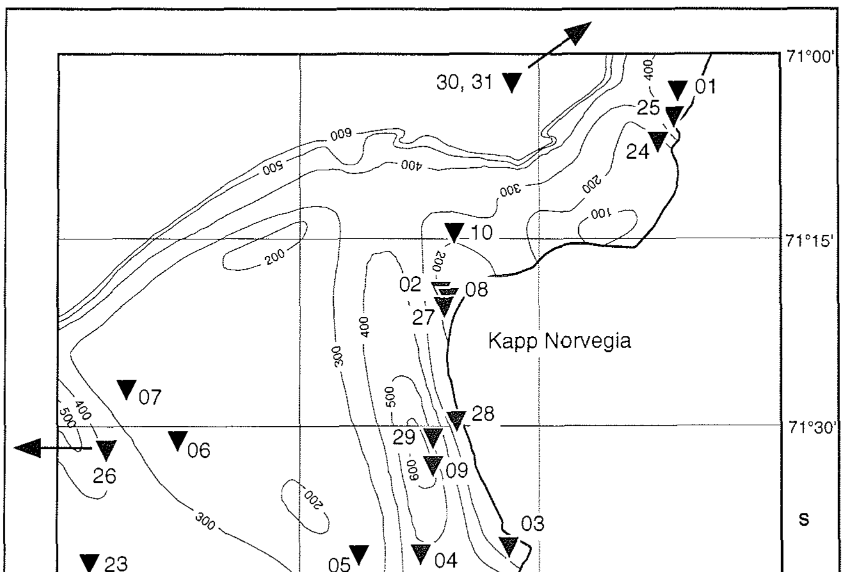

Fig. 2: The Kapp Norvegia working area with approximate location of stations (for exact coordinates consult the table in annex 3.2). Source: AWI, Bathymetric Chart of the Weddell Sea, Antarctica, Sheet 553, and helicopter measurements of the shelf ice edge during the cruise.

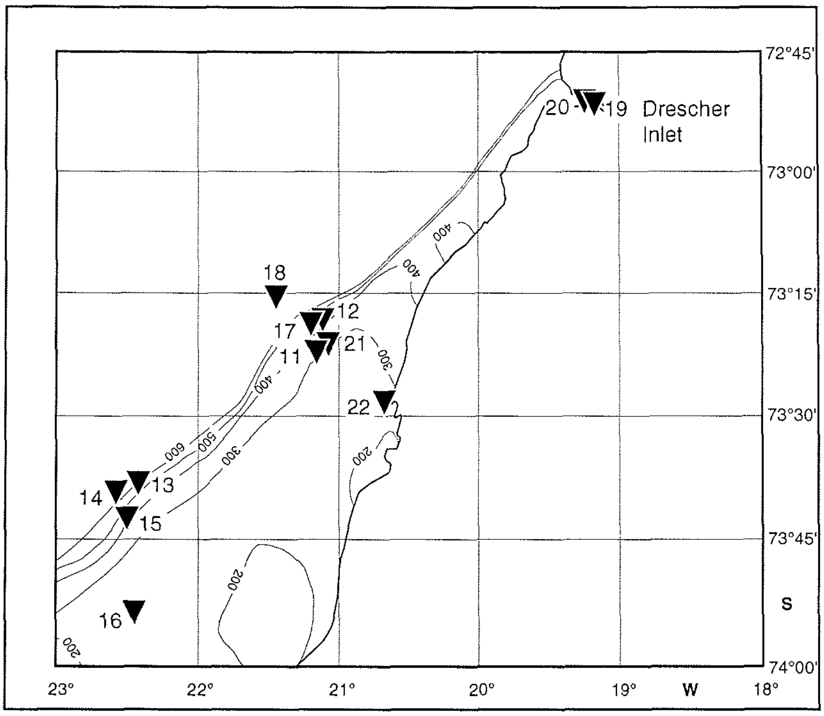

Fig. 3: The working area SW of Vestkapp including the Drescher inlet, with approximate location of stations (for exact coordinates consult the table in annex 3.2).

1.2 Summary Review of Results (W. Arntz)

Despite rather unfavourable ice and wind conditions during most of the cruise, ANT XIII/3 has yielded a large number of highly interesting results. Of course, many of them require further analysis; so this attempt of a summary must be considered preliminary.

In the study of iceberg impact on benthic communities, the ROV revealed a series of frequently reoccurring community structures, starting with sandy areas totally devoid of any fauna (recent scars) via bottoms with occasional motile animals and communities with a distinct dominance of certain groups (bryozoans, colonial ascidians, certain sponges), to obviously very old, dense associations of large calcareous and siliceous sponges of the "cabbage" type. Unfortunately, an attempt to sample the successional structures by means of the multibox corer was only partly successful, making major technical improvements necessary before the second EASIZ cruise. Another problem is to determine the age of dominant benthic species within the various successional stages, to be able to date the iceberg impact. This would be a prerequisite for evaluating the resilience of these benthic communities in response to iceberg scouring, which seems to be the principal disturbant in the area, and for getting an idea of the duration of the recolonisation process.

The impact of iceberg-related disturbance on benthic species diversity has yet to be determined on a larger scale. It is obvious that the immediate effects are disastrous, as most of the fauna is destroyed on the icebergs' path. Considering larger spatial and temporal time scales, however, iceberg disturbance is likely to result in an increase of benthic diversity due to the fact that a wide variety of successional stages with greatly differing fauna coexists in the iceberg impact area. The drift of icebergs, the position of which had been registered, during a gale was marked using

helicopters, and the present position of the shelf ice edge was compared with that encountered 10 to 15 years ago. Many icebergs which had not moved for weeks were shifted quite strongly during the gale which attained velocities >100 kn at times. The ice margin coincided only very roughly with our maps, and even the Drescher Inlet had changed position considerably.
Three daytime hauls with the benthopelagic trawl inside and outside the Drescher Inlet, fishing within the pycnocline where Weddell Seals had been found diving and foraging most frequently, did not yield any adult fish or squid (which both occurred in the bottom trawl) but a variety of postlarval and small juvenile fish up to 6 cm length. Their total number exceeded 400, including 4 species of Channichthyids and 4 species of Nototheniids of which *Pleuragramma antarcticum* was the most common. Fish and otoliths of adult *Pleuragramma* and small demersal notothenioids are frequently found in Weddell Seal stomachs in this area. It cannot be excluded that the juvenile fish contribute to the diet of Weddell Seals and that their otoliths are digested so rapidly that they are not detected in the stomachs. No hauls could be taken at night during this cruise. Nighttime trawling will have to be done, and more refined echoacoustic equipment will have to be used, to find out whether adult fish occur in the pycnocline. The "jigging machine" did not take any squid during the cruise, not even at localities where they were fairly common in the bottom trawl.
On all ROV pictures from the vicinity of the seafloor large amounts of particles were visible, indicating that at that time of the year the food input from the pelagial is very rich. However, quite surprisingly, food analyses of common suspension feeders (hydrozoans, gorgonarians, pennatularians) did not reveal the intake of any large seston food particles nor of phyto- or zooplankton. At least hydrozoans take, e.g., copepods in other areas, and it does not seem very reasonable that they should not make use of the rich food input during the short Antarctic summer season; much more so as freshly sedimented diatoms were very abundant in the area. From a trough at 600 m depth, close to the shelf ice edge, the box corer brought up a fresh green fluff layer 30 cm thick consisting almost exclusively of frustules of *Corethron* and a few *Chaetoceros*. Almost no macro- and meiofauna was found at this station that might use this food source. Further analyses using electron microscopy must show whether the suspension feeders had ingested small particles or no particulate food at all. At this time we can only speculate about the meaning of these results. Hypotheses trying to explain them include certain defense properties of the diatoms (spines, chemical substances), the physiological status of the suspension feeders (e.g., reproducing), or non-adaptation to the new food resource due to the short period since the last glaciation when ice covered most of the shelf and slope, and presumably no large particles were available to the suspension feeders that managed to survive under those conditions. Presently the stomach contents of the suspension feeders are subjected to electron microscopic study to find out about potential small food particles.
Taxonomical and ecological work during this first EASIZ cruise focused on sponges, bryozoans, molluscs, polynoid polychaetes, amphipods and scleractinian corals. With respect to the density of the station net of ROV and benthic samplers, the southeastern Weddell Sea shelf is now likely to be the best investigated region of the Antarctic. This is certainly true for intensely studied groups such as the sponges, which as a result of the combined EPOS/EASIZ data sets now exhibit the highest known species number anywhere in the Southern Ocean. The Weddell Sea also holds a leading position in terms of quantitative benthic sampling both of macro- and meiofauna. With the assistance of the two Russian colleagues from St. Petersburg, the Agassiz trawl catches were determined down to species level for the first time, thus allowing the calculation of species richness. Much material has also been sampled for the study of benthic key species, including organisms with ageable hard structures such as bryozoans, but also, e.g., polychaetes where pharyngeal teeth or the width of a certain segment are the only measurable structures.The key species - life history approach will require more sampling in the coming years and experimental validation at the shore-based stations, particularly in those cases where no direct measurements of growth and age are available, as e.g., in ascidians.
Echinoderms were marked to validate growth data derived from the analysis of length-frequency distributions and ring structures in skeletons. Isopods, which unfortunately yielded poor samples during this cruise, were collected to investigate genetic variability within and among species, and antifreeze proteins were collected from Antarctic fish. Ecophysiological work was

done on Antarctic cephalopods and fish exposed to temperature stress, and on the aerobic metabolic activity and the enzymatic antioxidant defence of sipunculids. Particular attention was paid to fish parasites which had not been intensely investigated in the Weddell Sea. Finally, as a byproduct, seabird occurrence was noted between South Africa and the Antarctic continent.

1.3 **Itinerary** (W.Arntz)

"Polarstern" left Cape Town (South Africa) on 26 January 1996 with an international research team of 40 marine biologists from 10 European countries and Korea, enforced by 3 bathymetrists and 2 meteorologists, together with 45 crew and 19 "guests" (Neumayer Station personnel, visiting engineers and helicopter team) (Fig.1). Despite some strong wind in the Cape area and a low from the west passing the vessel on 31 January, the approach to Neumayer station was without major events except for picking up, by helicopter, 5 colleagues from the Norwegian vessel "Polar Queen" on 1 February. These persons, who were going to do logistic and geophysical work at Neumayer, had not been able to leave the vessel because of difficult ice conditions.

On the morning of 4 February "Polarstern" arrived on schedule at the shelf ice edge of Atka Bay and immediately started with the unloading of materials and a helicopter shuttle taking the personnel to Neumayer station. Also, part of the fuel destined for the station was delivered to make use of the favourable ice conditions.

The vessel left Atka Bay the same evening and headed for the first working area off Kapp Norvegia. On the way, a benthopelagic trawl was taken north of Kapp Norvegia. During the following week, a variety of gears was deployed at a number of stations off Kapp Norvegia, both parallell to the ice edge and on a transect from the ice edge to the margin of the continental shelf (see Fig. 2). These gears included moorings and CTD, trawled nets and dredges such as AGT, D, GSN and BPN, corers sampling a fixed area (MG, MUC, GKG), underwater video (ROV) and amphipod baited traps (T). Frequent modifications of everyday's schedule were necessary as the ice situation changed continuously, with the pack ice belt shifting back and forth between the shelf ice edge and the continental slope. For this reason, it was often impossible, on return to a certain station, to deploy a gear exactly at the same site, and it is advisable to consult the exact coordinates given in the list of stations when referring to a particular haul or core.

Despite the unfavourable ice conditions, a considerable amount of work was done during this week before wind force off Kapp Norvegia attained 10 Bft and made further investigation in the area virtually impossible. "Polarstern" left the area turning south of Vestkapp to focus on the fishery programme intended not only to complement former work on fish and squids in the area but also to provide fish and invertebrate material for the study of ecophysiology and population dynamics. The wind immediately decreased on leaving Kapp Norvegia. Two fishing transects perpendicular to the ice edge were considered (Fig.3); however the more northerly one turned out to have an extremely difficult bottom topography whereas the one to the south provided suitable trawling grounds. Again, the pack ice barrier over the shelf edge impeded trawling at several deep stations. Two AGT catches from 1500 and 1800 m were little successful due to large boulders. The amphipod traps were deployed also in this area. Fishing was interrupted by ROV work in the Drescher Inlet, providing video sequences of the shelf ice edge, including its underside at about 80 m, and from below the fast ice which, however, was found to be relatively unattractive at this site as it revealed a plain underside without any crevices. Three BPN hauls in the pycnocline of the outer part of Drescher Inlet during daytime provided very few adult fish and almost no squids, however several hundred young fish, before the net sonde broke down.

During the return to Kapp Norvegia, a series of GKG cores was taken close to the shelf ice edge principally for the study of meiofauna. The remainder of February off Kapp Norvegia was dedicated, on the one hand, to supplement the station work done in the first week, trying to get as complete a set of samples from the various gears for each station as possible, and on the other to study in more detail the question of iceberg scouring. For this purpose attempts were made to identify younger and older scours by hydrosweep and ROV, and to sample them later by MG, but this was only partly successful due to difficulties in locating the scours a second time with the equipment presently available. However, the ROV took a number of very interesting sequencies, obviously revealing recurrent successional stages. Of particular interest was that of a small mount close to the ice edge whose summit was only 55 m from the surface. It was covered by large boulders which were colonized by a rich benthic fauna. Shallow-water conditions of this kind are extremely rare in the Weddell Sea, and further study of this mount may well be worth while.

Work during this second phase off Kapp Norvegia (cf. Fig. 2) was again hampered strongly by the shifting ice barrier. In addition, a gale started developing on 24 February reaching hurricane force two days later, reducing all work first to bathymetric charting close to the ice edge and finally suspending it altogether. Luckily, all moorings except one and the amphipod traps had been recovered on 25 February taking advantage of major pack ice shifts. The last mooring was recovered on February 28, when the gale was over. As not only the exact position of the shelf ice edge but also that of several icebergs in the "cemeteries" had been measured before the gale started, it was possible to demonstrate their movement which was found to be considerable. During the last haul of the BPN, the cable of the net sonde broke again, but the catch was successful. Further ROV series were only partly successful as the ship drifted unsteadily or the wind continued to be unfavourable, and further MG catches from the scoured bottom also failed. The second working phase off Kapp Norvegia finished on 29 February when due to the difficult ice and wind conditions, "Polarstern" headed for Atka Bay to have some spare time available for pumping over the remaining fuel and taking aboard 7 overwinterers of the past season and some freight. The vessel appeared on the morning of 1 March off Atka Bay but due to strong wind pressure on the pack ice, it was able to go alongside the shelf ice edge only on 3 March when the wind slackened and changed slightly in direction, and the pressure was released. Whilst waiting outside the bay, "Polarstern" ran a kind of opportunistic research including the use of traps, AGT and the new RG in deep water, but failed in finding further iceberg scars worth while studying.

The relief of Neumayer station was finished on 4 March. Despite a dense pack ice layer, the amphipod traps were recovered from 2000 m outside Atka Bay. A further station planned to provide MG samples from 4000 m failed due to a cable leakage at 2800 m. The return, despite some 8 Bft wind and considerable snow, was quiet on the whole, and the vessel arrived at Cape Town on schedule on 15 March 1996.

1.4 **Weather conditions** (R. Strüfing, DWD)

Leaving Cape Town "Polarstern" encountered the "Cape doctor", a well known southeasterly gale force wind near the Cape of Good Hope. Later on moderate winds and clouds prevailed when the vessel passed an area of high pressure. During the morning of 31 January "Polarstern" was overtaken by a gale force depression following a massive central low just north of Antarctica at 10° East. For about 12 hours the wind speed rose to about 41 knots from the west. Another low travelling further to the east weakened the pressure field again thus leaving moderate easterly wind conditions for the next three days. On the approach to "Neumayer" base on 4 February a southeasterly wind dissolved the clouds giving way to a glorious sunny day at "Neumayer".

During the trip to Kapp Norvegia a meso scale low developed over Antarctica near the eastern Weddell Sea. The resulting westerly winds up to force 8 did not affect the ongoing research work because due to the difficult ice situation waves could not develop. Therefore during the next weeks ice coverage became at least as important to planning next day's work as the weather situation. For frequencies of wind forces and wind directions see Figs. 4 and 5.

For the following days moderate southwesterly winds prevailed caused by high pressure near South Georgia and a low north of Antartica at 20° East. On 12 February a low moved towards the Weddell Sea. While its trough penetrated into the research area a wedge of high pressure was building up at "Neumayer" just 180 km away. The wind speed close to the shelf ice near Kapp Norvegia rose to northeast force 10 with heavy snow drift while "Neumayer" registered

force 6 only. When "Polarstern" left the area, wind speed decreased to force 7 thus indicating how much the weather around Kapp Norvegia is affected by local winds.
Research was continued south of Vestkapp at about 74° South. The weather situation became rather quiet again due to some lows moving along the subpolar low pressure area north of the Weddell Sea and north of the Antarctic coast near 25° East. Wind directions were variable and wind speed light to moderate with clouds prevailing. On 17 February a wedge of high pressure extending from South Georgia into the Wedell Sea pushed away most of the clouds while "Polarstern" stayed at Drescher Inlet (72.9° South, 19.2° West). So far air temperature had not fallen below -5° C but for a short time on 18 February it dropped to -13° C causing frost smoke which quickly developed into heavy fog. The occurrence of grease ice was observed as well.

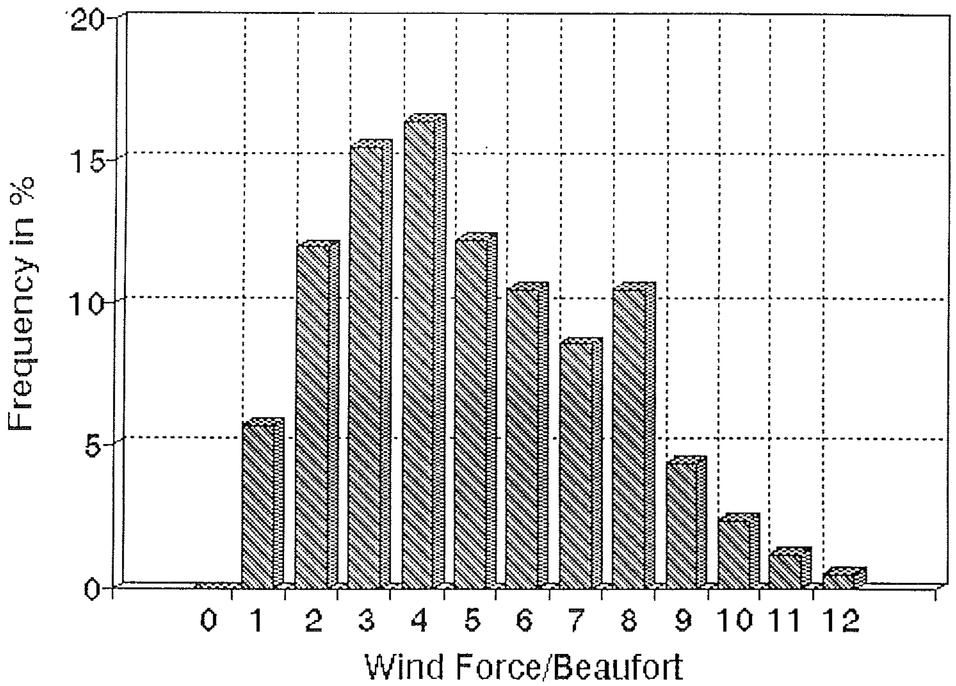

Fig. 4: Frequencies of wind forces (Beaufort) encountered during cruise ANT XIII/3, period 04 February to 05 March 1996.

When "Polarstern" steamed back to Kapp Norvegia the weather situation worsened considerably due to a central low over the Weddell Sea and higher pressure to the southeast of "Neumayer". A trough caused northeasterly winds force 8 on 21 February. The next gale affected "Polarstern" on the night from 24 to 25 February with force 9 when a secondary low moved from the Drake Strait to the southeast. Wind speed increased even further when on 26 February "Polarstern" encountered northeast force 10 to 11 with heavy snow drift near the shelf ice. The grand finale came 24 hours later when another secondary low passed to the north of "Polarstern" and winds in excess of force 12 with gusts up to 100 knots were observed. Gale force winds of this intensity for such a long period - force 9 to 10 from 1 to 3 March has to be mentioned as well - are quite unusual for this time of the year although the top wind speeds were caused by barrier effects of the Antarctic continent near Kapp Norvegia. Radio soundings

showed the strongest winds at the lowest layers of the atmosphere thus indicating some catabatic influence, too.
"Polarstern" returned to "Neumayer" station on 1 March but pack ice inhibited all attempts to get close to the shelf ice. On 3 March "Polarstern" was successful after coastal currents had cleared most of the pack ice. Despite gale force winds from the east loading started. The lowest recorded temperature was -13.8° C at 01.00 UTC.

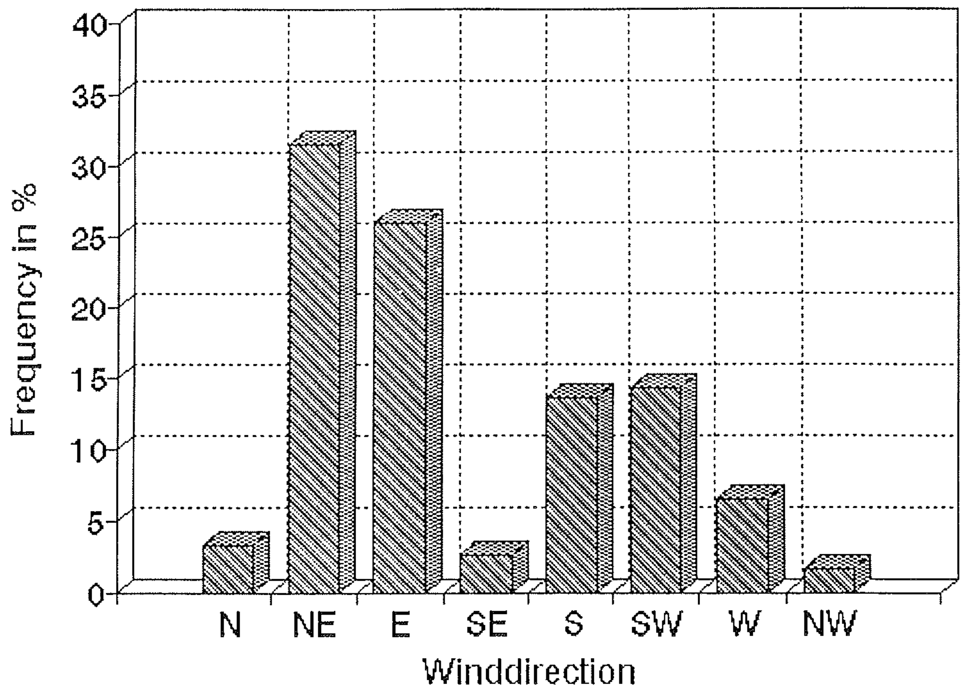

Fig. 5: Frequencies of wind directions encountered during cruise ANT XIII/3, period 03 February to 05 March 1996.

The home leg began on 5 March and was dominated at first by light to moderate winds from the northwest caused by some shallow lows northwest of the Weddell sea and another low decaying near the coast of Antartica at 25° East. The weather stayed mostly cloudy with snow showers developing when the water temperature started to rise. During the evening of 10 March wind speed picked up when a low developed just east of "Polarstern". However, a southerly direction of force 6 to 7 meant very little to the ship's behaviour. With the water temperature now up to 10° C and an air temperature around 4° C deep convection developed with heavy snow showers and gusts of force 8. These showers died out as an extended high pressure system moved to the west of "Polarstern". Its strong sometime even gale force, winds mostly from the south gave good company until Cape Town. The winds behaved as unusually well on the voyage to Cape Town as they had been unusually strong at Kapp Norvegia.

2. Results

2.1 Bathymetry

2.1.1 Seafloor Mapping and Side Looking Sonar Studies with Hydrosweep (F. Niederjasper, N. Frey, T. Grünwald)

Objectives

ANT XIII/3 continued a series of expeditions on which a detailed bathymetric survey was performed in the South Atlantic and the Weddell Sea. Seafloor topography is poorly known in areas off the shipping routes and in particular in polar regions with mainly ice covered seas. These are the last regions of the earth with unknown topography. However, the knowledge of the seafloor topography is important for many fields of marine science.

Since 1985 the AWI has performed bathymetric surveys during selected cruises in these areas. For that purpose "Polarstern" is equipped with the powerful multibeam sonar system Hydrosweep. First graphical output of the multibeam data consists of a contour map plotted in a scale of 1 : 200,000. These PPS (Polarstern Plotting Sheets) are used for the processing of the bathymetric data, but are also used as working charts for planning of ship profiles and stations. The boundaries of the PPS are fitted with the GEBCO plotting sheets (General Bathymetric Chart of the Ocean) and the AWI BCWS (Bathymetric Chart of the Weddell Sea).

The AWI BCWS is founded on the precise Hydrosweep data, but other data from different sources and of different quality are included, too. It will be published as a contour chart in the scale of 1 : 1,000,000. The chart series may serve as a basic chart for most fields of marine science. Bathymetric data from this leg are used to improve the BCWS and make it more reliable.

The Hydrosweep system now also allows the collection of side-looking sonar (SLS) data. The physical principle and its use for detecting iceberg marks in shallow water areas is described in detail in chapter 2.3.4. In deep - sea areas the SLS also provides important information on the seafloor roughness that can be caused by fine-scale sediment structures such as sediment waves or different seafloor materials. This gives additional information which cannot be obtained by bathymetry only.

Work at sea and preliminary results

a) Navigation and data processing

The Hydrosweep system was continuously operated from 27 January to 13 March. All data including the SLS measurements were stored on magnetic tape. Accurate seafloor mapping needs precise positioning. Therefore navigation data were sampled in a 10 second interval and checked against errors. Errors and offsets larger than 100 m were corrected. With this improved navigation data new positions for the Hydrosweep bathymetric data were calculated. Hydrosweep depths were checked against outliers and corrected by use of statistical and geometrical methods.

b) Single swath survey

Shortly after leaving the 200 nm economic zone of South Africa, Hydrosweep was put into operation. The track from Cape Town to Neumayer station was planned in a way that it mainly covered areas not yet surveyed. In addition it was attempted to discover unknown undersea features by use of a map which gave information about areas with a disturbed earth gravity field. This information is derived from satellite altimetry measurements. Disturbances of the earth gravity field are caused by features such us seamounts, fracture zones etc. This investigation failed because "Polarstern" changed the course to meet "Polar Queen" on the open sea. During the track to Neumayer the following undersea features were surveyed with Hydrosweep: Agulhas Ridge, Xhosa Seamount, Zulu Seamount, Southwest Indian Ridge between Moshesh and Islas Orcadas Fracture Zone and the Weddell Abyssal Plain. A supplement of the existing profiles was done during transfers between Neumayer and the working areas of the biologists. During the track from Neumayer to Cape Town several unknown undersea features were discovered by help of the gravity map. West of Maud Rise a seamount was found. About 50% of its central area was surveyed with only one single swath. The flat top of the seamount rises to a depth of 3150 m. The surrounding seafloor lies at an average depth of 4900 m. Several small hills extend to the northeast side of the seamount. In N-S direction it is about 20 km wide. The top of the seamount was found at 65° 35' S and 1° 9' W. All seamounts and other features were found by means of the gravity map. They are not yet charted in the current GEBCO chart no. 516. This result confirmed that in poorly surveyed areas the gravity information proved to be an accurate and reliable guide to the general seafloor topography.

Box survey

Some Hydrosweep box surveys were performed during the night in the main working areas of the biologists. North of Halley Bay a part of the upper continental slope was covered by some parallel Hydrosweep profiles. At the steep part of the slope some small scaling ridges and channels were found. At about 1400m water depth the slope flattened out. The small scale ridges and channels continue in this area but became wider and deeper.

On the continental shelf near Kapp Norvegia a trench was covered with several Hydrosweep profiles. Because of the shallow water depth, profiles had to be very close to each other to get the full coverage. The processing of the southern half of the trench was already done on board.

The trench tends towards NNW-SSE. The eastern slope of the trench continues under the ice shield of Kapp Norvegia. The maximum depth is about 640 m. As seen on the contour chart (Fig. 6), the SE part of the trench is covered with an amount of hillocks up to 70 m high. In the south the trench is bounded by a plateau of about 440 m water depth.

A 3-dimensional view of the area helps to interpret the complex topography of the trench and shows some additional features (Fig. 7). The southern part of the plateau ends in a slope which cannot be seen easily in the contour chart. The slope is about 40 m high. The plateau and the following area to the south are covered with parallel grooves. The grooves and the slope tend towards NE-SW. This area seems to have been shaped by a glacier during one of the last glaciations.

The part of Fig. 8 is shown in Fig. 6 by a bounding box. The SLS image may improve the bathymetric interpretation. The 4 profiles cover a part of the trench with a smooth shaped slope and bottom in the north and the hillock area in the south. Because of the higher resolution of the SLS data it may be recognized that the combination of hillocks and small valleys show a uniform trend. They describe a large circle trending SSE. A complete interpretation of the small-scale morphology of the whole trench has to be done later together with the results of current measurements in that area.

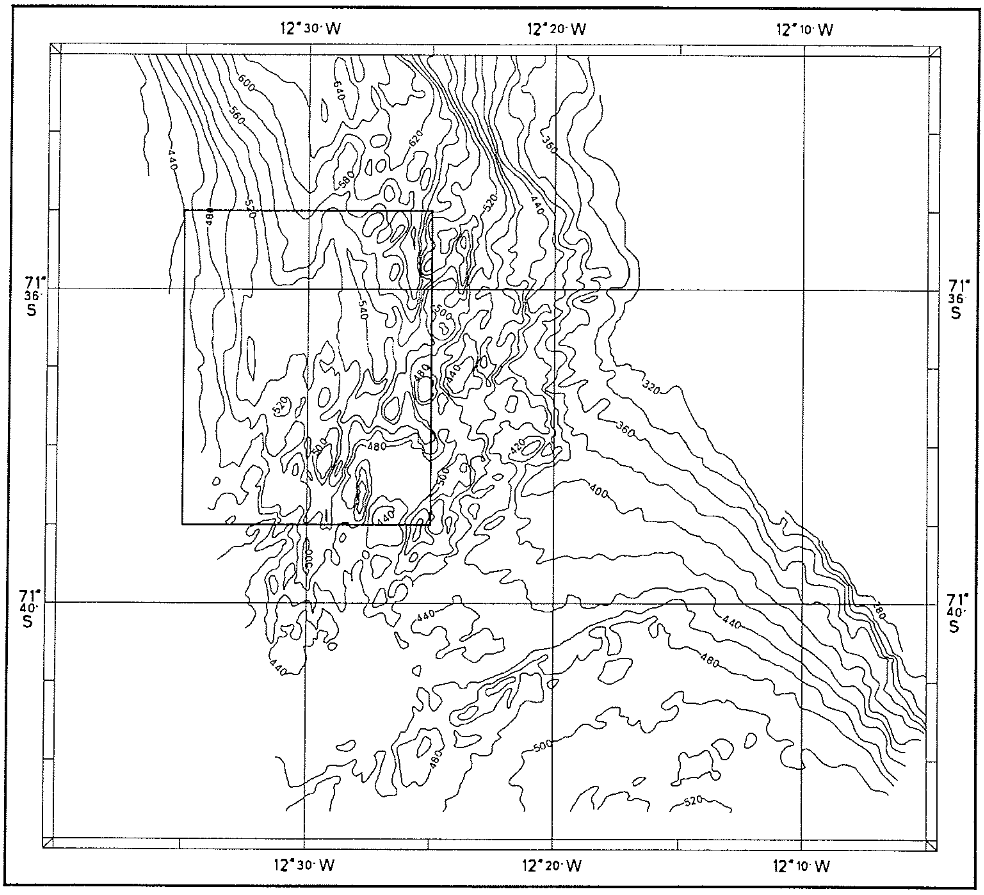

Fig.6: Contour map of the southern part of the trench off Kapp Norvegia.

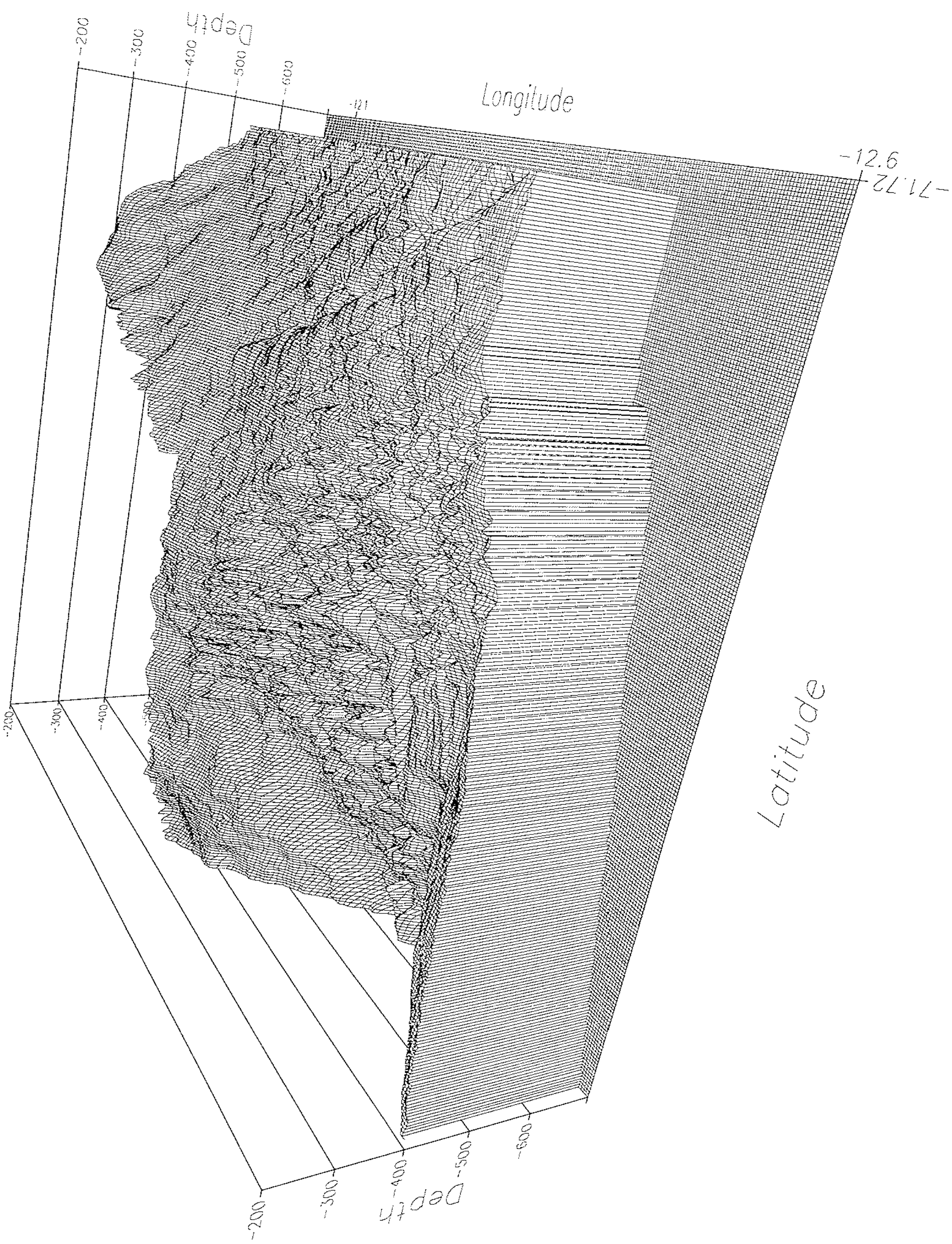

Fig.7: Perspective view of the southern part of the trench off Kapp Norvegia. View is from West to East.

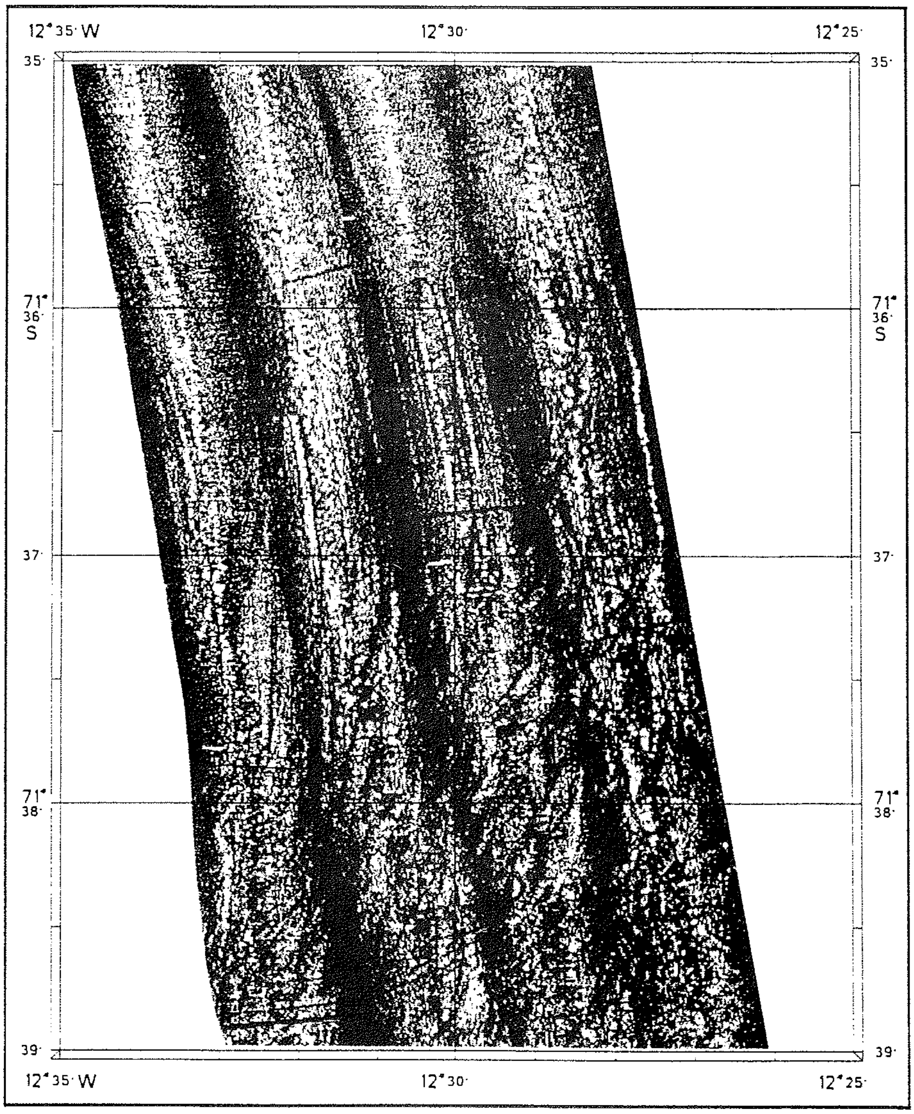

Fig.8: Side-looking sonar image of a part of the area shown in Fig. 6.

2.2 Pelagobenthic Coupling

2.2.1 Feeding Ecology of Antarctic Cnidarian Suspension Feeders (Hydrozoa, Gorgonacea, Pennatulacea)

(V. Alvà, C. Orejas and M. Zabala)

Objectives

Suspension feeders are abundant in the Antarctic benthic communities. They might play an important role in the energy transfer processes, mainly for their feeding activity on the seston. During the Antarctic summer, plankton production is higher and it could be hypothesized that the suspension feeders should show also a higher feeding activity. The cnidarians are one of the more important macrobenthic suspension feeding groups in the Antarctic, but there is little information on their diet and their feeding rates. The objective of this study was to identify the most abundant cnidarian suspension feeders, to analyse their diet and the energetic value of their preys, and to measure their feeding rates as estimated from the intensity of predation and the digestion time.

Work at sea

a) Material collected

Sampling was done mainly by Agassiz trawl (12 samples), bottom trawl (10 samples), epibenthic sledge (4 samples), bentho-pelagic trawl (1 sample), box corer (2 samples) and multibox corer (1 sample) at 23 stations (see Table 1). A first identification (at genus or species level if possible) was made for each cnidarian collected. They belonged mainly to the Hydrozoa, Pennatulacea and Gorgonacea groups. Most of the collected specimens were immediately fixed for later studies of their diet and energetic value of preys and also for histological purposes. The reproductive state of these specimens will also be studied. Only the specimens undamaged by the trawl were immediately put alive in aquaria for experimental use to estimate digestion time.

Simultaneously, vertical plankton samples were obtained by standard and bongo plankton nets (mainly from 200 to 0 meters) at the same stations, in order to get natural and fresh food for the live specimens in the aquaria. With the same aim, *Artemia salina* cultures were kept as supplementary food.

b) Gut contents

50 polyps of the more frequent species of Hydrozoa, Pennatulacea and Gorgonacea were dissected under the binocular and the gut contents were examined with a microscope. Each item (particulate organic matter, phyto- and zooplankton) was identified, counted and measured. The energetic value of the items will be estimated later.

c) Digestion time

The study of feeding rates was carried out experimentally with specimens kept in the aquaria. Each experimental specimen was maintained during 4 hours in sea water enriched with fresh food (natural plankton, in some cases also with *Artemia salina* eggs and nauplii). After this incubation period, a sample of at least 50 polyps was obtained and fixed, and the experimental specimens were transferred to an aquarium with filtered sea water. Subsequently, a sample of at least 50 polyps was taken and fixed every hour for a maximum period of five hours. The gut contents of the sampled polyps were studied as indicated. The digestion time of three species of Gorgonacea, one of Hydrozoa and one of Pennatulacea was studied following this experimental procedure.

Preliminary results

In contradiction with what was expected, the results obtained during this study do not support the hypothesis that Antarctic cnidarian suspension feeders should show a high feeding activity during the Antarctic summer. The guts of all cnidarians examined inmediately after sampling appeared almost empty, without any prey except for some diatoms.

Tab. 1: Presence of Cnidarian suspension feeders at each sampled station (for each gear used)

gear	date	depth	station	HYDROZOA			PENNATULACEA*		GORGONACEA							ALCYONACEA
				Schizotricha	*Staurotheca*	Other Hydrozoa	*Umbellula*	Other Pennatulacea	*Primnoella*	*Ascolepsis*	*Armadillogorgia*	*Thouarella*	*Dasystenella*	*Primnoisis*	*Mopsea*	
GSN-1	05.02.96	462	001	0	++	0	13	1	0	-	0	0	++	-	0	0
MG	22.02.96	>180	002	0	0	0	0	0	0	0	0	0	0	0	-	0
GKG-16	26.02.96	209	003	0	0	0	0	0	0	0	0	0	0	0	0	0
AGT-5	20.02.96	440	004	-	0	0	0	0	0	0	0	-	0	-	-	0
GSN-2	07.02.96	227	005	0	0	-	4	25	0	0	0	+	-	-	0	0
EBS-1	06.02.96	254	005	0	0	0	0	0	0	0	0	0	0	0	0	0
EBS-2	07.02.96	234	006	0	0	0	0	0	0	0	0	0	0	0	0	0
AGT-1	08.02.96	254	006	0	0	0	0	0	0	-	-	-	0	-	0	0
AGT-9	25.02.96	362	006	0	0	0	0	0	0	0	0	-	0	+	0	0
AGT-3	11.02.96	212	007	-	0	-	0	0	0	0	0	0	-	-	0	0
EBS-3	08.02.96	223	007	0	0	0	0	0	0	0	0	0	0	0	0	0
GKG-3	11.02.96	263	007	0	0	0	0	0	0	0	0	0	0	0	0	0
AGT-2	09.02.96	170	008	0	0	++	0	4	-	0	0	-	-	+	0	0
EBS-4	09.02.96	171	008	0	+	0	0	0	-	0	0	++	+	+	+	0
GSN-3	10.02.96	604	009	0	0	0	0	0	0	0	0	-	0	-	0	0
AGT-10	26.02.96	560	009	0	0	-	2	1	-	-	0	++	0	-	+	0
AGT-11	26.02.96	570	009	0	0	-	0	1	0	0	0	+	0	0	0	0
GSN-4	13.02.96	338	011	-	0	0	0	0	0	0	-	-	-	0	0	-
GSN-5	13.02.96	459	012	0	0	0	5	0	0	0	0	+	++	0	0	0
GSN-6	14.02.96	620	013	-	0	0	0	0	0	0	0	+	0	0	0	0
GSN-7	14.02.96	850	014	0	0	0	3	0	0	0	0	0	0	0	0	0
GSN-8	15.02.96	446	015	-	++	0	8	0	-	-	0	++	+	-	0	0
GSN-9	15.02.96	246	016	-	0	0	0	0	0	0	0	+	0	++	-	0
GSN-10	16.02.96	468	017	-	-	0	1	0	0	0	0	-	++	0	0	-
AGT-4a	16.02.96	1704	018	0	0	0	3	0	0	0	0	0	0	0	0	0
AGT-4b	16.02.96	1538	018	0	0	0	0	0	0	0	0	0	0	0	0	0
AGT-6	21.02.96	123	024	-	0	0	0	26	0	0	0	0	0	-	-	0
AGT-7	23.02.96	615	025	0	++	0	0	0	0	0	0	-	0	-	0	0
AGT-8	23.02.96	622	025	0	0	0	0	0	0	0	0	++	0	+	0	0
BPN-4	28.02.96	504	029	0	0	0	9	5	0	++	0	++	+	0	0	0
AGT-12	01.03.96	2315	030	0	0	-	0	0	0	0	0	0	0	0	0	0

0: Absent; -: Scarce; +: Regular to fairly common; ++: Very common; *Number of colonies.

This is in striking contrast to the results obtained in other marine areas (Coma *et al.* 1995, Gili *et al.* 1996a, b). One first explanation of this surprising result might be the stress experienced by the specimens during the sampling process, crushed under the weight (sometimes several tons) of the sponges and stones collected by the trawl. Nevertheless, the fact that cnidarians collected from cores (specimens not crushed) also show empty guts makes this interpretation unlikely. Instead it seems that during the Antarctic summer the cnidarian suspension feeders are not feeding on the seston, although it is present in the water column in high concentrations and supposedly constitutes a food source of high quality (fresh material; see chapter 2.2.2). Consequently, an alternative hypothesis could be put forward: the fine fraction of the seston (flagellates, bacteria, ...) should be the main food source for the cnidarian suspension feeders. The study of the ingestion of the fine fraction of the seston was out of the scope of the present study, but may constitute the basis for a new hypothesis to be tested in the future.

The experimental study of the digestion time has not been possible. In all studied species, all the polyps had empty guts, even after incubation in a rich environment. This negative result may be a consequence of the harsh conditions during trawling, too rigorous for cnidarian suspension feeders which appear to be delicate animals unable to overcome the stress of sampling. However, cnidarians taken from the giant box corer did not reveal a more positive response.

References

Coma, R., J.M. Gili & M. Zabala, 1995. Trophic ecology of a benthic marine hydroid, *Campanularia everta. Mar. Ecol. Prog. Ser.* 119: 211-220.

Gili, J.M., R.G. Hughes & V. Alvà, 1996a. Feeding cycles and prey capture of*Tubularia larynx*. Ellis and Solander, 1786. *Sci. Mar.* 60: 43-54.

Gili, J.M., V. Alvà, F. Pagès, H. Klöser & W.E. Arntz, 1996b. Benthic diatoms as the possible principal food source in the sub-Antarctic marine hydroid *Silicularia rosea. Polar Biol.* 16: 507-512.

2.2.2 Presence of Fluff in an Antarctic Shelf Trough, at 600 m Depth
(D. Barthel)

St. 39-009 is situated at the bottom of a trough in 600 m depth; deployment of a large bottom trawl (GSN 3) brought an unusual catch of 10 tons soft sediment on deck. Closer inspection of the "sediment" showed that for a large part it consisted not of the usual black mud, but of a greenish-grey material with a consistency of wet cotton. Microscopic inspection of some of this material showed it to consist of sedimented plankton material, i.e. a fluff-like phenomenon. The find of such enormous amounts of fluff prompted deployment of a large box core at this depth, which contained mostly fluff material.
Analysis of this box core gave the following results:

a) Vertical structure of the sediment
On top, the sediment was covered with a thin, dark grey-green layer. Down to a depth of 25 cm, fluff constituted the larger part of the sediment. Two kinds of fluff were distinguishable, namely a light greenish kind with a very coherent, almost fiberlike structure and a more grey variant with a more grainy consistency. From top to 25 cm depth, the relative share of the light green material decreased, and the proportion of the greyish material increased. Below 25 cm, black mud prevailed. However, there was no pure vertical stratification, instead the different components were present in varying amounts in different depths, giving the sample a coarsely marbled look.

b) Composition of fluff material
Samples were taken from the thin top layer, both varieties of fluff and the sediment in the bottom of the box core. Microscopic inspection showed the greenish fluff to consist almost exclusively of frustules of *Corethron criophilum* with very low numbers of *Chaetoceros* sp.,

few large centric diatoms with diameters of up to 124 um, and fragments of *Eucampia* sp.. Only few cells were still intact. Besides this material, there were large amounts of finely grained greenish-brown detritus, which was probably responsible for the colour of the material. The greyish fluff variant had the same components with a more pronounced admixture of sediment grains. Additionally, the diatom frustules were much more fragmented and less recognizable than in the greenish variant. Material from the thin dark layer on top of the core consisted mainly of sediment grains with some admixture of sedimented material. The black mud from below 25 cm sediment depth mostly consisted of inorganic particles with little admixture of fluff material. However, a few still intact diatom cells containing 5-10 small dark spherules were observed in this layer.

c) Faunal elements

Very surprising in the analysis of the contents of the box core was the virtual absence of faunal elements. Sieving of the upper 2 thirds of the box core brought only one nemertean, one ophiuroid, two bivalves and two polychaetes, all very small individuals. During the microscopic inspection, only one single nematode was found, otherwise meiofauna was completely absent.

The material found in the trough is evidence of at least one, but probably repeated massive sedimentation events, in which *Corethron criophilum* is the absolute dominating component. At the sampling time, potential consumers of this sedimented material were virtually absent, but then the material may not have been very recent. Subsamples were frozen for later analysis of content of organic material, C/N-proportions and pigments of the different layers.

The phenomenon observed here seems to be limited to the very bottom of the trough: Two Agassiz trawls taken at 520-570 m depth at the same station contained mud, stones and the faunal components expected at this depth on the Weddell Sea shelf, but no trace of fluff. The same held true for a number of multicore samples taken at the same station. Troughs like the one sampled are common on the Antarctic shelf, so input of large quantities of sedimenting diatom material may be of widespread occurrence, even at depths of 600 m.

Regular sampling of surface phytoplankton during the larger part of the cruise showed it to consist mostly of different species of *Chaetoceros*, with only relatively few cells of *Corethron criophilum* present. In somewhat deeper layers, large centric diatoms dominated. Other phytoplankton groups were hardly represented. This means that the living phytoplankton during the time of our cruise was composed of exactly the components present in the fluff. However, proportions of the single groups differed much between live plankton and fluff.

2.3. Benthos: Community Related Research

2.3.1 Meiobenthos (S. Vanhove, H.-U. Dahms, H.J. Lee, J. Vanaverbeke)

Objectives

During the EPOS cruise leg 3 (ANT VII/4: 13 Jan. -10 March 1989) it became clear that the meiofauna (intermediate sized group of organisms between the micro-and macrofauna; both protozoan and metazoan, permanent and temporary meiofauna) in the Weddell Sea is abundant and highly diverse, revealing a distinct depth distribution. A gross scale study of a full transect crossing the shelf and slope off Halley Bay (200-2000 m depth) showed that meiobenthic standing stock and diversity was distributed rather homogeneously (*e.g.* variability was low among stations). Only the shelf break (500-600 m) could clearly be distinguished (Herman & Dahms 1992).

In contrast, at Kapp Norvegia, a clear difference concerning the stocks of nematodes between ice-shelf and off-shore communities was found, mainly in terms of density and biomass, and probably structured by hydrographic features, sediment texture, fresh food availability and macrobenthic occurrence. However, in an attempt to correlate meiofauna distribution with environmental cues we were confronted with high within-sample variance. Due to this small-scale patchiness, the answer towards the questions of structuring factors of the meiobenthos remained unclear (Vanhove *et al.* 1995).

The primary aim of the EASIZ meiofauna programme was to do a more detailed investigation on the typical Antarctic environmental forces that influence meiobenthic community patterns.

a) Small-scale patchiness of the meiofauna and its relation with the benthic environment:
Previous ecological research showed a high spatial variability in the benthic environment, both on macro-, meso- and microscale. The complex heterogeneity within the abiotic/biotic benthic realm and the prevailing macrofaunal component will certainly have an influence on the small-scale distribution patterns of the meiofauna (see also chapter on macrobenthos).
Therefore: Sediment cores were sampled and processed in a way that the vertical and horizontal microbial, biogeochemical concentration and the faunal distribution profiles could be studied.

b) Diversity:
Among the several factors inducing the heterogeneity and complexity of a deep-sea environment in general, typical polar conditions (ice, sponges, bryozoans, iceberg scours) and depth will certainly affect the species richness and functional diversity (*e.g.* trophic, morphological diversity) of the benthic meiofauna.
Therefore: Sediments were sampled at various sea bottom situations and depth levels.

c) Recolonisation:
Iceberg scouring is one of the conspicuous features of the eastern Weddell Sea bottom. As a result the bottom fauna is regularly destroyed and hence, recolonisation in the form of successions of faunal associations may be one of the major processes providing a high diversity. Meiofauna shows a high recolonisation capability in temperate regions. However, nothing about meiofauna recolonisation potential is known from the Antarctic. Recolonisation studies of the meiofauna parallels similar work on the macrofauna (see chapter on impact of icebergs).
Therefore: Iceberg scour tracks were sampled at different stages of faunal recolonisation and succession.

d) Feeding preferences of the meiofauna:
Meiofaunal organisms either directly use DOM (dissolved organic matter), POM (particulate organic matter) or the microbiota developed on POM as food. Gut content and fecal pellet analysis, feeding and preference experiments of selected meiofauna taxa will provide an insight into the feeding biology of these organisms.
Therefore: Selected meiofauna taxa, especially the Harpacticoida, are maintained and cultivated for feeding experiments; fresh material was fixed immediately for gut content analysis.

e) Demersal drift:
Near-bottom drifting organisms might be an important link between the water column and the sea bottom. Demersally drifting organisms may be derived from the pelagic realm as holoplankton, as a community of plankton close to the bottom (hypoplankton), or as early life-history stages of benthic macrofauna and emergent meiofauna. Demersal drift is of ecological significance, with *e.g.* trophic, autecological, synecological, and zoogeographic implications.
Therefore: The hyperbenthic association was sampled by EBS (epibenthic sledge), GKG, MG, RG, AGT, GSN and especially D (Rauschert dredge). The water column was sampled by BONGO and HN (Hand-net), and making use of the seawater pipe system of the ship.

Work at sea
Meiofauna was collected qualitatively and quantitatively at 26 stations and from 67 gear drops along the shelf ice of the eastern Weddell Sea from Atka Bay to NE of Halley Bay Station with special emphasis on the Kapp Norvegia area.

Qualitative meiofauna samples were obtained from all bottom gears by washing and stirring up macrofauna and sedimental debris (where meiofauna is frequently trapped) in a bucket and subsequently sieving the meiofauna-carrying supernatant on a fine screen. Immediate fixation and subsequent histological analysis will *e.g.* provide evidence on gut content composition.

Various gears such as the epibenthic sledge (EBS), the giant box corer (GKG), the Agassiz trawl (AGT), the bottom trawl (GSN) and the Rauschert dredge (D) were used for qualitative collection of the meiofauna (Table 2).

Tab. 2: Quantitative meiofauna sampling by the MG, GKG and RG.

Station	Depth (m)	Gear	Type	Comment
39/005	255	MG2	DIV	mooring M4
39/006	249	RG2	DIV	
39/007	214	RG4	DIV	
39/008	174	MG4	DIV	bryozoan debris
39/008	172	MG5	DIV	
39/009	588	MG7	ENV, SSP	
39/006	234	MG9	REC	iceberg
39/006	235	MG10	REC	iceberg
39/006	239	MG11	REC	iceberg
39/006	225	MG12	REC	iceberg
39/017	447	MG16	DIV	
39/022	217	MG17	ENV	
39/004	437	MG20	ENV	mooring M3
39/005	228	MG21	ENV, SSP	mooring M4
39/005	212	MG23	DIV	mooring M4
39/009	628	GKG11	DIV	fluff
39/024	119	GKG12	DIV	sponge spicule mat
39/024	119	MG26	DIV	sponge spicule mat
39/002	182	MG27	DIV	sponge spicules + bryozoan debris
39/002	159	MG28	SSP	
39/002	181	MG29	DIV	sponge spicules + bryozoan debris
39/025	628	GKG14	DIV	
39/026	218	MG33	REC	iceberg/gravel
39/006	227	MG35	REC	iceberg/fine sediment
39/006	241	MG36	REC	iceberg/fine sediment
39/006	238	MG37	REC	iceberg/compact sediment
39/006	234	MG38	SSP	iceberg
39/031	1581	RG6	DIV+SSP	very fine deep-sea sediment

DIV: diversity, REC: recolonisation, SSP: small scale patchiness, ENV: relation meiofauna-environment). Note: Further information on (qualitative) meiofauna sampling is provided in Annex 3.5.

a) Small scale patchiness of the meiofauna and its relation to the sea bottom environment and the macrofauna (Table 2)

In order to determine the small-scale (m and cm scale) patchiness of the meiofauna, the sediment of four multibox corers was sampled with 25 x 5ml hypodermic syringes (the distal end removed) at five different stations, all revealing different sedimentary properties typical for the coastal situation along the shelf-ice coast.

This approach was applied both for the multibox corer (MG) and revolverbox corer (RG), in order to study the differential catchability of the sampling gear.

The relation between the meiofauna and its ambient environment will be investigated from samples taken for meiofauna distribution on one hand. On the other hand vertical patterns of sediment texture, concentration profiles of the main interstitial nutrients (NH_4, NO_3, NO_2, $PO4$, SiO_2), chloropigments and their degradation products, organic matter (POM and DOM) and densities of benthic diatoms and bacteria will be measured.
This should give us an idea of how meiofauna respond to small-scale food input and to the availability of the different food sources. The results will also be compared with the distribution and abundance of the macrofauna as well as hydrographic factors (see also chapter on macrobenthos). Some stations were sampled several times, in order to define mesoscale (m) variability.

b) Diversity (Table 2)
The diversity of the meiofauna as a whole and the nematodes in particular (being the dominant meiofauna taxon) will be investigated from several characteristic sediment types of the inner Weddell Sea coast (sponge spicule mats, bryozoan debris mats, mixture of both, fluff, soft sediments, iceberg abraded sediments, stony sediments close to the ice-shelf). The results will be compared with macrofaunal diversity and distribution (see also chapter on macrobenthos).

c) Recolonisation (Table 2)
Recolonisation of the meiofauna will be studied from different stages of iceberg scouring. This will be in the frame of a general programme on faunal recolonisation (see also chapter on impact of icebergs).

d) Cultivation of nematodes and harpacticoid copepods / feeding studies
Subsamples of various sediments at different sampling locations (including iceberg abraded sediments, sponge spicule and bryozoan shell mats) were taken for the cultivation of nematodes and harpacticoid copepods. The samples were kept as sludges at low temperature conditions, hence keeping the animals under circumstances close to the natural environment. Back home they will be sorted out and cultured according to methods proven to be useful already for nematodes from temperate waters.

Ovigerous females of harpacticoid copepods were kept in petri dishes and their offspring provided the stock for single-species cultures in order to study, *e.g.* reproductive processes, larval morphology, behaviour, functional morphology, ecophysiology, and feeding biology.

e) Demersal drift:
The main gear deployed for the study of demersal drift was the Rauschert dredge (D) and the epibenthic sledge (EBS). The meiofauna catches from this gear will be compared with the meiofauna from sediment cores to examine possible inferences of meiofaunal horizontal and vertical distribution and dispersal potential *via* the water column. Additionally, the emergence potential of meiofauna was studied by two kinds of *in vitro* experiments both under natural temperature conditions. On the one hand, sediment was stirred into plexiglass cylinders of 100 cm height. In a second experimental set up sediment cores and their meiofaunal inhabitants were exposed to different water flow velocities in flume-troughs of 100 cm lengths.

Preliminary results

Diversity of the meiofauna in a bryozoan mat and a deep-sea site

An intact bryozoan mat of 2x2x2 cm (Station 39/008) and the 0-1 cm layer (10 cm^2) of a deep-sea location (about 1600 m depth, Station 39/031) were investigated for the comparison of abundances and diversity. The bryozoan mat consisted of a 1 cm layer of bryozoan debris with a high oxygenated soft sediment layer underneath. The sediment from the deep sea consisted mainly of silt. A total of 640 individuals were found, comprising members of 14 taxa (including permanent and temporary meiofauna) in the bryozoan mat and 41 individuals comprising 4 taxa in the deep-sea sediment (Table 3). Nematodes were the most abundant group in both environments. Harpacticoid copepods (and their naupliar and copepodid stages) were the second most dominant group in the bryozoan mat whereas only one individual was found in the deep-sea sediment. Tardigrades were found as only one specimen in the bryzoan mat, and turbellarians, isopods, and kinorhynchs were completely absent.

Tab. 3: Meiofauna abundances from an intact bryozoan mat (170m) and a deep-sea site (1580m).

Taxa	**Bryozoan mat**	**Deep sea**
	4 cm^2 (8 cm^3)	**10 cm^2 (10 cm^3)**
Nematoda	359	38
Harpacticoida	115	1
Nauplii	96	0
Calanoida	12	0
Amphipoda	2	0
Oligochaeta	4	1
Tardigrada	1	0
Ostracoda	17	0
Tanaidacea	2	1
Polychaeta	12	0
Gastropod shells	4	0
Bivalve shells	10	0
Halacaridae	3	0
Cumacea	4	0
Total numbers	**641 ind. (14 taxa)**	**41 ind. (4 taxa)**

Harpacticoid copepods are represented by at least 14 families, namely the Neobradyidae, Ectinosomatidae, Tisbidae, Peltidiidae, Tegastidae, Harpacticidae, Tachidiidae, Thalestridae, Diosaccidae, Laophontidae, Cletodidae, Cylindropsyllidae, Ancorabolidae, and Clytemnestridae. All those belonging to the clade Harpacticoida-Oligoarthra (namely Canuellidae and Longipediidae) are missing from the Southern Ocean. To this point the previous assumption can be maintained that all Harpacticoids are endemic to the Southern Ocean, at least on species level (except possibly the planktonic *Microsetella norvegica* belonging to the Ectinosomatidae). This demonstrates a high degree of Antarctic isolation.

Cultivation of Nematoda and Harpacticoida/ feeding biology

It seems that the nematodes were resistent to such big temperature shifts when staying alive for at least one day while being kept under room temperature conditions. Approximately 170 egg-sac-bearing harpacticoid females belonging to 11 families and more than 30 genera (as well as numerous planktonic females from the Cyclopoida and Calanoida) are kept separately for cohort studies and rearing purposes in a cooling laboratory. The primary objective is to compare their population ecology with the same species, or their next relatives, from King George Island. The size distribution of the Harpacticoida is marked by some dwarf epibenthic species most of them with low egg numbers (2-7) but with comparatively large egg sizes. Remarkable are females of a new species of cyclopoid copepods which carry just 2 large eggs (which is similar to the harpacticoid *Pseudotachidius* sp., cf. Dahms 1989). This shows that a small number of large-sized yolky eggs is even more the rule among Antarctic benthic microcrustaceans than in temperate regions - leaving an r-selected trait being exceptional (Dahms 1995).
Gut contents and fecal pellet analysis of harpacticoids suggest that most harpacticoid species are opportunistic and omnivorous feeders (Table 4). No typical carnivorous species could be

obtained to this point judging from the architecture of oral appendages or gut/ fecal pellet analysis. However, some include protozoan or copepod bodies in their diet (as predators or scavengers) - a phenomenon already known from species of temperate regions. Otherwise, there is reliable information for obligate carnivory from one group of harpacticoid species, however, only from the deep sea environment (Dahms, in press).

Tab. 4: Preliminary gut contents / fecal pellet analyses of some representatives of harpacticoid copepods.

	Amorphous POM-mass (*e.g.* bacteria, mucus)	Phototrophic protista (*e.g.* flagellates)	Diatom frustrules	Anorganic particles (*e.g.* sand grains)	Skeletal debris (Arthropoda/ Sarcomastigophora)	Radiolarian spicules
TAXA (n = specimens)						
NEOBRADYIDAE *Antarcticobradya tenuis* (2)	++	-	-	+	-	-
TACHIDAE *Tachidiopsis* sp. (7)	++	+	-	+	-	-
HARPACTICIDAE *Harpacticus furcifer* (13)	++	++	+	-	+ (nauplii)	+
Perissocope typicus (2)	++	+	+	+	-	-
TISBIDAE *Tisbe* sp. 1 (5)	++	+	-	+	-	+
Tisbe sp. 2 (5)	++	+	-	-	+ (Copepoda)	+
Zosime sp. (2)	+++	-	-	+	-	+
PELTIDIIDAE *Eupelte villosa* (5)	++	+	+	+	+	-
Alteutha polarsternae (3)	++	+	+	+	-	+
TEGASTIDAE *Syngastes* sp. (1)	+++	-	-	-	+ (undefinable)	-
THALESTRIDAE *Rhynchothalestris tenuicornis* (5)	+++	+	-	-	+ (Sarcomastigophora)	-
DIOSACCIDAE *Robertgurneya falklandiensis* (5)	+++	+	-	+	-	-
LAOPHONIDAE *Laophontodes whitsoni*(5)	++	-	-	+	-	-

(-: absent; + -> +++: increasing importance)

Demersal drift / flume experiments
Very few true larval stages of macrofauna were found in the water column, compared for instance with temperate waters of the North Sea. This would confirm long established assumptions about the predominance of direct development and brooding under polar conditions. However, especially D(redge) and EBS (epibenthic sledge) samples are by far not worked up sufficiently as yet. They may, on the other hand, reveal some more larval forms and

the trends proposed among others by Pearse et al. (1991) that more macrobenthic taxa than previously assumed show a kind of pelagic development (may the instars be plankto- or lecithotrophic).
Despite thorough microscopical examination not a single specimen of the following larvae (as examples of common types in temperate seas) of macrofaunal taxa (adult taxon in parenthesis) could be identified when carefully checking pelagic samples from various gears (Table 5): Parenchymula (Porifera); Planula (Cnidaria); Cyphonautes (Bryozoa); Pilidium (Nemertini); Müllersche or Göttsche Larve (Turbellaria); Protonymphon (Pycnogonida); nauplii (other than copepod and euphausiid) for instance from the Cirripedia Thoracica, Ascothoracida, Rhizocephala; Ophio- (Ophiuroidea), Echinopluteus (Echinoidea), Auricularia (Holothuroidea).

Tab. 5: Developmental instars of benthic fauna.

TAXA	**Ontogenetic form**	**Realm**	**Gear**
CTENOPHORA	Cydippe	Plankton	BO/HN
POLYCHAETA			
sp. 1	Troch./Metatr./Juv.	Plankton	BO/HN/SWPIPE
sp. 2	Metatr./Juv.	Plankton	BO
sp. 3	Metatr./Juv.	Plankton	BO
sp. 4	Metatr./Juv.	Plankton	BO
sp. 5	Metatr./Juv.	Plankton	BO
CRUSTACEA			
Ostracoda	Nauplii/Juv.	Benthos	GKG/MG
Copepoda			
Calanoida	Nauplii/Copepodids	Plankton	BO/HN/SWPIPE
Cyclopoida	Nauplii/Copepodids	Plankton/Demersal	BO/HN/SWPIPE
Harpacticoida	Nauplii/Copepodids	Plankton/Demersal	GKG/MG etc.
Euphausiacea	Nauplii/Calyptopis/Furcilia	Plankton/Demersal	BO/HN/GKG
Decapoda/Natantia	Metazoea/Juv.	Plankton	EBS/BO/GSN
Peracarida			
Isopoda	Manca (Gnathiidae)	Demersal	GSN
Amphipoda	Juv.(Hyperiidae)	Plankton	BO
MOLLUSCA			
Bivalvia	Veliger	Plankton	BO
	Juv.	Demersal/Benthos	EBS/MG/D/GKG
Gastropoda sp. 1	Veliger	Plankton	BO
Gastropoda sp. 2	Veliger/Juv./Adult	Plankton	BO/SWPIPE
ECHINODERMATA			
Asteroidea	Dipleurula (-> Bipinnaria)	Plankton	BO
VERTEBRATA			
Teleostei sp. 1	Fish larvae	Demersal	D/EBS
Teleostei sp. 2	Fish larvae	Demersal	D
Teleostei sp. 3	Fish larvae	Plankton	BO

SWPIPE: seawater pipe system
Juv.: juvenile, Troch.: trochophora, Metatr.: metatrochophora

To study the meiofaunal response to different flow velocities of the overlying water, several flume experiments were performed. Sediment cores (sampled by GKG) were exposed to different water-flow-velocities during 1 to 3 hours. Current velocities in the different flume channels were calibrated by measuring the amount of outflowing water during 1 minute (5 measurements). The experimental design was such that 2 channels (out of 6) showed the same flow velocitiy. Three different velocities were maintained and each experiment was repeated 3 times. Eroded organisms were collected on a 80 µm screen and the remaining sediment was kept for further examination. Table 6 shows the results of a 2 hour experiment (v1=v2>v3=v4>v5=v6/ v=velocity). Only the meiofauna collected on the screen was counted. Therefore, these results do not reflect the relative amount of animals that were eroded from the sediment. A total of 9 major taxa (+ nauplii) were found to be washed out or showing emergence. There was no clear difference in the meiofaunal response to the different current velocities neither in the amount of eroded specimens nor in the amount of eroded taxa. This may be due to the fact that an observation time of 2 hours is much too long for the processes involved. On the other hand the interpretation of the data is impossible without examination of the original sediment (which can be done only later after centrifugation using a density gradient).

Tab. 6: Meiofaunal response to different current velocities (individuals / 2 hours).

	v 1	v 2	v 3	v 4	v 5	v 6
Nematoda	181	152	210	115	91	173
Harpacticoida	7	6	5	4	9	1
Calanoida	0	0	0	1	0	0
nauplii	0	2		1	4	4
Polychaeta	3	2	1	4	3	3
Amphipoda	0	0	1	0	0	0
Isopoda	0	0	0	1	1	1
Halacaridae	4	2	1	0	1	1
Turbellaria	0	0	4	0	0	0
Cnidaria	0	0	0	0	1	1
sum	**195**	**164**	**222**	**126**	**110**	**184**

Cylinder experiments were carried out to get some insight into the behaviour of meiofauna during resuspension events. Cylinders with outlets every 10 cm were filled up to a height of 40 cm. Sediment cores (sampled by GKG) were suspended into the cylinders. The cylinders were emptied at different time intervals by letting out the water*via* the outlets. This allowed us to study sinking rates or swimming behaviour of the meiofauna after resuspension events. Four series of experiments were performed in wich the cylinders were emptied at certain time intervals (duration: 2, 3 and 6 hours). The material sinking to the bottom of the cylinders was collected after finishing the experiment in order to estimate the residual meiofauna content.

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References

Dahms, H.-U. (1989). First report of a lecithotrophic nauplius among Harpacticoida (Crustacea, Copepoda) from the eastern Weddell Sea. Polar Biology 10: 221-224.

Dahms, H.-U. (1995). Dormancy in the Copepoda - an overview. Hydrobiologia 306 (3): 199-211.

Dahms, H.-U. (in press). Cannibalism in the Copepoda Harpacticoida. Mar. Biol.

Herman, R. L. & H.-U. Dahms (1992). Meiofauna communities along a depth transect off Halley Bay (Weddell Sea - Antarctica). Polar Biology, Suppl. 12: 313-320.

Pearse, J. S., J. B. McClintock & I. Bosch (1991). Reproduction of Antarctic benthic marine invertebrates: tempos, modes and timing. Amer. Zool. 31: 65-80.

Vanhove, S., J. Wittoeck, G. Desmet, B. Van den Berghe, R. L. Herman, R. P. M. Bak, G. Nieuwland, J. H. Vosjan, A. Boldrin, S. Rabitti & M. Vincx (1995). Deep-sea meiofauna communities in Antarctica: structural analysis and relation with the environment. Mar. Ecol. Prog. Ser. 127: 65-76.

2.3.2 Taxonomic Biodiversity of Bottom Invertebrates in the Eastern Weddell Sea (B.Sirenko, I.Smirnov, W. Arntz)

Objectives

Knowledge of the taxonomic biodiversity (species richness) of the whole fauna of each community is a prerequisite for a better comprehension of ecosystem function. The comparison of taxonomic biodiversity among different areas gives an additional opportunity for the explanation of peculiarities of each region. Species richness of the whole fauna of the eastern Weddell Sea was not studied during previous expeditions (Voss, 1988; Arnaud et al., 1990; Galéron et al., 1992; Gerdes et al., 1992).

The principal goals of investigation were:

- to estimate the number of species of each group of animals in each trawl catch
- to define peculiarities in distribution of taxonomic biodiversity in different regions of the eastern Weddell Sea
- to compare taxonomic biodiversity of bottom invertebrates in the Antarctic and Arctic
- to determine relative abundance of major taxa from the AGT, trawl and dredge catches.

Work at sea

Five liter subsamples were taken from each of 16 suitable trawl catches (GSN, BPN and AGT). If a catch was very small - 2-10 kg (AGT-4b, AGT-5, AGT-7 and AGT-12) - we asked all scientists who selected different groups to give us the information about the number of species for their groups. In all cases after collecting material by hand from the trawl catch on deck we washed and sieved most of the remains on a set of three sieves with 10x10, 5x5, and 1x1 mm mesh size. The material retained by the three sieves was sorted on board into 41 groups of animals (Tabs. 7 and 8). The preliminary number of species for most groups of invertebrates was counted by ourselves. Preliminary species numbers for several other groups of animals were received from our colleagues on board R/V "Polarstern":

Porifera	- Dagmar Barthel and Ole Tendal
Scleractinia	- Ole Tendal
Bryozoa	- Mikel Zabala
Polychaeta	- Maria Cristina Gambi
Octopoda	- Louise Allcock
Amphipoda	- Claude de Broyer
Isopoda	- Christoph Held
Nudibranchia	- Thomas Brey
Echinodermata from AGT-1	- Corinna Dahm

We are very grateful to all of them for these data. In those cases where the species number provided by the colleagues differed from our counts, we used the higher estimate of the two. After identification and counting the material that was not retained by the specialists was fixed in 75% alcohol (bryozoans, molluscs, echinoderms, scleractinians, brachiopods and alcyonarians) or in 4% buffered formaldehyde (other groups). Later the material will be distributed among scientists mainly of the Zoological Institute, St.-Petersburg and several other institutions in Russia for exact identification.

Most of the species with a small size (molluscs, crustaceans, different worms and small echinoderms), which sometimes constituted 15-25 % of the whole number of species, were selected from material retained by the narrowest sieve.

Besides the trawl catches material from other gears (Rauschert's dredge, GKG, MG) was washed, sieved, sorted and fixed for future identification on land. We thank very much Martin Rauschert, Dieter Gerdes and Hans-Uwe Dahms for this additional material.

To determine relative abundance of major taxonomic groups, the catches from the trawled gears (AGT, GSN, BPN, D) were subjected to a visual check by a group of four scientists who then agreed on a classification within a simple four-point scheme: 0=absent, -=scarce, +=regular to fairly common, ++=very common, dominant.

The use of GSN and AGT during this expedition showed their low efficiency on hard stony bottoms. For the purpose of this study, on these bottoms a dredge would yield better results than a trawl. The optimal size of entrance opening of a dredge is about 100 x 25-30 cm. A dredge of this size was used successfully near Commander Islands (North-West Pacific) on rocks and stony hard bottoms on the continental slope.

Preliminary results
The comparison of the number of species taken by GSN, AGT and BPN (in the cases when it reached the bottom) did not show any great differences. Maximum numbers of species are very close for GSN (234) and AGT (233) and a little bit higher for BPN (274) (Tabs. 7 and 8). Therefore we decided to consider all three kinds of gears as the same.

The trawl catches were concentrated in two regions: near Kapp Norvegia and south-west of Vestkapp. Differences in the topography of these regions and in their physical oceanography are assumed to be causes of differences in species distribution.

For the region south-west of Vestkapp we encountered a classical distribution of taxonomic biodiversity (Fig. 9). From 246 to 446 m depth the number of species increases from 163 to 202, then (from 446 to 1538 m) it decreases from 202 to 69 species. It is very interesting to notice that the species richness is approximately the same (196-202 species per 1 trawl catch) for three of the trawl catches (GSN-8, GSN-5, GSN-10, at depths from 446 to 468 m). Three groups of invertebrates (polychaetes, crustaceans and ascidians) contribute mainly to the large number of species at these depths.

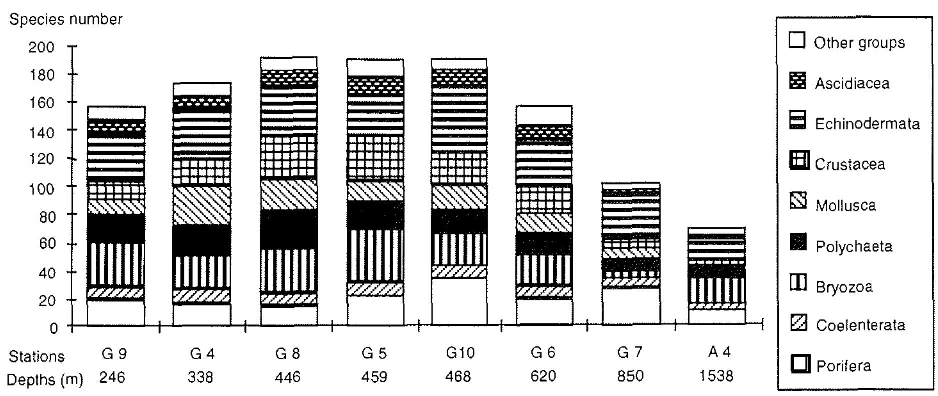


Fig.9: Taxonomic biodiversity SW of Vestkapp. G: GSN, A: AGT.

Tab. 7: GSN (G) and BPN (BP), number of invertebrate species per catch.

No. gear	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	BP4
No. station	001	005	009	011	012	013	014	015	016	017	029
Depth [m]	462-481	227-232	604-574	338-333	459-457	620-640	850-859	446-428	246-242	468-465	504-529
Porifera	45	27	6	17	22	20	28	15	20	34	30
Hydrozoa	4	2	1	2	3	1	-	1	1	2	5
Actiniaria	5	6	2	4	2	4	2	4	5	4	7
Scleractinia	6	1	-	2	1	4	-	4	1	4	2
Gorgonaria	4	3	2	1	2	1	-	2	1	1	5
Alcionaria	-	-	-	2	1	2	3	1	-	1	2
Pennatularia	1	1	-	-	1	-	1	1	1	1	1
Brachiopoda	4	1	1	-	1	1	-	1	1	1	1
Bryozoa	20	16	4	23	39	22	6	32	32	22	34
Nemertini	-	1	2	-	2	4	-	2	1	2	5
Nematoda	1	-	-	-	-	-	-	-	-	-	1
Kamptozoa	-	-	-	-	-	-	-	-	-	-	-
Priapulida	1	-	1	-	-	-	1	-	-	-	1
Sipunculida	1	2	1	-	1	-	-	-	1	-	2
Echiurida	1	1	-	1	1	1	1	-	1	-	1
Polychaeta	18	14	12	22	18	15	8	26	18	1	24
Polyplacophora	3	2	1	1	2	1	1	2	1	2	2
Aplacophora	1	2	-	1	-	-	-	1	-	-	3
Prosobranchia	18	15	4	16	5	8	3	9	6	8	19
Opisthobranchia	23	1	2	3	1	1	2	2	2	3	
Bivalvia	9	11	9	7	4	2	1	8	2	5	6
Scaphopoda	-	1	1	-	-	-	-	-	-	-	-
Cephalopoda	6	6	3	4	6	4	6	7	7	4	6
Pycnogonida	7	6	4	8	6	8	4	5	4	2	10
Cirripedia	2	-	-	1	1	1	1	-	-	1	1
Leptostraca	-	-	-	-	-	-	-	-	-	-	1
Natantia	1	1	1	2	2	4	1	2	1	2	3
Reptantia	-	-	-	-	-	-	-	-	-	-	-
Mysidacea	1	-	-	1	2	1	1	2	1	2	1
Amphipoda	25	4	3	6	20	10	2	21	10	14	33
Cumacea	2	1	-	-	2	-	-	1	-	-	2
Tanaidacea	-	-	-	-	-	-	-	-	-	-	-
Isopoda	3	3	2	9	5	3	2	4	1	5	6
Pogonophora	-	-	-	-	-	-	-	-	-	-	-
Pterobranchia	1	2	1	1	2	1	-	2	2	3	2
Crinoidea	1	1	1	1	1	1	1	1	1	1	3
Holothuroidea	10	6	6	9	9	5	10	8	10	12	19
Echinoidea	3	3	1	3	1	3	3	3	2	2	3
Asteroidea	6	8	5	10	7	12	7	12	12	16	13
Ophiuroidea	26	10	12	11	12	13	9	12	9	16	14
Ascidiacea	6	7	3	10	12	9	4	11	9	12	12
Total	244	167	90	177	196	162	107	202	163	197	283

Tab. 8: AGT (A) and EBS (E), number of invertebrate species per catch.

No. gear	A1	A2	A3	A4b	A5	A6	A7	A9	A10	A12	E1
No. station	006	002	006	018	004	024	025	006	009	03	005
Depth [m]	254-261	170-174	212-215	1500-1500	440-449	123-118	634-615	362-354	560-571	2315-2334	254-239
Porifera	33	16	26	12	10	22	40	10	30	0	10
Hydrozoa	4	4	4	-	4	6	6	2	4	1	3
Actiniaria	4	1	4	1	3	5	1	4	2	-	1
Scleractinia	1	-	-	2	-	-	-	-	-	-	-
Gorgonaria	2	3	2	-	2	3	1	4	3	-	2
Alcionaria	-	-	-	-	-	-	2	1	1	-	-
Pennatularia	-	1	-	1	-	-	-	-	1	-	-
Brachiopoda	1	1	1	1	-	1	1	2	1	-	1
Bryozoa	40	46	50	18	42	62	58	42	40	8	28
Nemertini	1	2	2	-	1	2	-	2	3	1	2
Nematoda	-	-	-	-	-	-	-	1	-	-	-
Kamptozoa	-	-	-	-	-	-	-	-	-	-	-
Priapulida	-	-	-	-	-	-	-	1	1	-	-
Sipunculida	1	1	1	-	-	-	-	1	1	-	-
Echiurida	-	1	1	-	-	-	-	-	1	-	-
Polychaeta	18	16	19	6	5	16	8	23	21	4	14
Polyplacophora	2	2	2	-	-	2	-	-	-	-	1
Aplacophora	1	1	1	-	-	-	1	1	1	-	1
Prosobranchia	14	30	18	2	1	23	4	10	12	2	10
Opisthobranchia	2	3	3	-	1	2	1	3	1	-	1
Bivalvia	14	14	9	1	3	9	3	14	15	6	6
Scaphopoda	1	-	1	-	-	-	-	1	1	1	1
Cephalopoda	2	1	3	-	-	-	-	2	4	-	1
Pycnogonida	5	5	6	2	1	4	5	4	4	1	5
Cirripedia	1	1	-	-	-	-	1	-	-	-	-
Leptostraca	-	-	-	-	-	-	-	-	-	-	-
Natantia	2	1	2	1	-	1	1	2	3	1	1
Reptantia	-	-	-	-	-	-	-	-	-	-	-
Mysidacea	1	1	-	-	-	-	1	1	1	1	-
Amphipoda	31	33	20	1	0	26	11	13	8	4	6
Cumacea	1	2	2	-	-	1	1	-	-	1	1
Tanaidacea	-	-	-	-	-	-	-	-	-	-	-
Isopoda	3	3	1	2	-	3	2	3	1	4	8
Pogonophora	-	-	-	-	-	-	-	-	-	-	-
Pterobranchia	2	2	2	1	2	1	2	2	2	-	2
Crinoidea	1	1	1	1	3	-	2	1	2	1	1
Holothuroidea	7	7	7	6	8	6	4	7	9	3	5
Echinoidea	2	2	3	1	1	3	3	3	1	3	1
Asteroidea	8	10	9	3	2	3	4	7	5	5	5
Ophiuroidea	16	8	14	5	6	5	11	11	11	3	12
Ascidiacea	14	6	8	2	3	7	5	8	4	1	4
Total	235	225	222	69	98	213	179	186	194	51	133

A different distribution of invertebrate species is typical of the region of Kapp Norvegia (Fig.10). The presence of a deep depression nearshore (i.e., close to the ice edge) rather complicates the picture of biodiversity in this region. The highest species richness (283) was found on the slope of the depression towards the ice edge, at a depth of 504 m. A rather poor fauna (only 90 spp.) inhabits the bottom of the depression on muddy ground with few stones. Further offshore the biodiversity increases to 244 species (at 254 m depth), and then gradually decreases to 179 species with increasing depth (634 m). The lowest species number of invertebrates (51 spp.) from a deep trawl catch which was taken to the north of Atka Bay at 2300 m depth (AGT-12) fits in the picture of distribution of biodiversity rather well. However, it has to be taken into account that the deep AGT catches always contain very little fauna. Presumably much of the catch is washed out on the long way up, before the net is on board.

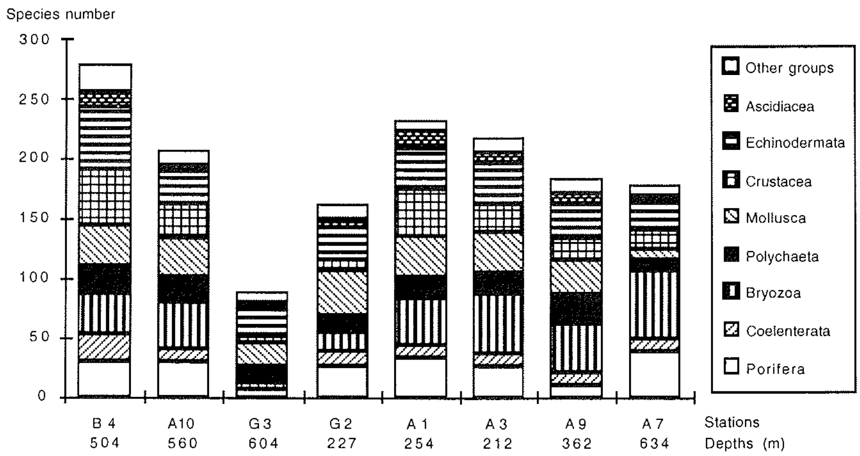


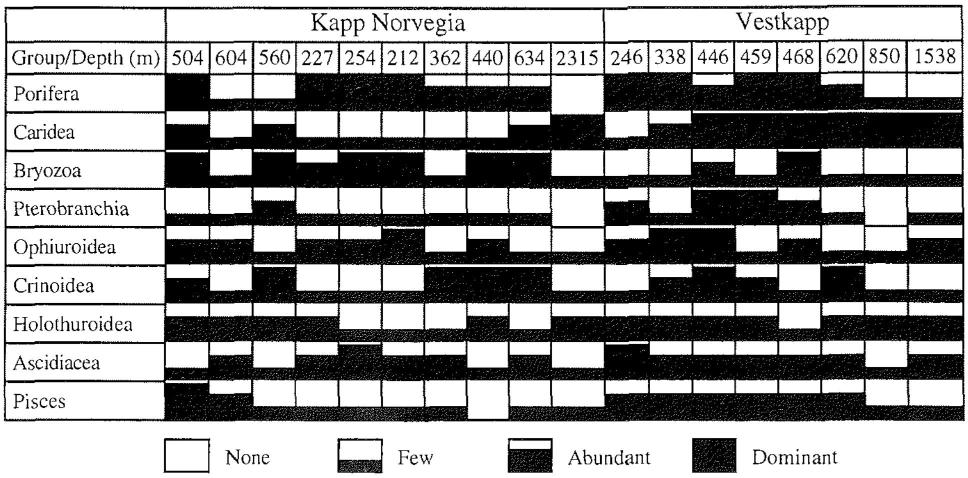
Fig.10: Taxonomic biodiversity at Kapp Norvegia. B: BPN, A: AGT, G: GSN.

The fauna at the bottom of the depression includes some species which are absent or rare in other parts of the shelf. The depression fauna is really "pseudobathyal" according to the terminology of Andrijashev (1977).

It is interesting to compare the data on taxonomic biodiversity of the Weddell Sea, as a typical region of Antarctica, with the biodiversity of the Laptev Sea as a typical region of the Arctic (Rachor et al., 1994). There are differences both in the quantity of species and the composition of different groups of invertebrates. The maximum number of species per catch in the Weddell Sea (283) is 3 times higher than that found in the Laptev Sea (80 spp.).

The differences may have been caused by various reasons:

- by predominance of grounds with a great number of pebbles and stones on the Antarctic shelf, whereas in the Arctic muddy grounds are dominant;
- by absence of Antarctic river runoff which is very important in the Arctic, because it brings both fresh water, destructive for a genuine marine fauna, and a great quantity of fine sediments;
- by the presence of strong currents along the coast which prevent an accumulation of fine sediments on most parts of the Antarctic shelf and also prevent oxygen deficiency.



GEAR HAUL	Depth (m)	*Chorismus antarcticus*	*Notocrangon antarcticus*	*Nematocarcinus lanceopes*	*Lebbeus antarcticus*	*Eualus kinzeri*
AGT 6	123	-				
AGT 2	170	-				
AGT 3	212	+				
GSN 2	227	+				
GSN 9	246	+				
AGT 1	254	+	-			
GSN 4	338	+	++			
AGT 9	362	-	+			
GSN 8	446	+	++			
GSN 5	459	+	++			
GSN 10	468	+	++			
GSN 1	462	-	++			
BPN 4	504	-	++		+	
AGT 10	560		+		-	-
GSN 3	604		+	-		
AGT 7	634			+		
GSN 6	620		-	++	-	-
GSN 7	850			++		
AGT 4(b)	1538			++		
AGT 12	2315			++		

Empty = 0 - = 1-10 + = 11-100 ++ = >100

Fig. 11: Above - Relative abundance (4-point method, see text) of major taxa in AGT and GSN catches off Kapp Norvegia and SW of Vestkapp. Stations are grouped according to distance from the shelf ice edge and water depths.
Below - Depth zonation of caridean decapods. (In both cases water depths refer to begin of haul. For the decapods the two areas have been combined.)

It is necessary to note that in the Weddell Sea species richness on muddy grounds which are accumulated in depressions of the shelf and on the slope is restricted to 51-90 species which is rather similar with the maximum number of species per one trawl catch in the Laptev Sea.

The preliminary results of the visual abundance check of major taxonomic groups caught by the trawled gears are summarized in Annexes 3.3 and 3.4. The results from the small Rauschert dredge are presented separately due to the fact that this dredge retains many small-sized groups which escape through the wider meshes of the trawls. For this reason the findings for various groups exhibit distinct differences between the two tables.
The data based on the 4-point check can be compared directly with data compiled in an identical way in the Magellan region (Arntz & Gorny, 1996). They will be subjected to further analysis (see Galéron et al., 1992).
A first attempt to group the relative abundance data in the two areas of study according to distance from the shelf ice edge and water depth (Fig. 11, above) did not reveal any clear trends, which may reflect the primarily eurybathic character of the Weddell Sea shelf and slope fauna. However, separation into species is likely to change this picture to some extent, as can be seen from a grouping of caridean decapods (Fig. 11, below). The three dominant shrimp species, contrary to many other taxa in the area, do reveal a clear depth zonation.

References
Andriashev, A.P., 1977. Some additions to schemes of the vertical zonation of marine bottom fauna. In G.A. Llano (ed.), Adaptations within Antarctic Ecosistems. Proc. of the 3d SCAR Symposium on Antarctic Biology. Gulf Publ. Co., Houston: 351-360.
Arnaud, P.M., J. Galéron, W.E. Arntz & G.N. Petersen, 1990. Semiquantitative study of macrobenthic assemblages on the Weddell Sea shelf and slope using trawl catch subsamples. Ber. Polarforsch. 68: 98-104.
Arntz, W.E. & M. Gorny, 1996. Cruise report of the Joint Chilean-German-Italian Magellan "Victor Hensen" Campaign in 1994. Ber. Polarforsch. 190: 113 pp.
Galéron, J., R. Herman, P.M. Arnaud, W.E. Arntz, S. Hain & M. Klages, 1992. Macrofaunal communities on the continental shelf and slope of the southeastern Weddell Sea, Antarctica. In Hempel, G. (ed.), Weddell Sea Ecology. Results of EPOS European *Polarstern* Study. Springer, Berlin 1993. Polar Biol. 12: 283-290.
Gerdes, D., M. Klages, W.E. Arntz, R.L. Herman, J. Galéron & S. Hain, 1992. Quantitative investigations on macrobenthos communities of the southeastern Weddell Sea shelf based on multibox corer samples. In Hempel, G.(ed.), Weddell Sea Ecology. Results of EPOS European *Polarstern* Study. Springer, Berlin 1993. Polar Biol. 12: 291-301.
Rachor, E., K. Hinz & B. Sirenko, 1994. Macrofauna. The expedition ARCTIC' 93, leg ARK-XI/4 of RV "Polarstern" 1993. Ber. Polarforsch.149: 96-106.
Voss, J., 1988. Zoogeographie und Gemeinschaftsanalyse des Makrozoobenthos des Weddellmeeres (Antarktis). Ber. Polarforsch. 45: 145 pp.

2.3.3 Small/Medium Scale Distribution Patterns of Macrobenthic Invertebrates in Relation to Environmental and Biotic Parameters
(D. Gerdes, H. Bohlmann)

Objectives
The zoogeographical results from several expeditions carried out during the last decade provide quite a good overview of the large-scale distribution patterns of benthic assemblages along the Weddell Sea shelf. From these investigations we know that large areas are rich both in the number of macrobenthic species, especially epibenthic species, as well as in abundance and biomass, and that they are often dominated by sessile sus-pension feeders; the shelf off Kap Norvegia is a typical example of such an area. There are also other regions where infaunal species are more abundant albeit with a lower diversity. Within such different benthic assemblages extremely high patchiness seems to be normal and has often been described. These highly variable distribution patterns are probably caused by environmental parameters.

The general goal of this project is to study the influence of such environmental parameters on the meso- and smallscale distribution of macrobenthic invertebrates. As primarily ecologically relevant parameters we chose for this study

- the mesoscale bottom topography of an inner shelf depressionand, for comparison, of a shelf plateau in the near vicinity, both off the shelf ice edge of Kapp Norvegia. From this region, we already had a lot of information about the bottom topography and the inhabitating benthic assemblages;
- the near-bottom mesoscale current regime affected by the shelf ice coast and the bottom topography regulating the food input to the benthos,
- areas with iceberg scours, i.e. disturbed communities; and
- different types of sediment including the sometimes thick sponge spicule mats and bryozoan/hydrozoan debris mats.

Work at sea

Moorings

Our original plan was to deploy 5 moorings (Table 9) for several weeks equipped with current meters and traps, in order to get a first information on the near bottom current regime at different places on the shelf and on the vertical flux rates at these places. The measurements of water temperature, salinity, current velocity, and flow direction (and, additionally, turbidity in the case of the Influxmeter) were performed 8 m above seafloor level.
Due to logistic problems flux measurements were finally only possible with mooring No. 4, which was equipped with an Influxmeter instead of an Aanderaa current meter as was the case in the moorings Nos. 1, 2, 3, and 5.

Tab. 9: Moorings deployed in the vicinity of the seafloor during ANT XIII/3.

Mooring	Position	Deployed	Recovered	Depth (m)
M 1	71°19.29 S; 12°24.68W	05.02.96, 16:30	22.02.96; 17:30	275
M 2	71°39.58 S; 12°07.11W	05.02.96, 19:50	25.02.96; 20:13	238
M 3	71°40.23 S; 12°29.96W	06.02.96, 07:30	25.02.96; 18:42	417
M 4	71°40.22 S; 12°45.56W	06.02.96, 10:27	25.02.96; 17:39	222
M 5	71°30.65 S; 13°31.38W	06.02.96, 16:52	28.02.96; 16:48	224

Analysis of the stored data has to be carried out in Bremerhaven because no DSU reader was available aboard the ship.

CTD measurements

CTD measurements were performed with a Seabird 911 plus at 28 stations along the SE shelf of the Weddell Sea between Kapp Norvegia and the southern shelf off Drescher Inlet. Station data and CTD profiles are presented in the Annex.
The measurements at the shelf stations reflect a typical late summer situation for the hydrographic regime with a warmer and less saline surface water layer down to about 50 m to a maximum of 150 m water depth and with a colder and more saline water layer below.
Temperatures of the surface water layer at stations off Kapp Norvegia were found to vary between about -1.50 to -1.93° C. The corresponding values from the CTD-stations on the southern shelf off Drescher Inlet were somewhat higher, varying between about -0.8 and -1.4°C.

At several stations (St. Nos. 004,006,009) measurements were performed twice during the cruise; at the beginning and at the end of the working activities. According to these measurements the temperature of the surface water layer decreased within this period by about 0.02°C day^{-1}.
The southern shelf stations off Drescher Inlet (St. Nos. 011, 013, 014, and 021) were characterized by a marked temperature increase in the near bottom water layer, probably due to the intrusion of Warm Deep Water onto the shelf. This Warm Deep Water with temperatures up to +0.8°C was found at the deep-water station No. 030 from about 500m water depth down to the bottom.

a) Quantitative work on distribution patterns of the macrofauna
Methods: The main gear for our work was the multibox corer equipped with an UW video camera. This gear was deployed at 39 stations along the shelf between Kapp Norvegia and the southern shelf off Drescher Inlet at water depths between 119 and 3775 m. All samples were sieved over 0.5 mm mesh size and preserved in 4% formalin buffered with hexamethylen tetramin prior to further examination in the laboratory.
For test purposes, a recently developed 5-fold corer (Revolvergreifer = RG) was, for the first time, deployed at 7 stations on the shelf and at greater water depths off the shelf of Kapp Norvegia. Due to the extremely difficult sediment characteristics with lots of stones, the first 4 drops on the shelf only yielded 3 successful cores. However, the 3 drops at the deep-water stations (St. Nos. 030 and 031) provided 13 undisturbed cores, each more than 30 cm in length with water on top.
The data from this gear provide the basis for comparison with respective data from the multibox corer.

Preliminary results
The multibox corer was the main gear for the quantitative work of the macro- and meiofauna group during this cruise. 39 MG stations yielded a total of 207 single cores whilst the 7 RG stations provided an additional 16 cores. According to our general concept, the majority of stations were situated in the Kapp Norvegia area, 3 drops (St. Nos. 017 twice and 022) were done SW off Drescher Inlet and an additional 4 drops were done at deep water stations (Nos. 030, 031, and 033).
Tab. 10 gives an overview of the number of drops carried out for the different topics of our work.

Tab. 10: Quantitative sampling stations with MG and RG (bold) for different topics.

Topic of work	*Kapp Norvegia*	*Drescher Inlet*
Small-/mesoscale distribution	17 (5), **3 (1)**	3
Iceberg scours	9 (1)	-
Substrate specificity	3	-
Slope/deep water stations	1 (2) **3**	-

( ) = failures due to stony sediments or technical problems

Most of the stations were performed around the mooring positions because one of our main questions is whether there are any relationships between the distribution patterns of macrobenthic organisms and the near-bottom current regime and/or the bottom topography. The Influxmeter attached to mooring M 4 enables us to consider the turbidity in the near-bottom water layer as an additional environmental parameter which may affect the composition of the benthic community on the stations in its vicinity.

The multibox corer was deployed at 7 stations around mooring position M 1, at 3 stations around M 3, at 6 stations around M 4 and at 11 stations around M 5; some of those are also involved in the iceberg impact studies.

Tab. 11: Numbers of cores taken by multibox corer (MG) and "revolver corer" (RG) during ANT XIII/3, and distribution of samples to macro- and meiofauna.

Date	Station	Cordination S/W	Depth	Gear No.	No. of cores	Macro/Meiofauna
06.02.96	05	71°40.03 / 12°42.41	246	MG 1	9	all macrofauna
06.02.96	05	71°39.75 / 12°41.00	255	MG 2	6	3 x meio
07.02.96	06	71°31.58 / 13°31.18	232	MG 3	0	-
09.02.96	06	71°31.31 / 13°32.67	251	RG 1	0	-
09.02.96	06	71°32.11 / 13°32.15	249	RG 2	1	meio
09.02.96	07	71°26.80 / 13°43.41	212	RG 3	1	macro
08.02.96	07	71°26.72 / 13°43.79	214	RG 4	1	meio
09.02.96	08	71°18.20 / 12°16.00	174	MG 4	1	macro
09.02.96	08	71°18.10 / 12°16.00	172	MG 5	2	macro/meio
09.02.96	08	71°18.00 / 12°16.30	174	MG 6	3	2x meio, 1x macro
10.02.96	09	71°34.31 / 12°26.80	588	MG 7	9	meio
10.02.96	08	71°34.50 / 12°26.00	574	MG 8	7	6 macro
11.02.96	06	71°31.90 / 13°30.19	234	MG 9	7	3 x meio, 4 x macro
11.02.96	06	71°32.05 / 13°31.31	235	MG 10	8	2 x meio,6 x macro
11.02.96	06	71°32.27 / 13°31.32	239	MG 11	5	2 x meio, 3 x macro
11.02.96	06	71°32.63 / 13°28.00	225	MG 12	9	3 x meio, 6 x macro
12.02.96	11	Position M 2	239	MG 13	0	-
12.02.96	11	Position M 2	214	MG 14	0	-
16.02.96	17	73°19.50 / 21°16.10	449	MG 15	3	3 x meio
16.02.96	17	73°19.50 / 21°15.70	447	MG 16	9	1 x meio
18.02.96	22	73°28.80 / 20°38.60	217	MG 17	9	5 x meio
20.02.96	23	71°41.12 / 12°30.28	431	MG 18	1	macro
20.02.96	23	71°41.16 / 12°30.59	436	MG 19	1	macro
20.02.96	23	71°41.27 / 12°31.02	437	MG 20	9	3 x meio, 5 x macro
20.02.96	05	71°40.30 / 12°44.00	228	MG 21	9	all meio
20.02.96	05	71°40.80 / 12°45.60	222	MG 22	1	macro
20.02.96	05	71°40.20 / 12°45.60	212	MG 23	9	3 x meio, 6 x macro
20.02.96	05	71°39.60 / 12°45.50	219	MG 24	4	macro
21.02.96	24	71°08.10 / 11°32.00	119	MG 25	4	1 x meio/1 x macro
21.02.96	24	71°08.10 / 11°31.80	119	MG 26	9	3 x meio/5 x macro
22.02.96	02	71°19.81 / 12°24.96	182	MG 27	9	3 x meio, 6 x macro
22.02.96	02	71°19.18 / 12°22.77	161	MG 28	9	4 x meio, 5 x macro
22.02.96	02	71°18.70 / 12°25.40	181	MG 29	9	3 x meio, 6 x macro
22.02.96	02	71°19.20 / 12°26.90	250	MG 30	4	4 x macro
23.02.96	25	71°23.10 / 14°19.70	628	MG 31	3	macro
23.02.96	25	71°23.10 / 14°19.70	628	MG 32	0	
24.02.96	26	71°29.20 / 14°16.90	217	MG 33	6	3 x meio, 3 x macro
24.02.96	26	71°29.50 / 14°18.30	215	MG 34	0	-
25.02.96	06	71°31.69 / 13°38.29	279	MG 35	9	3 x meio, 6 x macro
28.02.96	06	71°31.90 / 13°31.30	241	MG 36	9	3 x meio, 6 x macro
28.02.96	06	71°31.90 / 13°31.20	238	MG 37	8	3 x meio, 5 x macro
28.02.96	06	71°31.90 / 13°31.00	234	MG 38	7	4 x meio, 3 x macro
01.03.96	30	70°05.20 / 08°22.70	2375	RG 05	4	4 x macro
02.03.96	31	70°31.30 / 10°47.00	1649	RG 06	4	4 x macro
02.03.96	31	70°30.60 / 10°44.10	1581	RG 07	5	5 x meio
05.03.96	33	68°34.90 / 04°52.70	3775	MG 39	0	-

No quantitative samples resulted from mooring position M 2 due to the type of sediment and especially due to the very high current velocities in the bottom water layer at that station.

We are currently unable to present any quantitative results because all the samples have to be sorted in Bremerhaven. The UW videos, however, gave the impression that the composition of the benthic communities is markedly different and extremely patchy, both among the mooring positions and also on very small scales around one position. The area of M 1 can be regarded as a typical "Kapp Norvegia sponge community", however, there are patches that have been disturbed to a greater or lesser extent by iceberg groundings. At M 4 no iceberg scours were visible at all but pronounced differences in the community structure of the different MG stations in the vicinity of the mooring became apparent: at MG station No. 21 hardly any sponges were seen on the UW video, but there were bryozoans, crinoids and many brittle stars; MG 22 was taken on a very stony sediment with bryozoans being the most abundant epifaunal elements; the area of MG 23 was characterized by a community dominated by sponges and crinoids, and at MG station No. 24 ophiuroids and a few sponges were most abundant on a hard sediment with many stones. The community structure of mooring M 5 was comparable to M 1 with sponges being the most abundant epifaunal group. The area E and SE of this mooring, however, seems to be heavily influenced by grounding icebergs. We found several distinct scours without any visible epifauna at all and larger areas which also have to be considered as disturbed or recovering from former disturbance. Our reference station MG No. 12 stands as one example of such an area.

NE of Kapp Norvegia, in front of the "Four Season Inlet", MG Nos. 25 and 26 were deployed in an area covered by spicule mats up to 30 cm thick. These spicule mats obviously act like a sedimentation trap retaining a lot of organic material from the water column by means of the sieve-like aggregation of sponge spicules. From sieving the cores we got the impression that small and motile benthic species, especially forms such as amphipods, bivalves and juveniles of brittle stars, are much more abundant in this habitat than elsewhere. However, this impression has to be confirmed in more detail after the samples have been sorted out.

2.3.4 The Impact of Icebergs on Benthic Assemblages

(J. Gutt, A. Buschmann, W. Dimmler, N. Frey, D. Gerdes, H. Bohlmann, T. Grünwald, H. J. Lee, F. Niederjasper, T. Schickan, S. Vanhove)

Introduction and objectives

Rationale: One major topic of the expedition was to investigate the impact of grounded icebergs on the benthic habitat for two reasons. Firstly this seems to be an important physical factor, which shapes the benthic structure, biodiversity and long-term dynamics. According to a first estimate, between 4 and 5 % of the Antarctic shelf are affected by such a natural disturbance. The extinction of all life in large areas and the subsequent recolonisation can be regarded as a large in situ experiment, which can improve our knowledge about the environmental factors affecting this part of the ecosystem. Secondly, if enough data are available we can predict the consequences of increased iceberg grounding due to Global Warming.

Background: The giant ice masses which cover almost the entire continent move continuously seaward with locally differing velocity, which can reach more than 1 km per year. Parts of the floating ice shelves permanently break off and table icebergs come into existence. The height of the ice-shelf coast can vary significantly from about 10 m to more than 60 m and consequently the draught of most icebergs is between 60 and 400 m. Part of the coastline in the area of investigation, mainly at Kapp Norvegia, consists of glaciated rock; here the size of pieces breaking off must be smaller. Most of the icebergs drift with the Weddell Gyre along the coast. When they run aground they can either cause deep gouge marks with steep embankments, they can plane the sediment surface or create other small-scale bottom topographic features.

Sampling strategies: The combination of bathymetric and imaging methods and the use of the video equipped multibox corer provided a detailed insight into the physical structure and biology of such disturbed areas. Gouge marks which are deeper than 10 m are easy to detect by the hydrosweep system and the side-looking sonar provides data with a higher spatial resolution. These methods cover a much larger area than biological sampling and therefore such gouge marks can be mapped. Additional information can be gained if concentrations of grounded icebergs ("cemetries") are known. Although a rough estimate of the age of a gouge mark can be made from the side-looking sonar images, since erosion smoothens sharp and young topographic structures, these methods do not provide further results e.g. about the stage of recolonisation in the gouge marks. With the Remotely Operated Vehicle (ROV) the macroepifauna was observed by means of underwater video and -photography along transects. With the pressure sensor of the ROV fine-scale topographic structures, generated by icebergs, can also be measured with a maximum accuracy of 10 cm. These data serve as additional information in order to interprete the side-looking sonar images. The video images and photographs of the ROV provide qualitative data on the faunal composition with a high spatial resolution since abundances can be determined for each metre squared separately. Therefore it is also possible to detect the margins of species assemblages at a stage of equilibrium followed by devastated areas due to iceberg groundings. Significant changes in the faunal composition can also be interpreted as areas disturbed by icebergs. Since the multibox corer is equipped with video cameras, an optically controlled sampling of the meio- and macrofauna in both the disturbed and undisturbed areas was possible. Samples taken in combination with the continuous recording of the megafauna were done in order to check the hypothesis that the recolonisation by different size classes and life forms of the benthos differs significantly in terms of time.

General hypotheses: It is expected that together with vagile forms of the macrofauna the smaller size fractions of the meiofauna occur first on the scars within a period of only some weeks. Due to the absence of suspension feeders at this time a surplus of particulate organic matter might lead to much higher abundances than would normally be expected from an undisturbed sediment. It is expected that the meiofauna will at an unknown time reach a sort of equilibrium. Maybe after this a stage of recolonisation by a single species of the sessile macrofauna can dominate the entire epifaunal assemblage in terms of abundance. In contrast, the benthos of undisturbed areas is expected to be of relatively high diversity if it is not reduced by other factors.

Large-scale faunistic approach: The samples taken in the undisturbed areas also serve as material for the general faunistic approach under the aspect of how the species assemblages can be explained by oceanographic factors (current and water masses) in relationship to the bottom topography, and the location of the sampling site in relation to the ice-shelf coast (see biodiversity chapter). In addition, the results about the macrofauna from the multibox corer and from the ROV as well as from the photosled are part of a larger project comparing different polar and subpolar regions, e.g. Northeast Greenland, Magellan Region, South Georgia, and South Shetlands along latitudinal gradients. The goal of this study is a benthos ecological comparison especially under the aspect of biodiversity on shelf areas.

Work at sea

a) Side-looking sonar

A recent modification to the Hydrosweep system allows the collection of side-looking sonar data (SLS) which consist of the amplitude of the backscattered energy returned from the sea-floor. The signal provides information on the small-scale seafloor topography that cannot be obtained from the bathymetric information alone. The Hydrosweep SLS was operated during the whole expedition and the data were stored on magnetic tapes for further processing. In the area of investigation the SLS online display was permanently observed. The position, orientation and shape of iceberg scours were plotted for further analyses.

b) Macro- and megafauna (ROV)

Random sampling: In order to improve the statistical value of the above mentioned 4 to 5 % of areas recently disturbed by icebergs, the ROV was deployed nine times in the Kapp Norvegia box and northeast of it in water depths between 60 and 360 m, independent whether or not the sampling site was known for frequent iceberg groundings. Most of these were the general core benthos stations.

Sampling at iceberg concentrations. Information about the recolonisation of devastated areas was gained from sampling three times in the direct vicinity of iceberg concentrations (total of 10 casts) at approx. 71°31'S 014°20'W, 71°07'S 011°30'W and 71°30'S 014°20'W in waters shallower than 230 m.

Directed observation of an iceberg scour: At one station (06) two iceberg scour marks were first detected by the Hydrosweep bathymetry and the Sidescan sonar, and afterwards both were crossed by two independent ROV transects. A reference observation was carried out east of the scour marks during an additional attempt which was not successful due to the difficult ice conditions. Most stations comprised approximately 110 minutes of video observation of the sea floor. The length of all transects was given by the drift or a very gentle active speed of the ship and had an average length of roughly 1.5 km. The width of the transects (average of approximately 50 cm) is known due to two parallel laser beams which act as a scale in the image. Under these conditions and at the given optical resolution of the cameras each organism larger than 1 cm can be quantified. In addition to the video observations an average of 100 photographs have been taken by the ROV during each cast in order to achieve a better identification of the taxa.

Other stations. One additional attempt (stn 23) has been made to observe directly how an iceberg is resting on the sea floor. The ROV has also been used for observations under both the sea ice and at the lower edge of the ice-shelf coast.

c) Meio- and Macrofauna

Two attempts have been made to get quantitative samples from iceberg scours. Meio- and macrofauna samples were achieved simultaneously from the same drop. Triplicate samples were taken for meiofauna analysis from two to three boxes at each station. An additional sediment core was preserved for analysis of the sediment texture, the determination of organic matter and pigment content. The remaining cores provide quantitative data on the macrofauna distribution in the scour and its undisturbed vicinity.

The scour under study and the surrounding "undisturbed" reference stations were all situated in the vicinity of St. No. 06. At a very first glance MG No. 9 situated NE of the scour appears to have sampled an undisturbed station with sponges, bryozoans, crinoids, brittle stars and asteroids being the most abundant epifauna elements. MG No. 10, about 400 m SW of the MG 9-station, is situated directly in the scour. At the beginning of the UW-video transect the fauna looked very much the same as in the former station. With the westward drifting of the ship this community switched over to a disturbed type with many stones, bryozoan debris but hardly any visible epifauna. The sediment in the MG cores was overcompacted and fine. MG No. 11 was taken directly on the western border of the scour. The epifauna looked similar as in MG 9, though even richer, dominated again by sponges, bryozoans and echinoderms. Station MG No. 12 was situated some distance SE of the scour under study and represented a fairly disturbed area, however, with some dense patches of sponges and associated faunal elements.

In order to get an undisturbed reference site on the western side of the scour, an additional station (MG No. 35) was sampled. This sample should provide proper data of a typical undisturbed Kapp Norvegia community.

The second attempt to investigate the same scour provided 2 additional reference stations W and E of the scour (MG Nos. 36 and 37) but we did not succeed in getting samples from inside.

Preliminary results

a) Side-looking sonar (SLS)
The abundance of scours, visible on the on-line display, was less than during the expedition ANT XII/3 in the area off the Filchner ice shelf. A few transects close to concentrations of icebergs did not reveal a higher abundance of scours than elsewhere with the exception of the iceberg cemetery (central position 71°S and 12°W) which displayed different scars. The time schedule of the expedition in combination with the weather and ice conditions did now allow further investigations of this area with the ROV. Iceberg ploughs, with similar abundance as in the area off the Filchner ice shelf, were found south of the Kapp Norvegia area (71°58'S 15°50' W). Here the sea floor is almost plain with a water depth of nearly 350 m, which represents similar conditions as in the area off the Filchner ice shelf. The planned operation of the ROV was not successful due to the ice conditions. Of one gouge mark at approximately 71°30'S 13°32'W, which was detected by both, Hydrosweep bathymetry and the SLS, a three-dimensional model was designed. This gouge mark as well as another one west of the above mentioned position was crossed two times by video-transects of the ROV and sampled by the multibox-corer.
From our preliminary results we conclude that high concentrations of plough marks are most abundant in areas with a plain sea floor in water depths adequate to the draught of a standard tabular iceberg (less than 350 m). In order to achieve sufficient mapping plough marks must have a minimum length and must be situated perpendicular to the side-looking sonar Hydrosweep fan.

b) Macro- and megafauna
Disturbance by icebergs: A rough estimate of the abundance of scour marks (Table 12) shows that there is no obvious difference between the random stations and those situated between iceberg concentrations. In this preliminary calculation only recent scour marks have been considered which were identified according to the following criteria. A scour mark can show fine-scale features of the bottom topography such as slight roundish elevations, parallel ridges, steep embankments or slight roundish depressions which can not have been caused by other factors. In combination with these characteristics the abundance of most sessile benthic organisms must show a decrease by one order of magnitude or even more within a very few metres. The devastated areas can also show higher abundances of motile taxa such as ophiuroids, crinoids or fish (e.g. *Trematomus scotti* at station 26 III). First stages of recolonisation were also included and it seems that stalked sponges such as the oblong and spheric form of *Stylocordyla borealis*, some bryozoans, gorgonarians and hydrozoans are good indicators for that (Fig. 12a). If other demosponges or especially hexactinellids were present we assumed that this area had not been physically disturbed for a long time (Fig. 12b). Within a detailed analysis we will try to identify more accurately such key species and with the help of such indicators we will try to find late stages of recolonisation. The second scour mark at station 06, which was first detected by the side looking sonar method, was apparently an old one since even large hexactinellids were present. We could not recognise an abrupt change in the faunal composition and abundance at both margins for all scour marks. Sometimes it seemed as if recolonisation might have started already in part of the disturbed area. This might have been due to a patchy settlement of early life stages or due to a second overlapping scour by an iceberg when it floated again after it had rested for a longer period at one locality. At other stations mainly on the banks west and east of Kapp Norvegia, besides clear scour marks, the entire station seemed to be disturbed if compared with other neighbouring stations. Whether or not a permanent disturbance prevents the development of a relatively mature benthic assemblage here cannot yet be decided.

Faunistic approach. At all stations which were investigated by the ROV the benthos seemed to belong to the "Eastern Shelf Assemblage" dominated by sessile suspension feeders with a rich accompanying fauna according to previous community analyses. The only exception was station 09 where we found a dense concentration of the detritophagous sea-cucumber

Fig. 12a: Scour mark of an iceberg in a first stage of recolonisation by *Cellaria* spp. (Bryozoa) at stn 24 I.

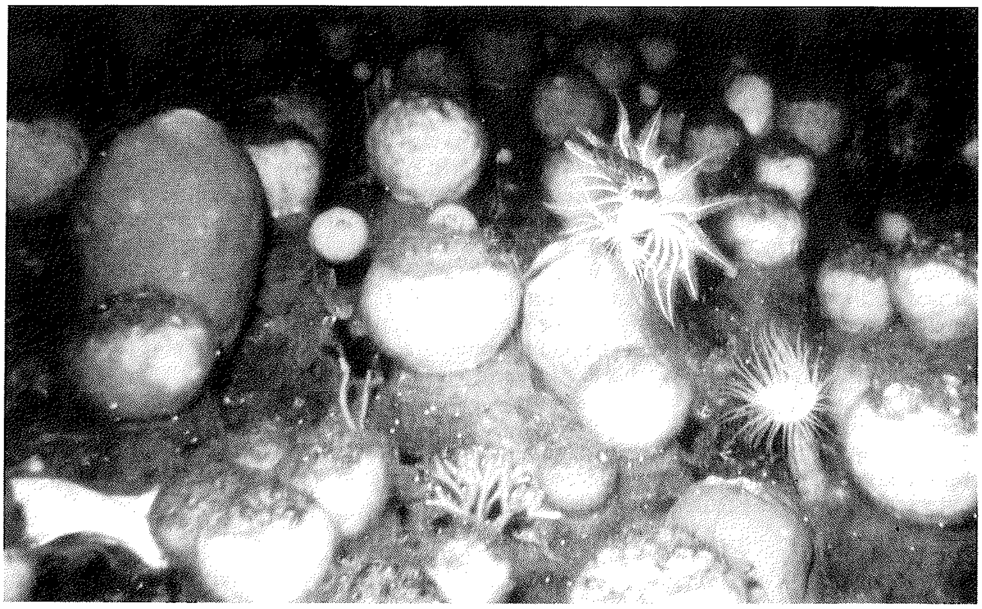


Fig. 12b: Undisturbed benthic assemblage dominated by demosponges, glass sponges and other suspension feeders taken only several metres apart from the scour mark (Fig. 12a) at stn 24 I.

Achlyonice violaecuspidata, which is a typical deep-sea form, however, so far exclusively recorded for the shelf of the Weddell Sea. Since such holothurians are good indicators for the "Southern Trench Assemblage", which is independent of the water depth, after a more detailed analysis the benthos of this station must be regarded to belong to a different assemblage. This impression is also supported by the fact that this station was located at the slope of the inner shelf depression southwest of Kapp Norvegia. Within the "Eastern Shelf Assemblage" also considerable differences were observed which cannot be explained by physical disturbance (see paragraph below). At station 24, for example, the abundance of the demosponge *Cinachyra barbata* was very high and this species covered locally more than 50% of the seafloor. As a consequence the diversity seemed to be low. The phenomenon known as the "multi-storied" assemblage was most obvious at station 06 II and 10 where the glass sponge *Rossella racovitzae* and the gorgonarian *Thouarella* spp. served mostly as substrata for different echinoderms, mainly the brittle star *Astrotoma agassizii*, the sea-cucumber *Abyssocucumis liouvillei* and feather stars.

Peculiarities. The ROV transect at station 24II started at a water depth of 150 m and crossed a sill with a steep slope and a minimum depth of 59 m. At the deepest part the megafauna was rich in terms of biomass, however not very diverse since it was dominated by patches of the sponge *Cinachyra barbata.* At the slope we found high abundances of pennatularians, gorgonarians and hydrozoans of which some species were very rare at other stations. In addition a branched sponge which might be a good indicator for a certain stage of recolonisation of disturbed areas was fairly dense. On top of the sill the sediment consisted almost exclusively of gravel, stones and large boulders which served as a substratum e.g. for the sea-urchin *Sterechinus*, mosslike alcyonarians and dense concentrations of small solitary hydrozoans, which we never saw on any images of the seafloor in the area of investigation before, and an additional hydrozoan species. Bryozoan colonies of a size (diameter of between 0.5 and 1 m and altitude of up to 30 cm) never previously observed in this part of the Weddell Sea except in Atka Bay were registered at the stations 32II and IV. At station 26I whale bones, probably the jaws, were seen, which were not colonised by any sessile organisms although it seemed that they had already been lying on the sea floor for a long period. At station 32 IV which was situated in a bight of the ice shelf coast a krill swarm was visible close to the bottom. To which degree the krill was attracted by the strobes of the ROV is unclear, however, independent of this, its abundance must have been higher than elsewhere. The cast under the sea ice in the Drescher Inlet (Vestkapp) did not show any remarkable diatom layer or accompanying pelagic fauna at the subsurface of the ice; only extremely scattered and locally limited platelet ice was found. The lower shelf edge of the ice shelf coast seemed to be round, the structure of the surface with numerous indentations was reminiscent of a golf ball. Here several small fishes were attached with their ventral side to the ice. It was apparently the same species which also occurred under the sea ice. With the help of the photographs taken and the support of taxonomic specialists we will try to identify this and other species mentioned above.

Meio- and macrofauna

The samples from the multibox corer for both the meio- and macrofauna were not checked for preliminary results since they were preserved immediately after they had been taken. They will be treated quantitatively at the home institutes.

Conclusion

The investigation of the impact of grounded icebergs on the benthic environment was a new approach in which different scientific disciplines were involved. For the first time we successfully undertook some extremely fine-scale controlled sampling with different gears at localities which had been chosen before by the bathymetric and side-looking sonar methods. The first results show that this physical disturbance by icebergs has a significant relevance for the benthic communities on the shelf. The weather and ice conditions as well as the tight time schedule did not allow an intense sampling. We think, however, that we now have good arguments to continue this kind of ecological research.

Tab. 12: Preliminary estimate of the abundance of recent iceberg scours investigated by the Remotely Operated Vehicle.

	number of casts	m^2	depth range (m)	number of scours
Random stations	9	6.700	60-360	23
Stations at/in disturbed areas	2 (no. 06)	1.300	245	1 (2*)
Stations at iceberg concentrations	10	8.200	140-225	32
Station directly at an iceberg	1	>100	215	0
Under sea ice and at the ice shelf	2		2-100	
total	24	16.200	60-360	56

* includes one totally recolonised scour mark

The dynamics of the ice shelf and icebergs influence benthic communities. Therefore, a feasibility study was carried out to map the ice shelf coast and concentrations of icebergs using a helicopter equipped with a GPS receiver. Approximately 1000 point measurements at regular intervals were made along the coastline from 70°30'S 008°15'W to 74°16'S 025°33'W. This study should be repeated during future expeditions to measure the progress and retreat of the ice shelf edge and to study this process in relation with benthic assemblages. Off Kapp Norvegia, 27 apparently grounded icebergs were located in two small boxes. Surveys were carried out before (23 February) and after a heavy storm (29 February), revealing significant changes in iceberg patterns. For more precise results, the shape and location of individual icebergs should be registered to enable identification after a certain period. This can be achieved through aerial photography from a plane, a helicopter at great altitude, or from satellite images, which may require less effort.

2.3.5 The Trophic Structure of the Benthic Community on the Weddell Sea Shelf (T. Brey, C. Dahm, K. Beyer)

Our knowledge of the trophic structure of the Weddell Sea benthic community is still rather limited, despite many studies on food and feeding of certain species. This is mainly due to the large number of benthic and benthopelagic species (>1500) and the wide and variable food spectra of many of these. Hence, the analysis of tissue stable isotope ratios ($^{15}N/^{14}N$ and $^{13}C/^{12}C$), which indicate the trophic position of the animal in question, can provide additional information on long term trophic relations. This technique has been successfully applied to the pelagic community and the top predators of the Weddell Sea (Rau et al. 1991a, 1991b, 1992).

Objectives

- To collect specimens of frequently occurring benthic and benthopelagic species representative of the community as well as plankton samples
- To prepare tissue samples of these specimens for stable isotope analysis
- To analyze $^{15}N/^{14}N$ and $^{13}C/^{12}C$ ratios in these samples
- To establish a ranking pattern of trophic positions of all species included
- To cross-check and combine this ranking with available information on food spectra and feeding habits to reveal the main links between the pelagic, benthopelagic and benthic compartment of the system

Work at sea

During the cruise ANT XIII/3 more than 500 samples referring to 110 species (from sponges to finfish) were collected and freeze dried for subsequent determination of stable isotope ratios at the AWI (Table 13). Additional phytoplankton and zooplankton samples were collected from the onboard seawater circuit.

Preliminary results

The most impressive observations during the cruise were the permanent bloom of large diatoms (*Corethrum* sp. and *Chaetoceros* sp.) in the water column and the presence of large amounts of fluff consisting of the same algae at all benthic stations (see contribution by D. Barthel). The question arises, if and how those suspension feeders which feed on small particles exclusively (such as sponges) profit from this food source.
The stomach contents of benthopelagic fish and squid showed benthic shrimps to be a favourite prey. This indicates that benthic decapods may be an important uplink from the benthic to the pelagic and higher predators compartments.

Tab. 13: Number of species per major group collected for isotope analysis

Major Group	Taxon	No. of Species
Porifera	Hexactinellidae	2
	Demospongia	6
Cnidaria	Hydrozoa	2
	Anthozoa	8
Bryozoa	-	8
Echiurida	-	3
Sipunculida	-	2
Nemertini	-	3
Mollusca	Polyplacophora	2
	Bivalvia	4
	Gastropoda	6
	Cephalopoda	2
Polychaeta	Errantia	6
	Sedentaria	2
Crustacea	Amphipoda	8
	Decapoda	3
	Euphausiacea	1
	Isopoda	2
	Mysidacea	1
Pantopoda	-	2
Echinodermata	Asteroidea	4
	Crinoidea	2
	Echinoidea	4
	Holothuroidea	7
	Ophiuroidea	5
Hemichordata	Pterobranchia	1
Tunicata	Ascidiacea	3
Fish	Rajiformes	1
	Other fish	11
	Total	**111**

References

Rau, G.H., D.G. Ainley, J.L. Bengtson, J.J. Torres & T.L. Hopkins TL, 1992. $^{15}N/^{14}N$ and $^{13}C/^{12}C$ in Weddell Sea birds, seals, and fish: implications for diet and trophic structure. Mar. Ecol. Prog. Ser. 84: 1-8.

Rau, G.H, T.L. Hopkins, J.J. Torres, 1991a. $^{15}N/^{14}N$ and $^{13}C/^{12}C$ in Weddell Sea invertebrates: implications for feeding diversity. Mar. Ecol. Prog. Ser. 77: 1-6.

Rau, G.H, C.W. Sullivan, L.J. Gordon, 1991b. d^{13}C and d^{15}N variations in Weddell Sea particulate organic matter. Mar. Chem. 35: 355-369.

2.3.6 Population Dynamics of Echinoderms (T. Brey, C. Dahm, K. Beyer)

It has been obvious since the first "Polarstern" expeditions to the Weddell Sea that echinoderms are one of the dominant groups of the macrobenthic shelf community. During the last years, growth and productivity of the most abundant echinoids and brittle stars were investigated. However, little is known about reproduction of these species, and population dynamics of asteroids, crinoids and holothuroids are completely unknown.

Objectives

- To collect representative samples of echinoderms at all stations for further analysis at the AWI
- To check skeletal parts of asteroids, crinoids and cidaroid echinoids for natural growth marks usable for ageing purposes
- To keep dominant species in aquaria for behavioural studies and subsequent transport to the AWI for further investigations
- To test the suitability of various chemicals as artificial growth markers in skeletal parts of ophiuroids and echinoids
- To examine the reproductive cycle of dominant ophiuroid species by histological gonad analysis.

Work at sea

During the cruise representative samples of echinoderms were collected from all trawls for further studies of feeding, growth, age, reproduction, productivity and mortality. Emphasis was put especially on tiny or juvenile specimens of ophiuroids, echinoids and crinoids which are easily overlooked. Ophiuroids were preserved in 4% Formalin, whereas for all other echinoderms we used 70% ethanol. The preserved material will be examined at the AWI.

For behavioural studies and further investigations we kept different species of ophiuroids (*Ophionotus victoriae*, *Astrotoma agassizii*, *Astrochlamys bruneus*, *Ophioceres incipiens*, *Ophiurolepis gelida*, *Ophiurolepis brevirima*, *Ophiosparte gigas*), echinoids (*Sterechinus neumayeri*, *Sterechinus antarcticus*) and crinoids in aquaria. They were fed with shrimp meat, fish and phytoplankton.
The artificial growth markers Calcein and Strontium Chloride we tested with *Ophionotus victoriae* and *Sterechinus antarcticus*. Following Gage (pers. comm.) we used 1 g Calcein l^{-1} seawater for 6 hours to mark brittle stars and echinoids. In a second attempt the exposition time for the animals was 12 hours at the same Calcein concentration. Only *O. victoriae* was used for a third attempt with 2 g Calcein l^{-1} seawater for 6 hours. All solutions were buffered with NaOH to pH 8. The animals were fed before and after the experiment to make sure they were growing.
According to Baker (1993) we used Strontium Chloride ($SrCl_2 \cdot 6H_2O$) in isotonic solution with seawater (35‰) with a concentration of Ca:Sr = 1:1. The animals were exposed 10 to 12 days and were fed before and during the experiment.
At least five specimens of the dominant brittle star species *Ophionotus victoriae*, *Ophiurolepis gelida*, *Ophiurolepis brevirima*, *Ophioceres incipiens* and *Ophiuroglypha carinifera* were preserved in 2.5% Glutaraldehyde. The gonads were removed, washed several times and stored in 0.1 mol Sodium Cacodylate at +4 C°. The histological gonad analysis will be done at the AWI.

Preliminary results

Collecting echinoderms from each trawl supported us with a large amount of material for further studies. Due to careful sampling the specimens, especially the very fragile crinoids, were usually in good condition and less damaged than in samples collected during previous cruises.
The most striking observation was the ubiquitous high abundance of ophiuroids. Especially the genus *Ophiurolepis* (obligatorily overgrown by the sponge *Iophon* sp.) and the copepod

feeding *Astrotoma agassizii* were present in surprisingly high numbers. At the shallower stations we found large numbers of very small *Sterechinus neumayeri* (Echinoidea) which indicated recent recruitment of this species.
Our aquaria experiments confirmed the observations of Fratt & Dearborn (1984) that *Ophionotus victoriae* is very difficult to keep alive over longer periods, whereas echinoids and crinoids seem to be less sensitive.
For the tagging experiments we used Calcein and Strontium Chloride which are incorporated in the skeletal structure where new skeleton is formed. Calcein produces a fluorescent mark visible under UV light, whereas Strontium tags are made visible with SEM and EDX techniques. We were able to see Calcein tags in all ophiuroids and echinoids checked after an exposition time of 6 h in 1g Calcein l^{-1} seawater. Longer exposition time or higher concentrations do not seem to improve the intensity of the mark.

References

Baker, A.C., 1993. Feeding and growth in the Antarctic limpet *Nacella concinna*: the use of Sr labels in the analysis of molluscan growth rates. BAS internal report.
Fratt, D.B. & J.H. Dearborn, 1984. Feeding biology of the Antarctic brittle star *Ophionotus victoriae* (Echinodermata: Ophiuroidea). Polar Biol. 3: 127-139.
Hurley, G.V., P.H. Odense, R.K. O'Dor & E.G. Dawe, 1985. Strontium labelling for verifying daily growth increments in the statolith of the short-finned squid *Illex illecebrosus*. Can. J. Fish. Aquat. Sci. 42: 380-383.

2.4 Benthos: Individual Taxonomic Groups

2.4.1 The Sponge Fauna of the Weddell Sea and Its Integration in Benthic Processes (D. Barthel, O.S. Tendal, S. Gatti)

Introduction

Through the collecting efforts of many of the classic Antarctic expeditions, the sponge fauna of the Subantarctic and Antarctic regions has become rather well known, as first summarized by Burton (1929) and Koltun (1964/1966, 1976).

One of the last major areas that were poorly investigated, is the inner Weddell Sea. Voss (1988) in the context of a general community analysis, included the hexactinellids in broad terms ("Kieselschwämme"), but not the demosponges. An important step further was taken through the initiative of Barthel during the EPOS I cruise, leg 3 (1989). The outcome has been results concerning community structure and dynamics, development of spicule mats, chemical composition, ultrastructure, associated fauna, biogeography and bathymetric distributions, general biology and faunistics (Barthel 1992, 1995, Barthel et. al. 1990, 1991; Barthel & Gutt 1992; Barthel & Tendal 1989, 1992, 1994; Kunzmann 1992; Salomon & Barthel 1990). Some of these publications had a profound influence on further research pertaining to the area (Sará et al. 1992; Gutt & Koltun 1995). The EASIZ cruise provided an excellent opportunity to go more into details of ecological aspects, community structure and faunistics of sponges in the Weddell Sea.

Main objectives

- Continuing the faunistic survey with special attention to very small, thinly encrusting forms and calcareous sponges
- Survey of reproduction units and juvenile stages of dominant sponges to clarify life histories
- determination of population structure by size - frequency distribution analysis
- Investigation of small and medium scale distribution in context with habitat structure (co-occurrence of other species, substrate structure, currents, sedimentation, etc.)

- Analysis of fauna associated with spicule veils of live hexactinellids with special attention to small sessile forms
- Particle uptake of sponges as a first step towards clarification of food spectrum
- Structure, dynamics and ecology of sponge spicule mats and spicule mat/ bryozoan debris substrates.

Work at sea

Material was collected at virtually every station in the Kapp Norvegia box and at most stations at Halley Bay and iceberg cemeteries with GSN, BPN, AGT, BC and EBS. Sponges were sorted and protocolled while fresh. Size/frequency distributions of the dominant species were recorded. The majority of the species was identified immediately; for the remaining species, tissue samples were frozen for spicule preparation. The greater part of permanent spicule preparations were made on board. Most of the faunistic material was fixed in 4% borax buffered formaldehyde, and were transferred into 80% ethanol later. Calcareous sponges were immediately fixed in ethanol. Stones and boulders were inspected for small and thinly encrusting forms. Routinely, large hexactinellids were cut open and inspected for associated infauna.

For the analysis of fauna associated with spicular veils and tufts of live hexactinellids, whole sponges and spicule tufts were taken of the following species: Hexactinellida: *Rossella vanhoeffeni, R. nuda, R. racovitzae, R. fibulata, R. villosa* ; Demospongiae: *Cinachyra barbata.*

Depending on the size, the samples were preserved in formaldehyde or frozen. For analysis of fauna living in spicule mats, samples were taken with the large box corer and the multicorer. If spicule mats were present, the sample was divided into quarters which were partly fixed for later macrofauna and mat structure analysis, partly handed over to the meiofauna working group for analysis of meiofaunal elements.

For analysis of reproduction, sponges were cut open and inspected for visible reproductive elements (eggs, embryos, larvae). In the case of hexactinellids, samples of three different species (*R. racovitzae, R. nuda, R. villosa*) were fixed for later EM-analysis (Jan Köster, IfM Kiel).

For particle uptake experiments, sponges of different species were put into cold sea water and transferred into aquaria as soon as possible after collection. Specimens of the following species were taken into aquarium maintenance: *R. racovitzae* (very small individuals), *Cinachyra antarctica, Stylocordyla borealis, Artemisina plumosa* and *Tedania tantula.* With the exception of *C. antarctica* which was collected with Agassiz and benthopelagic trawl, the specimens were removed from the surface of box core samples.

Preliminary results

a) Faunistics

The Weddell Sea sponge fauna in continental Antarctic context

The list of identifications comprises about 100 species, of which 25% are new to the Weddell Sea. Five species have been recorded only once or twice before. Two may be new to science, and these two illustrate well a part of the span in morphology and size shown by this fauna, one being a < 0.5 mm thick encrusting *Hymedesmia* sp., the other a 1 m high branched *Isodictya* sp. For quite a number of species, the known geographical range is extended, especially with respect to circumantarctic distribution. The new records bring the total number of species (calcarea, hexactinellids, demosponges) recorded from the Weddell Sea up to 159, with probably another 25 species in the still unidentified parts of the collections. This is about 75% of the sponge fauna known from continental Antarctica, i.e. about 250 species as compared to about 350 species from the whole of Antarctica.

Calcarea

Most calcareous sponges are small and fragile, and in the large, mixed catches they easily disappear, being damaged or taken for fragments of demosponges, especially haliclonids. In Antarctica it is, therefore, typical that large numbers of species and specimens originate from restricted areas where work has been done over a longer period of time. Good examples are the "Winterstation" of the Deutsche Südpolar-Expedition 1901-03 off Kaiser Wilhelm II-Land, and "Winter Quarters" of the National Antarctic Expedition 1901-04 in the Ross Sea.

With 8 species from 10 catches, the EASIZ collection counts among the better ones, probably because there was an active search for representatives of the group. The species preliminarily identified are all new to the Weddell Sea, but, except for one, of widespread Antarctic occurrence. The exception is the very large *Pericharax* here identified as *P. pyriformis*, which may after closer inspection be removed from synonymization with *Leucetta primigenia*.

Thinly encrusting species

The thinly encrusting forms < 0.5 mm thick, mostly placed in the genera *Hymedesmia*, *Stylopus* and *Hymenanchora* are tedious and problematic to work with. They are difficult to find, often totally used up when spicule preparations are made, and there is always the possibility that such forms are young stages of species that later develop another skeletal arrangement.

Compared to areas of a similar size very few such species have been recorded from different regions of the Antarctic shelf. During the EASIZ they were especially searched for. Preliminarily, only 5 species, all new to the Weddell Sea, could be identified from the material. One was known only from the type locality, and another is new to Antarctica.

In the North Atlantic, where the group is most abundant, there is a steep decrease in the number of species present when moving from the cold temperate area to the Arctic. The group seems to be relatively poorly represented in the southern hemispere, and this in combination with the seemingly negative reaction to negative temperatures may be the explanation for the low number of species recorded in the Antarctic.

Sponge fauna zonation on the slope

One haul, AGT 4b, was successful at a depth of 1540 m. In the very diversified catch, 13 sponge species were found, 12 of which could be identified to at least genus. Four are hexactinellids, the other 8 demosponges.

Two hexactinellids, *Chonelasma choanoides* and *Bathydorus spinosus*, were recorded for the Weddell Sea during the EPOS Expedition, at 2000 m (Barthel & Tendal 1994). *Caulophacus* cf. *instabilis* was decribed from the northern Weddell Sea, at 3249 m (Topsent 1910). *Rhapdocalyptus australis* was synonymized with *Rossella antarctica*, but deserves a status of its own; it is here recorded for the Weddell Sea for the first time.

For the 8 demosponges, nothing new is added for *Polymastia invaginata* and *Mycale asigmata*, while *Guitarra antarctica novazealandiae*, *Dolichocantha macrodon*, *Hymedesmia* sp., and *Stylopus longurius antarcticus* are new to the Weddell Sea.

The bathymetric range is considerably (600-900 m) extended for *Rhabdocalyptus australis*, *Tentorium papillatum, Raspailia irregularis, G. antarctica novazealandiae, D. macrodon*, and *S. longurius antarcticus,* and especially for *C.* cf. *instabilis* (1700 m).

C. choanoides, *B. spinosus* and *C.* cf. *instabilis* can be considered deep-sea species here ranging into shallower depth, while all the rest (exept *Hymedesmia* sp.) are shelf species, showing the wellknown Antarctic larger depth range to an exceptional degree. Accordingly, this small sample supports the opinion offered by Barthel & Tendal (1989) on the basis of EPOS material, that in the Antarctic there is no special bathyal sponge fauna.

Tab. 14: List of sponge species preliminarily identified during the EASIZ. "x" denotes species new to the Weddell Sea, "*" indicates species hitherto known from only one or two records at all.

CALCAREA
Clathrina primordialis (Haeckel, 1872) x
C. challengeri (Polejaeff, 1883) x
Leucetta gelatinosa (Jenkin, 1908) x
L. primigenia Haeckel, 1872 x
Pericharax pyriformis Burton, 1932 x*
Grantia scotti (Jenkin, 1908) x
Achramorpha truncata (Topsent, 1907) x
Jenkina articulata Bröndsted, 1931 x

HEXACTINELLIDA
Chonelasma choanoides Schulze & Kirkpatrick, 1910
Caulophacus cf. *instabilis* Topsent, 1910 *
Rossella antarctica Carter, 1872
R. racovitzae Topsent, 1901
R. villosa Burton, 1929
R. fibulata Schulze & Kirkpatrick, 1910
R. nuda Topsent, 1901
R. vanhoeffeni (Schulze & Kirkpatrick, 1910)
Rhabdocalyptus australis Topsent, 1901 x*
Bathydorus spinosus Schulze, 1886
Anoxycalx ijimai Kirkpatrick, 1907 x
Scolymastra joubini Topsent, 1916

DEMOSPONGIAE
Homosclerophorida
Plakina sp.

Choristida
Monosyringa longispina (Lendenfeld, 1907)

Spirophorida
Tetilla leptoderma Sollas, 1886
Cinachyra antarctica (Carter, 1872)
C. barbata Sollas, 1886

Hadromerida
Polymastia invaginata (Kirkpatrick, 1907)
P. isidis Thiele, 1905
Tentorium papillatum (Kirkpatrick, 1907)
T. semisuberites (Schmidt, 1870)
Suberites montiniger Carter, 1880 x
Pseudosuberites antarcticus (Carter, 1876)
P. hyalinus (Ridley & Dendy, 1887)
P. mollis (Ridley & Dendy, 1887)
P. nudus Koltun, 1964
P. sulcatus Thiele, 1905
Latrunculia apicalis Ridley & Dendy, 1887

Sphaerotylus sp.
Stylocordyla cf. *boralis* (Lovén, 1887)

Halichondrida (+Axinellida)
Halichondria hentscheli Koltun, 1964
Homaxinella flagelliformis (Ridley & Dendy, 1886) x
H. balfourensis (Ridley & Dendy, 1887) x
Raspailia irregularis Hentschel, 1914
Plicatellopsis sp.

Poecilosclerida
Mycale acerata Kirkpatrick, 1907
M. magellanica (Ridley, 1881)
Asbestopluma belgicae (Topsent, 1902)
A. calyx Hentschel, 1914 x
Isodictya antarctica (Kirkpatrick, 1908)
I. cavicornuta Dendy, 1924
I. delicata megachela (Thiele, 1905) x
I.. erinacea (Topsent, 1916)
I. setifera (Topsent, 1901)
I. toxophila Burton, 1932
I. sp.
Cercidochela lankesteri Kirkpatrick, 1907
Guitarra antarctica novazealandiae Dendy, 1924
Inflatella belli (Kirkpatrick, 1907)
Myxilla australis (Topsent, 1901)
M. asigmata (Topsent, 1902)
M. mollis Ridley & Dendy, 1886
M. pistillaris Topsent, 1917 x
Kirkpatrickia coulmani (Kirkpatrick, 1907)
K. variolosa (Kirkpatrick, 1907)
Iophon abnormalis Ridley & Dendy, 1886 x
I. aceratus Hentschel, 1914
I. spatulatus Kirkpatrick, 1907
Acanthorhabdus fragilis Burton, 1929
Tedania oxeata Topsent, 1916
T. tantula (Kirkpatrick, 1907)
T. triraphis Koltun, 1964
T. vanhoeffeni Hentschel, 1914
Hymedesmia sp. 1 x
H. antarctica Hentschel, 1914 x
H. gaussiana Hentschel, 1914 x*
H. leptochela Hentschel, 1914 x
Stylopus longurius antarctica Hentschel, 1914 x
Phorbas (Anchinoe) areolataus (Thiele, 1905)
P. (A.) glaberrimus (Topsent, 1916)
Dolichacantha macrodon Hentschel, 1914 x*
Clathria pauper Bröndsted, 1926
Clathria sp.
Axociella flabellata (Topsent, 1916)
A. nidificata (Kirkpatrick, 1907)
A. rameus Koltun, 1964

Artemisina plumosa Hentschel, 1914
Ectyodoryx ramilobosa (Topsent, 1917)

Haplosclerida
Haliclona bilamellata Burton, 1932
H. pilosa (Kirkpatrick, 1907)
H. (Orina) spongiosa (Topsent, 1916)
Gellius bidens Topsent, 1902
Hemigellius fimbriatus (Kirkpatrick, 1907)
H. pachyderma Burton, 1932
Calyx arcuarius (Topsent, 1913)
Microxina benedi (Topsent, 1901)

Dendroceratida
Dysidea sp. 1 x
D. sp. 2
Dendrilla antarctica Topsent, 1905
Halisarca cf. *dujardini* Johnston, 1842

b) Reproductive units
Specimens of most species were routinely inspected for presence of visible reproductive units, i.e. large eggs, embryos, larvae or internal buds. Reproductive units were found in surprisingly few species (Tab. 15).

Tab. 15: Reproductive units found in sponge species during the EASIZ cruise.

Station	Species	Rep. stage found
39-001, 39-015	*Guitarra antarctica*	large larvae, not very numerous
39-008	*Stylocordyla* cf. *borealis*	large "internal buds", in about 50% of spec.
39-008, 39-024	*Isodictya* cf. *delicata*	large larvae, extremely numerous
several stations	*Mycale acerata*	large larvae, numerous at base
39-029	*Cercidochela lankesteri*	large orange larvae in clusters in central part
39-029	indet. demosponge	small larvae, very numerous

c) Population structure
Size-frequency distributions were recorded of 3 species, namely *Cinachyra antarctica* (2 stations), *Cinachyra barbata* (1 station), and *Stylocordyla borealis* (2 stations). The results on *C. antarctica* (Fig. 13) from St. 39-007 show for the first time a population structure with several peaks, i.e. probably the presence of 4 age classes. As ageing of these sponges is as yet impossible, we cannot put any time scale to the results, but pulses of reproduction seem to occur in this species. For *C. antarctica* from the other station, only two cohorts are visible, and the size-frequency distribution of *C. barbata* only has one peak in the middle to large sizes. There are no indications for periodical reproduction events.

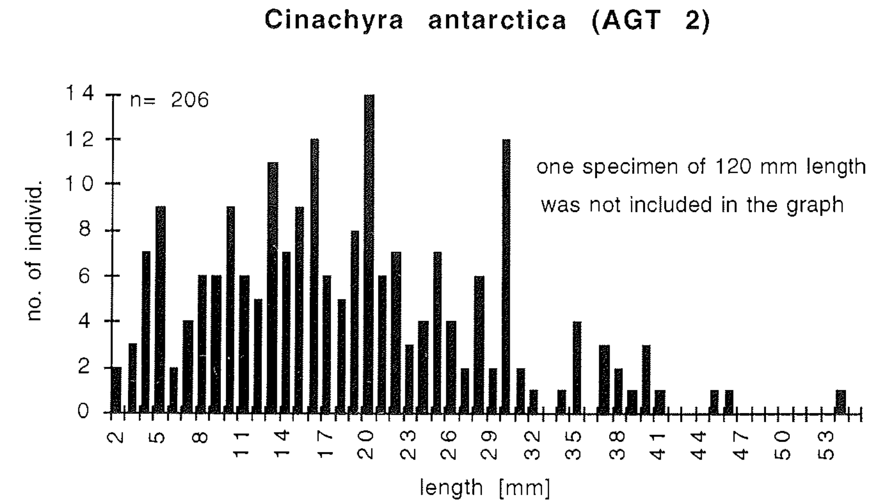


Fig. 13: Cinachyra *antarctica*, length-frequency distribution

d) Small and medium scale distribution patterns

The distribution of species at the different stations shows that there is a large pool of common species over the whole Kapp Norvegia box and also over the Halley Bay area. This result confirms the observations made during EPOS in 1989. However, dominance and equity vary very much from station to station. It is especially obvious that of all species present, different ones predominate at different stations. Partly, this is based on differences in substrate structure, as shown by Barthel & Gutt (1992). Other possible factors have as yet to be investigated.

e) Associated fauna

In her study about associated fauna, Kunzmann (1992) showed that more than 100 species of benthic invertebrates are associated either part of their lives or permanently to sponges. In this respect, hexactinellid sponges are of special importance, because they provide more different microhabitats than demosponges. Kunzmann (loc. cit.) showed that hexactinellids can serve as a 'kindergarden' for a number of invertebrate juvenile stages, for example very small ophiuroids. In our samples from this cruise, we can document two further instances of developmental stages to be present in hexactinellids.

e.1) Pentacrinoid stages of comatulid Crinoidea

Members of the free-swimming, unstalked crinoid order Comatulidae produce free-swimming larvae which at a later stage settle onto a variety of substrates to form stalked so-called pentacrinoid stages, which in turn develop into the free adults (e.g. Dearborn & Rommel 1969). Pentacrinoid stages have been observed in Subantarctic material before (Speel & Dearborn 1983), but no mentioning of the respective substrate is made. In our material, we found pentacrinoids in hexactinellid sponges from 2 stations: St. 39-024 at about 120 m depth (AGT 6) and at St. 39-029 at 504-529 m depth. The pentacrinoids were found attached to the inner dermal membrane of the suboscular cavity singly or in small groups of up to about 40 specimens in distances of up to 10 cm from the oscular rim. The diameter of the calyx was 1-1.5 mm, the length of the stalks up to 10 mm. Microscopic inspection revealed a very early stage of development without any visible trace of a crown of arms. In total, pentacrinoids were found in 10 specimens of hexactinellids of two different species, i.e. *Rossella nuda* and the large non-budding type of *R. racovitzae*. The samples of EASIZ contain 6-8 species of comatulid crinoids (pers. comm. C. Dahm & T. Brey), but it is impossible to determine, to which species the pentacrinoid stages belong.

e.2) Fish eggs

An Agassiz trawl deployed at St. 39-007 (AGT 3, 212-215 m) showed the benthic community to be dominated by large hexactinellids, with all the common species of the group present. All in all, about 80 specimens of hexactinellids were inspected for presence of infauna in the suboscular cavity. In 16 specimens of hexactinellids, fish egg masses were present. The eggs were obviously all of the same species, of white colour and about 3 mm diameter. They did not contain any signs of developing embryos yet. Egg numbers were calculated by first counting 100 eggs, estimating and weighing 500 eggs, and then weighing all eggs in one sponge. Of the hexactinellid species present, egg masses were found in 4 species, namely *Rossella nuda, R. vanhoeffeni, R. racovitzae* and *R. villosa*. The external spiculation of these sponges is very different from each other. While *R. nuda* does not have an external spicule veil, *R. villosa* is totally covered by it, and long sturdy spicules protrude upwards around the osculum. This does not seem to deter the spawning fish. The eggs filled the suboscular cavity either partly or totally, with egg numbers of up to more than 8000. Eggs from one sponge were put into an aquarium to try to hatch them. After 2 weeks, the first signs of developing cell masses were visible in the eggs.

The eggs could not be attributed to any fish species; the only species containing ripe eggs in the catches was *Trematomus* sp.. However, the development of eggs of Antarctic fish species takes such long periods that the eggs found during EASIZ may stem from species now beyond their spawning time.

St. 39-007 was the only station, in which this phenomenon was observed, but here it occurred in about 20% of the hexactinellids in the catch. This indicates a spatially limited area for spawning of a given fish swarm, but also that the hexactinellids play an important role as protected sites for the early development of some fish species. This is yet another instance of hexactinellids contribution to the structuring of the benthic community.

Additionally to the hexactinellid material inspected for associated fauna, some trawls gave considerable numbers of specimens of the species *Stylocordyla* cf. *borealis*. In contrast to the relatively few specimens collected during the EPOS cruise (Barthel et al. 1990), the specimens collected now were much larger in size and were covered with a dense epifaunal community. All specimens were measured, checked with respect to presence of larvae and fixed in formaldehyde for later analysis of epifauna.

f) Fauna associated with spicule veils and tufts

In contrast to the material from the EPOS expedition, the material from this cruise included many hexactinellids with intact spicular veils and intact basal spicule tufts. Visual inspection showed the spicules to serve as substrate to many small sessile forms of invertebrates and foraminifera. These samples will be worked up upon return to Kiel.

g) Aquarium maintenance and particle uptake experiments

g.1) Aquarium maintenance

These experiments were originally planned as one of the central topics of the cruise. However, on board of the ship it turned out that we could only use a fraction of the cool container space we had planned for; thus, only very few sponges were tested for their suitability in live maintenance. However, the first experiments with aquarium maintenance of Antarctic sponges performed during this cruise were very successful. Most, if not all of the specimens of the species selected for maintenance survived in the aquaria for at least three weeks. In the case of *Cinachyra antarctica* and *Stylocordyla borealis*, the specimens were extremely contracted when coming on deck. Only after 2-3 days had the sponges reached a fully relaxed condition again. After about 2 weeks, some of the specimens died. Interestingly, specimens of *C.*

antarctica started to form outgrowths on their surface, while the specimens themselves became soft and hollow. Microscopic inspection showed the outgrowths to consist of masses of dedifferentiated cells in a large size range. Reduction bodies have never been observed in this genus before, but it seems to be a reaction to suboptimal conditions in the aquarium.
Possibly, these reduction bodies can serve as survival units which are transported away with the current and can reorganize into a functional sponge under suitable conditions.

g.2) Particle uptake experiments

Particle uptake experiments were only performed on *Cinachyra antarctica.* A total of 14 specimens were fed with mixtures containing fluorescent microspheres with diameters of 0.1 to 80 micrometers. Samples were taken at 0, 0.5, 1, 2, 4, 6, 8, 12 and 18 hrs. At the end of the experiments (14 and 18 hours respectively), the water was visibly cleared in some jars, while others seemed unchanged. The samples will be analyzed with a flow cytometer upon return to Kiel.

References

Barthel, D, 1992. Do hexactinellids structure Antarctic sponge associations ? Ophelia 36: 111-118.

Barthel, D. 1995: Tissue composition of Antarctic sponges: Not much meat on the bones. Mar. Ecol. Prog. Ser.123: 149-153.

Barthel, D. & J. Gutt, 1992: Sponge associations in the eastern Weddell Sea. Antarctic Science 4: 137-150.

Barthel, D., J. Gutt & O. Tendal, 1991. New information on the biology of Antarctic deep-water sponges derived from underwater photography. Mar. Ecol.Prog. Ser. 69: 303-307.

Barthel, D. & O.S.Tendal, 1989. The sponge fauna of the deep Weddell Sea: status and the need for further biological and faunistic investigation. Deep-Sea Newsl. 16: 8-9.

Barthel, D. & O.S.Tendal, 1992. The Antarctic deep-sea hexactinellid fauna. Deep-Sea Newsl. 19: 20-22.

Barthel, D., O.Tendal & K. Panzer. 1990. Ecology and taxonomy of sponges in the eastern Weddell Sea shelf and slope communities. Ber. Polarforsch. 68: 120-130.

Barthel, D. & O.S. Tendal, 1994. Antarctic Hexactinellida. Synopses of the Antarctic Fauna 6. Koeltz Scientific Books.154 pp.

Burton, M., 1929. Porifera. Part II. - Antarctic Sponges. British Antarctic ("Terra Nova") Expedition 1910, Zoology 6(4): 393-458.

Dearborn, J.H. & J.A. Rommel, 1969. Crinoidea. In: Distribution of selected groups of marine invertebrates in waters south of 35°S latitude, Antarctic Map Folio Ser., 11: 35-36, pl. 21. American Geographical Society, New York.

Gutt, J. & V.M. Koltun, 1995. Sponges of the Lazarev and Weddell Sea, Antarctica: explanations for their patchy occurrence. Antarctic Science 7: 227-234.

Koltun, V.M., 1964. Sponges of the Antarctic. 1. Tetraxonida and Cornacuspongida. *In*:: Biological results of the Sovjet Antarctic Expedition 1955/1958, vol 2. Issled. Faunei Morei. Moskva-Leningrad. 131 pp. (English translation: 1966, Israel Program for Scientific Translations)

Koltun, V.M., 1976. Porifera. - Part I: Antarctic Sponges. B.A.N.Z. Antarctic Research Expedition 1929-1931. Reports - Series B (Zoology and Botany) 9(4): 153-198.

Kunzmann, K., 1996. Die mit ausgewählten Schwämmen (Hexactinellida und Demospongiae) aus dem Weddellmeer, Antarktis, vergesellschaftete Fauna. Ber. Polarforsch. 210: 93 pp.

Salomon, D. & D. Barthel,1990. External choanosome morphology of the hexactinellid sponge *Aulorossella vanhoeffeni* Schulze & Kirkpatrick, 1910. Senckenbergiana maritima 21: 87-99.

Sara, M., A. Baduzzi, M. Barbieri, G. Bavestrello & B. Burlando, 1992. Biogeographic traits and checklist of Antarctic demosponges. Polar Biology 12: 559-585.

Speel, J.A. & J.H. Dearborn, 1983. Comatulid crinoids from R/V Eltanin cruises in the Southern Ocean. In Biology of the Antarctic Seas XIII, Antarctic Research Series, Vol. 38., Paper 1: 60 pp.

Voss, J., 1988. Zoogeographie und Gemeinschaftsanalyse des Makrozoobenthos des Weddellmeeres (Antarktis). Ber. Polarforsch. 45: 145 pp.

2.4.2 Composition and Distribution of the Eastern Weddell Sea Scleractinian Coral Fauna (O. S. Tendal, D. Barthel)

Introduction

Many of the well-known Antarctic expeditions have over time brought home collections of Scleractinia from various parts of the Antarctic continent. These collections were mostly small, because there are few species and mass occurrences are rare; accordingly, the history of Antarctic Scleractinia was written in many small publications.

It seems that until Cairns gave surveys (1982, 1990a), no coherent treatment of Weddell Sea corals existed. Voss (1988) briefly mentioned the group, but did not try to identify the species, as they were inferior in the context of his work.

Objectives

The main objectives of the study were:

- identification of scleractinian corals;
- to extend the knowledge on the geographic and bathymetric distribution of each species;
- analysis of species co-occurrence

Work at sea

Samples were taken with GSN, AGT and BPN. Because corals occur sparsely in many of the often large catches, the help of colleagues during the sorting procedure was invaluable; here should especially be mentioned Wolf Arntz, Tom Brey, Susanne Gatti, Boris Sirenko, Igor Smirnov, and Martin Rauschert. The skeleton of one or more specimens of each supposed species was cleaned in strong NaOH. The preliminary identifications were mainly carried out following Cairns' key and descriptions (1990a). Specimens with tissues were initially fixed in 4% formaldehyde and transferred into 80% alcohol after some weeks.

Preliminary results

The species

Seven of the 20 species of recent Scleractinia listed for the Antarctic and Subantarctic regions by Cairns (1990a, 1990b) have been recorded in the present study (Table 1). All are solitary. Colonial scleractinians have so far not been reported from the Antarctic continent; it should be borne in mind that stylasterid hydrozoans occur in many areas, and that a mistake is easily made, especially when one is presented with somewhat worn branches.

Only 2 species, *Caryophyllia antarctica* and *Flabellum flexuosum*, were taken in the "Kapp Norvegia Box". The station richest in species was situated somewhat north of Kapp Norvegia, and by far the largest number of records came from the area between Vestkapp and Halley Bay.

The maximum height for *Flabellum flexuosum* has been given as 67 mm; one of the new specimens measured 80 mm. The maximum diameter of *F. gardineri* was given as 8.9 x 8.3 mm, as the species typically is slightly oval; the single specimen found here is circular, measuring 18 mm in diameter, and, accordingly, small size may not be reliable as distinguishing character.

Distribution

One of the 7 species, *Fungiacyathus marenzelleri*, is distributed outside the Antarctic-Subantarctic area. *Flabellum gardineri* is for the first time recorded from the Antarctic continent, hitherto being known only from Shag Rocks, the type locality. For the last 5 species, the present records are within their known geographical range. The new records bring the number of Scleractinia known from continental Antarctica up from 10 to 11.

For *Caryophyllia antarctica* and *Flabellum gardineri* the Weddell Sea records extend their known bathymetrical range into greater depths with about 300 m.

Co-occurrence
Several species are often found in the same catch (Table 16), up to 6 species occurring together, 4 of them in several samples. Because they were taken in gear towed over long distances (500-1000 m), different communities and patches may have been sampled. On the other hand, similar gear, in a similar number of operations (12:10), took no corals in nearby stations.
The presence of hard substrate, often found to be of gravel size, is a decisive factor for coral colonization. Judged from the condition of the stalk, some specimens of this study were freeliving, and some obviously broken from a substrate. Had this been spicule mat or bryozoan debris, some fragments should still have been fastened at the coral bases, since they are both less solid than the coral itself. It is to be concluded that the two kinds of hard biogenic substrate are not suitable for corals, at least not after they reach a size of 10 mm diameter or more.

Tab. 16 Scleractinia preliminarily identified during the-EASIZ cruise. Depths given are for the arrival of gear on bottom.

Species	Gear (in order of increasing depth)									
	AGT 6 123 m	AGT 1 254 m	GSN 4 338 m	GSN 8 446 m	GSN 1 462 m	GSN 10 468 m	BPN 4 504 m	AGT 10 560 m	GSN 6 630 m	AGT 4 1704 m
Fungiacyathus marenzelleri (Vaughan, 1906)					x					
Caryophyllia antarctica (Marenzeller, 1904)	x			x	x	x			x	x
Gardineria antarctica (Gardiner, 1929)			x	x	x	x	x	x	x	
Flabellum impensum (Squires, 1962)			x	x	x	x	x		x	
Flabellum flexuosum (Cairns, 1982)		x		x		x			x	
Flabellum gardineri (Cairns, 1982)					x					
Javanaria antarctica (Gravier, 1914)					x					
No of species	1	1	2	4	6	4	2	1	4	1

References

Cairns, C., 1982. Antarctic and Subantarctic Scleractinia. - Antarctic Research Series 34: 74 pp.
Cairns, C., 1990a. Antarctic Scleractinia. - Synopses of the Antarctic Benthos 1. Koeltz Scientific Books, Koenigstein. 78 pp.
Cairns, C., 1990b. Ordnung Scleractinia (Steinkorallen). - *In* J. Sieg & J.W. Wägele (eds.): Fauna der Antarktis, p. 26-29. P. Parey, Berlin. 197 pp.
Voss, J., 1988. Zoogeographie und Gemeinschaftsanalyse des Makrozoobenthos des Weddellmeeres (Antarktis). - Berichte zur Polarforschung 45: 145 pp.

2.4.3 Bryozoans of the Weddell Sea (M. Zabala, C. Orejas, V. Alvà)

Introduction

Bryzoans together with sponges and crinoids range among the most significant components of marine benthic communities over large areas of the Antarctic continental shelf (between 30 and 600 m). Their skeletons form, with sponge spicules, large mats which carpet the bottom and contribute a large part of the coarse biogenic sediment (Bullivant, 1961, 1967). Antarctic bryozoan communities have also proven to be very complex both in species richness and morphological patterns. Approaches to the ecology of Antarctic benthic communities cannot easily be made without a knowledge of bryozoan diversity, and there is a need for systematic research which provides the basis for further ecological studies.

Up to now, ecologists who attempted to identify Antarctic bryozoans were facing discouraging difficulties because of the insufficient and sparse bibliography and confuse synonymies. However, recently an excellent Synopsis of the Antarctic Cheilostomatous Bryozoa was published (Hayward, 1995) which will simplify the task a great deal, cheilostomatous bryozoans being, by far, the most important group in Antarctic waters. In fact, there still are considerable uncertainties in the study of cyclostomatous and ctenostomatous bryozoans. We can confidently predict that Hayward's work will steadily increase the number of further contributions, as it did stimulate this one.

Large areas of the seafloor of the Antarctic shelf have still to be explored by bryozoologists, and this is strikingly evident for the Weddell Sea. A glance at the historical account by Hayward on the Antarctic bryozoans suffices for stating that not a single report has been published for the Weddell Sea, although large amounts of bryozoans were collected from this area by recent German Antarctic expeditions (e.g. EPOS I leg 3; Galéron et al.,1992). In contrast with the abundant references to the Antarctic Peninsula or to the Ross Sea, references to the Weddell Sea appear scattered (Hayward, 1995), and only few species have been registered from this area (about 10, less than 4 % of the 264 species presently known for the whole Antarctic region).

Objectives

The main purpose of this work is to fill in part the large gap in the knowledge of the fauna of bryozoans of the Weddell Sea. Furthermore, all collected material has to be properly labelled in order to provide the AWI with a comprehensive collection of bryozoans from the Weddell Sea region. The study of specimens on board (and still "in vivo") has allowed the observation of some details on the morphology and biology of the species which cannot be deduced from fixed material. Special attention has been paid to the study of colours, which can help in the discrimination of species (e.g. those belonging to difficult genera - as Cellarinella or Retepo-rella -, or showing similar morphology - as flustriform species -) but are quickly lost after fixation. Reproductive status has been studied by noting the presence of ovicells and incubated embryos.

Sadly, the amount of biomass that was caught by an array of different gears (bottom trawl, Agassiz trawl, benthopelagic sled), added to the capricious sorting of these samples shared by many zoologists, has made possible only rough estimates of biomass.

A more or less dense array of samples concentrated in three rather restricted areas (NE of Kapp Norvegia, Kapp Norvegia and Vestkapp areas), but with a wide depth range (120 to 2300 m). This design allowed to look for the existence of different bryozoan assemblages. It will also allow to discuss for the bryozoans the assumed eurybathy of the Antarctic benthic megafauna, and the role that site and depth could play in this spatial pattern.

Results

Bryozoans coming from 30 samples collected by different gears (10 AGT, 9 GSN, 4 EBS, 1 BPN, 1 D, 1 stomach content and 4 GKG) have been totally sorted, identified and labelled for collection purposes. More than 350 individually labelled specimens, plus 17 larger buckets containing mixed remnants of the whole sample, make up the collection.

Around 147 different species of cheilostomatous bryozoans have been recognized. 122 species have been properly identified, in full agreement with the descriptions provided by Hayward (Table 1 in Annex 3.6). 112 of these species (92 %) were not previously known to be present in the Weddell Sea (all except those marked with a "W" in Table 3.6-1). 16 are very rare species, which were only known to the present from a sole or a few localities around Antarctica (marked with "R" in Table 3.6-1). There are also 19 strange forms (or varieties) of well described (Hayward, 1995) species, which do not match exactly these descriptions and wait for further studies and discussion with specialists (listed at the end of Table 3.6-1). Still, specimens belonging to around 25 species seem to be clearly different from all those described by Hayward, and presumably belong to species never seen in Antarctica (marked with a "N" in Table 3.6-1).

Tables 2 and 3 in Annex 3.6 are intended to provide some insight into distribution of biomass by means of ordinate values (from 1 to 5), which roughly represent the natural logarithm of the number of fragments sorted in each sample (be aware that not all the fragments are similar in size). An overwhelming diversity seems to be the rule, and up to 62 different species (almost half of the whole list known for all the Weddell Sea) can be found in a sole sample.

Spatial pattern

In general, there is not a clear spatial pattern for species richness, at least not among samples coming from the continental shelf (120-800 m). No distinct assemblages can be discerned among the three main sites, even if Kapp Norvegia appears to be richer than the other two localities (Fig.14). There is not a clear bathymetric pattern on the shelf (between 120-800 m), but it should be noted that the shallower sites use to have more species per sample (Fig.15). On the other hand, the two samples from below 1000 m depth have provided much poorer samples, their bryofauna being composed of only small inconspicuous species, living on pebbles. A high percentage of these colonies belong to rare species, and some kind of faunistic discontinuity appears below this depth. Nevertheless, the lower limit of the shelf seems not to be a clear bathymetric border for most bryozoan species, in which eurybathy seems to be the rule (Fig. 16).

A significant part of the bryozoans collected during the cruise showed reproductive structures, suggesting that summer is the reproductive season for most of the species.

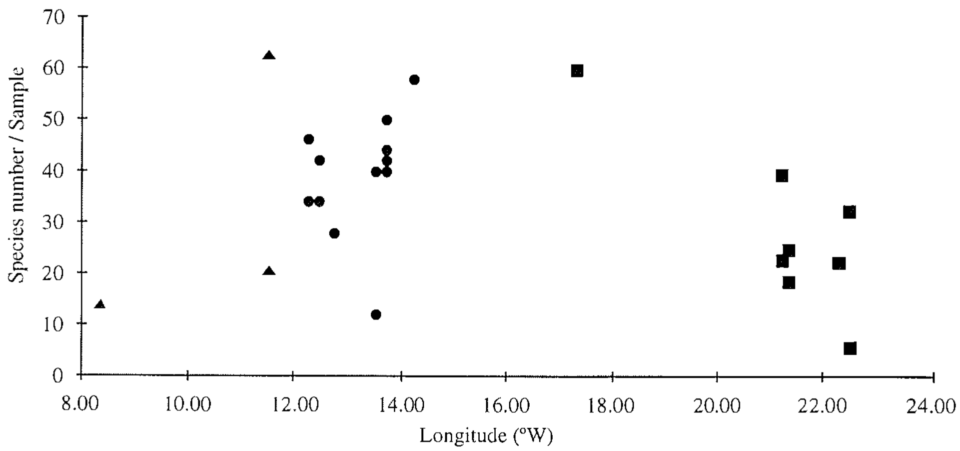


Fig.14: Longitudinal variation of species richness of bryozoans in samples collected during the EASIZ cruise to the Weddell Sea. (NE; triangles): samples coming from the area NE of Kapp Norvegia; (KN; circles): from the Kapp Norvegia area, (VK; squares) from the Vestkapp area. The bryofauna of the Vestkapp area seems to be poorer than that from the easternmost regions.

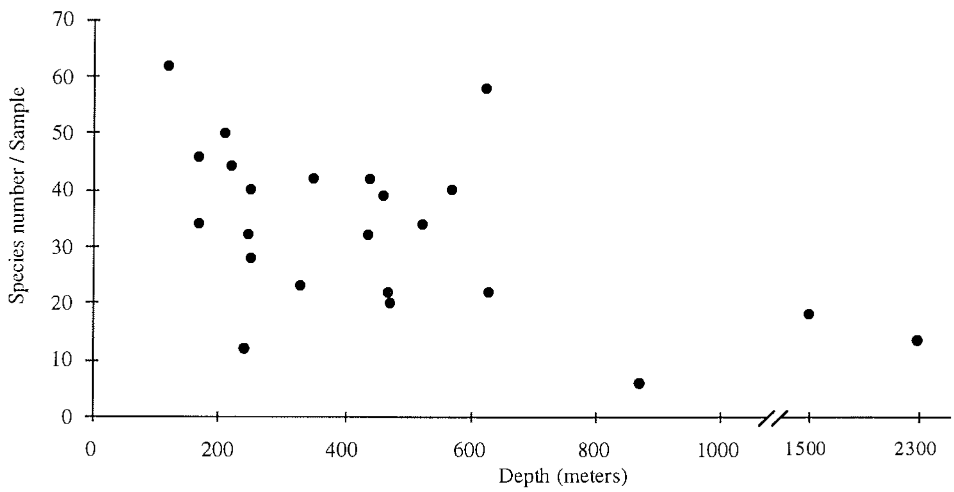


Fig.15: Bathymetric variation of species richness of bryozoans collected during the EASIZ cruise to the Weddell Sea. Although samples coming from the deep sea are poorer than the others, no clear bathymetric patterns arise in the range of the shelf-slope depths (200-800 m).

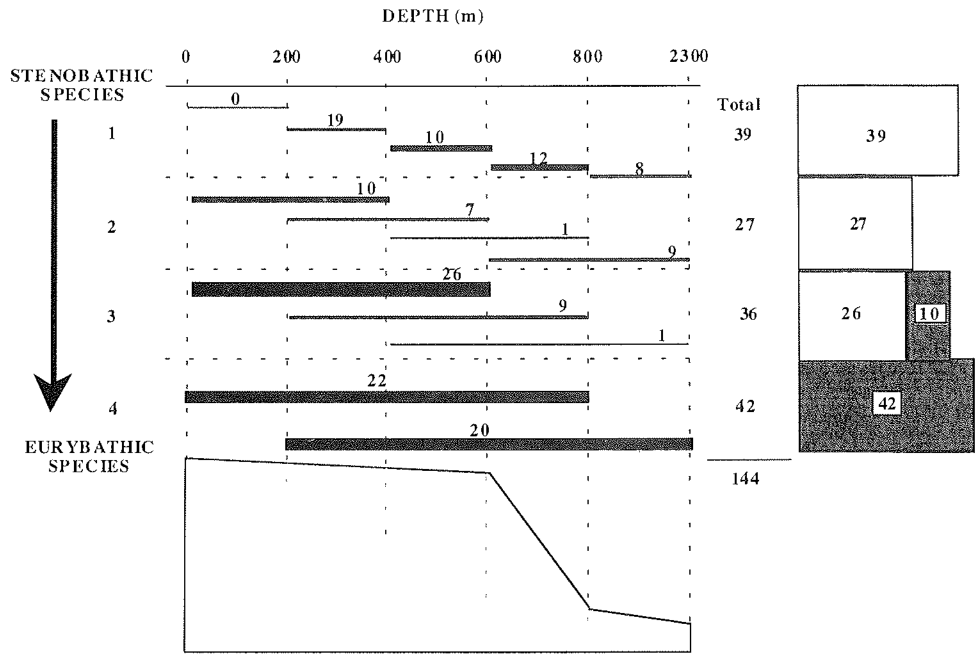


Fig. 16: Steno- vs eurybathic patterns of distribution of bryozoans collected during the EASIZ cruise to the Weddell Sea. Because of the uneven distribution of samples with depth, bathymetric ranges have been arbitrarily selected. Upper left, number of species found in only one bathymetric segment; centre left, number of species found in two and three consecutive bathymetric segments; lower left, number of species found in four segments. No species was found to occur over all bathymetric ranges. Right, accumulated number of species showing narrow (top) to wider bathymetric ranges (bottom); dark boxes refer to the number of species which exceed the limit of the continental shelf.

Seven large morphological groups of bryozoans can be roughly distinguished (Fig. 17a), three of flexible or articulated forms (flustriform, buguliform and cellariform) and four of rigid forms (encrusting, rolling-laminar, branched-erect and reteporiform). Even if there is a significant homogeneity among all samples in the way they share the whole biomass amongst these seven morphotypes (mean values: 9 % flustriform, 3 % buguliform, 3 % cellariform, 18 % encrusting, 45 % rolling-laminar, 18 % branched-erect, 4 % reteporiform), there are slight differences among sites and depths in the contribution of each morphotype (Fig. 17b-c). Provided that no strong patterns in the distribution of the species are found, these shifts in the relative abundance of morphotypes are a more conspicuous feature which shapes the differences among samples. To the present, factors driving these changes are not clear, but they can be probably related with topography and current regimes. On the other hand, and perhaps in disagreement with results found in other groups of megafauna (Arntz et al.,1994), there is not a clear effect of iceberg scouring events, as it was difficult to find differences between samples coming from the area of iceberg calving and other areas. However, sampling may not have been sufficiently fine-scaled to reveal this kind of differences.

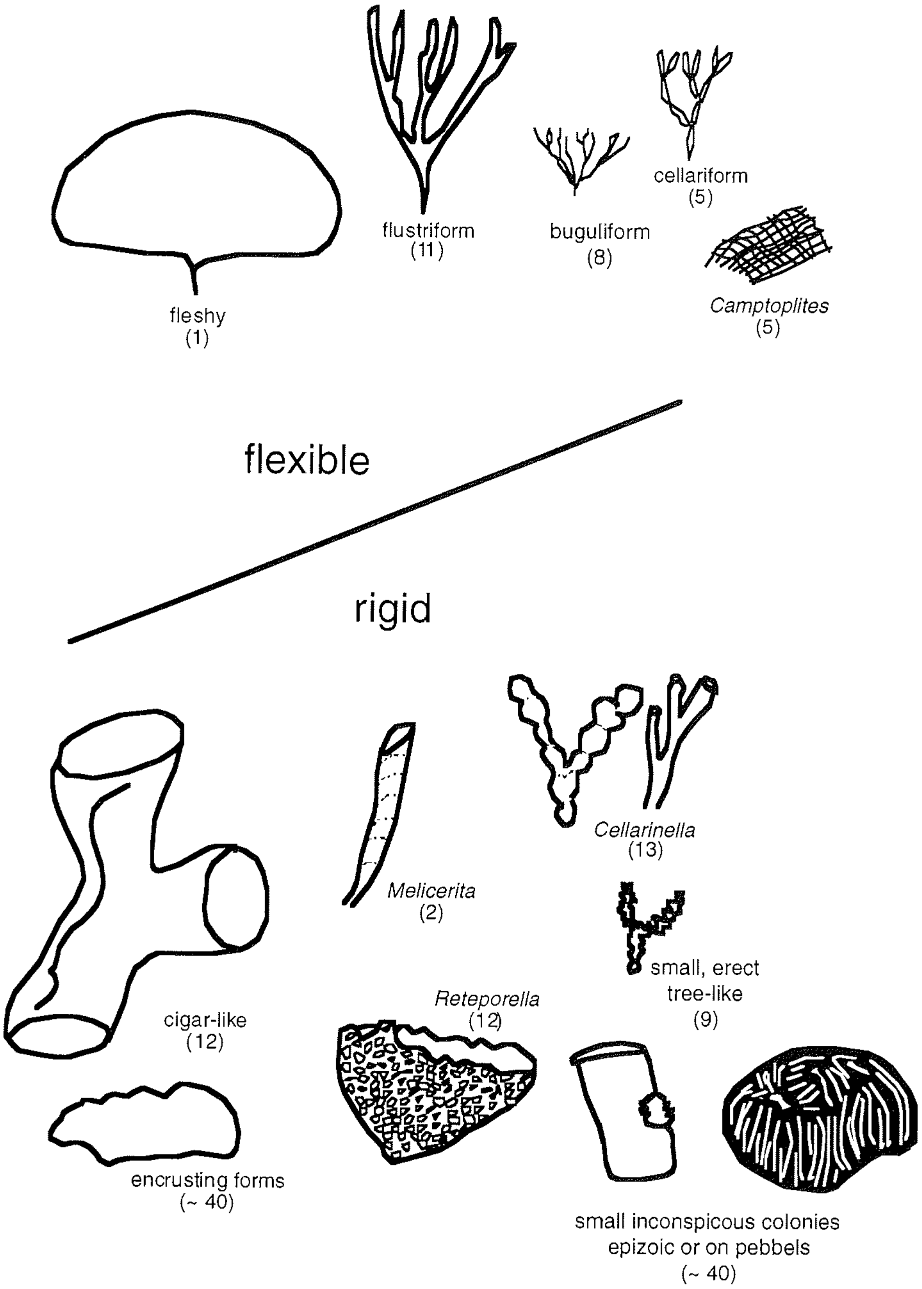


Fig. 17a: Different morphotypes of bryozoans (Number of species in parenthese).

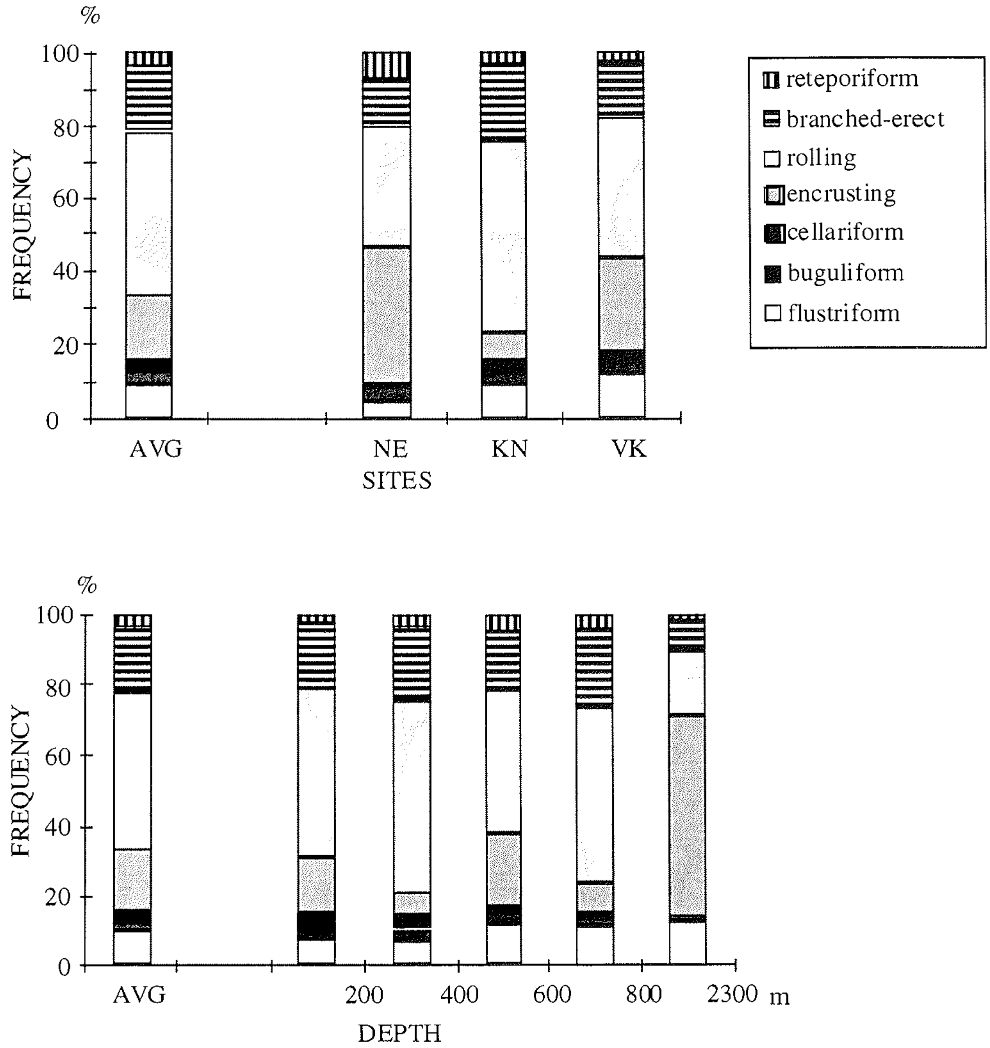


Fig. 17b - c: Spatial changes in the biomass of the seven main morphotypes of bryozoans collected during the EASIZ cruise to the Weddell Sea. Top: Morphotypes, a) flustriform; b) buguliform; c) cellariform; d) encrusting; e) rolling-laminar; f) branched-erect; g) reteporiform. Top: Changes between localities. AVG: average, NE: northeast of Kapp Norvegia, KN: Kapp Norvegia area, VK: Vestkapp area. Bottom: Changes with depth. Biomasses have been estimated by adding the relative biomass (see the text) of all species assigned to each morphotype.

Reproductive status

Bryozoans seem to reproduce mainly during the summer season. A high percent (101 species, 69 % of the whole bryozoans) showed reproductive structures (ovicells or other gonozooids for growing embryos, although this picture does not mean exactly 101 species to be just in reproduction, because calcareous reproductive structures are known to remain also in dead colonies. Not all the species are easy to check for the presence of growing embryos inside the ovicells (which is the true evidence that reproduction is just occurring), however a significant amount were effectively observed to be fertile in this season (44 species; 30 % of all bryozoans). A wide difference in the total number of embryos brooded by each colony has been observed among species, pointing to the suggestion of Winston (1983) that strong different life-strategies should be at work.

Conclusions

This cruise has allowed to write the first faunistic report on the bryofauna of the Weddell Sea. Even though only cheilostomatous bryozoans have been studied, materials collected during the EASIZ cruise have enlarged the number of species known from the Weddell Sea from 10 to 122. That means that around one-half of the bryofauna as yet known for the whole Antarctic (264 species in the Hayward account) are present in the Weddell Sea. An important number of undescribed, new or odd species remain to be fully described after proper discussion with specialists. The rate of apparition of unknown (for the Weddell Sea) species being still high during the sorting of the last samples (5 for the last one), and remembering that the total number of hauls was rather small, we think that further efforts will provide a significant enlargement of this preliminary list. This image agrees with the suggestion by Hayward (1995) that most Antarctic cheilostomatous bryozoans should exhibit a wide distribution all around the Antarctic coasts.

At a smaller scale, there is not a clear spatial pattern in the distribution of the species. The area off Vestkapp seems to be poorer in species richness than the area off Kapp Norvegia, in full agreement with previous suggestions as to differences in the relative abundance of sessile suspension feeders vs motile fauna of the two areas (Galéron et al.,1992).

Antarctic bryozoans exhibit a surprising eurybathy (in the range of 200-800 m depth) if related to the more stenobathic distribution of the warm water bryofaunas, which is in agreement with accepted hypotheses on the distribution of other benthic groups (Arntz et al.,1994). Even so, a sharp faunistic discontinuity seems to separate the bryofauna of deep-sea bottoms (below 1000 m) from those of the continental shelf and the slope.

Slight shifts in the frequencies of appearance of morphological groups, mainly between flexible and rigid forms, are the most conspicuous differences among sites and depths.

References

Arntz, W.E., Brey, T. & V.A. Gallardo, 1994. Antarctic zoobenthos. Oceanogr. Mar. Biol. Ann. Review 32. 241-304.

Bullivant, J.S., 1961. Photographs of Antarctic bottom fauna. Polar Record, 10(68): 505-508.

Bullivant, J.S., 1967. Ecology of the Ross Sea benthos. In: Bullivant, J.S. and Dearborn, J.H. (eds.) The fauna of the Ross Sea. Part 5, General accounts, station lists and benthic ecology. New Zealand Oceanographic Institute, Memoir 32: 1-77.

Galéron, J., R.L. Herman, P.M. Arnaud, W.E. Arntz, S. Hain & M. Klages, 1992. Macrofaunal communities on the continental shelf and slope of the southeastern Weddell Sea, Antarctica. In Hempel G.(ed.) Weddell Sea Ecology. Results of EPOS European Polastern study. Springer, Berlin 1993. Polar Biol., 12: 283-290.

Hayword, P., 1995. Antarctic Cheilostomatous Bryozoa. Oxford University Press. Oxford.

Winston, J., 1983. Patterns of growth, reproduction and mortality in bryozoans from the Ross Sea, Antarctica. Bulletin of Marine Science, 33(3): 688-702.

2.4.4 Ecology and Taxonomy of Molluscs in the Eastern Weddell Sea
(B. Sirenko)

Introduction
Although chitons, shelled gastropods and bivalves of the Weddell Sea were studied during previous expeditions (Voss, 1988; Hain, 1990; Hain & Arnaud, 1990), their ecology and taxonomy still remain poorly studied. 135 species of shelled gastropods and bivalves are known for the Weddell Sea (Hain, 1990), but more than 20 per cent of the species encountered were identified only up to genus or higher systematic level. Part of the gastropod species with small shell sizes which were collected during previous expeditions have still not been identified. Some species of gastropods are known only from broken specimens that did not reveal all characters for taxonomic study. As to small groups of molluscs (chitons, scaphopods, caudofoveats and solenogastres), their species composition is unknown till now.

Objectives
The main goals of the investigation were:
- to gather additional material especially of rare species for future taxonomic study
- to gather material for the study of feeding of chitons and gastropods
- to add to faunistic and ecological data on molluscs of the eastern Weddell Sea
- to compare malacofaunas of the Antarctic and Arctic

Work at sea
Molluscs were gathered from 23 trawl catches (AGT, GSN, BPN), one epibenthic sledge (EBS-1), several Rauschert's dredge catches, and several GKG and MG samples. Material was collected both from unsifted and sifted samples. After gathering of molluscs and other animals by hand from the trawl catch on deck we washed and sifted most of remains of each catch on a set of three sieves with 10x10, 5x5 and 1x1 mm meshes. Most molluscs with sizes less than 5 mm were gathered after sifting. Owing to sifting of catches we received about 80 % of mollusc species whereas hand gathering on deck provided only 20%. Shelled molluscs were preliminarily identified making use of available publications (Powell, 1951; Dell, 1964; Hain, 1990). The total material of molluscs except nudibranchs was fixed in 75% alcohol. Nudibranchs were fixed in 4% buffered formaldehyde.
All material of molluscs collected during the expedition will be distributed among scientists of St. Petersburg and Moscow for exact identification.

Preliminary results
Taxonomy and ecology
134 species of molluscs except cephalopods were preliminarily identified:

Polyplacophora	3
Aplacophora	4
Gastropoda (Prosobranchia)	84
Gastropoda (Opisthobranchia)	5
Scaphopoda	2
Bivalvia	36

In the collected material several species are new for the Weddell Sea: *Stenosemus* sp. of the Polyplacophora, Mesogastropoda fam. spp. (3 species); Rissoidae gen. spp. (2 species); *Cerithiella* sp. (1 species); Buccinulidae gen. spp. (2 species) of the Gastropoda, and *Cyclopecten* sp. (1 species), Thyasiridae gen. spp. (2 species) and Philobryidae gen. spp. (2 species) of the Bivalvia.
Quite a number of species represented with only few specimens from previous Antarctic expeditions were found again: *Trophon cf. scotianus*, *T. drygalskii*, *Pleurotomella enderbiensis* and others.

In most samples several large-sized species occurred: *Harpovoluta charcoti*, *Trichoconcha mirabilis, Aforia magnifica*. Among the small-sized species sometimes *Margarella* sp. was very abundant (in sponges) and *Balcis* sp., which probably is a non-obligatory parasite of echinoderms.

One of the peculiarities of Antarctic shelf bivalves is the abundance of molluscs which possess a byssus. These representatives of the epifauna are abundant in most catches on the shelf. Several species (*Limopsis marionensis, Lissarca notorcadensis, Philobrya sublaevis, Limatula hodgsoni* and others) were met very often on Antarctic shelf grounds with muddy sand, pebbles and stones. There was only one catch on the shelf (GSN-3) where representatives of infauna (*Propeleda longicaudata, Yoldiella valettii* and Thyasiridae gen. sp.1) dominated. The sediment at those stations was muddy.

The molluscan fauna inhabiting the slope at 1540 m (AGT-4), 1600 m (Dredge 26) and 2330 m depth (AGT-12) is different from the fauna of the shelf. On the slope several deep-water species were present. They are Philobryidae gen. sp. (1540 m), *Yoldiella* spp. (2 species, 1600 m, 2330 m), Thyasiridae gen. sp.2 (1600 m, 2330 m), *Cyclopecten* sp.3 (2330 m) and Rissoidae gen. sp.2 (2330 m). These molluscs were met for the first time in the Weddell Sea. There were only three empty shells of molluscs that are widespread on the shelf, and live *Cuspidaria* sp. were distributed on the shelf and also in the deep water catch (2330 m).

The Antarctic fauna has 369 species of prosobranchs and bivalves whereas the fauna of the Arctic molluscs has only 231 species (Egorova, 1994). The most abundant bivalves in the Arctic are representatives of infauna whereas in Antarctic epifauna bivalves are dominant. The greatest difference in species composition is found in the gastropods. There are 259 species of gastropods in Antarctica and only 143 species in the Arctic. One of the causes of the differences of polar malacofaunas may be the greater age of the Antarctic fauna. Another cause may be the rich epifaunal communities which are widespread along the Antarctic shelf.

Investigation on feeding (Fig. 18)

Aboard the icebreaker the chitons *Nutallochiton mirandus* and *Callochiton gaussi* were examined to study their food. Because little large-sized material was encountered, only a few specimens of *N.mirandus* were studied. The body lengths in the examined specimens were from 73.0 to 75.5 mm. Their stomachs and guts contained 70-100 % of bryozoans, 20-25 % of greenish mass (not identified) and about 5 % of sand and foraminiferans. *Nutallochiton mirandus* destroys colonies of bryozoans and swallows big pieces of bryozoans up to 6-7 mm long. *Callochiton gaussi* feeds on bryozoans also. But as opposed to big *Nutallochiton mirandus*, *Callochiton gaussi*, which is considerably smaller (its body length is up to 10 mm), has another feeding behaviour. The chiton opens an operculum and the upper part of a bryozoan shell by its radula and eats tissues of the bryozoan without destroying its colonies. For this reason there are only opercula, very small pieces of frontal membranes and tissues of bryozoans in the digestive tracts of *C.gaussi.*

Bryozoans from chiton guts were identified by M. Zabala whom I would like to thank. The length of the digestive tract of *N.mirandus* is 2.5 times greater than the length of its body. This is in accordance with the digestive tracts of other representatives of the family Mopaliidae whose species feed on epizooides.

The structural study of radulae of *N.mirandus* showed an unusual vigorous hook plate. The hard radulae serve for the destruction of hard shells of bryozoans.

The feeding ecology of other molluscan species will be examined at the Zoological Institute in St. Petersburg.

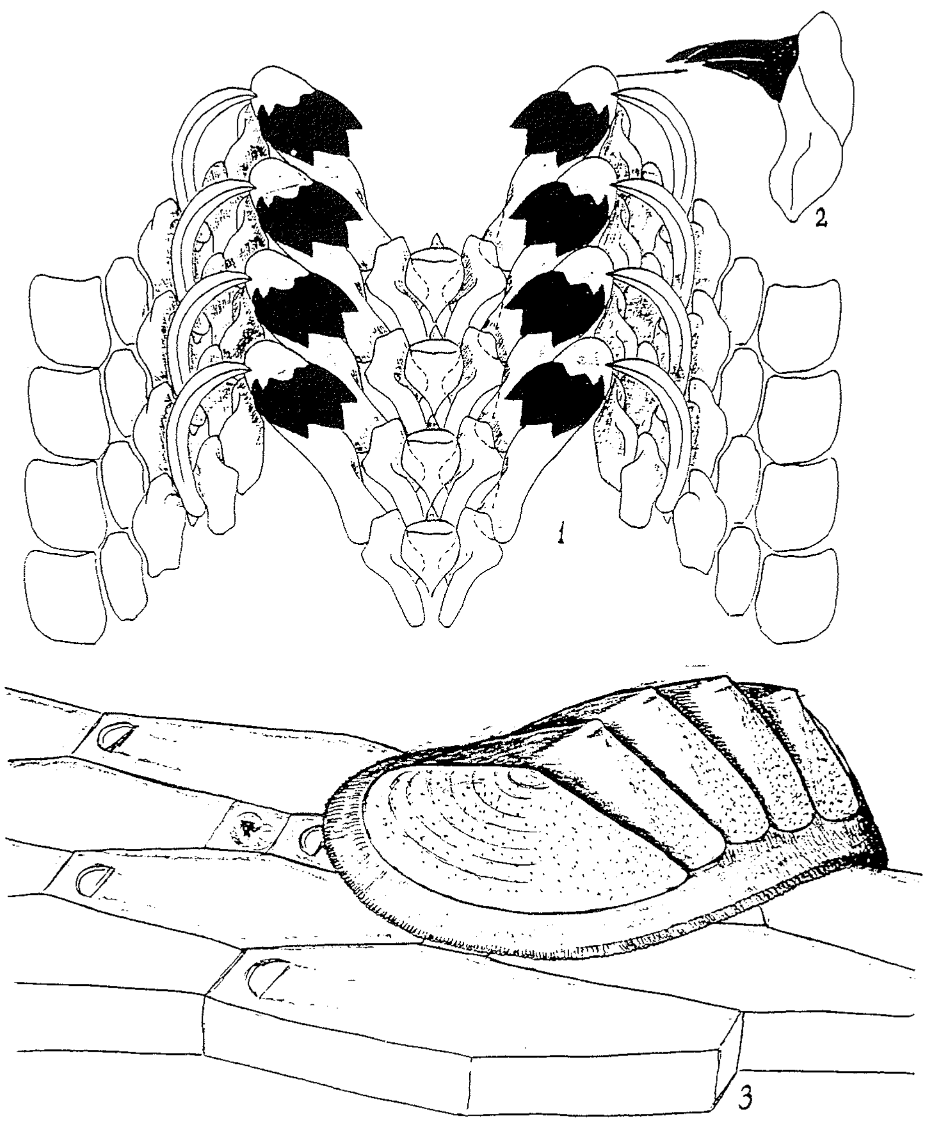


Fig. 18: Four transverse rows of radulae of *Nutallochiton mirandus* (1); hook teeth of radulae, side-view (2); *Callochiton gaussi* feeds on bryozoan *Isosecuriflustra angusta.*

References

Arnaud, P.M. & S. Hain, 1992. Quantitative distribution of the shelf and slope molluscan fauna (Gastropoda, Bivalvia) of the eastern Weddell Sea (Antarctica). In Hempel, G. (ed.), Weddell Sea Ecology. Results of EPOS European *Polarstern* Study. Springer, Berlin, 1993. Polar Biol. 12: 103-109.

Dell, R.K. 1964. Antarctic and Subantarctic Mollusca: Amphineura, Scaphopoda and Bivalvia. Discovery Reports 33: 93-250.

Egorova, E.N. 1994. Comparative characteristics of cold-water Antarctic and Arctic malacofaunas (Abstract). SCAR Sixth Biology Symposium - Antarctic Communities: Species, Structure and Survival. Venice, 80.
Hain, S., 1990. Die beschalten benthischen Mollusken (Gastropoda und Bivalvia) des Weddellmeeres, Antarktis. Ber. Polarforsch. 70: 152.
Hain ,S.& Arnaud P.M., 1990. Ecological and faunistic investigation on shelled molluscs. Ber. Polarforsch. 70: 111-113.
Powell, A.W.B., 1951. Antarctic and Subantarctic Mollusca: Pelecypoda and Gastropoda. Discovery Reports 26: 47-196.
Voss, J. 1988. Zoogeographie und Gemeinschaftsanalyse des Makrozoobenthos des Weddellmeeres (Antarktis). Ber. Polarforsch. 45: 1-145.

2.4.5 Aerobic Metabolism and Antioxidant Defence in Antarctic Sipunculids (T. Buchner)

Objectives

Compared to marine invertebrates from boreal zones polar marine invertebrates are exposed to lower temperatures and elevated oxygen levels. These factors have been demonstrated to determine the rate of aerobic metabolism. In addition, these factors and also the level of environmental H_2O_2 will influence the activity levels of antioxidant enzymes which remove toxic oxygen species. However, the effect of temperature, O_2- and H_2O_2 concentration on the physiology of marine invertebrates is, in general, incompletely understood, as is the specific importance of these factors in the physiology of polar species. Therefore, we intended to study the aerobic metabolic activity and the enzymatic antioxidant defence of Antarctic sipunculids. These results will be compared with data on sipunculids from boreal zones.
One toxic effect of reactive oxygen species is the peroxidation of lipids. The extent of possible oxidative damage in animal tissues is measurable by the determination of malondialdehyd concentrations as a marker for lipid peroxidation.
For the evaluation of abiotic factors in the environment of Antarctic sipunculids the levels of H_2O_2 in the sediment water boundary were to be determined, and sediment samples for porosity and organic carbon determination were to be collected.

Work at sea

Four species of sipunculids were collected from GSN, AGT, D, BPN and MG and were maintained aboard the vessel in aquarium containers at $0{,}0 \pm 0{,}5$ °C. Sediment as well as water samples from the sediment water boundary were collected from MG. H_2O_2 concentration in the water samples was measured directly after sampling. Frozen sediment samples for determination of porosity and organic carbon concentration will be transferred to the AWI.
Two weeks after collection various tissue samples from sipunculids were taken for subsequent measurement of H_2O_2, antioxidant enzyme activities and malondialdehyd concentration. The aerobic metabolic rate of the sipunculids (i.e. the rate of oxygen consumption) was measured at different temperatures (0 - 6°C). For investigation of the influence of temperature on antioxidant enzyme activities as well as on the H_2O_2 concentration in coelomic fluid sipunculids were kept over 5 days at 5 °C. Afterwards, H_2O_2 concentration in coelomic fluid was determined and frozen tissue samples were taken for subsequent measurement of antioxidant enzyme activities and malondialdehyd concentration . H_2O_2 concentration in coelomic fluid and the activity of one antioxidant enzyme were measured during the cruise, other enzyme activities will be measured at the AWI.

Preliminary results

The mean H_2O_2 concentration in the sediment water boundary at station 004, 006 and 009 was $407 \pm 12{,}7$ nmol l^{-1}. From boreal invertebrates it is known, that H_2O_2 concentration at these levels do not have an influence on enzymatic antioxidant defence.
Both the H_2O_2 concentration in coelomic fluid and the activity of one antioxidant enzyme

(glutathione reductase) in body wall tissue were higher after the incubation for 5 days at 5 °C than under control conditions (0°C).

Tab. 17: *Golfingia* sp.: H_2O_2 concentration in coelomic fluid and activity of glutathione reductase (GR) in incubated (5 days at 5°C) and in control animals (n=3/4).

	U GR mg^{-1} protein	µmol H_2O_2 l^{-1}
0 °C	0,00053 ± 0,00013	13,52 ± 0,33
5 °C	0,00503 ± 0,0062	15,14 ± 1,5

This may indicate an increased generation of toxic oxygen species, probably due to higher metabolic rates at elevated temperatures. The first impression of the measurement of the aerobic metabolic rate is, that oxygen consumption rates are indeed higher at elevated temperatures. However these results have to be verified.

2.4.6 Autecology of Aphroditidae and Polynoidae (Polychaeta) on the Continental Shelf and Slope of the Eastern Weddell Sea
(M. C. Gambi)

Introduction
Aphroditidae and Polynoidae polychaetes (scaleworms) are two phylogenetically closely related families. Aphroditidae occur in the Antarctic seas with a few species (6 according to Hartman, 1964), while Polynoidae represent one of the most diverse and abundant groups of polychaetes in the Southern Ocean with up to 52 described species (Hartman, 1964). Many species of both families show in the Antarctic waters a wide ecological (e.g., depth, biotopes) and geographical distribution. They can reach relatively large dimensions (up to 20 cm), therefore it is consistent that they may have quite long life spans (in the order of various years) and likely reproduce several times during life (iteroparous).
An extensive study on species distribution and on some reproductive features of Aphroditidae and Polynoidae in the eastern Weddell Sea has been carried out recently by Stiller (1995), who confirmed for many species the above mentioned features. Stiller (1995) reported 2 species of Aphroditidae and 20 species of Polynoidae, considering the data of several expeditions carried out in the Weddell Sea also in different seasons besides austral summer. Species composition and distribution of Aphroditidae and Polynoidae were studied, at a smaller spatial and temporal scale, also on various coastal biotopes of Terra Nova Bay (Ross Sea) (Castelli, 1992; Gambi et al., 1994; Gambi & Castelli, 1994; Gambi et al., in press). Among the various species collected at Terra Nova Bay, some were common to the eastern Weddell Sea; e.g., *Laetmonice producta*, *Harmothoe spinosa*, *Barrukia cristata*, *Polyeunoa laevis*.

Objectives
The aim of this research was to investigate some aspects of the autecology of Aphroditidae and Polynoidae; the main objectives were to study:
- species composition and distribution of Aphroditidae and Polynoidae at the investigated spatio-temporal scale of the cruise;
- allometric analysis, possibly age evaluation and population structure of the most abundant species of both families;
- some reproductive features, such as state of the gonads, size and number of eggs;
- possible associations (symbiosis, commensalism, etc.) of these polychaetes with other organisms, mainly sponges, cnidarians, echinoderms;
- feeding ecology of some of the most abundant species of both families;
- comparisons with previous data of the same geographic area and with the Terra Nova Bay (Ross Sea) populations.

Work at sea

Polychaetes were mainly collected, together with other benthic organisms, by means of different gears: Agassiz trawl (AGT), bottom trawl (GSN), epibenthic sledge (EBS). Further specimens were occasionally obtained from the small epibenthic Rauschert dredge (D) and from the benthopelagic net (BPN). During sampling particular attention was paid to collect all the specimens of both Aphroditidae and Polynoidae that were encountered, regardless of their abundance in previous samples, conditions and sizes, in order to study the population structure and to have the largest size range for allometric analysis and age determination. It is known, in fact, that many polynoids possess "rings" in their jaws that may represent annual growth marks (Britaiev, 1991). Polynoids, as many other polychaetes, are quite delicate organisms and easily break or autotomise during sampling and handling. For this reason, after collection worms were kept for some hours at ambient temperature to let them relax before fixation. The relaxed animals were separated under the stereomicroscope into presumably different species, looking mainly at the number, colour pattern and shape of papillae on the dorsal surface of the elitres. Specimens so sorted were separately fixed with 4% formaldehyde. Some specimens of various species were reared for short periods (days) for photographic documentation and for some behavioural observations. A few specimens of some of the most abundant and easily recognizable species were given to the group coordinated by T. Brey for isotopic analysis of their tissues. Finally, some ecto- and endoparasites found on a few species of scaleworms were collected and given to the specialists on board (K. Zdzitowiecki and H. Palm).

On some of the most abundant species a preliminary analysis of the population structure was carried out by measuring, for each of the samples, all the individuals collected. For the polynoid *Polyeunoa laevis*, that lives mainly in symbiosis with some gorgonarians, an analysis of the host-worm relationships was initiated on board due to the collaboration of the cnidarian group of scientists of the University of Barcelona (Spain).

Besides the collection of Aphroditidae and Polynoidae, I was requested to collect also the other polychaetes occurring in the samples. These other worms were separated into different families and fixed in 4% formaldheyde. Finally, for different research purposes, several individuals of some species of Sabellidae (mainly *Perkinsiana* cf *littoralis*) and of one Serpulidae (*Serpula narconensis*) were frozen in liquid nitrogen and stored at -120°C for DNA phylogenetic analysis, while other specimens were fixed with the suitable fixatives (2% glutaraldehyde and 1% osmium) for the electron microscopy analysis of gamete ultrastructure.

Preliminary results

The method of fixation adopted (by first letting the animals relax and sorting them) prevented in many cases the breaking and autotomisation of the worms, allowing the collection of many entire specimens. However, some species (e.g., *Barrukia cristata)* break anyway when fixed, or lose their elitres.

A total of 28 samples, belonging to 22 stations, were preliminarily examined. The samples analysed belong to different sampling gears: 11 AGT, 10 GSN, 3 EBS, 3 D and 1 BPN. Scaleworms were collected in all samples, except stn 39/031 (D), and a total of 1838 specimens of both Aphroditidae (571 individuals) and Polynoidae (1267) have up to now been examined. A preliminary list of taxa of both families is given in Table 18. Among the Aphroditidae only *Laetmonice producta* was found, while among the polynoids about 30 taxa have been recognized, 27 in the Kapp Norvegia area and 23 in the Vestkapp-Halley Bay one. This has to be considered a preliminary species richness estimate because many of the polynoids found need still to be properly identified. It was not possible to accomplish this on board. Some other specimens also still have to be taxonomically analysed. However, even if the final number of taxa will be slightly reduced, the overall species richness recorded is relatively high, especially when compared with previous expeditions where more stations and wider depth ranges were considered (Hartman, 1974; Stiller, 1995). Most of the taxa up to date identified at species level (10) were already reported for the region by Hartman (1974). It is interesting to note that the species *Harmothoe spinosa* was found with two forms characterized by different colour pattern that, according to Stiller (1995) who found the same pattern, were indicated as "light" and "dark" forms.

Tab. 18: Preliminary species list of Aphroditidae and Polynoidae in the areas Kapp Norvegia (KN) and Vestkapp/Halley Bay (V-HB).

	N ind.	Frequency %	depth-range (m)	KN	V-HB
APHRODITIDAE					
Laetmonice producta Grube	571	12	200->1500	x	x
POLYNOIDAE					
Polyeunoa laevis McIntosh	233	21	100-800	x	x
Barrukia cristata (Willey)	102	17	100-800	x	x
Eulagisca gigantea Monro	96	12	200-800	x	x
Eulagisca cf *corrientis* Monro	52	11	300-800	x	x
Eucranta mollis (McIntosh)	39	7	300-500	x	x
Harmothoe spinosa Kinberg(light form)	107	14	100-500	x	x
Harmothoe spinosa (dark form)	54	10	200-600	x	x
Harmothoe cf *monroi* Ushakov	2	2	400-500	x	x
Harmothoe sp. a	11	2	300-400	x	x
Harmothoe sp. b	131	13	100-500	x	x
Harmothoe sp. c	1	1	300	x	-
Harmothoe sp. d	12	7	100-600	x	-
Harmothoe sp. e	1	1	>1500	-	x
Hermadion cf *ferox* Baird	56	13	100-600	x	x
Hermadion cf *magalhaensis* Kinberg	104	15	100-600	x	x
Hermadion type	104	16	100-600	x	x
Eunoe cf *anderssoni* (Bergstrom)	1	1	200	x	-
Eunoe opalina McIntosh	23	9	200-800	x	x
Eunoe cf *spica* Hartman	16	10	100-500	x	x
Eunoe sp. a	32	8	100-500	x	x
Eunoe sp. b	4	3	200-600	x	x
Austrolaenilla sp. a	4	4	400->1500	x	x
Austrolaenilla sp. b	2	2	400-500	-	x
Austrolaenilla sp. c	7	3	500-600	x	-
Gorekia crassicirris (Willey)	3	2	500-600	x	-
Gorekia type	1	1	>1500	x	-
Polynoe sp. (?)	39	9	200-500	x	x
Macellicephala sp.	1	1	800	-	x
Polynoidae gen. sp. 1	1	1	400	-	x
Polynoidae gen. sp. 2	1	1	200	x	-
other Polynoidae (to be identified)	28	8			
No. of individuals	1838				
Total no. of taxa	31			27	23

Analysing the species depth distribution (Table 18), most of the taxa were found on the shelf (100-600 m depth) and many taxa revealed quite a large bathymetric distribution (e.g., *Polyeunoa laevis* and *B. cristata*). Other species showed a slightly restricted depth range, mainly in the shallower areas (e.g., *Harmothoe spinosa*, *Harmothoe* sp. b) or in the intermediate zone (300-500 m) (e.g., *Eucranta mollis*). Finally, a few species showed a relatively deep distribution (e.g., *Austrolaenilla* spp., *Gorekia crassicirris*, *Macellicephala* sp.). However, the different sampling gears used at the various stations, and the different number of replicates available for each depth range considered, may bias the actual distribution of some of the species. In fact the whole GSN analysed contained 80% of the species found, the AGT 67.7%, the BPN 58% and the EBS and the D 35.5% and 22.6%, respectively. Also species abundance was found to be dependent on the sampling method, especially for the species of larger dimensions and with a quite high motility. As an example, 99% of the specimens of *L. producta*, 95% of *Eulagisca gigantea* and 92% of *E. mollis* were collected with the bottom trawl (GSN).

The analysis of the distribution of the number of taxa according to depth and to geographic areas (Fig. 19) showed a slight increase in biodiversity from shallow depths (100-200 m) to the shelf limit (500-600 m), followed by a more pronounced decrease in the deeper samples (800->1500 m). The area between Vestkapp and Halley Bay seemed to show a slightly higher number of species with respect to the Kapp Norvegia area, especially considering the lower number of samples that have been collected in this zone. However, this pattern may be biased once again by the effect of the various gears utilized and by the number of replicates available for each depth range considered.

The list of the other polychaete families collected in the samples is given in Table 19. The most widespread and abundant families of the Errantia were Nephtyidae, mainly represented by the genus *Aglaophamus*, followed by Syllidae (mainly *Trypanosyllis* sp.) often observed within the tissues or at the base of sponges of the genus *Rossella*. Among the Sedentaria many families occurred quite regularly and with a relatively high number of individuals, such as Terebellidae (mainly *Pista* spp.), Maldanidae (mainly *Maldane* spp.) and Sabellidae (mainly *Perkinsiana* cf *littoralis*). The above mentioned families (except Sabellidae) represent infaunal species that are linked to the presence of soft sediments and were more abundant at stations with a high sediment component (e.g., stn 39/009).

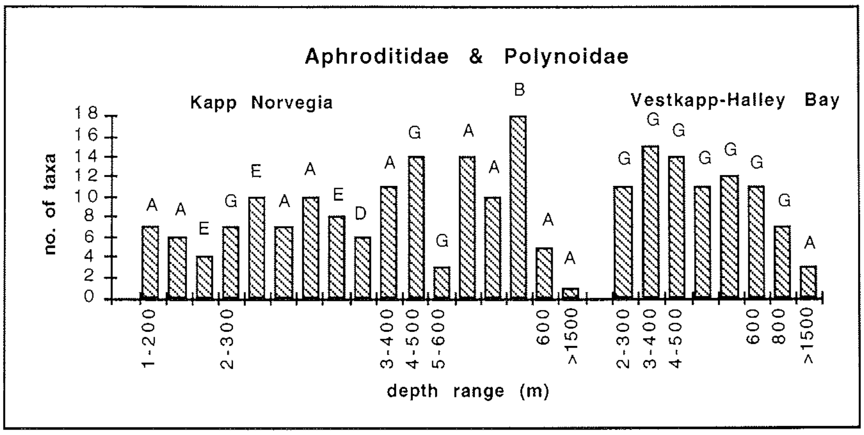


Fig. 19: Distribution of the number of taxa of Aphroditidae and Polynoidae according to depth ranges and geographic area. Letters above the columns represent various sampling gears: A= AGT; E= EBS; G= GSN; D= Rauschert's dredge; B= BPN.

Autecological observations

Some autecological observations on a few of the most abundant or peculiar species can be made at this preliminary stage of the study.

Laetmonice producta, collected mainly with GSN and BPN, represented the most abundant species, and the specimens found were spread over a large size range from 2.5 to 19 cm length. A first analysis of the length-frequency distribution in some of the samples where the species was more abundant showed that, while in some stations the population was quite well structured (Fig. 20a, stn. 39/001, 39/013), in other samples there was an excess of the small or óf the large length classes (Fig. 20b). The station dominated by small specimens was located at 850 m depth (39/014), while that with very large animals was at around 440 m (39/015). This pattern suggests that there may be a zonation of sizes along depth, and that in deeper areas the small, likely younger specimens are favoured. Finally, it is worth mentioning that in many large specimens of this species an unknown flat worm-like endoparasite was found.

Tab. 19: Other Errantia and Sedentaria polychaete families.

	approx. No. of taxa	Frequency (No. of stations)
Errantia		
Euphrosinidae	1	1
Phyllodocidae	3	14
Hesionidae	2	8
Syllidae	2	15
Nereididae	1-2	5
Glyceridae	1	5
Nephtyidae	2	14
Eunicidae	1	2
Lumbrineridae	1-2	5
Sedentaria		
Orbiniidae	1-2	4
FlabelligeridaeE	2	4
Capitellidae	1	1
Ophelidae	3	4
Chaetopteridae	1	2
Maldanidae	3-4	15
Ampharetidae	1-2	8
Terebellidae	3-4	21
Sabellidae	4-5	13
Serpulidae	1	3

Polyeunoa laevis was previously reported to live often associated with various gorgonarians (Hartman, 1964, 1974). The analysis on board revealed that 59% of the specimens collected lived in associations with various colonial hosts, and that most of the animals found occurring free in the samples probably left their host due to the stress during sampling. The size-frequency distribution of both symbiont and free specimens (Fig. 21) showed quite a similar pattern with only one modal class.

However, all very small specimens were mainly found as symbionts, whereas many of the largest ones were free animals. The analysis of the cnidarian hosts where *P. laevis* was found in various samples, revealed the occurrence of worms in 7 different colonial species, or morphotypes (Fig. 22). Colonies of types 2 and 3 probably belong to different species of gorgonarians of the genus *Primnoisis*, types 4, 6 and 7 are very close to the genus *Thouarella*, but with different polyp and colony morphologies, whereas type 5 is very close to the genus *Dasystenella*. One specimen of *P. laevis* was found also in a pennatulacean colony. Finally, a slightly positive relationship was observed between worm size (length) and the length of the colonial hosts (Fig. 23).

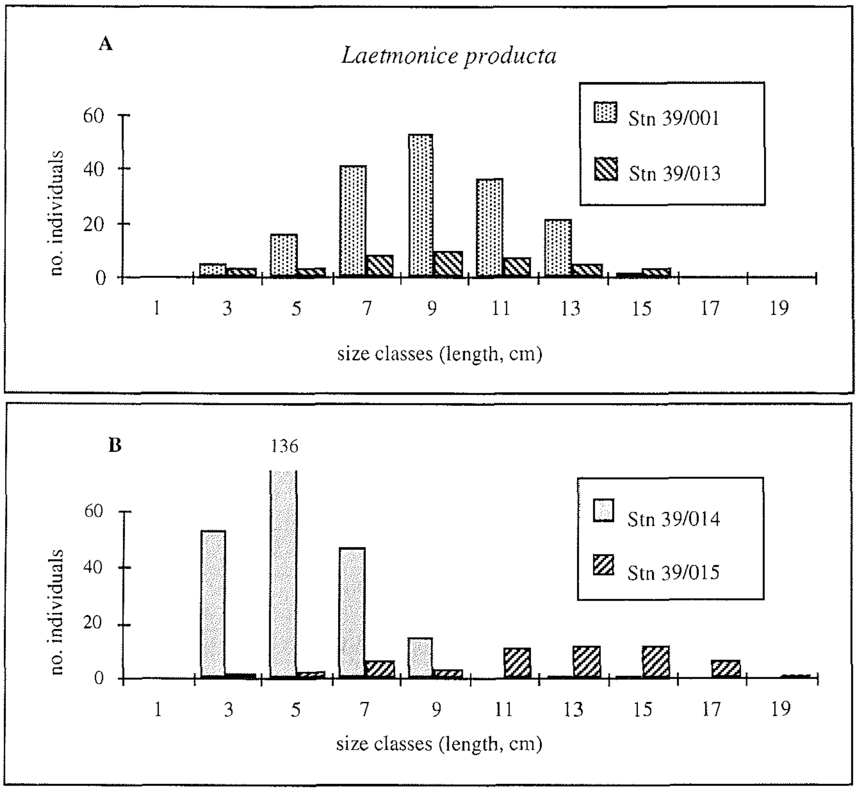


Fig. 20a-b: Length-frequency distribution of the aphroditid *Laetmonice producta* in various stations sampled with the GSN.
Numbers of specimens at Stn 001: 176, 013: 41, 014: 253, 015: 59.

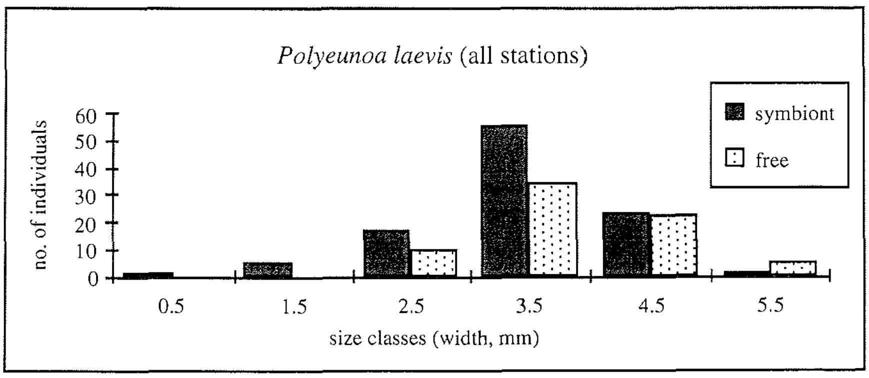


Fig. 21: Width-frequency distribution of both symbiont and free specimens of the polynoid *Polyeunoa laevis* found in various stations. Total number: 173

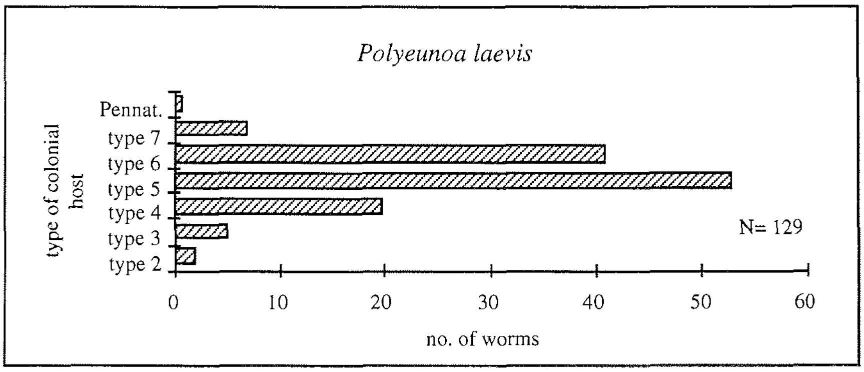


Fig. 22: Abundance of *Polyeunoa laevis* (N = 129) in the various cnidarian colonial host types. Types 2 and 3: close to *Primnoisis*; types 4, 6 and 7 close to the genus *Thouarella*; type 5 close to *Dasystenella*; Pennat.=pennatulacean.

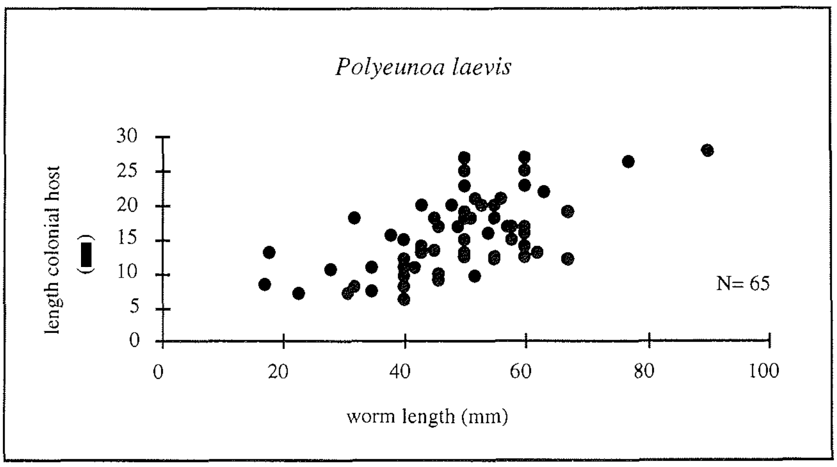


Fig.23: Relationship between worm size (length) and the length of the cnidarian colonial host in *Polyeunoa laevis*.

Eulagisca gigantea was found mainly in the bottom trawl and was the species that reached the largest dimensions, with some individuals up to 23 cm in length. However, also quite small individuals were found (2-3 cm), and this will allow a better evaluation of the size-age relationships. This species was found very often with ectoparasitic copepods on the parapodia, whereas the largest specimens quite often contained a giant endoparasitic nematode.

As regards scaleworm associations with other organisms, except for *P. laevis* and the gorgonians, other symbiotic relationships were very difficult to detect using trawl samples where animals are mixed together at random. However, a few observations can be made for an *Hermadion*-type polynoid that was found quite often inside sponges of the genus *Rossella*, and for *Eunoe opalina* two specimens of which were observed on the ventral groves of the large asteroid *Leptychaster magnificus* (Koeler).

As regards the reproductive features, some specimens of *Harmothoe* sp. b and of the *Hermadion*-type polynoid were observed to bear mature eggs on their backs, under the elitres. The eggs were included in a thin membrane and had the shape of flat cilindrical, rope-like lines located on both sides of the worm. Mean egg diameter for both species was 150 microns. This fact is quite interesting because no polynoids have been reported to brood eggs in Antarctica. However, egg dimension and the fact that the elitres are very delicate organs, suggest that the external brooding of the eggs is short and that the eggs probably hatch pelagic planctotrophic larvae.

Acknowledgements

I would like to thank all colleagues on board for their kind help in the collection of polychaetes. I whish to thank in particular C. Orejas and V. Alvà for collaboration in checking the polychaetes hosted in the gorgonarians and for the preliminary classification of the host colonies. Thanks are also due to M. Rauschert who provided nice photographs of many species of scaleworms and other polychaetes.

References

Britaiev, T.A., 1991. Life cycle of the symbiotic scaleworm *Arctonoe vittata* (Polychaeta: Polynoidae). Ophelia, Suppl. 5: 305-312.

Castelli, A., 1992. Primi dati sulla distribuzione batimetrica dei Policheti erranti della baia Terra Nova (Mare di Ross, Antartide). Oebalia, vol. 17, Suppl. 2: 331-333.

Gambi, M.C., M. Lorenti, G.F.Russo & M.B. Scipione, 1994. Benthic associations of the shallow hard bottoms off Terra Nova Bay (Ross Sea): zonation, biomass and population structure. Antarctic Science, 6(4): 449-462.

Gambi, M.C. & Castelli A., 1994. First quantitative data on coastal soft bottom populations off Terra Nova Bay (Ross Sea, Antarctica): Polychaetes. National Scientific Committee Antarctic Oceanographic Campaign 1989-90, Data Report (1994) II: 179-186.

Gambi, M.C., Castelli A. & M. Guizzardi, in press. Polychaete populations of the shallow soft bottoms off Terra Nova Bay (Ross Sea, Antarctica): distribution, diversity and biomass. Polar Biology (1996).

Hartman, O., 1964. Polychaeta Errantia of Antarctica. Antarctic Research Series, vol. 3: 11-43.

Hartman, O., 1974. Polychaeta from the Weddell Sea quadrant, Antarctica. Biology of the Antarctic Seas VI (Antarctic Research Series vol. 26): 125-137.

Stiller, M., 1995. Untersuchungen zur Verbreitung und Lebensweise der Aphroditiden und Polynoiden (Polychaeta) im östlichen Weddellmeer (Antarktis). Ber. Polarforsch.155: 81-82.

2.4.7 Genetic Isolation of Benthic Isopoda (Crustacea) and Speciation Mechanisms in the Southern Ocean (C. Held)

Objectives

Previous work has revealed a high degree of morphological variability among populations of Antarctic isopods (BRANDT 1988; WÄGELE 1986, 1991). Although epigenetic effects (e.g. influence of water temperature) may enhance the observed differences in morphology, the relatively low mobility of isopods due to the lack of planktonic stages in ontogenesis makes a true genetic differentiation of local populations most likely.

Since preservation in formaldehyde degrades the primary structure of the DNA molecule, most collections from the past cannot be used to investigate variability on genetic level. Our main purpose during this cruise was therefore to build up a collection of suitably preserved isopod material for later studies of genetic variability within and among species of Antarctic isopods. The genetic polymorphisms within species will be compared with known morphological polymorphisms and correlated with possible dispersal barriers.

In addition to that, respiration measurement on *Glyptonotus antarcticus* was desirable. Despite the fact that this is one of the most conspicuous Antarctic isopods, only two, grossly different, measurements of its oxygen consumption have been published until now (BELMAN 1975, WHITE 1975).

Work at sea
Isopods were collected from 26 successful trawl catches (AGT, GSN, D, EBS, BPN) and 5 baited traps. Living isopods were sorted out by hand from the catch and temporarily kept alive in temperature controlled aquaria. Freshly dead material was obtained by sieving. Colour photographs of living specimens were taken to allow comparison of colour patterns between populations, then the material was fixed for later DNA studies. Different fixation methods were carried out in order to prevent digestion of DNA by the highly active DNAse of marine isopods (unpublished result).
DNA was extracted on board from 48 specimens belonging to 9 different species, the rest of the collected material was sent home for further analysis. DNA sequencing will be done in the home laboratory.
The respiration measurement was carried out in an intermittent flow respirometer at 1.2°C (in collaboration with the ecophysiology group). The specimen was transferred from appr. 0°C to 1.2°C and measured after an overnight acclimatization period.

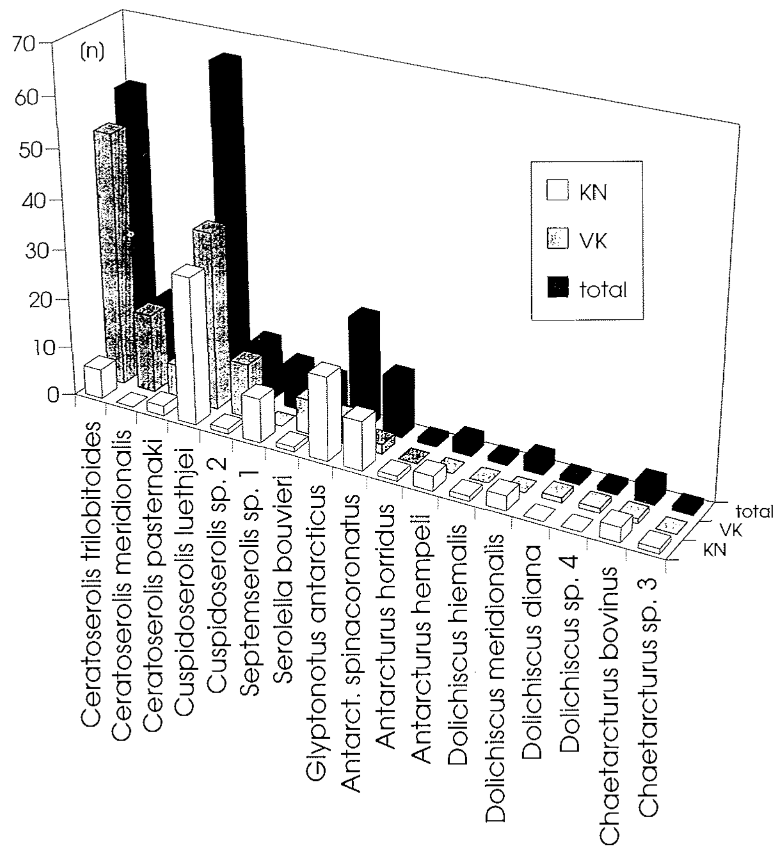


Fig. 24: Abundance of selected isopods during ANT XIII/3 (Serolidae, Chaetiliidae, Arcturidae).

Preliminary results

Since DNA cannot be sequenced on board, only results concerning the morphology of *Ceratoserolis trilobitoides* and oxygen consumption of *Glyptonotus* can be presented.
The sampling of isopods concentrated on the families *Serolidae*, *Chaetiliidae*, *Arcturidae, Aegidae* and *Cirolanidae*. In total 7 serolid species, 1 chaetiliid (*Glyptonotus*), 8 arcturid species and an unidentified number of species from the latter two families have been found (Fig. 24; provisional numbers). Isopods were exceptionally scarce during this cruise. Material from the next leg (ANT XIII/4), however, will complement the collection and add specimens from populations from the Antarctic Peninsula.

The morphological variation in pleotelsonic spine numbers of *C. trilobitoides* did not differ significantly between Kapp Norvegia (KN) and the Vestkapp (VK) area (Fig. 25, filled squares and circles). In comparison to the whole range of variation that occurs in the species, the within population variability is rather small.
The number of mediodorsal spines appears to be lower than in the closest area that has been sampled during the EPOS cruise. This may reflect a change over time, but more likely the sampling sites differed sufficiently between the EPOS and EASIZ cruises to catch slightly different populations.
DNA-sequencing will reveal the degree of molecular variability within and among the different morphotypes of *Ceratoserolis trilobitoides*.

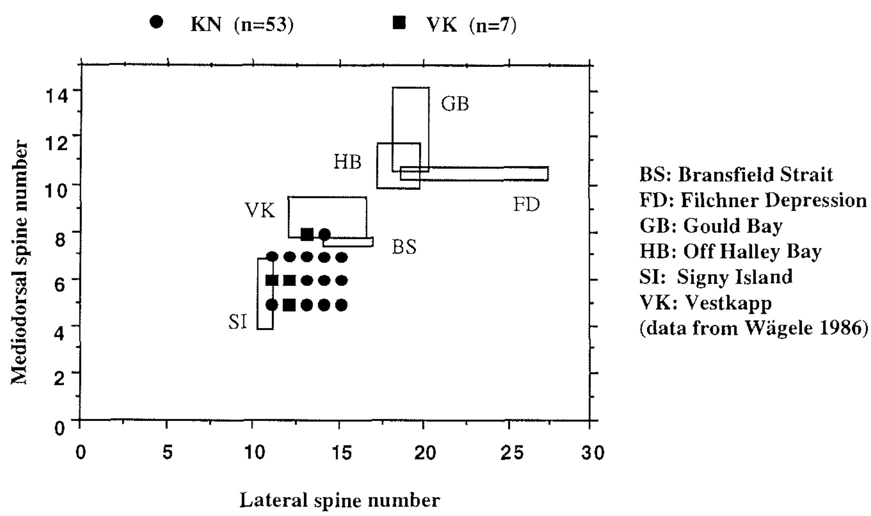


Fig. 25: Variation of pleotelsonic spine numbers among populations of *Ceratoserolis trilobitoides*.

Oxygen consumption of *Glyptonotus antarcticus:* It is obvious that the only published data on oxygen consumption of the Antarctic isopod *Glyptonotus* differ more than should be expected with regard to measurement errors (Table 20). The most plausible explanation of this would be an elevated metabolic rate of the experimental animal due to handling stress and lack of acclimatization time to environment and water temperature. WHITE (1975) describes an elaborate experimental design intending to minimize this source of error, whereas BELMAN (1975) does not mention such precautions and uses a magnetic stirrer inside the respiration chamber.

Even though some data are not directly comparable, the lower values of oxygen consumption appear to be more reliable, because larger body sizes and lower temperatures should decrease the amount of oxygen consumed.
Although the single measurement carried out during this cruise cannot fully solve the problem, it may be taken as a first hint that the data presented by BELMAN (1975) are probably overestimated.

Tab. 20: Oxygen consumption of *Glyptonotus antarcticus*.

Reference	wet weight	water temp.	oxygen consumption
Belman 1975	25-30g	-1.8°C	216 µl O_2/g/h
White 1975	10-30g	-1.5°C	25.2 µl O_2/g/h
White 1975	3-10g	0.5°C	37.4 µl O_2/g/h
this work	3.3g	1.2°C	128 µl O_2/g/h

Acknowledgements:
I would like to thank P. v. Dijk for his support in measuring the oxygen consumption and C. de Broyer, G. Chapelle and M. Rauschert for sharing the isopod catch of their baited traps and dredge with me.

References:

Belman, B.W., 1975. Oxygen consumption and ventilation of the Antarctic isopod *Glyptonotus*. Comp. Biochem. Physiol. *50A: 149-151*

Brandt, A., 1988. Antarctic Serolidae and Cirolanidae (Crustacea: Isopoda). In: Fricke, R. (ed.), Theses Zoologicae, Vol. 10, Koenigstein, Koeltz Scientific Books: 143 pp.

Wägele, J.W., 1986. Polymorphism and distribution of *Ceratoserolis trilobitoides* (Eights, 1833) (Crustacea, Isopoda) in the Weddell Sea and synonymy with *C. cornuta* (Studer, 1879). *Polar Biol. 6: 127-137*

Wägele, J.W., 1991. Antarctic Isopoda Valvifera. *In: Fricke, R. (ed.), Theses Zoologicae, Vol. 14, Koenigstein Koeltz Scientific Books: 206 pp.*

White, M.G., 1975. Oxygen consumption and nitrogen excretion by the giant Antarctic isopod *Glyptonotus antarcticus* Eights in relation to cold-adapted metabolism in marine polar poikilotherms. In: Barnes, H. (ed.), Proc. 9th Eur. mar. biol. Symp., Aberdeen Univ. Press: 707-724.

2.4.8. Trophodynamics, Biodiversity and Gigantism of the Amphipod Crustacea Taxocoenosis (C. De Broyer, M. Rauschert, G. Chapelle)

Objectives

a) Trophodynamics

To characterize and quantify the trophodynamic role of the amphipod taxocoenosis in Kapp Norvegia, eastern Weddell Sea, and compare it with the Admiralty Bay system, King George Island.

The particular topics to investigate are: diet composition, food consumption and assimilation efficiency, characterization and functional role of the amphipod trophic guilds, significance of amphipods as preys for other macrobenthos and demersal fish.

b) Biodiversity

To further document the structural and ecofunctional biodiversity: taxonomy, geographical and bathymetric distribution, habitats and microhabitats, and ecological traits of the eastern Weddell Sea amphipod fauna (and other selected peracarid Crustacea and Leptostraca).

One particular topic is a zoogeographical comparison between the Weddell Sea, the South Shetland Islands and the Magellan gammaridean amphipods and benthic leptostracan faunas, with a special attention to the family Stenothoidae.
This biodiversity approach takes place in the framework of the preparation of the "Synopses of Antarctic Amphipods" (De Broyer, Andres, Bellan-Santini, Coleman, Jazdzewski, Rauschert, Takeuchi, Vader, Wakabara in prep.), of the monograph of the "South Shetlands Amphipod Fauna" (Rauschert in prep.) and the development at IRSNB, Brussels, of the first "EASIZ-SA 2000 Antarctic Biodiversity Research Reference Center" focussing on Amphipoda.

c) Gigantism

To characterize the life history, growth and ecological traits of the largest Antarctic amphipod species in order to compare them with the giant Baikal gammarids.
Focus will be put on life history traits such as fecundity, size of eggs and frequency of reproduction, and on the other hand, live specimens of 2 species will be selected for long term studies of growth.

Work at sea

Gammaridean amphipods and, in addition, Mysidacea, Cumacea, Leptostraca and Pycnogonida were collected from 48 GSN, AGT, D, BPN and EBS catches, from baited traps, and from the GKG and MG corers samples. Systematic sampling by baited traps was performed for the first time in the Weddell Sea at depths between 219m and 2009m (6 operations).
Samples for life history, growth and fecundity studies, for stomach contents analysis as well as data on amphipod predators were systematically collected .
Live specimens of 33 species were kept in aquaria in cool containers for ethological observations and feeding experiments on board and for further feeding, ethological and growth studies in the cool laboratory at IRSNB, Brussels.
Sorting material from traps and trawl samples to at least the family level was performed on board, taking advantage of the natural colours of live or freshly preserved material.

Preliminary results

a) Trophodynamics

To identify the trophic type of at least the most common species, stomach content samples were taken and in a few cases analysed on board. In addition, observations on feeding behaviour were made in aquaria on predators or potential predators (*Eusirus* spp., *Epimeria* spp., *Epimeriella* spp., *Rhachotropis* sp, *Paraceradocus* sp.) and on "predatory grazers" (*Iphimediella* spp., *Maxilliphimedia* sp., and *Gnathiphimedia* spp.), allowing to compare the different modes of detection and prehension of the food items.
The trap results indicated 29 spp. to be regular scavengers. On the other hand, the very low occurrence in trawl catches of presumed filter feeders (corophiids, ischyrocerids...) was noticed and contrasts with the abundance and diversity of presumed specialists (iphimediids).
Six quantitative feeding experiments using calibrated lyophilized squid as food were performed for 7 days on 4 scavenger species (*Abyssorchomene nodimanus, Parschisturella carinata, Tryphosella murrayi, Waldeckia obesa*) showing an important peak of the feeding rate in the first 24h after starvation, followed by a much lower rate during the rest of the week. Systematic observations were also made of general behavioural traits (attitude, swimming, burrowing and other locomotory activity,...)

b) Biodiversity

More than 12 000 specimens of at least 122 spp. of gammaridean amphipods have been sorted, as well as 2 species of Caprellidea and 3 species of Hyperiidea. 11 species (2 Cyproideidae, 1 Eusiridae, 4 Lysianassoidea, 1 Oedicerotidae, 3 Stenothoidae) are presumably new to science. In addition, new material completing existing samples of poorly known species will provide comparative material for variability studies and detection of possible new taxa. Selected species samples have been preserved for DNA analysis. Dredge samples (22 successful dredgings) allowed to collect a good number of small amphipods and other peracarids usually in good condition, and this very usefully supplemented the larger mesh-sized Agassiz trawl catches.

The faunal composition of the 22 dredge catches was so diverse that an analysis can only be provided later; a preliminary list of amphipod species is given in Annex 3.4. The following families (groups) were found: Acanthonotozomellidae, Ampeliscidae, Colomastigidae, Cyproideidae, Eusiridae, Gammarida (*Ceradocus* group), Iphimediidae, Ischyroceridae, Liljeborgiidae, Lysianassoidea, Melphidippidae, Oedicerotidae, Phoxocephalidae, Podoceridae, Stegocephalidae, Stenothoidae, Synopiidae, Urothoidae, Caprellidea, Hyperidea.
As previously observed (De Broyer & Klages1991), the lysianassoid component of the fauna (with 37 spp) is clearly dominant, followed by Iphimediidae (14 spp) and Eusiridae s.l. (14 spp.). The Epimeriidae (with 10 spp) take the fourth rank in the faunal composition. The family Stenothoidae, so far often overlooked by previous expeditions, possibly because of their small size, was discovered in most of the samples. At least 3 species of stenothoids seem to be new to science, and one of them, found in several samples, differs from the Stenothoidae normal habitus. One commensal stenothoid was found living in the ascidian *Molgula* sp., mainly at depths around 200m. Stenothoids were found in the same host at depths of 400m as well, but lysianassoids and stegocephalids were more common there. The family Cyproideidae was detected for the first time in Antarctic waters, represented by 2 species which are probably new to science.
Two species of Leptostraca were found in some dredge samples and were caught for the first time, to our knowledge, in baited traps.
Baited trap samples (Table 21) provided 30 different amphipod species (28 lysianassoids, 1 eusirid, 1 iphimediid) represented by more than 10 000 specimens in good condition. Among them, 15 species were not collected by other gears. These samples, along with trawl and some corer samples, will complete the already existing distributional data. Differences in bathymetric occurrence of different stages of several species have been noted for the first time. The deepest trap operation (2009m) provided 8 different species, mostly of abyssal affinities, among which 7 were not found in shallower operations. Four specimens (up to 12cm long) of the giant abyssal species *Eurythenes gryllus* were collected for the first time in the East Antarctic.

On the other hand, the extension to the East Antarctic (or at least to the eastern Weddell Sea) of several species so far known only from the West Antarctic, has been noted. For example, the stenothoid species *Antatelson walkeri*, a well known and very common species in the West Antarctic was detected for the first time in the East Antarctic.
The natural habitats (in sponges, in the sediment,...) have been identified for few species e.g. by means of observation of undisturbed box corer samples and experiments in aquaria, but the precise identification of the microhabitats remains problematical for most specialists (iphimediids for instance), with the investigation gears used during this cruise.
c) Selection and maintenance of live specimens for long-term studies
About 3400 specimens of 33 species have been kept alive onboard in aquaria using a permanently running open seawater system. This allowed feeding experiments and observations, and general behaviour observations on board. Samples of 21 species have been selected for long-term studies of life history and growth, and to continue feeding biology studies in the cool laboratory of IRSNB, Brussels, after transportation by air.
d) Gigantism
Paraceradocus sp and *Epimeria similis* have been selected as the 2 principal species for growth studies. Some other epimeriid and lysianassoid species will also be included in these investigations. In addition, ovigerous females of the most common species have been systematically isolated and preserved to allow the characterization of reproductive traits in "giant" species.
e) Photographic inventory of the macrobenthic species
More than 1000 colour photographs of live specimens of zoobenthos (320 species of 36 taxonomic groups) have been systematically taken to record natural colours and attitudes.

In addition, about 500 pictures of more than 70 species of amphipods were taken in aquaria to show natural attitudes and colours, including cases of polychromatism.

Tab. 21: Results of trap operations.

Station	Location	Depth	Hours on bottom	AMPH	ISOP	MYSI	LEPT	DIVERS
				spp (ind)	spp (ind)	spp (ind)	spp (ind)	spp (ind)
05/T1	KN	223m	23h	13 (548)	1 (1)	1 (9)	-	ostr 1 (123)
06/T2	KN	234m	74h	15 (>2,614)	1 (28)	-	1 (1)	-
28/T5	KN	219m	74h	11 (2,838)	1 (5)	1 (2)	1 (4)	deca 1 (1)
04/T4	KN	421m	132h	10 (2,923)	1 (10)	1 (2)	1 (1)	ostr 1 (2)
12/T3	VK	791m	65h	13 (769)	1 (1)	-	2 (17)	ostr 1 (4) cope 1(1) fish 1 (1)
30/T6	KN	2009m	86h	8 (818)	-	-	-	gast 1 (1) cope 2 (2)
TOTAL				30 (>10,510)	2 (45)	1 (13)	2 (23)	

Amph: Amphipoda, Isop: Isopoda, Mysi: Mysidacea, Lept: Leptostraca, Ostr: Ostracoda, Deca: Decapoda (*Chorismus antarcticus*), Cope: Copepoda, Gast: Gastropoda, Fish: Zoarcidae.

2.5 Nekton: Cephalopods

2.5.1 Cephalopod Ecology and Physiology

(S. Steimer, L. Allcock, H. Palm)

The cephalopods of the samples taken in the Weddell Sea were divided between the working groups of the University of Liverpool, working on octopus, and the Institute of Marine Research, Kiel, working on squid.

Objectives

Cephalopods play an important role in the high Antarctic ecosystem. It is known from stomach content investigations that many top predators such as whales, seals, penguins and other sea birds prey mainly on cephalopods. However, in contrast to the important role of cephalopods in the food chain, the research in this field of interest is still in the elementary stages. For example, distribution patterns and life cycles of high Antarctic squids as well as their feeding ecology are still unknown. In Antarctic octopods, even the taxonomic status of several groups is unclear. Therefore, on the EASIZ cruise, a combination of basic research in both squid and octopod ecology was undertaken.

The focal point of the study on squids was to get more detailed information on the life cycle and distribution of the most abundant species in the eastern Weddell Sea. To achieve this aim it was necessary to take statoliths for age determination. Another field of interest was the functional morphology of squid tentacles and arms.

The aim of the research on octopods was to elucidate the taxonomic status of the most abundant species using traditional taxonomic methods in conjunction with a biochemical technique, namely allozyme electrophoresis. A secondary objective was to provide data on the distribution and depth zonation of the different octopod species.

Work on board

Squid

The majority of the specimens caught were taken by bottom trawl; only the paralarvae and 2 *Psychroteuthis glacialis* were caught by benthopelagic trawl. The jigging machine was used at night at several localities in the Kapp Norvegia region and north of Halley Bay. It worked properly but without success. A possible reason for this failure could be a reduced attractive effect of the chosen light source to the squids due to the very bright nights in the high Antarctic. A second possibility could be that the species known from this area do not undertake diel vertical migrations. Unfortunately, because of the unfavourable ice situation and the weather conditions, it was not possible to use the jigging machine as often as necessary to get a good estimation of its efficiency and usefulness in Antarctic waters.

The animals were examined and standard morphometric measurements were taken. Some of them were frozen and will be stored in Kiel and kept as a reference collection. Statoliths were taken from each squid directly after the catch and will be prepared at the University of Kiel for ageing. In combination with the maturation and length data the age estimate will give us a better idea of the life span and cycle of the species. To get an idea of the role of squid in the Antarctic food web all stomachs were taken and stomach contents will be examined in Kiel as well. Samples of arm tips and tentacular clubs of *Psychroteuthis glacialis* were taken und preserved for the subsequent SEM photography of the suckers. The extracted beaks will also be preserved, measured and stored after the cruise.

Octopods
The bottom trawl was the most effective gear for catching octopods. However, one benthopelagic trawl that was fished right on the bottom yielded nearly 20% of all specimens captured. The Agassiz trawl regularly yielded small numbers of octopods. The epibenthic sled also yielded a single specimen whilst the multibox corer yielded two. The majority of the animals in the catch were still alive and they were maintained in aquaria. Selected specimens were photographed whilst still alive to document the natural coloration patterns which are usually lost upon preservation. Samples of mantle tissue were taken from freshly killed animals and frozen immediately at -30°C for subsequent biochemical analyses. Standard morphometric measurements were recorded and beaks were extracted. The best specimens were frozen and will be preserved as a reference collection.

Preliminary results
Squids
Altogether 144 specimens of probably 3 squid species were collected during the cruise: *Psychroteuthis glacialis* (n=136), *Galiteuthis glacialis* (n=1) and 7 paralarvae which have not yet been finally identified, but it seems that they belong to the species *Galiteuthis glacialis* as well.

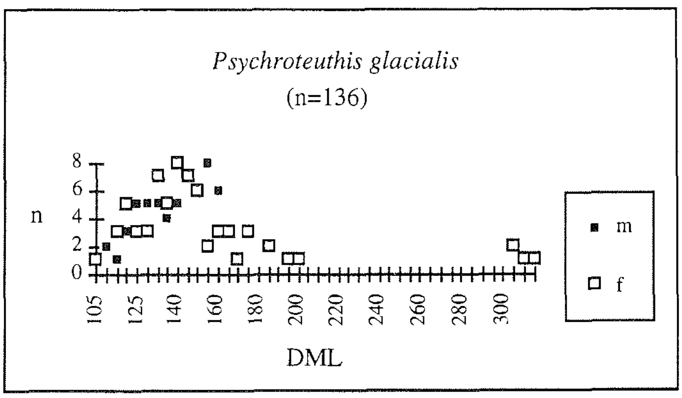


Fig.26: Length-frequency distribution of *Psychroteuthis glacialis,* m=males, f=females.

Except for 4 fully mature females most of the specimens were still in the process of maturation. The dorsal mantle length (DML) of the animals collected varied from 120 to 360 mm (Fig.26). Nearly all of them were caught north of Halley Bay at depths between 340 and 600 m.
It is only the second time that this amount of *Psychroteuthis glacialis* was caught in the Weddell Sea. It has to be mentioned that the EPOS cruise in 1989 on which they were previously caught in high numbers, took place at the same time of the year and at nearly the same places as this cruise. This leads to the conclusion that there might be a population of *Psychroteuthis glacialis* appearing periodically in the area of Halley Bay.

Octopods
A total of 446 specimens comprising 12 species were captured. Of these, just three species could be clearly identified using existing descriptions and identification sheets. Dorsal mantle lengths of the specimens varied between 11 and 145 mm. Although abundance decreased with depth, octopus were caught at nearly all stations. This suggests that this group is widespread and plays an important role in the high Antarctic ecosystem. Preliminary analyses suggest that there is no marked difference in species composition between Kapp Norvegia and Halley Bay.

2.5.2 Ecological Physiology of Antarctic Cephalopods (S. Zielinski)

Objectives
We intended to elaborate the physiology of Antarctic cephalopods under conditions of low temperature, which may lead to specific adjustments in the relationship between the use of aerobic and anaerobic resources. Therefore, activities of key enzymes of aerobic and anaerobic metabolism were to be measured in various tissues. In addition, the temperature dependence of their kinetic properties was to be investigated. Since allometric relationships may interfere, different life stages and sizes should be compared.
In order to evaluate the coordination of acid-base regulation and energy metabolism at low temperature tissue samples were to be taken from animals incubated at different temperatures.

Work at Sea
Living specimens of the octopod species *Pareledone charcoti* and *Pareledone polymorpha* were collected from GSN, BPN and AGT and maintained in aquaria at 0°C. The activities of three enzymes - octopine-dehydrogenase (ODH), malatedehydrogenase (MDH) and argininekinase (AK) were measured in fresh material of both species and in some living squid (*Psychroteuthis glacialis*) at 0°C. All investigations were made in tissues from mantle muscle, gills, and arms.
Furthermore, specimens of *P.charcoti* were incubated at 3°C. Temperature increased over a period of seven to eight hours. After 12 and 24 hours enzyme activities were measured at 3°C. From all animals additional tissue was frozen for further enzyme studies and for measurements of intracellular pH and metabolites of energy metabolism.

Preliminary results
An accidental increase in temperature up to 5 to 6°C due to a failure of the cool container led to the death of about 2/3 of the octopods.
Comparison of enzyme activities in the three different tissues showed, that with the exception of the ODH activity in the gills of *P.glacialis*, ODH and AK activity is always lowest in the gills. This is to be expected since ODH and AK are involved directly in energy supply during movement. The arms and mantle clearly have a far more important role to play in this function than the gills.
An interspecies comparison showed that in the mantle of the squid *P.glacialis* all three enzymes showed the highest activity. Squid are pelagic in nature and they use jet propulsion to maintain their position in the water column. Octopods, however, are truly benthic and their normal locomotory behaviour involves only slow crawling. Whilst jet propulsion is possible for

octopods it is used only as an escape response and thus under normal environmental conditions their energy requirements should be less.

Incubation of *P.charcoti* at 3°C only led to an increased AK activity in the arms after 24 hours, in all other cases enzyme activity did not change significantly. It is therefore apparent that this species exhibits a degree of tolerance to elevated temperatures, at least over short periods of time. However, this clearly needs further investigation, for example by incubation at a range of temperatures over longer periods of time.

2.6 Nekton: Fish and Fish Parasites

2.6.1 Weddell Sea Fish Ecology (E. Balguerías, B. Morales-Nin)

Introduction

In the Antarctic Ocean, an association of closely related fishes comprises a unique fauna which has been evolving in an area of the world where most other fishes have been excluded. This fauna has been confined to the Antarctic for a very long time, and may have descended from elements present during the breakup of Gondwanaland that have persisted against the cold, adapting and evolving ever since. The Notothenioidei are the main component of this fish fauna, representing 52% or more of the fish species known from within the Antarctic Convergence. More than 90% of notothenioid species and 85% of notothenioid genera are endemic to these waters (Andriashev, 1965).
The Weddell fish fauna has been studied in the last decade, inter al., by Hubold (1984, 1992), Ekau (1988, 1990), Kock et al. (1990), Schwarzbach (1988), Hureau et al. (1990) and Wöhrmann & Zimmermann (1992). However, the knowledge of the fish assemblages and their spatial and temporal distributions is still incomplete. The ecology of most of the species is also poorly known. Trophic interrelations, growth rates, age structure, maturity and mortality data of Antarctic fish populations are generally fragmentary, due to sampling limitations and to methodological problems.

Objectives

As a continuation of the above cited studies and in order to contribute to the current knowledge of the Antarctic fish fauna, in the framework of the EASIZ programme, the following specific objectives were focussed on:

- General faunistic studies of the ichthyofauna including taxonomy, biogeography, mesoscale distribution of the species, typification of the fish assemblages, and comparison with those of other areas along the continent;
- Determination of some biological and population characteristics, such as age composition, growth and reproduction, of the most important species;
- Studies on diet composition, feeding activity and trophic interrelations of the most important species;
- Preservation of fish specimens for phylogenetic studies and for reference collections. A data base of otolith images will be implemented for phylogenetic studies and to identify fish remains in gut contents.

Work at sea

Sampling

Three different fishing gears were deployed for the collection of demersal and pelagic fish, in order to investigate the bottom and midwater layers in the Kapp Norvegia and Halley Bay areas:

- Agassiz Trawl (AGT)

An AGT with 10 mm mesh in the cod-end and a mouth opening of 3 by 1 m, was towed with a speed of around 1 knot for 5 to 32 min. Thirteen hauls were made between 170 m and 2334 m depth. Two hauls were made between Vestkapp and Halley Bay, and the remainder in the Kapp

Norvegia area. Catches were only analysed qualitatively for fish composition and biological sampling.

- Bottom Trawl (GSN)

The net was a commercial-scale 47 m headline bottom trawl with an effective mouth opening of 22.5 by 3 m. The mesh size at the cod-end was 20 mm. The net was used ten times on bottom depths between 227 m and 889 m. The hauling times varied between 14 and 26 min at 3 knots. Three hauls were made in the Kapp Norvegia area and six in the Halley Bay area. Catches from this net were analysed both quantitatively and qualitatively for species composition, abundance estimates and distribution, biological sampling and length-frequency distributions.

- Semi-pelagic trawl (BPN)

The net was a commercial-scale 1088 meshes sized semi-pelagic trawl with a 12 mm liner in the cod-end. The mouth opening was about 18 by 18 m. The net was towed at 3.5-5 knots for 31 to 43 min. Three hauls were made at Drescher Inlet, one inside and two in the outer part, and one at Kapp Norvegia. The first two hauls were carried out at the pycnocline level and the two last ones from close to the bottom to the surface. The fishing depth was not completely controlled in the last tows due to technical problems of the net sounder cable. Catches were analysed qualitatively and for biological sampling.

Accidentally some few larvae and juvenile fish analysed for qualitative purposes were caught during the Rauschert Dredge (D) operations.

Processing

Once the catch was on the deck, the live fishes were inmediately transferred into buckets with cold sea water for physiological studies. Also specimens were provided for parasitological studies (see contributions by Palm and Zdzitowiecki). Dead fish were taken to the fish laboratory, where species were identified according to the FAO identification sheets (Fischer & Hureau, 1985) and to Gon & Heemstra (1990). The total number and weight of each species was determined. Three different procedures were followed depending on the sample. The small fish, such as the Artedidraconidae, were measured to determine their length frequency and were frozen for their complete analysis in the laboratory. Abundant species of greater sizes were analyzed onboard and around five individuals were selected for each 0.5 cm length interval for biological sampling. Less abundant species were completely sampled. Fish for biological sampling were measured to the nearest inferior mm, weighed with a precision of 5 g, and sexed. Maturity stage was determined according to a 5-stage scale (Kock & Kellermann, 1991). Stomach fullness was determined according to a 5-stage scale: 1=empty, 2=partially full, 3=half full, 4= full, 5=evaginated. Gonads and stomachs were collected and preserved frozen or in buffered formalin. Sagittal otoliths and scales (when present) were extracted and dry preserved for future studies.

All Liparididae, Bathylagidae, Muraenolepididae and Zoarcidae individuals in the catches, as well as samples of several other species, were preserved in formalin (4% in sea water) for taxonomical studies.

More than 400 fish larvae and juveniles were also collected, mainly in the BPN catches. They were preserved in buffered formalin for otolith extraction and gut content determination in the laboratory.

Preliminary results

The type of information gathered during the cruise almost only permits us to provide some faunistic results obtained from the very preliminary analyses that have been possible to conduct onboard. For the remaining topics a simple enumeration of the amount of material collected and the perspectives of the work to be done in the near future is given in the sections that follow.

Net efficiency

Concerning the comparison of the efficiency of the nets, the GSN provided the bigger catches both in weight and in number of species. The AGT catches were low in number and species richness, probably due to the hauling speed and net characteristics, which might allow fish to escape capture as well as to swim out of the net. The BPN showed a very different performance depending on the fishing depth relative to the bottom. When the net was hauled at mid water the catch was composed of fish larvae and juveniles. The larvae and juvenile identifications should be considered tentative, however, the most numerous species were recognisable. Members of the suborder Notothenioidei dominated the samples with four species of channichthyids and four species of nototheniids, *Pleuragramma antarcticum* being the most common. Due to problems with the cable of the net sounder, a haul was carried out close to and on the bottom (Station 39/029). This fish catch was very rich and diverse, comprising demersal as well as benthopelagic species. Also many larvae and juvenile fish were present in the capture.

Fish species composition and fish abundance
A total of 11,720 fish specimens, weighing 1069 kg have been identified and investigated (Tab. 22). With twelve families and 64 species the fish fauna is highly diverse. However, several species of Artedidraconidae, Liparididae, Bathylagidae and Zoarcidae were very difficult to identify on board. Thus, the number of species might increase after the doubtful ones are identified and revised in the future. The species richness was similar to that observed during the EPOS cruise (Hureau et al., 1990) and suggests that biodiversity in the high Antarctic is great.

The species composition by stations and gears as well as their respective occurrence indices (F), expressed in percentages of appearance in the total number of stations, are shown in Tab. 22. When more than one haul was carried out at the same station the data were pooled together. According to this index *Trematomus scotti* was the most ubiquitous fish, appearing in the majority of the catches. Other frequent species, enumerated by order of occurrence, were *Trematomus lephidorhinus*, *Chionodraco myersi*, *Cryodraco antarcticus* and *Dolloidraco longedorsalis*. In numbers, 65.55 % of the fish present in the catch belonged to the family Channichthyidae, represented by 11 species. Besides them Nototheniidae, with 31.32% and 14 species, were second in importance. The Artedidraconidae were the first in specific diversity contributing 18 species to the total catch; *Dolloidraco longedorsalis* was the dominant species in number. *Macrourus holotrachys* was the most abundant and frequent species not belonging to the Suborder Notothenioidei. *Pleuragramma antarcticum* dominated the BPN catches, both as larvae and as adults.
Fig. 25 shows the mean relative abundance (npue) of most of the species in the GSN catches expressed as the number of individuals caught in a standard hauling time of 15 minutes (ind/15 min). *Chionodraco myersi* with a npue close to 250 ind/15 min was the most abundant species in the whole cruise. It accounted for 23.56 % in number and for 49.31 % in weight of the total catch appearing in most of the stations. *Trematomus lepidorhinus* and *Trematomus scotti* reached npues around 20 ind/15 min and were also present in most of the hauls. Other species such as *Cryodraco antarcticus, Trematomus loennbergi, Chaenodraco wilsoni* and *Chionodraco hamatus* occurred in more than one third of the stations but in much lower numbers.

Fish distribution
Some technical difficulties mainly related to time constraints and ice conditions arose during the cruise making it impossible to follow the pre-established sampling scheme for faunistic studies that included the typification and distribution of fish assemblages in the area as well as the abundance estimates of the populations of the most important species. Because of these difficulties, it was only feasible to conduct three isolated hauls in the Kapp Norvegia area and a more or less depth stratified pseudo-transect north of Halley Bay without replicates.
Therefore the results provided in this section should be considered as very preliminary and inconclusive. Tab. 22 shows the list of species caught during the cruise and their presence (black boxes) in the different fishing operations sorted by ascending depth. In general terms the more characteristic families Artedidraconidae, Bathydraconidae, Channichthyidae and Nototheniidae were mainly present in the bathymetric range extending from the shallowest station (227 m) down to 600 m even though some species can reach deeper waters.

Tab. 22: Species composition by station and gear. Nt: number of fish caught, F: occurrence index.

Depth (m)	227	246	338	428	450	460	481	600	630	850	123	174	254	440	571	634	1700	2334	128	150	210	529			
NET	GSN										AGT								BPN						
SPECIES / STATION	5	16	11	15	12	17	1	9	13	14	24	2	6	4	9	25	18	30	20	21	22	29	Kg	Nt	F
ARTEDIDRACONIDAE																									
Artedidraco loennbergi	■	■	■	■	■	■	■															■	1.03	161	29.63
Artedidraco orianae		■	■	■	■	■																■	0.93	57	22.22
Artedidraco shackletoni	■	■				■																	0.15	7	11.11
Artedidraco skottsbergi	■	■			■			■			■	■	■										0.38	69	25.93
Artedidraco sp. 1	■																						0.13	8	3.70
Artedidraconidae larvae																■			■	■	■			17	14.81
Dolloidraco longedorsalis	■	■	■	■	■	■	■	■					■		■							■	7.46	689	40.74
Histiodraco velifer	■	■						■															0.91	13	11.11
Pogonophryne albipinna																	■						0.16	1	3.70
Pogonophryne barsukovi	■	■		■		■																	1.39	14	14.81
Pogonophryne lanceobarbata					■			■															0.25	9	7.41
Pogonophryne macropogon					■	■											■						0.76	4	11.11
Pogonophryne marmorata		■	■		■	■	■						■										1.31	53	22.22
Pogonophryne permitini		■	■				■															■	1.13	17	14.81
Pogonophryne phyllopogon?																						■	0.03	1	3.70
Pogonophryne scotti	■	■		■																			3.46	20	11.11
Pogonophryne sp. 1			■																				0.02	1	3.70
Pogonophryne ventrimaculata																						■	0.06	1	3.70
BATHYDRACONIDAE																									
Bathydraco macrolepis																	■					■	0.07	2	7.41
Bathydraco marri				■		■		■		■					■		■					■	0.89	84	25.93
Bathydraco sp.																		■					0.02	2	3.70
Bathydraconidae sp.																			■	■	■			4	11.11
Cygnodraco mawsoni	■			■																			0.19	8	7.41
Gerlachea australis		■	■	■			■	■							■							■	4.43	124	25.93
Gymnodraco acuticeps	■	■	■		■	■	■																2.23	12	22.22
Prionodraco evansii	■		■				■																0.68	74	11.11
Racovitzia glacialis		■	■	■	■		■	■	■				■		■							■	6.24	122	37.04
Vomeridens infuscipinnis																						■	0.64	11	3.70

Tab. 22 (continued):

Depth (m)	227	246	338	428	450	460	481	600	630	850	123	174	254	440	571	634	1700	2334	128	150	210	529			
NET				GSN										AGT						BPN					
SPECIES / STATION	5	16	11	15	12	17	1	9	13	14	24	2	6	4	9	25	18	30	20	21	22	29	Kg	Nt	F
BATHYLAGIDAE																									
Bathylagus sp.																							0.05	29	3.70
CHANNICHTHYIDAE																									
Chaenodraco wilsoni																							7.32	87	33.33
Channichthyidae larvae																							0.16	70	18.52
Chionobathyscus dewitti																							1.99	8	3.70
Chionodraco hamatus																							7.16	36	37.04
Chionodraco myersi																							527.17	2761	51.85
Chionodraco sp. *larvae*																									3.70
Cryodraco antarcticus																							27.67	126	40.74
Dacodraco hunteri																							10.17	103	25.93
Neopagetopsis ionah																							2.97	3	11.11
Pagetopsis macropterus																							0.34	4	11.11
Pagetopsis maculatus																							3.18	27	25.93
LIPARIDIDAE																									
Careproctus sp.																							0.31	4	7.41
Liparididae sp.																								1	3.70
Paraliparis antarcticus																							1.37	46	11.11
Paraliparis sp.																							0.2	13	14.81
MACROURIDAE																									
Macrourus holotrachys																							20.74	119	18.52
MURAENOLEPIDIDAE																									
Muraenolepis sp.																							0.11	3	7.41
MYCTOPHIDAE																									
Electrona antarctica?																							0.02	5	7.41
Gymnoscopelus bolini?																							0.87	33	7.41

Tab. 22 (continued):

Depth (m)	227	246	338	428	450	460	481	600	630	850	123	174	254	440	571	634	1700	2334	128	150	210	529			
NET				GSN										AGT						BPN					
SPECIES / STATION	5	16	11	15	12	17	1	9	13	14	24	2	6	4	9	25	18	30	20	21	22	29	Kg	Nt	F
NOTOTHENIIDAE																									
Aethotaxis mytopterix																							38.49	146	18.52
Cryothenia peninsulae?																							0.04	3	7.41
Dissostichus mawsoni																							6.21	6	14.81
Nototheniidae juveniles																							0.05	13	11.11
Nototheniidae larvae																								3	3.70
Pagothenia hansoni																							7.34	21	18.52
Pleuragramma antarcticum																							234.7	4038	33.33
P. antarcticum larvae																							0.05	192	14.81
Trematomus bernachii?																							0.16	1	3.70
Trematomus eulepidotus																							29.15	278	29.63
Trematomus lepidorhinus																							51.87	926	59.26
T. lepidorhinus larvae																								1	11.11
Trematomus loennbergi																							16.58	85	33.33
Trematomus nicolai																							3.6	26	22.22
Trematomus pennelli																							0.74	18	7.41
Trematomus scotti																							13.82	758	62.96
T. scotti larvae																							0.02	7	11.11
PARALEPIDIDAE																									
Notolepis coatsi																							0.11	1	3.70
Paralepididae larvae																								1	3.70
RAJIDAE																									
Bathyraja maccaini																							16.32	8	11.11
Bathyraja sp.																							1.47	1	3.70
ZOARCIDAE																									
Lycenchelys sp. 2																							0.31	27	3.70
Lycodichthys antarcticus																							0.21	14	14.81
Ophthalmolycus amberensis																							0.16	3	7.41
Zoarcidae sp. 1																							0.21	7	7.41

The Artedidraconidae *Pogonophryne albipinna* was found in an AGT at 1800 m depth, which extends by1000 m the known bathymetric distribution of the species. The Channichthyidae *Chaenodraco wilsoni* was always present in catches shallower than 450 m appearing also in stations 1 (GSN at 481 m) and 14 (GSN at 850 m).
The ubiquitous Nototheniidae *Trematomus lepidorhinus* was caught in the whole prospected range while *Trematomus loennbergi* appeared without any interruption in all hauls carried out from 428 m downwards. *Pleuragramma antarcticum* was present in almost all the hauls making its real distribution pattern difficult to elucidate given its pelagic habits. *Aethotaxis mitopteryx* and *Dissostichus mawsoni* were clearly restricted to bottoms deeper than 460 m.
Among the Bathydraconidae at least two species, *Bathydraco marri* and *Bathydraco macrolepis*? seem to occur from intermediate to deep waters and *Bathydraco antarcticus*? can reach depths greater than 2000 m as demonstrated by its presence in an AGT conducted at 2334m. The remaining species of the family, with the exception *of Cygnodraco mawsoni* which was restricted to stations 5 (GSN at 227 m) and 15 (GSN at 428 m), were occasionally encountered in the whole fished range even below 600 m.
The deep fish fauna was characterized during the cruise by the families Bathylagidae, Macrouridae, Muraenolepididae, Myctophidae and Paralepididae, all of them apparently confined to depths greater than 600 m. The only exception was an odd haul carried out north of Halley Bay at a depth of 246 m (station 39/016) in which, among other species, some *Macrourus holotrachys*, a *Bathyraja maccaini* and an *Ophthalmolycus amberensis* were caught. The possibility that these represent contamination from a previous haul should be discounted as these hauls were also in quite shallow water.
In addition to the above described groups of more or less eurybathic and deep stenobathic fish another group of species was also identified. It comprised the families Liparididae, Rajidae and Zoarcidae which mostly occupied the depth stratum between 250 and 600 m. The exception was an AGT+D station driven at a depth of 2334 m in which three specimens, probably belonging to the genus *Careproctus*, were fished. One of them was a juvenile measuring 4 cm, that could indicate the possibility of deep water recruitment for that species.
In summary, from a purely qualitative analysis of the fish composition of the catches obtained during the cruise, the two groups formerly identified by various authors at a mesoscale level representing, respectively, the communities of the shelf and the slope can be recognized.
In order to try to elucidate trends in abundance and for comparative analysis between geographical localities the number of individuals in 15 minutes of hauling (npue) of each single species in the GSN catches was used. Data from the BPN and the AGT were rejected for these purposes due to the impossibility of assessing the actual depth sampled and because of the unrepresentativeness of the catches.
Fig. 27 shows the npue of most of the species caught at Kapp Norvegia and north of Halley Bay. Both the species composition and their relative abundance were different between areas. The most abundant species in Kapp Norvegia was *Chionodraco myersi* with a npue of 434 individuals per 15 minutes haul (ind/15 min) followed by *Trematomus scotti* and *Trematomus lepidorhinus* which accounted for more than 60 ind/15 min. Other important species in the area were *Artedidraco loennbergi, Dolloidraco longedorsalis, Racovitzia glacialis, Trematomus eulepidotus* and *Gerlachea australis*. However this structure of the assemblage is probably very unrealistic since it is affected by the extremely high amount of *Chionodraco myersi* caught in station 1 (60.35% of the total catch in terms of number of individuals). North of Halley Bay the dominant species were, in decreasing order of importance, *Trematomus lepidorhinus, Trematomus scotti, Dolloidraco longedorsalis, Chionodraco myersi, Trematomus eulepidotus* and *Pleuragramma antarcticum*. All others had abundance indices lower than 20 ind/15 min. The main differences in the species composition and abundance of both areas were the absence in Kapp Norvegia of major components of the slope community that suggest that they are almost certainly due to the different depth range sampled within each area.
A more detailed analysis of the family composition by depth in the two areas (Figures 28 and 29) seems to confirm the observation given above but does not provide any clear picture about

the trends in total abundance and on the contribution of the different families of fish to it in relation to depth.
The only three available hauls in the Kapp Norvegia area (Fig. 28) suggest that the minimun abundance is found in shallow depths in which the Nototheniidae are the major components. The stratum of maximum abundance was situated around 450 m and was dominated by the Channichthyidae concurring with an slight decrease in abundance of the Nototheniidae and with an increase in that of the Artedidraconidae and Bathydraconidae. It was also at this station that the presence of Liparididae and Zoarcidae was first recorded although they are hardly distinguishable in the figure due to their low abundance. At the deepest haul a general decrease was observed in the contribution of all families situating the corresponding total abundance at an intermediate level. Again Liparididae and Zoarcidae were present at this station. This pattern in the abundance is characterized by a continous and neatly marked reduction in the Shannon-Wiener diversity index (Shannon and Weaver, 1949) as well as in the evenness index (Platt and Lambshead, 1985).
In the area north of Halley Bay a somewhat more intense sampling allowed us to get better information on the trend of the abundance along the bathymetric axis (Fig. 29). Contrary to what happened in the Kapp Norvegia area the maximum abundance was observed at the shallowest station which was clearly dominated by the Nototheniidae. Going deeper to the next station situated at 336 m a general decrease was detected in the abundance of all families except in the Bathydraconidae, the Nototheniidae still being the main component of the assemblage. As occurred in Kapp Norvegia a secondary peak appeared around 450 m in which Channichthyidae accounted for the main part of the total abundance. Bathydraconidae also increased their abundance at that level and Liparididae, Rajidae and Zoarcidae were represented. From here downwards the general npue diminished as a consequence of the decrease in the abundance of all the families with the exception of that of the Bathydraconidae which remains more or less constant until the station at 467 m. The shift from the shelf to the slope communities was detected at 630 m with the appearance of the Macrouridae and somewhat deeper with the appearance of the Bathylagidae, Muraenolepididae and Myctophidae. In this area the Shannon-Wiener diversity index was quite constant along depths fluctuating from above 2.3 at 467 m to about 1.9 at 870 m. The evenness index exhibited a slight increase shifting from a value of 0.6 at the shallowest station to a value of 0.8 at the deepest one.
Biological and population data
Tab. 23 summarizes the number of fish sampled for biological studies (N1), for length frequency distribution (N2), and the total number in the catch (Nt). The length range of each species is shown, and the minimum length corresponding to larvae and juveniles, when available, is in brackets. The number of ovaries, stomachs and otoliths and scales collected by species are also included.
Maturity stages of all species sampled on board were determined. Ripe gonads close to spawning were only found in *Trematomus eulepidotus* and in a few individuals of *Chionodraco myersi.* The relatively high percentage of adult females of *Pleuragramma antarcticum* in maturity stage 5 might indicate that the species had already spawned. The rest of the species were immature or in early developmental stages. Histological studies of the collected ovaries (N=273) will provide data on fecundity and spawning periods.
The fish populations in the Southern Ocean are apparently characterized by relatively slow but seasonal growth rates and annual reproductive cycles (White, 1991). These characteristics, largely due to the highly seasonal polar marine environment, should result in seasonal annuli in the body hard parts (otoliths, scales, vertebrae) and in clear modes when length-frequency distributions are plotted. However, the interpretation of growth increments and length sizes are difficult in Antarctic fish. A combination of length size methods and increment analysis will be carried out, at least for the first age groups, to evaluate and validate the age and growth estimates of some species. A total of 1261 sagittal otoliths were collected from adult fish. Fish larvae and juvenile fish otoliths (N=400) will be analysed in the laboratory for daily growth increments, to complete the age-length relationships and to calculate growth models. Scales (N=624) were collected for cross-reference studies. Age determination will be validated in an attempt to reduce errors and biases. The birthdate distribution of larvae and juvenile fish,

determined by means of the daily growth rings of the otoliths, will be compared with the available reproduction data to obtain insights into the recruitment processes.
A total of 2669 fish were measured on board (Tab. 24) and subsamples were frozen for subsequent biological analysis in the laboratory. The measured fish represent 89 % of the capture, without considering the 4038 *Pleuragramma antarcticum* caught in the last BPN haul (station 39/029) that were consequently sub-sampled.

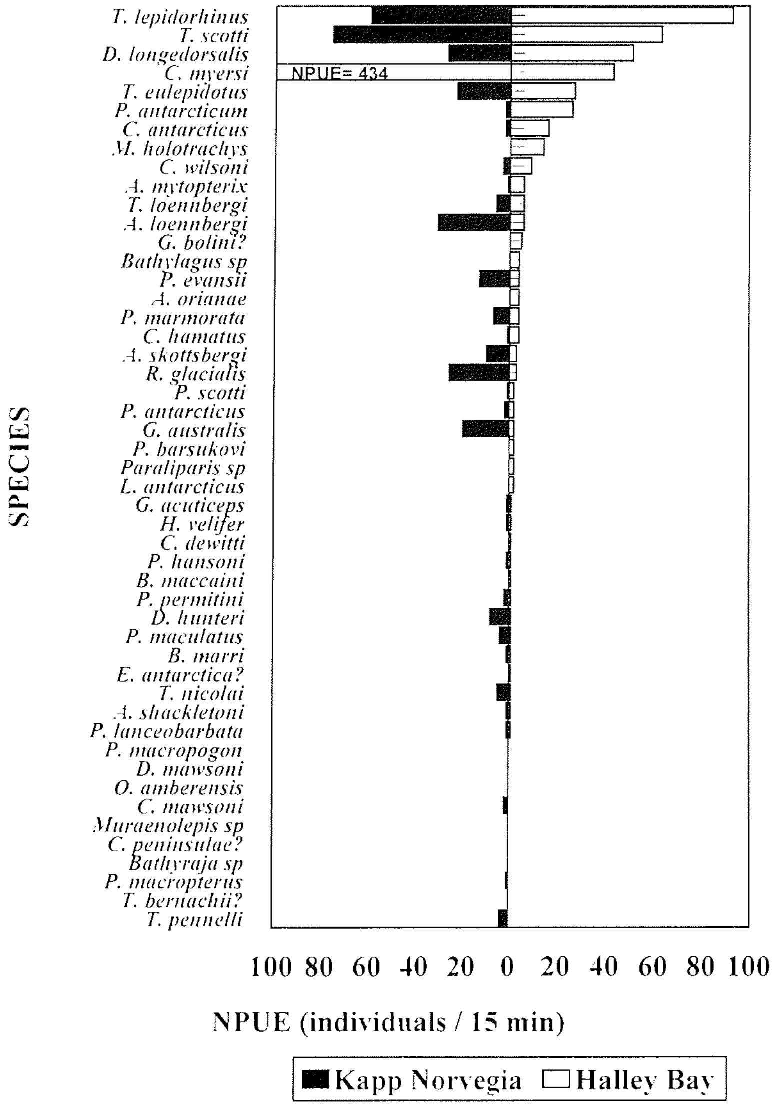


Fig. 27: Species relative abundance (NPUE = number of individuals in 15 minutes haul) GSN in the catches off Kapp Norvegia and Halley Bay.

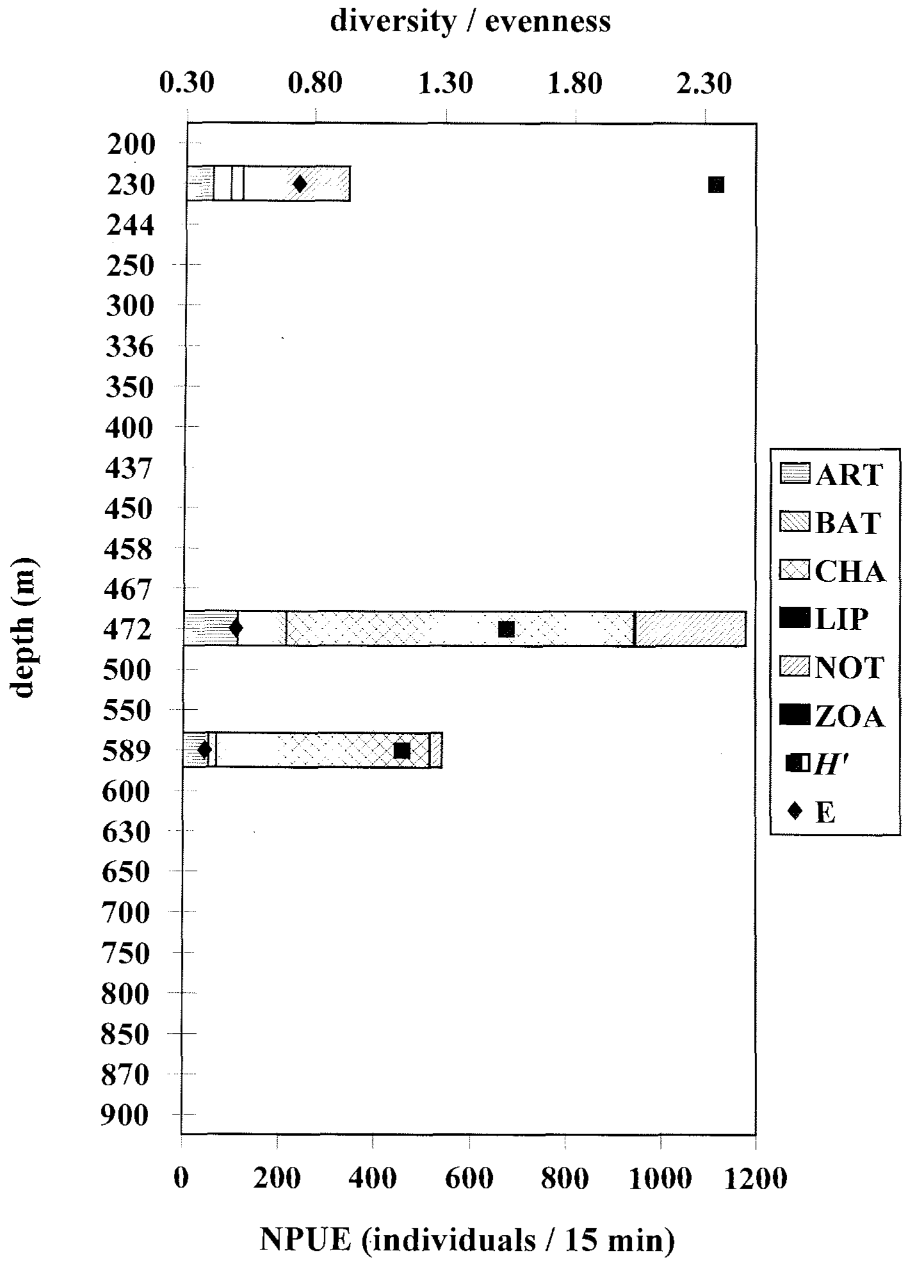


Fig. 28: Familiy relative abundance distribution by depth from GSN catches off Kapp Norvegia. Diversity index (H') and evenness index (E) by station are also included. ART = Artedidraconidae, BAT = Bathydraconidae, CHA = Channichthyidae, LIP = Liparididae, NOT = Nototheniidae, ZOA = Zoarcidae

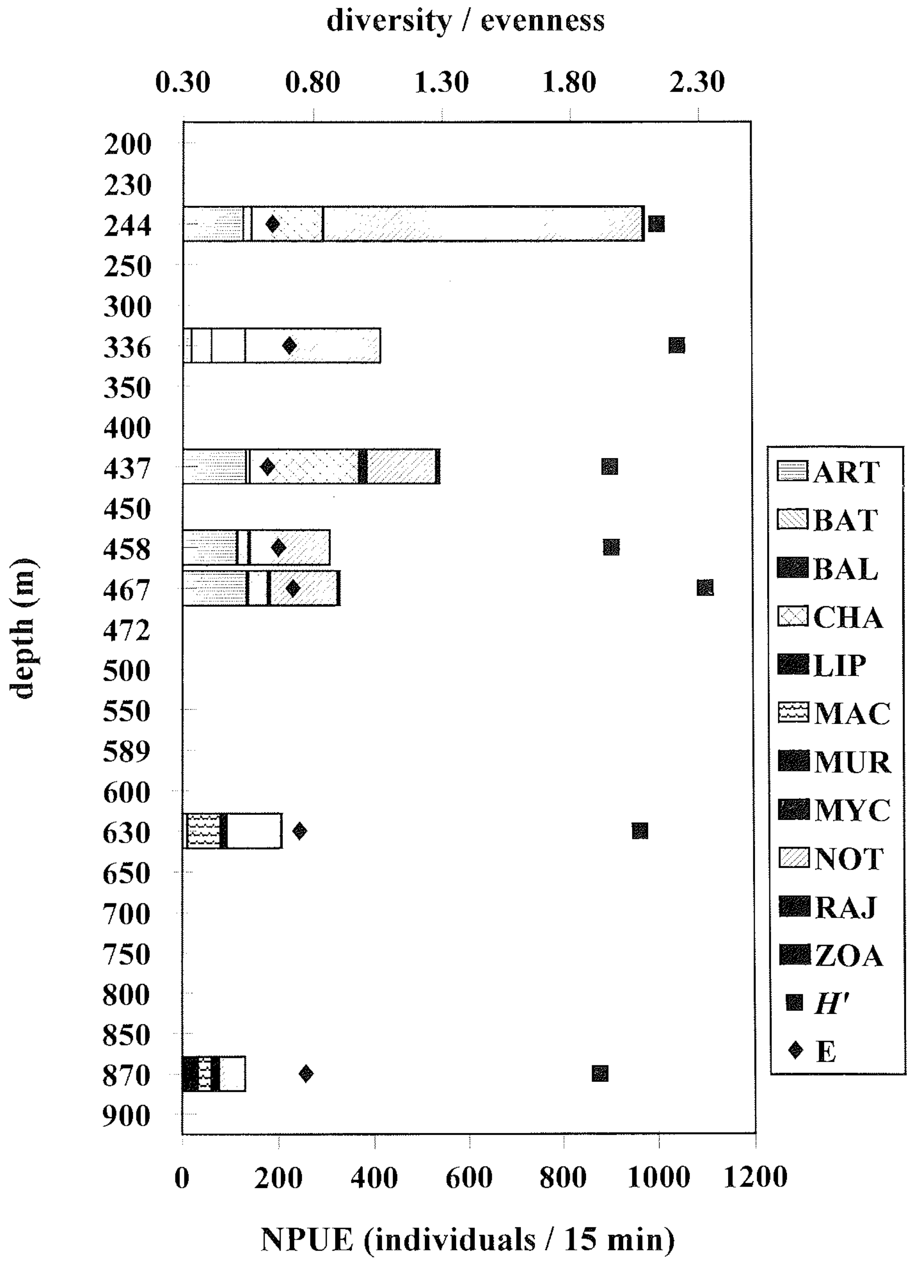


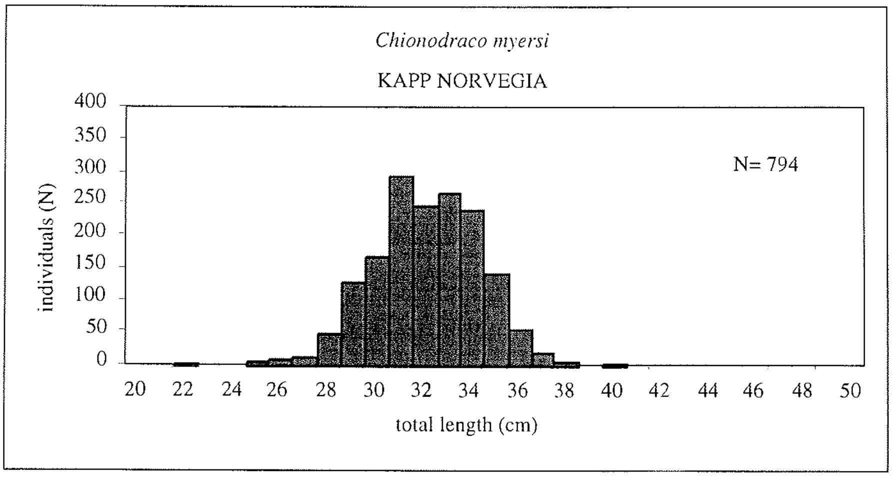
Fig. 29: Familiy relative abundance distribution by depth from GSN catches north of Halley Bay. Diversity index (H') and evenness index (E) by station are also included. ART =Artedidraconidae, BAT = Bathydraconidae, BAL = Bathylagidae, CHA = Channichthyidae, LIP = Liparididae, MAC = Macrouridae, MUR = Muraenolepididae, MYC = Myctophidae, NOT = Nototheniidae, RAJ = Rajidae, ZOA = Zoarcidae.

Tab. 23: Biological sampling by species. N1 = number of fish sampled, N2 = number of fish measured, Nt = number of fish caught. Lmin = smallest length recorded, in brackets larvae or juvenile measurements, Lmax = largest length measured.

SPECIES	N1	N2	Nt	Lmin (cm)	Lmax (cm)	stomachs	ovaries	otoliths	scales
BATHYDRACONIDAE									
Cygnodraco mawsoni	2	7	8	15.5	29.3	-	-	-	-
Gymnodraco acuticeps	6	10	12	17.3	34.8	3	2	5	-
Vomeridens infuscipinnis?	11	11	11	15.8	27.3	7	1	7	7
CHANNICHTHYIDAE									
Cryodraco antarcticus	96	96	126	16.1	53.0	26	2	87	-
Chaenodraco wilsoni	76	84	87	17.4 (3.0)	36.2	34	21	69	-
Chionobathyscus dewitti	8	8	8	29.1	38.0	3	-	6	-
Chionodraco hamatus	27	27	39	22.4	40.8	1	3	24	-
Chionodraco myersi	555	1394	2749	21.3	40.3	114	69	268	-
Dacodraco hunteri	92	104	104	19.1 (2.5)	31.2	31	26	80	-
Neopagetopsis ionah	3	3	3	45.6	56.0	1	1	2	-
Pagetopsis macropterus	4	4	4	11.9	22.8	1	-	2	-
Pagetopsis maculatus	27	27	27	17.2	28.8	20	10	24	-
MACROURIDAE									
Macrourus holotrachys	85	123	123	13.5 (9.5)	45.1	3	2	59	47
NOTOTHENIIDAE									
Aethotaxis mitopteryx	145	145	146	11.2	49.0	18	17	122	105
Dissostichus mawsoni	3	6	6	14.3 (5.0)	67.5	1	-	1	1
Pagothenia hansoni	19	19	21	24.0	36.0	9	10	17	15
Trematomus eulepidotus	216	243	278	10.9	31.5	48	51	195	171
Trematomus lepidorhinus	228	767	926	12.6 (4.5)	27.7	127	28	212	200
Trematomus loennbergi	83	83	85	15	32.2	35	30	67	66
Trematomus nicolai	18	26	26	14.2 (10.0)	34.9	7	-	12	11
Trematomus pennelli	18	18	18	7.1	22.2	-	-	2	1
TOTAL	1722	3205	4807			489	273	1261	624

Tab. 24: Species measured and frozen for subsequent studies in the laboratory. Codes as in Table 23.

SPECIES	N2	Nt	Lmin (cm)	Lmax (cm)
ARTEDIDRACONIDAE				
Artedidraco loennbergi	160	161	5.5	12.0
Artedidraco orianae	60	60	8.0	15.0
Artedidraco shackletoni	6	7	12.5	14.0
Artedidraco skottsbergi	55	69	5.0	10.5
Artedidraco sp. 1	7	8	9.0	13.0
Dolloidraco longedorsalis	561	689	4.5	13.0
Histiodraco velifer	9	13	13.0	20.0
Pogonophryne barsukovi	13	14	16.0	23.0
Pogonophryne lanceobarbata	9	9	5.0	19.0
Pogonophryne macropogon	4	4	9.0	35.0
Pogonophryne marmorata	49	53	5.0	19.0
Pogonophryne permitini	11	17	7.0	19.0
Pogonophryne phyllopogon?	1	1	13.5	13.5
Pogonophryne scotti	13	20	12.5	27.0
Pogonophryne ventrimaculata	1	1	17.0	17.0
BATHYDRACONIDAE				
Bathydraco macrolepis	2	2	17.5	21.0
Bathydraco marri	93	93	6.0	22.5
Gerlachea australis	115	124	13.0	27.0
Prionodraco evansii	78	78	7.5	15.5
Racovitzia glacialis	124	124	6.5	36.5
BATHYLAGIDAE				
Bathylagus sp.	29	29	7.0	16.0
LIPARIDIDAE				
Careproctus sp.	3	4	4.0	26.0
Paraliparis antarcticus	45	46	5.0	22.0
Paraliparis sp.	16	16	7.0	11.5
MURAENOLEPIDIDAE				
Muraenolepis sp.	2	3	15.0	17.5
MYCTOPHIDAE				
Electrona antarctica?	5	5	6.5	9.5
Gymnoscopelus bolini?	33	33	10.5	19.5
NOTOTHENIIDAE				
Cryothenia peninsulae?	2	3	4.5	10.5
Pleuragramma antarcticum	538	4038	4.5	27.0
Trematomus bernachii?	1	1	25.5	25.5
Trematomus scotti	614	758	4.5	22.0
ZOARCIDAE				
Lycodichthys antarcticus	9	13	9.0	20.0
Ophthalmolycus amberensis	1	1	22.5	22.5
TOTAL	2669	6497		



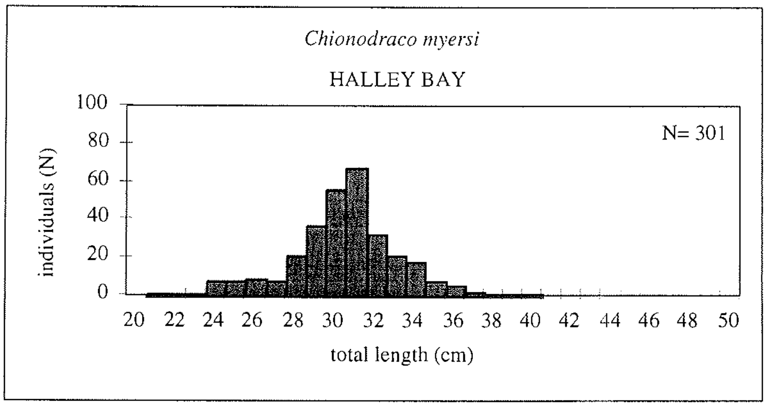
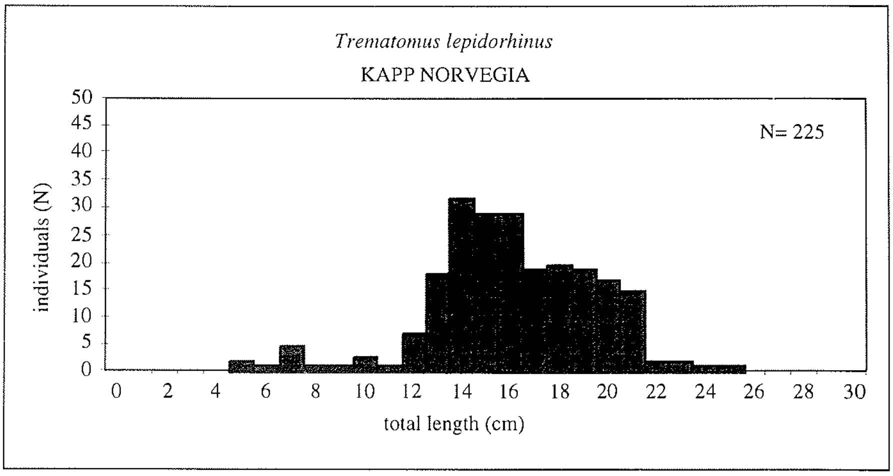


Fig. 30a, b: Length distribution of *Chionodraco myersi* by study area.

As an example, Figures 30 and 31 show the length distributions of the two most abundant species caught in the GSN stations during the cruise in the two prospected areas. *Chionodraco myersi* (Fig. 30) were predominantly larger in Kapp Norvegia than north of Halley Bay, although the length range present in the catches was similar. The inverse tendency was observed in *Trematomus lepidorhinus* (Fig. 31), where the bigger lengths were found north of Halley Bay. These differences among areas might be due to the different depth range sampled with the GSN, but could also indicate a migratory behaviour associated to a biological event such as reproduction.



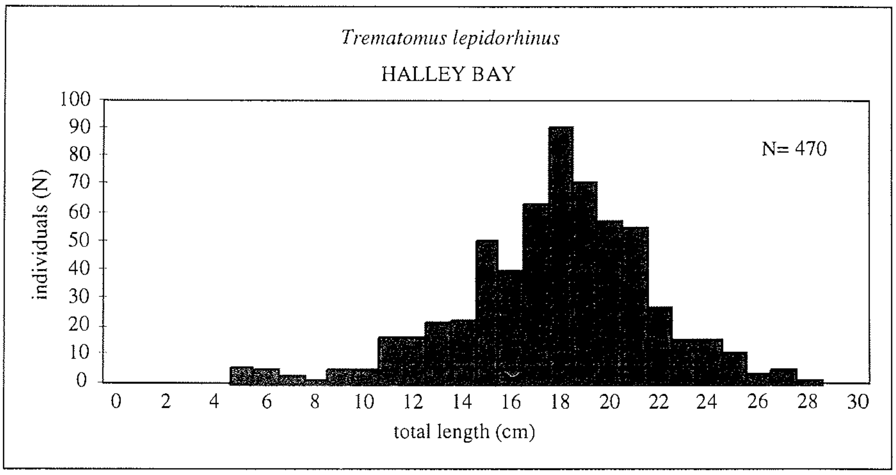


Fig. 31a, b: Length distribution of *Trematomus lepidorhinus* by study area.

Trophic studies

The number of empty stomachs was generally high and almost all *Macrourus holotrachys* analysed had evaginated stomachs. Evidence of regurgitated stomachs was found in several species, probably caused by the stress of capture. A total of 489 stomachs were preserved for future feeding studies and trophic interrelations analysis.

A preliminary qualitative observation of the stomach contents carried out during sampling onboard and in the parasitological studies, showed that *Pleuragramma antarcticum* was the main prey of many species such as *Chionodraco myersi*. Krill was also an important item in the diet of many fish such as *Chaenodraco wilsoni*, whereas polychaetes and other benthic organisms were commonly found in the stomachs of some Artedidraconidae.

Reference collection

A total of 213 specimens of 48 species, belonging to 11 families, were collected for reference and for doubtful species identification.

Acknowledgements
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References

Andriashev, A.P., 1965. A general review of the Antarctic fish fauna.-In: van Mieghem, J. & van Oye, P.(eds). Biogeography and ecology in Antarctica. Junk Publishers, The Hague, 491-550.

Ekau, W., 1988. Ökomorphologie nototheniider Fische aus dem Weddellmeer, Antarktis.-Ber.Polarforsch.51:1-112.

Ekau, W., 1990. Demersal fish fauna of the Weddell Sea, Antarctica. Antarctic Science 2(2): 129-137.

Fisher, W. & J. C. Hureau, 1985. FAO species identification sheets for fishery purposes, Southern Ocean.-Food and Agriculture Organization of the United Nations, FAO, Rome, 1-400

Gon, O. & P. C. Heemstra, (eds)., 1990. Fishes of the Southern Ocean. J.B.L. Smith Institute of Ichthyology, Grahamstown, 462 pp.

Hubold, K.G., 1984. The spatial distribution of *Pleuragramma antarcticum* (Pisces:Nototheniidae) near the Filchner and Larsen Ice Shelves (Weddell Sea/Antarctica). Polar Biol. 3(4): 231-236.

Hubold, G., 1992. Ecology of Weddell sea fishes. Ber. Polarforsch.103: 1-150.

Hureau, J.-C., E. Balguerías, G. Duhamel,G, C.-H. Kock, C. Ozouf-Costaz & M. White, 1990. Fish fauna of the Eastern Weddell Sea. Ber. Polarforsch.68: 32-57.

Kock, K.-H. & A. Kellermann, A., 1991. Reproduction in Antarctic notothenioid fish. Antarctic Science 3(2): 125-150.

Kock, K.-H. R. Schneppenheim & V. Siegel, V., 1990. A contribution to the fish fauna of the Weddell Sea. Arch. Fisch.Wiss. 34(2/3): 103-120

Schwarzbach, W., 1988. Die Fischfauna des östlichen und südlichen Wedellmeeres: geographische Verbreitung, Nahrung und trophische Stellung der Fischarten.-Ber.Polarforsch.54: 1-94.

Wöhrmann, A.P.A. & C. Zimmermann, 1992. Comparative investigations on fishes of the Weddell Sea and the Lazarev Sea. Reports on Polar Research, 100: 208-222.

White, M. G., 1991. Age determination in Antarctic fish. In: Biology of Antarctic Fish, G.di Prisco, B.Maresca, B.Tota (eds). Springer-Verlag, Berlin: 87-100.

2.6.2 Ecophysiology of Antarctic Fish (P. v. Dijk)

Ecophysiology

The influence of temperature on important physiological parameters such as acid-base balance, ion regulation, energy status, enzyme activity and oxygen radicals were investigated. The results on Antarctic animals will be compared with data on animals, with a similar lifestyle, from temperate water. This will be done to expand our knowledge about the physiological reasons behind temperature dependent distribution limits and about the physiological mechanisms underlying the adaptation to the extreme polar environment.

Objectives:

To determine:

a) the influence of a temperature increase on the metabolic rate of a Zoarcidae and possibly of another more active species and to compare these results with data on temperate species. This is to shed more light on whether there is such a phenomenon as metabolic cold adaptation;

b) to what extent the various metabolic processes such as acid-base balance, energy status, and ion balance are responsible for the extreme sensitivity of Antarctic fish to temperature changes;

c) the metabolic anaerobic scope for Antarctic fish.

d) whether Antarctic fish, to decrease the cost for ion regulation, are less hypoosmotic - in comparison to sea water - than temperate species.

Work at sea

a) Respiration experiments have been performed with *Ophthalmolycus amberensis* (?) and with *Trematomus scotti*. Control measurements at 0°C were followed by measurements at higher temperatures - increasing the temperature with one degree a day - up to 6°C.

b) The planned temperature incubation experiments could not be performed due to a lack of recovered fish.

c) Control tissue samples (at 0°C) of white muscle, liver, gills, and plasma of recovered *Trematomus lepidorhinus* were taken, but the planned strenuous exercise experiments could not be performed due to a lack of suitable fish.

d) From a wide variety of species white muscle and plasma samples were collected. Of these samples the ion content will be determined to see which ions are possibly responsible for a higher intracellular osmolarity. In plasma it can be expected that the concentrations of sodium, chloride, and potassium are increased. Since many enzymes are sensitive for the intracellular levels of these ions the situation might be different for white muscle. Possibly here the higher osmolarity is caused by an increased intracellular concentration of free amino acids. For instance in *Carcinus maenas* fluctuations in external osmolarity are followed by parallel changes in FAA while other ions such as sodium and chloride are kept at a constant level.

Preliminary results

In Fig. 32 the oxygen consumption of a Zoarcidae, *Ophthalmolycus amberensis* (?), is shown in dependence on the water temperature.

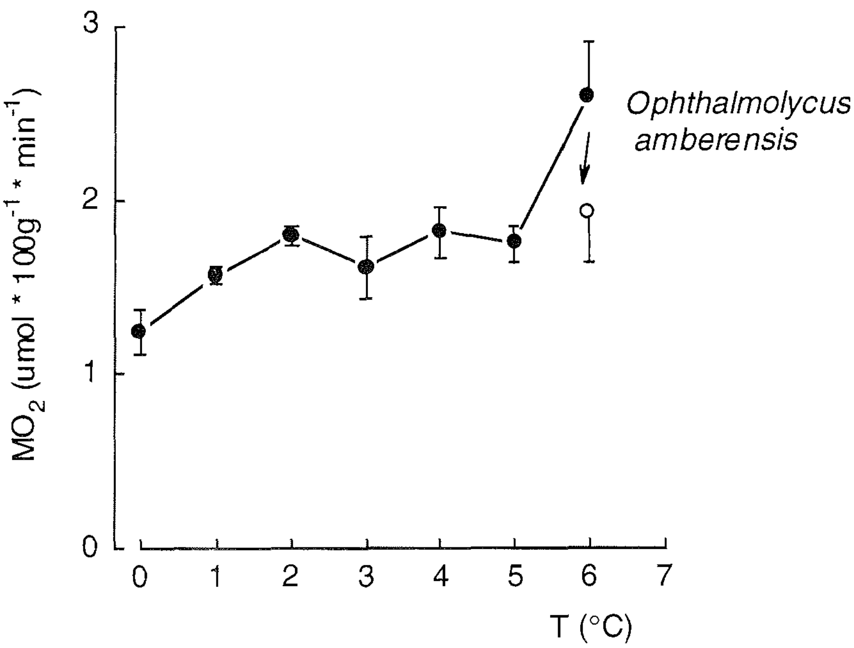

Fig. 32: Oxygen consumption of *Ophtalmolycus amberensis* in dependence of water temperature. Prior to experimentation fish were held in the lab for at least one week at 0°C. Temperature was raised at a rate of 1°C/day. The open symbol indicates the oxygen uptake on the second day at 6°C.

The extreme sensitivity of Antarctic fish to temperature changes was again proven when a temporary (unwanted) increase of the water temperature in the fish containers to 5°C or less caused a 100% mortality among all fish. Involved were: *Trematomus scotti*, *T. lepidorhinus*, *T. loennbergi*, *T. eulepidotus*, and some *Zoarcidae*, mainly *Lycodichthys antarcticus*.
From a total of 65 Antarctic fish specimens of 19 species, belonging to five different families, samples were taken for ion analysis. These samples might also give us some first information about the anaerobic metabolism of the concerned species. The following species were sampled (the number of specimen; the question mark gives the number of fish of which the species could not with certainty be determined):*Racovitzia glacialis* (7), *Cryodraco antarcticus* (3), *Chionodraco myersi* (6), *Trematomus scotti* (2), *T. hansoni* (4), *T. lepidorhinus* (4), *T. loennbergi* (3), *Pogonophryne marmorata* (5 + 3?), *P. perrmitini* (1), *Dolloidraco longedorsalis* (2), *Pleuragramma antarcticum* (5), *Prionodraco evansii* (6), *Cryothenia peninsulae* (1?), *Aethotaxis mitopteryx* (7), *Artedidraco skottsbergi* (2), *Bathydraco marri* (1), *Gerlachea australis* (1), *Artedidraco orianae* (1), *Ophthalmolycus amberensis* (1).

2.6.3 Antifreeze Proteins from Antarctic Fish (S. Krey)

Objectives
The aim of our project is to clone the coding genes for antifreeze proteins in Antarctic and Arctic fish species. These genes will then be transferred into suitable expression vectors to produce sufficient amounts of recombinant antifreeze protein for further analysis and evaluation of a potential application aiming at the protection of cells and possibly organs against the hazardous effects of freezing.
The task on board was to take several fresh tissue samples from suitable Antarctic fish species (mostly two or three of each species) and to freeze them immediately in liquid nitrogen for subsequent work in the molecular genetic lab in Kiel.

Work on board
A total of 59 live fish of 7 families (Table 25) were taken from various trawls deployed in the Kapp Norvegia and north of Halley working areas. The fish were kept in aquaria at 0°C for the immediate extraction of blood, heart, liver, gonads, skin, muscle and brain. As soon as possible the tissue was frozen in liquid nitrogen and transferred to a -125° C freezer for storage because the basic material will be m-RNA which is easily destroyed by RNAses. Rapid freezing and storage at ultra low temperatures prevents this degradation.
M-RNA will be transcribed into a c-DNA library in Kiel. The advantage of this approach is the selective isolation of genes which are expressed in the particular tissue, without cloning intron sequences.
Every treated fish was frozen at -30° C. Of some more frequently occurring fish species, additional material was frozen at -30° C for further investigation in the Kiel laboratory.

Tab. 25: List of families and species of which samples were taken for antifreeze protein analysis

Nototheniidae:
Aethotaxis mitopteryx
Pleuragramma antarcticum
Trematomus eulepidotus
T. hansoni
T. lepidorhinus
T. loennbergii
T. nicolai
T. scotti
Artedidraconidae
Artedidraco orianae
A. shackletoni
A. skottsbergi
Histiodraco velifer
Pogonophryne marmorata
P. scotti
P. permitini
Bathydraconidae
Bathydraco marri
Gerlachea australis
Gymnodraco acuticeps
Racovitzia glacialis
Vomeridens infuscipinnis
Channichthyidae
Chaenodraco wilsoni
Chionodraco myersi
Cryodraco antarcticus
Muraenolepidae
spp. *
Zoarcidae
spp. *
Liparididae
spp. *
* species not yet determined

2.6.4 A Contribution to the Parasitic Fauna of the Weddell Sea (H. Palm)

Objectives

Recent investigations on the parasitic fauna of the eastern Weddell Sea are restricted to a few observations on nematodes of seals and of some of the most abundant fish species (Klöser *et al.* 1992, Palm *et al.* 1994). An important result of these studies was the identification of 3

nematode species, which use mainly benthic (*Contracaecum osculatum, Pseudoterranova decipiens*) and pelagic (*C. radiatum*) intermediate hosts within their life cycles. However, using multilocus electrophoresis, a third *Contracaecum* species was discovered which is not distinguishable using traditional methods. One aim was to sample fish species infested by the different *Contracaecum* species to get material for further molecular biological investigations. Furthermore, studies on the local distribution of these seal nematodes will be carried out with the collected material, including a comparison with earlier investigations in the eastern Weddell Sea. This study is supposed to complete the parasitological investigations on the helminth fauna of fishes from the Weddell Sea (see report by K. Zdzitowiecki).
Another important aim of this participation on ANT XIII/3 was the possibility to collect parasites from cephalopods in order to enlarge our knowledge about Antarctic cephalopod ecology (see report by Steimer et al.). Furthermore, samples of parasites of other Antarctic invertebrates were to be taken.

Work at Sea

Fishes of 11 species from both the Kapp Norvegia and north of Halley Bay region were collected and deep frozen immediately after the catch. Specimens of several parasite species were collected and preserved from fishes as well as from cephalopods, polychaetes, isopods and amphipods.

Preliminary results

Most parasites collected belong to the Hirudinea. They were found on the teleost *Cryodraco hamatus* and on isopods. The occurrence of leeches on the squid *Psychroteuthis glacialis* was demonstrated for the first time. Parasitic copepods and nematodes were found to infest the polychaete *Eulagisca gigantea*. Other, not yet identified, parasites were detected in a second polychaete species, *Laetmonice producta*, and in the amphipod *Eusirus perdentatus*. Investigations for further identification of the different parasite species will be carried out at the Institute of Marine Research, Kiel.

References

KLÖSER, H., J. Plötz, H. Palm, A. Bartsch & G. Hubold (1992): Adjustment of anisakid nematode life cycles to the high Antarctic food web as shown by *Contracaecum radiatum* and *C. osculatum* in the Weddell Sea. Antarctic Science 4: 171-178.

PALM, H., K. Andersen, H. Klöser, J. Plötz (1994): Occurrence of *Pseudoterranova decipiens* (Nematoda) in fish from the south-eastern Weddell Sea (Antarctic). Polar Biology 14: 539-544.

2.6.5 Faunistic Analysis of Fish Parasites (K. Zdzitowiecki)

Objectives

The analysis is restricted to parasitic worms belonging to 3 higher taxa: spiny-headed worms (Acanthocephales, Palaeacanthocephala), tapeworms (Plathelminthes, Cestoda) and flukes (Plathelminthes, Digenea). The occurrence of 8 acanthocephalan species, 12 cestode species and 36 digenean species, all in sexually mature stages of development, was previously reported from Antarctic fish. The numbers for the high Antarctic are considerably smaller - 2 or 3, 1 and 15, respectively. Apart from species occurring in the adult stage, 6 acanthocephalan species were reported in the juvenile (cystacanth) stage (adults parasitise seals and marine birds), as well as 6 different forms of cercoids of cestodes (Tetraphyllidea, adults parasitise elasmobranch fish) and undeterminable plerocercoids of cestodes (Diphyllobothriidae, adults probably parasitise seals). Up to now, the West Antarctic was the only area investigated fairly well. The data for the high Antarctic are much less exact, most of the reports were from the Ross Sea. Only 2 acanthocephalan and 1 digenean species were reported from the Weddell Sea.
Most parasites are difficult to determine or are even undeterminable if they are not collected alive, relaxed and correctly fixed. Thus, only the collection of fresh material gives exact results.

According to the present author's previous experience, the examination of 20 specimens of each fish species is sufficient for preparing lists of parasites typical of each host and for calculation of coefficients of the infection (prevalence, relative density). Only a few parasites can be exactly determined without staining and clearing, which needs much time. Thus, the purpose of this work on "Polarstern" was to collect as many parasitic worms as possible from various fishes for further elaboration at the Institute of Parasitology in Warszawa.

Work at sea

Fishes were caught between 5 February and 4 March 1996 in two areas - off Kapp Norvegia and north of Halley Bay (geographical position of both areas together is 70.5°-74°S, 8°-22.5°W) using the bottom trawl (10 catches), Agassiz trawl (10 catches), benthopelagic net (2 catches) and dredge (9 specimens) at various depths (120 - 1560 m). In total 404 bottom fishes, including 4 elasmobranchs, were examined (Table 26). Most specimens were examined a short time after being caught (up to 24 hours), but circa 100 specimens were received from Dr. P. van Dijk after maintenance in aquaria. Because of this help, it was possible to increase the samples of some species to over 20 specimens. Fishes were determined with the help of Dr. E. Balguerías.

The examination of the fishes was restricted to the alimentary tract and body cavity and was done using a stereomicroscope. All acanthocephalans and digeneans, and almost all adult cestodes were collected, fixed and stored in 75 % ethanol with 5 % glycerine for further elaboration. Of the larval cestodes, only tetraphyllidean cercoids were fixed and stored. Quantitative samples (10 - 50 %) were taken in each case of strong infection. Plerocercoids were not collected, but only counted. Approximate numbers of species of parasites could be stated, but exact specific determinations were possible only in a few cases. Most parasites could be provisionally assigned only to genera or even families or superfamilies.

Preliminary results

The infection of fishes examined by representatives of 3 higher taxa is shown in Table 26. Most of fishes belonging to all 34 species were infected. However, only 10 fish species were investigated with sufficient numbers of specimens (20 or more). Thus results are regarded as preliminary and further investigations are needed.

A: Acanthocephales

Acanthocephalans occurred in fishes of 15 species, with a total number of 111 parasites. Levels of infection are extremely low, usually 1 - 2 parasites in a fish, in one case 12. Probably they belong to 5 species. Surprisingly, cystacanths of *Corynosoma bullosum* (Linstow) (in adult stage a parasite of elephant seals) were the most abundant. This species is recorded in the high Antarctic fish for the first time. Apart from this cystacanths of *Corynosoma pseudohamanni* Zdzitowiecki (a parasite of Weddell seals, leopard seals and crabeater seals), as well as 3 species in adult stage belonging to the genera *Metacanthocephalus*, probably *M. campbelli* (Leiper et Atkinson) and *M. rennicki* (Leiper et Atkinson), and *Echinorhynchus*, probably *E. longiproboscis* Rodjuk were found. The last one was previously recorded in the Magellan subregion of the Subantarctic, others occur in both the high and low Antarctic. *M. campbelli* was not previously recorded in the Weddell Sea. Both the diversity of species and levels of infections are much lower than in the West Antarctic.

B: Cestoda

Adult cestodes were found in a total number of circa 100 - 150 specimens in all 4 skates (2 species) examined and in 7 of 23 specimens of *Macrourus whitsoni*. The last one was the only previously reported host of adult cestodes in the high Antarctic (not in the Weddell Sea). Probably the material from skates consists of 2 - 3 parasite species of the order Tetraphyllidea; from macrourids the material consisted of one species of the family Bothriocephalidae.

Larval cestodes occurred in representatives of all 26 species of notothenioid fish and in macrourids. Not less than 2 (probably more) forms of tetraphyllidean cercoids were found in the intestine, whereas there were undeterminable plerocercoids in the body cavity and stomach

Tab. 26: Preliminary results on the investigation of fish parasites in the Weddell Sea in 1996 (number of acanthocephalan and digenean specimens in parentheses).

Fish families and species	No. examined	No. infected with Acantho-cephales	Cestoda	Digenea
I. Nototheniidae:				
1. *Aethotaxis mitopteryx*	5	-	4	-
2. *Trematomus bernacchii* (?)	1	-	1	1(1)
3. *Trematomus eulepidotus*	12	1 (1)	12	4 (27)
4. *Trematomus hansoni*	5	2 (14)	5	4 (25)
5. *Trematomus lepidorhinus*	46	7 (9)	42	23 (76)
6. *Trematomus loennbergi*	25	1 (1)	24	19 (c. 110)
7. *Trematomus nicolai*	4	1 (1)	2	3 (10)
8. *Trematomus pennelli*	1	1 (12)	1	1 (4)
9. *Trematomus scotti*	28	15 (29)	24	5 (15)
II. Artedidraconidae:				
10. *Artedidraco loennbergi*	20	5 (8)	1	7 (10)
11. *Artedidraco orianae*	7	1 (2)	1	5 (10)
12. *Artedidraco skottsbergi*	18	-	2	8 (10)
13. *Dolloidraco longedorsalis*	44	-	2	8 (10)
14. *Pogonophryne marmorata*	6	2 (4)	1	2 (3)
15. *Pogonophryne permitini*	3	1 (1)	3	1 (1)
16. *Pogonophryne ventrimaculata*	1	-	1	-
III. Bathydraconidae:				
17. *Bathydraco marri* (?)	14	-	5	3 (4)
18. *Gerlachea australis*	20	-	5	-
19. *Prionodraco evansii*	3	1 (1)	3	2 (3)
20. *Racovitzia glacialis*	22	4 (9)	17	13 (20)
IV. Channichthyidae:				
21. *Chaenodraco wilsoni*	4	-	3	-
22. *Chionodraco hamatus*	20	-	20	1 (1)
23. *Chionodraco myersi*	21	-	21	-
24. *Cryodraco antarcticus*	7	-	7	2 (3)
25. *Dacodraco hunteri*	5	-	5	-
26. *Pagetopsis maculatus*	2	-	2	-
V. Zoarcidae:				
27. *Lycenchelys* sp.	5	-	-	5 (20)
28. *Lycodichthys antarcticus* (?)	9	3 (5)	-	-
29. *Ophthalmolycus amberensis* (?)	5	-	-	3 (33)
VI. Liparididae				
30. *Paraliparis antarcticus* (?)	12	-	-	3 (34)
31. *Paraliparis* sp.	2	-	-	1 (1)
VII. Macrouridae: 32. *Macrourus whitsoni*	23	8 (14)	8	21 (c. 210)
VIII. Rajidae:				
33. *Bathyraja maccaini*	3	-	3	-
34. *Bathyraja* sp. 2	1	-	1	-

wall. Levels of infection were often very high, similar to those in the West Antarctic. Predators belonging to the family Channichthyidae (icefish) were the most strongly infected, up to circa 3000 specimens in one *Cryodraco antarcticus*. Quantitative samples were taken. Probably they consist of circa 10,000 specimens; the total number of larval cestodes occurring in fishes examined probably exceeds 50,000 specimens. It will be estimated after examination and counting of samples.

C: Digenea
Digeneans occurred in bony fish of 24 species in a total number of about 630 - 650 parasites. Levels of infection were low, with the exception of *Macrourus whitsoni*, in which 1/3 of the total number of digeneans were found, with a maximum intensity of ca. 50. Parasites belong to about 20 species. 9 species were provisionally determined. Two of them were recorded in the high Antarctic for the first time, *Macwicaria ophthalmolyci* Zdzitowiecki and *Stenakron glacialis* Zdzitowiecki. Only one, *Elytrophalloides oatesi* (Leiper & Atkinson), was previously reported from the Weddell Sea. Apart from these, 10 - 12 further species occurred in the fishes examined.
Ca. 5 species seem to be new for the whole Antarctic and probably for science. The level of infection is not less than 10 times smaller than that in the West Antarctic. However, the diversity of species seems to be similar to that in the West Antarctic. The further elaboration of digeneans will be much more difficult than that of acanthocephalans and cestodes, because some species are represented by only one to several specimens.

2.7 Seabird Observations Between South Africa and the Eastern Weddell Sea (C. Held, G. Chapelle, J. Vanaverbeke)

General

Apart from a short section treating the birds observed near the Antarctic shelf ice (5 February - 3 March 1996), this report concentrates on the pelagic bird species that occurred during the passages from Cape Town to Neumayer station (26 January - 4 February 1996) and back (4 - 15 March 1996). Truly coastal birds, restricted to the immediate vicinity of South African shores (cormorants, some gulls and terns) have been omitted for the sake of clarity.

The list of birds presented here is probably far from being comprehensive since (1) our observation time was limited due to other activities on board (especially on the way back), and (2) in some groups of bird species, an identification at sea is often next to impossible. Thus especially in large groups of seemingly conspecific birds, some members of rarer but otherwise similar species might well have escaped our attention.

Nevertheless, these data may still be of some value for their biogeographic and migrational significance, and as a reference for other birdwatchers on cruises to come.

Bird sightings during the passages

Species composition
A total of 39 positively identified species (see Table 27) was observed during the passages. The high number of Procellariiformes (Tubenoses, incl. Diomedeidae, Procellariidae, Oceanitidae, and Pelecanoididae) reflects the pelagic habitat.

It should be mentioned that the systematics of some groups are still subject to discussion. In case of doubt, we followed Harrison (1991), thus counting Broad-billed and Antarctic Prions as belonging to a single species.
Diving petrels could not be identified to species level at sea; two species (Common and Georgian) occur regularly in the area.

Tab. 27: Bird species observed between Cape Town and Neumayer station. In parentheses specimens which were identified with doubts, but which probably were not covered by other taxa (see also text).

Family	No. of species	Scientific name	Common name
Spheniscidae	3	*Aptenodytes forsteri*	*Emperor Penguin*
		Pygoscelis adeliae	*Adelie Penguin*
		Spheniscus demersus	*Jackass Penguin*
Diomedeidae	7	*Diomedea exulans*	*Wandering Albatross*
		Diomedea melanophris	*Black-browed Albatross*
		Diomedea cauta	*White-capped Albatross*
		Diomedea chlororhynchos	*Yellow-nosed Albatross*
		Diomedea chrysostoma	*Grey-headed Albatross*
		Phoebetria fusca	*Sooty Albatross*
		Phoebetria palpebrata	*Light-mantled Sooty Alb.*
Procellariidae	19	*Macronectes halli*	*Northern Giant Petrel*
		Macronectes giganteus	*Southern Giant Petrel*
		Fulmarus glacialoides	*Antarctic Fulmar*
		Thalassoica antarctica	*Antarctic Petrel*
		Daption capense	*Cape Pigeon*
		Pagodroma nivea	*Snow Petrel*
		Pterodroma macroptera	*Great-winged Petrel*
		Pterodroma lessonii	*White-headed Petrel*
		Pterodroma brevirostris	*Kerguelen Petrel*
		Pterodroma mollis	*Soft-plumaged Petrel*
		Halobaena caerulea	*Blue Petrel*
		Pachyptila vittata	*Broad-billed Prion*
		Pachyptila belcheri	*Fairy Prion*
		Procellaria aequinoctalis	*White-chinned Petrel*
		Calonectris diomedea	*Cory's Shearwater*
		Puffinus gravis	*Great Shearwater*
		Puffinus griseus	*Sooty Shearwater*
		Puffinus puffinus	*Manx Shearwater*
		Puffinus assimilis	*Little Shearwater*
Oceanitidae	4	*Oceanites oceanicus*	*Wilson's Storm Petrel*
		Fregetta tropica	*Black-bellied Storm Petrel*
		Fregetta grallaria	*White-bellied Storm Petrel*
		Oceanodroma leucorhoa	*Leach's Storm Petrel*
Pelecanoididae	(1sp)	*(Pelecanoides georgicus/urinatrix)*	*(Georgian/Common Diving-Petrel)*
Sulidae	1	*Sula capensis*	*Cape Gannet*
Stercorariidae	3 (+1sp)	*Catharacta maccormicki*	*South Polar Skua*
		Catharacta antarctica	*Antarctic Skua*
		(Stercorarius parasiticus/pomarinus)	*(Arctic/Pomarine Skua)*
		Stercorarius longicaudus	*Long-tailed Skua*
Laridae	2	*Larus sabini*	*Sabine's Gull*
		Sterna paradisea	*Arctic Tern*

Zonation of species relative to the Antarctic Convergence

Even though all birds in this section can be considered pelagic, they were not evenly distributed over the large area covered during the passages. Many species displayed preferences presumably influenced by many factors, such as temperature of air and water, food availability etc. The Antarctic Convergence has been taken into separate consideration because of its role as a genuine border between two ecosystems (Table 28).

Tab. 28: Occurrence of bird species relative to the Antarctic Convergence. Sightings of species that are remarkable in being either close to their known distribution range, or covering only a small part of the normal distribution range are marked with an asterisk (*). Rare species have been omitted.

North of convergence	both	South of convergence
Jackass Penguin	*Wandering Albatross*	*Emperor Penguin*
Black-browed Albatross	*Light-mantled Sooty Albatross*	*Adelie Penguin*
White-capped Albatross	*Grey-headed Albatross*	*Southern Giant Petrel*
Great-winged Petrel	*White-headed Petrel*	*Antarctic Fulmar* *
Cory's Shearwater	*Soft-plumaged Petrel*	*Antarctic Petrel*
Little Shearwater	*Antarctic Prion*	*Cape pigeon* *
White-bellied Storm Petrel	*White-chinned Petrel*	*Snow Petrel*
Leach's Storm Petrel	*Great Shearwater* *	*Kerguelen Petrel*
Sabine's Gull	*Sooty Shearwater*	*Blue Petrel* *
Cape Gannet	*Antarctic Skua*	*Wilson's Storm Petrel* *
		Black-bellied Storm Petrel *
		South Polar Skua
		Arctic Tern *

Change over time

Although some species did not show a marked preference for either region, a change over time (Jan/Feb vs. March) can be seen or at least be suspected.

With exception of the Arctic Tern, all Northern Hemisphere breeders (Cory's and Manx Shearwater, Leach's Storm Petrel, *Stercorarius* Skuas and Sabine's Gull) were observed only during the earlier passage (Jan/Feb).

The sightings of many species shifted to the North later in the Austral summer (Light-mantled Sooty Albatross, White-headed Petrel, Soft-plumaged Petrel, White-chinned Petrel), whereas only for the Snow Petrel the observed distribution range shifted further south.

The observed specimen density decreased in almost all species in March, although especially this second conclusion suffers from the lower observation frequency on the return to Cape Town. It should also be kept in mind, that the observation periods represent rather narrow time windows and that differences between them can indicate migrational movements. This is clearly the case in Arctic Tern, but this phenomenon may also be generated by the life history of many other species.

A common feature applying to almost all species except the winter breeders (Emperor Penguin, Great-winged and Grey Petrel) is that after the breeding season and fledging of the juveniles, the birds are not longer concentrated in the seas adjacent to their breeding colonies and disperse over larger areas, often combined with pronounced northward movements. This may account for the observed changes in distribution patterns and densities in many species.

Tab. 29: Bird species (and their frequency) encountered along the Antarctic coastal shelf between the 4/02 and 4/03/96.

Species	Number of days
Emperor Penguin	10
Adelie Penguin	11
Light-mantled Sooty Albatross	1
Southern Giant Petrel	11
Antarctic Petrel	19
Antarctic Fulmar	1
Snow Petrel	20
Wilson's Storm Petrel	10
South Polar Skua	10
Kelp Gull	1
Arctic Tern	5

Birds near the Antarctic shelf ice

The occurrence of 2 Kelp Gulls in Drescher Inlet (75°S) is particularly remarkable as these vagrants were observed 10° further south than their regular distribution range (65°S on the Antarctic Peninsula) (Table 29).

Comments on selected species

Some species have been surprisingly rare on this cruise or even missing. Both Atlantic Petrel, Grey Petrel and Thin-billed Prion lack positive sightings although they should occur in the area and are reported to follow ships. The rare species include Sooty Albatross, Northern Giant Petrel and Fairy Prion and the Yellow-nosed Albatross.

Prion species are especially prone to misidentification or being overlooked, when they pass the ship in large groups in their erratic flight, but also in other species the actual numbers might have been higher than those recorded.

Additional observations

Further observations and raw data are available on request from the first author.

References

Harrison, P.. 1991. Seabirds, an Identification Guide, 2nd ed. Christopher Helm, London.
Watson, 1975. Birds of the Antarctic and Sub-Antarctic, Ant. Res. Ser. 24: 350pp.

3. Annexes

3.1 Abbreviations of gears

AGT	Agassiz trawl
BO	Bongo net (plankton)
BPN	Benthopelagic trawl
CTD	CTDr with water bottles
D	Small dredge ("Rauschert' dredge")
EBS	Epibenthic sledge
FTS	Underwater camera
GKG	Large box corer 50 x 50 cm
GSN	Ground trawl
HN	Small hand net (plankton)
JIG	Jigging mashine (cephalopods)
M	Mooring
MG	Multibox corer (9 samples jointly; macrobenthos)
MUC	Multicorer (meiobenthos)
RG	Multiple box ("revolver") corer (5 individual samples; macrobenthos)
ROV	Remotely operated vehicle (underwater video)
T	Baited trap (amphipods, fish)

3.2 Station list

Station No.	Location	Date	Gear	Haul No.	Time Begin *	Time End *	Duration [min]	Position Begin* °S	min	°W	min	Position End * °S	min	°W	min	Depth [m] Begin *	Depth [m] End *	Wind	Comments	Failure
39/01	NE of KN	05.02.	GSN	1	11:22	11:48	26	71	3.10	11	25.50	71	2.10	11	19.30	462	481	SE 6	500 kg catch, clean	
39/02	NW of KN	"	M	1	16:54			71	19.29	12	24.68					277		SSW 5	Mooring	
"	"	"	CTD	1	17:25			71	19.90	12	25.00					258		SSW 5		
39/03	SW of KN	"	M	2	19:20			71	39.58	12	7.85					238		W 4		
"	"	"	CTD	2	20:24			71	40.20	12	8.30					351		W 4		
39/04	"	06.02.	M	3	7:41			71	40.10	12	29.90					417		NW 3		
"	"	"	CTD	3	0:844			71	40.50	12	31.60					431		NW 3		
39/05	"	"	M	4	10:27			71	40.22	12	45.56					222		SW 4		
"	"	"	T	1	11:45			71	40.19	12	45.35					223		WSW 4	Amphipod trap from board	
"	"	"	CTD	4	12:19			71	40.70	12	45.00					227		SW 4		
"	"	"	D	1	12:54	13:23	29	71	40.50	12	44.60	71	40.40	12	44.30	229		SW 4	Rauschert dredge	
"	"	"	ROV	1	14:46	15:51	65	71	40.60	12	45.00	71	40.03	12	42.41	226	226	SW 3	Remotely operated vehicle	
"	"	"	MG	1	16:14			71	40.03	12	42.41					246		SW 4	Multibox corer,9 successful cores	
"	"	"	MG	2	17:10			71	39.75	12	41.00					255		SW 4	Mud + stones, 6 s.c.	
"	"	"	HN	1	17:24	17:55	31	71	39.66	12	40.50	71	39.66	12	40.50	264	264	SW 4	Vertical plankton net	
"	"	"	EBS	1	19:29	19:39	10	71	40.49	12	41.70	71	40.87	12	43.26	254	239	SW 4	Epibenthic sledge	
"	"	07.02.	FTS	1	6:16	7:06	90	71	40.49	12	43.51	71	40.59	12	43.24	232	240	SW 3	Fotoschaukel	
"	"	"	GSN	2	8:31	8:47	16	71	41.10	12	44.30	71	41.70	12	46.90	227	232	SW 3	Huge sponge catch, 6 t	
"	"	"	T	1	10:43							71	40.14	12	44.91		226	SW 3	Amphipod trap on board	
39/06	W of KN	"	FTS	2	14:10	14:46	36	71	31.10	13	30.80	71	30.80	13	31.00	223	226	SW 4		
"	"	"	CTD	5	14:53			71	30.70	13	31.10					224		SW 3		
"	"	"	M	5	16:52			71	30.65	13	31.38					224		SSW 3		
"	"	"	D	2	17:20	17:25	5	71	30.80	13	31.48	71	30.80	13	31.44	300		SSW 3		
"	"	"	T	2	19:25			71	31.50	13	31.36					234		SSW 3	Amphipod trap from board	
"	"	"	HN	2	19:00	19:07	7	71	31.22	13	31.76					237	237	SSW 3	40 m	
"	"	"	MG	3	19:34			71	31.58	13	31.18					232		SSW 3	Stones	*
"	"	"	EBS	2	21:04	21:36	32	71	32.20	13	30.70	71	33.10	13	30.70	234	247	SSW 3		*
"	"	08.02.	ROV	2	6:42	6:57	15	71	32.04	13	31.74	71	32.22	13	32.25	244		WS 3		
"	"	"	RG	1	9:53	10:14		71	31.31	13	32.67					251		W 1	Revolvergreifer	*
"	"	"	RG	2	10:27	10:42		71	31.31	13	32.40	71	32.11	13	32.15	249		W 1	1 s. c.	(*)

* "Begin/End" in connection with trawled gear (AGT, GSN, D, EBS) means that net arrives at seafloor (winch stops)/operation starts again. For nets in the water column, "Begin/End" marks the time when the net is at the water surface before/after trawl.

Station No.	Location	Date	Gear	Haul No.	Time Begin *	Time End *	Duration [min]	Position Begin* °S	min	°W	min	Position End * °S	min	°W	min	Depth [m] Begin *	End *	Wind	Comments	Failure
"	"	"	AGT	1	11:21	11:36	15	71	31.80	13	34.50	71	31.86	13	35.50	254	261	W 1	Spicule mats, few lg. hexactin; many small demosp.	
"	"	"	CTD	6	13:00			71	27.00	13	43.20					213		W 2		
39/07	"	"	FTS	3	13:24	14:00	36	71	26.90	13	43.10	71	26.80	13	42.70	212	212	W 2		
"	"	"	D	3	14:30	14:45	15	71	26.70	13	42.70	71	26.60	13	42.40	213		W 2		
"	"	"	EBS	3	15:03	15:13	10	71	26.50	13	42.40	71	26.20	13	42.20	223	224	0		
"	"	"	HN	3	16:05	16:12	7	71	26.87	13	43.22					212	212	0	41 m	
"	"	"	RG	3	16:40			71	26.80	13	43.41					212		0	1 s. c.	(*)
"	"	"	RG	4	17:22			71	26.72	13	43.79					214		0	1 s. c.	(*)
"	"	"	ROV	3	18:06	20:15	129	71	26.68	13	43.72	71	26.80	13	44.00	214		0		
"	"	"	GKG	1	20:33			71	26.80	13	44.00					215		0	Großkastengreifer	
"	"	09.02.	JIG	1	0:00	1:10	110	71	37.20	14	1.20					266		SSW 3	Jigging mashine/no squid caught	*
"	"	"	CTD	7	6:12			71	26.50	13	42.50					219		S 2		(*)
39/08	NW of KN	"	CTD	8	11:00			71	19.80	12	22.70					167		SSW 2		
39/02**	"	"	** "39/08" was used erroneously on return to																	
"	"	"	AGT	2	11:52	12:06	14	71	18.70	12	17.10	71	18.45	12	16.30	170	174	SW 2	Few large hexactin., rich diverse fauna, few fish	
"	"	"	ROV	4	12:40	14:21	41	71	18.20	12	16.10	71	17.10	12	14.20	174	175	SSW 3		
"	"	"	MG	4	15:21		9	71	18.20	12	16.00					174		SW 2	Intact bryozoan debris mats, 1 s. c.	(*)
"	"	"	MG	5	16:06		6	71	18.20	12	16.20					172		SW 2	Stones + fine sediment, 2 s.c.	(*)
"	"	"	HN	4	16:33	16:41	8	71	18.10	12	16.30	71	18.10	12	16.30	169	168	SW2	70 m	
"	"	"	MG	6	17:04		7	71	18.10	12	16.30					169		SW 2	3 s. c.	(*)
"	"	"	D	4	17:52	17:57	5	71	17.95	12	16.30	71	17.94	12	16.50	170	172	SW 2		*
"	"	"	EBS	4	18:46	19:07	21	71	17.56	12	16.61	71	17.96	12	16.61	171	167	SW 2	Much macrofauna, sponges	(*)
"	"	"	GKG	2	20:08			71	17.15	12	15.30					172		W 3	Lots of compact mud	
"	"	"	FTS	4	21:00	21:42	42	71	16.80	12	15.10	71	16.70	12	15.20	171	172	W 3		
"	"	10.02.	JIG	2	1:10	2:57	107	71	32.10	12	28.20					598		SW 3	No squid caught	*
"	"	"	ROV	5	6:18	8:12	54	71	33.10	12	20.60	71	33.50	12	20.50	366	359	SW 2		(*)
39/09	W of KN	"	GSN	3	9:48	10:02	14	71	34.00	12	25.80	71	34.30	12	25.30	604	574	SW 2	Net badly torn. Stones, lot of silt in codend	(*)
"	"	"	CTD	9	13:13			71	33.90	12	26.20					592		SW 2		
"	"	"	FTS	5	14:00	15:09	69	71	34.00	12	26.10	71	34.10	12	26.10	590	607	SW 2		
"	"	"	HN	5	15:16	15:26	10	71	34.20	12	26.10	71	34.20	12	26.00	599	598	SSW 2	40 m	
"	"	"	MG	7	16:21			71	34.31	12	26.80					588		SSW 2	9 s. c.	
"	"	"	MG	8	17:34		37	71	34.50	12	26.00					574		SSW 2	Coarse sediment, 7 s. c.	
"	"	"	D	5	18:55	18:58	3	71	34.80	12	26.27	71	35.11	12	26.50	574	546	SSW 2		

Station No.	Location	Date	Gear	Haul No.	Time Begin *	Time End *	Duration [min]	Position Begin* °S	min	°W	min	Position End * °S	min	°W	min	Depth [m] Begin *	End *	Wind	Comments	Failure
39/06	"	"	T	2	21:51							71	31.40	13	31.60		236	NE 2	Amphipod trap on board	
"	"	11.02.	ROV	6	6:21	8:11	110	71	31.88	13	31.56	71	32.70	13	33.40	239	260	NE 5		
"	"	"	MG	9	9:15			71	31.90	13	30.90					234		NE 6	Ice berg track,7 s. c.	
"	"	"	MG	10	10:26			71	32.00	13	31.10					235		NE 6	Ice berg track, 8 s. c.	
"	"	"	MG	11	11:14			71	32.20	13	31.20					239		NE 6	Ice berg track, 5 s .c.	
"	"	"	MG	12	12:37			71	30.60	13	28.20					225		NE 6	Ice berg track, 9 s. c.	
"	"	"	AGT	3	14:54	15:09	15	71	27.40	13	43.30	71	27.30	13	44.40	212	215	NE 6	400 kg	
39/07	"	"	CTD	10	15:37			71	27.60	13	44.40					230		NE 6		
"	"	"	GKG	3	17:05			71	28.60	13	45.10					263		NE 6		
"	"	"	D	6	17:38	17:42	4	71	28.60	13	45.10					279	268	NE 6		
39/10	NW of KN	"	ROV	7	21:46	23:09	23	71	14.50	12	21.20	71	14.80	12	23.60	219	193	NE 6		
39/03	SW of KN	12.02.	CTD	11	8:39			71	37.60	12	9.70					171		NE 9		
"	"	"	GKG	4	9:55			71	38.10	12	9.10					235		NE 9-10	Spicule mats, live sponges	
"	"	"	GKG	5	11:27			71	38.60	12	9.80					171		NE 10	Spicule mats, live sponges	
"	"	"	GKG	6	12:51			71	38.70	12	10.70					268		NE 10		*
"	"	"	GKG	7	13:34			71	39.00	12	11.10					336		NE 10		*
"	"	"	GKG	8	14:14			71	38.80	12	9.70					185		NE 10		*
"	"	"	HN	6	14:40	14:49	9	71	38.80	12	9.50	71	38.70	12	9.70	172	168	NE 10	150 m	
"	"	"	MG	13	16:18			71	38.60	12	10.72					246		NE 8	Strong currents (20 m add. wire)	*
"	"	12.02.	MG	14	16:45			71	38.50	12	10.78					222		NE 8	Slope of depression, heavy currents+stones	*
39/11	Between	13.02.	GSN	4	14:42	14:57	15	73	22.60	21	10.60	73	23.00	21	12.90	338	333	NW 2-3	Soft bottom, very diverse catch, 300 kg	
"	Vestkapp	"	CTD	12	15:58			73	24.50	21	17.30					331		NW 3		
"	and Halley	"	HN	7	16:51	17:20	29	73	24.50	21	17.30	73	24.50	21	17.30	325	325	NW 3	300 m	
"	"	"	D	7	17:51	18:03	12	73	24.60	21	18.30	73	24.60	21	18.60	322	333	N 4		
39/12	"	"	GSN	5	19:21	19:36	15	73	18.10	21	10.10	73	17.70	21	8.20	459	457	N 4	250 kg. Gravel, "clean" catch, many shrimps	
"	"	"	T	3	20:31			73	15.70	21	4.83					791		NNE	Amphipod trap from board	
"	"	14.02.	JIG	3	0:15	1:35	80	73	20.20	21	20.00					463		NE 2	No squid caught	*
39/13	"	"	CTD	13	9:38			73	37.90	22	25.00					604		SE 2		
"	"	"	HN	8	10:40	11:01	21	73	37.80	22	24.60	73	37.90	22	24.30	601	597	SE 2	200 m	
"	"	"	D	8	11:29	11:42	13	73	37.90	22	14.20					594	585	SE 2		
"	"	"	GSN	6	13:09	13:24	15	73	36.30	22	19.00	73	36.00	22	16.60	620	640	0	300 kg. 2 Dissostichus, 2 Bathyraya, shrimps	
39/14	"	"	CTD	14	16:16			73	39.00	22	35.00					667				
"	"	"	GSN	7	18:00	18:15	15	73	36.10	22	35.70	73	35.30	22	35.20	850	889	SW 3	70 kg, many shrimps	

Station No.	Location	Date	Gear	Haul No.	Time Begin *	Time End *	Duration [min]	Position Begin* °S	min	°W	min	Position End * °S	min	°W	min	Depth [m] Begin *	Depth [m] End *	Wind	Comments	Failure
"	"	"	D	9	20:03	20:20	17	73	33.70	22	32.60	73	33.50	22	31.40	1049	1038	SW 3		
"	"	15.02.	JIG	4	1:40	3:15	95	73	23.80	21	34.40	73	24.90	21	38.10	697		SW 3	No squid caught	*
39/15	"	"	GSN	8	8:15	8:31	16	73	42.00	22	30.50	73	41.40	22	28.50	446	428	VAR. 1	400 kg, shrimps, rich fish fauna	
"	"	"	CTD	15	9:27			73	40.40	22	26.00					438		NEE 4		
"	"	"	HN	9	10:18	10:39	21	73	40.40	22	26.10	73	40.40	22	26.40	436	439	NEE 4	200 m	
"	"	"	D	10	11:28	11:45	17	73	40.60	22	27.00	73				441		NEE 4		
39/16	"	"	GSN	9	13:40	13:55	15	73	53.40	22	26.90	73	52.70	22	25.30	246	242	NE 4	>10 t, mostly sponges and synascidians	
"	"	"	CTD	16	14:53			73	51.50	22	24.20					252		E 3		
"	"	"	D	11	15:30	15:45	15	73	51.50	22	24.20	73	51.60	22	25.20	246	252	E 4		
39/17	"	16.02.	GSN	10	7:33	7:49	16	73	18.00	21	9.90	73	19.10	21	14.90	468	465	E 4	350 kg, many shrimps	
"	"	"	CTD	17	8:48			73	19.80	21	17.00					446		EzN 4		
"	"	"	D	12	9:50	10:04	14	73	19.80	21	16.90	73	19.90	21	16.90	447	441	EzN 4		
"	"	"	HN	10	10:38	10:45	7	73	19.80	21	16.40					443		E 4	200 m	
39/12	"	"	T	3	13:18							73	15.80	21	4.60	791		SE 3	Amphipod trap on board	
39/17	"	"	MG	15	14:38			73	19.50	21	16.10					450		SE 3	Very stony, 3 s. c.	(*)
"	"	"	MG	16	15:30			73	19.50	21	15.70					446		SE 3	Stony; 9 s. c.	
39/18	"	"	AGT	4 a)	17:35	18:05	30	73	15.40	21	27.60	73	15.90	21	29.00	1704	1760	SE 3	Net totally torn, stones	*
"	"	"	AGT	4 b)	20:35	20:59	24	73	16.70	21	25.50	73	16.10	21	24.70	1538	1543	SzE 3	3 large stones, many shrimps	
39/19	Drescher	17.02.	CTD	18	8:22			72	51.30	19	10.20					386		SzW 3/4		
"	Inlet	"	ROV	8	11:58	12:40	42	72	51.20	19	10.60	72	51.60	19	10.70	385	385	SSW 4	Under sea ice	
"	"	"	ROV	9	13:30	15:28	118	72	51.60	19	13.20	72	51.60	19	13.20	405	405	SW 4	Under ice shelf	
39/20	"	18.02.	CTD	19	6:05			72	51.23	19	11.87					386		NE 1		
"	"	"	BPN	1	7:35	8:15	40	72	50.50	19	26.00	72	49.90	19	37.10	428	807	NE 1	Trawled at 120 m. Only juv. fish	
"	"	"	HN	11	9:18	9:43	25	72	50.10	19	42.40	72	50.10	19	42.70	1486	1501	NE 3	200 m	
39/21	Between	"	CTD	20	13:43			73	20.00	21	4.70					350		EzS 4		
"	Vestkapp	"	BPN	2	14:47	15:18	31	73	22.90	21	10.00	73	25.20	21	15.20	283	321	EzS 4	Trawled at 150 m. Only juv. fish	
"	and Halley	"	BPN	3	17:45	18:28	43	73	26.50	21	10.50	73	23.80	21	1.20	253	248	E 4	Trawled at 210 m. Juv. fish, 2 squid, 3 fish	
39/22	"	"	MG	17	20:27			73	28.40	20	40.80					220		E 4	Stones, 9 s. c.	
"	"	"	GKG	9	22:11			73	29.10	20	36.80					237		EzS 4		
39/23	"	19.02.	ROV	10	15:28	18:17	169	71	57.60	15	50.40	71	57.80	15	51.00	351	348	S 4		
39/04	SW of KN	20.02.	T	4	6:18			71	40.62	12	31.01					421		WSW 2	From board	
"	"	"	AGT	5	7:12	7:33	21	71	41.60	12	29.40	71	42.00	12	29.00	440	449	WSW 2	Stones, net torn, small subsample	(*)
"	"	"	CTD	21	8:18			71	40.90	12	29.70					433		W 1		

Station No.	Location	Date	Gear	Haul No.	Time Begin *	Time End *	Duration [min]	Position Begin* °S	min	°W	min	Position End * °S	min	°W	min	Depth [m] Begin *	Depth [m] End *	Wind	Comments	Failure
"	"	"	HN	12	9:00	9:18	18	71	41.00	12	30.00	71	41.00	12	30.10	437	433	W 1	200 m	
"	"	"	MG	18	9:28			71	41.00	12	30.10					438		Var. 1	Stones, 1 s. c.	(*)
"	"	"	MG	19	10:17			71	41.20	12	30.60					436		Var. 1	1 s. c.	(*)
"	"	"	MG	20	10:54			71	41.20	12	30.80					438		WNW 2	9 s. c.	
"	"	"	GKG	10	12:57			71	41.50	12	31.70					436		W 2		
"	"	"	D	13	13:54	14:09	15	71	41.40	12	31.60	71	41.50	12	31.70	436	438	W 2		
39/05	"	"	MG	21	15:21			71	40.30	12	44.00					231		W 2	9 s.c.	
"	"	"	MG	22	16:07			71	40.70	12	45.60					224		W 2	1 s.c.	(*)
"	"	"	MG	23	17:07			71	40.10	12	47.20					216		WNW 2	35-40 cm cores, 9 s.c.	
"	"	"	MG	24	18:22			71	39.60	12	45.50					223		WNW 2	Stones, 4 s.c.	(*)
39/09	W of KN	"	GKG	11	21:09			71	33.20	12	26.50					628		NzE 2		
39/24	NE of KN	21.2.	ROV	11	6:27	9:21	174	71	6.90	11	30.30	71	8.00	11	34.50	133	151	ENE 7		
"	"	"	AGT	6	10:31	10:36	5	71	8.15	11	32.25	71	8.16	11	31.62	123	118	ENE 7	600 kg, large sponges	
"	"	"	ROV	12	11:17	13:53	156	71	7.30	11	26.80	71	7.60	11	29.50	171	112	ENE 8		
"	"	"	GKG	12	14:16			71	8.30	11	32.40					119		EzN 8	Sediment+some spicule mats	
"	"	"	GKG	13	14:56			71	8.20	11	32.30					119		EzN 8	Sediment+some spicule mats	
"	"	"	D	14	15:19	15:36	17	71	8.10	11	32.40	71	8.10	11	32.10	121	120	ENE 8		
"	"	"	MG	25	15:59			71	8.10	11	32.10					119		ENE 8	Sponge spicule mat, 4 s.c.	(*)
"	"	"	MG	26	16:30			71	8.10	11	31.90					118		ENE 8	Sponge spicule mat, 9 s.c.	
"	"	"	ROV	13	17:40	19:16	96	71	6.50	11	31.40	71	7.00	11	34.50	156	171	ENE 8		
"	"	"	BO	1	19:36	19:47	11	71	7.00	11	35.10	71	7.10	11	35.50	173	173	ENE 8	100 m	
"	"	"	CTD	22	20:12			71	8.10	11	31.60					119		ENE 8		
"	"	"	ROV	14	21:02			71	6.10	11	34.30	71	6.00	11	35.70	191	188	ENE 8		
"	"	"	CTD	23	23:32			71	5.30	11	26.70					431		ENE 8		
39/02	NW of KN	22.02.	MG	27	9:29			71	19.70	12	24.80					182		ENE 8	9 s.c.	
"	"	"	MG	28	10:22			71	19.10	12	22.80					159		ENE 7	9 s.c.	
"	"	"	BO	2	11:08	11:25	17	71	18.50	12	25.10	71	18.60	12	25.30	171	176	NEzE6/7	150 m	
"	"	"	MG	29	12:13			71	18.60	12	25.40					181		ENE 6	9 s. c.	
"	"	"	MG	30	13:07			71	19.20	12	27.00					253		ENE 6	Boulder in gear, 4 s.c.	(*)
"	"	"	M	1	14:07	17:30						71	21.90	12	29.10		178	ENE 6	On board	
"	"	"	D	15	19:01	19:14		71	24.30	12	30.90	71	24.50	12	31.10	426	448	NE 5		
39/25	NE of KN	23.02.	AGT	7	7:25	7:40	15	71	23.10	14	19.80	71	23.00	14	19.40	634	615	NE 6	15 kg, bryozoans and crinoids	
"	"	"	CTD	24	8:07			71	23.10	14	19.00					541		NEzE 6		

Station No.	Location	Date	Gear	Haul No.	Time Begin *	Time End *	Duration [min]	Position Begin* °S	min	°W	min	Position End * °S	min	°W	min	Depth [m] Begin *	Depth [m] End *	Wind	Comments	Failure
"	"	"	D	16	9:07	9:26	19	71	23.50	14	19.70	71	23.50	14	19.60	475	472	NEzE 6		
"	"	"	BO	3	10:01	10:14	13	71	23.70	14	20.20	71	23.70	14	20.50	476	492	EzN 5/6	200 m	
39/25	"	23.02.	D	17	10:40	11:17	37	71	23.20	14	20.00	71	23.20	14	19.80	633	621	EzN 5/6		*
"	"	"	D	18	12:00	12:37	37	71	23.20	14	20.00	71	23.10	14	20.60	662	730	EzN 5/6		*
"	"	"	GKG	14	13:14			71	23.10	14	19.70					621		ENE 6		
"	"	"	MG	31	14:27			71	23.10	14	19.70					628		ENE 6	Stones! 3 s.c.	(*)
"	"	"	MG	32	15:30			71	23.10	14	19.70					630		ENE 6		*
"	"	"	GKG	15	16:44			71	23.10	14	19.70					628		ENE 6/7	Stony	
"	"	"	EBS	5	17:44	17:52	8	71	23.10	14	19.70	71	23.00	14	19.50	621	617	ENE 6		
"	"	"	EBS	6	18:51	18:57	6	71	23.10	14	19.40	71	22.90	14	19.20	597	614	ENE 6/7		
"	"	"	AGT	8	19:56	20:26	30	71	22.90	14	19.20	71	22.80	14	18.50	622	636	ENE 6/7	Net torn by large stones, no fauna	*
"	"	"	D	19	19:56	20:26	30	71	22.90	14	19.20	71	22.88	14	18.50	622	636	ENE 6/7		
"	"	"	FTS	6	21:48	22:40	112	71	22.90	14	19.20	71	23.20	14	20.40	625	672	EzN 5/6		
39/26	W of KN	24.02.	ROV	15	6:07	7:43	96	71	31.80	14	12.00	71	32.50	14	13.50	228	220	ENE 4/5		
"	"	"	ROV	16	9:16	9:50	34	71	34.70	14	7.60	71	34.70	14	7.60	213	213	NEzE 5		
"	"	"	ROV	17	10:59	13:18	139	71	29.20	14	15.90	71	29.60	14	18.60	206	197	NEzE 6		
"	"	"	MG	33	14:29			71	29.20	14	16.90					218		NEzE 7	Ice berg/gravel; 6 s.c.	
"	"	"	MG	34	15:16			71	29.20	14	17.00					215		NEzE 7	Stones!!	*
"	"	"	D	20	17:07	17:23	16	71	29.30	14	18.60	71	29.20	14	18.40	216	222	NE 8		
"	"	"	D	21	17:59	18:14	15	71	29.30	14	19.50	71	29.30	14	19.60	210	214	NEzE 7		
"	"	"	ROV	18	18:46	20:31	105	71	28.70	14	18.10	71	29.70	14	19.70	228	196	ENE 7/8		
39/06	"	25.02.	CTD	25	8:16			71	31.50	13	37.90					283		ENE 8		
"	"	"	AGT	9	9:20	9:34	14	71	32.10	13	44.10	71	32.30	13	42.60	362	354	ENE 8	Mud and stones, ca. 100 kg fauna	
"	"	"	BO	4	10:40	10:53	13	71	32.70	13	43.90	71	32.90	13	44.30	372	386	ENE 6/7	200 m	
"	"	"	MG	35	11:36			71	31.70	13	38.20					279		ENE 6/7	Ice berg/fine sediment, 9 s.c.	
"	"	"	ROV	19	13:24	15:04	100	71	31.90	13	26.90	71	32.40	13	28.30	227	220	NE 6/7		
39/05	SW of KN	"	M	4	17:19							71	40.10	12	45.70		224	NE 6	On board	
39/04	"	"	M	3	18:18							71	40.30	12	30.30		416	NE 7	On board	
"	"	"	T	4	18:43							71	40.40	12	30.00		417	NE 7	On board	
39/03	"	"	M	2	19:51							71	39.60	12	7.80		253	NE 7	On board	
39/27	NW of KN	26.02.	ROV	20	0:20	2:00	100	71	20.50	12	23.90	71	21.30	12	26.00	185	210	NEzE 7		
39/28	W of KN	"	T	5	5:38			71	29.60	12	20.80					219		NE 10	From board	
39/03	"	"	GKG	16	7:34			71	39.30	12	5.10					209		NE 11		

Station No.	Location	Date	Gear	Haul No.	Time Begin *	Time End *	Duration [min]	Position Begin* °S	min	°W	min	Position End * °S	min	°W	min	Depth [m] Begin *	Depth [m] End *	Wind	Comments	Failure
39/09	"	"	AGT	10	9:59	10:08	9	71	34.70	12	26.60	71	34.80	12	25.90	560	571	NE 11	Many large stones, ca. 100 kg fauna	
"	"	"	D	22	9:59	10:08	9	71	34.70	12	26.60	71	34.80	12	25.90	560	571	NE 11		
"	"	"	CTD	26	10:56			71	35.40	12	24.60					494		NEzE 11		
"	"	"	AGT	11	13:40	13:50	10	71	32.60	12	26.30	71	32.40	12	26.10	570	554	NE 11	No subsample taken (same as AGT 10)	
39/29	"	28.02.	BPN	4	10:11	10:40	29	71	31.50	12	25.50	71	30.30	12	27.80	504	529	NEzE 9	Touched bottom; fish and inv., 1 big stone	
"	"	"	CTD	27	13:08			71	30.50	12	34.00					549		NEzE 9		
"	"	"	BO	5	13:48	14:02	14	71	30.50	12	34.20	71	30.60	12	34.30	549	548	NEzE 9	200 m	
39/06	"	"	M	5	16:48							71	30.60	13	31.10		228	NE 7	On board	
"	"	"	MG	36	18:35			71	31.90	13	31.30					241		NEzE 8	Ice berg; 006 E, 9 s.c.	
"	"	"	MG	37	19:22			71	31.90	13	31.20					238		NE 8	Ice berg; 006 W, 7 s.c.	
"	"	28.02.	MG	38	20:40			71	31.90	13	31.00					234		NEzE 8	Ice berg; 7 s.c.	
"	"	"	ROV	21	21:46	0:26	160	71	31.70	13	31.20	71	32.50	13	33.40	236	248	NEzE 7		
39/28	"	29.02.	T	5	7:25							71	29.60	12	21.20		234	NE 8	On board	
39/29	"	"	D	23	9:08	9:21	13	71	31.40	12	25.60	71	31.00	12	26.70	503	518	NE 8		*
"	"	"	GKG	17	10:27			71	30.70	12	26.40					494		NE 8		
39/30	N of Atka	01.03.	T	6	14:16			70	0.96	8	16.48					2009		EzS 6	From board	
"	"	"	AGT	12	16:02	16:34	32	70	5.30	8	20.00	70	5.30	8	21.80	2315	2334	ESE 6	No stones. Small catch; shrimps	
"	"	"	D	24	16:02	16:34	32	70	5.30	8	20.00	70	5.30	8	21.80	2315	2334	ESE 6		
"	"	"	CTD	28	17:51			70	5.20	8	21.80					2328		E 6/7		
"	"	"	RG	5	19:14			70	5.10	8	22.80					2326		E 6/7		
"	"	"	BO	6	21:19	22:00	41	70	5.20	8	22.60	70	5.30	8	22.40	2327	2336	E 7	200m	
39/31	NE of KN	02.03.	RG	6	10:38			70	30.80	10	45.10					1604		EzS 9/10		
"	"	"	D	25	13:37	13:47	10	70	32.60	10	55.80	70	33.00	11	1.40	1660	1641	EzS 9		*
"	"	"	RG	7	16:34			70	30.50	10	44.10					1583		ESE 10		
"	"	"	D	26	19:01	20:06	65	70	30.90	10	44.20	70	31.70	10	51.20	1586	1666	E 10		
39/32	NW of	03.03.	ROV	22	23:34	1:08	94	70	30.70	8	30.40	70	30.40	8	31.80	179	187	SW 4/5		
"	Atka	04.03.	ROV	23	1:44	4:02	138	70	31.90	8	29.60	70	30.40	8	31.80	157	157	SSE 5		
"	"	"	D	27	19:14	19:30	16	70	28.90	8	15.10	70	28.80	8	15.10	286	283	ESE 5		
"	"	"	BO	7	20:21	20:40	19	70	29.10	8	14.00	70	29.10	8	14.30	278	282	ESW 5	200m	
"	"	"	ROV	24	22:52	0:28	96	70	29.50	8	39.60	70	29.80	8	38.40	195	191	WSW 4/5		
"	"	05.03.	ROV	25	1:29	3:27	118	70	32.50	8	36.20	70	31.50	8	37.00	135	139	Uml./d 1		
39/30	N of Atka	"	T	6	5:48							70	9.60	8	16.40		1972	W 3	On board	
39/33	"	"	MG	39	17:24			68	34.90	4	52.70					3815		WSW 2/3		

3.3 AGT/GSN check aboard

Gerät:			GSN 1	GSN 2
Station:			001	005
Datum:			05.02.	07.02.
Gruppe:				
Porifera			+	++
Cnidaria	Hydroidea		-	-
	Actiniaria		-	-
	Gorgonaria		+	+
	Pennatularia		+	+
	Alcyonaria		0	0
	Scleractinia		-	-
Nemertini			-	-
Mollusca	Bivalvia		-	-
	Aplacophora		-	0
	Gastropoda	Prosobranchia	-	-
		Ophistobranchia	-	+
	Polyplacophora		-	-
	Cephalopoda / Octopoda		+	-
	Scaphopoda		0	-
Polychaeta	Sedentaria		-	+
	Errantia		+	+
Priapulida			-	0
Sipunculida			-	-
Echiurida			-	-
Crustacea	Cirripedia		-	0
	Amphipoda		+	-
	Isopoda		-	-
	Cumacea		-	0
	Mysidacea		-	0
	Decapoda	Natantia	++	-
		Reptantia	0	0
Pantopoda			+	+
Bryozoa			-	+
Brachiopoda			+	-
Pterobranchia			+	-
Echinodermata	Ophiuroidea		++	+
	Asteroidea		++	+
	Echinoidea		+	-
	Crinoidea		++	-
	Holothuroidea		+	+
Ascidiacea			-	+
Pisces			++	-

0 = absent - = scarce + = regular to fairly common ++ = very common, dominant

Gerät:			AGT 2	GSN 3	AGT 3
Station:			002	009	007
Datum:			09.02.	10.02.	11.02.
Gruppe:					
Porifera			++	-	++
Cnidaria	Hydroidea		-	-	-
	Actiniaria		-	+	-
	Gorgonaria		-	-	-
	Pennatularia		-	0	0
	Alcyonaria		0	0	0
	Scleractinia		0	0	0
Nemertini			-	-	-
Mollusca	Bivalvia		-	-	-
	Aplacophora		-	0	0
	Gastropoda	Prosobranchia	-	-	-
		Ophistobranchia	-	0	-
	Polyplacophora		-	0	-
	Cephalopoda / Octopoda		-	-	-
	Scaphopoda		0	-	-
Polychaeta	Sedentaria		-	+	+
	Errantia		-	-	-
Priapulida			0	-	0
Sipunculida			-	-	-
Echiurida			-	-	-
Crustacea	Cirripedia		-	0	0
	Amphipoda		++	-	-
	Isopoda		-	-	-
	Cumacea		-	-	-
	Mysidacea		-	-	-
	Decapoda	Natantia	-	-	-
		Reptantia	0	0	0
Pantopoda			-	-	-
Bryozoa			++	-	++
Brachiopoda			-	-	-
Pterobranchia			+	-	-
Echinodermata	Ophiuroidea		++	+	++
	Asteroidea		-	+	+
	Echinoidea		-	-	-
	Crinoidea		-	-	-
	Holothuroidea		-	+	-
Ascidiacea			++	+	+
Pisces			-	+	-

0 = absent - = scarce + = regular to fairly common ++ = very common, dominant

Gerät:			GSN 4	GSN 5	GSN 6
Station:			011	012	013
Datum:			13.02.	13.02.	14.02.
Gruppe:					
Porifera			++	++	+
Cnidaria	Hydroidea		-	-	-
	Actiniaria		-	-	-
	Gorgonaria		+	-	-
	Pennatularia		0	-	0
	Alcyonaria		-	-	-
	Scleractinia		-	-	-
Nemertini			-	-	-
Mollusca	Bivalvia		-	-	-
	Aplacophora		0	0	0
	Gastropoda	Prosobranchia	-	-	-
		Ophistobranchia	+	-	-
	Polyplacophora		-	-	-
	Cephalopoda / Octopoda		-	-	-
	Scaphopoda		0	0	0
Polychaeta	Sedentaria		+	-	-
	Errantia		-	-	+
Priapulida			0	0	0
Sipunculida			0	-	0
Echiurida			-	-	-
Crustacea	Cirripedia		-	-	-
	Amphipoda		+	+	-
	Isopoda		-	+	-
	Cumacea		0	0	0
	Mysidacea		-	+	-
	Decapoda	Natantia	+	++	++
		Reptantia	0	0	0
Pantopoda			+	-	-
Bryozoa			-	-	-
Brachiopoda			0	-	-
Pterobranchia			-	++	-
Echinodermata	Ophiuroidea		++	-	-
	Asteroidea		+	-	+
	Echinoidea		+	-	-
	Crinoidea		+	+	++
	Holothuroidea		+	+	+
Ascidiacea			+	+	+
Pisces			+	+	+

0 = absent - = scarce + = regular to fairly common ++ = very common, dominant

Gerät:			GSN 7	GSN 8	GSN 9
Station:			014	015	016
Datum:			14.02.	15.02.	15.02.
Gruppe:					
Porifera			-	+	++
Cnidaria	Hydroidea		0	-	-
	Actiniaria		-	-	-
	Gorgonaria		0	-	-
	Pennatularia		-	-	-
	Alcyonaria		-	0	0
	Scleractinia		0	-	-
Nemertini			0	-	-
Mollusca	Bivalvia		-	-	-
	Aplacophora		-	-	0
	Gastropoda	Prosobranchia	-	-	-
		Ophistobranchia	-	-	-
	Polyplacophora		-	-	-
	Cephalopoda / Octopoda		-	-	+
	Scaphopoda		0	0	0
Polychaeta	Sedentaria		-	-	-
	Errantia		+	++	+
Priapulida			0	0	0
Sipunculida			0	0	-
Echiurida			-	0	-
Crustacea	Cirripedia		-	0	0
	Amphipoda		-	-	-
	Isopoda		-	-	-
	Cumacea		0	0	0
	Mysidacea		-	-	-
	Decapoda	Natantia	++	++	-
		Reptantia	0	0	0
Pantopoda			-	-	-
Bryozoa			-	+	-
Brachiopoda			0	-	-
Pterobranchia			0	++	+
Echinodermata	Ophiuroidea		-	++	+
	Asteroidea		-	+	+
	Echinoidea		-	+	-
	Crinoidea		-	++	-
	Holothuroidea		+	+	+
Ascidiacea			-	+	++
Pisces			-	+	+

0 = absent - = scarce + = regular to fairly common ++ = very common, dominant

Gerät:			GSN 10	AGT 4 (a+b)	AGT 5
Station:			017	018	004
Datum:			16.02.	16.02.	20.02.
Gruppe:					
Porifera			++	-	+
Cnidaria	Hydroidea		-	o	+
	Actiniaria		-	-	-
	Gorgonaria		-	0	-
	Pennatularia		-	-	0
	Alcyonaria		0	0	0
	Scleractinia		-	-	0
Nemertini			-	0	-
Mollusca	Bivalvia		-	-	-
	Aplacophora		0	0	0
	Gastropoda	Prosobranchia	-	-	-
		Ophistobranchia	-	0	-
	Polyplacophora		-	0	0
	Cephalopoda / Octopoda		-	0	0
	Scaphopoda		0	0	0
Polychaeta	Sedentaria		-	-	-
	Errantia		+	0	-
Priapulida			0	0	0
Sipunculida			0	0	0
Echiurida			0	0	0
Crustacea	Cirripedia		0	0	0
	Amphipoda		+	-	0
	Isopoda		-	-	0
	Cumacea		0	0	0
	Mysidacea		-	-	-
	Decapoda	Natantia	++	++	0
		Reptantia	0	0	0
Pantopoda			-	-	-
Bryozoa			++	-	++
Brachiopoda			-	-	0
Pterobranchia			+	-	-
Echinodermata	Ophiuroidea		+	+	+
	Asteroidea		+	-	-
	Echinoidea		-	-	-
	Crinoidea		-	-	++
	Holothuroidea		-	+	+
Ascidiacea			+	+	-
Pisces			+	-	0

0 = absent   - = scarce   + = regular to fairly common   ++ = very common, dominant

Gerät:			AGT 6	AGT 7	AGT 8 No fauna
Station:			024	025	025
Datum:			21.02.	23.02.	23.02.
Gruppe:					
Porifera			++	+	
Cnidaria	Hydroidea		+	+	
	Actiniaria		-	-	
	Gorgonaria		-	-	
	Pennatularia		-	0	
	Alcyonaria		0	-	
	Scleractinia		0	0	
Nemertini			-	-	
Mollusca	Bivalvia		+	-	
	Aplacophora		0	-	
	Gastropoda	Prosobranchia	-	-	
		Ophistobranchia	-	-	
	Polyplacophora		-	0	
	Cephalopoda / Octopoda		0	0	
	Scaphopoda		0	0	
Polychaeta	Sedentaria		-	-	
	Errantia		-	-	
Priapulida			0	0	
Sipunculida			0	0	
Echiurida			0	0	
Crustacea	Cirripedia		0	-	
	Amphipoda		-	-	
	Isopoda		-	0	
	Cumacea		-	-	
	Mysidacea		0	-	
	Decapoda	Natantia	-	+	
		Reptantia	0	0	
Pantopoda			-	-	
Bryozoa			+	++	
Brachiopoda			-	-	
Pterobranchia			+	-	
Echinodermata	Ophiuroidea		-	-	
	Asteroidea		-	-	
	Echinoidea		-	-	
	Crinoidea		0	++	
	Holothuroidea		-	-	
Ascidiacea			-	+	
Pisces			-	-	

0 = absent - = scarce + = regular to fairly common ++ = very common, dominant

Gerät:			AGT 9	AGT 10	AGT 11 No subsa.
Station:			006	009	009
Datum:			25.02.	26.02.	26.2.
Gruppe:					
Porifera			+	-	
Cnidaria	Hydroidea		-	-	
	Actiniaria		-	-	
	Gorgonaria		-	-	
	Pennatularia		0	-	
	Alcyonaria		-	-	
	Scleractinia		0	-	
Nemertini			-	-	
Mollusca	Bivalvia		-	-	
	Aplacophora		-	0	
	Gastropoda	Prosobranchia	-	-	
		Ophistobranchia	-	0	
	Polyplacophora		0	0	
	Cephalopoda / Octopoda		-	-	
	Scaphopoda		-	-	
Polychaeta	Sedentaria		+	-	
	Errantia		-	-	
Priapulida			0	-	
Sipunculida			-	-	
Echiurida			0	-	
Crustacea	Cirripedia		0	0	
	Amphipoda		-	-	
	Isopoda		-	-	
	Cumacea		0	0	
	Mysidacea		-	-	
	Decapoda	Natantia	-	+	
		Reptantia	0	0	
Pantopoda			-	-	
Bryozoa			-	++	
Brachiopoda			-	-	
Pterobranchia			-	+	
Echinodermata	Ophiuroidea		-	-	
	Asteroidea		-	-	
	Echinoidea		-	-	
	Crinoidea		++	++	
	Holothuroidea		-	+	
Ascidiacea			+	-	
Pisces			-	-	

0 = absent - = scarce + = regular to fairly common ++ = very common, dominant

Gerät:			BPN 4 *	AGT 12
Station:			029	030
Datum:			28.02.	01.03.
Gruppe:				
Porifera			++	0
Cnidaria	Hydroidea		-	-
	Actiniaria		+	0
	Gorgonaria		+	0
	Pennatularia		-	0
	Alcyonaria		0	0
	Scleractinia		-	0
Nemertini			-	0
Mollusca	Bivalvia		-	0
	Aplacophora		0	0
	Gastropoda	Prosobranchia	-	0
		Ophistobranchia	-	0
	Polyplacophora		-	0
	Cephalopoda / Octopoda		+	0
	Scaphopoda		0	0
Polychaeta	Sedentaria		-	-
	Errantia		+	-
Priapulida			-	0
Sipunculida			-	0
Echiurida			-	0
Crustacea	Cirripedia		-	0
	Amphipoda		++	-
	Isopoda		-	-
	Cumacea		-	0
	Mysidacea		+	-
	Decapoda	Natantia	+	++
		Reptantia	0	0
Pantopoda			+	-
Bryozoa			++	-
Brachiopoda			-	0
Pterobranchia			-	0
Echinodermata	Ophiuroidea		+	-
	Asteroidea		-	-
	Echinoidea		-	-
	Crinoidea		+	-
	Holothuroidea		+	+
Ascidiacea			-	-
Pisces			++	-

0 = absent - = scarce + = regular to fairly common ++ = very common, dominant

* BPN 1-3, no benthic fauna

3.4 Preliminary list of amphipod species

	trawls	traps	dredge
ACANTHONOTOZOMELLIDAE (2)			
cf. *Acanthonotozomella* sp.	x		x
gen. sp. (D)			
AMPELISCIDAE (2+)			
Ampelisca richardsoni	x		x
Ampelisca sp. 1	x		x
Ampelisca sp. 2	x		
COROPHIIDAE (2)			
cf. *Haplocheira* sp. 1	x		x
gen. sp. 1	x		x
DEXAMINIDAE (2) -			
cf. *Lepechinella* sp. 1			
Polycheria antarctica (in sponges)	x		x
EPIMERIIDAE (10)			
Epimeria georgiana	x		x
Epimeria grandirostris	x		x
Epimeria cf. *Inermis* (rose yeux rouges)	x		
Epimeria macrodonta	x		x
Epimeria pulchra	x		x
Epimeria cf. *robusta* (porcellane)	x		
Epimeria rubrieques	x		x
Epimeria similis	x		x
Epimeriella "bicolor"			
Epimeriella cf. *walkeri*	x		x
EUSIRIDAE (14)			
Eusirus cf. *antarcticus* (=bariole ?)	x		x
Eusirus bouvieri (=blanc ?)	x	T4/X	x
Eusirus cf. *laticarpus*	x		
Eusirus microps			x
Eusirus perdentatus (spotted+normal)	x		x
Eusirus propeperdentatus			
Eusirus n. sp.	x		
cf. *Liouvillea* sp. 1	x		x
cf. *Liouvillea* sp. 2	x		
Rhachotropis antarctica	x		x
Rhachotropis cf. *kergueleni*			x
gen. sp. 1			x
gen. sp. 2			x
gen. sp. 3			x
gen. sp. 4			x
GAMMARIDA (Ceradocus group) (2)			
Paraceradocus sp. 1 (a bandes blanches)	x		x
Paraceradocus sp. 2 (caramel)			

	trawls	traps	dredge
IPHIMEDIIDAE (14)			
Echiniphimedia hodgsoni	x		x
Echiniphimedia sp. 1	x		x
Gnathiphimedia mandibularis	x		x
Gnathiphimedia sp. 1 (nacre)	x		
Gnathiphimedia sp. 2 (PT faecal pellets)	x		
Gnathiphimedia sp. 3 (point rouge, bande blanche)			x
Iphimediella octodentata (or *rigida*)	x		x
Iphimediella sp. 1 (pink)	x		
Maxillimedia "brown"	x		
gen. sp. 1	x		x
gen. sp. 2	x		
gen. sp. 3	x		
gen. sp. 4	x		
gen. sp. 5		T6	
ISCHYROCERIDAE (3)			
cf. *Jassa* sp. 1 (grey-brown)	x		x
cf. *Jassa* sp. 2	x		x
gen. sp. 1 (dos joune)	x		x
LEUCOTHOIDAE (1)			
Leucothoe cf. *spinicarpa*	x		x
LILJEBORGIIDAE			
Liljeborgia sp. 1	x		x
Liljeborgia sp. 2	x		x
Liljeborgia sp. 3 (PT)	x		x
LYSIANASSIDAE (37)			
Abyssorchomene nodimanus	x	12/T4	x
Abyssorchomene rossi	x	T4	x
cf. *Abyssorchomene deep sea*		T6	
Lyso sp. 7		T6	
Ambasiopsis sp. 1 (a oeil rose)	x		
Aristias cf. *antarcticus*	x		x
Euony n. sp.		T3	
Eurythenes gryllus		T3/T6	
cf. *Hippomedon deep sea*		T6	
Hirondellea cf. *antarctica*	x	T1/T3	x
Lepidepecreum sp. 1	x		x
Orchomenella cf. *acanthura*			x
Orchomenella cf. *cavimanus*			x
Orchomenella cf. *rotundifrons*	x		
Orchomenella "orange" cf. *pinquides*		T2	
Orchomenella "o oeil noir"	x	T2	
Orchomenella "a oeil roux"		13/T4	
Orchomenella cf. *orchomeny*			
Orchomenella "pink"	x	T2	
Orchomenella (PT)		T3	

	trawls	traps	dredge
Pachynid sp. 1	x		
Parschisturella cf. *carinata*		T2/T3/T4	
Pseudorchomene cf. *coatsi*		T4	x
Shackletonia robusta	x		x
Tryphosella sp. 1 (cf. *murrayi*)	x	T1/T2/T4	x
Tryphosella sp. 2 (cf. *Uristes stebbingi*)	x	T2	
Tryphosella sp. 3	x	T2/13	
Tryphosella sp. 4 (cf. *bidentata*)	x	T2	
Tryphosella sp. 5		T3	
Tryphosella sp. 6			
Tryphosella sp.	x	T2	x
Tryphosella "a oeil rose" (GT/TM)	x	T4	
Tryphosella "Pseudorchomene like"		T3	
Tryphosella "aurosomite 1 rect"		T3	
Waldeckia obesa	x	T1/T3/T4	x
cf. *Uristes* "latimanus" n. sp.		T3	
Lysianassidae gen. sp. 1 (a grds yeux noirs)	x		x
Lysianassidae gen. sp. 2 (blanc, long Up 3)		T2	
Lysianassidae gen. sp. 6		T4	
Lysianassidae gen. sp. 8		T6	
Lysianassidae gen. sp. 9		T6	
MELPHIDIPPIDAE (3)			
cf. *Melphidippa* sp. 1	x		x
cf. *Melphidippa* sp. 2	x		
cf. *Melphidippa* sp. 3	x		
OEDICEROTIDAE (5)			
Oediceroides cf. *calmani*	x		x
Oediceroides sp. 2	x		x
Oediceroides sp. n. "toucanoides"	x		
gen. sp. 1	x		x
gen. sp. 2	x		x
PHOXOCEPHALIDAE (3)			
gen. sp. 1	x		x
gen. sp. 2	x		x
gen. sp. 3	x		x
PODOCERIDAE (1)			
gen. sp. 1	x		x
SEBIDAE (1)			
Seba sp.			x
gen. sp. 1 (in sponges)	x		
STEGOCEPHALIDAE (4)			
gen. sp. 1	x		x
gen. sp. 2	x		x
gen. sp. 3		T6	
gen. sp. 4		T6	

	trawls	traps	dredge
STENOTHOIDAE (5)			
Metopoides heterostylis			x
Thaumatelson herdmani			x
gen. sp. 1			x
gen. sp. 2			x
gen. sp. 3 n. sp.			x
gen. sp. 4 n. sp.			x
gen. sp. 5 n. sp.			x
STILIPEDIDAE (3)			
gen. sp. 1	x		
gen. sp. 2	x		
gen. sp. 3	x		
total gammaridea: 118 spp.			
CAPRELLIDAE (1+)			
gen. sp. 1			x
(gen. sp. 2 ?)			x
HYPERIDEA (3)			
gen. sp. 1 juv ?			
gen. sp. 3			
total amphipods: 122 spp.			

3.5 Qualitative meiofauna sampling

Qualitative meiofauna sampling for taxonomic and population ecology purposes (from a total of 8 different gears/ 12 stations/ 49 gear drops)

Station	Date	Gear	Depth (m)
39/001	05/02	GSN	462-481
39/005	06/02	MG	255
39/005	06/02	EBS	254-239
39/005	07/02	GSN	227-232
39/006	07/02	EBS	234-247
39/007	08/02	D	213
39/007	08/02	EBS	223-224
39/007	08/02	GKG	215
39/008	09/02	D	170-172
39/008	09/02	EBS	171-167
39/009	10/02	D	574-546
39/007	11/02	GKG	263
39/007	11/02	D	279-268
39/003	12/02	GKG	171
39/011	13/02	D	322-333
39/013	14/02	HN	601-597
39/013	14/02	D	594
39/015	15/02	D	441
39/016	15/02	D	246-252
39/017	16/02	GSN	468-465
39/017	16/02	MG	450
39/004	20/02	D	436-438
39/004	20/02	GKG	436
39/024	21/02	GKG	119
39/024	21/02	BO	173
39/002	22/02	BO	171-176
39/002	22/02	D	426-448
39/025	23/02	BO	476-492
39/025	23/02	GKG	628
39/025	23/02	EBS	621-617
39/025	23/02	EBS	597-614
39/026	24/02	D	216-222
39/026	24/02	D	210-214
39/006	25/02	BO	372-386
39/009	26/02	AGT	560-571
39/009	26/02	D	560-571
39/029	28/02	BO	549-548
39/006	28/02	MG	238
39/006	28/02	MG	234
39/029	29/02	GKG	494
39/030	01/03	AGT	2315-2334
39/030	01/03	D	2315-2334
39/030	01/03	RG	2326
39/030	01/03	BO	2327-2336
39/031	02/03	D	1660-1641
39/031	02/03	RG	1583
39/031	02/03	D	1586-1666
39/032	04/03	D	286-283
39/032	04/03	BO	278-282

3.6 Bryozoa, additional information

Tab. 3.6-1 Zoogeographic remarks and reproductive status of the bryozoans from the EASIZ cruise, and abundance in samples from the area NE of Kapp Norvegia. W, previously reported from the Weddell Sea; R, rare species previously cited once or few times for the whole Antarctic; N, probably new species for the Antarctic fauna; O, ovicells; E, embryos. Numbers, from 1-5, roughly refer to the natural logarithm of the number of fragments sorted in each sample; numbers followed by a + sign refer to the abundance of dead colonies.

			DATE	05/2	09/2	09/2	21/2	20/2	01/3	04/3
			STATION	001	002	002	024	024	030	032
			GEAR	BT	AGT	EBS	AGT	MBC	AGT	MRS
	B	**R**	DEPTH	470	170	170	120	223	2300	289
CHEILOSTOMATA	W									
Brettiopsis triplex (Hastings)										1
Carbasea curva (Kluge)					2		2			
Carbasea ovoidea Busk										
Klugeflustra antarctica (Hastings)		E								
Klugeflustra drygalskii (Kluge)										
Klugeflustra vanhoffeni (Kluge)		O			2	1				
Isosecuriflustra angusta (Kluge)										1
Isosecuriflustra tenuis (Kluge)		E			1		3			
Isosecuriflustra thysanica (Moyano)	R					1	4			1
Austroflustra vulgaris (Kluge)					1					
Nematoflustra flagellata (Waters)					2	2	3			
Ellisina antarctica (Hastings)				1	1		1			
Ellisina constantia (Kluge)							1			
Amphiblestrum inermis (Kluge)		E					1			
Amphiblestrum rossi Hayward and Thorpe		E								
Crassimarginatella inconstantia (Kluge)										
Crassimarginatella perlucida (Kluge)	R	O								
Chaperiopsis protecta (Waters)		O								
Chaperiopsis quadrispinosa (Kluge)	R	O								
Camptoplites areolatus (Kluge)	R									
Camptoplites bicornis (Busk)										1
Camptoplites giganteus (Kluge)		O								
Camptoplites latus (Kluge)		E								
Camptoplites lewaldi (Kluge)					2		2			1
Camptoplites retiformis Hastings		O					1			
Camptoplites tricornis (Waters)					1		1			1
Cornucopina pectogemma (Goldstein)		E								
Cornucopina polymorpha (Kluge)		E					3	1		1
Himantozoum antarcticum (Calvet)		O			1		1			
Klugella echinata (Kluge)		E								

Caberea darwinii Busk				1					
Amastigia gaussi (Kluge)									1
Amastigia solida (Kluge)	R	O							
Notoplites antarcticus (Waters)				1					
Notoplites drygalskii (Kluge)		E							
Notoplites tenuis (Kluge)									1
Notoplites vanhoffeni (Kluge)				1					
Notoplites n.sp. R-11	N	E							
Beania erecta Waters				1	1	1			1
Micropora brevissima Waters					1				1
Micropora sp. R-8	N	O							
Apiophragma hyalina (Waters)	R								
Chondriovelum adeliense (Livingstone)			2	2	4				
Cellaria aurorae Livingstone				3	1			1+	
Cellaria diversa Livingstone		O		1		1			
Cellaria incula Hayward and Ryland	W								
Cellaria moniliorata Rogick		E		1	1	1			
Paracellaria wandeli (Calvet)				3	4	1			1+
Swanomia membranacea (Thornely)		O			1	2+			
Swanomia belgica Hayward and Ryland	W							1+	
Swanomia brevimandibulata (Moyano)									
Melicerita flabellifera Hayward and Winston	R	O		1		1			
Melicerita obliqua (Thornely)			1	2	1				
Aspidostoma coronatum (Thornely)									
Larvapora mawsoni (Livingstone)		O			2				
Dendroperistomata projecta (Waters)	W		1	1		1			
Filaguria spatulata (Calvet)				1					
Arachnopusia avicularia Hayward and Thorpe		E							1
Arachnopusia gigantea (Kluge)		O				1			
Arachnopusia latiavicularis Moyano		E				3			
Arachnopusia sp. R-14	N	O							
Trilaminopora trinervis (Waters)	W	O			1	2			
Astochoporella cassidula Hayward and Thorpe		E							
Exochella hymanae (Rogick)		O				1			
Exochella rogickae Hayward	W, R	O				2			
Escharella watersi Hayward and Thorpe		E			1	1			
Escharella sp. R-2	N	O		1		3			
Escharoides praestita (Waters)	W	E		2	1	1			
Romancheina barica (Rogick)						2			

Antarcticaetos bubeccata (Rogick)		O		1				1
Lageneschara lyrulata (Calvet)	W	E			3	2		1
Polirhabdotos inclusum (Waters)				1	2	1		
Celarinella foveolata Waters			1	2	2		1+	1
Cellarinella laytoni Rogick				2				1+
Cellarinella njegovanae Rogick				2		2,10+	1+	
Cellarinella nodulata Waters				3		2,8+		1
Cellarinella nutti Rogick		O	2		1	1	1+	1
Cellarinella rogickae Moyano						2,7+		
Cellarinella watersi Calvet		E		3				
Cellarinelloides crassus Moyano								1
Cellarinelloides sp. R-48	N	O						
Systenopora contracta Waters				3	3	2		1
Celleporella alia Hayward						1		
Eminnoecia carsonae (Rogick)		O				3		
Isoschizoporella tricuspis (Calvet)		O		1	2			
Isoschizoporella secunda Hayward and Taylor		O			1			
Isoschizoporella similis Hayward and Taylor	R							
Isoschizoporella virgula Hayward and Taylor		O						
Dakariella dabrowni (Rogick)								
Dakariella sp. p-14	N	E						
Toretocheilum turbinatum Hayward						1		
Kymella polaris (Waters)		O	3					
Buffonellodes antarctica Hayward		E	1		1	1+		
Lacerna watersi Hayward and Thorpe		E		1	1	1		1
Smittina alticollarita Rogick		E						
Smittina anecdota Hayward and Thorpe	W	E						
Smittina antarctica (Waters)		E		2				
Smittina excertaviculata Rogick		O		1	1	1		
Smittina rogickae Hayward and Taylor	W	E			1	1		
Smittina "globosa" R-21	N	E					2	
Smittoidea albula Hayward and Taylor		E	1					
Smittoidea malleata Hayward and Thorpe		E				5		
Smittoidea ornatipectoralis Rogick		O						
Thrypticocirrus contortuplicata						1		
Thrypticocirrus phylactelloides (Calvet)		E	4					
Thrypticocirrus rogickae Hayward and Thorpe						1		
Pemmatoporella marginata (Calvet)		E				1		

Pemmatoporella sp.p.14	N	E				5		
Bostrychopora dentata (Waters)		E						
Rhamphosmittina bassleri (Rogick)			1			2		
Microporella stenoporta Hayward and Taylor		O						
Fenestrulina cervicornis Hayward and Ryland	R			1	2			
Fenestrulina parvipora (Waters)							2	
Fenestrulina proxima (Waters)								1
Adelascopora secunda Hayward and Thorpe								
Osthimosia bicornis (Busk)		O			1			
Osthimosia notialis Hayward		O						
Osthimosia rudicula Hayward	R	O		1				
Spigaleos horneroides (Waters)	R							1
Reteporella antarctica (Waters)		E			2			2
Reteporella erugata Hayward			2					1
Reteporella frigida (Waters)		E				4		
Reteporella gelida (Waters)		E	3					3
Reteporella hippocrepis (Waters)		E	1			1		1
Reteporella lepralioides (Waters)	R	E	1					
Reteporella longichila Hayward	R	O	1					1
Reteporella parva Hayward	R	O						
Reteporella R-6 saturninoi(=R-34)	N	O						
Reteporella sp. R-12	N	O						
Reteporella sp R-23	N	E						
Reteporella sp. R-30	N	O				1		
Reteporella sp. R-41	N	E						
Orthoporidra compacta (Waters)		O	1	2	3	1+		1
Orthoporidra brachyrhyncha Moyano	R							
Smittina sp.5		E						
Osthimosia p.6		E	1					
Fenestrulina alcicornis ?		O		1				
Microporella sp. (stenoporta ?) R-7		O				2		
Toretocheilum absidatum ? R-13								
Aimulosia antarctica (?) R-18		E					2	
Smittoidea conspicua (?) R-19		O						
Osthimosia sp. R-24								
Isosecuriflustra thysanica? R-26								
Cellaria diversa ? R-27								
Fenestrulina sp. R-31		O						
Reteporella gelida (?) R-38								
Reteporella gelida (?) R-39		O						
Escharella sp. R-40		O				4		
Lacerna eatoni ? R-46		O						

Fenestrulina sp. 3 spines R-47								
Ellisina R-50							2	
Chaperiopsis sp. R-57		O					1	
INCERTA SAEDIS								
Blue uniseriate Anasca R-25								
Crassimarginatella ? "spinossisima"	N	O						
Schizoporelloide-gimnocistidea? R-9	N	E						
Lacerna sp.p-8	N		1					
Buffonellodes sp. R-17	N	O						
R-20 (*Chiton gut content*)	N							
Exochella sp. 22	N							
Buffonellaria (?) sp.R-33	N							
Smittinidae sp. 43	N	E						
Smittinidae R-44	N	O						
Escharella (?) R-52	N	O					2	
Buffonellodes (?) R-53	N						1	
Escharella (?) sp. R-55	N	O					1+	
CYCLOSTOMATA								
Hornera cf. lichenoides			3	4		3		1
Hornera sp (small species)						1		1
Idmidronea cf. coerulea				5	4			2
Frondipora--Mecynoecia-like			2	1	2			2
Idmidronea ? (small species) R-28		O						
Hornera (small species) R-29		O						
Enthalophoroecia-like								3
Crisia sp.? R-62		O						1
Plagioecia-like sp. R-32								
Branched Idmidronea-like								
Tubulipora like R-36								
Diaperoecia-like								
Lichenopora-like		O						
Tubulipora plumosa-like R-62		O						1
CTENOSTOMATA								
Kinetoskias-like (with spines)			1					
Branched Alcyonidium R-3				1				
Alcyonidium "latifolium"						2		
Kinetoskias (?) sp.			2	2	2			1

Tab. 3.6-2 Bryozoan abundance in the region off Kapp Norvegia. Numbers, from 1-5, 'roughly refer to the natural logarithm of the number of fragments sorted in each sample; numbers followed by a + sign refer to the abundance of dead colonies.

DATE	20/2	06/2	07/2	08/2	25/2	11/2	08/2	26/2	10/2	23/2	28/2
STATION	004	005	006	006	006	006	007	009	009	025	029
GEAR	AGT8	EBS	EBS	AGT	AGT9	AGT3	EBS	AGT10	BT3	AGT	BPT
DEPTH	445	250	240	250	350	210	220	570	600	625	520
CHEILOSTOMATA											
Carbasea curva (Kluge)	2			4	3	1	2	4		3	4
Carbasea ovoidea Busk										4	
Klugeflustra vanhoffeni (Kluge)	1	1				1		1		1	
Isosecuriflustra angusta (Kluge)	2		3	1	1	3	2	3		2	4
Isosecuriflustra tenuis (Kluge)					2		1	5		3	2
Isosecuriflustra thysanica (Moyano)											1
Austroflustra vulgaris (Kluge)								1			1
Nematoflustra flagellata (Waters)	3		2	1	2	3		4		3	4
Ellisina antarctica (Hastings)							1			2	1
Ellisina constantia (Kluge)										1	
Amphiblestrum rossi Hayward and Thorpe										1	
Crassimarginatella inconstantia (Kluge)										1	
Crassimarginatella perlucida (Kluge)				1		1					
Chaperiopsis protecta (Waters)		1									
Chaperiopsis quadrispinosa (Kluge)		1									
Camptoplites latus (Kluge)	1				1			2			
Camptoplites lewaldi (Kluge)	1										1
Camptoplites retiformis Hastings				1						2	
Camptoplites tricornis (Waters)		1									
Cornucopina pectogemma (Goldst.)										1	
Cornucopina polymorpha (Kluge)								2			1
Himantozoum antarcticum (Calvet)	2					1	1	4			3
Klugella echinata (Kluge)	4							4			4
Caberea darwinii Busk	2	2	1			1	3				
Amastigia solida (Kluge)						1	1				
Notoplites drygalskii (Kluge)	2			1	1		1	3		1	2
Notoplites vanhoffeni (Kluge)						1					
Beania erecta Waters		1									1
Micropora brevissima Waters		1						3		3	3
Chondriovelum adeliense (Livingst.)				4		2	4				
Cellaria aurorae Livingstone	1	2	1			4	4			1	1
Cellaria diversa Livingstone					1	2					2
Cellaria incula Hayward and Ryland										4	

DATE	20/2	06/2	07/2	08/2	25/2	11/2	08/2	26/2	10/2	23/2	28/2
STATION	004	005	006	006	006	006	007	009	009	025	029
GEAR	AGT8	EBS	EBS	AGT	AGT9	AGT3	EBS	AGT10	BT3	AGT	BPT
DEPTH	445	250	240	250	350	210	220	570	600	625	520
Cellaria moniliorata Rogick	1			1	1	1	1				
Paracellaria wandeli (Calvet)		4	2	3		4	2			1	
Swanomia membranacea (Thornely)	1	1		1	1	1					3
Swanomia belgica Hayward and Ryland	1				1			1		1	1
Swanomia brevimandibulata Moyano										1	
Melicerita flabellifera Hayward and Winston					1						
Melicerita obliqua (Thornely)		2		3	1	1	3			2	1
Aspidostoma coronatum (Thornely)										1	
Larvapora mawsoni (Livingstone)	1	2		2		3	4				
Dendroperistomata projecta (Waters)		1		1		1	1			1	1
Arachnopusia avicularia Hayward and Thorpe		1	1	1		1	1	1		1+	1
Arachnopusia gigantea (Kluge)						1					
Arachnopusia latiavicularis Moyano	1			1	1	1					
Arachnopusia sp. R-14										1	
Trilaminopora trinervis (Waters)		1			1+		1			1	1
Astochoporella cassidula Hayward and Thorpe	1						1				
Exochella hymanae (Rogick)										1+	
Exochella rogickae Hayward						1				1	
Escharella watersi Hayward and Thorpe	1	1		1	1	1	1			1	1
Escharoides praestita (Waters)						1					
Romancheina barica (Rogick)					1						
Antarcticaetos bubeccata (Rogick)	3										
Lageneschara lyrulata (Calvet)	2	3	2	2	2	4	2	2			2
Cellarinella njegovanae Rogick	3	1		1	2	1	2	3		1	2
Cellarinella nodulata Waters	4		2	2	3	4	4	2		1+	3
Cellarinella nutti Rogick	2	3		2	3	1	2	5		1	3
Cellarinella rogickae Moyano					3			3		5	1
Cellarinelloides crassus Moyano	1				1			4			3
Cellarinelloides sp. R-48											2
Systenopora contracta Waters	1+	4		2	1	2	2	1		1	1
Eminnoecia carsonae (Rogick)					1+						
Kymella polaris (Waters)	2	4		2		3		3			5
Buffonellodes antarctica Hayward						1					
Lacerna watersi Hayward and Thorpe		1		1		2	1				1
Smittina alticollarita Rogick										1	

DATE	20/2	06/2	07/2	08/2	25/2	11/2	08/2	26/2	10/2	23/2	28/2
STATION	004	005	006	006	006	006	007	009	009	025	029
GEAR	AGT8	EBS	EBS	AGT	AGT9	AGT3	EBS	AGT10	BT3	AGT	BPT
DEPTH	445	250	240	250	350	210	220	570	600	625	520
Smittina anecdota Hayward and Thorpe				1							
Smittina antarctica (Waters)				2	2	3	2	4		1	2
Smittina excertaviculata Rogick						1					
Smittina rogickae Hayw. and Taylor		1		1			1				
Smittoidea albula Hayw. and Taylor								1			
Smittoidea malleata Hayward and Thorpe	1	4				3	3	1			
Thrypticocirrus phylactelloides Calvet				2	3	3	2	4		3	2
Thrypticocirrus rogickae Hayward and Thorpe	1+			1	1	1	2	1		1	
Pemmatoporella marginata (Calvet)		3			1					2	
Pemmatoporella sp.p.14					3	1				1	
Bostrychopora dentata (Waters)		4	2	5	3	3	2				1
Rhamphosmittina bassleri (Rogick)						1	1	4			
Microporella stenoporta Hayward and Taylor								3			
Adelascopora secunda Hayward and Thorpe	2									1	
Reteporella antarctica (Waters)				3		1	4	1			
Reteporella frigida (Waters)	1							1			
Reteporella gelida (Waters)	2				1			1		5	2
Reteporella hippocrepis (Waters)	1				2	1	1	4		1	1
Reteporella lepralioides (Waters)							1			3	
Reteporella longichila Hayward	1+				2					1	
Reteporella parva Hayward							1				
Reteporella R-6 saturninoi(=R-34)						3					
Reteporella sp. R-30	1				1						
Reteporella sp. R-41										4	
Orthoporidra compacta (Waters)		1		1	1		2			2+	
Orthoporidra brachyrhyncha Moyano				1							
Isosecuriflustra thysanica? R-26	1										
Reteporella gelida (?) R-38					1						
Reteporella gelida (?) R-39								3			
Lacerna eatoni ? R-46								2			
Fenestrulina sp. 3 spines R-47										1	
INCERTA SAEDIS											
Buffonellodes sp. R-17										1	
Buffonellaria (?) sp.R-33										1	

DATE	20/2	06/2	07/2	08/2	25/2	11/2	08/2	26/2	10/2	23/2	28/2
STATION	004	005	006	006	006	006	007	009	009	025	029
GEAR	AGT8	EBS	EBS	AGT	AGT9	AGT3	EBS	AGT10	BT3	AGT	BPT
DEPTH	445	250	240	250	350	210	220	570	600	625	520
Smittinidae sp. 43										2	
Smittinidae R-44								3			
CYCLOSTOMATA											
Hornera cf. lichenoides			1	4	3	5	5	2			2
Hornera sp (small species)				1			1	2		2	1
Idmidronea cf. coerulea	1		1	5	3	5	3				
Frondipora--Mecynoecia-like	1	5		2	4	2	3	3	2		3
Hornera (small species) R-29	2										
Enthalophoroecia-like	2										
Alcyonidium "latifolium"	3				3			4		2	4
Kinetoskias (?) sp.				2							

Tab. 3.6-3 Bryozoan abundance in the region off Vestkapp. Numbers, from 1-5, roughly refer to the natural logarithm of the number of fragments sorted in each sample; numbers followed by a + sign refer to the abundance of dead colonies.

DATE	13/2	13/2	14/02	14/02	15/2	15/02	16/02	16/02
STATION	011	012	013	014	015	016	017	018
GEAR	BT	BT	BT	BT	BT	BT	BT	AGT
DEPTH	330	460	630	870	435	245	465	1500
CHEILOSTOMATA								
Brettiopsis triplex (Hastings)								
Carbasea curva (Kluge)		2	1		2	1		
Carbasea ovoidea Busk								
Klugeflustra antarctica (Hastings)						1		
Klugeflustra vanhoffeni (Kluge)								
Isosecuriflustra angusta (Kluge)		5				2		
Isosecuriflustra tenuis (Kluge)								
Isosecuriflustra thysanica (Moyano)								
Austroflustra vulgaris (Kluge)								
Nematoflustra flagellata (Waters)		2	2	3	2	4		
Ellisina antarctica (Hastings)								1
Ellisina constantia (Kluge)								
Amphiblestrum inermis (Kluge)		1						
Amphiblestrum rossi Hayward and Thorpe								
Crassimarginatella inconstantia (Kluge)								
Crassimarginatella perlucida (Kluge)								
Chaperiopsis protecta (Waters)								
Chaperiopsis quadrispinosa (Kluge)								
Camptoplites areolatus (Kluge)		1						
Camptoplites bicornis (Busk)								
Camptoplites giganteus (Kluge)						1		
Camptoplites latus (Kluge)	1							
Camptoplites lewaldi (Kluge)			1					
Camptoplites retiformis Hastings								
Camptoplites tricornis (Waters)						2		
Cornucopina pectogemma (Goldstein)								
Cornucopina polymorpha (Kluge)								
Himantozoum antarcticum (Calvet)						1		
Klugella echinata (Kluge)		1	1					
Caberea darwinii Busk					2			
Amastigia gaussi (Kluge)								
Amastigia solida (Kluge)		1						
Notoplites antarcticus (Waters)								

DATE	13/2	13/2	14/02	14/02	15/2	15/02	16/02	16/02
STATION	011	012	013	014	015	016	017	018
GEAR	BT	BT	BT	BT	BT	BT	BT	AGT
DEPTH	330	460	630	870	435	245	465	1500
Notoplites drygalskii (Kluge)		2				1		
Notoplites tenuis (Kluge)								
Notoplites vanhoffeni (Kluge)								
Notoplites n.sp. R-11								1
Beania erecta Waters								1
Micropora brevissima Waters		1			1			
Micropora sp. R-8								
Apiophragma hyalina (Waters)								1
Chondriovelum adeliense (Livingstone)								
Cellaria aurorae Livingstone					1			
Cellaria diversa Livingstone								
Cellaria incula Hayward and Ryland		3						
Cellaria moniliorata Rogick		1			1	1		
Paracellaria wandeli (Calvet)		1			5	1		
Swanomia membranacea (Thornely)	1							
Swanomia belgica Hayward and Ryland	1							
Swanomia brevimandibulata (Moyano)								
Melicerita flabellifera Hayward and Winston								
Melicerita obliqua (Thornely)					1			
Aspidostoma coronatum (Thornely)								
Larvapora mawsoni (Livingstone)		3			2			
Dendroperistomata projecta (Waters)		1	1					
Filaguria spatulata (Calvet)								
Arachnopusia avicularia Hayward and Thorpe		1	1			1		
Arachnopusia gigantea (Kluge)								
Arachnopusia latiavicularis Moyano	1				1			
Arachnopusia sp. R-14							1	2
Trilaminopora trinervis (Waters)		1				1		
Astochoporella cassidula Hayward and Thorpe		1						
Exochella hymanae (Rogick)								
Exochella rogickae Hayward								1
Escharella watersi Hayward and Thorpe								
Escharella sp. R-2								
Escharoides praestita (Waters)								
Romancheina barica (Rogick)					2			

DATE	13/2	13/2	14/02	14/02	15/2	15/02	16/02	16/02
STATION	011	012	013	014	015	016	017	018
GEAR	BT	BT	BT	BT	BT	BT	BT	AGT
DEPTH	330	460	630	870	435	245	465	1500
Celarinella foveolata Waters	4	1	3+			2		
Cellarinella laytoni Rogick								
Cellarinella njegovanae Rogick	1							
Cellarinella nodulata Waters		1						
Cellarinella nutti Rogick	2+	1			2			
Cellarinella rogickae Moyano						3		
Cellarinella watersi Calvet						1		
Cellarinelloides crassus Moyano	4							
Cellarinelloides sp. R-48								
Systenopora contracta Waters			1+					
Celleporella alia Hayward								
Eminnoecia carsonae (Rogick)								
Isoschizoporella tricuspis (Calvet)	1	1	1			2		
Isoschizoporella secunda Hayward and Taylor								
Toretocheilum turbinatum Hayward								
Kymella polaris (Waters)		2	1					
Buffonellodes antarctica Hayward								
Lacerna watersi Hayward and Thorpe								
Smittina alticollarita Rogick								
Smittina anecdota Hayward and Thorpe								
Smittina antarctica (Waters)	1	2	1		5			
Smittina excertaviculata Rogick					1			
Smittina rogickae Hayward and Taylor								
Smittina "globosa" R-21								2
Smittoidea albula Hayward and Taylor								
Smittoidea malleata Hayward and Thorpe		1			3			
Thrypticocirrus contortuplicata					1			
Thrypticocirrus phylactelloides (Calvet)	5	2	3,2+	1+				
Thrypticocirrus rogickae Hayward and Thorpe		1						
Pemmatoporella marginata (Calvet)	4	1						
Pemmatoporella sp.p.14								
Bostrychopora dentata (Waters)					3			
Rhamphosmittina bassleri (Rogick)	3							
Microporella stenoporta Hayward and Taylor								
Fenestrulina cervicornis Hayward and Ryland								

DATE	13/2	13/2	14/02	14/02	15/2	15/02	16/02	16/02
STATION	011	012	013	014	015	016	017	018
GEAR	BT	BT	BT	BT	BT	BT	BT	AGT
DEPTH	330	460	630	870	435	245	465	1500
Osthimosia notialis Hayward								
Osthimosia rudicula Hayward								
Spigaleos horneroides (Waters)								1
Reteporella antarctica (Waters)								
Reteporella erugata Hayward				1+				
Reteporella frigida (Waters)		2						
Reteporella gelida (Waters)		4		1+		2		
Reteporella hippocrepis (Waters)		1						
Reteporella lepralioides (Waters)								
Reteporella longichila Hayward								
Reteporella parva Hayward								
Reteporella R-6 saturninoi(=R-34)								
Reteporella sp. R-12				1+		1		1
Reteporella sp R-23						1		
Reteporella sp. R-30								
Reteporella sp. R-41								
Orthoporidra compacta (Waters)	1					3		
Orthoporidra brachyrhyncha Moyano								
Osthimosia p.6								
Fenestrulina alcicornis ?								
Microporella sp. (stenoporta ?) R-7		1						
Toretocheilum absidatum ? R-13								1
Aimulosia antarctica (?) R-18								1
Smittoidea conspicua (?) R-19								2
Osthimosia sp. R-24	1							
Isosecuriflustra thysanica? R-26						1		
Cellaria diversa ? R-27						1		
Fenestrulina sp. R-31							1	
Reteporella gelida (?) R-38								
Reteporella gelida (?) R-39								
Escharella sp. R-40								
Lacerna eatoni ? R-46								
Fenestrulina sp. 3 spines R-47								
Ellisina R-50								
Chaperiopsis sp. R-57								

DATE	13/2	13/2	14/02	14/02	15/2	15/02	16/02	16/02
STATION	011	012	013	014	015	016	017	018
GEAR	BT	BT	BT	BT	BT	BT	BT	AGT
DEPTH	330	460	630	870	435	245	465	1500
Crassimarginatella ? "spinossisima"								
Schizoporelloide-gimnocistidea? R-9								1
Lacerna sp.p-8								
Buffonellodes sp. R-17								1
R-20 (Chiton gut content)								
Exochella sp. 22								1
Buffonellaria (?) sp.R-33								
Smittinidae sp. 43								
Smittinidae R-44								
Escharella (?) R-52								
Buffonellodes (?) R-53								
Escharella (?) sp. R-55								
CYCLOSTOMATA								
Hornera cf. lichenoides		3	4	2	4			
Hornera sp (small species)			1		1			
Idmidronea cf. coerulea			1		3			
Frondipora--Mecynoecia-like		3	1+		4			
Idmidronea ? (small species) R-28						1		
Hornera (small species) R-29						1		
Enthalophoroecia-like						1		
Crisia sp.? R-62						1		
Diaperoecia-like								
Lichenopora-like								
Tubulipora plumosa-like R-62								
CTENOSTOMATA								
Kinetoskias-like (with spines)								
Branched Alcyonidium R-3								
Alcyonidium "latifolium"								
Kinetoskias (?) sp.		2						

3.7 Participants

EASIZ ***Participants***

Allcock, Louise	ULML	UK
Alvà, Víctor	ICM	E
Arntz, Wolf	AWI	D
Balguerías, Eduardo	COC	E
Barthel, Dagmar	IFM	D
Beyer, Kerstin	AWI	D
Brey, Thomas	AWI	D
Buchner, Tanja	AWI	D
Buschmann, Alexander	AWI	D
Chapelle, Gauthier	IRSNB	B
Dahm, Corinna	AWI	D
Dahms, Hans-Uwe	UOB	D
De Broyer, Claude	IRSNB	B
van Dijk, Peter	AWI	NL
Dimmler, Werner	T & S	D
Frey, Norbert	AWI	D
Gambi, Maria Cristina	SZI	I
Gatti, Susanne	IFM	D
Gerdes, Dieter	AWI	D
Grünwald, Tanja	AWI	D
Gutt, Julian	AWI	D
Held, Christoph	UBB	D
Krey, Sonja	UKK/IPÖ	D
Lee, Hee Joong	UGZ	KOR
Morales-Nin, Beatriz	IEAB	E
Niederjasper, Fred	AWI	D
Orejas, Covadonga	ICM	E
Palm, Harry	IFM	D
Rauschert, Martin	AWI	D
Schickan, Thomas	AWI	D
Sirenko, Boris	ZISP	UKR
Smirnov, Igor	ZISP	RUS
Steimer, Silke	IFM	D
Tendal, Ole Secher	ZM	DK
Vanaverbeke, Jan	UOB	B
Vanhove, Sandra	UGZ	B
Zabala, Mikel	UBE	E
Zdzitowiecki, Krzysztof	IPW	P
Zielinski, Susanne	AWI	D

Helicopter Crew, Meteorologists:

Dinkeldein, Wolfgang	HELI	D
Lahrmann, Uwe	HELI	D
Lundström, Volker	HELI	D
Schreiber, Detlev	HELI	D
Sonnabend, Hartmut	DWD	D
Strüfing, Reinhard	DWD	D

To and from Neumayer:

Heinze, Ottmar		D
Hoge, Ulrich		D
König-Langlo, Gert		D
Krüger, Wolfgang		D
Malitz, Gerhard		D
Miller, Georg		D
Minikin, Andrea		D
Müller, Norbert		D
Nolting, Michael		D
Tibcken, Michael		D
Trefzer, Ulrich		D
Weynand, Markus		D
Wohltmann, Holger		D

3.8 Ship's Crew:

Greve, Ernst-Peter	Master	D
Pahl, Uwe	1. Offc.	D
Rodewald, Martin	1. Offc.	D
Knoop, Detlef	Ch.Eng.	D
Grundmann, Uwe	2. Offc.	D
Spielke, Steffen	2. Offc.	D
Schuster, Friedrich	Doctor	D
Hecht, Andreas	R. Offc.	D
Koch, Georg	R. Offc.	D
Erreth Monostory, Gy	1. Eng.	D
Ziemann, Olaf	2. Eng.	D
Fleischer, Martin	2. Eng.	D
Lembke, Udo	Electron.	D
Muhle, Helmut G.	Electron.	D
Muhle, Heiko	Electron.	D
Greitemann-Hackl, A.	Electron.	D
Roschinsky, Jörg	Electron.	D
Dimmler, Werner	Electron.	D
Clasen, Burkhard	Boatsw.	D
Reise, Lutz	Carpenter	D
Winkler, Michael	A. B.	D
Bindernagel, Knuth	A. B.	D
Pousada Martinez, Sat	A. B.	E
Gil Iglesias, Luis	A. B.	E
Kreis, Reinhard	A. B.	D
Schultz, Ottomar	A. B.	D
Burzan, Gerd-Ekkeh.	A. B.	D
Pulss, Horst	A. B.	D
Müller, Klaus W. H.	Storek.	D
Ipsen, Michael	Mot-man	D
Husung, Udo Chr.M.	Mot-man	D
Hartmann, Ernst-Uwe	Mot-man	D
Grafe, Jens	Mot-man	D
Preußner, Jörg	Mot-man	D
Haubold, Wolfgang	Cook	D
Tupy, Mario	Cooksmate	D
Völske, Thomas G.H.	Cooksmate	D
Jürgens, Monika	1. Stwdess	D
Dähn, Ulrike	Stwdss/Kr	D
Czyborra, Bärbel	2. Stwdss	D
Deuß, Stefanie	2. Stwdss	D
Tu, Jian-Min	2. Steward	China
Neves, Alexandre	2. Steward	PL
Wu, Chi Lung	2. Steward	D
Yu, Chung-Leung	Laundrym.	China

3.9 Participating Institutions

AWI	Alfred-Wegener-Institut für Polar- und Meeresforschung Postfach 12 01 61 27525 Bremerhaven GERMANY
COC	Instituto Español de Oceanografía Centro Oceanográfico de Canarias Carretera San Andrés S/N 38120 Santa Cruz de Tenerife SPAIN
DWD	Deutscher Wetterdienst Seewetteramt Bernhard-Nocht-Straße 76 20359 Hamburg Germany
HELI	Helicopter-Service Wasserthal Kätnerweg 43 22393 Hamburg GERMANY
ICM	Institut de Ciències del Mar Passeig Joan de Borbó s/n 08039 Barcelona SPAIN
IEAB	Institut Estudis Avançats Illes Balears Campus Universitario 07071 Palma de Mallorca SPAIN
IFM	Institut für Meereskunde an der Universität Kiel Düsternbrooker Weg 20 24105 Kiel GERMANY
IPÖ	Institut für Polarökologie der Universität Kiel Wischhofstraße 1 - 3 Geb. 12 24148 Kiel GERMANY
IPW	Institute for Parasitology Polish Academy of Sciences Ul. Pasteura 3 Postbox 153 00-973 Warszawa POLAND

IRSNB	Institut Royal des Sciences Naturelles de Belgique Rue Vautier, 29 1040 Bruxelles BELGIUM
SZI	Stazione Zoologica "Anton Dohrn" Villa Comunale 80121 Napoli ITALY
T & S	Transport und Service GmbH & Co. Geo-Plate-Straße 1 27578 Bremerhaven GERMANY
UBB	Universität Bielefeld Fakultät für Biologie Abt. Morphologie der Tiere Morgenbreede 45 (Geb. Verhaltensforschung) 33615 Bielefeld GERMANY
UBE	Universitat de Barcelona Departament d'Ecologia Avgda. DIAGONAL 645 08028 Barcelona SPAIN
UGZ	University of Gent Institute of Zoology Marine Biology Section K.L. Ledeganckstraat 35 9000 Gent BELGIUM
UKK	Klinik für Allgemeine Pädiatrie Universitäts-Kinderklinik Molekularbiolog. Labor Schwanenweg 20 24105 Kiel GERMANY
ULML	University of Liverpool British Antarctic Survey Port Erin Marine Laboratory Port Erin, Isle of Man IM9 6JA UNITED KINGDOM
UOB	Universität Oldenburg Fachbereich Biologie FB 7 26111 Oldenburg GERMANY

ZISP	Zoological Institute Russian Academy of Sciences Universitetskaya Emb. 1 St. Petersburg 199034 RUSSIA
ZM	Zoologisk Museum Universitetsparken 15 2100 Copenhagen DENMARK