Expedition ANTARKTIS XIX/5 (LAMPOS) of RV „Polarstern" in 2002

Edited by Wolf E. Arntz and Thomas Brey
with contributions of the participants

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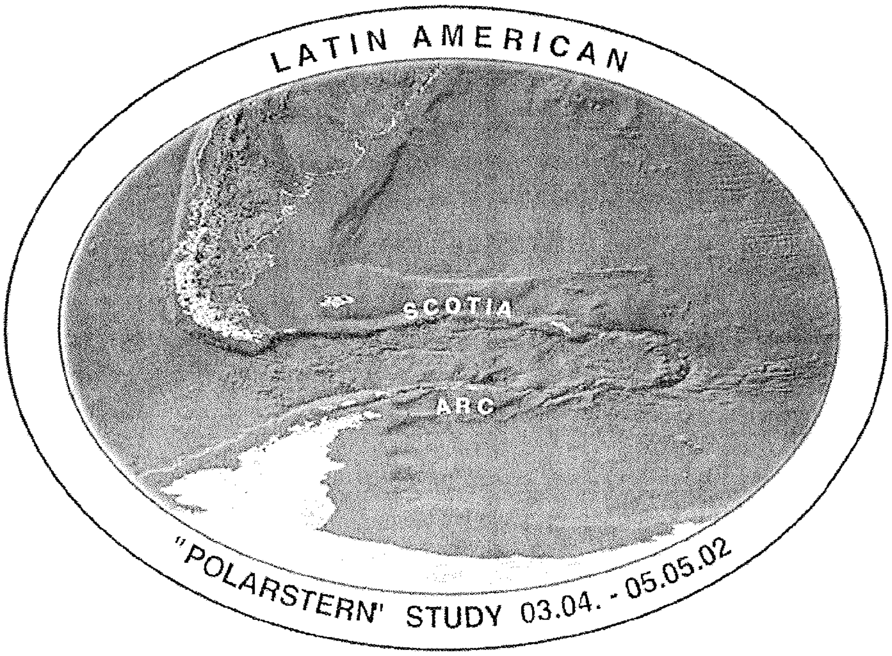
LATIN AMERICAN
SCOTIA
ARC
"POLARSTERN' STUDY 03.04. - 05.05.02

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1. Introduction

1.1 Objectives of the Cruise (W.E. Arntz)

Special relationships exist between the waters around the southern part of South America, the Magellan Province, and the waters around the Subantarctic islands and the Antarctic continent. They have their origin in the common past of these regions as part of the Gondwana continent and in their close vicinity up to the present day as compared to the distances between Antarctica and the other surrounding continents. Both factors, as well as the actual isolation of Antarctica by deep water and the current system, and periods of interchange, radiation and extinction in the past, are reflected in the present-day marine biota on either side of the Drake Passage. This context represents a singular case of ecosystem change and evolution on our planet, and a great challenge to research.

LAMPOS – Latin American „Polarstern" Study" – was planned, in a way, as a successor of EPOS, the European „Polarstern" Study which in 1988/89 assembled many European polar scientists in an effort to study Antarctic ecosystems. This time the challenge was principally addressed to Latin scientists and to Europeans who have demonstrated a particular interest in Latin American cooperation. Obviously LAMPOS had to be a more modest approach as compared to EPOS due to only one month of available ship time. LAMPOS also continued the scientific line followed, in a much wider latitudinal frame, during the EASIZ cruises of „Polarstern", the „Victor Hensen" Campaign in 1994 and various expeditions of the Spanish RV „Hespérides", the Italian RV „Italica", and the Chilean vessel „Vidal Gormaz".

The LAMPOS cruise was planned to study biogeographic and evolutionary links between the Magellan region (South America) and the Antarctic continent. For this purpose, work focussed on the benthic fauna, and „Polarstern" followed the Scotia Arc, concentrating biological sampling on depths between 200 and 600 m. The idea was to study the Magellan and Antarctic influence on faunal dispersal in the northern and southern chain of islands and shallows within the Arc, and thus explore potential pathways of recolonisation of the Antarctic shelf after climate-induced extinctions. LAMPOS is therefore complementary to the ANDEEP cruises, which were intended to investigate recolonisation via the deep sea.

The principal subjects of research during this expedition included the study of

- biogeographic and evolutionary links
- biodiversity
- structural properties of benthic and fish communities
- pelago-benthic coupling
- ecological and physiological adaptations of benthic invertebrates and fish.

Research to be addressed included, above all, the following questions:

- *Is the Scotia Arc a transitory area between the Magellan and the Antarctic regions?*
- *Are changes – e.g., diversity clines - gradual, or are there breaks? Do patterns found along either side of South America continue into the Antarctic, or vice versa?*
- *Do the various islands and shallows serve as footsteps supporting faunal distribution?If so, does this work only in a W-E direction, i.e. following the Circumpolar Current?*
- *Do species composition and larval occurrence on the northern branch of the Scotia Arc rather resemble conditions in the Magellan region, and are these patterns more similar to Antarctic conditions on the southern branch, as would be expected from the current pattern? Do the South Sandwich Islands present a N-S connection?*
- *Are species distribution patterns found helpful in explaining the (non)existence of certain taxa on the Antarctic side? What does this mean for evolution?*
- *How do (mega-, macro-, meio-) benthic and fish communities along the Scotia Arc compare with those in the high Antarctic Weddell Sea, around the Antarctic Peninsula, and in the Magellan region?*
- *To what extent do topographic patterns at the seafloor influence community structure and diversity?*
- *What is the role of the Polar Front for benthic distribution, structure, diversity, and for pelago-benthic coupling?*
- *What are the reproductive, population dynamic, or physiological properties of the fauna in the Scotia Arc in autumn? In which way do these characteristics reflect latitudinal gradients?*

Biological work was to concentrate on few stations along the Scotia Arc where the whole range of coring, trawling and visual equipment was to be employed, supported by CTD, plankton nets and baited traps. At a number of additional stations, only Agassiz trawls were to be taken to provide more material for answering biogeographic and biodiversity issues. Hydrosweep was to be used to better recognize small-scale topographic patterns at the seafloor and avoid losses of gear. A specific Russian programme using hydrosweep addressed larger topographic features in the Scotia Arc to disclose the way this bridge of islands and shallow water originated in the past. Logistic tasks included removal of samples and gear from the Dallmann laboratory (Jubany station, King George Island).

1.2 **Summary Review of Results** (W.E. Arntz)

General aspects

The LAMPOS expedition was planned as a complementary cruise adding to the knowledge gained during various former expeditions to the high Antarctic Weddell Sea, the Antarctic Peninsula, and the Magellan region. While these former cruises, as did also LAMPOS, concentrated on the shelf and upper slope, the recent ANDEEP cruises focussed on the deep sea. The idea behind these expeditions, all of which were predominantly benthic with support from physical and chemical oceanography as well as plankton research, is a coverage of the Atlantic sector of the Southern Ocean in the Antarctic, Subantarctic and Magellan biogeographic provinces, with the goal of comparing biogeographic and depth distribution of species, biodiversity, community structure, pelagobenthic coupling, physiological and ethological adaptations, reproductive and trophic characteristics, and other life cycle traits along the latitudinal gradient. In this context the LAMPOS results represent keystones in the overall Antarctic-Magellan puzzle, which may be particularly important due to the characteristics of the Scotia Arc as a transitory area between the two regions.

Environmental conditions and limitations

This expedition, contrary to the preceding EASIZ cruises which continued a well-established approach in the high Weddell Sea and the Antarctic Peninsula region, both areas being fairly well known from former "Polarstern" work, touched unknown territory. Ideally, it would have been much longer to allow for stratified sampling at all locations and a more complete faunal inventory. During the cruise, it became obvious that topographic and substrate variability in the Scotia Arc are even higher than in the Antarctic and Magellan regions studied so far, making direct comparisons between stations difficult and regular sampling, particularly by corers, often impossible.

Sediment conditions appeared to have a key influence on taxonomic composition. This caused problems above all on the poorly colonized volcanic bottoms covered with pumice, lava or ashes, and the barren clean-washed surfaces of some of the banks exposed to strong currents. Soft shelf bottoms with a sufficiently thick silt layer to host a typical endofauna seemed to be very scarce and may be restricted to a limited number of depressions in the area whose efficiency as footsteps may largely depend on the species' larval or drifting capabilities, and less on Antarctic or Magellan conditions to the south or north of the Polar Front.

The Antarctic Convergence is a broad belt, which on the LAMPOS and previous ANDEEP cruises was meandering between 54 and 56°S, thus largely separating South Georgia and the South Sandwich Island chain, although the southern part of the former and the northern part of the latter may be situated - at least at times - within the Polar Front. The temperature gradient in the Polar Front seemed to be less distinct at the seafloor than in surface waters. Clear temperature clines existed between South American inland seas (Straits of Magellan, Beagle) and Burdwood Bank (about 1.5 °C) as well as between South Georgia and the Sandwich Islands (about 2 °C). From this island group temperatures declined by only 1 °C along the Southern branch of the Scotia Arc to the South Orkneys, where the coolest temperatures were found with about –1 °C.

It may turn out difficult to separate the effects of substrate, currents and temperature on the basis of relatively few stations from a rather narrow depth zone as was sampled during this cruise. Moreover, as most conclusions related to biogeography and biodiversity will be based on careful identification of species in the home laboratories, DNA analyses for phylogeny, etc., results at this time have to be considered rather preliminary. With this in mind, we might arrive at the following tentative conclusions:

Biogeographic patterns, distributional aspects

Our basic hypothesis that the northern branch of the Scotia Arc should belong to the Magellan, and the southern branch to the Antarctic region seems to hold true in principle, however this separation is not obligatory for each individual taxon. The clearest case may be drifting algae, which were encountered in dense assemblages drifting east from Tierra del Fuego. They would definitely be worth a specific study next time, also because they might carry a lot of associated fauna. Some fauna known hitherto exclusively for Antarctic waters was found north of the Antarctic Convergence, and some species considered exclusively Magellan were collected south of it. An explanation may be that the exact location of the Convergence is subject to changes, and a species that got settled may survive as an adult under suboptimal conditions if the Polar Front undergoes another shift. It remains doubtful to what extent the South Sandwich Islands, due to their north-south extension, may function as a bridge between the two regions. Shallow water around these volcano peaks is extremely restricted, and most of the shallow bottoms are covered by rather inhospitable substrates such as lava and pumice much of which may be very young. Shallow-water, soft-bottom endofauna may encounter particular difficulties in changing from one region to the other, because shallow depressions filled with soft sediment are scarce on the northern branch of the Arc (except some areas around South Georgia), along the Sandwich chain and on the current-swept Herdman and Discovery Banks. Meiofauna may use the deep sea for exchange rather than the shallows. Those macrofauna species that occurred along most of the Scotia Arc, e.g. certain molluscs, also appeared to be eurybathic.

Many of the shallow areas studied around the islands and on the banks showed a high degree of individuality, rather representing small assemblages of their own than parts of an overall ecosystem. This high degree of patchiness in the Scotia Arc suggests interaction by a multitude of species specific, small-scale processes rather than by a general mechanism. To what extent this geographic fragmentation may have led to the formation of cryptic species can be decided only after the molecular genetic analyses have been made in the home laboratories. Taxonomic overlap between stations was higher in fish, despite greater dominance of notothenioids south of the Convergence, than in benthic species (esp. polychaetes and amphipods). There seems to be an ecotone between South Georgia and the South Sandwich chain for many taxa but by no means all. For example, South Georgia is a mixture area for Magellan and Antarctic molluscs, the northern limit for Antarctic ascidians, and the southern limit for reptant decapods except lithodids (which are known from the Antarctic Peninsula and further south but have never been caught in the high Antarctic Weddell Sea). Holothurian distribution occurred according to expectations, Magellan species to the north and Antarctic species to the south of the

Convergence, with some overlap of Magellan and Antarctic species at the South Sandwich Islands; also the (scarce) crinoids revealed these two groups and a third one on both sides. Other echinoderms seemed to overlap along the South Sandwich Islands. Polychaetes did not show much difference on family and genus level anywhere provided the substrate was the same, but may differ in species. Subpolar emergence was registered in a number of decapods, ophiuroids, and the pennatularian *Umbellula*.

Biodiversity

In terms of biodiversity, the Scotia Arc is yet another stone in the latitudinal inventory from the Magellan region to the high Antarctic continental shelf. Trawl species richness was lower than in the high Antarctic; there may, however, be a bias due to the "sponge filter" in high Antarctic trawl catches retaining many small species. The ROV transects revealed that faunal densities were mostly lower than in the Weddell Sea and the Magellan region.
Species richness of some groups (cnidarians, gastropods, asteroids, ophiuroids) was unexpectedly high, that of other taxa (e.g., crinoids, isopods) was surprisingly low. Stomatopods and echiurids were not found at all, priapulids were extremely rare. Generally, however, the pattern observed so far, with the number of many taxa increasing towards higher latitudes, was confirmed, especially in the echinoderms. There was, however, also the reverse trend. Antozoans, with a total of 79 "morphospecies", were almost twice as rich in species north of the Convergence than south. In the case of gorgonians, a second hotspot seems to exist in the Magellan region, particularly on Burdwook Bank, whose biomass was not inferior to the high Antarctic Weddell Sea, and whose biodiversity may be even higher. 6 gorgonian families were found here versus 2 families in the Antarctic. As we expected, reptant decapods (Brachyura, Anomura and Astacura) appeared only north of the Convergence whereas Caridean shrimps – with several species and one family new to these waters - occurred on either side. More of the > 200 morphospecies of gastropods and bivalves were also found in the north; again Burdwook Bank contributed much to diversity. Detailed analysis of the collections made will yield a large number of species new to science in many taxa; in amphipods alone, where 131 morphospecies were caught, they will account for more than 10 % of the material from this cruise.
Certain forms of mutualism (symbiosis, commensalism, parasitism) seem to occur between identical or very closely related taxa over the whole geographic Antarctic-Magellan range, suggesting they may date back to Gondwana.

Reproduction incl. autumnal aspects

The "autumnal aspect" of reproductive biology was of particular interest, because it can be compared with the conditions encountered in other Antarctic and Subantarctic areas. Many species in very different taxa were found mature or in advanced maturity stages during the cruise, including cnidarians, polychaetes, pantopods, peracarids, molluscs, colonial ascidians, and fish. Brooders were found in gorgonians, many gastropods, some bivalves, a scaphopod, a cidaroid urchin, an actinian, some ophiuroids, decapods and, of course, in many peracarids. *Munida subrugosa* at Burdwood Bank showed delayed spawning compared to the Beagle population whereas *M. spinosa* had well-developed ovaries and carried eggs. Notocrangon were 100% ovigerous at South Georgia vs. only 26% at the South Orkneys; in this species, size at gonad maturity seems to increase with latitude.

Other results
There were numerous other results from the LAMPOS expedtion which are presented in detail in chapter 2. In more general terms it can be stated that this expedition, filling the gap between former studies in the Magellan region and the Antarctic, has come up to our expectations. The Scotia Arc is an extremely interesting environment, as can be seen also from the results of the Russian bathymetric group, which included the detection of two unknown seamounts (Fig. 2). Further studies in the depth range covered by this cruise and in even shallower waters, together with an expansion of the ANDEEP deep-sea approach, would certainly be worthwhile.

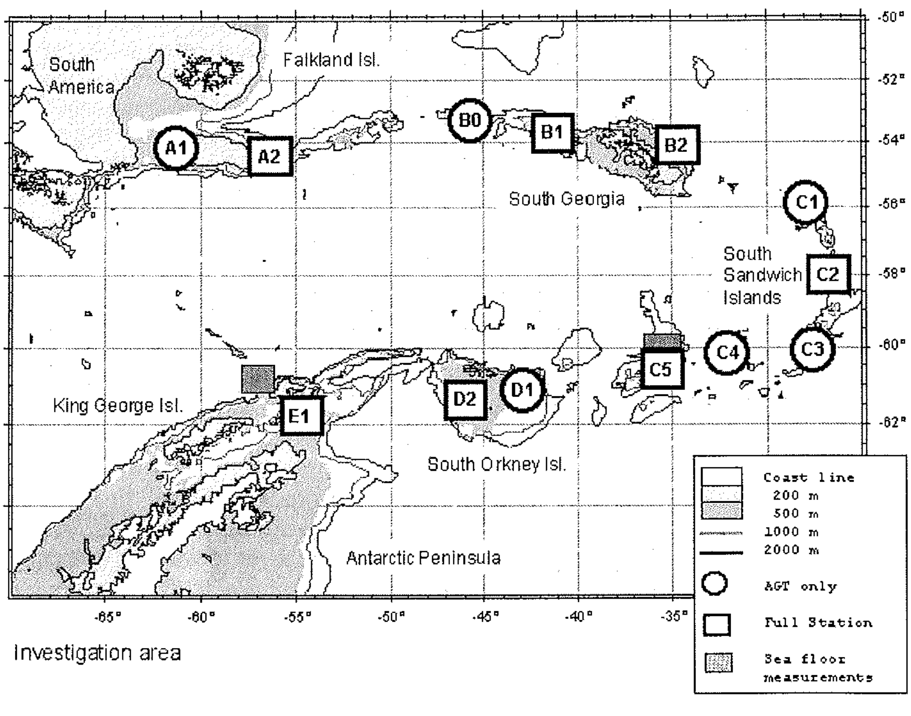

Fig. 1 Stations sampled by PFS "Polarstern" during ANT XIX/5

1.3 **Itinerary** (W.E. Arntz)

RV "Polarstern" left Punta Arenas (Chile) in the afternoon of April 03, 2002 with an international team of 50 marine scientists, 20 of whom came from the South American countries Argentina, Chile and Peru. Another 9 scientists were from European countries outside Germany (Belgium, Spain, and Russia). The scientific group was enforced by 2 meteorologists, 4 helicopter pilots and technicians, and 44 ship's crew. Unfortunately, a last minute breakdown of the large midship crane could not be repaired before sailing, and the "useless" crane was towed fast to avoid moving during the voyage.

The vessel left the Straits of Magellan via Primera Angostura under decreasing northerly winds and passed Isla de los Estados in calm weather before turning east towards Burdwood Bank, the western part of which was scheduled as the first "small" station on the northern branch of the Scotia Arc (Fig. 1). Agassiz trawl and Rauschert's small dredge were deployed successfully, however an attempt to use the small Argentinean decapod trawl yielded poor results. Burdwood-E was sampled using all gear on 06 April, with increasing winds, and brought a spectacular epifauna whereas the sediment turned out to be too firm for the corers. The decapod trawl was badly damaged and considered to be too brittle for the large vessel, so it was no longer used. Due to a thunderstorm and misty conditions which impeded the use of the helicopters, the recovery of the baited traps was postponed to the next day. Recovery of one trap was successful on April 07 despite 9 Bft and heavy rolling of the vessel, but the second one could not be released and had to be left behind. Steaming was continued towards Shag Rocks, still under rough sea conditions, and interrupted for an AGT haul on the plateau of a volcanic mount. Under calmer conditions, a full station followed off Shag Rocks on April 09, being however only partially successful due to very firm sediments. After recovery of the Belgian amphipod trap the voyage was continued towards South Georgia. A planned visit could not be realized because the British authorities denied the use of our "civil" helicopters for the transport ashore, and the boats could not be watered because of the damaged crane. As the meteorologists announced a hurricane low from the west, the originally scheduled full station on the western side of South Georgia was cancelled, and the vessel headed for the protected eastern side of the island. There work continued on April 11 and 12 under calm sea conditions, enabling successful deployment of all towed gear and corers, while the gale hit the western side of South Georgia with full force. This created complications, however, once we left the protection of the island on the afternoon of April 12. Although the wind had decreased to Bft 8, the state of the sea was still extremely rough, and life on the heavily rolling "Polarstern" was not enjoyable for almost two days although the Master finally decided to heave to for a while.

The eastward voyage was resumed on April 13 and 14 in a gradually calming sea, and work was continued at an AGT station about 20 nm west of the northernmost island of the South Sandwich group. Here the sediment was found to be pumice cobbles mixed with loose volcanic ash, hosting a strongly reduced fauna on a narrow shelf with a steep gradient towards the deep sea.

There was no clear Antarctic aspect of this fauna although the station was situated south of the Polar Front. Further south, off Saunders Island, a full station on 15/16 April presented a clearly Antarctic fauna on lava bottoms at 300 m which yielded, however, no samples in the corer; so the MG was deployed additionally at 750 and 1000 m, this time with satisfactory results. This full station can be considered an extension of an ANDEEP deep-sea station off the central South Sandwich Islands taken a month before. Another AGT station off Thule on April 17 on non-volcanic sediments completed sampling along the South Sandwich island chain, and "Polarstern" turned west to work her way back to the Antarctic Peninsula on the southern branch of the Scotia Arc.
As contrary to expectations no water depths above 500 m and almost no sediment cover were encountered on Herdman Bank, work was restricted to a CTD and an AGT which showed that it is primarily echinoderms that dominate these current exposed polished bottoms. Further west, on Discovery bank, biological work was interrupted for about two days to carry out the first Russian bathymetric grid. On April 19, another low with 8 Bft complicated steaming against the wind, but the grid was completed successfully on April 20. A particular highlight was the detection of a very regular, volcano-shaped seamount at about 60°S, 37°W, at about 2400 m water depth, on April 19. The AGT and GSN hauls revealed a poor fauna on highly concreted bottoms with almost no sediment cover which once again caused the failure even of the MG. On the way west, another seamont was detected at about 2300 m and measured before "Polarstern" approached the South Orkneys under increasing iceberg cover on April 22. Two small and one complete station were worked on the eastern, southern and western sides of the islands in calm weather, and thick layers of fine sediment were encountered, which satisfied also the needs of the scientists using the corers. The trawl catches showed a typical Antarctic fauna with dominance of molluscs and polychaetes but a lower share of echinoderms than usually. In the afternoon of April 24 the cruise was continued, and Elephant Island was reached in the night of April 24/25. Iceberg cover continued to be rather dense and weather conditions favourable, and all gear worked satisfactorily on the soft bottoms off this island. The fauna proved to be characteristically Antarctic. "Polarstern" then approached the South Shetland Islands and arrived in front of the Potter Cove (South Georgia) on April 26. The reduced glacier and green hills around the Cove revealed the effects of global warming. In bright weather cargo was exchanged with the Dallmann laboratory, a sediment trap was deployed in the Cove, fish and amphipod traps were set out in Admiralty Bay, and a mutual programme of invitations and visits began between the Argentinean Jubany station and "Polarstern" which culminated in a joint party on the vessel on Friday night. Next morning the weather had deteriorated, with poor visibility and strong wind, and the remaining work, which included the retrieval of the traps, had to be done under worsened conditions. In the night of April 27/28 "Polarstern" moved east again to start the second Russian bathymetric survey north-east of Elephant island. This survey was completed successfully until the afternoon of April 30, when the vessel began her return, steaming north in an attempt to recover the fish trap left behind on Burdwood Bank at the start of the cruise. This attempt met with success on May 02, enabling "Polarstern" to

continue her return voyage in a westerly direction. On the way to Tierra del Fuego, we had to face another gale from the west, but the vessel arrived on schedule in the dawn of May 05 in Punta Arenas.

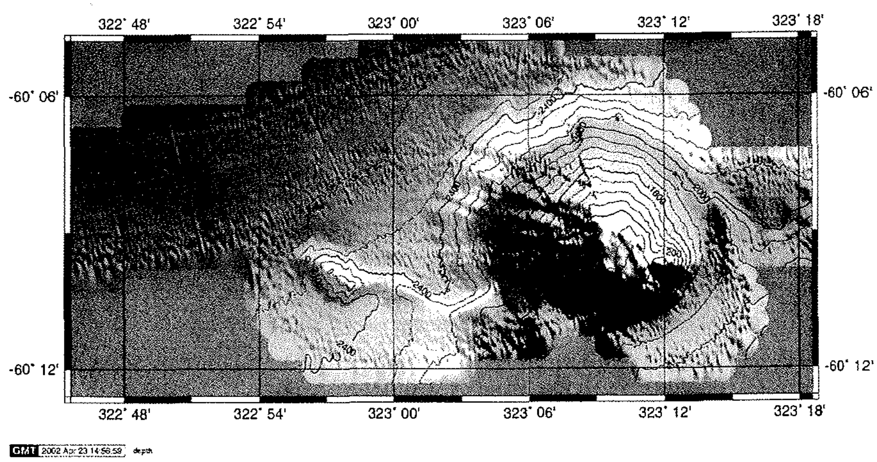

Fig. 2 Seamount encountered rising from 2400 m water depth west of Discovery Bank, 60°09'S, 36°50'W

1.4 Weather Conditions during leg ANT-XIX/5 (H.J. Möller, H. Sonnabend)

The weather conditions during leg ANT-XIX/5 corresponded more or less with what can be expected in this late season. This is shown below in the frequency graphs of wind force and direction. Westerly and northerly winds predominated in the northern part of the Scotia Sea while in the southern part winds from southeast and southwest prevailed.

Some special weather events are worth mentioning:

On April 06, 2002 thunderstorms, which are very rare in this area, occurred at Burdwood Bank while a cold front was passing. The cumulonimbus clouds grew up to 12 km with a minimum temperature < -64°C. Therefore much lightning and 8 litre of precipitation per square metre were observed on board.

During April 08 we got our first impression of wind speeds and sea states near severe Southwest Atlantic gale centres in autumn conditions. An eastward gale eddy crossing the northern Weddell Sea caused west winds up to 10 Bft for some times. Swell higher than 10 metres was observed on the next day as well.

Starting from a small wave the next gale with hurricane force built up southwest of South Georgia on April 11 quite rapidly, as indicated by an air pressure decrease of more than 7.5 hPa in 3 hours. Warned in time, the ship moved to the northeastern coast of South Georgia. On the lee side of the island the wind decreased rapidly down to 4 to 5 Bft and the sun broke through the clouds while heavy snow showers and winds up to hurricane force occurred on the opposite side of South Georgia.

On its way to the South Sandwich Islands RV "Polarstern" had to pass an area of high sea states leading the vessel to heavy rolling. Because of waves reaching up to more than 10 metres the vessel heaved to for night, turned into the wind and delayed its voyage to the South Sandwichs.

While the former gales crossed the Scotia Arc to the east, the next gale centres formed at subtropical latitudes. Coming from the Southwest Atlantic they passed easterly of the South Sandwich Islands and affected the weather in the research areas only sometimes.

One low in the western Scotia Sea showed an unusual behaviour as it did not move eastwards but intensified on position to a gale with hurricane force between April 18 and April 20. Also the dissipating took place in the same area. Because RV "Polarstern" was located under this stationary frontal system snowfall on board persisted for more than 40 hours.

During the next days the air pressure rose continuously and reached a high with 1020 hPa centred on the northern coast of South Georgia. Along with a wedge extending to the southern Weddell Sea it blocked approaching lows in the Drake Passage until beginning of May. Nevertheless a gale formed on May 02 in the northeast of the Falkland Islands moved south-westwards and entailed southerly winds up to 9 Bft for a short time.

Although a front approached with compact cloudiness from the West, the visit of the Argentinean research station "JUBANY" on April 26 was favoured by good weather conditions for helicopter flights. Caused by foehn effects at Potter Bay temperatures rose to +5°C and typical cloudiness with foehn wall and lenticular altocumulus clouds occurred that day. Stratocumulus clouds formed also at sea, in shapes of waves and rolls. Changing winds from northerly to easterly directions at night turned the next day's weather conditions. Jammed very low clouds covered Maxwell and Admiralty Bay.

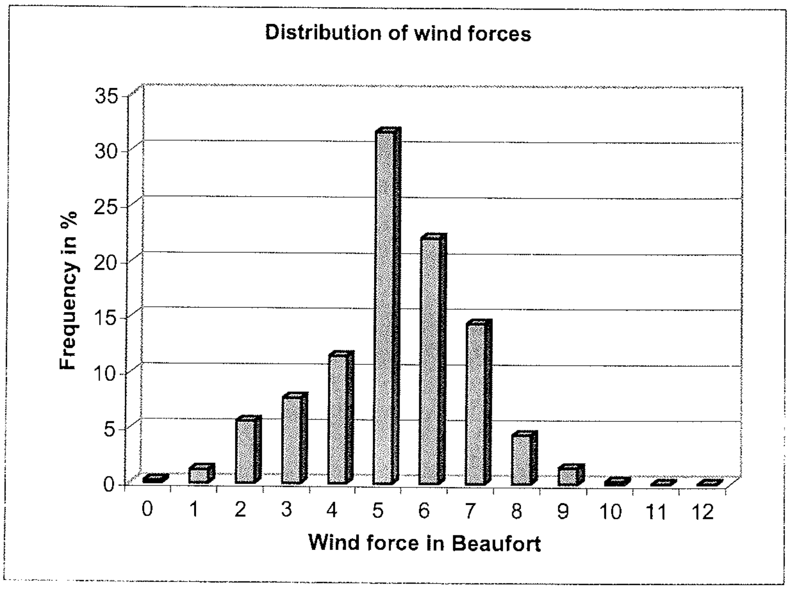

Fig. 3 Frequency of wind force between April 3rd and May 5th 2002

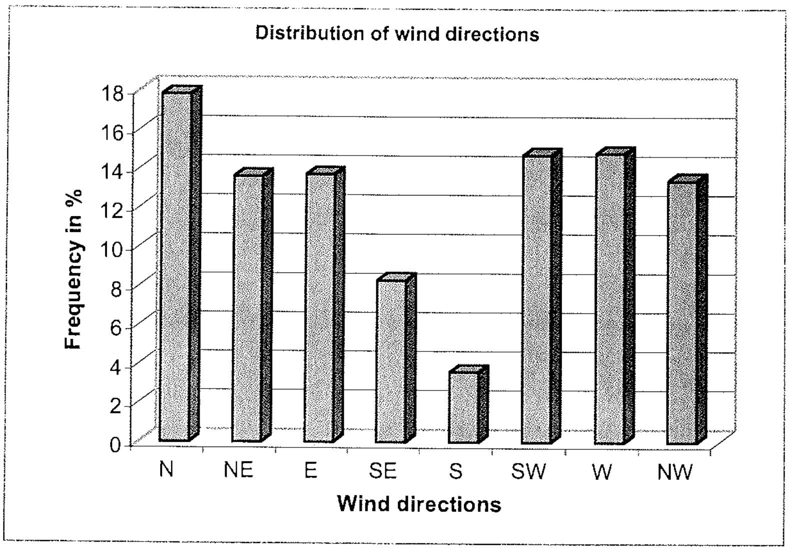

Fig. 4 Frequency of wind direction between April 3rd and May 5th 2002

2. Results

2.1 Ecology, Biodiversity, Biogeography and Evolution

Studies on ecology, biogeography and biodiversity of specific taxa were mainly based on samples collected with towed gear, i.e. Agassiz trawl, bottom trawl and Rauschert dredge.

2.1.1 Biogeography of Porifera (N. Vert, P. López-González, E. Rodríguez)

Objectives

Sponges are assumed to play a similarly significant role among the benthic suspension feeders as cnidarians do. During this cruise we planned to compare the sponge fauna sampled by RV "Polarstern" along the Scotia Arc with the sponges already collected by the Spanish vessel "Hespérides" in the same area.

Work at sea

Sponges were collected with Agassiz and bottom trawls. The animals were labelled and fixed properly for further taxonomic studies.

Preliminary results

As the final identification of the sponge material will be done in the CEAB (Centro de Estudios Avanzados de Blanes, Girona), we include here a preliminary list of the number of morphospecies (Table 1).

Tab. 1 Number of morphospecies of Porifera and number of Hydroidea species (except *Stylasterina*) collected during ANT XIX/5. Area codes according to Annex table 3.1.

Area	Station	Porifera No. Morphospec	Hydroidea No. Species
A1	145	7	5
A2	150	0	2
A2	153	0	5
B0	160	5	7
B1	164	3	2
B1	167	0	0
B2	174	1	1
B2	182	12	2
C1	187	0	0
C2	194	7	6
C2	196	3	5
C2	207	0	3
C2	208	1	2
C3	214	8	6
C4	217	10	0
C5	223	7	0
C5	229	6	3
D1	231	6	3
D2	238	1	3
D2	241	5	0
E1	252	2	0
E1	253	6	12

2.1.2 **Biogeography and Ecology of Cnidaria** (P. López-González, E. Rodríguez, N. Vert)

Objectives

- To check for latitudinal boundaries in the distribution of cnidarians at different taxonomic levels (family, genus, species) in the Scotia Arc area.
- To infer the potential origin of the Antarctic anthozoan fauna from the distribution of genera/species in this and in other biogeographic areas.
- To detect new species that may facilitate the understanding of the biogeographic relationships between the Antarctic and surrounding continental shelves, and the deep sea.

Work at sea

Material was collected from 22 stations (14 AGT and 8 GSN). Hydrozoa were fixed immediately in ethanol (70%), and some large colonies of *Stylasterina* were dried and conveniently packed. Octocorals, scleractinians and soft hexacorals were fixed in buffered formaldehyde (4%), the latter were relaxed by means of menthol crystals before fixation. Small tissue samples were taken from fresh specimens and fixed in 96% ethanol for molecular studies. Further material was frozen for secondary metabolite analyses.

Preliminary results

Hydrozoans (except *Stylasterina*) will be identified at the ICM (Barcelona), the Scleractinia and Stylasterina material will be identified at the USE (Sevilla) and the Smithsonian Institution (Washington), and the anthozoans will be worked up at the USE (Sevilla) and the ICM (Barcelona).

A preliminary list of the number of hydrozoan species per station is shown in Table 2.

Anthozoans were the most abundant of all cnidarians. About 900 colonies or individuals belonging to 79 species were collected (Table 2), 49 of them were octocorals, and 30 were hexacorals. Most of the hexacoral species were of the order Actiniaria (25 species). The octocoral fauna was dominated by gorgonians, especially the families Primnoidae and Acanthogorgiidae. The soft corals were mainly represented by the families Alcyoniidae and Clavulariidae. The pennatulacean families Umbellulidae and Kophobelemnidae were restricted to the deeper stations. The distribution of the genera and families of the octocorals is shown in Tables 3 and 4, respectively.

Some symbiotic relationships were observed in the samples collected. Polynoid polychaetes inhabited hydrocorals and gorgonians producing various modifications in the morphology of the host colonies (galleries, groves, etc.). In addition, several phyla (mainly echinoderms, but also cirripeds) used erect cnidarians as support or substrate. Other relationships between sea anemones and prosobranch gastropods similar to the one between the actiniarian *Isosicyonis* sp. and the prosobranch *Harpovoluta charcoti* have been observed, too.

Combining the distribution of octocoral genera along the Scotia Arc (Table 3) with information from the literature and from EASIZ cruises, we can conclude that: (1) the genus *Convexella* is restricted to the Magellan region; (2) the genus *Lignopsis* is present from Burdwood Bank to South Georgia; (3) the genus *Thouarella* occurs frequently in all Subantarctic and Antarctic regions; (4) the distribution of some genera such as *Dasystenella*, *Ainigmaptilon*, *Plexauridae* gen., *Rosgorgia* in the Scotia Arc seems to be strongly affected by bottom type variability, thus making biogeographical comparisons difficult; and (5) the distribution of the recently described genus *Rosgorgia* is extended from off the Antarctic Peninsula to the Magellan region.

There is some evidence pointing towards hitherto undescribed new genera and species.

Tab. 2 Geographical distribution of anthozoan species collected during ANT XIX/5. Area codes according to Annex table 3.1.

Area	A1	A2		B0	B1		B2		C1	C2				C3	C4	C5		D1	D2		E1	
Station	145	150	153	160	164	167	174	182	187	194	196	207	208	214	217	223	229	231	238	241	252	253
Abasiliaria sp 1		+																				
Abasiliaria sp 2									+													
Acanthogorgia sp				+	+	+	+	+	+	+	+		+	+	+	+	+	+		+		+
Acanthogorgiidae gen 1		+	+			+																
Acanthogorgiidae gen 2		+																				
Acontiaria sp 1			+																			
Acontiaria sp 2		+																				
Actiniaria sp 1		+																				
Actiniaria sp 2								+						+								
Actiniaria sp 3		+	+											+								
Actiniaria sp 4		+	+																			
Actiniaria sp 5		+																				
Actiniaria sp 6		+																				
Actiniaria sp 7		+	+																			
Actiniaria sp 8																+						
Actiniaria sp 9		+																				
Actiniaria sp 10		+																				
Actiniaria sp 11			+																			
Actiniaria sp 12																		+				
Actiniaria sp 13		+													+					+		+
Actiniaria sp 14			+																			
Actiniaria sp 15		+	+																			
Actinostola ?							+	+														
Ainigmaptilon antarcticum								+														
Alcyonidae gen 1										+												
Alcyonidae gen 2						+																
Alcyonidae gen 3					+																	
Alcyonium sp		+	+			+	+			+	+								+	+		
Alcyonium sp 1											+		+									
Alcyonium sp 2										+	+											
Anthomasthus sp																						+
Armadillogorg. cf *cyathella*			+		+	+																
Bolocera sp	+	+	+																			
Caryophyllya sp		+	+					+							+							
Clavularia sp						+	+	+						+			+			+		
Convexella magelhaenica	+																					

Area	A1	A2		B0	B1		B2		C1	C2				C3	C4	C5		D1	D2		E1	
Station	145	150	153	160	164	167	174	182	187	194	196	207	208	214	217	223	229	231	238	241	252	253
Corallimorphus cf *profundus*											+	+		+	+	+						
Dactylanthus antarcticus								+														
Dasystenella acanthina		+	+		+	+	+														+	
Desmophyllum cristagalli			+																			
Epiactis sp																						+
Fannyella cf *kuekenthali*					+																	
Fannyella lemnos		+	+																			
Fannyella mawsoni				+				+									+					
Fannyella nodosa			+		+	+									+							
Fannyella sp		+	+	+												+	+	+				
Flabellum sp		+			+	+				+	+	+			+	+	+	+			+	
Gersemia sp																			+			+
Glyphoperidium bursa							+									+						
Hormathia lacunifera							+	+								+						
Inflatocalyx sp						+										+						+
Isididae gen					+	+		+														
Isosicyonis sp		+																+				+
Kophobelem. cf *molanderi*																		+				
Lignopsis sp			+	+	+	+	+															
Notisis sp										+		+				+	+	+				
Parazoanthus sp					+	+								+								
Plexauridae gen	+	+			+	+		+														
Primnoella cf *murrayi*			+																			
Primnoella cf *scotiae*	+	+	+	+	+	+		+	+													
Primnoella ramificada		+																				
Primnoella sp				+												+						
Primnoella sp 2				+																		
Primnoidae gen 1			+			+	+															
Primnoidae gen 2		+	+																			
Primnoidae gen 3			+																			
Primnoidae gen 4					+	+																
Primnoisis sp											+	+	+	+	+							
Primnoisis sp 4					+	+		+														
Rosgorgia inexspectata			+		+	+		+														
Tenuisis microspiculata													+				+					
Thouarella sp 1	+					+																+
Thouarella sp 2	+				+																	+
Thouarella sp 3	+																					

Area	A1	A2		B0	B1		B2		C1	C2				C3	C4	C5		D1	D2		E1	
Station	145	150	153	160	164	167	174	182	187	194	196	207	208	214	217	223	229	231	238	241	252	253
Thouarella sp 4		+	+	+	+	+	+	+		+		+	+	+	+	+	+	+		+	+	
Thouarella sp 5		+																				
Thouarella sp 6						+																
Tokoprimno sp								+														
Umbellula sp									+	+	+	+	+									
TOTAL NO. OF SPECIES	**7**	**28**	**25**	**8**	**17**	**22**	**10**	**16**	**4**	**8**	**8**	**6**	**6**	**8**	**8**	**11**	**8**	**8**	**2**	**5**	**3**	**9**

Tab. 3 Geographical distribution of octocoral families collected during ANT XIX/5. Area codes according to Annex table 3.1.

Area	A1	A2		B0	B1		B2		C1	C2				C3	C4	C5		D1	D2		E1	
Station	145	150	153	160	164	167	174	182	187	194	196	207	208	214	217	223	229	231	238	241	252	253
Plexauridae	+	+			+			+														
Primnoidae	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+
Alcyonidae		+	+		+	+	+			+	+		+			+			+	+		+
Acanthogorgiidae		+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+		+		+
Briareidae			+	+	+	+	+															
Subergorgiidae			+		+	+		+														
Isididae					+	+		+		+	+	+	+	+	+	+	+	+				
Clavulariidae						+	+	+						+			+			+		
Umbellulalidae									+	+	+	+	+									
Kophobelemnidae																		+				
TOTAL NO. OF FAMILIES	**2**	**4**	**5**	**3**	**7**	**7**	**5**	**6**	**3**	**5**	**5**	**3**	**5**	**4**	**3**	**4**	**4**	**4**	**1**	**4**	**1**	**3**

Tab. 4 Geographical distribution of octocoral genera collected during ANT XIX/5. Area codes according to Annex table 3.1.

Area	A1	A2		B0	B1		B2		C1	C2				C3	C4	C5		D1	D2		E1	
Station	145	150	153	160	164	167	174	182	187	194	196	207	208	214	217	223	229	231	238	241	252	253
Convexella	+																					
Plexauridae gen	+	+			+			+														
Primnoella	+	+	+	+	+	+		+	+							+						
Thouarella	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+
Acanthogorgiidae gen 2		+																				
Acanthogorgiidae gen 1		+	+			+																
Dasystenella		+	+		+	+	+															
Fannyella		+	+	+	+	+		+							+		+					
Alcyonium		+	+			+	+			+	+		+							+		
Primnoidae gen 2		+	+																			
Primnoidae gen 3			+																			
Armadillogorgia			+			+																
Primnoidae gen 1			+			+	+															
Lignopsis			+	+	+	+	+															
Rosgorgia			+		+	+		+														
Acanthogorgia				+	+	+	+	+	+	+	+		+	+	+	+	+	+		+		+
Alcyonidae gen 3					+																	
Primnoidae gen 4					+	+																
Isididae gen					+	+		+														
Primnoisis					+	+		+			+	+	+	+	+							
Alcyonidae gen 2						+																
Inflatocalyx						+										+						+
Clavularia						+	+	+						+			+			+		
Ainigmaptilon								+														
Tokoprimno								+														
Umbellula									+	+	+	+	+									
Alcyonidae gen 1										+												
Notisis										+		+				+	+	+				
Tenuisis													+				+					
Kophobelemnon																		+				
Anthomasthus																						+
Gersemia																			+			+
TOTAL NO. OF GENERA	4	9	12	5	12	17	7	11	4	6	5	4	6	4	4	5	6	4	1	4	1	5

2.1.3 Biodiversity, Biogeography and Evolution of Mollusca (K. Linse, M. Schrödl, D. Zelaya)

Objectives

The malacofauna of the islands and shallows along the Scotia Arc was investigated during the LAMPOS cruise. The main objectives were to study the biodiversity, biogeographical and ecological patterns, as well as the evolutionary history of the molluscs with special reference to relationships with the Magellan region and the Antarctic. The break-up of the continental bridge between South America and the Antarctic Peninsula was one main event to influence the evolution of the Antarctic marine benthic fauna. The role of the Scotia Arc islands as a transitory area is studied. During the last decades many expeditions including studies on molluscan taxa took place in the Magellan region (e.g., RVs "Vidal Gormaz", "Victor Hensen", and "Italica" cruises) and Antarctic waters (e.g., RVs "Hespérides" and "Polarstern" expeditions), but the island arc in between was largely neglected. Recent sampling in the Scotia Arc was done by the USNS "Eltanin" in the seventies and eighties but since then no cruise focusing on mollusc collections has taken place. The collections of the LAMPOS cruise will enable us to gain a better understanding of the species distributions and will throw further light on the evolution of the present fauna. The investigations focus on

- Micromollusc assemblages from the Scotia Sea and their links with Magellanic and Antarctic faunas
- Molluscan diversity patterns between the Magellan region, Antarctica, and along the Scotia Arc – from the shelf to the deep sea
- Revisions of selected groups, e.g. Opisthobranchia, Neoleptonidae, Montacutidae, and Philobryidae
- Gametogenesis and reproduction strategies in Cyamiidae, Kelliidae, Thyasiridae, and Cuspidariidae
- Molecular phylogenies of selected groups, e.g. Opisthobranchia, Philobryidae, Limidae, Anomalodesmata, including collections for the molluscan mitochondrial genome project
- Data collection for SOMBASE (Southern Ocean Mollusc Database)
- Photo and data collection for the "Atlas of Antarctic Mollusca".

Work at sea

During LAMPOS all molluscs were collected from trawled gear. In total 8 bottom trawl (GSN), 14 Agassiz trawls (AGT) and 16 Rauschert dredge (RD) catches were sorted and analyzed. While the material of the GSN and most of the AGTs was sorted on deck, muddy AGT catches were sieved through 500µm sieves and the remainders as well as those of the Rauschert dredge were sorted under stereomicroscopes. The remainders and RD catches were stored at +4°C until sorting so that the animals stayed alive. The molluscs were sorted to morphospecies level and identified to genus. Living material was kept in aquaria for some time and live photographs were taken. Specimens for histological studies were fixed in formaldehyde, those for DNA studies were fixed as soon as possible after collection in pre-cooled 96% ethanol, and all other specimens were fixed in 70-96% ethanol. For molecular studies DNA from selected molluscan taxa was extracted by following the QUIAGEN DNeasy method.

Preliminary results

- Biodiversity

More than 2500 specimens of 7 molluscan classes (Caudofoveata, Solenogastres, Polyplacophora, Gastropoda, Bivalvia, Scaphopoda, and Cephalopoda) were collected belonging to more than 220 morphospecies. The most species rich group are gastropods with 154 morphospecies followed by 47 species of bivalves. As usual, the other classes occurred in lower species numbers: 7 species of Solenogastres, 4 species of Scaphopoda, and 3 species each of Caudofoveata and Polyplacophora. The species ratio of 3:1 between gastropods and bivalves is quite similar to the ratios in the range of 1.94-2.94:1 reported in previous studies on the Antarctic shelf (93 G: 39 B - Weddell Sea, 97 G: 33 B – Enderby Land to Ross Sea, 98 G: 50 B – Davis Sea). About 80% of the collected fauna is smaller than 10 mm explaining why there is a significant difference in species numbers per station between AGT+RD and GSN hauls (Tables 5, 6). Stations on Burdwood Bank were most species rich with 68 (AGT 150) and 41 species (AGT 145) while in all the other areas the maximum species numbers varied between 20 and 30 species per station.

Tab. 5 Gastropod species per haul/station. Station numbers according to Annex table 3.2.

Taxon	AGT 145	AGT 150	LD 151	AGT 153	AGT 160	AGT 164	RD 179	AGT 182	AGT 187	AGT 194	GSN 196	RD 200	AGT 207	AGT 214	AGT 217	AGT 223	AGT 231	AGT 238	AGT 252	GSN 253
LEPETIDAE																				
Lepeta sp1		x				X														
FISSURELLIDAE																				
Puncturella sp1		x				X														
Puncturella sp2																x				
SCISSURELLIDAE																				
Anatoma sp1		x				X														
Anatoma sp2										X		x	X		x	x				
TURBINIDAE																				
Turbinidae sp1						X														
Turbinidae sp2						X														
Turbinidae sp3										X		x	X	X	x	x				
Turbinidae sp4										X										
Turbinidae sp5														X			x			
TROCHIDAE																				
Margarella sp1		x				X														
Margarella sp2						X	x													
Submargarita sp1									x											
Submargarita sp2										X			X	X						
Calliostoma sp1	X																			
Falsimargarita sp1	X	x																		
SKENEIDAE																				

Taxon	AGT 145	AGT 150	LD 151	AGT 153	AGT 160	AGT 164	RD 179	AGT 182	AGT 187	AGT 194	GSN 196	RD 200	AGT 207	AGT 214	AGT 217	AGT 223	AGT 231	AGT 238	AGT 252	GSN 253
Brookula sp1		x																		
Brookula sp2							x	X												
Brookula sp3																			x	
EATONIELLIDAE																				
Eatoniella sp1	X	x																		
Eatoniella sp2						X														
Eatoniella sp3									x	X										
Eatoniella sp4															x					
RISSOIDAE																				
Onoba sp1	X	x				X														
Onoba sp2	X	x				X														
Onoba sp3						X														
Onoba sp4							x													
Onoba sp5							x	X												
Onoba sp6									x											
Onoba sp7									x	X										
Onoba sp8										X				X						
Onoba sp9																			x	
Onoba sp10																			x	
CALYPTRAEIDAE																				
Trochita sp1	X																			
CAPULIDAE																				
Capulus sp1		x																		
LAMELLARIIDAE																				
Lamellaria sp1		x	x																	
Marseniopsis sp1																x				
Marseniopsis sp2	X																			
Marseniopsis sp3	X																			
Marseniopsis sp4		x																		
Marseniopsis sp5		x																		
Marseniopsis sp6		x																		
Marseniopsis sp7		x																		
Marseniopsis sp8		x																		
Marseniopsis sp9				X																
Marseniopsis sp10				X																
Marseniopsis sp11				X																
Marseniopsis sp12																				x
Marseniopsis sp13																				x
TURRITELLIDAE																				
Colpospirella sp1	x						x	X												
TRICHOTROPIDAE																				
Torellia sp1						X						x								
Torellia sp2													x							
NATICIDAE																				
Naticidae sp1	x	x																		
Naticidae sp2						X														
Naticidae sp3										x										
Naticidae sp4															x					
Naticidae sp5																			x	

Taxon	AGT 145	AGT 150	LD 151	AGT 153	AGT 160	AGT 164	RD 179	AGT 182	AGT 187	AGT 194	GSN 196	RD 200	AGT 207	AGT 214	AGT 217	AGT 223	AGT 231	AGT 238	AGT 252	GSN 253
Naticidae sp6								x												
Amauropsis sp1								x												
Sinuber sp1																	x			
TRIPHORIDAE																				
Cerithiella sp1		x																		
Cerithiella sp2																	x		x	
Triphoridae sp1						X														
CERITHIOPSIDAE																				
Eumetula sp1															x					
LITTORINIDAE																				
?L. labioflecta																				x
EPITONIIDAE																				
Acirsa sp1															x					
Epitoniidae sp1		x																		
EULIMIDAE																				
Melanella sp1	x	x				X														
Melanella sp2	x									x		x	x	x	x	x				
Melanella sp3																x				
BUCCINULIDAE																				
Chlanidota sp1							x													
Chlanidota sp2																		x		
Chlanidota sp3																			x	
Meteuthria sp1		x								x			x							
Parabuccinum sp1		x																		
Parabuccinum sp2		x																		
Neobuccinum sp1										x										
Pareuthria sp1		x																		
Pareuthria sp2	x																			
Prosipho sp1										x		x								
Prosipho sp2												x		x						
Prosipho sp3															x					
Prosipho sp4																x				
Tromina sp1		x																		
Tromina sp2										x		x								
Tromina sp3										x		x	x		x					
Bathydomus sp1						X														
Antistreptus sp1		x				X														
Cavineptunera sp1															x					
Savatieria sp1		x																		
Buccinulidae sp1							x	x												
Buccinulidae sp2														x	x					
VOLUTIDAE																				
Harpovoluta sp1	x			x													x			
Zidona sp.1						x														
Volutidae sp1																x				
MARGINELLIDAE																				
Marginella sp1	x	x				x														
Marginella sp2																x				
MURICIDAE																				

Taxon	AGT 145	AGT 150	LD 151	AGT 153	AGT 160	AGT 164	RD 179	AGT 182	AGT 187	AGT 194	GSN 196	RD 200	AGT 207	AGT 214	AGT 217	AGT 223	AGT 231	AGT 238	AGT 252	GSN 253
Trophon sp1	x																			
Trophon sp2		x																		
Trophon sp3							x													
Trophon sp4								x												
Trophon sp5						x														
VOLUTOMITRIDAE																				
Volutomitra sp1						x														
Volutomitra sp2								x												
Volutomitra sp3													x							
CANCELLARIIDAE																				
Admete sp1	x	x																		
TURRIDAE																				
Aforia sp1																			x	
Leucosyrinx sp1																	x			
Leucosyrinx sp2																	x			
Typhlodaphne sp1																x				
Ponthiotauma sp1																x				
Turridae sp1	x	x																		
Turridae sp2	x	x																		
Turridae sp3								x												
Turridae sp4									x											
Turridae sp5										x		x								
Turridae sp6													x							
Turridae sp7															x					
Turridae sp8																	x		x	
Turridae sp9																			x	
Turridae sp10	x																			
Turridae sp11	x																			
Turridae sp12	x																			
PYRAMIDELLIDAE																				
Turbonilla sp1		x																		
Turbonilla sp2										x										
Turbonilla sp3															x					
ACTEONIDAE																				
Neactaeonina sp1							x													
Acteonidae sp1	x	x																		
CYLICHNIDAE																				
Cylichna sp1	x	x				x														
Cylichna sp2							x	x												
Cylichna sp3									x	x								x		
DIAPHANIDAE																				
Toledonia sp1										x		x	x		x					
Toledonia sp2	x	x																		
BULLIDAE																				
Bullidae sp1	x																			
PHILINIDAE																				
Philine sp1		x																		
LIMACINIDAE																				
Limacina sp.	x																			

Taxon	AGT 145	AGT 150	LD 151	AGT 153	AGT 160	AGT 164	RD 179	AGT 182	AGT 187	AGT 194	GSN 196	RD 200	AGT 207	AGT 214	AGT 217	AGT 223	AGT 231	AGT 238	AGT 252	GSN 253
PLEURO-BRANCHIDAE																				
Berthella sp1	x	x																		
Bathyberthella sp1								x												
BATHYDORIDIDAE																				
Bathydoris sp1		x																		
PLATYDORIDIDAE																				
Gargamella sp1		x																		
DORIDIDAE																				
Austrodoris sp1	x	x		x	x															
AEGIRETIDAE																				
Aegires sp1		x																		
?GONIODORIDIDAE																				
?Goniodorididae sp1	x	x																		
?ONCHIDORIDIDAE																				
?Onchidorididae sp1		x																		
ZEPHYRINIDAE																				
Janolus sp1	x																			
TRITONIIDAE																				
Tritonia sp1		x		x																
Tritonia sp2											x						x			
DOTIDAE																				
Doto sp1																				x
NOTAEOLIDIIDAE																				
Notaeolidia sp1										x										
TERGIPEDIDAE																				
Cuthona sp1										x										
Cuthona sp2												x								
Indet																				
Gastropoda sp1						x														
Gastropoda sp2										x										
Gastropoda sp3															x					
Sum of species	31	45	1	6	1	23	10	11	6	21	1	11	10	7	15	11	8	2	9	4

AGT-Agassiz trawl, GSN-bottom trawl, LD-Lovrich's dredge, RD-Rauschert dredge

Tab. 6 Bivalve species per haul/station. Station numbers according to Annex table 3.2.

Taxon	AGT145	AGT150	AGT164	GSN167	RD 169	RD 179	AGT182	AGT187	AGT194	RD 200	AGT207	AGT214	AGT217	AGT223	AGT231	AGT238	GSN241	AGT252
NUCULIDAE																		
Ennucula sp1		x				x	x											
PHASEOLIDAE																		
Phaseolus sp1											x				x			x
NUCULANIDAE																		
Yoldiella sp1													x	x		x		x
Yoldiella sp2															x	x		
Yoldiella sp3		x																
Propeleda sp1						x	x								x			x
LIMOPSIDAE																		
Limopsis sp1		x				x	x	x			x							
Limopsis sp2						x	x		x	x	x			x	x			
Limopsis sp3							x											
PHILOBRYIDAE																		
Adacnarca sp1		x								x				x		x		
Adacnarca sp2													x					
Lissarca sp1	x	x	x	x	x				x	x		x	x	x	x		x	
Philobrya sp1		x	x															
Philobrya sp2		x																
Philobrya sp3							x						x					
Philobrya sp4													x					
Philobrya sp5														x				
MYTILIDAE																		
Crenella sp1		x																
LIMIDAE																		
Limatula sp1							x	x			x		x	x				x
Limatula sp2		x	x															
Limatula sp3						x	x	x										
THYASIRIDAE																		
Thyasira sp1																x		
Genaxinus sp1		x	x			x	x		x	x	x		x	x	x	x		x
KELLIIDAE																		
Kellia sp1	x																	
Kellia sp2							x											
PECTINIDAE																		
Zygochlamys sp1	x	x																
Adamussium sp1											x				x			
Pectinidae sp1		x																
Pectinidae sp2						x	x											
Pectinidae sp3													x					
MONTACUTIDAE																		
Mysella sp1	x																	x
Waldo sp1						x	x								x			
CYAMIIDAE																		
Cyamium sp1		x											x					

Taxon	AGT 145	AGT 150	AGT 164	GSN 167	RD 169	RD 179	AGT 182	AGT 187	AGT 194	RD 200	AGT 207	AGT 214	AGT 217	AGT 223	AGT 231	AGT 238	GSN 241	AGT 252
Cyamiocardium sp1	x	x				x	x								x			
Ptychocardium sp1						x												
NEOLEPTO-NIDAE																		
Neolepton sp1		x																
Neolepton sp2	x	x	x															
CARDITIDAE																		
Carditella sp1		x																
Cyclocardia sp1	x					x	x		x	x				x	x			
ASTARTIDAE																		
Astarte sp1																		x
HIATELLIDAE																		
Hiatella sp1	x	x																
LYONSIIDAE																		
Lyonsia sp1		x							x	x	x		x					
POROMYIDAE																		
Poromya sp1			x						x									
THRACIIDAE																		
Thracia sp1		x	x			x	x								x			x
CUSPIDARI-IDAE																		
Cuspidaria sp1	x	x					X				x	x	x					x
Cuspidaria sp2	x	x				x	X		x	x			x					x
Indet																		
Bivalvia sp1		x					X											
Sum of species	10	23	7	1	1	13	18	3	7	7	8	2	12	8	11	5	1	10

AGT-Agassiz trawl, GSN-bottom trawl, RD-Rauschert dredge

Members of various trophic levels occurred in the collected material, e.g. herbivorous grazers such as the gastropods *Margarella* spp and *Puncturella* spp, detritivores like nuculid and nuculanid bivalves, filter feeders like the bivalves *Limatula* spp, *Adamussium* sp, *Philobrya* spp, predators like cuspidariid bivalves or naticid gastropods, specialized predators like lamellariid and turrid gastropods, scavengers like *Neobuccinum* sp, and parasites like the eulimid gastropod genus *Melanella* spp. First examinations of some of the collected taxa indicate undescribed species, especially within the gastropods. Most of these probably new species were found on Burdwood Bank, around South Georgia and the South Sandwich Islands, for example some unknown nudibranchs (see below).

- Biogeography

The results of the LAMPOS cruise alone cannot clarify whether there is a sharp barrier for molluscan species' distributions and a corresponding (latitudinal) decline in biodiversity or not. Only a few stations with different types of substrates were sampled along the Scotia Arc, so that the collected (although rich) material is likely to represent only a minor proportion of the real faunal diversity of the respective areas. Species remain to be identified and compared with the literature before general conclusions can be drawn. It is, however, already evident that the new collected material will extend the distribution records for many species, especially for Magellanic species that now have been also found in South Georgia. The faunal composition on Burdwood Bank and Shag Rocks showed the typical members of the Magellanic malacofauna but only about 1/6 of that fauna was found. Some of the species gathered there are also known from Antarctic waters and show both a wide geographical and bathymetrical range. In the stations off South Georgia the proportion of Magellanic elements decreases while more "true" Antarctic elements occur. For benthic molluscs, South Georgia seems to be a transitory area. From the South Sandwich Islands to Elephant Island the fauna was quite similar to the one found in similar habitats in the eastern Weddell Sea.

- Reproduction including autumnal effects

The reproductive biology and gametogenesis of selected taxa will be studied in detail in the laboratories at home. Brief investigations while sorting the material pointed out that several taxa seemed to be close to spawning/highly mature. For example eggs were found in the bivalves *Waldo* sp1, Kellia sp1, *Cyamiocardium* sp, *Cuspidaria* sp2 and the gastropod *Anatoma* spp, as well as embryos near to hatching size in the brooding bivalve *Adacnarca* sp. Further ripe and hatching egg masses of different gastropods, e.g. buccinulids, turrids and naticids, were found. The ovaries of different species, for example of the scaphopod *Cadulus dalli antarcticus*, were ripe. Specimens of Kellia sp.1, Hiatella sp.1, Genaxinus sp.1 and Cuspidaria sp.2 were fixed and conserved for reproductive studies, and this material will be routinely processed for histology in the laboratory. In addition, 5 gastropod egg capsules were collected, measured and drawn. Juveniles hatched from two of these in the aquaria during the trip. The anatomical and systematical studies of the collected material will be carried out at the Museo de La Plata, Buenos Aires, Argentina.

- Ecology

Different types of symbioses and parasitism were recorded. Quite common is the symbiosis of different sea anemones with various gastropods, for examples *Harpovoluta charcoti* with *Isosicyonis alba* or *Aforia magnifica* with an unknown anemone, but also the symbiosis of nuculid bivalves and turrid gastropods with hydroids. The bivalve *Lissarca* cf. notorcadensis is almost always attached to cidaroid sea urchins and this partnership can be recorded from Burdwood Bank along the arc islands to the Antarctic Peninsula and the Weddell Sea. Another symbiosis occurred between *Laevilittorina labioflecta* and pantopods, where the gastropod shell even shows a gap in the aperture for better attachment to the skinny legs and body of the pantopod.

- Molecular evolution and population genetics
The phylogenetic relationships of the genus *Philobrya* and its position within the Philobryidae will be analysed using mitochondrial gene sequences. DNA material of 14 species is already available. During LAMPOS further 8 species were collected and their DNA (mitochondrial 16 S, COI, CytB and nuclear ITS-1 regions) extracted on board. Further taxa of interest were arcoidean species of putative free spawning *Limopsis* and brooding philobryids (*Adacnarca, Lissarca, Philobrya*), as well as the limid Limatula, which shows both reproduction modes. Of special value are the samples of *Lissarca cf notorcadensis* because a complete sample set is available for population genetic studies from Burdwood Bank along the Scotia Arc to the Antarctic Peninsula and eastern Weddell Sea. In total 168 DNA extractions from limopsids, philobryids, limids, pectinids and trochids were done during LAMPOS.

- Opisthobranch diversity, biogeography and evolution
While the coastal Magellan and Antarctic opisthobranch faunas are already fairly well known, information on the fauna and function of the Scotia Arc as a possible link was still lacking. During LAMPOS, we found at least 5 cephalaspidean, 1 pleurobranchid, and 8 nudibranch species on the eastern Magellan shelf and the Burdwood Bank. These records include considerable range extensions for the Magellanic *Berthella cf platei* and *Gargamella immaculata*. Members of the cephalaspid family Bullidae and of the nudibranch genus *Janolus* are recorded for the first time from the Southern Ocean. In addition, 3 nudibranch species (Aegiretidae sp., cf. Onchidorididae sp. and cf. Goniodorididae sp.) appear to be new to science.
With just 3 opisthobranch species found, the Shag Rocks and South Georgia showed a low diversity, which, however, may be due to limited sampling. *Bathyberthella antarctica* and *Cylichna* sp.3 are Antarctic species, *Austrodoris kerguelenensis* is an ubiquitous Antarctic and Subantarctic species which also extends to the Magellan region. An earlier zoogeographic analysis already suggested that South Georgia is a transitory area for Magellanic and Antarctic nudibranchs.
At the South Sandwich Islands 5 opisthobranch species were found. Two tergipedid species need to be studied anatomically for identification. *Tritonia challengeriana* is an ubiquitous Antarctic and Magellanic species, while *Cylichna* sp.3 and *Notaeolidia depressa* are true Antarctic ones. Thus, regarding ophistobranchs, the South Sandwich Islands seem to be part of the Antarctic. Apart from a few widely distributed Subantarctic and Antarctic species, the Antarctic Convergence appears to be a faunal barrier for coastal Magellan and Antarctic opisthobranch species.
Tissue samples were taken from all opisthobranch species and fixed for later molecular analysis. Of *Tritonia challengeriana*, samples are now available of specimens from southern Chile over Patagonia and all along the Scotia Arc to the Antarctic Peninsula, as well as from several localities in the eastern Weddell Sea. This species will serve as a model to investigate genetic similarities and possible gene flow between southern nudibranch populations.

2.1.4 2.1.4 Biogeography and Ecology of Polychaeta (A. Montiel, J. Tarazona, A. Roux, G. Vera, L. Quipúzcoa, E. Enríquez)

Objectives
Species composition and taxonomy of shallow water polychaetes from some of the Scotia Arc islands have been examined by Hartmann-Schröder (1990, 1993). The zoogeographical role of this area, however, is still an open question. The aims of our investigations were:
- to identify trends in the faunistic composition of benthic polychaetes along the Scotia Arc.
- to analyse differences in polychaete population structure north and south of the Antarctic Convergence.
- to identify the biogeographic and evolutionary links between the Magellanic and Antarctic polychaete faunas.

Work at Sea
Polychaetes were collected by means of Agassiz Trawls (14 samples), Bottom Trawls (7 samples) and Rauschert Dredge (8 samples). All polychaetes were sorted, fixed in borax-buffered 4% formaldehyde, and identified to species where possible. All individuals of the abundant *Leatmonice producta* were counted and their length was mesured. Some evidence of symbiotic relationships as well as of reproductive development was collected, too.

Preliminary results

- Diversity & distribution

19 polychaete families were found. The family Polynoidae was the most frequent one (>80%), followed by Aphroditidae, Nereidae and Terebellidae (Fig. 5). A total of 51 taxa was identified in the AGT samples. Station 214 provided the maximum of 13 species, followed by stations 194 and 231, where 11 species occurred (Table 7). Polychaete species richness did not differ significantly between samples of the northern and southern branch of the Scotia Arc. We suggest that sediment heterogeneity and different sampling effort (5 AGT sampled in the north versus 9 in the south) affected the number of species caught in both branches. The most frequent species was the aphroditid *L. producta*, which was collected in large numbers at stations 182 and 252. Also the polynoid *Polyeunoa laevis* was found in more than 80% of the AGT samples. Nevertheless >50% of the species or morphospecies were encountered just once.

- Zoogeography:

Despite the apparent similarities in polychaete species composition between areas C and D (8 common species) and areas B and C (7 common species), our preliminary results should be interpreted with caution, because more than 80% of the species are not yet identified.

- Size frequency data:
L. producta and *Eulagisca corrientis* are the largest species in the Scotia Arc, with recorded sizes up to 216 mm and 217 mm, respectively. These species were most abundant in the areas C (South Sandwich Islands) and E (Elephant Island). The population size structure of *L. producta* was different in the areas C and E. In C the size frequency curve showed 4 high-frequency modes, whereas in E the curve was bimodal (Fig. 6).
- Symbiotic relationships:
Four relationships were observed between polychaetes and other taxa, with the polychaete being either host or epizoit. The polynoid *P. laevis* living in the "branches" of the gorgonian *Thouarella* sp. has been reported from previous expeditions, too. Similar relationships were found on this cruise, e.g. between *Acanthogorgia* sp. and an undentified *Harmothoinae* sp1, and the holothuroids *Bathyplotes bongraini* and another *Harmothoinae* sp2. The polynoid *Hermadion* sp1 was found to be host for the ectoparasitic copepod Herpyllobidae gen. et sp 1. This relationship was described once before, but based on a few records only.

- Reproduction:
As to be expected during autumn conditions, many of the common polychaete species had ripe gonads, e.g. Aphroditidae (*L. producta*), Polynoidae (*P. laevis* and *E. corrientis*), and Phyllodocidae (*Eulalia* sp1).

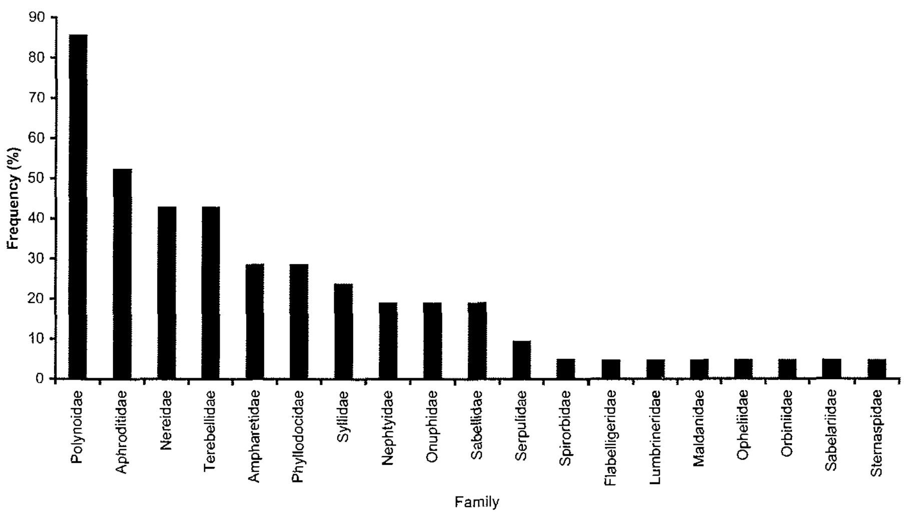

Fig. 5 Frequency of occurrence of polychaete families in trawl samples.

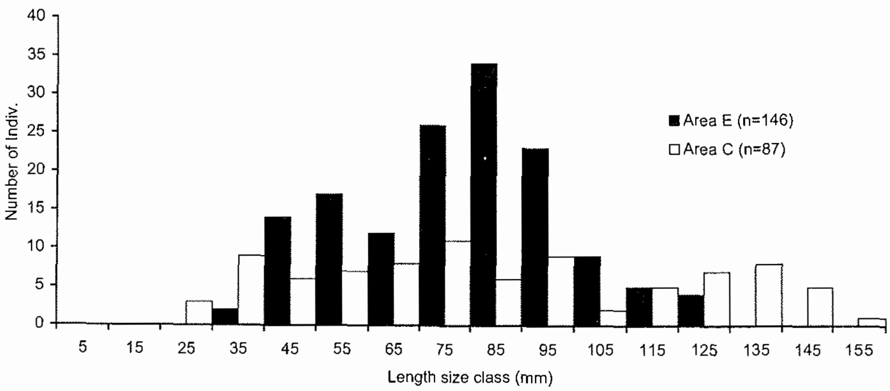

Fig. 6 Size-frequency distribution of *Laetmonice producta* in areas E and C.

Tab. 7 Polychaetes sampled during ANT XIX/5. Area codes and station numbers according to Annex table 3.1 & 3.2.
Ma: Magellan; Sa: Subantarctic; An: Antarctic; Co: Cosmopolitan; Sd: South America;
B: Biotic Substrate; M: Mud; P: Pumice; VD: Volcanic Debris

Family	Species/Station	Author	Stat 145	150	160	164	182	187	194	207	214	217	223	231	238	252	Distrib.
APHRODITIDAE	*Laetmonice producta*	Grube, 1877					■	■		■		■					Ma,Sa,An
	Laetmonice sp.1												■	■		■	
POLYNOIDAE	*Polyeunoa laevis*	McIntosh, 1885	■	■	■	■		■	■		■		■	■		■	Sa, An
	Harmothoe campoglacialis	Hilbig & Montiel, 2000	■														Ma
	Harmothoe spinosa	Kinberg, 1855						■									Ma, Sa
	Harmothoe sp. 1			■		■				■							
	Harmothoe sp. 2								■		■						
	Harmothoe sp. 3						■										
	Hermadion sp.1										■						
	Hermadion ferox	Baird, 1865									■						Ma, Sa
	Eulagisca corrientis	McIntosh, 1885			■				■	■							Sa, An
	Harmothoinae sp. 1					■							■	■			
	Harmothoinae sp. 2												■	■			
	Harmothoinae sp. 3							■	■								
	Harmothoinae sp. 4									■							
	Harmothoinae sp. 5										■						
	Antinoella sp.										■						
	Polynoidae sp.1													■			
PHYLLODOCIDAE	*Eulalia sp.*								■		■						
	Phyllodocidae sp. 1											■		■			
	Eteone sp.														■	■	
	Steggoa sp.										■						
ONUPHIDAE	*Onuphis sp.*			■	■	■										■	
NEPHTYDAE	*Aglaophamus sp.1*					■	■	■				■					
	Nephtydae sp.1														■		
NEREIDAE	*Nicon ehlersi*	Hartman, 1953	■	■		■					■					■	Ma,Sd,Sa
LUMBRINERIDAE	*Lumbrineris sp.*						■										

Family	Species/Station	Author	145	150	160	164	182	187	194	207	214	217	223	231	238	252	Distrib.
SYLLIDAE	*Typosyllis sp.*		■										■				
	Trypanosyllis gigantea	(McIntosh, 1885)		■						■	■						Sa,An,Ma
	Trypanosyllis sp.												■				
	Eusyllis sp.								■								
	Ehlersia sp.									■							
	Syllidae sp.1											■					
	Autolytus sp.										■						
ORBINIIDAE	*Orbiniidae sp.1*													■			
OPHELIIDAE	*Ophelia sp.*						■										
FLABELLI-GERIDAE	*Flabelligera sp.*								■								
SABELLIDAE	*Perkensiana spp.*						■		■		■						
SABELLARI-IDAE	*Lygdamis sp.*		■														
AMPHARE-TIDAE	*Amphicteis sp.*								■	■							
	Ampharetidae sp. 1										■			■	■		
TEREBELLIDAE	*Thelephus cinncinata*	(Fabricius, 1780)	■														Co
	Pista cristata	(O.F.Möller, 1776)	■														Co
	Polycirrus sp.		■														
	Terebellidae sp.1											■			■		
	Thelepus sp.							■	■				■	■		■	
SERPULIDAE	*Serpula narconensis*	Baird, 1865						■	■								An,Ma,Sa
	Serpulidae		■	■													
SPIRORBIDAE	Spirorbidae			■													
MALDANIDAE	Maldanidae sp. 1													■			
STERNASPIDAE	*Sternaspis scutata*	(Renier, 1807)												■			Co
Total taxa			9	7	3	6	6	7	11	7	13	5	7	11	4	6	
Substrate			B	B		B	M	P	VD	VD	VD	VS	VS	M	M	M	
Area			A	A	B	B	B	C	C	C	C	C	C	D	D	E	

2.1.5 Biodiversity, biogeography, phylogeny and trophodynamics of amphipod and isopod crustaceans (C. De Broyer, A.-N. Lörz , F. Nyssen, M. Rauschert, Y. Cariceo, C. Ríos)

Objectives

Their diversity, abundance, ubiquity and low dispersal capabilities make amphipods and isopods good model groups for studying patterns and processes of biodiversity and biogeography. A large dataset on amphipod diversity, distribution and ecology has been produced by previous cruises in the eastern Weddell Sea, the Antarctic Peninsula and the Magellan region. Many of these data and reference collections have been concentrated in the Biodiversity Reference Centre for Antarctic Amphipods ("Ant'Phipoda") at IRScNB, Brussels. The Ant'Phipoda reference centre is supported by the "Antarctic Amphipodologist Network (AAN)". Isopods have been scarcely analyzed both from a taxonomical and zoogeographical point of view since the seminal work of Brandt (1991, 1999). New material collected in the Magellan region and along the Scotia Arc will allow a general comparison of geographical distribution.

Relying on this expertise, the present project aims at characterising the biodiversity and biogeography of the Scotia Arc amphipods and at investigating the phylogeny and phylogeography of selected amphipod and isopod taxa in order to contribute to the understanding of the biogeographical and evolutionary links between the Magellan region (South America) and the Antarctic continent.

Investigations on habitat, trophic diversity and trophic role of amphipods in the benthic shelf communities of the eastern Weddell Sea indicated a large diversity of trophic niches and types. The LAMPOS cruise along the Scotia Arc offered a new opportunity to pursue the investigation of the ecological roles, in particular the trophic role, of the amphipod taxocoenosis in the shelf benthic communities by a multiple approach (stomach contents, feeding behaviour, functional morphology, stable isotopes, and fatty acids).

This project will contribute to the following programmes: SCAR EASIZ, SCAR EVOLANTA, DIVERSITAS (Systematics Agenda 2000) and Census of Marine Life.

Several complementary objectives are addressed by the project:

Biodiversity:

- To characterize the composition of the Scotia Arc amphipod and isopod fauna in comparison with other zoogeographic regions (Magellan, Subantarctic, Antarctic) and with the Antarctic deep sea (ANDEEP).
- To complete the comprehensive photographic documentation of live benthic animals (in particular amphipods) undertaken in previous cruises.
- To contribute to the ongoing revision of the whole Antarctic amphipod fauna and the preparation of new identification tools undertaken by the AAN.

Phylogeny:

- To investigate the phylogeny of selected amphipod families (Epimeriidae, Iphimediidae, Lysianassidae s.l., Oedicerotidae) by parallel molecular and ecomorphological approaches.

Biogeography and phylogeography:
- To evaluate distributional patterns along the Scotia Arc and the role of the Polar Front.
- To investigate the Scotia Arc colonisation and the polar submergence hypotheses within selected taxa by a molecular approach.

Ecofunctional diversity and trophodynamics:
- To characterize the ecological traits of the amphipod and isopod taxocoenosis, in particular habitat diversity, ecomorphological types and life styles.
- To investigate in detail the trophodiversity and the trophodynamics of the amphipod taxocoenosis in the Scotia Arc benthic communities by a multiple approach involving: digestive tract analyses and feeding behaviour observations in aquaria and the use of stable isotope (carbon and nitrogen) ratio and fatty acids as tracers to delineate the trophic relationships involving amphipods in the benthic food webs of the Scotia Arc shelf.
- To evaluate the significance of the amphipods as prey for macrobenthos and demersal fish by stable isotope and fatty acid analyses.

Work at sea

Sampling, sorting, measuring and identifying: Amphipoda (De Broyer, Lörz, Nyssen, Rauschert) and Isopoda (Cariceo, Rios) were collected at all benthic stations by AGT, RD, GSN and traps. A large part of the samples was sorted on board to species level and identified, where possible.

Preserving and extracting DNA samples (Anne-Nina Lörz): selected taxa (in particular Iphimedoidea, Lysianassoidea and serolid isopods) were preserved for molecular analyses in pre-chilled ethanol 100 or 96 % soon after sampling, preferably alive, in order to avoid possible DNA degradation by enzymatic activity.

Trophodiversity and trophodynamics (Fabienne Nyssen): Samples from selected species were collected and frozen for isotopic, fatty acid and gut content analyses. Gut content analysis was performed on some fixed specimens and digital pictures of stomach structure and contents were taken. Live specimens of more than 20 amphipod species (some collected during ANDEEP) and one isopod species were kept in a cool container at a temperature of -1°C (±1°C). Animals were reared in different aquaria (of 6 to 30 l) permanently alimented by fresh sub-surface seawater and provided with various biological or inorganic substrates. Ethological observations of all species were performed as well as feeding experiments on some selected species. The performed experiments were of four different types:
- Feeding rate estimation (on the herbivorous eusirid *Djerboa furcipes* and the scavenger lysianassoids *Abyssorchomene plebs*, *A. rossi*, *Eurythenes gryllus*, *Pseudorchomene coatsi*) with calibrated food (i.e. brown algae or pre-weighed pieces of freeze-dried squid).
- Estimation of the isotopic fractionation and tissular turnover rates of selected species (idem 1 & the scavenger lysianassid *Waldeckia obesa*). Isotopically known food (i.e. soy beans or pieces of freeze-dried cod) was provided *ad*

libitum to a defined number of amphipods. Food and amphipod specimens were regularly collected and frozen for isotopic and fatty acid analyses.

- Study of starvation effects on the isotopic ratios of selected amphipod species. A defined number of amphipods of selected species was isolated and starved. Amphipods were regularly sampled and frozen for isotopic and fatty acid analyses.
- Estimation of the gut clearance time in species collected in traps (amphipod species: *A. plebs*, *P. coatsi*, *A. rossi*, *W. obesa*; isopod species: *Natatolana* sp.).

Specimens that survived till the end of the LAMPOS cruise were transported by air to I.R.Sc.N.B., Brussels for further behaviour observations and feeding experiments. Samples from different phyla which are known or suspected to be prey or predators of amphipods were collected and frozen for further lipid and stable isotope analyses.

Photographic documentation of living crustaceans and benthos (Martin Rauschert): More than 1900 colour slides of live specimens of macrobenthos were taken with the purpose to create at the AWI a photographic identification guide. About 500 species of the following taxa were documented: Porifera, Cnidaria, Tentaculata, Mollusca, Polychaeta, Chelicerata, Crustacea, Echinodermata and Ascidiacea.

Preliminary results

- Material collected

About 24000 specimens of amphipods and 3200 isopods were collected (Table 8). Additional material is expected from multibox corer (MG) and multicorer (MUC) samples.

Tab. 8 Numbers of specimens collected per gear

Gear	Amphipoda	Isopoda
AGT	< 100	> 83
TRAP	18748	1033
GSN	< 50	> 19
RD	~ 5000	?
TOTAL	~ 24000	> 1135

- Biodiversity

The amphipod species collected by trawls, dredge and traps have been provisionally attributed to 131 (morpho)species belonging to 88 genera and 33 families. Fifteen species are probably new to science. A preliminary list of the sorted and identified species is given in Table 9.

Tab. 9 Preliminary list of identified amphipod species. Station numbers according to Annex table 3.2.

Family	Genus	Species	Station	A	B 1	B 2	C1-3	C4-5	D	E
ACANTHONOTOZOMELLIDAE	*Acanthonotozomoides*	cf. *oatesi* (eyes without teeth)	169		x					
ACANTHONOTOZOMELLIDAE	*Acanthonotozomoides*	*oatesi* (K.H. Barnard, 1930)	223					x		
ACANTHONOTOZOMELLIDAE	*Acanthonotozomoides*	*sublitoralis* Schellenberg, 1931	145	x						
AMPELISCIDAE	*Ampelisca*	*bouvieri* Chevreux, 1912	179, 182, 231			x			x	
AMPELISCIDAE	*Ampelisca*	*richardsoni* Karaman, 1975	179, 231, 252			x			x	x
AMPELISCIDAE	gen.	sp.	164, 179		x	x				
AMPHILOCHIDAE	gen.	sp. n.	194, 252				x			x
CAPRELLINOIDIDAE	*Caprellinoides*	*spinosus* Barnard, K.H., 1930	223					x		
CAPRELLINOIDIDAE	*Caprellinoides*	cf. *spinosus* Barnard, K.H., 1930	194				x			
COLOMASTIGIDAE	*Colomastix*	*castellata* K.H. Barnard, 1932	169		x					
COROPHIIDAE	*Gammaropsis*	*serricra* (K.H. Barnard, 1932)	187, 252				x			x
COROPHIIDAE	*Jassa*	*goniamera* Walker, 1903	252							x
DEXAMINIDAE	*Lepechinella*	sp.	252							x
EPIMERIDAE	*Epimeria*	*georgiana* Schellenberg, 1931	169		x					
EPIMERIDAE	*Epimeria*	*inermis* Walker, 1903	252							x
EPIMERIDAE	*Epimeria*	*puncticulata* K.H. Barnard, 1930	169		x					
EPIMERIDAE	*Epimeria*	*similis* Chevreux, 1912	194, 252, 253				x			x
EPIMERIIDAE	*Metepimeria*	*acanthurus* Schellenberg, 1931	150	x						
EUSIRIDAE s.l.	*Atyloella*	*magellanica* (Stebbing, 1888)	214				x			
EUSIRIDAE s.l.	*Atylopsis*	cf. *fragilis* Rauschert, 1989	145	x						
EUSIRIDAE s.l.	*Atylopsis*	cf. *megalops* (red eyes)	169		x					
EUSIRIDAE s.l.	*Atylopsis*	*megalops* Nicholls, 1938	194, 200, 252		x		x			x
EUSIRIDAE s.l.	*Eusirus*	*antarcticus* Thomson, 1880	194, 200				x			
EUSIRIDAE s.l.	*Eusirus*	*perdentatus* Chevreux, 1912	258							x
EUSIRIDAE s.l.	*Liouvillea*	sp.n. (cf. oculata)	194, 217, 223				x	x		
EUSIRIDAE s.l.	*Oradarea*	*tricarinata* K.H. Barnard, 1932	194				x			

Family	Genus	Species	Station	A	B 1	B 2	C1-3	C4-5	D	E
EUSIRIDAE s.l.	*Oradarea*	*tridentata* K.H. Barnard, 1932	169		x					
EUSIRIDAE s.l.	*Oradarea*	*walkeri* Shoemaker, 1930	194				x			
EUSIRIDAE s.l.	*Prostebbingia*	*brevicornis* (Chevreux, 1906)	187							
EUSIRIDAE s.l.	*Rhachotropis*	*antarctica* K.H. Barnard, 1932	214, 217, 223, 237, 252				x	x	x	x
EUSIRIDAE s.l.	*Schraderia*	*gracilis* Pfeffer, 1888	169, 179, 187		x	x	x			
EUSIRIDAE s.l.	*Schraderia*	*barnardi* Thurston, 1974	194, 217, 223, 252				x	x		x
EUSIRIDAE s.l.	*Schraderia*	cf. *gracilis* Pfeffer, 1888	223					x		
EUSIRIDAE s.l.	*Atylopsis*	sp.n. (cf. fragilis)	223					x		
EXOEDICEROTIDAE	*Parhalimedon*	*turqueti* Chevreux, 1906	217					x		
GAMMARELLIDAE	*Austroregia*	*huxleyana* (Bate, 1862)	145, 187	x			x			
GAMMARELLIDAE	*Austroregia*	sp.(n.?)	145, 164, 169	x	x					
HYPERIIDAE	*Themisto*	*gaudichaudii* Guerin, 1825	157		x					
IPHIMEDIIDAE	*Echiniphimedia*	sp.	166		x					
IPHIMEDIIDAE	*Gnathiphimedia*	*sexdentata* (Schellenberg, 1926)	145	x						
IPHIMEDIIDAE	*Iphimedia*	*magellanica* Watling & Holman, 1980	145	x						
IPHIMEDIIDAE	*Pseudiphimediella*	*glabra* (Schellenberg, 1931)	150	x						
ISCHYROCERIDAE	*Cerapus*	sp.	252							x
ISCHYROCERIDAE	gen.	spp.	231						x	
ISCHYROCERIDAE	gen.	sp.	187			x				
ISCHYROCERIDAE	*Haplocheira*	*barbimana* (Thomson, 1879)	237						x	
ISCHYROCERIDAE	*Pseudericthonius*	cf. *hesperidesi* Rauschert, 1997	187				x			
ISCHYROCERIDAE	*Pseudericthonius*	*hesperidesi* Rauschert, 1997	217					x		
ISCHYROCERIDAE	*Pseudericthonius*	sp.	164		x					
LAPHYSTIOPSIDAE	gen.nov.	sp.n..	217					x		
LAPHYSTIOPSIDAE	*Prolaphystiopsis*	*platyceras* Schellenberg, 1931	145	x						
LEUCOTHOIDAE	*Leucothoe*	*spinicarpa* (Abildgaard, 1789) s.l.	169, 214, 217, 252		x		x	x		x
LILJEBORGIIDAE	*Liljeborgia*	*longicornis* (Schellenberg, 1931)	194				X			

Family	Genus	Species	Station	A	B 1	B 2	C1- 3	C4 -5	D	E
LILJEBORGIIDAE	*Liljeborgia*	*macrodon* Schellenberg, 1931	145, 187, 217, 223	x			x			
LILJEBORGIIDAE	*Liljeborgia*	*quadridentata* Schellenberg, 1931	214, 217				x	x		
LYSIANASSIDAE s.l.	*Abyssorchomene*	*plebs* (Hurley, 1965a)	162,191, 234, 261		x		x		x	x
LYSIANASSIDAE s.l.	*Abyssorchomene*	*rossi* (Walker, 1903a)	191, 261				x			
LYSIANASSIDAE s.l.	*Eurythenes*	*gryllus* (Lichtenstein, 1822)	261							x
LYSIANASSIDAE s.l.	*Hippomedon*	*kergueleni* (Miers, 1875)	214				x			
LYSIANASSIDAE s.l.	*Hirondellea*	sp.	223					x		
LYSIANASSIDAE s.l.	*Opisa*	sp.	214				x			
LYSIANASSIDAE s.l.	*Orchomenella*	sp. SG 1	187				x			
LYSIANASSIDAE s.l.	*Orchomenopsis*	cf. *acanthura* (Schellenberg, 1931)	187				x			
LYSIANASSIDAE s.l.	*Orchomenopsis*	sp. (orange)	187				x			
LYSIANASSIDAE s.l.	*Orchomenopsis*	sp. SG1	162		x					
LYSIANASSIDAE s.l.	*Orchomenopsis*	sp.T1	157	x						
LYSIANASSIDAE s.l.	*Orchomenopsis*	sp.T2	157	x						
LYSIANASSIDAE s.l.	*Orchomenopsis*	sp.T3	261		x					
LYSIANASSIDAE s.l.	*Pachychelium*	sp.	145	x						
LYSIANASSIDAE s.l.	*Pseudorchomene*	cf *coatsi* (Chilton, 1912)	157, 162, 261		x					x
LYSIANASSIDAE s.l.	*Shackletonia*	*robusta* K.H. Barnard, 1931	194				x			
LYSIANASSIDAE s.l.	*Stomacontion*	sp.	145	x						
LYSIANASSIDAE s.l.	*Tryphosella*	sp T1 (us.1 sharp)	261							x
LYSIANASSIDAE s.l.	*Tryphosella*	sp T2	261							x
LYSIANASSIDAE s.l.	*Tryphosella*	sp. (red antennae)	214				x			
LYSIANASSIDAE s.l.	*Tryphosella*	sp. Burdwood 1	157	x						
LYSIANASSIDAE s.l.	*Tryphosella*	sp. Burdwood 2	157, 162	x	x					
LYSIANASSIDAE s.l.	*Tryphosella*	sp. Burdwood 3	162		x					
LYSIANASSIDAE s.l.	*Tryphosella*	sp. SG1	162		x					
LYSIANASSIDAE s.l.	*Uristes*	sp. (special eye)	214				x			
LYSIANASSIDAE s.l.	*Uristes*	sp. 1 (Burdwood 2)	157	x						

Family	Genus	Species	Station	A	B 1	B 2	C1-3	C4 -5	D	E
LYSIANASSIDAE s.l.	*Uristes*	sp. 2 "red"	191				x			
LYSIANASSIDAE s.l.	*Waldeckia*	*obesa* (Chevreux, 1905)	191				x			
MELITIDAE	*Maera*	sp.	252							x
MELITIDAE	*Paraceradocus*	*miersi* (Pfeffer, 1888)	231						x	
MELITIDAE	*Paraceradocus*	sp.	169		x					
MELPHIDIPPIDAE	*Melphidippa*	*antarctica* Schellenberg, 1926	194, 217, 252				x	x		x
ODIIDAE	*Odius*	sp.n. (cf. antarcticus Watl. & Holman, 1981)	214, 217, 223				x	x		
OEDICEROTIDAE	*Monoculodes*	sp.	237						x	
OEDICEROTIDAE	*Oediceroides*	*emarginatus* Nicholls, 1938	160		x					
PARDALISCIDAE	gen.	sp.	217, 223					x		
PARDALISCIDAE	*Halice*	cf. *profundi* Barnard, K.H., 1932	214				x			
PARDALISCIDAE	*Pardalisca*	cf. *magellanica* Schellenberg, 1931	194				x			
PARDALISCIDAE	*Pardalisca*	*magellanica* Schellenberg, 1931	223					x		
PHOXOCEPHAEALID	*Proharpinia*	*antipoda* Schellenberg, 1931	252							x
PHOXOCEPHALIDAE	gen.	sp.	169		x					
PHOXOCEPHALOPSIDAE	*Phoxocephalopsis*	*zimmeri* Schellenberg, 1931	145	x						
PHRONIMIDAE	*Phronima*	sp.								
PHTISICIDAE	*Aeginoides*	cf. *gaussi* Schellenberg, 1926	187				x			
PLEUSTIDAE	*Parepimeria*	*bidentata* Schellenberg, 1931	164, 179, 200		x	x	x			
PLEUSTIDAE	*Parepimeria*	cf. *crenulata* Chevreux, 1912	252							x
PLEUSTIDAE	*Parepimeria*	*minor* Watling & Holman, 1980	223, 252					x		x
PODOCERIDAE	*Neoxenodice*	cf. *hoshiai* Takeuchi & Takeda, 1992	187				x			
PODOCERIDAE	*Podocerus*	*capillimanus* Nicholls, 1938	145	x						
PODOCERIDAE	*Podocerus*	cf. *septemcarinatus* Schellenberg, 1926	164, 169, 217		x			x		

Family	Genus	Species	Station	A	B 1	B 2	C1-3	C4-5	D	E
PODOCERIDAE	*Podocerus*	*cristatus rotundatus* Schellenberg, 1931	169		x					
PODOCERIDAE	*Podocerus*	*septemcarinatus* Schellenberg, 1926	223, 252					x		x
PODOCERIDAE	*Podocerus*	sp.n. (cf. septemcarinatus)	169, 187		x		x			
STEGOCEPHALIDAE	gen.	sp.	164, 169		x					
STENOTHOIDAE	gen.	sp. (rot gestreift)	145	x						
STENOTHOIDAE	gen.	sp.1	194				x			
STENOTHOIDAE	gen.	sp.2	194				x			
STENOTHOIDAE	gen.	sp.3	194				x			
STENOTHOIDAE	gen.	sp.4	194				x			
STENOTHOIDAE	*Probolisca*	*elliptica* (Schellenberg, 1931)	194				x			
STENOTHOIDAE	*Probolisca*	*nasutigenes* (Stebbing, 1888)	194				x			
STENOTHOIDAE	*Probolisca*	*ovata* (Stebbing, 1888)	223					x		
STENOTHOIDAE	*Scaphodactylus*	sp.	194				x			
STENOTHOIDAE	*Thaumatelson*	*herdmani* Walker, 1906	194, 217				x	x		
STENOTHOIDAE	*Torometopa*	cf. *carinata* (Schellenberg, 1931)	164		x					
STENOTHOIDAE	*Torometopa*	sp.n.	200				x			
STENOTHOIDAE	*Torometopa*	sp.n.(humpbacked)	194				x			
STILIPEDIDAE	*Alexandrella*	*dentata* Chevreux, 1912	252							x
STILIPEDIDAE	*Alexandrella*	sp.	169		x					
SYNOPIIDAE	*Syrrhoe*	*nodulosa* Barnard, K.H., 1932	214				x			
SYNOPIIDAE	*Syrrhoe*	*psychrophila* Monod, 1926	179, 223, 252			x		x		x
SYNOPIIDAE	*Syrrhoites*	*anaticauda* Barnard, K.H., 1930	169, 187, 194, 200		x		x			
UROTHOIDAE	*Urothoe*	*oniscoides* (Barnard, K.H., 1932)	252							x
UROTHOIDAE	*Urothoe*	sp.1	217					x		
UROTHOIDAE	*Urothoe*	sp.2	217					x		

Isopods represented a small fraction only of the total catches obtained with AGT and GSN trawls (Table 10). At a first glance, the preliminarily identified species are not closely related with isopods collected at several places in the Straits of Magellan. Serolidae were the most abundant family, whereas Arcturidae were the most frequent one.

Tab. 10 Preliminary list of isopod species abundance in AGT and GSN samples. Station numbers according to Annex table 3.2.

AGT	Station													
	145	150	160	164	182	187	194	207	214	217	223	231	238	TOTAL
Serolis sp. 1	16	0	0	1	0	0	0	0	0	0	0	0	0	17
Serolis sp. 2	4	0	0	1	0	0	0	0	0	0	0	3	0	8
Serolis sp. 3	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Natatolana sp. 1	1	3	0	4	1	0	1	0	0	0	0	0	0	10
Natatolana sp. 2	0	1	0	0	1	0	0	0	0	0	0	6	4	12
Natatolana sp. 3	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Janthopsis laevis	3	0	0	0	0	0	0	0	0	0	0	0	0	3
Ianiridae INDET	3	0	0	0	0	0	0	0	0	0	0	0	0	3
Iathrippa sp.	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Sphaeromidae INDET. 1	3	0	0	0	1	0	0	0	0	0	0	0	0	4
Sphaeromidae INDET. 2	0	8	0	0	0	0	0	0	0	0	0	0	0	8
Antarcturidae INDET.	2	0	3	5	0	0	1	0	1	0	0	3	0	15
TOTAL	33	12	3	11	3	0	2	0	1	1	0	13	4	83

GSN	Stations							
	154	166	174	196	208	229	241	TOTAL
Serolis sp. 1	0	0	0	0	0	0	1	1
Serolis sp. 2	0	0	0	0	0	0	7	7
Serolis sp. 3	0	4	0	0	0	0	0	4
Natatolana sp. 1	1	0	0	0	0	0	0	1
Sphaeromidae INDET. 2	6	0	0	0	0	0	0	6
Antarcturidae INDET.	0	5	0	1	0	0	1	7
TOTAL	7	9	0	1	0	0	9	26

- Biogeography

A preliminary analysis of the new records indicated significant new range extensions along the Scotia Arc for several species. Species seen as typical Magellan species so far were found at Antarctic locations (e.g. the liljeborgiid *Liljeborgia macrodon* off South Sandwich Islands and on Discovery Bank). On the other hand, some typical Antarctic species extended their distribution towards the middle of the Scotia Arc (e.g. the lysianassid scavenger *Abyssorchomene plebs* was found west of South Georgia). 51 amphipod species occurred north of the Polar Front (areas A-B) and 91 species occurred south of the Polar Front (areas C-D). 11 species occur on both sides of the Polar Front.

Cluster analysis of amphipod data indicated overall low similarity between the sampled areas of the Scotia Arc. Especially the Burdwood Bank amphipod assemblage differs distinctly from the other six areas. Only three of the 116 species used for clustering show a wider distribution within the Scotia Arc. More quantitative studies are necessary to determine which species are related with the level of dissimilarities between areas observed with this qualitative analysis.

- Ecofunctional diversity

Scavenger guild investigation: the 5 baited trap deployments provided 17 scavenger amphipod species (all Lysianassidae), 4 species of isopods (Natatolana, Cirolanidae), one ostracod species and one fish, *Patagonotothen guntheri* (Nototheniidae) (Table 11). The animals collected were usually in good condition and part of them were kept in aquaria for observations and further feeding experiments. At Station 261 we caught 471 specimens of the giant cosmopolitan amphipod *Eurythenes gryllus*.

Tab. 11 Animals collected with baited amphipod traps (TrapA). Station numbers according to Annex table 3.2.

Station TrapA	Depth (m)	Duration (h)	Amphipoda	Isopoda	Ostracoda	Pisces
			N spp/N ind	N spp/N ind	N spp/N ind	N spp/N ind
157	416	24	5/1429	2/864	1/2	
162	293	19	6/639	1/1058		1/3
191	266	22	4/6000	1/133		
234	311	14	1?/10000	1/97		
261	745	23.30	7/680	1/17		
TOTAL			17/18748	4/3033	1/2	1/3

The isopod size distribution in the trap samples indicated an overall size range of 13 to 35 mm at all stations but a distinct separation of size ranges in sympatrically occurring species. Apparently the height of the trap above ground did affect the numbers caught, but not the size range.

- Habitat characterisation

The microhabitats, e.g. sponges, hydrozoans or actinians, of some species were identified more precisely. Compared to previous studies (EASIZ III: Lörz, 2001), surprisingly few amphipods were found living in sponges. They all belonged to the families Lysianassidae and Stegocephalidae.

- Molecular phylogeny and phylogeography of selected amphipod taxa

Only a few specimens of the target genera within the Iphimedoidea and Lysianassoidea were found. Specimens of expected outgroup taxa were also collected for further analysis. On board DNA was extracted from 104 amphipods (29 species, 20 genera, 12 families) collected during ANDEEP and LAMPOS.

- Trophodiversity and trophodynamics

Ingestion and assimilation rates could be determined on board. Stomach content analysis focused on few species, in particular *Epimeria similis*, due to its abundance and large size. This species seems to have a very specific diet mainly composed of hydrozoans (stomach content dominated by nematocysts characteristic of Leptomedusae and Anthomedusae) as indicated by previous observations made in the eastern Weddell Sea.

2.1.6 Echinodermata of the Scotia Arc (J. Bohn)

Objectives

The LAMPOS expedition offered the chance to investigate the echinoderm fauna of the Scotia Arc in terms of biodiversity, biogeography and evolution. Starting with a faunal inventory, questions such as the relationships of the Scotia Arc echinoderm fauna to the faunas of Antarctica and the Magellanic region, and its relationships to the fauna of the surrounding deep sea (ANDEEP I & II) were to be adressed. Together with phylogenetic investigations of selected taxa (Asteroidea: J. Pearse [USA], E. Mutschke [UMAG] and W.Arntz [AWI]; Cidaroida: J. Pearse, R.J. Mooi and S. J. Lockhard [all USA]) of this area it might be possible to determine the origins and directions of colonisation.

Tab. 12 Preliminary number of echinoderm species collected during LAMPOS. AGT Agassiz trawl, GSN bottom trawl, LD Lovrich dredge, RD Rauschert dredge Station numbers according to Annex table 3.2.

Station No.	Gear	Crinoidea	Asteroi-dea	Ophiuroi-dea	Echinoi-dea	Holothuroi-dea
145-1	AGT	2	7	5	2	5
150-1	AGT	2	14	7	3	5
151-1	LD	1	-	2	-	2
153-1	GSN	1	12	6	1	3
160-1	AGT	1	2	-	-	1
164-1	AGT	2	8	6	4	4
167-1	GSN	1	10	5	2	-
169-1	RD	2	1	7	2	3
174-1	GSN	-	1	1	1	-
182-1	AGT	-	4	4	4	-
187-1	AGT	1	7	5	1	5
194-1	AGT	2	12	4	1	6
196-1	GSN	1	11	3	1	5
200-1	RD	1	1	4	-	6
207-1	AGT	1	7	3	1	7
208-1	GSN	1	4	3	-	2
214-1	AGT	2	12	5	2	5
217-1	AGT	-	5	4	2	6
223-1	AGT	1	4	4	2	5
229-1	GSN	-	5	4	2	-
231-1	AGT	-	6	5	5	4
238-1	AGT	-	1	2	1	-
241-1	GSN	-	1	1	1	2
251-1	RD	-	-	2	1	-
252-1	AGT	1	9	6	5	2
253-1	GSN	-	8	3	6	1

Work at sea

During the LAMPOS expedition Echinodermata have been collected from four different nets (Agassiz trawl, bottom trawl, Lovrich dredge, Rauschert dredge, Table 12). The specimens were sorted to species level, specimens in good condition were photographed to document colouration and all specimens were fixed in ethanol (for molecular studies) or formalin (for histological studies)

Preliminary results

- Crinoidea: The crinoid fauna in total was quite poor, with about 4 different species in the northern branch of the Scotia Arc and 4 species in the southern branch. Both typical high Antarctic species *Promachocrinus kerguelensis* and *Anthometra adriani* seem to have their northern limit of distribution in the Scotia Arc at the South Sandwich Islands, where especially *P. kerguelensis* is quite common.

- Cidaroida (Echinoidea): For the phylogenetic and reproductive studies on cidaroid sea-urchins of J. Pearse, R.J. Mooi and S.J. Lockhard 190 cidaroids from 12 stations have been fixed in 96% ethanol (Table 13).

Tab. 13 Preliminary number of echinoderm species collected during LAMPOS. Station numbers according to Annex table 3.2.

Station No.	145	150	153	160	164	187	214	217	223	229	251	252
Specimens	1	22	5	11	31	2	3	2	7	11	80	15

- Asteroidea: see chapter "Biogeography of Asteroidea"

- Holothuroidea: About 20 different holothurian species were caught in 20 trawls with up to 7 species per trawl (Table 12). The majority of the species belong to the Dendrochirotida (13), but also some Apodida (4) and Aspidochirotida (3) were present.

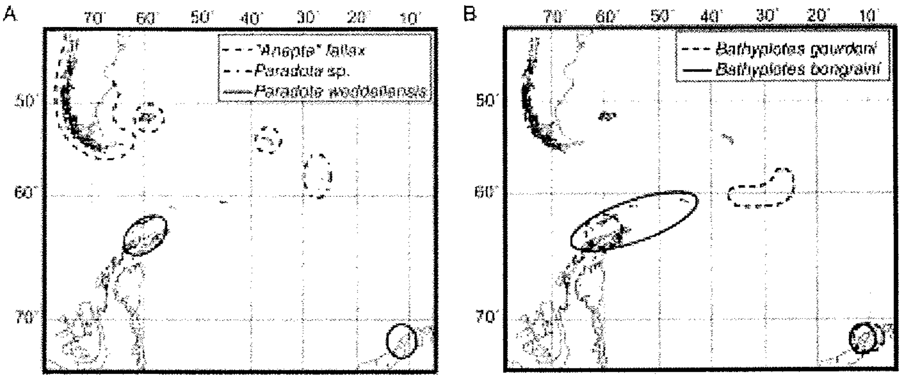

Fig. 5 Distribution of selected Holothuroidea in the Scotia Arc area. – A. "*Anapta*" *fallax*, *Paradota* sp. and *Paradota weddellensis* (Chiridotidae), for further explanations see text. – B. *Bathyplotes gourdoni* and *Bathyplotes bongraini* (Synallactidae), for further explanations see text.

Very little is known about the zoogeographical relationships of the three species of the genus *Paradota* (Apodida: Chiridotidae). *P. weddellensis* is known from the Weddell Sea and the Antarctic Peninsula (Fig. 5A), *P. marionensis* from Marion Island, and *P. ingolfi* from the North Atlantic deep sea. On five stations off the South Sandwich Islands (Fig. 5B) a *Paradota* sp.

has been found, which is definitely different from the high Antarctic *Paradota weddellensis*. A quite similar species *Anapta fallax* placed within the family Synaptidae is known to occur in southern South America and the Falkland Islands (Pawson 1969) and with some doubts also in South Georgia (only a fragment is known, see Ekman 1925). From the description given by Pawson (1969) it is obvious that this species is not a Synaptidae, but a Chiridotidae and then should be placed within the genus *Paradota*. The *Paradota* sp. found off the South Sandwich Islands seems to be quite similar to *"Anapta" fallax* if not conspecific, but this has to be proven by further investigations. These data would rise the species number in *Paradota* to four and extend the distributional range further to the north.

New records of the Synallactidae (Aspidochirotida) *Bathyplotes gourdoni* (= *B. rubipunctatus*, synonymised by O'Loughlin, in press) and *Bathyplotes bongraini* (= *B. fusciviculum* synonymised by O'Loughlin, in press) extend their distributional range in western Antarctica from the eastern Weddell Sea and the Antarctic Peninsula to the southern branch of the Scotia Arc (Fig. 1B). For *Bathyplotes bongraini* the new records are from off Elephant Island and off the South Orkneys, for *B. gourdoni* on the Herdman Bank and off the southern islands of the South Sandwich Islands.

Altogether for the holothurians and crinoids there is a change in the faunal composition along the Scotia Arc. Some very characteristic high Antarctic species seem to have their northern limits of distribution somewhere around the South Sandwich Islands, but also the southern limits of distribution of some Magellanic species seem to be at the South Sandwich Islands, which may prove to be a transitional area. However, our data are still too scarce to draw any further conclusions.

2.1.7 **Biogeography of Asteroidea** (C. Ríos, Y. Cariceo)

Objectives

The southern South America and Antarctic starfish fauna show high species richness and a high level of endemism. At the same time there is a considerable faunal overlap between the two regions on higher taxonomic level (e.g. family and genus). The Scotia Arc may act as a natural bridge for faunal exchange between South America and the Antarctic continent. Its fauna is, however, less known compared with the former two areas. The main goal of our investigation was to study the distribution of asteroids in the Scotia Arc and their zoogeographical connections to the Antarctic and to South America.

Work at sea

Seastar specimens were collected from 21 samples taken with AGT (n=13) and GSN (n=8). After picking material by hand from the catches on deck, most seastars were fixed in 75% alcohol or 4% buffered formaldehyde-seawater for detailed taxonomical identification at the UMAG and AWI laboratories. Asteroid tissue samples were taken for analysis by a multinational molecular genetic project (J.Pearse et al.). Additional tissue samples will be taken from specimens collected in the Magellan region.

Preliminary results

A large number of specimens were caught using both trawls, which enable us to separate at first glance at least 33 different morphotypes of asteroids (Table 14). Fig. 6 indicates that the number of animals caught per trawl was highest at the South Sandwich Islands (C1, C2a, C2b, C3) and at Elephant Island (E), i.e. those stations with softer sediments.

Tab. 14 Collected numbers of asteroid specimens (CNA) and preliminary estimation of species numbers (PNS) from AGT and GSN catches. Station numbers according to Annex table 3.2.

	AGT				GSN		
Stn	Area	CNA	PNS	STN	Area	CNA	PNS
145	Burdwood Bank (A1)	15	7	153	Burdwood Bank (A2)	30	12
150	Burdwood Bank (A2)	29	14	166	Burdwood Bank (B1)	16	10
160	Burdwood Bank (B0)	2	2	174	South Georgia (B2)	3	1
164	Shag Rock (B1)	10	8	196	South Sandwich (C2)	114	11
182	South Georgia (B2)	7	4	208	South Sandwich (C2)	12	4
187	South Sandwich north (C1)	17	7	229	Discovery Bank (C5)	13	5
194	South Sandwich (C2a)	64	12	241	South Orkney (D2)	1	1
207	South Sandwich (C2b)	56	7	253	Elephant Island (E1)	27	8
214	South Sandwich (C3)	71	12				
217	Herdman Bank (C4)	5	5				
223	Discovery Bank (C5)	9	4				
231	South Orkney (D1)	10	6				
238	South Orkney (D2)	1	1				
252	Elephant Island (E1)	81	9				
		372				216	

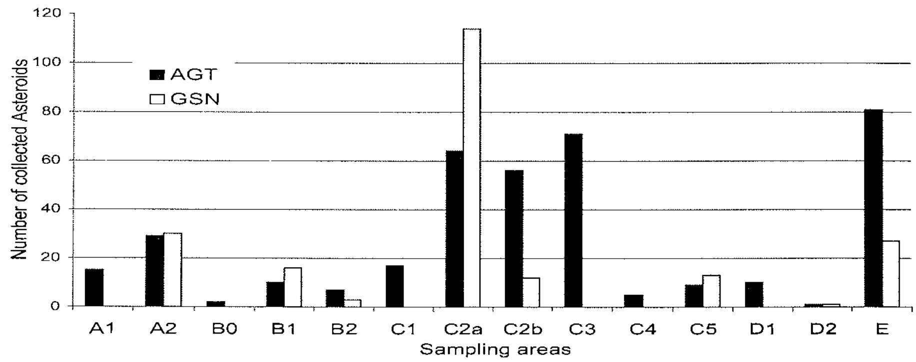

Fig. 6 Number of asteroids captured by AGT and GSN along the Scotia Arc. Area codes according to Annex table 3.1.

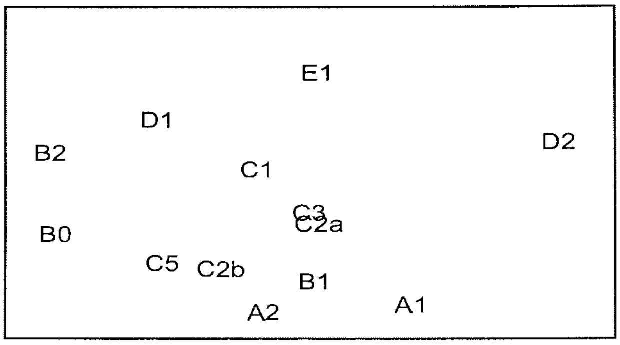

Fig. 7 MDS plot from Bray-Curtis similarities computed for presence/absence transformed asteroid species data. Area codes according to Annex table 3.1. (Stress value=0.12).

2.1.8 Biodiversity, Distribution and Evolution of Ascidians (M. Tatián, R. Sahade)

Objectives

- to determine ascidian species
- to analyse the ascidian distribution patterns in relation to the Polar Front
- to study ascidian gut contents

Work at sea

Ascidians were collected by Agassiz (AGT) and bottom (GSN) trawls in 250-600 m water depths. Live animals were photographed using a digital camera to document colouration which is usually lost after fixation. Animals were relaxed in seawater, later fixed in 4% buffered formalin seawater and identified to species morphologically. The reproductive status of colonial species was evaluated by recording the presence of tadpoles. Water and sediment samples were collected by CTD and multibox corer, respectively, at the same stations and fixed in formalin for further microscopical analyses.

Preliminary results

A total of 25 species/morphospecies were registered during the cruise (Table 15). Ascidians were found at nearly all stations and in more than 80% of the hauls. 9 out of the 12 families known worldwide were found, even some of those known to be rare in Antarctic and Subantarctic waters, e.g. Didemnidae and Octacnemidae. Species with a wide distribution in these waters, such as *Molgula pedunculata*, *Distaplia cylindrica* and *Sycozoa sigillinoides* were also present. Species richness was higher on soft bottoms than on hard substrates such as gravel, pebbles and volcanic stones. Associations with other benthic taxa were found, as those of incrusting Didemnidae on sponges and bryozoans or the epibiosis of small ascidian specimens on the tunic of large Styelidae. A meaningful interpretation of biodiversity and distributional patterns is difficult because of the high variability in substrate type and water

depths. Nevertheless, South Georgia appears to be the northern limit for the distribution of some Antarctic species like *Styela wandeli* and *Molgula pedunculata* but has endemic species, too, such as the species *Pyura georgiana*.
Gut contents of the macrophagous species *Cibacapsa gulosa* Monniot & Monniot 1983 consisted of copepods, halacarids, lumbrineriform polychaetes and larger items such as ophiurids.

Tab. 15 Species composition and abundance of ascidian specimens in the different areas sampled. BB: Burdwood Bank; SR: Shag Rocks; SG: South Georgias; S: South Sandwich; HB: Herdman Bank; DB: Discovery Bank; SO: South Orkneys; El: Elephant Island.
• 1 specimen, •• 2-10 specimens, ••• >10specimens

	BB	SR	SG	S	HB	DB	SO	EI
Polyclinidae 1	••						•	
Polyclinidae 2	•							••
Polyclinidae 3	••							
Polyclinidae 4			•••				•••	••
Polyclinidae 5								••
Distaplia cylindrica			••				••	
Polycitoridae 1	••							
Sycozoa sigillinoides?					••	••		
Didemnidae			••				••	
Tylobranchion ?				••				
Cibacapsa gulosa				••				
Ascidia meridionalis	••	••						
Styelidae 1	•							
Styelidae 2		•						
Styelidae 3			••					
Styelidae 4				•				
Styelidae 5					••	•		
Styela wandeli			••					
Pyura squamata		•						
Pyura georgiana			••					
Pyura bouvetensis							••	•••
Eugyrioides sp								•••
Molgula pedunculata			••					•
Simple ascidian 1			••					
Simple ascidian 2							•	

2.1.9 The Scotia Arc Link in Macro- and Meiofauna (H. Bohlmann, W. Bonne, D. Gerdes, R. Herman, A. Montiel, A. Roux, M. Palma, E. Quiroga)

Objectives

The Scotia Arc acts as a natural biogeographic bridge or barrier for faunal exchange between South America and Antarctica, which, however, have a common history as part of the Gondwana continent. The LAMPOS cruise provided further quantitative samples along the various shallows of the Scotia Arc, thus complementing previous comprehensive biodiversity studies in both regions with "Polarstern", "Victor Hensen", and "Vidal Gormaz". Meiofauna studies in and near the Antarctic indicated strong similarity with comparable assemblages elsewhere in the world, at least at family and genus level.

These findings strongly contrast with the macrobenthos, which is in many cases different in the Antarctic. Slow speciation with relict faunas in similar habitat conditions might be one explanation for this meiofauna pattern. Recruitment and colonisation via the Scotia Arc area may be another explanation.

Important questions to be answered are:

- Is the Scotia Arc a transitory area?
- Do the shallows along the Arc serve as footsteps for faunal distribution and if so, in which direction?
- Are there any clines or breaks in diversity, abundance and biomass along the Arc?
- To which extent does eurybathy and high trophic diversity exist?

Work at Sea

- Macrofauna

The multibox corer (MG) was deployed at 10 stations (Table 16). At station 154 the MG failed due to stony and overcompacted sediments, at station 177 a breakdown of the UW-camera caused a failure, and at station 222 the samples were washed out and hence not considered for quantitative analysis. From the other stations the gear provided 57 single cores. The material was sieved over 500 μm mesh size and preserved in buffered 4 % formalin prior to sorting in the home lab.

Tab. 16 Multibox Corer (MG) stations during ANT XIX/5. Station numbers according to Annex table 3.2.

Station No.	MG No.	Date	Long./Lat.	Depth (m)	No. of cores	Sediments
154	1	06.04.02	54°32.54; 55°56.29	395	0	overcompacted clay with stones
163	2	09.04.02	53°23.68; 42°40.55	278	5	thin layer of lava debris on rock
176	3	11.04.02	54°25.34; 35°38.48	210	7 (2)	clay with fluff on top
177	4	11.04.02	54°25.47; 35°38.68	278	0	clay with fluff on top
198	5	15.04.02	57°40.28; 26°27.59	558	5 (2)	coarse stone debris with thin fluff layer
199	6	15.04.02	57°37.93; 26°27.52	747	7 (2)	thin fluff layer with vulcanic stone debris
210	7	16.04.02	57°35.55; 26°23.75	1099	7 (2)	clay with fluff on top
222	8	20.04.02	60°08.05; 34°56.32	368	6,qualitative	stones of different size with clay
242	9	23.04.02	61°11.32; 45°45.36	307	7 (2)	stones with mud and fluff on top
254	10	25.04.02	61°23.98; 55°23.85	280	7 (2)	fine sand, silt and clay in deeper layers

- Meiofauna

Samples for meiofaunal studies were taken using a Barnett-Watson multiple corer (MUC) equipped with 12 core tubes of 62 mm diameter (25.5 cm^2 surface area) or by means of the multibox corer when the sediment was not appropriate to use the MUC. The MUC was deployed 4 times during LAMPOS and recovered a total of 48 cores, 12 per deployment. Each deployment 8 cores were used for meiofauna studies, 3 additional cores were used for extraction of macrofaunal polychaetes, 1 core was used for lipid content analysis and for the study of microbial organisms and Foraminifera. The supernatant water of the cores, down to 10 cm from the bottom, was fixed in order to study zooplankton larvae. For the meiofauna studies, 5 of the 8 cores were sliced at in situ temperature in slices of 0-1 cm, 1-3 cm, 3-5 cm, 5-10 cm and 10-15 cm. Three of the sliced cores are preserved on formaldehyde as pseudoreplicates for meiofauna community analysis. In the laboratory, the taxonomic composition of the meiofauna and the species composition of the nematode community will be determined. From the 2 remaining sliced cores subsamples of 1 ml per slice were taken with 2 cut off syringes, 1 for further analysis of organic carbon and 1 for granulometry per corer. The rest of the sediment per slice was kept for pigment analysis. All these samples for abiotic analysis are stored at –30°C. From 1 corer the upper 4 cm (in slices of 0-2 cm and 2-4 cm) were preserved for molecular analysis, another corer was fixed bulk. These samples for molecular analysis are fixed with aceton, from 16/04 they are fixed with ethanol. At 4 stations 2 boxes of the MG were used for quantitative meiofauna sampling, at 1 station for comparative purposes with the MUC and at 2 stations for additional material. Each box was subsampled with 3 corers for meiofauna community analysis, 1 corer for environmental variables and 2 corers for molecular analysis, treated in the same way as the MUC corers. In case the MG was not successful for quantitative analysis, only some qualitative samples could be taken, either from the MG, from the Rauschert dredge or from the AGT. Table 16 gives an overview of the type of meiofauna samples taken at the different locations.

Preliminary results

- Macrofauna

Detailed analyses will be done at home, but sample processing and the UW-video system provide some first impressions. The Scotia Arc was extremely difficult to sample with corers, especially on the northern branch of the Arc, where hard substrates and stones prevailed. Along the southern branch the stations showed a somewhat thicker sediment layer. Successful stations (177, 198) in the north were situated in depressions filled with clay and mud, which were identified by Parasound previously. These depressions represent only a tiny fraction of the total Scotia Arc area, they occur rather isolated within the usually hard substrates, and they are therefore not really representative for this area. The fauna in these ′mud holes′ appeared impoverished with hardly any visible epifauna. We assume this fauna to be rather specific with only little significance for the ′normal′ Scotia Arc hard bottom fauna. The further analyses of the samples, especially the breakdown to species level, will show whether the infauna of these holes acts as a link between benthos communities north and south of the Antarctic Convergence.

Tab. 17 Meiofauna stations during ANT XIX/5.
QCA: Quantitative community analysis. QMA: Quantitative molecular analysis.

Date	Area	Station No.	Coordinates	Depth [m]	Gear	Character
06/04	Burdwood Bank	PS61-154	54° 32.54' S 55° 56.29' W	395	MG1	QMA
09/04	Shag rocks	PS61-16	53° 23.95' S 42° 43.18' W	330	RD	QMA
11/04	South Georgia	PS61-176	54° 25.43' S 35° 38.43' W	278	MG3	QCA & QMA
		PS61-178	54° 25.46' S 35° 38.91' W	277	MUC1	QCA & QMA
15/04	Saunders Island	PS61-198	57° 40.29' S 26° 27.57' W	550	MG5	QMA
		PS61-199	57° 37.92' S 26° 27.46' W	747	MG6	QCA & QMA
16/04	Saunders Island	PS61-211	57° 35.58' S 26° 23.68' W	1095	MUC2	QCA & QMA
20/04		PS61-222	60° 8.06' S 34° 56.25' W	374	MG8	QMA
22/04		PS61-231	60° 59.31' S 43° 27.80' W	402	AGT	QMA
23/04	Signy Island	PS61-242	61° 11.40' S 45° 45.51' W	307	MUC3	QCA & QMA
25/04	Elephant Island	PS61-254	61° 23.87' S 55° 24.01' W	281	MG10	QCA & QMA
		PS61-255	61° 23.86' S 55° 23.65' W	280	MUC4	QCA & QMA

- Meiofauna

With respect to the hypothesis about the link between the Southern Ocean and South America, the conclusions made for macrobenthos are also valid for the meiofauna. Still two hypotheses remain as an explanation for the similar nematode fauna in Antarctic waters relative to other areas: the one about the relict fauna and the one about colonisation from the deep sea. Endemism is not found yet among the Antarctic nematode genera but the mud holes might be a source of endemism as colonisation might be rare. Additional to this the series of samples at Saunders Island, complementary to the ANDEEP transect, can be used to examine depth related changes in meiofauna communities, to accept or reject the hypothesis of eurybathy. In this way the possible colonisation from the deep sea can be demonstrated as well.

2.1.10 Visual Documentation of Megabenthos (M. Gorny, A. Buschmann, R. Schwartz, R. Alarcón, A. Mansilla)

Objectives

Since about 20 years, visual documentation of mega – epibenthic organisms forms part of the intensive studies on the benthos of the high Antarctic Weddell Sea. In the Magellan region the structures of benthic communities were described by means of underwater photography a few years ago, and during the last 2 years more than 50 video transects have been carried out covering most parts of the sublitoral of the Straits of Magellan. The aim of this study is to fill the gap of knowledge on benthic community structures and biodiversity for the Scotia Arc, as the islands of this particular area may function as "stepping stones" for the dispersal of benthic organisms between the Antarctic and South American continental shelves. Apart from this general approach, we want to evaluate the distribution patterns of *Munida subrugosa* towards the Subantarctic islands and to compare abundance data of this galatheid crab between the Magellan region and the Scotia Arc.

Work at sea

A ROV and a photosledge (FTS) were used for visual documentation of the benthos. The ROV was provided by the UMAG (Model Diavolo; Mariscope-Meerestechnik, Kiel), and the FTS was the standard AWI gear. The ROV was operated from a surface unit and connected with a telemetry cable. Video recording was done by an onboard digital camcorder. Steering of the ROV was controlled by another video camera, which was in front of the ROV, and which could be moved up and down. The images of both video cameras were recorded onboard "Polarstern" on standard VHS tapes, together with the data from the ROV's temperature sensor. The ROV was operated at 6 stations between Burdwood Bank and Elephant Island. 1 hour of digital video was recorded per station. Frame size of the images covered by the digital camera varied between 6x8 cm and about 60x80 cm. The FTS was used at 8 stations. The purpose of the FTS was to complement the video transects with high resolution images of about 100x100 cm size and to obtain visual information at places where it was impossible to use the ROV due to bad weather conditions or at depths outside the 300 m depth range. In general, both gear have been employed next to stations where sampling was performed by means of the Agassiz trawl or bottom trawl. Table 18 provides a compilation of all stations including sediment type and faunal characteristics.

Tab. 18 ROV and FTS stations during ANTXIX/5. Depth is given as the mean depth from the beginning to the end of the transect. D: Density of mega–epibenthos (- sparse; + sparse to medium). BB Burdwood Bank; SR Shag Rocks; SG South Georgia; SS South Sandwich Islands; SO South Orkney Islands; EI Elephant Island.

Gear	No.	Station	Area	Depth (m)	Temp. (°) Min.	Max.	Sediment	D	Most abundant groups	Comment
ROV	1	PS61/152	BB	290	+4.6	+5.0	Soft bottom with boulders	+	sponges, gorgonians, actinians, ophiuroids	
ROV	2	PS61/168	SR	-	-	-	-	-	-	Failure
ROV	3	PS61/180	SG	240	-0.5	-0.1	soft bottom with stones	-	sponges, gorgonians, crinoids, euphausiaceans, decapods, ophiuroids	Large amounts of krill
ROV	4	PS61/203	SS	255	-0.7	-0.5	hard substrate (volcanic)	+	sponges, gorgonians, ophiuroids	
ROV	5	PS61/236	SO	250	-1.4	-1.0	soft bottom	-	polychaetes, decapods, asteroids, ophiuroids, fishes	
ROV	6	PS61/250	EI	250	-0.3	0.0	soft bottom	-	actinians, polychaetes, pantopods, decapods, ophiuroids, fishes	
FTS	1	PS61/155	BB	404	-	-	soft bottom	-	sponges, actinians, sea urchins, ascideans	
FTS	2	PS61/165	SR	319	-	-	hard substrate (volcanic)	+	sponges, gorgonians	
FTS	3	PS61/175	SG	291	-	-	soft bottom	-	sponges	
FTS	4	PS61/201	SS	292	-	-	hard substrate (volcanic)	-	gorgonians, polychaetes, asteroids, ophiuroids	
FTS	5	PS61/202	SS	574	-	-	hard substrate (volcanic)	-	ophiuroids, asteroids, holothurians, crinoids	
FTS	6	PS61/226	HB	362	-	-	hard substrate (volcanic)	+	sponges, gorgonians, ophiuroids	
FTS	7	PS61/235	SO	325	-	-	soft bottom	-	sponges, actinians, sea urchins, ascideans	
FTS	8	PS61/249	EI	293	-	-	soft bottom	-	actinians, polychaetes, pantopods, ophiuroids	

2.1.11 **Demersal Fish** (K. Mintenbeck, R. Alarcón, E. Brodte, F. Vanella, R. Knust)

Objectives

The aim of our studies was to investigate the distribution of fish species in the area between South America and the Antarctic Peninsula. Since some species, such as *Chaenocephalus aceratus* or *Gobionotothen gibberifrons* are known to be widely distributed along the Scotia Arc, these islands may have served as stepstones during the dispersion process. Genetic analysis will show to what extent local stocks of one species are isolated from each other.

Work at sea

Material was collected from 14 Agassiz trawls (AGT) and 8 bottom trawls (GSN) (see Annex Table 3.2). Fishes were identified using appropriate literature, measured and weighed. Sex and maturity stages were determined. Otoliths were taken for age determinations and stomachs were removed for diet analyses (see "Fish Trophodynamics"). Tissue samples from white muscle for stable isotope analyses were frozen at –30°C. For population genetic studies in abundant species gill and muscle samples were stored at –30°C as well as in 90% ethanol.

Preliminary results

For this first evaluation only the shallow water (< 400m) bottom trawls (GSN) were considered. Numbers per catch were converted to numbers per 15 min trawling.

Tab. 19 Dominance of groups in the different areas (Myctophids excluded). *Data from expedtion ANT XVII-3. Area codes according to Annex table 3.1

% Portions	A2	B1	B2	C2	C5	D2	E1	Peninsula ANTXVII*
Notothenioids	99.5	98.6	99.7	99.4	100	100	90.7	98.3
Rajids	0.2	0.2	0	0	0	0	2.3	1.5
Others	0.3	1.2	0.3	0.6	0	0	7.0	0.2

The Antarctic suborder Notothenioidei is remarkably dominant in the whole area (Table 19). Only southwest of Elephant Island (E1) a few more non-notothenioids were found, mainly *Paradiplospinus gracilis* (Gempylidae, 'Others') and *Bathyraja* sp. ('Rajids'). The fish communities in the northern part of the Scotia Arc around Burdwood Bank (A2) and northwest of South Georgia (B1) were dominated by the small notothenioid species *Patagonotothen guntheri* (Table 20). *Trematomus lepidorhinus*, a species that is common on the north eastern Weddell Sea shelf, was found in high numbers only southeast of South Georgia (B2). The fauna around the South Sandwich Islands (C2, C5) is obviously dominated by *Lepidonotothen kempi*, whereas *Gobionotothen gibberifrons* was the most common species at the South Orkneys (D2). On the shelf of the Antarctic Peninsula several icefish species (Channichthyidae) were often dominating the communities, while *Lepidonotothen larseni* and *Gobionotothen gibberifrons* were also common species.

Tab. 20 Abundance 15 min^{-1} trawling time. Grey marks indicate center of distribution according to GON & HEEMSTRA (1990): Light Grey: Magellan and Patagonian-Falkland region; Dark Grey: Antarctica; Unmarked: widely distributed (e.g. Myctophidae, Zoarcidae) or restricted to special area (e.g. *Artedidraco mirus*, *Parachaenichthys georgianus*). Area codes and station numbers according to Annex tables 3.1 & 3.2. Area P: Antarctic Peninsula, expedition ANTXVII-3.

	Station-No.	61-153	61-166	61-174	61-196	61-229	61-241	61-253	56-173	56-177	56-183	56-184
	Area	A2	B1	B2	C2	C5	D2	E1	P	P	P	P
Nototheniidae	Dissostichus eleginoides	4.5	12.9	3.6								
	Dissostichus mawsoni								0.7		1.8	0.6
	Gobionotothen gibberifrons			31.6			162.2	1.8	12.9	4.0	21.0	0.6
	Lepidonotothen kempi				54.4	84.1	3.8		11.4			11.0
	Lepidonotothen larseni		3.6		23.0		25.3	6.6	5.7	3.5	46.2	8.7
	Lepidonotothen macrophthalma		2.6									
	Lepidonotothen nudifrons	0.8								8.1	27.0	
	Notothenia coriiceps										2.4	
	Notothenia rossi			0.5						0.6		
	Patagonotothen guntheri	825.0	202.8									
	Pleuragramma antarcticum							0.4				0.6
	Trematomus eulepidotus						0.5					
	Trematomus hansoni			1.0			0.5		0.7		0.6	0.6
	Trematomus lepidorhinus			72.4								
	Trematomus nicolai						0.5					
	Trematomus scotti									2.9	1.8	
Bovichtidae	*Cottoperca gobio*	2.3										
Channichthyidae	*Chaenocephalus aceratus*			15.5	0.9		18.3	2.6	0.7	11.5	18.6	0.6
	Champsocephalus gunnari		1.6	55.3			18.8	0.4	5.0	19.0	19.2	0.6
	Chionodraco rastrospinosus						3.3	2.2	12.9		4.2	19.0
	Cryodraco antarcticus					1.4			0.7			9.2
	Pseudochaenichthys georgianus			9.3			15.0	0.4	1.4	0.6	2.4	
Artedi-draconidae	*Artedidraco mirus*		1.0									
	Pogonophryne permittini						1.4					
Bathydracon.	*Parachaenichthys georgianus*			0.5								

	Station-No.	61-153	61-166	61-174	61-196	61-229	61-241	61-253	56-173	56-177	56-183	56-184
	Area	A2	B1	B2	C2	C5	D2	E1	P	P	P	P
Myctophidae	*Electrona antarctica*											
	Electrona carlsbergi							21.1				
	Gymnoscopelus nicholsi							56.0				
	Gymnoscopelus spp.						2.8					
	Myctophidae spp.		69.8		2.8		5.6					
	Protomyctophum choriodon							0.4				
Other Non-Notothenioidei	Gempylidae sp.		1.0									
	Lycodichthys antarcticus	0.8										
	Mancopsetta milfordi		0.5									
	Micromesistius australis	0.8										
	Muraenolepis marmoratus	0.8	1.0	0.5	0.5							
	Zoarcidae sp.								2.1		0.6	1.7
	Paradiplospinus gracilis							1.1				
Rajidae	*Bathyraja* sp.							0.4			0.6	
	Species No.	7	8	10	4	2	11	12	10	7	12	11
	Diversity H'	0.12	0.69	2.21	1.01	0.12	1.81	1.81	2.73	2.09	2.50	0.91

Species number and diversity (H') were highest at the Antarctic Peninsula but do not show a clear trend along the Scotia Arc. Species composition, however, changed distinctly along the Scotia Arc (Table 20). Regarding their centre of occurrence, most species found can be assigned either to the Magellan or to the Antarctic region. Magellanic species, such as *Dissostichus eleginoides* and *Patagonotothen guntheri* that occur on the northern branch up to South Georgia (B). Typical Antarctic species, common at the Peninsula (P; e.g. *Lepidonotothen larseni* and *Lepidonotothen kempi*), do not or only seldom occur further north. The genus *Lepidonotothen* was present along the whole Scotia Arc. *Lepidonotothen nudifrons* was the only notothenioid species found in the southern as well as in the northwestern part (Burdwood Bank, A2) of the investigation area, indicating a high degree of ecological flexibility. The region around South Georgia seems to form some kind of border for the distribution of most demersal fish, which correlates with the course of the Antarctic Convergence. The dispersion of some typical species found during this cruise is shown in Fig. 8.

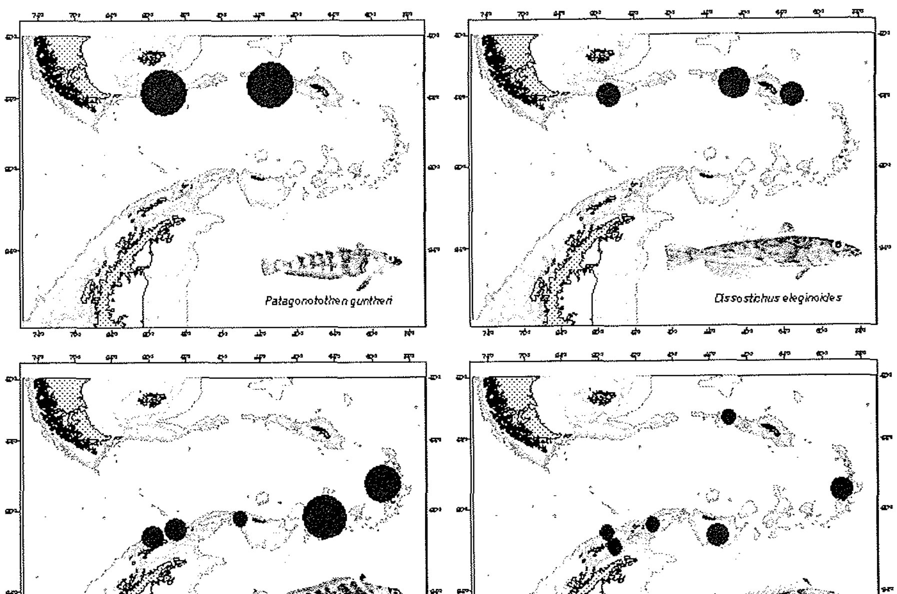

Fig. 8 Distribution patterns of four typical species, *Patagonotothen guntheri*, *Dissostichus eleginoides*, *Lepidonotothen kempi*, and *L. larseni* along the Scotia Arc.

2.2 Pelagobenthic Coupling and Trophodynamics

2.2.1 Ecology of Benthic Suspension Feeders (P. López-González, N. Vert, E. Rodríguez)

Objectives

- Description of the reproductive patterns of the most abundant species of octocoral anthozoans in the Scotia Arc, and comparison with previous data from the high Antarctic (EASIZ cruises).
- To obtain additional samples from several species of sponges and octocorals for further stoichiometric and chemical analyses (total lipids, proteins and carbohydrates) in order to know the stage of their biological cycle in autumn.
- To continue the biochemical analyses of the sediments, which were initiated during EASIZ III.

Work at sea

Samples were collected at 22 stations along the Scotia Arc (14 AGT and 8 GSN). Several samples of four octocoral species, *Acanthogorgia* sp, Acanthogorgiidae sp 1, Acanthogorgiidae sp 2 and *Thouarella* sp 2, were collected and fixed with 10% formalin. A preliminary check of their gastrovascular cavities was done by stereomicroscope, and the presence of mature oocytes and larvae was recorded. This study will be completed at the ICM and at USE. For the stoichiometric analyses samples from abundant octocoral species were taken (Table 21). The samples were immediately frozen (-27°C) until further analysis at CMIMA (CSIC), Barcelona.
For the biochemical analyses of the sediment we collected six surface sediment samples at South Sandwich Islands (stns. 198, 199, 211), South Orkney Islands (stns. 222, 242) and Elephant Island (stn. 255) by Multi-box corer. Total organic and inorganic carbon analysis will be performed at the sedimentology lab at CMIMA, Barcelona, as well as total nitrogen, proteins, total lipids and their fractions, carbohydrates and grain size analysis. All of these data will be compared with the results obtained in EASIZ III.

Preliminary results

The detailed analysis and description of octocoral reproductive patterns will be done at the ICM and USE. On board we observed mature oocytes (violet in colour) in numerous polyps of the colonies of *Acanthogorgia* sp. We also noticed the presence of oocytes and larvae (blue in colour) in most of the polyps examined of the colonies of Acanthogorgiidae gen.1. In the second studied genus of this family, only some polyps were involved in the reproduction of the colony, being transformed and distinctly differentiated from the feeding polyps. This species showed mainly larvae and some vitellogenic oocytes (yellow in colour) (Fig. 9). One species of the family Primnoidae (*Thouarella* sp. 2) was selected for further studies due to its abundance in the first hauls. The reproductive data obtained from this species (collected on Burdwood Bank) will be compared with some data in the literature

(*Thouarella variabilis* studied by Brito, 1996) and with data from the high Antarctic obtained during the EASIZ cruises (Orejas, 2000).

Tab. 21 Specimens collected for biochemical analysis. Stations see Annex table 3.2.

Species	Station	N° of colonies or individuals
Acanthogorgia sp	164,167,182,214,223	13
Acanthogorgiidae gen	150	1
Ainigmaptilon antarticum	182	1
Armadillogorgia cf cyathella	167	2
Dasystenella sp	252	1
Fannyella cf kuekenthali	164	1
Fannyella sp	160	1
Isididae gen	164	3
Lignopsis sp	164,167	3
Plexauridae gen	145,150,164	6
Primnoella cf scotiae	164,167	4
Primnoella sp	160	2
Primnoidae	150,164,167	6
Primnoisis sp	164	2
Rosgorgia inexspectata	164	2
Thouarella sp	145,150,164,167,214,223,252	19
Thouarella sp 3	167	1
Thouarella sp 4	150,160	2

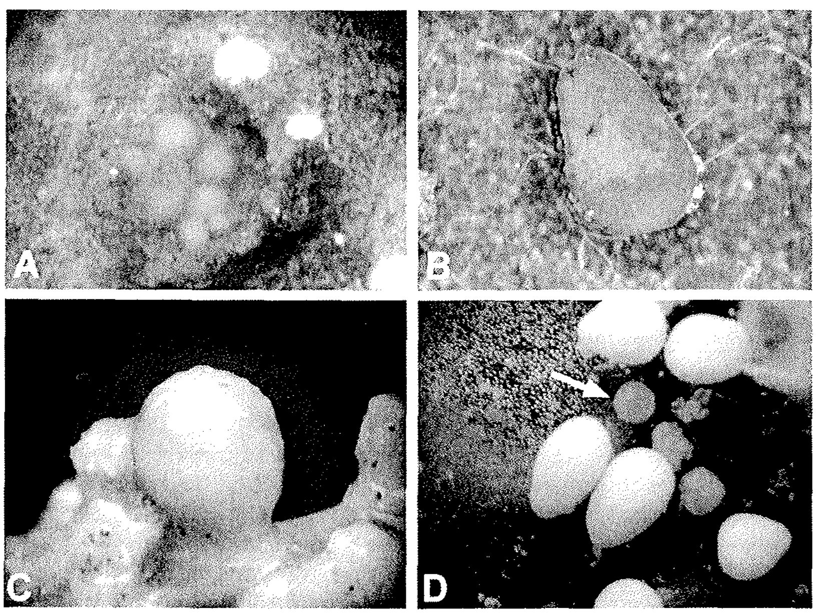

Fig. 9 Reproductive effort in gorgonians from the Scotia Arc. A & B: Acanthogorgiidae gen. 1: A: oocytes in different stages of development inside polyp; B: larva completely developed removed from the cavity of the same polyp. C & D: Acanthogorgiidae gen. 2: C: portion of a branch showing non-reproductive polyps and a large transformed reproductive one; D: larvae and developing oocyte (arrow) from the cavity of the polyps in C.

2.2.2 Trophic position of abundant invertebrate taxa (U. Jacob, K. Mintenbeck, T. Brey)

Objectives

The enrichment of the heavier isotopes of the stable isotope pairs 13C/12C and 15N/14N each time when C and N are transferred from prey to consumer tissue enables us to determine the relative trophic position of a particular organism by its respective stable isotope ratios d13C and d15N. Particular trophic links can be identified by stomach content analysis in invertebrate and fish species. These techniques will be applied to identify the trophic position of major components of the invertebrate fauna. These data will be used to construct balanced flow models of Antarctic communities using the ECOPATH software.

Work at sea

Invertebrates were sampled for analysis from 5 bottom trawls, 11 Agassiz trawls, 2 dredges and 3 CalCofi nets along the Scotia Arc and the Antarctic Peninsula. Small organisms were sampled completely, whereas in macro- and megafaunal specimens body wall pieces or muscle tissue samples were taken for analysis. All samples are kept frozen at –30°C until further analysis at home.

Preliminary results

In total 418 samples referring to about 121 species were collected (Table 22). Not all specimens have been determined yet, especially the ophiuroids and asteroids.

Tab. 22 Invertebrate specimens collected for stable isotope analysis.

Group	Family	Genus	Species
Porifera	Rossellidae	unidentified	
	unidentified		
Cnidaria			
Hydrozoa	unidentified		
Gorgonaria	Isididae	unidentified	
		Primnoisis	*Primnoisis scotiae*
	Primnoidae	Acanthogorgia	unidentified
		Amphilaphis	unidentified
		Primnoella	unidentified
		Rosgorgia	*Rosgorgia inexpectata*
		Thouarella	unidentified
Polychaeta	Aphroditidae	Laetmonice	*Laetmonice producta*
	Onuphidae	Onuphis	unidentified
	Onuphidae	unidentified	
	Serpulidae	unidentified	
	Syllidae	unidentified	
Bivalvia	Limopsidae	Limopsis	*Limopsis lillei*
	Nuculanidae	Propeleda	*Propeleda longicaudata*
	Phylobryidae	Lissarca	*Lissarca notorcadensis*
Scaphopoda		Cadulus	*Cadulus dalliantarcticus*
		Dentalium	*Dentalium majorinum*
Cephalopoda	Octopodidae	unidentified	(about 5 species)
Echiurida	Bonellidae	unidentified	
Pycnogonida	Ammotheidae	Ammothea	*Ammothea carolinensis*
	Nymphonidae	Pentanymphon	*Pentanymphon antarcticum*
		Nymphon	unidentified
Cumacea	unidentified		
Amphipoda	unidentified		
	Lyssianassidae	Tryphosella	
	Hyperiidae	unidentified	
Copepoda	Calanidae	Calanus	*Calanus propinquus*
	Eucalanidae	Pareuchaeta	unidentified
	Metridiidae	Metridia	*Metridia gerlachei*
Decapoda	Crangonidae	Notocrangon	*Notocrangon antarcticus*
Mysidacea	Mysidae	unidentified	
	unidentified		
Isopoda	Cirolanidae	Natatolana	*Natatolana meridionalis*
	Serolidae	unidentified	
	unidentified		
Bryozoa	Cellariidae	Melicerita	*Melicerita obliqua*
	Flustridae	Nematoflustra	unidentified
		unidentified	
Brachiopoda	Terebrantellidae	unidentified	
Pterobranchia	Cephalodiscidae	Cephalodiscus	unidentified
Asteroidea	unidentified		(about 17 species)
	Asteriidae	Labidiaster	*Labidiaster annulatus*
Crinoidea	Antedonidae	Promachocrinus	*Promachocrinus*
		Anthometra	*kerguelensis*
			Anthometra adriani
Echinoidea	Cidaridae	Ctenocidaris	*Ctenocidaris spinosa*
			Ctenocidaris rugosa
	Echinidae	Sterechinus	
	Schizasteridae	Abatus	*Abatus cavernosus*
			unidentified
			unidentified
Holothuroidea	Psolidae	Psolus	unidentified
			unidentified
	Synallactidae	Bathyplotes	*Bathyplotes bongraini*
			Bathyplotes gourdoni
Ophiuroidea	Gorgonocephalidae		
	unidentified		(about 16 species)

2.2.3 Fish Trophodynamics (K. Mintenbeck, U. Jacob, T. Brey, R. Knust)

Objectives

For understanding the trophic structure of Antarctic and Subantarctic shelf communities, knowledge on the diet and trophic position of demersal fish within these communities is required. There are already data available from the northeastern Weddell Sea and the Antarctic Peninsula. For these areas, preliminary attempts have been made to construct trophic models of energy flow. To complete these data and to examine potential connections to South American shelf ecosystems, the fish fauna along the Scotia Arc was investigated.

Work at sea

Material for trophic studies was collected with the Agassiz trawl and the bottom trawl. Stomachs of relatively abundant species were stored in 10% formalin. Additionally, muscle tissue samples for stable isotope analysis were frozen at –30°C. For details about stable isotopes see previous chapter. The examination of stomach contents and stable isotopes will be carried out at the AWI.

Preliminary results

We collected samples referring to 7 nototheniid and 4 icefish species (Channichthyidae). Most of these species were found at several stations within the Scotia Arc. A list of species and total number of samples taken is given in Table 23. Our data will be combined with the results of the benthic trophodynamic study (see above) and with existing data on the pelagic system in these areas. The ECOPATH programme will be used to construct trophic models of the different shelf ecosystems based on these data.

Tab. 23 Fish specimens collected for trophodynamic studies. Area codes according to Annex table 3.1.

Species	No. of stomachs	No. of tissue samples	Sampled areas
Nototheniidae			
Dissostichus eleginoides	28	22	A2, B1, B2
Gobionotothen gibberifrons	50	25	B2, D2, E1
Lepidonotothen kempi	98	38	C2, C3, C5, D2
Lepidonotothen larseni	45	30	C2, D2, E1
Lepidonotothen nudifrons	4	4	A1
Patagonotothen guntheri	47	20	A2, B1
Trematomus lepidorhinus	15	10	B2
Channichthyidae			
Chaenocephalus aceratus	46	30	B2, C2, D2, E1
Champsocephalus gunnari	30	20	B2, D2
Chionodraco rastrospinosus	13	13	D2, E1
Pseudochaenichthys georgianus	30	20	B2, D2

2.3 Ecophysiology and Population Dynamics

2.3.1 Ecophysiological Adaptations of Fish (M. Langenbuch, F. Vanella, B. Klein, E. Brodte)

Objectives

- Adaptive competence of the cold stenothermal *Pachycara brachycephalum*
Temperature is one of the most important abiotic factors determining the distribution boundaries of fish. The aim of the present study is to analyse physiological processes limiting the temperature tolerance of the whole animal. Better knowledge of these processes will help us to estimate future shifts of distribution boundaries in the context of global climate change. With respect to the scenario of increasing CO_2 partial pressure, we will compare the adaptational performance of a relatively CO_2 tolerant invertebrate species with that of stenoecious Antarctic fish. The Antarctic eelpout *Pachycara brachycephalum* is used as a model organism for a stenothermal as well as CO_2 sensitive animal. At cellular level the influence of increased CO_2 partial pressure on the energy metabolism of isolated hepatocytes of *P. brachycephalum* will be investigated by measuring oxygen consumption rates under different conditions. At the AWI the effect of temperature on the energy budget and the body composition of these eelpouts will be analysed in comparison with a boreal zoarcide.

- Comparative analysis of Antarctic and Subantarctic notothenioid fishes
The principal aim of this project is a comparative analysis between Antarctic and Subantarctic species of notothenioid fish from the Magellan region and the Scotia Arc from an ecophysiological point of view. Actually the Ecophysiology Laboratory of CADIC (Ushuaia) is studying similar aspects, i.e. reproduction, buoyancy, growth and development of muscle fibres, bioenergetics and energy budgets, in many species of the Magellan region.

Work at sea

- Catch of live animals by fish trap, bottom trawl and Agassiz trawl
Due to technical problems with the hydrophone and releaser system, traps were only deployed at stations 147 (A2), 192 (C2) and 258-260 (Maxwell Bay, Admiralty Bay). Living fish from Agassiz and bottom trawl hauls were transferred to the aquaria container as quickly as possible. Live animals were held in the aquaria container and are transported back to Bremerhaven on board RV "Polarstern" or to Ushuaia by airfreight.

- Sampling of axial muscle, pectoral muscle, liver and gonad tissue
Samples of gonads (testes and ovaries) were taken and fixed in Bouin Solution for a histological analysis of the structural pattern, degree of sexual maturity, identification of post spawning species (detection of postovulatory follicles, POF), determination of absolute and relative fecundity and development. The data obtained will be compared with data from Subantartic

fish fauna. Samples of ovaries were taken and fixed in formalin to make an estimation of reproductive effort and spawning frequency. Samples of gonads, white muscle and liver were taken and stored at -30 °C to analyze the energetic content in reproductive and storage compartments. Samples of pectoral muscle (abductoris profundis and abductoris superficialis) were taken because there is a strong relationship between swimming pattern and the development of different muscle packages.

- Measurements of cellular oxygen consumption of isolated fish hepatocytes
  Preparation of viable fish hepatocytes:
  - Anaesthetising fish using MS222
  - Liver extraction and washing out of erythrocytes
  - Perfusion and digestion of the liver with a collagenase IV buffer
  - Collection and washing of cells

  Incubation at different buffer pH and CO_2 partial pressures (45 min, 2°C):
  - Normocapnia (100% air): pH 7.9, 7.2, 6.5
  - Hypercapnia (99% air, 1% CO2): pH 7.9, 7.2, 6.5

  Measurement of cellular oxygen consumption rates:
  - Micro optode system "Microx TX2" (luminescence quenching by oxygen)
  - Temperature: 2°C
  - Volume: 150µl of cell suspension (cell density about 2¥107 cells /ml)

Preliminary results

- Survival of different fish species

Table 24 summarises the fish that survived in the aquaria container until the end of the cruise. Trawled animals have a much lower survival rate (14%) than animals caught with the trap (>99%).

Tab. 24 Fish and invertebrate specimens still alive in the aquaria at the end of the cruise.

Species	Number of individuals
Limopsis	55
Nacella concinna	61
Octopoda	22
Pantopoda	15
Pisces:	
Bathyraja maccaini	1
Patagonotothen guntheri	4
Gobionotothen gibberifrons	19
Lepidonotothen kempi	25
Artedidraco mirus	2
Pogonophryne permitini	3
Pachycara brachycephalum	184

- Tissue samples

Table 25 summarises the tissue samples collected from the different fish species.

Tab. 25 Fish species, sexual maturity status and tissue type sampled.
M1, M2: male gonads, maturity state 1, 2; F1, F2: female gonads, maturity state 1, 2, etc.; Liver: liver tissue; p.m.: pectoral muscle; a.m.: axial muscle.

Species	M1	F1	M2	F2	M3	F3	M4	F4	M5	F5	Liver	p.m.	a.m.
Patagonotothen guntheri		X	X	X					X		X	X	X
Dissostichus eleginoides	X	X	X	X	X	X			X	X	X	X	X
Chaenocephalus aceratus	X	X	X	X		X		X	X	X	X	X	X
Pseudochaenichthys georgianus	X	X	X	X	X	X		X			X	X	X
Lepidonotothen kempi	X	X	X	X		X		X		X	X	X	X
Chionodraco rastrospinosus	X		X	X		X	X	X		X	X	X	X
Gobionotothen gibberifrons	X	X		X	X	X					X	X	X
Lepidonotothen larseni	X	X				X					X	X	X

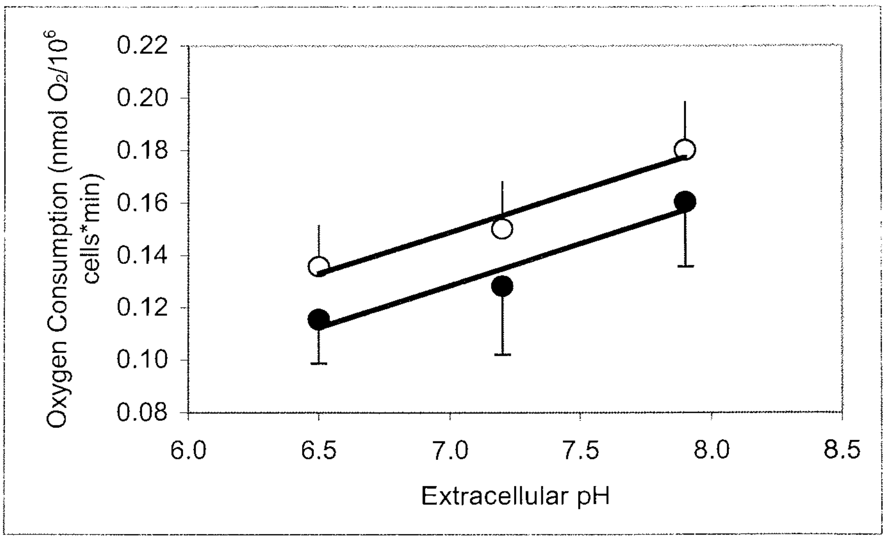

Fig. 10 Oxygen consumption rates of isolated hepatocytes from *Lepidonotothen kempi* after incubation of cells at different pH and CO2 partial pressures.

- Oxygen consumption rates of *Lepidonotothen kempi* isolated hepatocytes

Isolation of hepatocytes was successful although the high lipid content of most livers diminished the amount of cells. Fortunately we caught some mature females at Station 214 and 229 that had less fatty organs. Total cell numbers retained from four liver preparations (liver weight about 12 g) lay between 2×10^7 and 8×10^7 cells. In three of the four cell preparations the number of cells was high enough to measure oxygen consumption rates under all conditions mentioned above. Similar to the intertidal invertebrate *Sipunculus nudus*, hepatocytes of *Lepidonotothen kempi* show a reduction of oxygen consumption with decreasing extracellular pH. Under both normocapnic and hypercapnic conditions, we observed a decrease in aerobic metabolic rates of about 25% when extracellular pH was lowered from pH 7.9 to pH 6.5 (Fig. 10). These preliminary results have to be confirmed in further experiments.

2.3.2 Decapod Reproduction and Distribution (M.C. Romero, F. Tapella, G.A. Lovrich, S. Thatje)

Objectives

The Antarctic Convergence constitutes the distributional limit for most Magellanic and Atlantic decapod species. Reptant decapods, except a few lithodids, are assumed not to occur in the high Antarctic due to physiological and/or ecological constraints (e.g. magnesium metabolism). Energetic and reproductive parameters are assumed to serve as estimates for the ecological fitness of species living at their distributional limits.

Our aims are the study of:

- Biogeographic and distributional limits of decapod crustaceans
- Taxonomic state of the art of the decapod fauna
- Reproductive status of key species on either side of the Antarctic Convergence (including the South Atlantic and Magellanic fauna).
- Energetic proportion invested by the key species into reproduction and reproductive output.

Work at sea

We collected decapods with the Agassiz trawl (AGT), bottom trawl (GSN), Lovrich's (LD) and Rauschert's (RD) dredge. LD was used at two stations situated on Burdwood Bank, where it got seriously damaged and therefore was not used anymore. After hauling, all decapods present were removed and placed on ice. For taxonomic use, live animals were photographed by Martin Rauschert. All animals were cooled on ice and identified according to the available literature. Animals were sorted by sex, counted, and their carapace length (CL) was measured with a digital caliper to the nearest 0.01 mm. The proportion of ovigerous females and sex ratio were calculated for each species. Ovigerous females were identified by the presence of eggs attached to their pleopods. Females of most numerous species in each haul were randomly selected and dissected. Gonads, hepatopancreas and eggs were removed and dried at 55°C. Gonads were sorted into different developmental stages according to their general aspect (color, gonad and oocyte sizes).

Preliminary results

- Specific composition and distribution of benthic decapod crustaceans along the Scotia Arc:

A total of 18 benthic decapod species belonging to 10 families and 4 infraorders were collected during the cruise (Table 26). We found 4 new caridean morphotypes suspected to be new species. Two of them were determined to belong to the Campylonotidae, one of which was found at

Burdwood Bank, and the other occurred off the South Sandwich Islands, at approximately 600 m depth. Two individuals of an unknown hippolytid species were obtained at the same station. The same species was also found further south, at Herdman Bank. At this station we also found an unknown Palaemonidae species which is the first find of this family for Antarctic waters. On the basis of the infraorder level, we can clearly divide the benthic decapod fauna of the South Atlantic (including the Subantarctic Magellanic Region) and the Scotia Arc into two different distributional areas: north of the Antarctic Convergence still representing "Reptantia", i.e., anomuran and brachyuran crabs, whereas south of the Convergence only caridean shrimps ("Natantia") were found (Fig. 11).

On the species level, we observed an extension of the Magellanic decapod fauna eastwards (Fig. 12). Although the number of samples taken during the cruise is low, stations closest to the continent showed higher species richness in comparison to the rest of the sampling stations of the Scotia Arc (Fig. 12). At the Burdwood Bank stations, a predominance of the galatheid crab *Munida subrugosa*, a key species of the channels and fjords of Tierra del Fuego, was found. The second most abundant taxon was *Eurypodius* spp, the only brachyuran crabs in our samples. Station B0 further east off Burdwood Bank is situated at the plateau of a seamount which showed still Magellanic faunistic features with the presence of the shrimp *Campylonotus semistriatus*. A first faunistic change in Magellanic fauna was observed at Shag Rocks, where lithodids were still present, yet represented by different species than in the Magellanic Region and on Burdwood Bank. South of South Georgia the Antarctic shrimp fauna was evident and dominated by *Notocrangon antarcticus*. The shallow waters off the Sandwich Islands showed an extremely poor decapod fauna, being totally absent from some stations. The only station situated at 600 m depth was dominated by the deep-water shrimp *Nematocarcinus lanceopes*. Off South Orkney and Elephant Islands *N. antarcticus* was the only representative of decapod shrimps. At the latter, we found for the first time high abundances of decapodid and juvenile stages of *N. antarcticus*.

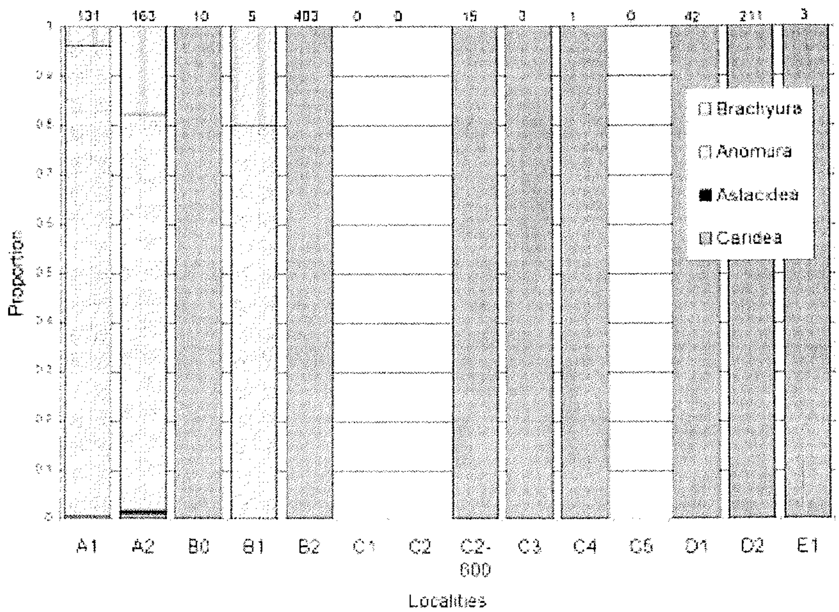

Fig. 11 Relative order compositon of the decapod fauna along the LAMPOS cruise. Numbers on top of the bars indicate the total number of specimens collected at each sampling station. Area codes according to Annex table 3.1.

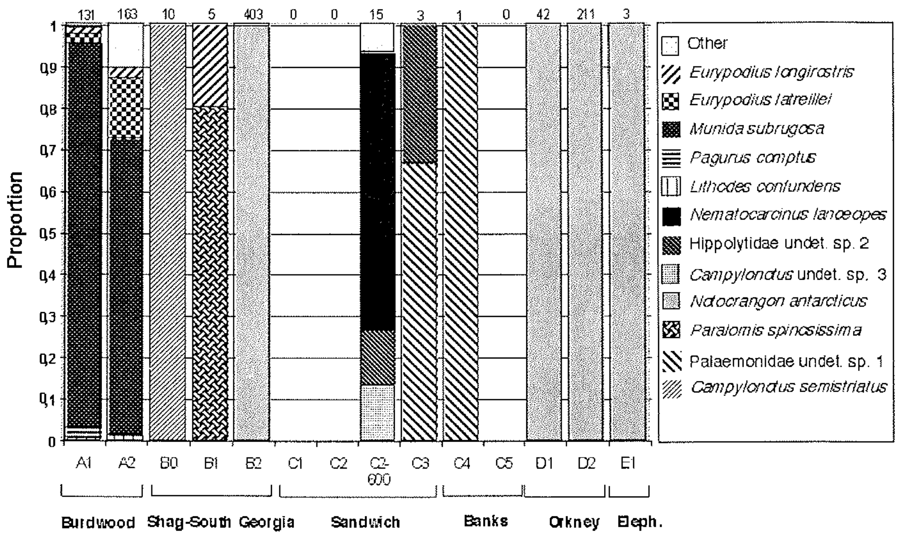

Fig. 12 Relative specific compositon of the decapod fauna. Numbers on top of the bars indicate the total number of specimens collected at each station. "Others" refers to rare species (<5%). Area codes according to Annex table 3.1.

Tab. 26 Species list of benthic decapod crustaceans collected during ANTXIX/5. Black squares indicate presence of the species. C2-600 = only sampling at >500 m depth. Eleph = Elephant Island. Area codes according to Annex table 3.1.

			Localities													
			Burdwood		Shag-Georgia			Sandwich					Banks	Orkneys		Eleph
Infraorder	Family	Species	A1	A2	B0	B1	B2	C1	C2	C2-600	C3	C4	C5	D1	D2	E1
Caridea		Undetermined Caridea								■						
	Nemato-carcinidae	*Nematocarcinus lanceopes*								■						
	Hippolytidae	*Chorismus antarcticus*					■									
		Undetermined sp. 2								■	■					
	Crangonidae	*Notocrangon antarcticus*					■							■	■	■
	Campylonotidae	*Campylonotus semistriatus*			■											
		Campylonotus vagans	■													
		Campylonotus sp. undetermined 3								■						
		Undetermined sp. 4		■												
	Palaemonidae	Undetermined sp. 1									■	■				
Astacidea	Nephropsidae	*Thymops birsteini*		■												
Anomura	Galatheidae	*Munida subrugosa*	■	■												
		Munida spinosa		■												
	Paguridae	*Pagurus comptus*	■													
		Pagurus forceps		■												
	Lithodidae	*Paralomis spinosissima*				■										
		Lithodes confundens	■	■												
Brachyura	Majidae	*Eurypodius latreillei*	■	■		■										
		Eurypodius longirostris	■	■												
		Eurypodius sp.		■												
Species Richness			6	9	1	2	2	0	0	4	2	1	0	1	1	1

- Reproductive and energetic condition of decapod crustaceans in the Scotia Arc compared with the Magellan region.

Key species of benthic decapod crustaceans were found at different states of their reproductive cycle (Table 27). All captured females of *Munida subrugosa* from Burdwood Bank (A1 & A2) were non-ovigerous. Moreover, their gonads were less developed compared with the non-ovigerous females of the Beagle Channel in April 1998/99. During this cruise, only 15% of females had well developed ovaries near extrusion (ovary green, oocytes easily noticeable). Another 47% of females had ovaries initiating the secondary vitellogenesis (light green, oocytes not evident). Hence, the reproductive cycle of *M. subrugosa* from the Burdwood Bank is likely delayed in comparison with the Beagle Channel. Contrastingly, the reproductive cycle of *Munida spinosa* was initiating, since all females either had eggs or well-developed ovaries.

Differences in the reproductive condition of two geographically separated populations of *Notocrangon antarcticus* were detected. At station B2 south of South Georgia, almost all female *N. antarcticus* were ovigerous, with non-developed ovaries. In contrast, in waters off the South Orkney Islands only 26% of all captured specimens carried eggs (Table 2), albeit non-ovigerous individuals showed well-developed gonads and for this reason were assumed to be close to egg extrusion. This assumption is supported by the observation of recently molted individuals at the same station. Hence, the reproductive cycle in *N. antarcticus* is apparently delayed at the South Orkney Islands in comparison with the population from South Georgia. This is likely due to lower temperatures south of the Antarctic Convergence.

Tab. 27 Reproductive condition of benthic decapod key species at different locations. Nd: number of dissected females for bioenergetic estimations. OF%: percentage of ovigerous females. N: total number of females in the sample. SexR: sex ratio male to female. Area codes according to Annex table 3.1.

Area	*Munida subrugosa*			*Munida spinosa*			*Nematocarcinus lanceopes*			*Notocrangon antarcticus*		
	Nd	OF% (N)	SexR M:F	Nd	OF% (N)	SexR M:F	Nd	OF% (N)	SexR M:F	Nd	OF% (N)	SexR M:F
A1	13	0 (53)	1.2:1									
A2	34	0 (78)	0.5:1	5	80 (5)	0.8:1						
B2										34	98.3 (115)	2.5:1
C2							3	0 (7)	0.4:1			
D1										6	14.3 (7)	5:1
D2										45	26.8 (112)	0.9:1

Differences in the size at gonadal maturity of female *Notocrangon antarcticus* were also detectable between the populations of South Georgia and South Orkneys Islands. The smallest ovigerous females occurring in our samples were 11.9 and 15.4 mm CL at South Georgia (B2) and South Orkney Islands (D1 & D2), respectively (Table 28).
Energy allocated to reproduction will be analyzed from female specimens of the species presented in Table 27. Gonads, eggs, hepatopancreas and the specimens were dried on board, and will be separately burned with a microcalorimeter to estimate the respective energetic contents.

Tab. 28 Reproductive condition of benthic decapod key species at different locations. *Nd: number of dissected females for bioenergetic estimations.* OF%: percentage of ovigerous females. N: total number of females in the sample.

	South Georgia		South Orkneys	
Size class CL (mm)	OF%	N	OF%	N
11-11.9	100	1	0	1
12-12.9	100	6	0	2
13-13.9	97.0	33	0	1
14-14.9	100	33	0	3
15-15.9	100	26	15.0	20
16-16.9	100	11	29.8	47
17-17.9	100	2	37.0	27
18-18.9	100	1	36.4	11
>19	0	0	0	2

2.3.3 Decapod and Fish Population Dynamics (R. Alarcón, R. Knust, G. Lovrich, K. Mintenbeck, E. Brodte, F. Vanella, F. Tapella, M. Romero, M. Gorny)

Objectives

- To compare basic population dynamics of common decapod and fish species between populations inhabiting different locations of the Scotia Arc.

Work at sea

Samples of decapods and fish were collected by means of Agassiz trawl (AGT), Bottom trawl (GSN), Lovrich's (LD) and Rauschert's (RD) dredges. After the haul, all specimens of decapods and fish were identified and sorted. The decapods were placed on ice before further analysis, and the fish were placed on ice if they were dead and in water if they were alive. Some of the live fish were used directly or stored in aquaria for ecophysiological studies. The decapods were sorted by sex, and carapace length (CL) was measured. Sex was identified by means of morphological characters, and the proportion of the sexes was calculated. The fish were identified, sorted, total length (TL) and weight (TW) were measured and sex and maturity were determined.

Preliminary results

- Size frequency distribution and sex ratio of decapods

18 species of decapods were found, but only 2 of them, *Munida subrugosa* (Anomura, Galatheidae) and *Notocrangon antarcticus* (Caridea, Crangonidae), were sufficiently abundant for further studies on population dynamics. 221 *Munida subrugosa* were caught at two stations of Burdwood Bank, 55% were males and 45% were females. The size frequency distribution was polymodal (with 3 modal groups), the main modal group was at 13 mm CL (Fig. 13). Mean carapace length was 14.11 mm CL (S.D. = 4.81). The largest individual was a female of 23.85 mm CL.

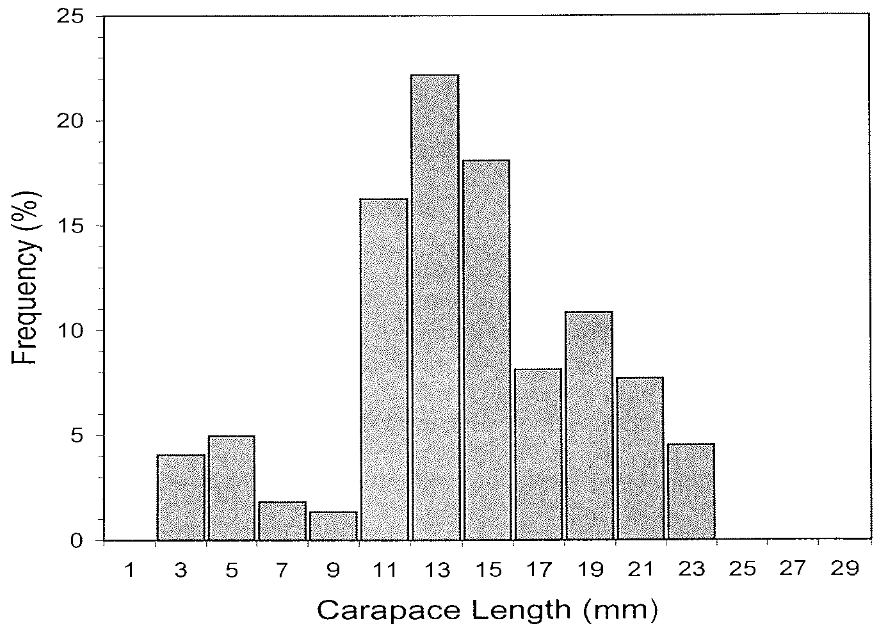

Fig. 13 Size-frequency distribution of *Munida subrugosa* at Burdwood Bank.

Notocrangon antarcticus seems to attain larger sizes around the South Orkney Islands compared to South Georgia Island (Fig. 14), however these differences were not significant. Males were dominant in both areas.

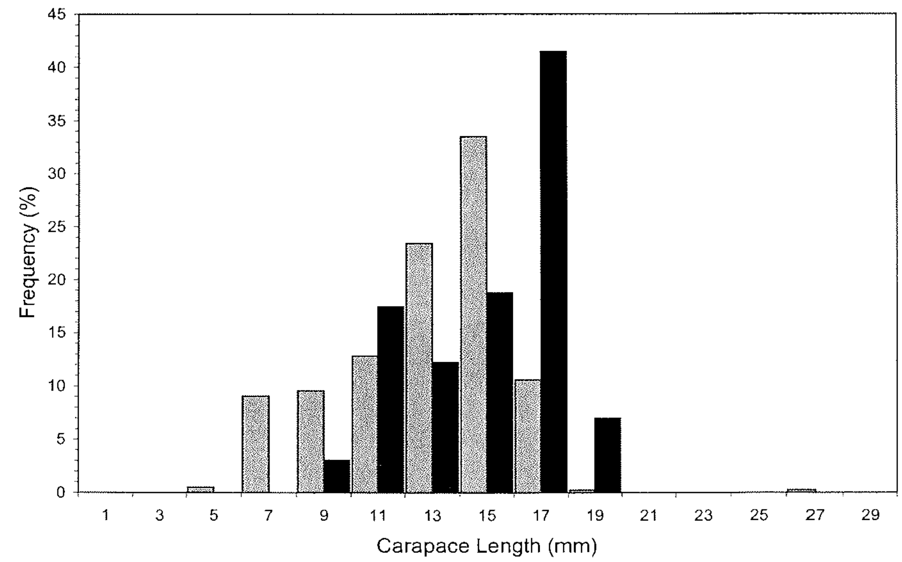

Fig. 14 Size frequency distribution of *Notocrangon antarcticus* at South Georgia Island (grey bars) and at the South Orkney Islands (black bars).

- Size frequency distribution of fishes

Four fish species were examined more closely, the Channichthyidae *Champsocephalus gunnari* and three Nototheniidae, *Gobionotothen gibberifrons*, *Lepidonotothen larseni* and *Patagonotothen guntheri*. The latter was present only on the northern branch of the Scotia Arc. The fish at Burdwood Bank were larger than at Shag Rocks, however with insignificant differences in mean length (Fig. 15).

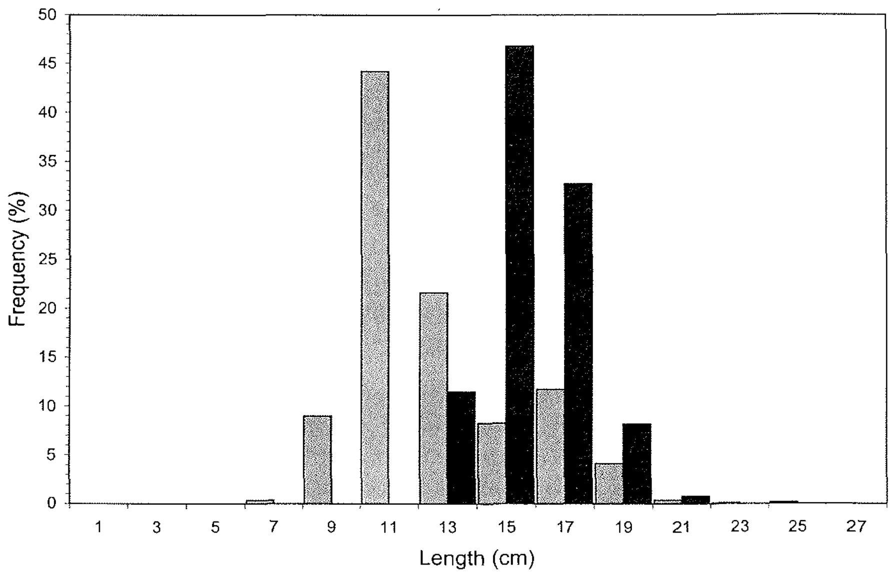

Fig. 15 Size frequency distribution of *Patagonotothen guntheri* at Burdwood Bank (grey bars) and at Shag Rocks (black bars).

Neither *Champsocephalus gunnari* nor *Gobionotothen gibberifrons* showed significant differences in mean size between South Georgia (Station B2) and the South Orkney Islands (Station D2). The same holds true for the populations of *Lepidonotothen larseni* living around the South Sandwich Islands (Station C2) and the South Orkney Islands (Stations D1 and D2).

- Length-weight relationship of fish

As there was no difference in the mean total length between stations, all length-weight data were pooled for each species (Table 29).

Tab. 29 Length-weight relationships of fish.
SSE: sum of the squares of error, n: sample size.

	Species			
Parameter	*P. guntheri*	*C. gunnari*	*G. gibberifrons*	*L. larseni*
a	4.952×10^{3}	4.162×10^{4}	9.028×10^{3}	4.162×10^{4}
b	3.191	3.797	3.668	3.797
SSE	2,941.786	50,160.3	114,880.3	50,160.3
n	340	76	92	76

2.3.4 Autumnal Zooplankton/Meroplankton communities (S. Grabbert, S.Thatje)

Objectives

- to analyse occurrence and geographic distribution of copepod species and invertebrate larvae (meroplankton) along the Scotia Arc (north and south of the Polar Front).
- to collect females of different copepod species for molecular analysis in order to build up a phylogenetic tree.
- to isolate and cultivate the copepod species *Calanus propinquus* and *Metridia gerlachei* for feeding experiments.

Work at sea

Plankton samples were taken at nine stations (See Annex table 3.2). For the study of vertical distribution of plankton organisms four multinets (MN, 4 x 500µm and 1 x 300µm mesh size) were taken from the bottom to the surface. Different depth strata were sampled according to the stratification detected by CTD profiles. In order to obtain more specimens five CalCofi net (100µm mesh size) samples were collected from 0-200m depth. The quantitative MN samples were preserved in 96% ethanol. CalCofi samples were preserved in ethanol and partially frozen for later chemical analysis. In addition, some water samples from the water bottles of the CTD probe were taken for the study of the associated phytoplankton community.
About 150 females of *C. propinquus* and *M. gerlachei* were cultivated in a plankton wheel for later feeding experiments. From all CalCofi catches females were sorted out for molecular analyses.
The meroplankton fraction of the zooplankton will be sorted and determined later in the laboratory. In addition to the water column samples, benthic surface water layer samples were obtained from the MUC at 4 stations. These samples were sieved through 30µm mesh size and preserved in 4% buffered formalin.The upper 3 cm of the sediment cores obtained from the MUC at these stations will also be studied to detect whether recently settled juveniles/metamorphed larvae did occur.

Preliminary results

8 genera and at least 26 species of copepods were identified (Table 30). Table 31 shows the distribution of the dominant copepod species among stations. While some of the species known to be endemic for the Antarctic were found only on the southern branch of the Scotia Arc, other species were distributed on the southern and the northern branches, which may be an indication for drift.

Tab. 30 Copepod genera and species collected during ANT XIX/5.

CALANOIDA	CYCLOPOIDA	POECILO-STOMATOIDA	HARPACTICOIDA
Aetideidae	Oithonidae	Oncaeidae	Euterpinidae
Gaetanus spp.	*Oithona* similis	*Oncaea* spp.	*Microsetella* sp.
Augaptiliidae			
Haloptilus sp.			
Calanidae			
Calanoides acutus			
Calanus propinquus			
Calanus simillimus			
Clausocalanidae			
Ctenocalanus sp.			
Microcalanus sp.			
Clausocalanus sp.			
Eucalanidae			
Rhincalanus gigas			
Eucalanus longiceps			
Euchaetidae			
Paraeuchaeta antarctica			
Paraeuchaeta biloba			
Heterorhabdidae			
Heterorhabdus spp.			
Metridinidae			
Metridia lucens			
Metridia curticauda			
Metridia gerlachei			
Pleuromamma spp.			
Scolecitrichidae			
Scolecithricella spp.			

Tab. 31 Distribution of dominant copepod species among stations. Station numbers according to Annex table 3.2.

Species	Latitudinal distribution	Stat. 157	171	184	185	197	205	225	240	247
Rhincalanus gigas	Antarctic (to 50°S)	x	x	x	x	x	x	x	x	x
Calanus simillimus	Subantarctic/ Antarctic	x	x	x	x					
Calanus propinquus	Antarctic/ Subantarctic		x	x	x	x	x	x	x	x
Calanoides acutus	Antarctic				x	x	x	x	x	x
Metridia gerlachei	Antarctic						x	x	x	x

2.4 Other Topics

2.4.1 Seabird Observations (M. Fröb, R. Herman, K. Linse, R. Loidl, S. Thatje, D. Zelaya)

Objectives
Seabirds were monitored during the entire cruise in order to get an impression of occurrence and distribution of birds in late southern autumn.

Work at sea
Since all bird watchers were occupied with other scientific work on board, no systematic observation was possible and effort varied considerably over the cruise. However, the attempt was made to make recordings at least on a daily basis. For this reason the presented results do not necessarily reflect absolute species richness and distribution aspects in the area under investigation. Birds found dead on board over the time of the cruise were identified and frozen for future stomach content analyses in the laboratory. Identification and nomenclature was done on the basis of available literature (Tuck & Heinzel, 1984).

Preliminary results
In total 30 bird species were recorded. In the following, we emphasize major transitions of the avifauna along the cruise. Based on dead birds found on board (Fig. 16) as well as bird sightings (Table 32) distinct avifaunal areas could be identified: The southern branch of the Scotia Arc is characterised by the Southern Antarctic Fulmar, the Blue and the Kerguelen Petrel, although at South Georgia only the White-chinned Petrel and the South Georgian Diving Petrel were found dead. Along the northern branch of the Scotia Arc the Southern Antarctic Fulmar was recorded neither dead nor alive, although Blue and Kerguelen Petrel were sighted frequently. Only 3 species were found dead along the northern branch of the Scotia Arc. The Mollymawk as ship-follower was most frequent. Six Cattle Egrets were observed resting on board "Polarstern" at Burdwood Bank, 2 of which were too exhausted and were later found dead on board. This Egret species is known to occur at the Falkland Islands as well as all over Patagonia. It shows a high dispersal while migrating and was found at the Antarctic Peninsula during an earlier cruise with RV "Polarstern" last year in April. The area from the Shag Rocks south to Herdman Bank showed the highest species richness with 18 recorded species, of which the Blue-eyed Cormorant was by far the most abundant one. Some species were observed all over the Scotia Arc. Cape Pigeons were most frequent and abundant, followed by the less abundant Southern Antarctic Fulmar, Southern Giant Petrel and Black-browed Albatross.
Penguins were observed occasionally but in high abundances along the southern branch of the Scotia Arc. Chinstrap Penguin and Gentoo Penguin were most frequent, the sighting of King Penguins north off King George Island was the only additional species recorded.

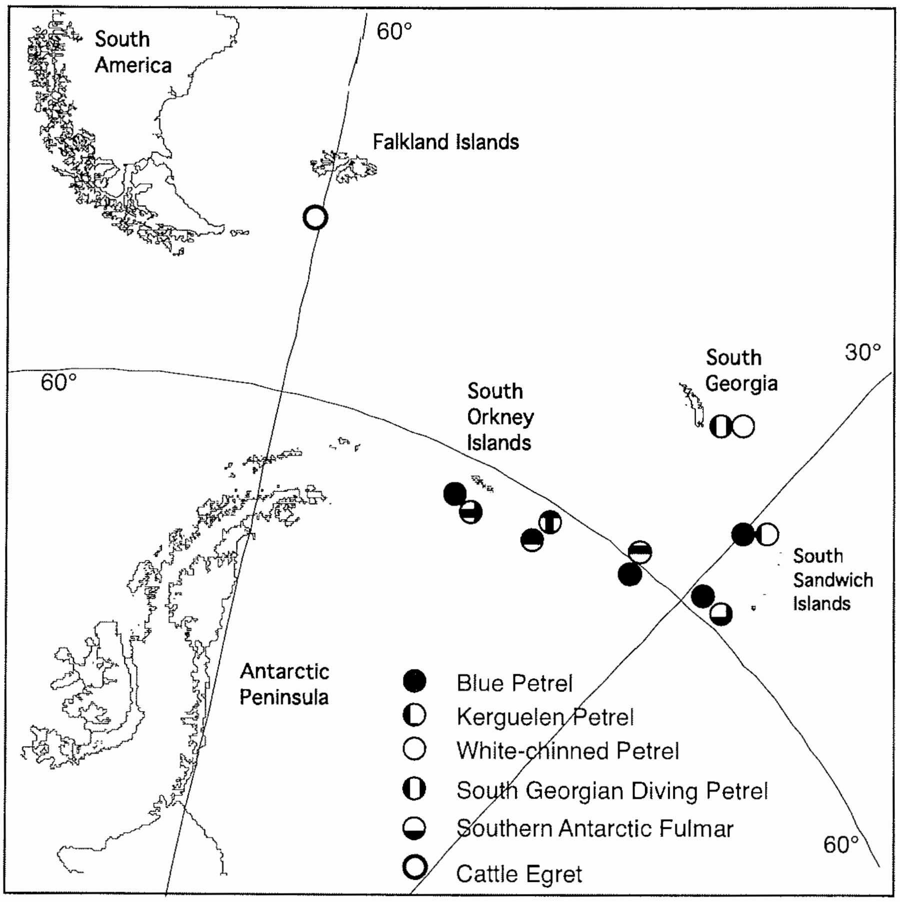

Fig. 16 Birds found dead on board RV "Polarstern" during ANT XIX/5.

Tab. 32 Bird sightings along the Scotia Arc during ANT XIX/5. Area codes according to Annex table 3.1.

Scientific Name	English Name	German Name	A1 A2	B0	B1 B2	C1	C2 C3	C4	C5	D1	D2	E1	KG	DP TR
Aptenodytes patagonicus	King Penguin	Königspinguin												x
Pygoscelis papua	Gentoo Penguin	Eselspinguin				x	x						x	
Pygoscelis antarctica	Chin-strap Penguin	Kehlstreifpinguin				x	x	x		x	x			
Diomedea exulans	Wandering Albatross	Wanderalbatros		x	x			x						
Diomedea melanophris	Black-browed Albatr.	Mollymauk	x	x	x	x		x		x	x	x	x	x
Diomedea chrysostoma	Grey-headed Albatr	Graukopfalbatros		x										x
Phoebetria fusca	Sooty Albatross	Dunkelalbatros		x										
Phoebetria palpebrata	Light-mantled Sooty A.	Rußalbatros					x	x						
Macronectes giganteus	Southern Giant Petrel	Südlicher Riesensturmv.		x	x	x	x	x	x	x	x	x	x	x
Fulmarus glacialoides	S. Antarctic Fulmar	Silbersturmvogel				x	x	x	x	x	x	x	x	x
Daption capensis	Cape Pigeon	Kapsturmvogel	x	x	x	x	x	x	x	x	x	x	x	x
Pagodroma nivea	Snow Petrel	Schneesturmvogel				x	x	x	x	x	x			
Thalassoica antarctica	Antarctic Petrel	Weißflügel-Sturmvogel												x
Halobaena caerulea	Blue Petrel	Blausturmvogel		x	x	x	x	x	x	x				x
Pachyptila sp.	Prion	Entensturmvogel		x	x	x	x	x	x	x				x
Procellaria aequinoctialis	White-chinned Petrel	Weißkinnsturmvogel		x	x		x	x	x	x				x
Ardenna gravis	Great Shearwater	Kappensturmtaucher		x										
Puffinus griseus	Sooty Shearwater	Dunkelsturmtaucher						x						
Pterodroma macroptera	Great-winged Petrel	Langflügelsturmvogel		x	x			x	x	x				
Pterodroma brevirostris	Kerguelen Petrel	Kerguelensturmvogel		x	x		x	x	x	x	x			
Oceanites oceanicus	Wilson´s Storm Petrel	Buntfußsturmschwalbe		x	x	x	x			x				
Fregetta tropica	Black-bellied Storm P.	Schwarzbauchmeerläufer		x	x	x	x	x						
Pelecanoides georgicus	Georgian Diving Petrel	Breitschnabelsturmvogel		x	x									
Pelecanoides urinatrix	Common Diving Petrel	Lummensturmvogel				x	x	x						
Phalacrocorax atriceps	Blue-eyed Cormorant	Blauaugenscharbe		x								x	x	
Bubulcus ibis	Cattle Egret	Kuhreiher	x											
Chionis alba	Yellow-billed Sheathbill	Weißgesicht-Scheidenschn.		x						x			x	x
Catharacta skua	Great Skua	Südliche Skua				x							X	
Larus dominicanus	S. Black-backed Gull	Dominikanermöwe				x	x					x	x	x
Sterna vittata	Antarctic Tern	Gabelschwanz-Seeschw.		x		x	x							

2.4.2 Warm Blooded Animals close to the Ship (T. Brey, M. Boche, S. Grabbert, R. Hartung, K. Lindner, L. Peine, E. Rumler)

Objectives

There is an ongoing discussion on whether echosounder emissions are harmful for marine warmblooded animals, especially for whales. Perception frequency range and sensitivity of whale ears have not been determined yet, hence any assumption that echosounders may be harmful is based on theoretical considerations of whale ear anatomy and echosounder characteristics. "Polarstern" expeditions to the Southern Ocean provide the opportunity to observe the reaction of marine warmblooded animals to a ship with various echosounders in operation, thus providing empirical evidence for disturbance or harmful effects of these devices.

Work at sea

RV "Polarstern is equipped with three echosounder systems:

- A standard navigation and fish finding echosounder
- The Parasound echosounder
- The Hydrosweep echosounder

Additionally, an echo sounding net probe was used for bottom trawling. All echosounder equipment was applied within permissions and regulations imposed by the German Umweltbundesamt.

Sightings of whales, dolphins, seals and penguins within a radius of about 500m around the ship were recorded in a non-systematic way. Whenever people on the bridge noticed such animals and had time to monitor them, they tried to determine species and numbers, and to track movement and activity.

Preliminary results

During the two cruises ANT XVII/3 and ANT XIX/5 38 encounters with warmblooded animals were recorded (Table 33). 21 observations refer to whales & dolphins, 10 observations to seals, and 7 observations to penguins. During all encounters except those two observed between commercial trawlers and whales at least the Hydrosweep echosounder was active. 23 of the 41 encounters (including three joint encounters with two penguin species) caused no apparent reaction of the animals. During 18 encounters we interpreted the behaviour of the animal as to be affected by the ship. This ranges from changing cruising course to active use of the ships activity, e.g. bow wave riding. On several occacions penguins were observed to be strongly attracted by bow and aft thruster activity. They may have fed on krill sucked through and damaged by the thruster. Only three of the 18 reactions observed were clearly negative. In these three cases seals gave way to the approaching ship.

Tab. 33 Apparent reaction of animals to the presence of the ship during cruises ANT XVII/3 and ANT XIX/5. *: 3 joint encounters with both species.

Species	Encounters	No reaction to ship	Reaction to ship	Negative reaction
Fin whale	2	2	0	0
Humpback whale	8	7	1	0
Minke whale	5	4	1	0
Orca	1	1	0	0
Dolphin	2	1	1	0
Unident. whale	3	3	0	0
Crabeater seal	1	1	0	0
Fur seal	5	1	4	2
Weddell seal	1	0	1	0
Unident. seal	3	1	2	1
Chinstrap penguin	6*	2	4	0
Gentoo penguin	3*	0	3	0
Rockhopper penguin	1	0	1	0
Sum	41	23	18	3

2.4.3 Biogeography of Macroalgae (A. Mansilla)

Objectives

- to compare the pigment concentrations of macroalgae between species from the Magellan region and Antarctica
- to study the intraspecific diversity of *Gigartina skottsbergii* from the Magellan region and from Antarctica

Work at sea

Specimens of the macroalgae species *Porphyra columbina* and *Gigartina skotsbergii* were collected at different places of Potter Cove, Maxwell Bay. The samples were carried immediately to "Polarstern" and maintained on bord at –40°C for spectrophotometric analysis, and to analyse the chlorophyll a and phycobilliprotein concentrations. Samples of different reproductive stages of *Gigartina skotsbergii* collected from the Magellan region and Antarctica will provide material for molecular analysis to carry out studies on the genetic variability of populations.

Preliminary results

At the moment only some qualitative differences between the Magellan and Antarctic macroalgae were noticed. Species of the genera *Enteromorpha* and *Porphyra* were collected in the intertidal zone of Potter Cove (Maxwell Bay). Species endemic in the Antartic as well as species occurring both in the Magellan region and in the Antarctic were found. Regarding the latter, analysis of the pigment concentration will provide information on physiological adaptations, and molecular genetic studies will show the extent of genetic difference between populations living at both sides of the Drake Passage.

2.4.4 Bathymetry and Potential Field (G. Udintsev, V. Udintsev, K. Lindner, I. Kruse)

Objectives

The area of activity of the Expedition were the Scotia Arc and the Scotia Sea. In the second half of the XIX century Eduard Suess developed the idea of the former connection of South America with Antarctica by the Scotia Arc. This arc was considered as a continuation of the Andean belt to the Trans-Antarctic Mountains. This idea is widely accepted by geographers and geologists. The Scotia Arc is also considered as a potential bridge for faunal exchange between South America and the Antarctic continent. They were united until episodes of isolation happened during the Cretaceous and later. This is the reason why the Expedition ANT XIX/5 attempts to investigate the role of the Scotia Arc and as an intercontinental biogeographical bridge in the past and in recent days.

Work at sea

- Technical basics

Depth was recorded with the multibeam Hydrosweep DS2 system of STN Atlas. The system delivers in each measurement (ping) 59 depth beams with an accuracy of +/- 1% of the depth. These depths are combined with actual positions retrieved from a triple GPS (Global Positioning system). The raw data are edited manually, large errors are flagged. Afterwards the raw data are converted by the HDCS program of STN Atlas into rectangular coordinates by UTM projection. Finally xyz coordinates are obtained.

Contrary to other cruises the DTM software (Digital Terrain Model) TASH (Topographic evaluation system of Hannover University, Germany) was used for data processing. Therefore xyz coordinates were used to create a DTM. The system runs on windows platforms and was modified partially during the cruise. The main problem has been the amount of data points. The programme computes from xyz coordinates the DTM and uses area polynomials (elliptic, hyperbolic, oblique plane, horizontal plane) or a irregular triangle net (TIN). From the DTM contour lines (depth lines) and perspective views are derived.

- Measurements

The bathymetry group conducted multibeam (hydrosweep) echosounding along the Scotia Arc from the moment of arrival at Burdwood Bank at the beginning of the cruise till returning to that Bank towards the end of the expedition. Total echosounding track length was 3954 nautical miles. The gravity survey was active during the whole expedition from Punta Arenas to Punta Arenas.

Detailed mapping surveys were carried out in two boxes, the southern part of the Discovery Rise (Bank) (Box 1), and the eastern part of the South Shetland Trench (SST) and its intersection with the Shackleton Fracture Zone (SFZ) (Box 2). Box 1 was selected because of the poor knowledge of the morphology and structure of this area. The Discovery Rise would become quite important in the palaeogeography of the Scotia Sea, if it would have been a part of the former bridge connecting the North Scotia Ridge and South Scotia Ridge. Box 2 represents a continuation of the surveys carried out in

1998 by RV "Polarstern" during the expedition ANT-XV/2 and by RV "Akademik Boris Petrov" during the GAP-98 expedition. The detailed survey of this area will help to understand the geological processes in the intersection region of the SST and SFZ. From the beginning of the Box 1 survey to the end of the Box 2 survey the hydrosweep sounding was complemented with sedimentary sounding by Parasound Profiler.
During the approach to each station from A1 to E1 a limited hydrosweep survey was carried out to identify a convenient ecological sampling area. Stones were collected from trawls to study their nature and significance for geological interpretation of the geophysical data.
During the Russian programme Hydrosweep surveys were combined with Parasound measurements. These Parasound data will be used to investigate the structure of the upper crust. The data are stored in analog and digital form. Further processing and interpretation of the data will be performed by specialists of AWI and the Vernadsky Institute of Geochemistry and Analytical Chemistry.

Preliminary results

Multibeam echosounding has been carried out practically along the crest or close to the crest of the Scotia Arc. In some areas the track from station to station was adjusted in order to obtain a better cover of the Arc. The data obtained on the morphology and gravity along the Scotia Arc give additional information about dissection and separation of the body of the Arc into a series of huge solid blocks (Fig. 17)
The profile along the North Scotia Ridge from station A1 to station C1 indicates the disintegration of the Ridge into at least 6 blocks. The most complex dissection was observed between Burdwood Bank in the west and a group of blocks from Shag Rocks to South Georgia Island in the east and between a last block and the northern tip of the South Sandwich Islands Arc. These two dissections of the Ridge are accompanied by distinct Bouger anomalies in the gravity field as indicated by high positive values up to 200 and 150 mgal, respectively. They result from the mantle diapirism in the northern propagations of the West Scotia Rift and East Scotia Rift systems.
The profile along the South Sandwich Islands Arc from station C1 to station C3 shows a less complex and shallower disintegration. The solid base of the islands chain is not dissected by deep fractures. The common basement of the individual volcanoes may consist of the folded belt arc. Correspondingly, Bouger gravity anomalies do not exceed 100 mgal.

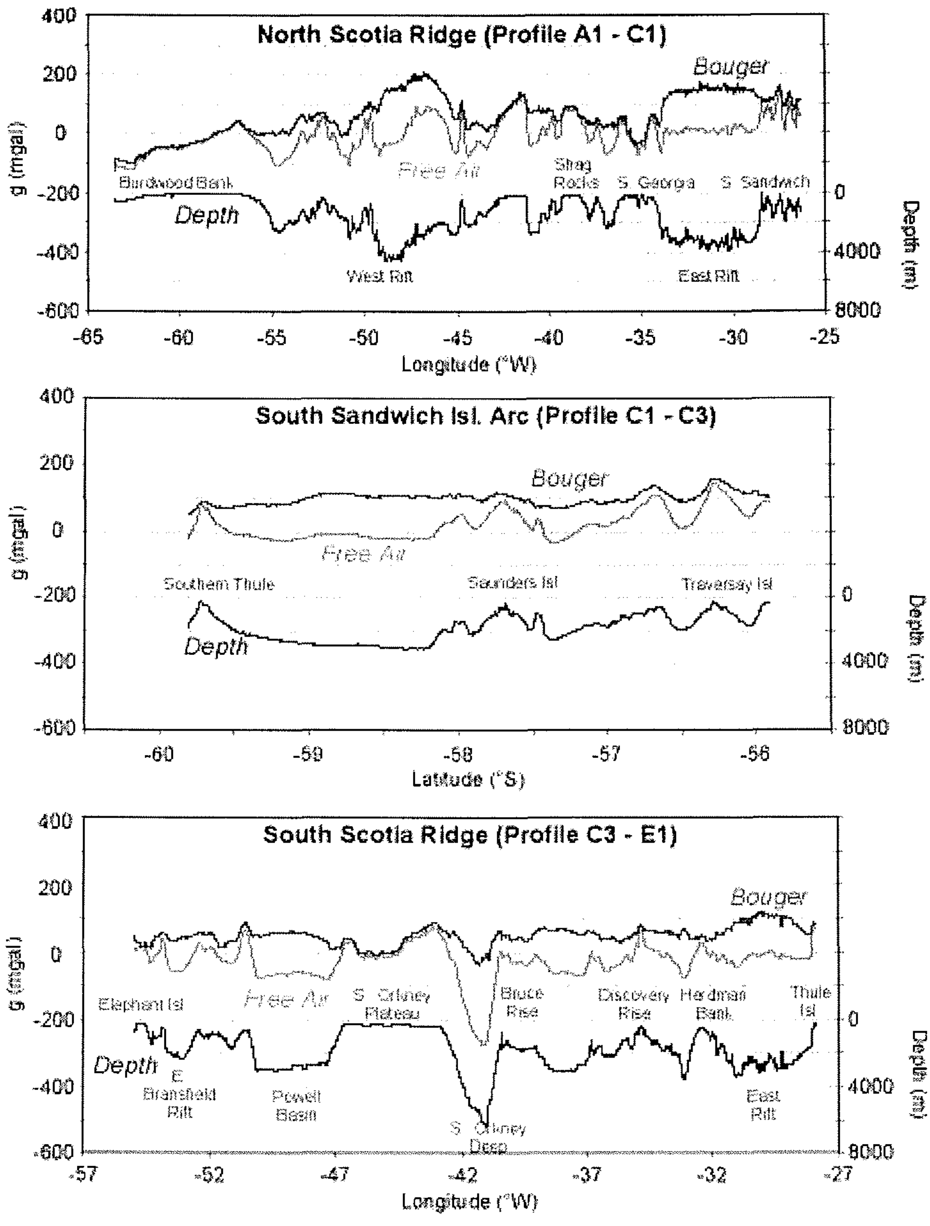

Fig. 17 Gravity profiles along the Scotia Arc.

The profile along the South Scotia Ridge from station C3 to station E1 indicates rather intense desintegration of the Ridge into 6 huge blocks. The most intensive dissection occurs in the western part of the Ridge, where a number of deep troughs separate the southern tip of the South Sandwich Islands Arc from Herdman Bank and Discovery Rise. The most eastern troughs coincide with positive maxima in Bouger anomaly values, presumably they represent the mantle uprise in the East Scotia Rift in the so-called Back

Arc Basin. The deep trough between Herdman Bank and Discovery Rise seems to be part of the rift system, but is not accompanied by a notably positive Bouger anomaly. The extremely deep trough between Bruce Rise and the large micro-continent of the South Orkney Plateau is accompanied by a negative anomaly and hence has to be interpretated as an extensive graben. Local maxima of positive Bouger anomalies correspond to basins between Discovery Rise and Bruce Rise as well as to Powell Basin. They appear to be evidence of some wide mantle plumes.

- Box 1 survey – Discovery Rise

The detailed mapping survey of the southern part of the Discovery Rise (Fig. 18) started with several short tracks for studying the most shallow (< 400 m) part of the Rise, i.e. the Discovery Bank (or the Bruce Ridge). This part of the Rise has clear alineation of about 45° azimuth and is limited on the south-eastern side by a deep graben-like trough with depths about 4000 m which separates the Discovery Bank from Herdman Bank. To the north of this shallow part an area of about 90 x 15 nm was covered. The Discovery Rise in this part is separated from the shallow Bank by troughs of about 1000-1200 m. The main feature of the Rise is the wide dome lineated along azimuth 340-350°. The surface of this dome is hummoked and its crest is shallower than 1200 m. Some hills rise to depths < 1000 m (minimum 100-400 m). The north-eastern flank of the dome is smooth, but the south-western wide slope is hilly. Some hills show 300-500 m relative height. The gradual submersion of the slope is interrupted by two notable lineated scarps - probably fracture lines of the same azimuth as the whole dome. Remarkable features are situated at the foot of the slope – a conical seamount of about 1100 m height with a minimal depth above the top of 1046 m and a little smaller one with a height of 900 m. To the south a third conical seamount was found. It has a height of 1100-1200 m and a minimal depth at the top of 1100 m. These three seamounts – supposedly volcanoes - may correspond to fractures along the western flank of the Discovery Bank. They may have been formed in the period of tectono-magmatic activity in the upper Cretaceous or early Cenozoic time.

The most important feature in this part of the Discovery Rise appears to be the smoothed, generally hummocked surface character, underlaid by a rather thick (about 700 m) layer of sediments (according to the data of seismic profiling by RV "Akademik Boris Petrov", 1998). This type of topography is similar to the hilly landscape of eastern Patagonia and Tierra del Fuego which experienced subaerial and marine erosion in their geological past. This topography is similar also to topography of the Pirie and Bruce Rises of the Scotia Sea Basin and with less probability to other rises in the more northern part of the Scotia Sea Basin. We may hypothesise that all these rises are relics of the bridge connecting the North and South Scotia Ridges before their fragmentation and submergence in the Upper Creaceous early Cenozoic period. The submergence and fragmentation of the former bridge was accompanied by magmatic activities during regional extension of the Earth crust and mantle diapirism as reflected in the model of the gravity field in the Bouger reduction.

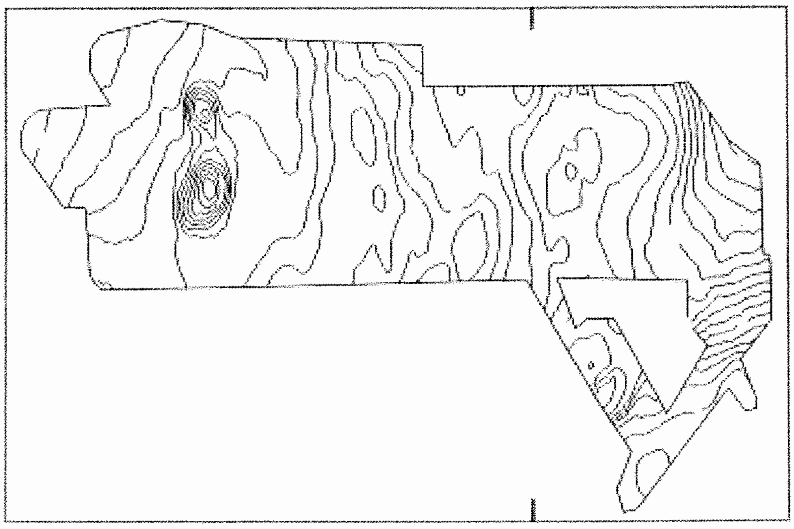

Fig. 18 Depth profile of Box 1, Discovery Rise.

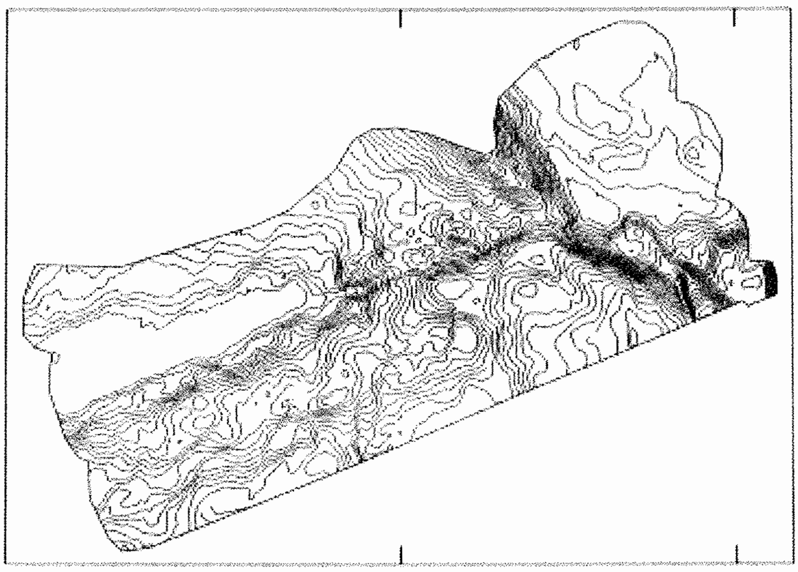

Fig. 19 Depth profile of Box 2, South Shetland Trench (SST) to Shackleton Fracture Zone (SFZ).

- Box 2 survey - S. Shetland Trench (SST) to Shackleton Fracture Zone (SFZ)

The second box survey covered an area of 25 x 60 nm (Fig. 19). The survey demonstrates a continuation of the flat abyssal plain of the SST of about 7 miles in width. The north-eastern tip of this plain is almost abruptly contoured by the -5000 m isoline at the foot of a steep escarp. This escarp is one of a series of at least three on both slopes of the SST marking the approach to the Shackleton fracture zone. At the intersection of the SST and SFZ is a saddle with a depth of about -3500 m; it is almost 1000 m deeper than the crest of the Shackleton Ridge (about –2500 m). The probable continuation of the Shackleton ridge on the slope of the Elephant Islands block of the South Shetland micro-plate is contoured with the –3500 m isoline. It is, however, not supported by the Bouger anomaly profiles and therefore it cannot be the basement structure, but only the sedimentary ridge.

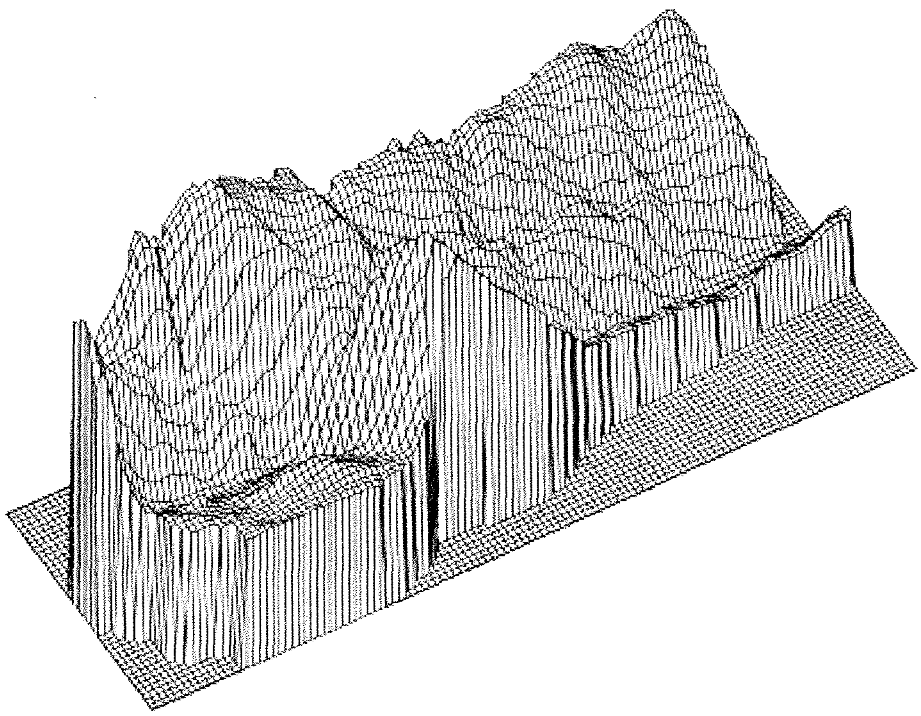

Fig. 20 Perspective view of box survey 2 near the Drake Passage (south/west: -61° 10' S, -57° 47' W; north/east: 60° 29' S, –56° 15' W) as computed by the DTM software TASH.

The morphology of the south-eastern slope of the SST has a complex hummocky topography and several wide terraces with depths of about -2500 m, -3000 m and -4000 m. Do these terraces result from subduction of the plate of the Drake Passage beneath the micro-plate of the South Shetland Island micro-plate? Or are they erosional terraces corresponding to the submergence of the South Shetland Islands block? And corresponding to this question, is the saddle on the crest of the Shackleton Ridge a result of propagation of the active axis of the SST to the north-east direction or is it a result of submersion of the South Shetland Island block? The latter idea may be supported by the clear propagation of the morphological continuation of the axis of the Trench to the north-east contoured by the -4500,-4000,-3500, and 3000 m isobaths and in the formation of the closed deep on the north-eastern side of the gap in the Shackleton Ridge contoured by the –4200 m isobath.

To answer these questions, further surveys are required including deep seismic profiles by seismic reflection and refraction methods.

The performance of the DTM software TASH is demonstrated by Fig. 20 which shows a perspective view of Box 2 near the Drake Passage (south/west: -61° 10' S, -57° 47' W; north/east: 60° 29' S, –56° 15' W). In this case about 700.000 data points are used for the computation of the DTM. Depth ranges are between 1600 and 5000 m.

2.4.5 **Hydrography** (S. Grabbert , D. Gerdes, R. Knust, H. Bohlmann)

Work at sea

The hydrographic situation at each of the 13 CTD stations of the cruise is described by vertical salinity and temperature profiles. The profiles were taken by a Seabird Electronics SBE 911 plus probe. Surface water temperature was recorded continuously along the ship's track by Polarstern's PODAS system.

Preliminary results

Vertical salinity and temperature profiles at 13 stations along the ship's track are presented in Figs. 21, 22, 23. In most of the stations we found a less saline and warmer surface layer of <= 150m thickness. Only at station 246 (Bransfield Strait) no stratification at all was found, probably owing to the strong southwesterly current regime. The spread between surface and bottom water temperatures is distinctly higher in the northern part of the Scotia Arc compared to the southern branch, where spreads were <= 1°C.

The hydrography of the Scotia Arc area is known to be rather complex owing to intense mixing processes of different water masses within and across the frontal system. This is indicated by a marked decline of surface water temperature from about 10 to 1 °C from Punta Arenas along the northern branch of the Scotia Arc to South Georgia/South Sandwich Islands. On the southern branch of the Arc (south of South Georgia) surface water temperatures varied only between about 1 and 0°C. The lowest subsurface temperatures were measured at station 232 and 239 adjacent to the South Orkneys (about –1°C at 200 m). Despite these pronounced north-to-south differences in surface water properties the position of the Polar Front could not be identified clearly. A plot of temperature against latitude along the ship's track showed the most pronounced decrease of temperature between 55 and 57° Latitude (Fig. 24).

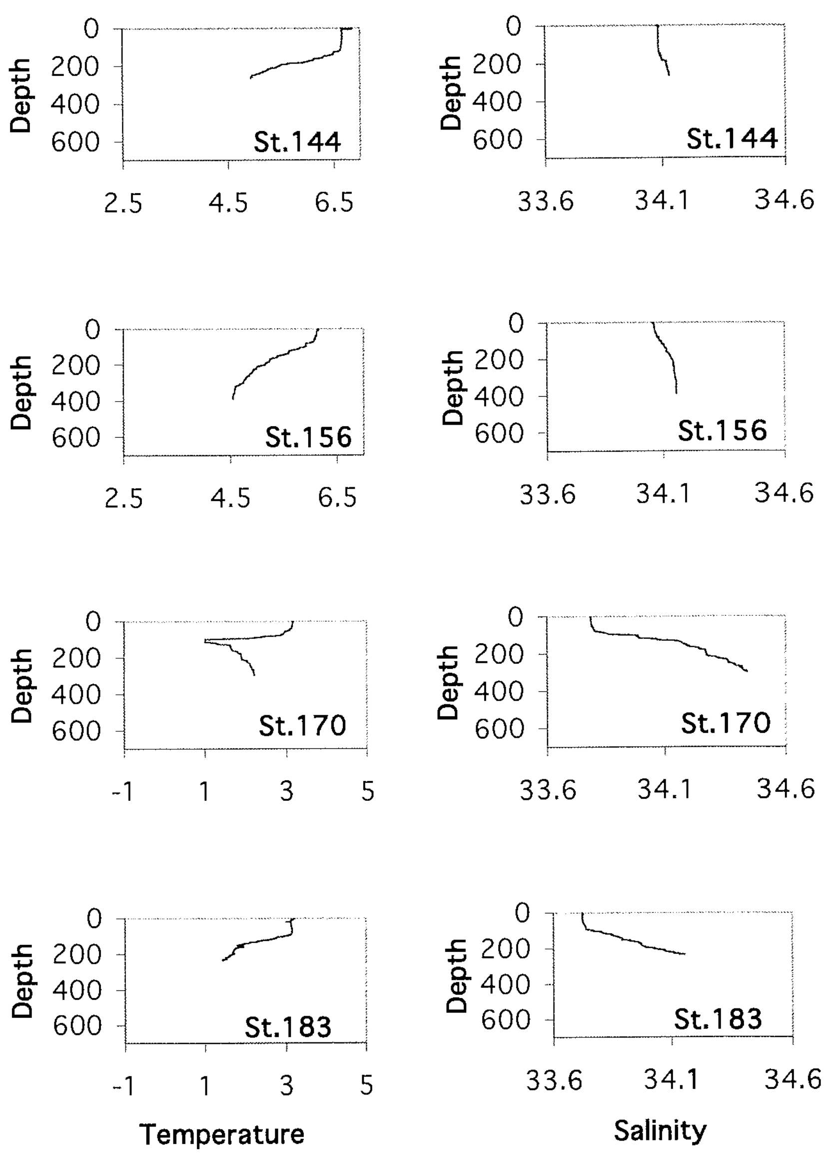

Fig. 21 Temperature and salinity profiles at stations 144, 156, 170, and 183. Station numbers according to Annex table 3.2.

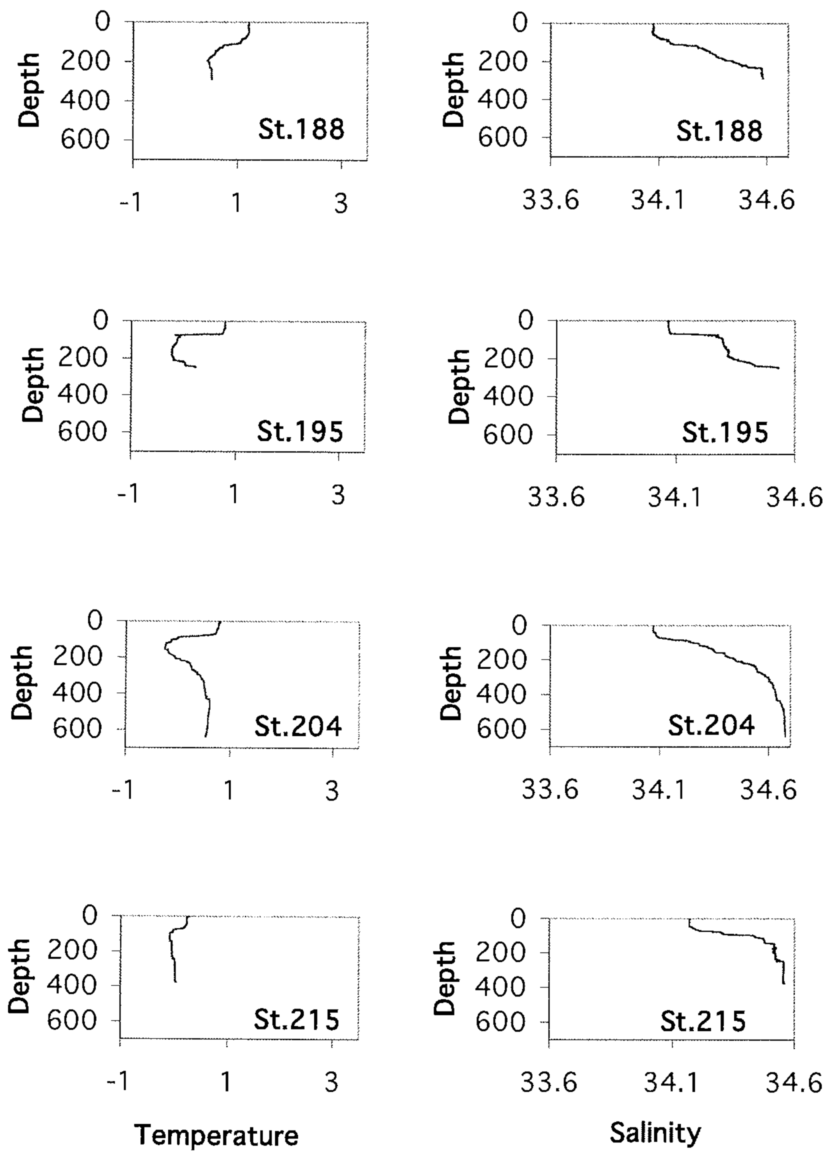

Fig. 22 Temperature and salinity profiles at stations 188, 195, 204, and 215. Station numbers according to Annex table 3.2.

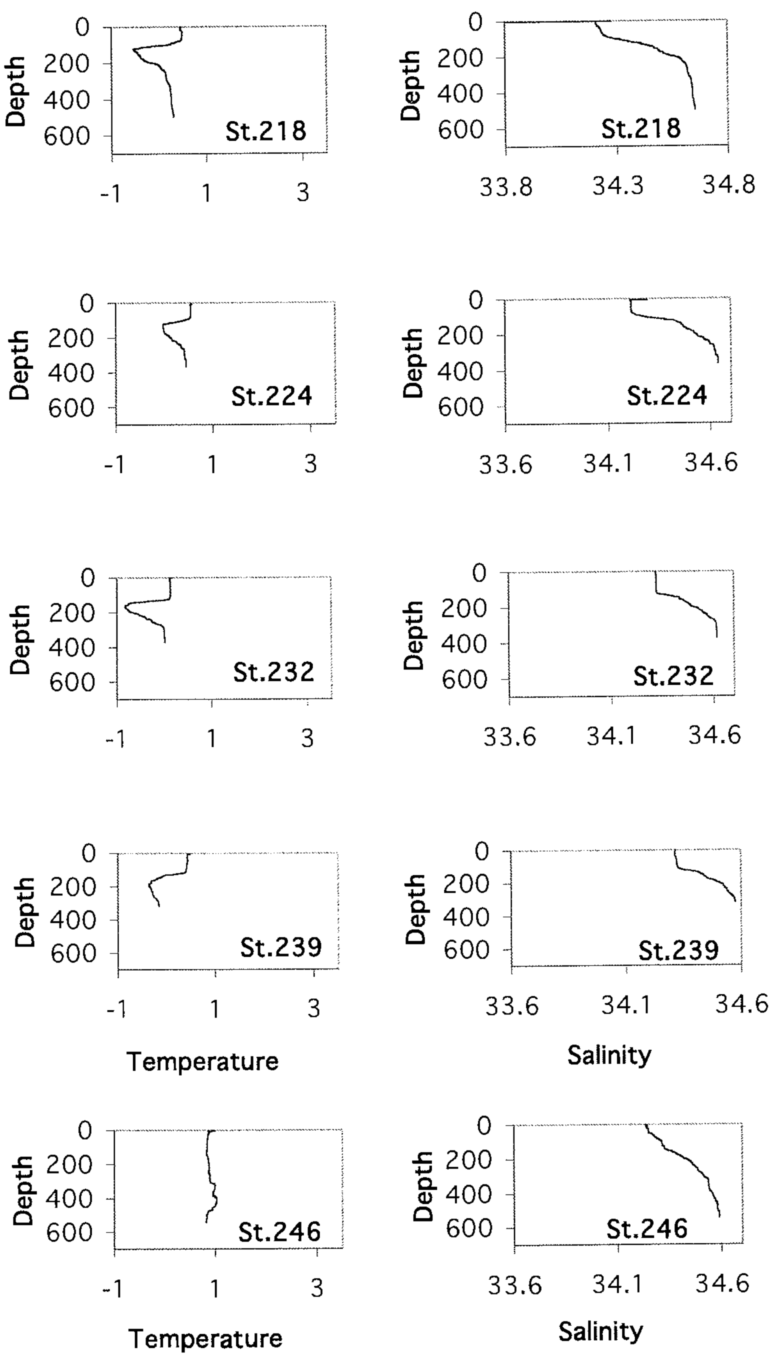

Fig. 23 Temperature and salinity profiles at stations 218, 224, 232, 239, and 246. Station numbers according to Annex table 3.2.

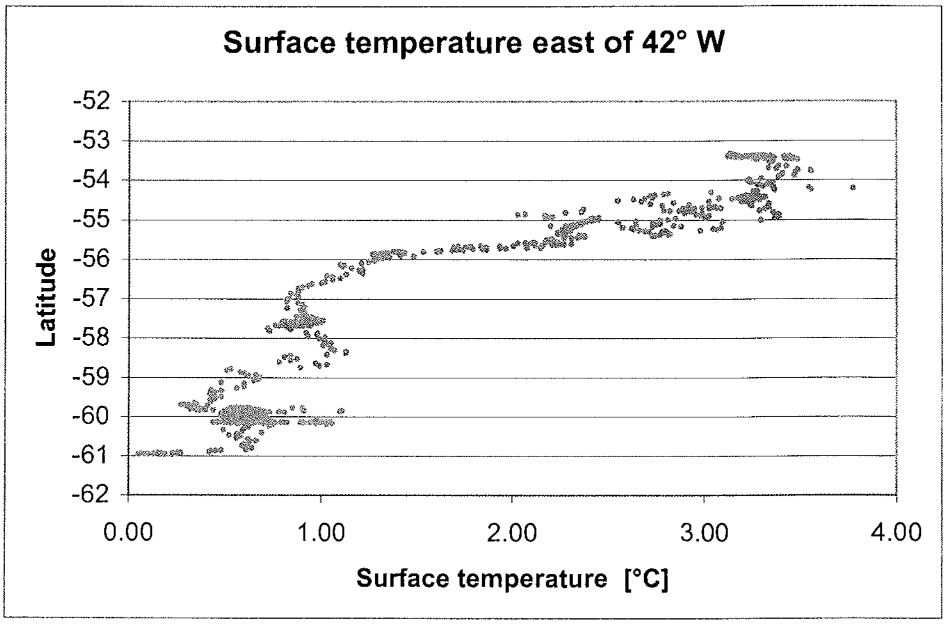

Fig. 24 Surface water temperature east of 42°W. Note the wide area covered by the Antarctic Convergence indicated by a temperature decrease of 2.5°C between 55 and 57°S.

3. ANNEXES

3.1 Abbreviations of Different Gear and Investigation Areas

Gears

Abbreviation	Gear
AGT	Agassiz trawl
AGT & RD	Agassiz trawl with Rauschert dredge
BIOROSI	Bio rosette
BO	Bongo net
CC	Calcofi plankton net
CTD	Conductivity-Temp-Depth data logger
EBS	Epibenthic sledge
FTS	Photo sledge
GSN	Bottom trawl
HS	Hydrosweep echo sounder
HS & PS	Hydrosweep & Parasound echo sounders
HDP	Hydrophone (Test or whale watching)
LD	Lovrich's dredge
MG	Multigrab (Multibox corer)
MN	Multinet
MUC	Multicorer
PS	Parasound echo sounder
RD	Rauschert's small dredge
ROV	Remotely operated vehicle
Trap A	Amphipod trap - deployment
Trap A rec	Amphipod trap - recovery
Trap F	Fish trap - deployment
Trap F rec	Fish trap - recovery

Investigation Areas

Abbreviation	Area
A1	W Burdwood Bank
A2	E Burdwood Bank
B0	Shag Rocks
B1	NW South Georgia
B2	SE South Georgia
C1	N South Sandwich Islands
C2	Central South Sandwich Islands
C3	S South Sandwich Islands
C4	Herdman Bank
C5	Discovery Bank
D1	E South Orkney Islands
D2	SW South Orkney Islands
E1	S Elephant Island
KGI	King George Island
DP	Drake Passage
TR	Transit

3.2 Station List

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
05.04.02	10:35	A1	144-1	54° 02.02'	62° 00.74'	273	CTD	surface
05.04.02	10:42	A1	144-1	54° 02.07'	62° 00.63'	272	CTD	at depth
05.04.02	10:47	A1	144-1	54° 02.12'	62° 00.55'	270	CTD	on deck
05.04.02	11:14	A1	145-1	54° 02.00'	62° 00.52'	272	AGT	surface
05.04.02	11:27	A1	145-1	54° 01.58'	62° 01.03'	271	AGT	on ground
05.04.02	11:38	A1	145-1	54° 01.36'	62° 01.33'	272	AGT	start trawl
05.04.02	11:58	A1	145-1	54° 01.11'	62° 01.63'	272	AGT	start hauling
05.04.02	12:12	A1	145-1	54° 01.11'	62° 01.49'	272	AGT	on deck
05.04.02	12:46	A1	146-1	54° 01.76'	62° 00.70'	270	LD	in the water
05.04.02	13:08	A1	146-1	54° 01.03'	62° 01.53'	273	LD	on the ground
05.04.02	13:11	A1	146-1	54° 00.94'	62° 01.63'	270	LD	start trawling
05.04.02	13:26	A1	146-1	54° 00.56'	62° 01.90'	271	LD	start hauling
05.04.02	13:34	A1	146-1	54° 00.42'	62° 01.91'	270	LD	off ground
05.04.02	13:41	A1	146-1	54° 00.34'	62° 01.82'	269	LD	on deck
06.04.02	10:15	A2	147-1	54° 32.01'	55° 55.09'	416	Trap F	on ground
06.04.02	10:30	A2	147-1	54° 31.99'	55° 55.05'	413	Trap F	on ground
06.04.02	10:37	A2	147-1	54° 31.99'	55° 55.04'	413	Trap F	on deck
06.04.02	10:42	A2	148-1	54° 32.00'	55° 55.05'	413	Trap A	to water
06.04.02	10:54	A2	147-1	54° 31.71'	55° 54.89'	398	Trap F	surface
06.04.02	11:13	A2	147-1	54° 31.75'	55° 54.91'	413	Trap F	releaser on deck
06.04.02	11:20	A2	149-1	54° 31.73'	55° 54.90'	413	HS & PS	start track
06.04.02	13:00	A2	149-1	54° 29.19'	56° 08.46'	284	HS & PS	profile end
06.04.02	13:27	A2	150-1	54° 30.66'	56° 08.58'	286	AGT	surface
06.04.02	13:43	A2	150-1	54° 30.22'	56° 08.20'	286	AGT	on ground
06.04.02	13:43	A2	150-1	54° 30.22'	56° 08.20'	286	AGT	start trawl
06.04.02	14:05	A2	150-1	54° 29.64'	56° 08.13'	290	AGT	stop trawl
06.04.02	14:05	A2	150-1	54° 29.64'	56° 08.13'	290	AGT	start hauling
06.04.02	14:13	A2	150-1	54° 29.64'	56° 08.09'	292	AGT	off ground

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
06.04.02	14:18	A2	150-1	54° 29.65'	56° 08.02'	292	AGT	on deck
06.04.02	14:55	A2	151-1	54° 30.67'	56° 08.69'	281	LD	in the water
06.04.02	15:07	A2	151-1	54° 30.33'	56° 08.25'	280	LD	on ground
06.04.02	15:10	A2	151-1	54° 30.22'	56° 08.25'	279	LD	start trawling
06.04.02	15:24	A2	151-1	54° 29.84'	56° 07.98'	290	LD	start hauling
06.04.02	15:29	A2	151-1	54° 29.78'	56° 08.00'	292	LD	off ground
06.04.02	15:36	A2	151-1	54° 29.72'	56° 08.06'	293	LD	on deck
06.04.02	16:09	A2	152-1	54° 29.79'	56° 08.28'	287	ROV	surface
06.04.02	16:36	A2	152-1	54° 29.82'	56° 08.15'	291	ROV	at depth
06.04.02	17:37	A2	152-1	54° 29.74'	56° 08.20'	293	ROV	on deck
06.04.02	18:12	A2	153-1	54° 33.23'	56° 10.12'	297	GSN	codend to surface
06.04.02	18:21	A2	153-1	54° 32.75'	56° 09.84'	299	GSN	otter bds to surface
06.04.02	18:39	A2	153-1	54° 31.22'	56° 08.93'	296	GSN	start trawling
06.04.02	18:59	A2	153-1	54° 30.04'	56° 08.33'	277	GSN	stop trawling
06.04.02	19:20	A2	153-1	54° 29.34'	56° 07.87'	286	GSN	otter bds on deck
06.04.02	19:34	A2	153-1	54° 28.89'	56° 07.62'	286	GSN	codend on deck
06.04.02	21:49	A2	154-1	54° 32.51'	55° 56.44'	400	MG	surface
06.04.02	22:08	A2	154-1	54° 32.55'	55° 56.04'	404	MG	on ground
06.04.02	22:28	A2	154-1	54° 32.48'	55° 56.01'	408	MG	on deck
06.04.02	22:43	A2	155-1	54° 32.46'	55° 55.94'	404	FTS	surface
06.04.02	23:00	A2	155-1	54° 32.45'	55° 56.09'	403	FTS	on ground
06.04.02	23:22	A2	155-1	54° 32.44'	55° 56.36'	404	FTS	off ground
06.04.02	23:29	A2	155-1	54° 32.46'	55° 56.44'	403	FTS	on deck
06.04.02	23:45	A2	156-1	54° 32.56'	55° 56.57'	404	CTD	surface
06.04.02	23:59	A2	156-1	54° 32.56'	55° 56.67'	400	CTD	at depth
07.04.02	00:07	A2	156-1	54° 32.58'	55° 56.76'	402	CTD	on deck
07.04.02	00:40	A2	157-1	54° 32.37'	55° 56.43'	402	MN	surface
07.04.02	00:57	A2	157-1	54° 32.44'	55° 56.71'	400	MN	at depth
07.04.02	00:58	A2	157-1	54° 32.44'	55° 56.72'	397	MN	hauling
07.04.02	01:18	A2	157-1	54° 32.53'	55° 57.01'	398	MN	on deck

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
07.04.02	10:27	A2	148-1	54° 32.13'	55° 55.20'	410	Trap A rec	released
07.04.02	10:35	A2	148-1	54° 32.07'	55° 55.17'	415	Trap A rec	surfaced
07.04.02	10:48	A2	148-1	54° 32.19'	55° 54.92'	412	Trap A rec	on deck
07.04.02	11:01	A2	147-1	54° 31.84'	55° 54.97'	413	Trap F rec	released
07.04.02	11:19	A2	147-1	54° 31.82'	55° 54.98'	412	Trap F rec	released
07.04.02	11:55	A2	147-1	54° 31.85'	55° 54.87'	413	Trap F rec	search by heli
07.04.02	12:15	A2	147-1	54° 31.86'	55° 54.85'	413	Trap F rec	trap not afloat
08.04.02	00:00	TR	158-1	54° 00.08'	52° 40.41'	1745	HS & PS	start track
08.04.02	01:33	TR	158-1	53° 53.46'	52° 25.39'	454	HS & PS	profile end
09.04.02	02:35	TR	159-1	53° 24.03'	44° 45.60'	436	HS & PS	start track
09.04.02	03:09	TR	159-1	53° 23.55'	44° 43.68'	438	HS & PS	profile end
09.04.02	04:14	B0	160-1	53° 23.55'	44° 44.06'	435	AGT	surface
09.04.02	04:28	B0	160-1	53° 23.72'	44° 44.92'	431	AGT	on ground
09.04.02	04:32	B0	160-1	53° 23.75'	44° 45.12'	435	AGT	start trawl
09.04.02	04:52	B0	160-1	53° 23.80'	44° 45.73'	435	AGT	stop trawl
09.04.02	05:08	B0	160-1	53° 23.69'	44° 45.78'	431	AGT	off ground
09.04.02	05:21	B0	160-1	53° 23.66'	44° 46.17'	435	AGT	on deck
09.04.02	05:44	B0	160-2	53° 22.94'	44° 47.41'	1131	Trap F	start releaser test
09.04.02	05:46	B0	160-2	53° 22.90'	44° 47.42'	1148	Trap F	end releaser test
09.04.02	13:24	TR	161-1	53° 24.03'	42° 44.49'	343	HS & PS	start track
09.04.02	13:45	TR	161-1	53° 24.01'	42° 38.11'	371	HS & PS	alter course
09.04.02	14:15	TR	161-1	53° 23.73'	42° 43.71'	324	HS & PS	alter course
09.04.02	15:00	TR	161-1	53° 23.43'	42° 40.11'	300	HS & PS	profile end
09.04.02	15:13	B1	162-1	53° 24.08'	42° 40.09'	293	Trap A	to water
09.04.02	15:29	B1	163-1	53° 23.65'	42° 40.54'	280	MG	surface
09.04.02	15:39	B1	163-1	53° 23.71'	42° 40.56'	282	MG	on ground
09.04.02	15:50	B1	163-1	53° 23.76'	42° 40.59'	285	MG	on deck
09.04.02	16:12	B1	164-1	53° 23.67'	42° 40.98'	280	AGT	surface
09.04.02	16:25	B1	164-1	53° 23.79'	42° 41.78'	299	AGT	on ground
09.04.02	16:30	B1	164-1	53° 23.80'	42° 42.03'	313	AGT	start trawl

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
09.04.02	16:44	B1	164-1	53° 23.82'	42° 42.46'	322	AGT	stop trawl
09.04.02	16:45	B1	164-1	53° 23.81'	42° 42.48'	323	AGT	start hauling
09.04.02	16:56	B1	164-1	53° 23.86'	42° 42.52'	335	AGT	off ground
09.04.02	17:07	B1	164-1	53° 23.91'	42° 42.61'	331	AGT	on deck
09.04.02	17:51	B1	165-1	53° 23.83'	42° 42.48'	328	FTS	surface
09.04.02	17:59	B1	165-1	53° 23.85'	42° 42.38'	324	FTS	on ground
09.04.02	18:49	B1	165-1	53° 24.30'	42° 41.34'	326	FTS	off ground
09.04.02	18:55	B1	165-1	53° 24.33'	42° 41.16'	314	FTS	on deck
09.04.02	19:20	B1	167-1	53° 24.68'	42° 38.85'	302	GSN	codend to surface
09.04.02	19:30	B1	167-1	53° 24.96'	42° 39.56'	316	GSN	otter bds to surface
09.04.02	19:35	B1	167-1	53° 24.80'	42° 40.08'	321	GSN	turn
09.04.02	19:54	B1	167-1	53° 23.68'	42° 42.23'	306	GSN	start trawling
09.04.02	20:14	B1	167-1	53° 22.93'	42° 43.75'	343	GSN	stop trawling
09.04.02	20:23	B1	167-1	53° 22.69'	42° 43.81'	357	GSN	off ground
09.04.02	20:35	B1	167-1	53° 22.34'	42° 43.38'	338	GSN	otter bds on deck
09.04.02	20:56	B1	167-1	53° 21.36'	42° 43.96'	400	GSN	codend on deck
09.04.02	23:06	B1	168-1	53° 23.10'	42° 41.33'	281	ROV	surface
09.04.02	23:59	B1	168-1	53° 23.08'	42° 41.28'	281	ROV	on deck
10.04.02	00:18	B1	169-1	53° 23.08'	42° 41.04'	281	RD	surface
10.04.02	00:30	B1	169-1	53° 22.94'	42° 41.37'	284	RD	start dredging
10.04.02	00:39	B1	169-1	53° 22.89'	42° 41.50'	-	RD	start hauling
10.04.02	01:00	B1	169-1	53° 22.78'	42° 41.67'	293	RD	on deck
10.04.02	01:25	B1	170-1	53° 22.61'	42° 41.71'	304	CTD	surface
10.04.02	01:39	B1	170-1	53° 22.56'	42° 41.86'	307	CTD	surface
10.04.02	01:46	B1	170-1	53° 22.55'	42° 41.89'	311	CTD	on deck
10.04.02	02:01	B1	171-1	53° 22.57'	42° 42.26'	307	MN	surface
10.04.02	02:13	B1	171-1	53° 22.62'	42° 42.46'	300	MN	at depth
10.04.02	02:14	B1	171-1	53° 22.62'	42° 42.47'	302	MN	hauling
10.04.02	02:32	B1	171-1	53° 22.71'	42° 42.79'	298	MN	on deck
10.04.02	02:46	B1	172-1	53° 22.78'	42° 42.90'	298	HS & PS	start track

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
10.04.02	09:54	B1	172-1	53° 24.33'	42° 42.10'	353	HS & PS	profile end
10.04.02	10:14	B1	162-1	53° 23.90'	42° 39.71'	301	Trap A rec	released
10.04.02	10:21	B1	162-1	53° 23.92'	42° 39.59'	291	Trap A rec	surfaced
10.04.02	10:49	B1	162-1	53° 24.01'	42° 39.41'	311	Trap A rec	on deck
11.04.02	09:30	TR	173-1	55° 24.00'	36° 00.00'	380	HS & PS	start track
11.04.02	17:57	TR	173-1	54° 23.47'	35° 34.11'	276	HS & PS	profile end
11.04.02	18:07	B2	174-1	54° 23.87'	35° 33.73'	280	GSN	codend to surface
11.04.02	18:18	B2	174-1	54° 23.66'	35° 34.53'	273	GSN	turn
11.04.02	18:20	B2	174-1	54° 23.71'	35° 34.77'	274	GSN	otter bds to surface
11.04.02	18:36	B2	174-1	54° 24.47'	35° 36.81'	278	GSN	on ground
11.04.02	18:36	B2	174-1	54° 24.47'	35° 36.81'	278	GSN	start trawling
11.04.02	18:56	B2	174-1	54° 25.30'	35° 38.50'	280	GSN	stop trawling
11.04.02	19:05	B2	174-1	54° 25.54'	35° 38.85'	277	GSN	off ground
11.04.02	19:13	B2	174-1	54° 25.76'	35° 39.11'	278	GSN	otter bds on deck
11.04.02	19:14	B2	174-1	54° 25.81'	35° 39.21'	277	GSN	turn
11.04.02	19:17	B2	174-1	54° 25.77'	35° 39.61'	275	GSN	codend on deck
11.04.02	19:48	B2	175-1	54° 25.75'	35° 41.00'	271	FTS	surface
11.04.02	19:55	B2	175-1	54° 25.76'	35° 41.01'	271	FTS	on ground
11.04.02	20:30	B2	175-1	54° 25.70'	35° 41.27'	270	FTS	off ground
11.04.02	20:35	B2	175-1	54° 25.70'	35° 41.30'	270	FTS	on deck
11.04.02	21:02	B2	176-1	54° 25.33'	35° 38.50'	280	MG	surface
11.04.02	21:23	B2	176-1	54° 25.43'	35° 38.58'	278	MG	on ground
11.04.02	21:32	B2	176-1	54° 25.45'	35° 38.63'	279	MG	on deck
11.04.02	21:49	B2	177-1	54° 25.47'	35° 38.66'	277	MG	surface
11.04.02	22:13	B2	177-1	54° 25.50'	35° 38.73'	277	MG	on ground
11.04.02	22:19	B2	177-1	54° 25.50'	35° 38.75'	278	MG	on deck
11.04.02	22:30	B2	178-1	54° 25.46'	35° 38.89'	277	MUC	surface
11.04.02	22:39	B2	178-1	54° 25.47'	35° 38.91'	277	MUC	on ground
11.04.02	22:48	B2	178-1	54° 25.47'	35° 38.92'	278	MUC	on deck
11.04.02	23:38	B2	179-1	54° 28.00'	35° 40.54'	244	RD	surface

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
11.04.02	23:50	B2	179-1	54° 27.97'	35° 40.73'	236	RD	start dredging
11.04.02	23:55	B2	179-1	54° 27.93'	35° 40.79'	240	RD	start hauling
12.04.02	00:07	B2	179-1	54° 27.80'	35° 40.78'	243	RD	on deck
12.04.02	00:29	B2	180-1	54° 27.88'	35° 40.60'	238	ROV	surface
12.04.02	00:47	B2	180-1	54° 27.93'	35° 40.60'	239	ROV	at depth
12.04.02	02:36	B2	180-1	54° 27.74'	35° 40.75'	226	ROV	on deck
12.04.02	03:09	B2	181-1	54° 27.66'	35° 40.34'	243	HS & PS	start track
12.04.02	09:30	B2	181-1	54° 25.10'	35° 41.72'	265	HS & PS	profile end
12.04.02	10:14	B2	182-1	54° 27.90'	35° 40.60'	240	AGT	surface
12.04.02	10:27	B2	182-1	54° 27.63'	35° 41.33'	249	AGT	start trawl
12.04.02	10:48	B2	182-1	54° 27.44'	35° 41.76'	256	AGT	start hauling
12.04.02	10:54	B2	182-1	54° 27.44'	35° 41.78'	256	AGT	off ground
12.04.02	11:03	B2	182-1	54° 27.43'	35° 41.80'	257	AGT	on deck
12.04.02	11:21	B2	183-1	54° 27.63'	35° 41.26'	247	CTD	surface
12.04.02	11:29	B2	183-1	54° 27.62'	35° 41.27'	247	CTD	at depth
12.04.02	11:39	B2	183-1	54° 27.64'	35° 41.20'	247	CTD	on deck
12.04.02	12:06	B2	184-1	54° 27.62'	35° 41.74'	256	CC	into water
12.04.02	12:16	B2	184-1	54° 27.74'	35° 42.29'	259	CC	on depth
12.04.02	12:33	B2	184-1	54° 27.98'	35° 43.10'	251	CC	on deck
12.04.02	12:55	B2	185-1	54° 27.90'	35° 42.35'	257	CC	into water
12.04.02	13:21	B2	185-1	54° 28.28'	35° 43.69'	245	CC	on depth
12.04.02	13:49	B2	185-1	54° 28.82'	35° 45.27'	194	CC	on deck
14.04.02	08:30	TR	186-1	55° 55.40'	28° 14.90'	0	HS & PS	start track
14.04.02	11:00	TR	186-1	55° 57.27'	28° 07.94'	239	HS & PS	profile end
14.04.02	12:22	C1	187-1	55° 55.70'	28° 07.09'	231	AGT	surface
14.04.02	12:32	C1	187-1	55° 56.06'	28° 07.46'	249	AGT	on ground
14.04.02	12:33	C1	187-1	55° 56.08'	28° 07.51'	255	AGT	start trawl
14.04.02	12:53	C1	187-1	55° 56.42'	28° 07.97'	264	AGT	stop trawl
14.04.02	12:53	C1	187-1	55° 56.42'	28° 07.97'	264	AGT	start hauling
14.04.02	13:02	C1	187-1	55° 56.41'	28° 08.06'	278	AGT	off ground

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
14.04.02	13:09	C1	187-1	55° 56.44'	28° 08.17'	301	AGT	on deck
14.04.02	14:13	C1	188-1	55° 56.17'	28° 07.81'	298	CTD	surface
14.04.02	14:21	C1	188-1	55° 56.11'	28° 07.87'	302	CTD	at depth
14.04.02	14:27	C1	188-1	55° 56.09'	28° 07.88'	295	CTD	on deck
15.04.02	01:20	TR	189-1	57° 26.30'	26° 32.95'	1933	HS & PS	start track
15.04.02	03:27	TR	189-1	57° 28.19'	26° 34.09'	1396	HS & PS	profile end
15.04.02	05:10	TR	190-1	57° 39.68'	26° 32.86'	1356	HS & PS	start track
15.04.02	11:30	TR	190-1	57° 40.34'	26° 23.55'	636	HS & PS	profile end
15.04.02	11:54	C2	191-1	57° 41.01'	26° 24.47'	270	Trap A	to water
15.04.02	12:03	C2	191-1	57° 41.00'	26° 24.47'	274	Trap A	HDP in the water
15.04.02	12:08	C2	191-1	57° 41.02'	26° 24.46'	266	Trap A	on bottom
15.04.02	12:09	C2	191-1	57° 41.03'	26° 24.45'	267	Trap A	HDP on deck
15.04.02	12:28	C2	192-1	57° 41.18'	26° 24.07'	256	Trap F	surface
15.04.02	12:44	C2	192-1	57° 41.16'	26° 24.13'	255	Trap F	released
15.04.02	13:24	C2	193-1	57° 40.32'	26° 23.88'	536	HDP	start observ.
15.04.02	13:33	C2	193-1	57° 40.34'	26° 23.86'	538	HDP	end observ.
15.04.02	13:44	C2	194-1	57° 40.42'	26° 24.12'	467	AGT	surface
15.04.02	13:53	C2	194-1	57° 40.53'	26° 25.00'	305	AGT	on ground
15.04.02	13:55	C2	194-1	57° 40.55'	26° 25.14'	309	AGT	start trawl
15.04.02	14:15	C2	194-1	57° 40.66'	26° 25.90'	289	AGT	start hauling
15.04.02	14:22	C2	194-1	57° 40.70'	26° 26.09'	278	AGT	off ground
15.04.02	14:22	C2	194-1	57° 40.70'	26° 26.09'	278	AGT	stop trawl
15.04.02	14:32	C2	194-1	57° 40.78'	26° 26.29'	273	AGT	on deck
15.04.02	14:54	C2	195-1	57° 40.92'	26° 26.45'	255	CTD	surface
15.04.02	15:02	C2	195-1	57° 40.89'	26° 26.45'	263	CTD	at depth
15.04.02	15:07	C2	195-1	57° 40.89'	26° 26.44'	262	CTD	on deck
15.04.02	15:45	C2	196-1	57° 40.22'	26° 20.67'	1203	GSN	codend to surface
15.04.02	15:53	C2	196-1	57° 40.05'	26° 21.39'	1126	GSN	turn
15.04.02	15:56	C2	196-1	57° 40.04'	26° 21.86'	1127	GSN	otter bds to surface
15.04.02	16:21	C2	196-1	57° 40.60'	26° 25.42'	301	GSN	start trawling

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
15.04.02	16:42	C2	196-1	57° 40.95'	26° 27.85'	286	GSN	stop trawling
15.04.02	16:53	C2	196-1	57° 41.12'	26° 28.59'	279	GSN	off ground
15.04.02	17:02	C2	196-1	57° 41.30'	26° 29.05'	480	GSN	otter bds on deck
15.04.02	17:12	C2	196-1	57° 41.59'	26° 29.59'	577	GSN	codend on deck
15.04.02	17:52	C2	197-1	57° 40.86'	26° 26.50'	274	CC	into water
15.04.02	18:09	C2	197-1	57° 40.95'	26° 27.85'	274	CC	on depth
15.04.02	18:25	C2	197-1	57° 41.10'	26° 28.92'	417	CC	on deck
15.04.02	18:51	C2	198-1	57° 40.28'	26° 27.58'	556	MG	surface
15.04.02	19:14	C2	198-1	57° 40.24'	26° 27.53'	550	MG	on ground
15.04.02	19:30	C2	198-1	57° 40.19'	26° 27.64'	594	MG	on deck
15.04.02	20:04	C2	199-1	57° 37.93'	26° 27.52'	747	MG	surface
15.04.02	20:29	C2	199-1	57° 37.92'	26° 27.46'	746	MG	on ground
15.04.02	20:49	C2	199-1	57° 37.87'	26° 27.56'	750	MG	on deck
15.04.02	21:21	C2	200-1	57° 40.54'	26° 24.56'	331	RD	surface
15.04.02	21:34	C2	200-1	57° 40.78'	26° 24.91'	270	RD	start dredging
15.04.02	21:39	C2	200-1	57° 40.84'	26° 24.98'	263	RD	start Hauling
15.04.02	21:55	C2	200-1	57° 40.93'	26° 24.77'	262	RD	on deck
15.04.02	22:14	C2	201-1	57° 40.63'	26° 25.91'	297	FTS	surface
15.04.02	22:23	C2	201-1	57° 40.64'	26° 25.82'	295	FTS	on ground
15.04.02	22:52	C2	201-1	57° 40.67'	26° 26.06'	290	FTS	off ground
15.04.02	22:57	C2	201-1	57° 40.67'	26° 26.09'	290	FTS	on deck
15.04.02	23:15	C2	202-1	57° 40.52'	26° 28.57'	613	FTS	surface
15.04.02	23:28	C2	202-1	57° 40.53'	26° 28.43'	573	FTS	on ground
16.04.02	00:02	C2	202-1	57° 40.62'	26° 28.63'	570	FTS	off ground
16.04.02	00:13	C2	202-1	57° 40.63'	26° 28.77'	580	FTS	on deck
16.04.02	00:46	C2	203-1	57° 40.87'	26° 25.02'	259	ROV	surface
16.04.02	00:59	C2	203-1	57° 40.89'	26° 25.08'	255	ROV	at depth
16.04.02	02:28	C2	203-1	57° 40.90'	26° 25.32'	248	ROV	on deck
16.04.02	02:56	C2	204-1	57° 39.62'	26° 26.58'	625	CTD	surface
16.04.02	03:10	C2	204-1	57° 39.58'	26° 26.45'	649	CTD	at depth

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
16.04.02	03:24	C2	204-1	57° 39.64'	26° 26.33'	640	CTD	on deck
16.04.02	03:39	C2	205-1	57° 39.60'	26° 26.31'	655	MN	surface
16.04.02	04:01	C2	205-1	57° 39.60'	26° 26.20'	663	MN	at depth
16.04.02	04:38	C2	205-1	57° 39.75'	26° 26.15'	618	MN	on deck
16.04.02	04:42	C2	206-1	57° 39.69'	26° 26.18'	639	HS & PS	start track
16.04.02	09:30	C2	206-1	57° 34.68'	26° 28.78'	902	HS & PS	profile end
16.04.02	10:22	C2	191-1	57° 41.04'	26° 24.13'	288	Trap A rec	HDP in the water
16.04.02	10:26	C2	191-1	57° 41.07'	26° 24.10'	278	Trap A rec	released
16.04.02	10:27	C2	191-1	57° 41.06'	26° 24.08'	282	Trap A rec	HDP on deck
16.04.02	10:31	C2	191-1	57° 41.04'	26° 24.01'	290	Trap A rec	surfaced
16.04.02	10:55	C2	191-1	57° 40.92'	26° 24.13'	326	Trap A rec	on deck
16.04.02	11:11	C2	192-1	57° 41.02'	26° 23.82'	317	Trap F rec	HDP to water
16.04.02	11:13	C2	192-1	57° 41.04'	26° 23.82'	311	Trap F rec	released
16.04.02	11:14	C2	192-1	57° 41.04'	26° 23.82'	307	Trap F rec	releaser on deck
16.04.02	11:35	C2	192-1	57° 41.09'	26° 23.78'	311	Trap F rec	on deck
16.04.02	12:08	C2	207-1	57° 39.78'	26° 27.09'	566	AGT	surface
16.04.02	12:23	C2	207-1	57° 40.31'	26° 27.81'	589	AGT	on ground
16.04.02	12:25	C2	207-1	57° 40.36'	26° 27.89'	587	AGT	start trawl
16.04.02	12:45	C2	207-1	57° 40.65'	26° 28.35'	514	AGT	start hauling
16.04.02	12:59	C2	207-1	57° 40.72'	26° 28.35'	475	AGT	off ground
16.04.02	13:12	C2	207-1	57° 40.79'	26° 28.41'	454	AGT	on deck
16.04.02	15:39	C2	208-1	57° 37.43'	26° 23.30'	1347	GSN	codend to surface
16.04.02	15:46	C2	208-1	57° 37.45'	26° 24.04'	1205	GSN	turn
16.04.02	15:50	C2	208-1	57° 37.60'	26° 24.57'	1077	GSN	otter bds to surface
16.04.02	16:31	C2	208-1	57° 40.25'	26° 27.97'	630	GSN	on bottom
16.04.02	16:31	C2	208-1	57° 40.25'	26° 27.97'	630	GSN	start trawling
16.04.02	16:43	C2	208-1	57° 40.62'	26° 29.18'	647	GSN	stop trawling
16.04.02	17:16	C2	208-1	57° 40.22'	26° 28.42'	724	GSN	off ground
16.04.02	17:30	C2	208-1	57° 40.45'	26° 29.10'	721	GSN	otter bds on deck
16.04.02	17:40	C2	208-1	57° 40.65'	26° 29.66'	762	GSN	codend on deck

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
16.04.02	18:24	C2	209-1	57° 39.62'	26° 27.28'	603	RD	surface
16.04.02	18:41	C2	209-1	57° 40.09'	26° 27.69'	624	RD	start dredging
16.04.02	18:46	C2	209-1	57° 40.18'	26° 27.75'	606	RD	stop dredging
16.04.02	18:47	C2	209-1	57° 40.20'	26° 27.76'	604	RD	start Hauling
16.04.02	18:48	C2	209-1	57° 40.22'	26° 27.78'	602	RD	on deck
16.04.02	20:01	C2	210-1	57° 35.54'	26° 23.76'	1099	MG	surface
16.04.02	20:35	C2	210-1	57° 35.51'	26° 23.71'	1104	MG	on ground
16.04.02	21:03	C2	210-1	57° 35.52'	26° 23.68'	1103	MG	on deck
16.04.02	21:20	C2	211-1	57° 35.50'	26° 23.65'	1105	MUC	surface
16.04.02	21:52	C2	211-1	57° 35.58'	26° 23.69'	1094	MUC	on ground
16.04.02	22:20	C2	211-1	57° 35.60'	26° 23.70'	1090	MUC	on deck
17.04.02	12:53	TR	212-1	59° 40.00'	27° 51.99'	678	HS & PS	start track
17.04.02	14:52	TR	212-1	59° 42.60'	27° 58.06'	344	HS & PS	profile end
17.04.02	15:02	C3	213-1	59° 42.31'	27° 56.39'	519	HDP	in the water
17.04.02	15:10	C3	213-1	59° 42.39'	27° 55.78'	407	HDP	start observ.
17.04.02	15:20	C3	213-1	59° 42.36'	27° 55.49'	331	HDP	end observ.
17.04.02	15:22	C3	213-1	59° 42.35'	27° 55.44'	319	HDP	on deck
17.04.02	15:33	C3	214-1	59° 42.67'	27° 55.69'	359	AGT	surface
17.04.02	15:46	C3	214-1	59° 42.56'	27° 56.83'	341	AGT	on ground
17.04.02	15:49	C3	214-1	59° 42.55'	27° 57.02'	332	AGT	start trawl
17.04.02	16:09	C3	214-1	59° 42.62'	27° 57.68'	340	AGT	stop trawl
17.04.02	16:09	C3	214-1	59° 42.62'	27° 57.68'	340	AGT	start hauling
17.04.02	16:16	C3	214-1	59° 42.60'	27° 57.73'	356	AGT	off ground
17.04.02	16:25	C3	214-1	59° 42.56'	27° 57.71'	384	AGT	on deck
17.04.02	16:43	C3	215-1	59° 42.56'	27° 57.57'	371	CTD	surface
17.04.02	16:53	C3	215-1	59° 42.53'	27° 57.63'	390	CTD	at depth
17.04.02	17:02	C3	215-1	59° 42.52'	27° 57.67'	395	CTD	on deck
18.04.02	05:00	TR	216-1	59° 58.95'	31° 58.55'	1030	HS	start track
18.04.02	10:00	TR	216-1	59° 55.25'	32° 26.13'	518	HS	profile end
18.04.02	10:24	C4	217-1	59° 55.24'	32° 26.46'	518	AGT	surface

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
18.04.02	10:45	C4	217-1	59° 55.02'	32° 28.11'	521	AGT	on ground
18.04.02	10:49	C4	217-1	59° 54.98'	32° 28.33'	521	AGT	start trawl
18.04.02	11:09	C4	217-1	59° 54.79'	32° 28.93'	518	AGT	start hauling
18.04.02	11:22	C4	217-1	59° 54.73'	32° 28.99'	518	AGT	off ground
18.04.02	11:37	C4	217-1	59° 54.69'	32° 29.15'	517	AGT	on deck
18.04.02	11:47	C4	218-1	59° 54.64'	32° 29.05'	518	CTD	surface
18.04.02	12:00	C4	218-1	59° 54.64'	32° 29.11'	517	CTD	at depth
18.04.02	12:10	C4	218-1	59° 54.57'	32° 29.09'	517	CTD	on deck
18.04.02	18:12	TR	219-1	59° 59.01'	34° 40.09'	1233	HS & PS	start track
18.04.02	18:36	TR	219-1	59° 59.10'	34° 47.21'	1466	HS & PS	profile end
18.04.02	18:40	C5	220-1	59° 59.52'	34° 47.63'	1385	HS & PS	start track
18.04.02	20:55	C5	220-1	60° 10.53'	34° 58.11'	420	HS & PS	alter course
18.04.02	21:40	C5	220-1	60° 06.85'	34° 51.22'	429	HS & PS	alter course
18.04.02	22:20	C5	220-1	60° 09.19'	34° 59.13'	414	HS & PS	alter course
19.04.02	00:46	C5	220-1	59° 58.42'	34° 36.88'	1297	HS & PS	alter course
19.04.02	06:00	C5	220-1	59° 55.49'	36° 15.36'	2133	HS & PS	alter course
19.04.02	16:48	C5	220-1	59° 54.86'	34° 41.14'	1759	HS & PS	alter course
19.04.02	22:50	C5	220-1	59° 50.59'	36° 24.20'	2506	HS & PS	alter course
19.04.02	23:40	C5	220-1	59° 53.27'	36° 19.06'	2305	HS & PS	alter course
20.04.02	09:06	C5	220-1	59° 53.12'	34° 43.22'	1868	HS & PS	alter course
20.04.02	09:55	C5	220-1	59° 48.80'	34° 50.92'	1475	HS & PS	alter course
20.04.02	14:22	C5	220-1	59° 48.77'	36° 09.62'	2319	HS & PS	alter course
20.04.02	14:45	C5	220-1	59° 46.76'	36° 14.66'	2429	HS & PS	alter course
20.04.02	18:52	C5	220-1	59° 46.49'	35° 28.77'	1329	HS & PS	profile end
20.04.02	19:15	C5	221-1	59° 48.38'	35° 25.99'	1374	HS & PS	start track
20.04.02	23:05	C5	221-1	60° 07.93'	34° 56.17'	427	HS & PS	profile end
20.04.02	23:28	C5	222-1	60° 08.04'	34° 56.36'	379	MG	surface
20.04.02	23:45	C5	222-1	60° 08.05'	34° 56.25'	375	MG	on ground
20.04.02	23:55	C5	222-1	60° 08.11'	34° 56.34'	382	MG	on deck
21.04.02	00:33	C5	223-1	60° 07.70'	34° 56.75'	399	AGT	surface

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
21.04.02	00:46	C5	223-1	60° 08.03'	34° 55.91'	375	AGT	on ground
21.04.02	00:51	C5	223-1	60° 08.16'	34° 55.59'	374	AGT	start trawl
21.04.02	01:11	C5	223-1	60° 08.39'	34° 54.96'	379	AGT	start hauling
21.04.02	01:20	C5	223-1	60° 08.43'	34° 54.97'	384	AGT	off ground
21.04.02	01:20	C5	223-1	60° 08.43'	34° 54.97'	384	AGT	stop trawl
21.04.02	01:33	C5	223-1	60° 08.49'	34° 54.91'	381	AGT	on deck
21.04.02	01:48	C5	224-1	60° 08.56'	34° 54.73'	397	CTD	surface
21.04.02	01:57	C5	224-1	60° 08.56'	34° 54.84'	391	CTD	at depth
21.04.02	02:04	C5	224-1	60° 08.57'	34° 54.94'	381	CTD	on deck
21.04.02	02:16	C5	225-1	60° 08.61'	34° 55.02'	389	CC	into water
21.04.02	02:34	C5	225-1	60° 08.73'	34° 53.86'	418	CC	on depth
21.04.02	02:56	C5	225-1	60° 08.74'	34° 52.45'	417	CC	on deck
21.04.02	03:26	C5	226-1	60° 08.43'	34° 55.07'	376	FTS	surface
21.04.02	03:36	C5	226-1	60° 08.42'	34° 55.03'	389	FTS	on ground
21.04.02	04:12	C5	226-1	60° 08.53'	34° 54.95'	392	FTS	off ground
21.04.02	04:20	C5	226-1	60° 08.54'	34° 54.97'	389	FTS	on deck
21.04.02	04:25	C5	227-1	60° 08.53'	34° 55.14'	374	HS & PS	start track
21.04.02	08:41	C5	227-1	60° 05.83'	34° 50.96'	477	HS & PS	alter course
21.04.02	09:44	C5	227-1	60° 00.96'	35° 00.44'	1007	HS & PS	alter course
21.04.02	10:49	C5	227-1	60° 04.32'	34° 57.65'	976	HS & PS	alter course
21.04.02	11:18	C5	227-1	60° 07.73'	34° 56.41'	380	HS & PS	profile end
21.04.02	11:20	C5	228-1	60° 07.89'	34° 56.08'	358	NAV	start track
21.04.02	11:45	C5	228-1	60° 10.20'	34° 52.61'	500	NAV	profile end
21.04.02	12:20	C5	229-1	60° 9.68'	34° 52.59'	473	GSN	codend to surface
21.04.02	12:40	C5	229-1	60° 10.68'	34° 51.06'	507	GSN	turn
21.04.02	13:01	C5	229-1	60° 10.02'	34° 52.83'	493	GSN	otter bds to surface
21.04.02	13:19	C5	229-1	60° 08.90'	34° 54.69'	379	GSN	on bottom
21.04.02	13:21	C5	229-1	60° 08.77'	34° 54.83'	371	GSN	start trawling
21.04.02	13:41	C5	229-1	60° 07.81'	34° 56.17'	362	GSN	stop trawling
21.04.02	13:52	C5	229-1	60° 07.54'	34° 56.52'	380	GSN	off ground

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
21.04.02	14:03	C5	229-1	60° 07.21'	34° 57.00'	416	GSN	turn
21.04.02	14:13	C5	229-1	60° 07.45'	34° 57.58'	426	GSN	otter bds on deck
21.04.02	14:25	C5	229-1	60° 07.91'	34° 57.41'	392	GSN	codend on deck
21.04.02	15:00	TR	230-1	60° 08.83'	35° 04.43'	388	HS & PS	start track
21.04.02	20:17	TR	230-1	60° 08.53'	37° 01.84'	2557	HS & PS	alter course
21.04.02	21:04	TR	230-1	60° 09.94'	36° 51.51'	1423	HS & PS	Seamount!
21.04.02	21:15	TR	230-1	60° 09.71'	36° 47.60'	1133	HS & PS	alter course
21.04.02	23:09	TR	230-1	60° 08.41'	37° 14.54'	2768	HS & PS	alter course
22.04.02	06:36	TR	230-1	60° 08.49'	39° 59.48'	1570	HS & PS	alter course
22.04.02	08:30	TR	230-1	60° 24.11'	40° 24.91'	1584	HS & PS	reboot HS
22.04.02	12:03	TR	230-1	60° 51.80'	41° 10.77'	6076	HS & PS	alter course
22.04.02	18:30	D1	230-1	60° 59.94'	43° 29.58'	401	HS & PS	profile end
22.04.02	18:45	D1	231-1	60° 59.67'	43° 29.15'	408	AGT	surface
22.04.02	19:01	D1	231-1	60° 59.31'	43° 27.80'	402	AGT	on ground
22.04.02	19:07	D1	231-1	60° 59.19'	43° 27.42'	402	AGT	start trawl
22.04.02	19:27	D1	231-1	60° 58.89'	43° 26.71'	399	AGT	stop trawl
22.04.02	19:27	D1	231-1	60° 58.89'	43° 26.71'	399	AGT	start hauling
22.04.02	19:40	D1	231-1	60° 58.80'	43° 26.66'	397	AGT	off ground
22.04.02	19:54	D1	231-1	60° 58.68'	43° 26.49'	399	AGT	on deck
22.04.02	20:09	D1	232-1	60° 58.61'	43° 26.65'	393	CTD	surface
22.04.02	20:19	D1	232-1	60° 58.56'	43° 26.71'	399	CTD	at depth
22.04.02	20:30	D1	232-1	60° 58.47'	43° 26.79'	392	CTD	on deck
22.04.02	20:32	TR	233-1	60° 58.43'	43° 26.85'	395	HS & PS	start track
23.04.02	03:37	TR	233-1	61° 11.50'	45° 49.93'	309	HS & PS	profile end
23.04.02	04:00	D2	234-1	61° 11.03'	45° 45.63'	311	Trap A	to water
23.04.02	04:21	D2	235-1	61° 11.11'	45° 43.35'	324	FTS	surface
23.04.02	04:30	D2	235-1	61° 11.13'	45° 43.37'	324	FTS	on ground
23.04.02	05:00	D2	235-1	61° 11.15'	45° 43.05'	324	FTS	off ground
23.04.02	05:07	D2	235-1	61° 11.15'	45° 42.96'	324	FTS	on deck
23.04.02	06:02	D2	236-1	61° 10.08'	45° 30.28'	251	ROV	surface

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
23.04.02	06:18	D2	236-1	61° 10.03'	45° 30.23'	250	ROV	at depth
23.04.02	08:04	D2	236-1	61° 9.70'	45° 29.56'	243	ROV	on deck
23.04.02	10:13	D2	237-1	61° 11.13'	45° 43.23'	324	RD	surface
23.04.02	10:30	D2	237-1	61° 11.24'	45° 42.37'	323	RD	start dredging
23.04.02	10:36	D2	237-1	61° 11.24'	45° 42.20'	323	RD	start hauling
23.04.02	11:00	D2	237-1	61° 11.19'	45° 42.29'	322	RD	on deck
23.04.02	11:22	D2	238-1	61° 11.05'	45° 43.76'	324	AGT	surface
23.04.02	11:37	D2	238-1	61° 10.82'	45° 42.78'	324	AGT	on ground
23.04.02	11:38	D2	238-1	61° 10.81'	45° 42.72'	322	AGT	start trawl
23.04.02	11:58	D2	238-1	61° 10.56'	45° 42.07'	322	AGT	start hauling
23.04.02	12:06	D2	238-1	61° 10.48'	45° 42.03'	322	AGT	off ground
23.04.02	12:06	D2	238-1	61° 10.48'	45° 42.03'	322	AGT	stop trawl
23.04.02	12:19	D2	238-1	61° 10.39'	45° 42.07'	322	AGT	on deck
23.04.02	12:42	D2	239-1	61° 10.34'	45° 42.19'	322	CTD	surface
23.04.02	12:52	D2	239-1	61° 10.34'	45° 42.24'	323	CTD	at depth
23.04.02	13:01	D2	239-1	61° 10.35'	45° 42.28'	322	CTD	on deck
23.04.02	13:13	D2	240-1	61° 10.39'	45° 42.14'	322	CC	into water
23.04.02	13:32	D2	240-1	61° 10.40'	45° 40.60'	320	CC	into water
23.04.02	13:58	D2	240-1	61° 10.24'	45° 38.97'	316	CC	on deck
23.04.02	14:40	D2	241-1	61° 11.48'	45° 49.50'	311	GSN	codend to surface
23.04.02	14:48	D2	241-1	61° 11.42'	45° 48.38'	311	GSN	turn
23.04.02	14:52	D2	241-1	61° 11.38'	45° 47.77'	305	GSN	otter bds to surface
23.04.02	15:12	D2	241-1	61° 11.19'	45° 44.28'	324	GSN	on bottom
23.04.02	15:15	D2	241-1	61° 11.15'	45° 43.84'	323	GSN	turn
23.04.02	15:35	D2	241-1	61° 10.95'	45° 41.42'	322	GSN	stop trawling
23.04.02	15:44	D2	241-1	61° 10.90'	45° 40.73'	321	GSN	off ground
23.04.02	15:53	D2	241-1	61° 10.86'	45° 40.09'	319	GSN	otter bds on deck
23.04.02	16:02	D2	241-1	61° 10.85'	45° 39.32'	317	GSN	codend on deck
23.04.02	17:18	D2	243-1	61° 11.42'	45° 45.66'	305	MUC	surface
23.04.02	17:29	D2	243-1	61° 11.39'	45° 45.41'	307	MUC	on ground

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
23.04.02	17:39	D2	243-1	61° 11.40'	45° 45.17'	311	MUC	on deck
23.04.02	17:52	D2	234-1	61° 10.92'	45° 45.92'	310	Trap A rec	HDP to water
23.04.02	17:54	D2	234-1	61° 10.91'	45° 45.88'	310	Trap A rec	released
23.04.02	18:01	D2	234-1	61° 10.91'	45° 45.84'	311	Trap A rec	surfaced
23.04.02	18:01	D2	234-1	61° 10.91'	45° 45.84'	311	Trap A rec	on deck
23.04.02	19:33	D2	242-1	61° 11.33'	45° 45.37'	307	MG	surface
23.04.02	19:46	D2	242-1	61° 11.33'	45° 45.31'	308	MG	on ground
23.04.02	20:07	D2	242-1	61° 11.18'	45° 45.31'	307	MG	on deck
23.04.02	20:20	TR	244-1	61° 10.59'	45° 45.89'	313	HS & PS	start track
25.04.02	03:14	TR	244-1	61° 24.87'	55° 19.53'	645	HS & PS	alter course
25.04.02	03:55	TR	244-1	61° 23.57'	55° 27.86'	289	HS & PS	profile end
25.04.02	03:55	E1	245-1	61° 23.57'	55° 27.86'	289	NAV	start track
25.04.02	04:11	E1	245-1	61° 24.83'	55° 22.76'	0	NAV	profile end
25.04.02	04:25	E1	246-1	61° 24.94'	55° 21.47'	0	CTD	surface
25.04.02	04:39	E1	246-1	61° 24.91'	55° 21.17'	546	CTD	at depth
25.04.02	04:52	E1	246-1	61° 24.94'	55° 20.94'	561	CTD	on deck
25.04.02	05:02	E1	247-1	61° 25.01'	55° 20.74'	580	MN	surface
25.04.02	05:28	E1	247-1	61° 25.00'	55° 20.25'	624	MN	at depth
25.04.02	05:29	E1	247-1	61° 25.01'	55° 20.23'	630	MN	hauling
25.04.02	06:01	E1	247-1	61° 25.04'	55° 19.59'	664	MN	on deck
25.04.02	06:06	E1	248-1	61° 24.99'	55° 19.51'	668	NAV	start track
25.04.02	06:43	E1	248-1	61° 24.57'	55° 26.48'	345	NAV	alter course
25.04.02	06:51	E1	248-1	61° 24.92'	55° 28.36'	422	NAV	alter course
25.04.02	06:52	E1	248-1	61° 24.80'	55° 28.47'	426	NAV	alter course
25.04.02	07:04	E1	248-1	61° 23.83'	55° 27.99'	289	NAV	profile end
25.04.02	07:05	E1	249-1	61° 23.83'	55° 27.98'	290	FTS	surface
25.04.02	07:15	E1	249-1	61° 23.88'	55° 27.93'	290	FTS	on ground
25.04.02	07:52	E1	249-1	61° 24.03'	55° 27.32'	298	FTS	off ground
25.04.02	07:59	E1	249-1	61° 24.06'	55° 27.26'	297	FTS	on deck
25.04.02	08:24	E1	250-1	61° 22.71'	55° 28.51'	248	ROV	surface

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
25.04.02	08:40	E1	250-1	61° 22.65'	55° 28.42'	249	ROV	at depth
25.04.02	09:39	E1	250-1	61° 22.62'	55° 28.51'	246	ROV	back to surface
25.04.02	09:59	E1	250-1	61° 22.60'	55° 28.57'	244	ROV	on deck
25.04.02	10:35	E1	251-1	61° 23.91'	55° 27.62'	293	RD	surface
25.04.02	10:51	E1	251-1	61° 23.79'	55° 26.87'	292	RD	start dredging
25.04.02	10:57	E1	251-1	61° 23.75'	55° 26.71'	290	RD	stop dredging
25.04.02	11:13	E1	251-1	61° 23.72'	55° 26.62'	288	RD	on deck
25.04.02	11:34	E1	252-1	61° 23.14'	55° 27.66'	268	AGT	surface
25.04.02	11:47	E1	252-1	61° 23.42'	55° 26.90'	283	AGT	on ground
25.04.02	11:49	E1	252-1	61° 23.45'	55° 26.82'	285	AGT	start trawl
25.04.02	12:09	E1	252-1	61° 23.75'	55° 26.55'	288	AGT	stop trawl
25.04.02	12:09	E1	252-1	61° 23.75'	55° 26.55'	288	AGT	start hauling
25.04.02	12:19	E1	252-1	61° 23.87'	55° 26.66'	293	AGT	off ground
25.04.02	12:29	E1	252-1	61° 23.95'	55° 26.91'	295	AGT	on deck
25.04.02	13:32	E1	253-1	61° 22.32'	55° 31.51'	211	GSN	codend to surface
25.04.02	13:40	E1	253-1	61° 22.61'	55° 30.68'	237	GSN	otter bds to surface
25.04.02	14:00	E1	253-1	61° 23.28'	55° 27.55'	273	GSN	on bottom
25.04.02	14:04	E1	253-1	61° 23.40'	55° 26.99'	282	GSN	start trawling
25.04.02	14:24	E1	253-1	61° 24.03'	55° 24.72'	276	GSN	stop trawling
25.04.02	14:41	E1	253-1	61° 24.40'	55° 23.52'	305	GSN	off ground
25.04.02	14:51	E1	253-1	61° 24.60'	55° 22.90'	415	GSN	otter bds on deck
25.04.02	15:00	E1	253-1	61° 24.81'	55° 22.21'	501	GSN	codend on deck
25.04.02	15:48	E1	254-1	61° 23.98'	55° 23.85'	279	MG	surface
25.04.02	15:57	E1	254-1	61° 23.94'	55° 23.89'	279	MG	on ground
25.04.02	16:09	E1	254-1	61° 23.87'	55° 24.02'	280	MG	on ground
25.04.02	16:18	E1	254-1	61° 23.82'	55° 24.12'	280	MG	on deck
25.04.02	16:41	E1	255-1	61° 23.83'	55° 24.16'	281	MUC	surface
25.04.02	16:49	E1	255-1	61° 23.85'	55° 23.80'	280	MUC	on ground
25.04.02	17:00	E1	255-1	61° 23.90'	55° 23.40'	280	MUC	on deck
25.04.02	18:06	E1	256-1	61° 24.13'	55° 21.05'	346	UBA	begin

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
25.04.02	20:19	E1	256-1	61° 24.15'	55° 23.21'	301	UBA	end
25.04.02	21:10	TR	257-1	61° 24.34'	55° 19.92'	468	HS & PS	start track
25.04.02	21:45	TR	257-1	61° 30.01'	55° 18.00'	433	HS & PS	alter course
25.04.02	23:41	TR	257-1	61° 48.61'	55° 24.04'	618	HS & PS	alter course
26.04.02	08:02	TR	257-1	62° 32.94'	57° 35.77'	1671	HS & PS	alter course
26.04.02	12:35	TR	257-1	62° 15.81'	58° 49.06'	415	HS & PS	profile end
26.04.02	12:36	KGI	258-1	62° 15.82'	58° 49.06'	418	Trap F	surface
26.04.02	12:47	KGI	258-1	62° 15.82'	58° 49.10'	381	Trap F	on ground
26.04.02	12:47	KGI	258-1	62° 15.82'	58° 49.10'	381	Trap F	HDP to water
26.04.02	12:48	KGI	258-1	62° 15.83'	58° 49.10'	419	Trap F	released
26.04.02	12:49	KGI	258-1	62° 15.83'	58° 49.10'	421	Trap F	releaser on deck
26.04.02	12:56	KGI	258-1	62° 15.85'	58° 49.13'	430	Trap F	releaser on deck
26.04.02	13:15	KGI	259-1	62° 15.21'	58° 50.58'	396	Trap F	surface
26.04.02	13:25	KGI	259-1	62° 15.20'	58° 50.51'	413	Trap F	on ground
26.04.02	13:25	KGI	259-1	62° 15.20'	58° 50.51'	413	Trap F	HDP to water
26.04.02	13:30	KGI	259-1	62° 15.24'	58° 50.48'	414	Trap F	not released
26.04.02	13:33	KGI	259-1	62° 15.27'	58° 50.46'	412	Trap F	HDP to water
26.04.02	13:34	KGI	259-1	62° 15.28'	58° 50.46'	415	Trap F	not released
26.04.02	13:40	KGI	259-1	62° 15.27'	58° 50.38'	439	Trap F	HDP to water
26.04.02	13:40	KGI	259-1	62° 15.27'	58° 50.38'	439	Trap F	released
26.04.02	13:43	KGI	259-1	62° 15.26'	58° 50.33'	455	Trap F	releaser on deck
26.04.02	16:59	KGI	260-1	62° 10.22'	58° 22.15'	437	Trap F	surface
26.04.02	18:00	KGI	261-1	62° 16.50'	58° 14.96'	745	Trap A	to water
27.04.02	12:25	KGI	258-1	62° 15.73'	58° 49.60'	416	Trap F rec	HDP to water
27.04.02	12:30	KGI	258-1	62° 15.77'	58° 49.54'	421	Trap F rec	released
27.04.02	12:52	KGI	258-1	62° 15.78'	58° 49.42'	424	Trap F rec	on deck
27.04.02	13:38	KGI	259-1	62° 15.22'	58° 50.81'	385	Trap F rec	HDP to water
27.04.02	13:40	KGI	259-1	62° 15.22'	58° 50.83'	387	Trap F rec	released
27.04.02	13:41	KGI	259-1	62° 15.22'	58° 50.85'	388	Trap F rec	releaser on deck
27.04.02	14:06	KGI	259-1	62° 15.20'	58° 50.82'	388	Trap F rec	on deck

Date	Time ship	Area	Stat. PS61/	Lat. (°S)	Long. (°W)	Depth (m)	Gear	Operation
27.04.02	17:24	KGI	261-1	62° 16.48'	58° 15.52'	727	Trap A rec	HDP to water
27.04.02	17:25	KGI	261-1	62° 16.46'	58° 15.49'	0	Trap A rec	HDP on deck
27.04.02	17:27	KGI	261-1	62° 16.44'	58° 15.45'	723	Trap A rec	released
27.04.02	17:42	KGI	261-1	62° 16.37'	58° 15.30'	0	Trap A rec	surfaced
27.04.02	18:02	KGI	261-1	62° 16.30'	58° 14.40'	722	Trap A rec	on deck
27.04.02	19:03	KGI	260-1	62° 10.05'	58° 22.31'	0	Trap F rec	HDP to water
27.04.02	19:06	KGI	260-1	62° 10.04'	58° 22.32'	10	Trap F rec	released
27.04.02	19:29	KGI	260-1	62° 10.26'	58° 22.20'	446	Trap F rec	on deck
27.04.02	20:10	DP	262-1	62° 11.29'	58° 22.27'	525	HS & PS	start track
27.04.02	21:15	DP	262-1	62° 15.99'	58° 14.71'	728	HS & PS	alter course
28.04.02	04:06	DP	262-1	61° 60.00'	57° 00.07'	653	HS & PS	alter course
28.04.02	12:09	DP	262-1	61° 10.13'	56° 41.94'	1507	HS & PS	alter course
28.04.02	16:31	DP	262-1	60° 51.12'	55° 55.34'	2297	HS & PS	alter course
28.04.02	17:02	DP	262-1	60° 47.42'	55° 54.99'	2883	HS & PS	alter course
29.04.02	00:50	DP	262-1	61° 08.55'	57° 47.69'	3327	HS & PS	alter course
29.04.02	01:22	DP	262-1	61° 05.35'	57° 51.16'	3673	HS & PS	alter course
29.04.02	08:37	DP	262-1	60° 45.81'	56° 03.19'	3067	HS & PS	alter course
29.04.02	16:06	DP	262-1	61° 00.67'	57° 54.43'	4462	HS & PS	alter course
29.04.02	16:48	DP	262-1	60° 55.57'	57° 56.94'	5233	HS & PS	alter course
29.04.02	23:14	DP	262-1	60° 39.01'	56° 10.05'	4147	HS & PS	alter course
30.04.02	03:03	DP	262-1	60° 44.21'	57° 02.50'	3876	HS & PS	alter course
30.04.02	13:35	DP	263-1	60° 50.87'	58° 00.96'	5033	HS & PS	start track
30.04.02	13:35	DP	262-1	60° 50.87'	58° 00.96'	5033	HS & PS	profile end
02.05.02	11:57	DP	263-1	54° 31.92'	55° 55.14'	415	HS	profile end
02.05.02	12:06	A2	264-1	54° 31.61'	55° 54.95'	415	Trap F rec	HDP to water
02.05.02	12:10	A2	264-1	54° 31.58'	55° 54.90'	411	Trap F rec	released
02.05.02	12:11	A2	264-1	54° 31.57'	55° 54.89'	394	Trap F rec	releaser on deck
02.05.02	12:36	A2	264-1	54° 31.53'	55° 54.81'	396	Trap F rec	on deck

3.3 Qualitative Visual Trawl Sample Analysis

AGT catches - visual check on deck

(++ very abundant, dominant; + abundant; - scarce; 0 missing)

Station		145	150	160	164	182	187	194	207	214	217	223	231	238	252
AGT No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mean depth		272	289	431	318	253	256	292	532	349	520	380	400	323	287
Area		Bur-W	Bur-E	Bur-Sh	Sh-Ro	S Geor	S Sa-N	S Sa-M	S Sa-M	S Sa-S	Her	Disc	S Or-E	S Or-W	Ele
Porifera		+	++	-	+	+	-	-	0	-	+	-	-	-	-
Cnidaria															
	Hydroidea	-	++	-	++	-	-	-	0	-	-	-	-	0	0
	Actiniaria	0	-	0	0	-	0	-	-	-	-	-	+	0	0
	Gorgonaria	++	++	-	++	-	-	+	-	++	-	-	-	0	-
	Pennatularia	0	0	0	0	0	-	-	-	0	0	0	-	0	0
	Alcyonaria	0	-	0	0	0	0	+	0	0	0	-	0	-	0
	Scleractinia	0	-	0	-	-	0	-	0	0	-	-	-	0	-
Nemertini		-	-	0	-	-	-	+	-	-	0	0	-	-	0
Mollusca															
	Bivalvia	-	-	0	-	+	-	+	+	++	-	-	+	+	+
	Aplacophora	0	0	0	-	0	0	-	0	0	0	-	0	0	0
	Gastropoda														
	Prosobranchia	-	-	0	-	-	0	-	-	-	-	0	-	-	-
	Opisthobranchia	-	-	-	0	0	0	-	0	0	-	-	-	0	0
	Polyplacophora	0	0	0	0	0	0	-	-	-	0	0	0	0	0
	Cephalopoda	0	-	0	0	-	0	-	0	0	-	0	-	0	-
	Scaphopoda	0	0	0	0	-	0	0	0	0	0	0	+	++	-
Polychaeta															
	Sedentaria	-	-	0	0	-	++	-	-	+	-	-	-	+	-
	Errantia	+	-	-	+	+	-	+	+	-	-	-	-	-	+
Priapulida		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sipunculida		-	0	0	0	0	0	0	0	0	0	0	0	0	0
Echiurida		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea															

Station	145	150	160	164	182	187	194	207	214	217	223	231	238	252
AGT No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mean depth	272	289	431	318	253	256	292	532	349	520	380	400	323	287
Area	Bur-W	Bur-E	Bur-Sh	Sh-Ro	S Geor	S Sa-N	S Sa-M	S Sa-M	S Sa-S	Her	Disc	S Or-E	S Or-W	Ele
Cirripedia	0	0	0	0	-	0	0	0	-	0	-	0	0	0
Amphipoda	-	-	0	-	-	0	-	-	-	-	-	-	0	-
Isopoda	-	-	-	-	-	0	-	0	-	-	0	-	-	-
Cumacea	0	0	0	0	0	0	0	0	0	0	0	-	0	0
Mysidacea	0	-	0	0	-	0	0	-	0	-	-	-	-	-
Stomatopoda	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Decapoda														
Natantia	-	-	-	0	+	0	0	-	0	0	0	-	-	0
Reptantia	+	-	0	-	0	0	0	0	0	0	0	0	0	0
Pantopoda	-	0	0	-	-	-	-	-	-	0	0	-	-	++
Bryozoa	-	-	-	-	-	0	-	-	-	-	-	++	-	-
Brachiopoda	-	-	0	-	-	0	++	+	-	-	0	0	0	0
Pterobranchia	0	+	0	0	0	0	0	0	0	0	0	-	0	0
Echinodermata														
Ophiuroidea	++	+	-	++	+	+	++	+	++	++	-	-	-	++
Asteroidea	-	-	-	-	-	+	+	+	+	-	-	-	-	+
Echinoidea														
Regularia	++	-	++	-	-	-	-	-	-	+	-	-	0	+
Irregularia	0	0	0	0	+	0	0	0	0	0	0	+	-	+
Crinoidea	-	-	-	-	0	-	+	+	+	0	-	0	0	-
Holothuroidea	-	-	0	-	0	-	-	+	+	+	-	+	0	+
Ascidiacea	-	-	-	-	+	-	-	-	0	-	-	-	0	-
Pisces	-	-	-	0	-	-	-	-	-	-	-	-	0	-

GSN catches - visual check on deck
(++ very abundant, dominant; + abundant; - scarce; 0 missing)

Station	153	167	174	196	208	229	241	253
GSN No.	1	2	3	4	5	6	7	8
Mean depth	286	325	278	290	639	380	323	279
Area	Bur-E	Sh-Ro	So Geo	S Sa-M	S Sa-M	Dis	S Or-W	Ele
Porifera	++	++	-	-	-	-	+	-
Cnidaria								
Hydroidea	++	+	-	-	-	-	-	-
Actiniaria	-	0	+	-	0	0	-	-
Gorgonaria	++	+	-	-	-	-	-	-
Pennatularia	0	0	0	-	-	0	0	0
Alcyonaria	+	-	-	-	-	0	+	-
Scleractinia	+	-	0	-	0	-	0	0
Nemertini	-	0	-	-	0	0	0	-
Mollusca								
Bivalvia	-	-	0	-	-	0	-	0
Aplacophora	0	0	0	0	0	0	0	-
Gastropoda								
Prosobranchia	-	0	0	-	0	0	0	-
Opisthobranchia	-	0	0	-	0	0	0	0
Polyplacophora	-	0	0	0	0	0	0	0
Cephalopoda / Octopoda	-	0	-	-	-	0	0	-
Scaphopoda	0	0	0	-	0	0	0	0
Polychaeta								
Sedentaria	-	0	0	-	-	0	-	0
Errantia	+	-	-	++	+	-	-	+
Priapulida	0	0	0	0	0	0	0	0
Sipunculida	-	0	0	0	0	0	0	0
Echiurida	0	0	0	0	0	0	0	0
Crustacea								
Cirripedia	-	0	0	0	-	-	0	0
Amphipoda	-	-	-	-	-	-	-	-
Isopoda	-	-	-	-	0	0	-	-
Cumacea	0	0	0	0	0	0	0	0
Mysidacea	0	0	-	0	0	0	-	-
Stomatopoda	0	0	0	0	0	0	0	0
Decapoda								
Natantia	-	0	+	0	-	0	+	0
Reptantia	+	-	0	0	0	0	0	0
Pantopoda	-	-	-	-	-	0	0	+
Bryozoa	-	0	-	-	-	-	-	-
Brachiopoda	-	0	-	++	-	0	0	0
Pterobranchia	+	0	0	-	0	0	0	-

			153	167	174	196	208	229	241	253
GSN No.			1	2	3	4	5	6	7	8
Mean depth			286	325	278	290	639	380	323	279
Area			Bur-E	Sh-Ro	So Geo	S Sa-M	S Sa-M	Dis	S Or-W	Ele
Echinodermata										
	Ophiuroidea		+	++	+	++	-	-	-	+
	Asteroidea		-	-	-	+	+	-	-	++
	Echinoidea									
		Regularia	-	-	0	-	0	-	-	-
		Irregularia	0	0	+	0	0	0	-	-
	Crinoidea		-	-	0	-	-	0	0	0
	Holothuroidea		-	0	0	-	-	0	+	+
Ascidiacea			-	0	-	-	0	-	-	-
Pisces			++	++	++	++	+	+	++	++

3.4 Participants

Scientists

Name	First Name	Institution	Country
Alarcón	Rubén	UMAG	CL
Arntz	Wolf	AWI	D
Bohlmann	Harald	AWI	D
Bohn	Jens	ZLMU	D
Bonne	Wendy	UGZ	B
Brey	Thomas	AWI	D
Brodte	Eva	AWI	D
Buschmann	Alexander	AWI	D
Cariceo	Yanko	UMAG	CL
DeBroyer	Claude	IRSNB	B
Enríquez	Edgardo	IMARPE	PE
Gerdes	Dieter	AWI	D
Gorny	Matthias	UMAG	CL
Grabbert	Sabine	AWI	D
Herman	Rudi	MFC	B
Jacob	Ute	AWI	D
Klein	Boris	AWI	D
Knust	Rainer	AWI	D
Kruse	Ingo	IKG	D
Langenbuch	Martina	AWI	D
Lindner	Kathleen	AWI	D
Linse	Katrin	BAS	UK
López González	Pablo	USE	E
Lörz	Anne-Nina	ZIM	D
Lovrich	Gustavo	CADIC	AR
Mansilla	Andrés	UMAG	CL
Mintenbeck	Katja	AWI	D
Montiel	Américo	AWI	D
Nyssen	Fabienne	IRSNB	B
Palma	Maritza	UCC	CL
Quipuzcoa	Luis	IMARPE	PE
Quiroga	Eduardo	UCC	CL
Rauschert	Martin	AWI	D
Ríos	Carlos	UMAG	CL
Rodríguez	Estefanía	USE	E
Romero	Carolina	CADIC	AR
Roux	Ana	INIDEP	AR
Sahade	Ricardo	UNC	AR
Schrödl	Michael	ZSM	D
Schwarz	Ralf	Mariscope	D
Tapella	Federico	CADIC	AR
Tarazona	Juan	UNMSM	PE
Tatián	Marcos	UNC	AR
Thatje	Sven	AWI	D
Udintsev	Gleb	GEOCHI	RUS
Udintsev	Vladimir	GEOCHI	RUS
Vanella	Fabián	CADIC	AR
Vera	Giovanna	IMARPE	PE
Vert	Neus	ICM/CSIC	E
Zelaya	Diego	FCNYM	AR

Helicopter Crew & Meteorologists

Name	First Name	Institution	Country
Büchner	Jürgen	HSW	D
Dinkeldein	Wolfgang	HSW	D
Feldt	Oliver	HSW	D
Möller	Hans-Jürgen	DWD	D
Sonnabend	Hartmut	DWD	D
Zepick	Burkhard	HSW	D

3.5 Participating Institutions

	Institution	Address
AWI	Alfred Wegener Institute for Polar and Marine Research	Columbusstrasse 27568 Bremerhaven, Germany
BAS	British Antarctic Survey	High Cross, Madingley Road Cambridge CB3 0ET, Great Britain
CADIC	Centro Austral de Investigaciones Científicas	CC 92 – V9410BFD Ushuaia Tierra del Fuego, Argentina
DWD	Deutscher Wetterdienst	Jenfelder Allee 70a 22043 Hamburg, Germany
FCNYM	Museo de la Plata-FCNyM	Paseo del Bosque s/n, (1900) La Plata Buenos Aires, Argentina
GEOCHI	Vernadsky Institute of Geochemistry and Analytical Chemistry	19, Kosygin Street, Moscow 117975, Russian Federation
HSW	Helicopter Service Wasserthal GmbH	Kätnerweg 43, 22393 Hamburg, Germany
ICM/CSIC	Institut de Ciències del Mar	Passeig Marítim de la Barceloneta, 37-49, 08003 Barcelona, Spain
IKG	Institut für Kartographie und Geoinformatik Universität Hannover	Appelstrasse 9a, 30167 Hannover, Germany
IMARPE	Instituto del Mar del Perú	Apartado 22, Callao, Peru
INIDEP	Instituto Nacional de Investigación y Desarollo Pesquero	Paseo Victoria Ocampo 1, 7600 Mar del Plata, Argentina
IRSNB	Institut Royal des Sciences Naturelles de Belgique	Rue Vautier, 29, 1000 Bruxelles, Belgium
Mariscope	Mariscope Meerestechnik	Wischhofstrasse 1-3, Halle F11, Kiel, Germany
MFC	Ministry of the Flamish Community Administratie Wetenschap en Innovatie	Boudewijnlaan 30, 1000 Bruxelles, Belgium
UBE	Universidad de Barcelona	Diagonal 645, 08028 Barcelona, Spain
UNC	Universidad de Córdoba (CONICET / IAA)	Av. Velez Sarsfield 299, 5000 Córdoba, Argentina
UCC	Universidad de Concepción	Casilla 160-c, Concepción, Chile
UGZ	University of Gent	K.L.Ledeganckstraat 35, 9000 Gent, Belgium
UMAG	Universidad de Magallanes Instituto de la Patagonia	Casilla 113-D, Punta Arenas, Chile
UNMSM	Universidad Nacional Mayor de San Marcos	Apartado 1898, Lima 100, Peru
USE	Universidad de Sevilla	Avd. Reina Mercedes No.6, 31012 Sevilla, Spain
ZIM	Zoologisches Institut und Museum Der Universität Hamburg	Martin-Luther-King-Platz 3, 20146 Hamburg, Germany
ZLMU	Zoologisches Institut der L.M. Universität München	Karlstr. 25, 80333 München, Germany
ZSM	Zoologische Staatssammlung München	Münchhausenstr. 21, 81247 München, Germany

3.6 Ship's Crew

Name	First Name	Rank	Country
Boche	Martin	Master	Germany
Grundmann	Uwe	1. Offc.	Germany
Schulz	Volker	Ch. Eng.	Germany
Fallei	Holger	2. Offc.	Germany
Hartung	René	2. Offc.	Germany
Peine	Lutz G.	2. Offc.	Germany
Hallenga	Petra	Doctor	Germany
Hecht	Andreas	R. Offc.	Germany
Erreth Monostori	G.	1. Eng.	Germany
Krohn	Günter	2. Eng.	Germany
Ziemann	Olaf	2. Eng.	Germany
Baier	Ulrich	Electron.	Germany
Fröb	Martin	Electron.	Germany
Hofmann	Jörg	Electron.	Germany
Holtz	Hartmut	Electron.	Germany
Piskorzynski	Andreas	Electron.	Germany
Loidl	Reiner	Boatsw.	Germany
Neisner	Winfried	Carpenter	Germany
Bäcker	Andreas	A. B.	Germany
Bastigkeit	Kai	A. B.	Germany
Guse	Hartmut	A. B.	Germany
Hagemann	Manfred	A. B.	Germany
Moser	Siegfried	A. B.	Germany
Schmidt	Uwe	A. B.	Germany
Schröder	Norbert	A. B.	Germany
Winkler	Michael	A. B.	Germany
Beth	Detlef	Storek.	Germany
Arias Iglesias	Enr.	Mot-man	Chile
Dinse	Horst	Mot-man	Germany
Fritz	Günter	Mot-man	Austria
Krösche	Eckard	Mot-man	Germany
Moll	Walter	Mot-man	Germany
Fischer	Matthias	Cook	Germany
Martens	Michael	Cooksmate	Germany
Tupy	Mario	Cooksmate	Germany
Dinse	Petra	1. Stwdess	Germany
Schöndorfer	Ottilie	Stwdess/Kr	Germany
Deuß	Stefanie	2. Stwdess	Germany
Schmidt	Maria	2. Stwdess	Germany
Streit	Christina	2. Stwdess	Germany
Tu	Jian-Min	2. Steward	China
Wu	Chi Lung	2. Steward	Germany
Yu	Chung Leung	Laundrym.	China
Rumler	Etienne	Trainee/D	Germany