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# The Expedition ANT-XXIII/8 of the Research Vessel "Polarstern" to the Antarctic in 2006/2007

Edited by
Julian Gutt
with contributions of the participants

HELMHOLTZ
GEMEINSCHAFT

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INTERNATIONAL POLAR YEAR

2007-2008

CENSUS of ANTARCTIC MARINE LIFE

www.caml.aq

ANT-XXIII/8

23 November 2006 – 30 January 2007

Cape Town – Punta Arenas

Fahrtleiter / Chief Scientist
Dr. J. Gutt

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# 1. INTRODUCTION

## 1.1 FAHRTVERLAUF UND ZUSAMMENFASSUNG

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ANT-XXIII/8 (PS-69) begann am 23.11.2006 um 18:00 Uhr Ortszeit in Kapstadt (Abb. 1.1). Die Hauptvorhaben der 52 Wissenschaftler aus 14 Ländern waren Beiträge zum "Census of Antarctic Marine Life" (CAML) und zur "Convention on the Conservation of Antarctic Marine Living Resources" (CCAMLR). Die Forschungsobjekte reichten von Mikroben über die Meiofauna, größere wirbellose Tiere und Fische bis zu Robben und Walen. Nach dem Auslaufen wurde die Internet-Standleitung erfolgreich getestet und am 27./28.11. das Hydrosweep-Fächerlot nach einer Reparatur neu geeicht. Bei 58° stieß *Polarstern* auf erste Packeisfelder. Bereits auf der Anfahrt nach *Neumayer*, auf der Transitstrecke *Neumayer* – Elephant Island, in einer Box um Elephant Island und die South Shetland Inseln, in der Bransfield Straße und anschlißend im nordwestlichen Weddellmeer, einschließlich des Larsen A/B Gebietes, erfolgten systematische Walzählungen. Die Passage bis in die Nähe der *Neumayerstation* verlief bis zum 6.12. problemlos bei unterschiedlichen Windstärken und leicht zu durchfahrendem Eis. Wegen schwieriger Eisbedingungen erfolgte die Brennstoffversorgung der *Neumayerstation* an einer ca. 40m hohen Schelfeiskante westlich des sogenannten Nordanlegers am 8.12., die des Stückguts am 10.12. über das Meereis am Ausgang der Atkabucht.

Mit fünf-tägiger Verspätung begann *Polarstern* die Überfahrt durch leichtes Eis nach Elephant Island, wo am 19.12. die CCAMLR-bezogenen fischereibiologischen Untersuchungen begannen (Abb. 1.2). Die Ergebnisse zeigen, dass die Biomassen des Marmorbarsches (*Notothenia rossii*) und der Gelbbauchnotothenia (*N. coriiceps*) gegenüber 2003 angestiegen sind, während der Bändereisfisch (*Chaempsocephalus gunnari*), der Scotiasee-Eisfisch (*Chaenocephalus aceratus*) und die Gelbe Notothenia (*Gobionotothen gibberifrons*) in ihrem Bestand zurückgegangen sind. *Polarstern* setzte die Fischerei bei den South Shetland Inseln am 27.12. fort, wo die Gelbbauchnotothenia die häufigste Fischart war. Das CCAMLR-Programm wurde mit 13 Hols an der Spitze der Antarktischen Halbinsel am 6.1.2007 beendet. Mit 85 Hols ist der Surveyplan vollständig abgearbeitet worden.

Während tagsüber die Fischerei stattfand, wurden nachts Proben für zusätzliche Einzelvorhaben (Taxonomie, Physiologie, Genetik, Schadstoffe, Nahrungsbeziehungen) überwiegend im Rahmen des "Census of Antarctic Marine Life", mit einer Vielzahl verschiedener Geräten genommen.

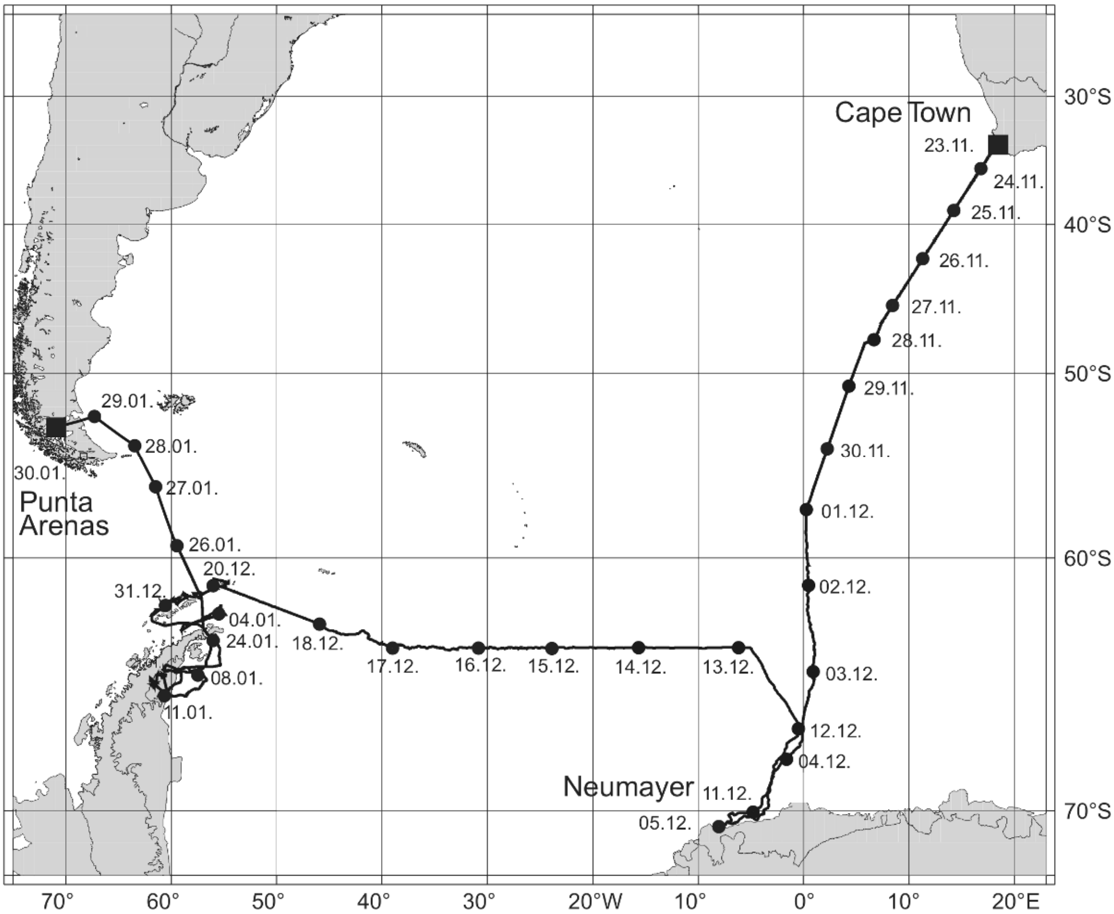


Abb. 1.1 Vollständiger Fahrtverlauf, ANT-XXIII/8.
Fig. 1.1 Complete cruise track, ANT-XXIII/8.

Am Abend des 6.1. fuhr *Polarstern* durch den Antarctic Sound in das norwestliche Weddellmeer. Auf dem Weg nach Süden blockierte eine Eisbarriere Verankerungsarbeiten im Larsen A Gebiet und das Weiterkommen Richtung Süden für 2,5 Tage. Am 9.1. begannen die Arbeiten zur Ökosystemforschung im Larsen B Gebiet. Sie konzentrierten sich auf die Fragen:

- Was für ein Leben gibt es unter dem Schelfeis?
- Welchen Einfluss hatte der Kollaps der Schelfeisgebiete?
- Was ist die Zukunft der dortigen Fauna?
- Können Berichte der Arbeitsgruppe E. Domack über eine Methanquelle mit chemotropher Lebensgemeinschaft bestätigt werden?

Auf vier Kernstationen ("B_South", "B_West", "B_Seep" und "B_North", Abb. 1.3) wurden fast alle Probennahmegeräte, geschleppte, stationäre, sedimentologische, benthologische und ozeanographische, teils mehrfach eingesetzt, um einen synoptischen, transdisziplinären Ansatz so weit wie möglich zu realisieren. Auffällig waren die großen Unterschiede in der Sedimentbeschaffenheit. Sie reichte von anliegendem Gestein, insbesondere bei "B_South", über Geröllfelder und sandige Böden bis zu sehr geringen

Korngrößen. Drop-stones waren überall vorhanden. Diese Merkmale waren nicht mit der Entfernung, bzw. Nähe zur Küste korreliert. Entsprechende Unterschiede gab es auch in der Epifauna, obwohl sie sehr viel geringere Abundanzen aufwies als z.B. im östlichen Weddellmeer. Unter der Epifauna war die große Anzahl verschiedener Seescheiden, insbesondere bei "B_North" sehr auffällig. Da diese sehr schnellwüchsig sind, kann vermutet werden, dass sie erst seit dem Aufbrechen des Schelfeises dort gewachsen sind. Begleitend zu der biologischen Probennahme wurde der Meeresboden in den Kerngebieten vermessen, einerseits, um den Geräteeinsatz zu optimieren und andererseits, um Informationen zu einem zusätzlichen wichtigen ökologisch relevanten Umweltparameter zu gewinnen. Mit demselben Hintergrund wurde eine Sedimentfalle mit Strömungsmesser bei der Kernstation "B_South" ausgebracht und nach neun Tagen geborgen. Die erste Sichtung der registrierten Werte ergab eine hohe bodennahe Strömungsgeschwindigkeit. Einige Hols mit dem Grundschleppnetz ergänzten die Kenntnis über die Fischfauna des nordwestlichen Weddellmeeres.

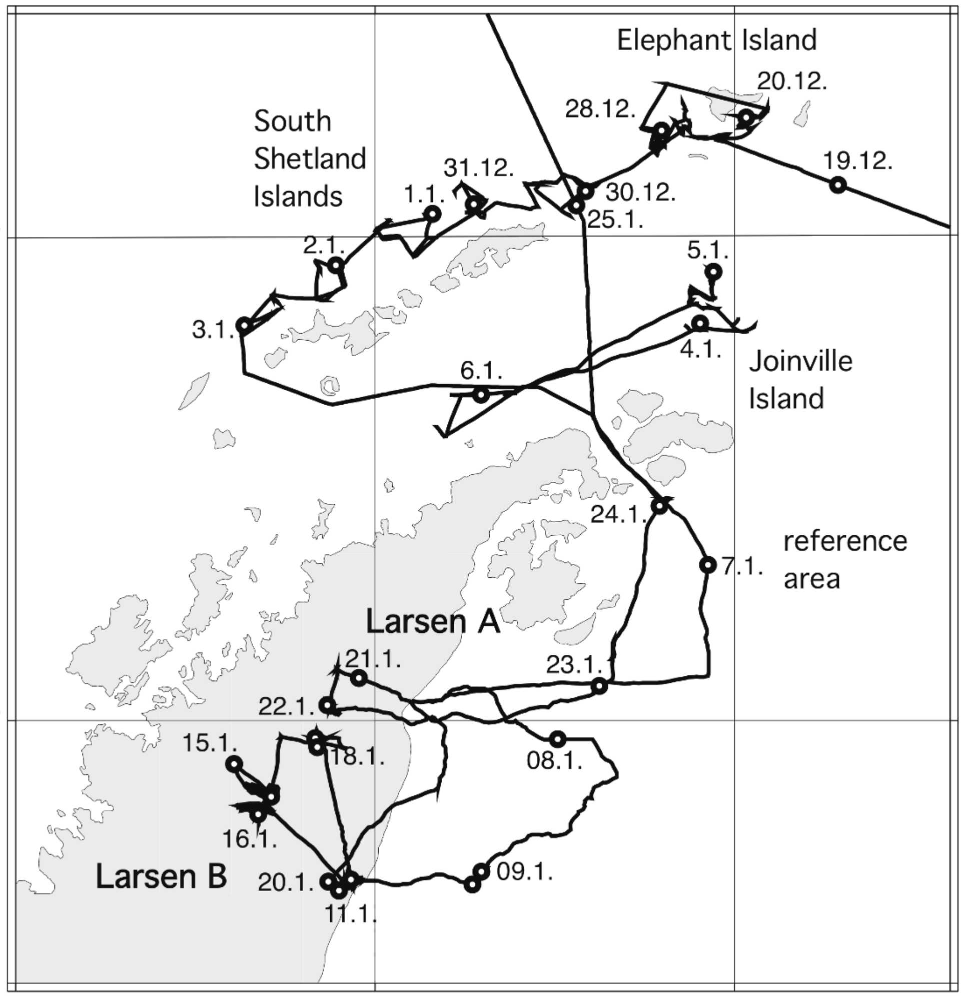


Abb. 1.2 Fahrtverlauf in den Arbeitsgebieten.
Fig. 1.2 Cruise track in areas of investigation.

Der bisher nur an Hand von Videos registrierte kleinräumige Seep wurde mit Hilfe des ROV an der Kernstation "B_Seep" in einer "inner-shelf depression" mit einer Wassertiefe von ca. 830m wiedergefunden. Makroskopisch sind hier die charakteristischen Stellen durch kleine Ansammlungen von offensichtlich toten Muschelschalen gekennzeichnet. Erste Sedimentanalysen ergaben eindeutige Hinweise auf einen Seep, möglicherweise einen Paläo-Seep. In diesem tiefen Bereich waren die auch im Flachen gefundenen Tiefsee-Seegurken am häufigsten. Das Bergen zweier amerikanischer Verankerungen scheiterte trotz gründlicher Versuche.

Am 20.1. versegelte *Polarstern* nach Larsen A, um dort zwei weitere Kernstationen, "A_North" vor dem Drygalski-Gletscher und "A_South" an der verbliebenen Schelfeiszunge zwischen den Seal-Nunataks erfolgreich abzuarbeiten. Auch hier waren die Sedimentunterschiede wieder auffällig. Nahe der von Gletschern unterbrochenen Felsküste bei "A_North" gab es sehr feines Sediment mit einer reichen aber artenarmen Infauna. Bei "B_South" hingegen war die Anzahl der größeren, langsamwüchsigen Glasschwämme für das gesamte Larsengebiet am höchsten, es kamen aber auch kleine Formen, die eine Neubesiedlung repräsentieren könnten, vor.

Eine für die ökologische Charakterisierung des Larsen A/B Gebietes wichtige Beprobung in einem Schelfeis-unabhängigen Referenzgebiet erfolgte auf zwei weiteren Kernstationen bei Snow Hill Island ("SHI") und Dundee Island ("DI"). Die flacheren Geräteeinsätze (150-200m), insbesondere des ROV, zeigten eine flächendeckende Zerstörung des Meeresbodens durch Eisberge mit geringer epibenthischer Diversität. Die Diversität war bei knapp 300m deutlich höher, aber durch einige frische Eisbergspuren unterbrochen. Die Seltenheit der Glasschwämme zeigt, dass sich auf langlebige Organismen aufbauenden Lebensgemeinschaften hier nicht entwickeln können.

Das Referenzgebiet nördlich von Larsen A und B am Ausgang des Antarktischen Sundes sowie ein Gebiet bei 59°S bildeten auch das Ende der Walbeobachtungen. Mit den Hubschrauberflügen wurden 17.300km und mit *Polarstern* 1.170km nach dem Vorkommen von Walen erkundet. Das Packeis war ausschließlich Heimat von Zwergwalen. Seltene Schnabelwalarten waren in erster Linie in der Box um Elephant Island zu beobachten. In ausgewählten Gebieten wurden auch Robben und Pinguine gezählt. Die Ergebnisse wurden bereits der Internationalen Walfangkommission (IWC) zur Verfügung gestellt und beim 59. jährlichen Treffen der IWC in Anchorage (USA) im May 2007 vorgestellt.

Nördlich 60°S wurden jeweils auf der An-und Abreise Drifter für ein französische und eine südafrikanische Arbeitsgruppe ausgebracht. *Polarstern* beendete pünktlich und erfolgreich die Expedition ANT-XXIII/8 (PS-69) am 30. Januar 2007 um 08:00 Uhr mit dem Einlaufen in Punta Arenas (Chile).

Trotz der Gliederung dieses Berichtes in CAML- und CCAMLR-Vorhaben, gibt es in vielen Fällen deutliche Überlappungen, z.B. trägt die Wal- und Tintenfischforschung auch wesentlich zum CAML bei und die

Fischuntersuchungen im nordwestlichen Weddellmeer bilden einen Beitrag zu CCAMLR. Eine Synthese der wichtigsten ökologischen Ergebnisse wurde zeitnah während eines von CAML finanzierten Workshops in Barcelona erarbeitet.

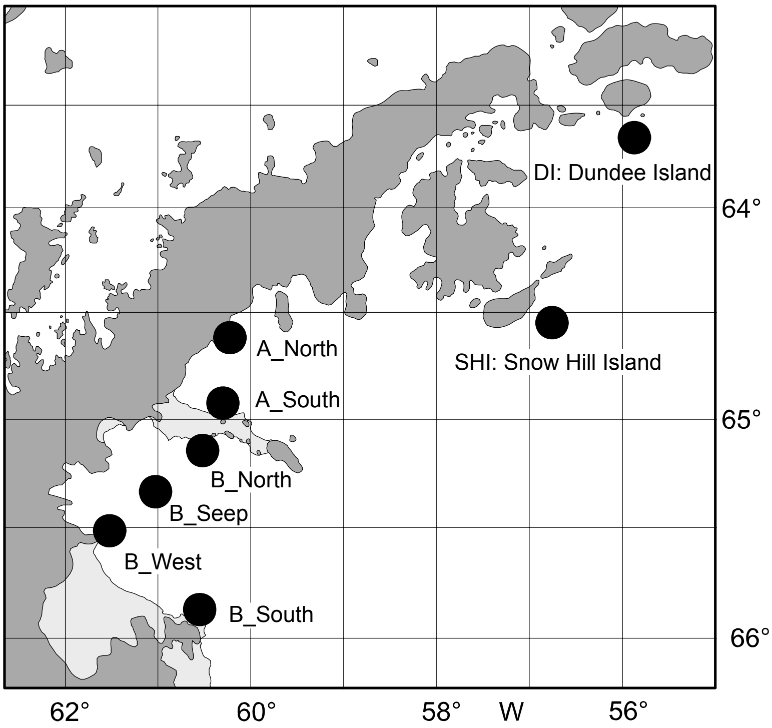


Abb. 1.3 Kernstationen im Larsen A/B-Gebiet und Referenzstationen.
Fig. 1.3 Core stations in the Larsen A/B area and reference stations.

## ITINERARY AND SUMMARY

ANT-XXXIII/8 (PS-69) started in Cape Town on 23 November 2006 at 6:00pm local time (Fig. 1.1). The main objectives of the 52 participating scientists from 14 countries were contributions to the “Census of Antarctic Marine Life” (CAML) and the “Convention on the Conservation of Antarctic Marine Living Resources” (CCAMLR). Objects of scientific investigation ranged from the size range of microbes to whales, including meiofauna, macroinvertebrates, fish and seals. After the departure, the permanent internet connection was successfully tested. On 27/28 November the Hydrosweep multi-beam echo-sounder was calibrated after some repair work had been undertaken. RV *Polarstern* hit the first pack ice at 58°S. Whale observations started early during the cruise and were continued during transit from the *Neumayer Station* to Elephant Island, in the box around Elephant Island, within the Bransfield Strait and in the northwestern Weddell Sea including the Larsen A/B area. Favourable weather prevailed on the passage until close to the *Neumayer Station* on 6 December and ice was easy to break. Unfortunately, difficult sea ice conditions at the “ice port” slowed down further progress. On 8 December the supply of fuel was accomplished using an approx. 40m high ice shelf edge west of the so called “Nordanleger” and on 10 December the remaining cargo was discharged on the sea ice at the entrance of Atka Bay.

RV *Polarstern* left *Neumayer Station* five days behind schedule. The passage to Elephant Island went through favourable ice conditions; CCAMLR related fisheries studies started south of the island on 19 December (Fig. 1.2). First results showed that the biomass of two notothenioid species, marbled notothenia *(Notothenia rossii)* and yellow-bellied rock cod *(N. coriiceps)* had increased in comparison to the survey conducted in 2003. However, at the same time stocks of blackfin icefish *(Chaenocephalus aceratus)* and mackerel icefish *(Champsocephalus gunnari)*, and yellow notothenia *(Gobionotothen gibberifrons)* declined. Fish investigations were successfully continued around the Shetland Islands from 27 December, where *N. coriiceps* accounted for the most abundant fish species. The programme finished with 13 hauls at the tip of the Antarctic Peninsula on 6 January 2007. 85 hauls with up to six hauls per day completed the CCAMLR survey successfully.

While fishing was conducted during day light hours, a variety of other sampling programmes were carried out at night in order to obtain additional samples predominantly for "Census of Antarctic Marine Life" research projects. These programmes covered aspects of taxonomy, physiology, genetics, pollutants and trophic interactions.

RV *Polarstern* passed through the Antarctic Sound into the northern Weddell Sea in the late evening of 6 January 2007. Further south, an ice barrier blocked the deployment of a mooring in the Larsen A area and further progress south for two and a half days. Investigations of the Larsen B area ecosystem began on the 9 January in order to answer the following questions:

- What form of life exists under the ice shelf?
- How did the ice shelf and its collapse impact the marine ecosystem?
- What will the future bring for the present fauna?
- Can we confirm reports of the working group around Domack (USA) about a cold seep and its associated chemotrophic community?

Four core stations ( “B_South”, “B_West”, “B_Seep” und “B_North”, see Fig. 1.3) were sampled by almost all sampling gear – towed, stationary, sedimentological, benthological, and oceanographical. In order to accomplish an integrated transdisciplinary approach as complete as possible, the majority of the gear was deployed several times. Large differences in sediment type were obvious. A variety of bedrock, especially around station “B_South”, boulder fields, sandy bottoms, and very fine-grained sediments could be observed. Drop-stones were ubiquitous throughout the station work. There was no correlation between the presence of drop-stones and proximity to the coast. The epifauna in this area was also variable but far less abundant compared to the eastern Weddell Sea. The high abundance of different sea squirts particularly at station “B_North” was very intriguing. These organisms are considered to be fast-growing appear to be able to colonize the Larsen B area after the break off of the ice shelf. Hydroacoustic surveys of the seafloor were undertaken near core stations to optimise gear deployment and to obtain information on additional important ecologically relevant environmental parameters. In addition, a sediment trap with an attached current meter was deployed for nine days and finally recovered. A preliminary look at the recorded data showed high current velocity close to the seafloor.

A small-scale cold seep, which has so far only been recorded with the help of underwater videography, was rediscovered with the help of the ROV at station "B_Seep" in an "inner-shelf depression" at approximately 830m water depths. Macroscopically obvious seep-places were covered with small clusters of dead clam shells. The first analysis of the sediments indicated the presence of a seep, probably a palaeo-seep. Deep-sea species of sea cucumbers which were also found in the shallow were the most abundant. The recovery of two US moorings failed despite several attempts to retrieve them. On 20 January RV *Polarstern* steamed to the Larsen A area to successfully sample two more core stations, "A_North" in front of the Drygalski Glacier and "A_South" near the remaining ice shelf tongue between the Seal Nunataks. Also in this area the differences of sediment type were obvious. At station "A_North" close to the rocky coast which is cut off by a glacier very fine sediment with a rich but species-poor infauna has been found. In contrast, at station "B_South" the number of larger slow-growing glass sponges was highest for the entire Larsen area. Smaller specimens have also been observed which could indicate re-colonization. In order to characterise ecologically the Larsen A/B area sampling in an ice-shelf free reference area took place at two additional core-stations near Snow Hill Island ("SHI") and Dundee Island ("DI"). All scientific gear and especially the ROV deployed at shallow water depths (150-200m), showed various degrees of devastation of the seafloor by icebergs and consequently low local epibenthic diversity. Epibenthic diversity was considerably higher at almost 300m water depths but still disrupted by fresh iceberg scours. The rareness of slow-growing glass sponges shows that these long-lived organisms and their associated fauna cannot prosper in this area.

The reference sites at the eastern entrance of the Antarctic Sound north of Larsen A and B and a small box at 59°S were also the last areas where a helicopter was used to conduct whale research. 17,300km and 1,170km were covered by helicopter and RV *Polarstern*, respectively, to record the presence of marine mammals especially whales. Minke whale sightings were exclusively made close the pack ice edge. Very rare beaked whale species were predominantly sighted within the box near Elephant Island. Seals and penguins were also counted in selected areas. The observations were fed into the work of the Scientific Committee of the International Whaling Commission (IWC). First results from the cruise were submitted to the 59$^{th}$ Annual Meeting of the IWEC in Anchorage (USA) in May 2007.

North of 60°S two drifter buoys for a French and a South African working group were deployed each time the *Polarstern* crossed this latitude. With the arrival in Punta Arenas (Chile) on 30 January 2007 at 08:00 am RV *Polarstern* successfully completed the expedition ANT-XXIII/8 (PS-69) in time.

Despite the two different objectives of the cruise, CAML and CCAMLR, an obvious overlap existed in many cases, e.g. whale and cephalopod research also contributed to the CAML and results of the fish survey in the western Weddell Sea was somewhat relevant to CCAMLR. A first synthesis of the most important ecological findings of the cruise was presented during a CAML financed workshop in Barcelona, Spain in September 2007.

## 1.2 OBJECTIVES OF THE CRUISE

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[2] Bundesforschungsanstalt für Fischerei, Hamburg, Germany

### Census of Antarctic Marine Life (CAML/EBA) and related topics

Ice shelves cover roughly one third of the continental shelf of Antarctica, consequently, ecological conditions beneath ice shelves are typical for the Antarctic. Due to difficulties to conduct research in such generally inaccessibly marine environments, only sparse data exist. In the past 15 years regional atmospheric warming has led to the total collapse of two ice shelves, Larsen A and B east of the Antarctic Peninsula with a total area of 10,000km$^2$. This area offers a unique opportunity to investigate a “white spot” with respect to Antarctic biodiversity and ecosystem research, thereby providing a basis for predictions on further environmental changes. The results obtained from this cruise will also contribute to a better understanding of the ecological functioning of marine systems using comparative scientific approaches. The main questions to be answered in the course of the cruise were:

A. What kind of benthic life exists under the former Larsen A/B ice shelves in comparison to a non-ice covered shelf?

B. What kinds of adaptations are found at the genetic, physiological, species and community level?

C. What were direct effects of the disintegration process?

D. Are there indications for a biodiversity shift after the collapse of the ice shelves and what will be the future of this ecosystem?

E. Can the report of a seep at Larsen B by the working group of E. Domack (Hamilton College, New York, U.S.) be confirmed? What kinds of micro- and macro-organisms live close to the seep, what are their environmental settings? Can the supposed seep be linked to the specific conditions under the ice shelf?

F. How do the ice edge and the recent glaciation history shape the distribution and abundance of whales and other warm-blooded animals?

G. How much does the bottom topography in the core investigation areas shape benthic structures and processes? Bathymetric soundings were also carried out during the transit distances.

H. A number of questions on physiological, genetic, taxonomic and ecological topics could be addressed based on the extensive sampling of demersal fish around Elephant Island, the South Shetland Islands and Joinville Island in a CCAMLR dedicated programme.

Under these considerations ANT-XXXIII/8 (PS-69) provided a major contribution to the project "Census of Marine Life" (CAML) as part of the biological SCAR programme "Evolution and Biodiversity in the Antarctic" (EBA) which has the following objective:

> "...will investigate the distribution and abundance of Antarctica's marine biodiversity, how it is affected by climate change, and how change will alter the nature of the ecosystem services currently provided by the Southern Ocean for the benefit of humankind."

Investigations by US scientists in the former Larsen A/B area mentioned above have shown first results on prerequisites for life on this newly available seafloor. Seafloor topography was found to be quite heterogeneous and shallow areas exist close to the grounding line both being features that are well known from the west coast of the Antarctic Peninsula but unusual for the rest of the Weddell Sea. Trenches on the continental shelf hint at a very complex current regime which leads to speculations of different food supply to the benthos. Examinations of the sediment in the Larsen A area showed that in the past 5,000 years there has always been a substantial input of organic material. In contrast, below the Larsen B ice shelf obviously very poor food for benthic and pelagic communities prevailed. For the first time an assumed sunlight and photosynthesis independent bacterial community had been discovered in the area of investigation.

The complexity of the questions raised above required a synoptic approach in order to be able to incorporate the many ecosystem components from microbes to whales. It was decided to focus on a few selected core stations (Fig. 1.3), which were sampled repetitively. It is envisaged that the comparison between the former Larsen A and B ice shelf areas will help explain how differences in long-term sedimentation impacted macrofauna, their trophic interactions and adaptations. From an evolutionary point of view it is to test whether and to what extent habitat fragmentation has therefore increased biodiversity in Antarctica. The role of ice shelves in the long-term and short-term development of benthic communities will be analysed by comparing the results from the Larsen areas with selected sample sites off Snow Hill and Dundee Islands, those taken west and at the tip of the Antarctic Peninsula and on previous expeditions to the eastern Weddell Sea.

This project is considered to form a substantial contribution as a ramp-up project to the International Polar Year 2007/2008 (IPY) particularly with respect to the expedition's implementation of the two core projects "Census of

Antarctic Marine Life" (CAML) and "Evolution and Biodiversity in the Antarctic" (EBA).

From the IPY programme:

> "The three fastest warming regions on the planet in the last two decades have been Alaska, Siberia and parts of the Antarctic Peninsula, Thus the Polar Regions are highly sensitive to climate change and this raises real concern for the future of polar ecosystems and Arctic society."

**Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) and related topics**

Germany is a member of the ‘Commission for the Conservation of Antarctic Marine Living Resources’ (CCAMLR) since CCAMLR came into force in 1982. Article XX of the underlying convention requests members to submit reports on the status of the resources on a regular basis. This work is conducted by the Federal Research Centre for Fisheries (BFAFi) in Hamburg on behalf of the Ministry for Nutrition, Agriculture and Consumer Protection (BMELV).

The BFAFi has a long–standing history in research on resources in the Southern Ocean. Research started on the composition, abundance, ecology, demography, and population dynamics of fish stocks in the western part of the Atlantic Ocean sector in 1975. One of the focal areas of research has been the Elephant Island – South Shetland Island region (CCAMLR Statistical Subarea 48.1). Fisheries–related research had been later extended to the north-western part of the Antarctic Peninsula.

CCAMLR Subarea 48.1 had been exploited by the commercial fishery from 1978/79 to 1982/83 and irregularly thereafter. Target species were the mackerel icefish (*Champsocephalus gunnari*) and the marbled notothenia (*Notothenia rossii*, in1979/80 only) in the Elephant Island – South Shetland Islands area, and the spiny icefish (*Chaenodraco wilsoni*) at the tip of the Antarctic Peninsula. By-catch species which were sometimes also targeted were yellow notothenia (*Gobionotothen gibberifrons*), yellow–bellied rock cod (*N. coriiceps*) and Scotia Sea icefish (*Chaenocephalus aceratus*). Stocks of the target species were fished to low levels within one season (*N. rossii*) or a few (*C. gunnari*). CCAMLR closed the area for any commercial fishing after the 1989/90 season until it has been demonstrated that finfish stocks have recovered from previous exploitation.

Since 1998, research in the southern Scotia Arc had been conducted in close collaboration with the Southwest Fisheries Science Centre of the National Marine Fisheries Service in La Jolla (USA). Research cruises to the area have been carried out in 1998, 2001, 2002, 2003 (Elephant Island – South Shetland Islands) and 2006 (north-western part of the Antarctic Peninsula) to follow the potential recovery of the stocks. Results of these investigations formed the basis for management decisions by CCAMLR as to whether and when the area might be re-opened for commercial finfishing and were published in the scientific literature.

The aims of the survey in 2006/07 were threefold:

- to estimate the biomass of the most abundant fish stocks in CCAMLR Subarea 48.1
- to study the demography of the most abundant fish species, and
- to collect additional information on reproduction and food and feeding of all abundant fish species.

## 1.3 WEATHER AND ICE CONDITIONS

Frank-Ulrich Dentler, Klaus Buldt; Deutscher Wetterdienst, Hamburg, Germany

RV *Polarstern* left Cape Town in the evening of 23 November 2006 bound for *Neumayer Station*. At first the ship headed for 46.68°S, 007.47°E where calibration work of the hydrosweep-system was done. The cruise started at fair weather, fresh breeze from West and moderate swell.

RV *Polarstern* met a first gale centre of the mid latitudes in the Southern Atlantic on 28 November, which caused storm und seas of more than 8 metres. During the next 3 days on the way to the ice edge the weather conditions improved slowly. Due to the high winds and seas the ice edge moved several miles to the North and was not well defined. *Polarstern* reached the ice edge at 57.2°S 000.4°E nearly one week after departure in Cape Town. The ice cover varied mostly between 60% and 80%.

South of 60°S RV *Polarstern* used the so called “winter polynya” near the Greenwich meridian to proceed to *Neumayer*. In this polynya the sea ice conditions improved noticeably. At the southern edge of the sub polar low pressure zone the weather was slightly unsettled but light to moderate winds were prevailing. When RV *Polarstern* approached Atka Bay on 5 December the ice conditions became worse. Due to ice coverage of 100% first-year ice up to 2m thickness, RV *Polarstern* was not capable to get to the ice shelf edge close to *Neumayer*. So unloading cargo for *Neumayer* had to take place on sea ice. Despite of acceptable weather conditions in the Atka Bay the operation required nearly five days.

From 10 to 19 December RV *Polarstern* sailed to Elephant Island. Since a crossing of the Weddell Sea was not considered due to the sea ice conditions, RV *Polarstern* used at first the same course out. To pass a storm centre at its southern side, RV *Polarstern* sailed at 64°S to the west to avoid high seas in open waters. The sea ice had a concentration of 30 to 50% and was easily to penetrate for the ship – except during night from 17 to 18 December when we approached a separated field of multi-year ice floes. To avoid unnecessary fuel consumption it was decided to make a detour around this ice field.

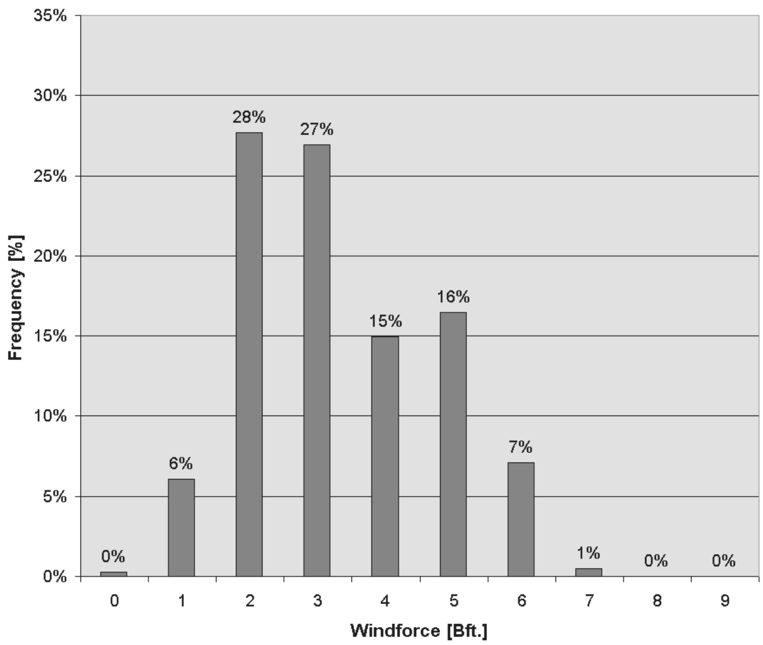


Fig. 1.4 Frequency distribution of wind speed (Bft) 2 - 18 Dec ‘06 (ship in ice).

With mostly moderate easterly to southerly breeze RV *Polarstern* continued sailing to Elephant Island, where she arrived on 19 December. Fig. 1.4 shows the frequency distribution of wind speed (10-minutes mean in Bft) based on hourly observations on board while the ship travelled through sea ice. In more than 60 % of the hours the wind speed was less or equal 5 m/s, the average speed 5.3 m/s, which equals force 3 – 4 Bft.

In the following 10 days RV *Polarstern* stayed on the shelf around Elephant Island. This area was more frequently affected by developing depressions moving from the Falkland Isles to the East or Southeast. So a gale centre hit Elephant Island on 26 December.

At the turn of the year there was a request for air transportation activities on King George Island in the vicinity of *Jubany Base*. This was supposed to be done by both ship based helicopters. Since sling load had to be transported, visual meteorological conditions (VMC) and low wind speeds were demanded. These flights were carried out on 30 and 31 December. Under the influence of a weak high pressure ridge over the South Shetland Islands the weather conditions allowed helicopter operations. However, due to the cloud base the operating height was limited to 1000 ft most of the time.

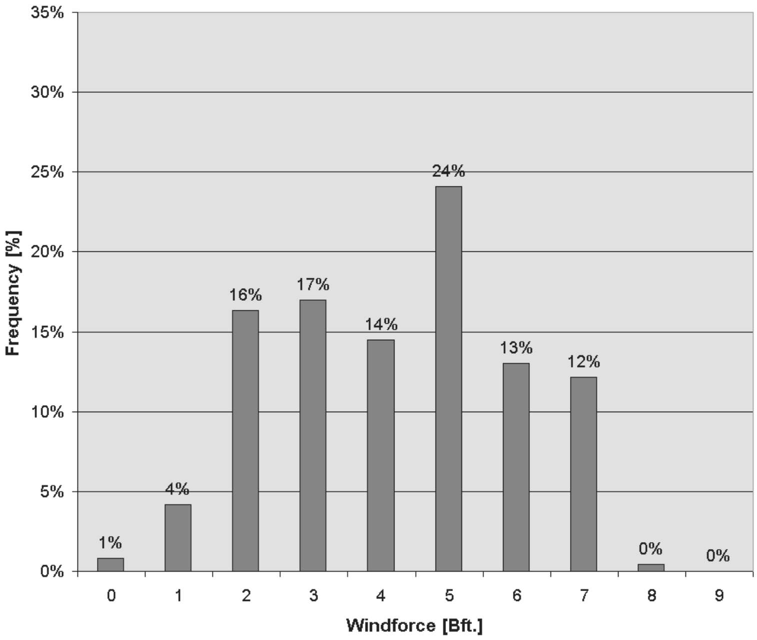


Fig. 1.5 Frequency distribution of wind speed (Bft) 18 Dec ’06 - 7 Jan ’07 (ship in open water).

Operating in the Bransfield Strait on 4 January the weather was influenced by the trough of a depression west of the South Shetland Islands with gale force winds for some hours. With moderate westerly wind the ship passed the Antarctic Sound in the night from 6 to 7 January bound for the Larsen Ice Shelf.

The frequency distribution of wind speed for the period RV *Polarstern* was operating outside the ice belt (18 December to 7 January) is shown in Fig. 1.5. The distribution shows a peak at force 5 Bft. The mean wind speed during this period was 7.7 m/s which equals force 4 – 5 Bft, about 1 Bft higher than on the first part.

The sea ice coverage in Larsen A as well as in Larsen B allowed station work from RV *Polarstern*. However a big iceberg with adjacent sea ice fields blocked the access to both former ice shelf areas (Fig. 1.6). Since the former Larsen A area was not accessible due to a barrier of thick multi-year ice at this time, RV *Polarstern* sailed around the big iceberg to Larsen B.

On 11 January the station work started at the Jason Peninsula. High pressure influence caused undisturbed weather conditions until 14 January. During the next three days frontal system from West and North approached to the Larsen area. They were accompanied by heavy snow fall und strong, sometimes gale-force winds from south-west.

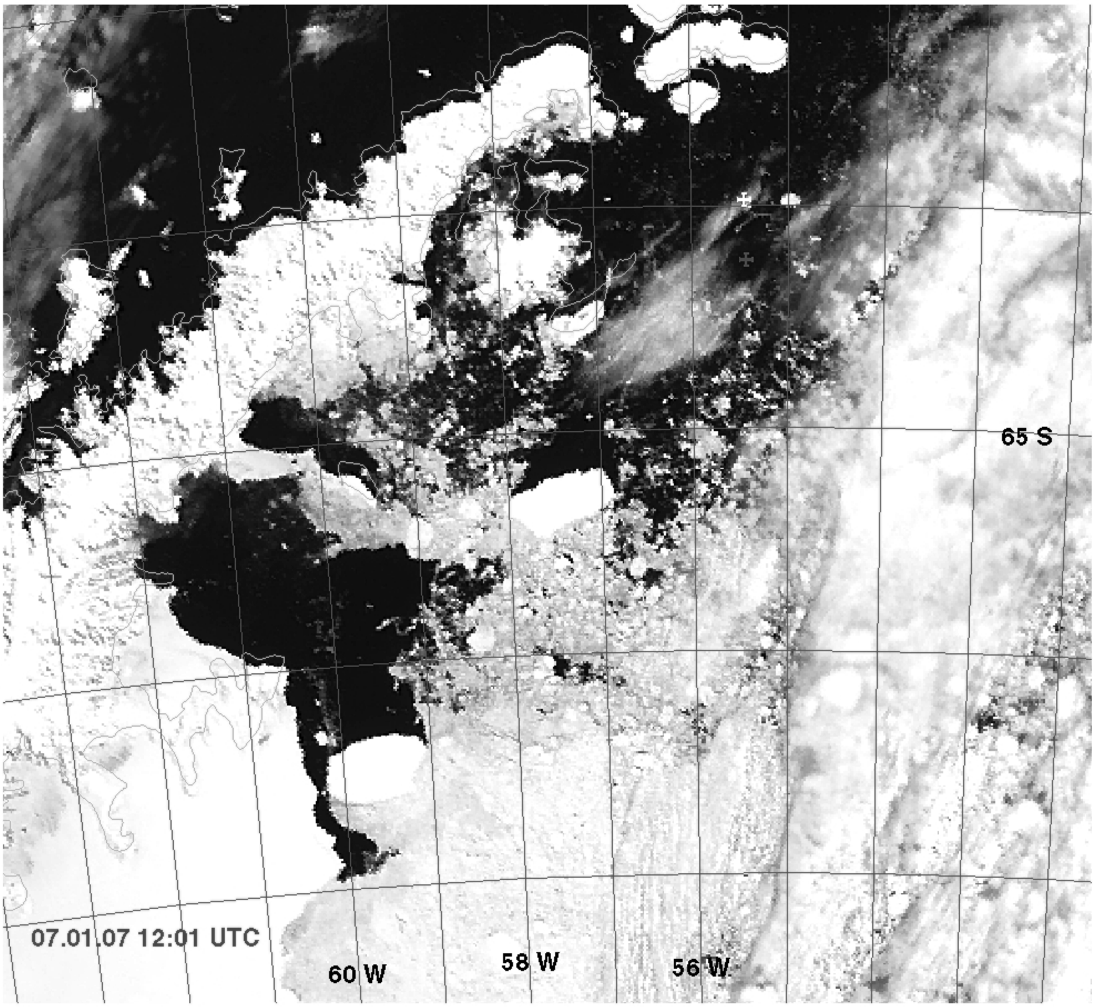


Fig. 1.6 NOAA 17, HRPT Channel 1 (VIS), 7 Jan ‘07, 12:01 UTC.

On 19 January a strong warming by subsidence occurred above 170m NN. But in the bottom layer close the sea surface temperatures remained some degrees below freezing level. Dense “freezing fog” was the result. In the early morning of 20 January a south-westerly föhn wind developed at the Jason Peninsula. The temperature raised from –3 to +3 °C, the relative humidity went down to less than 50%. The wind speed increased to 30 kt.

The fair weather conditions continued on 21 and 22 January. The wind speed decreased in some distance from the Cape while in Larsen A area there were light and variable winds as well as sunny skies were observed. The calm conditions continued during the return to the Antarctic Sound. In the Drake Passage gentle north-westerly breeze developed. At first it was accompanied by a poor visibility or fog, but north of 60°S the visibility improved.

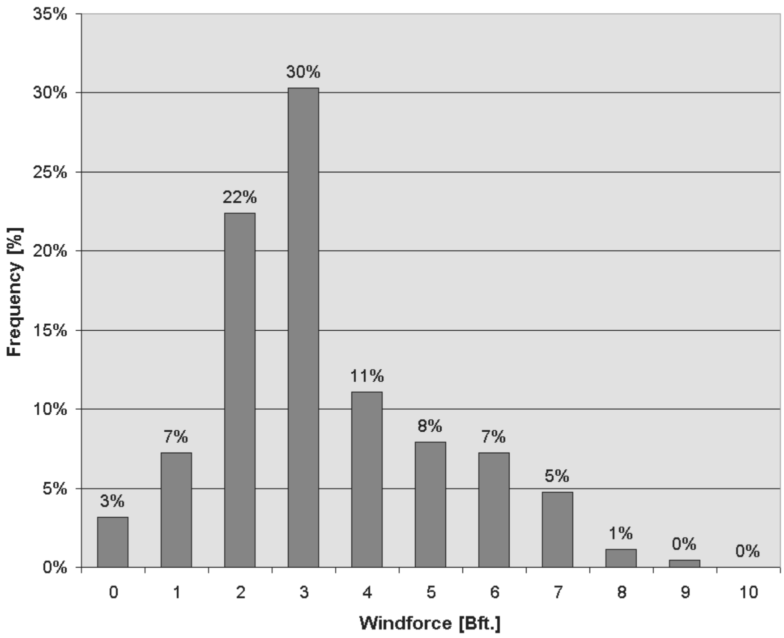


Fig. 1.7 Frequency distribution of wind speed (Bft) 7 - 24 Jan '07 (Larsen Ice Shelf).

The frequency distribution of wind speed for the time RV *Polarstern* was operating in the Larsen area (8 to 24 January) is shown in Fig. 1.7. The distribution shows a peak at force 3 Bft. The mean wind speed in that period was 5.5 m/s (force 3 – 4 Bft), similar to the values of on the first part.

Table 1.1 Mean wind speed and standard deviation for the different phases

| | 2 Dec - 25 Jan | 2 – 18 Dec | 18 Dec - 7 Jan | 7 – 24 Jan |
|---|---|---|---|---|
| | ANT-23/8 | "Supply NMYR" | "Fishery" | "Larsen" |
| Mean speed [m/s] | 6.2 | 5.3 | 7.7 | 5.5 |
| Stand. Dev. [m/s] | 4.1 | 3.1 | 4.3 | 4.2 |

Average wind speed with SD for the different areas of operation is listed in Table 1.1. Fig. 1.8 shows the frequency distribution of wind speed for the time RV *Polarstern* was operating south of 60°S (2 December to 25 January). This distribution shows two remarkable peaks: the lower one represents the time while travelling and operating in the ice of the Weddell Sea. The higher one represents while cruising and working in open waters near the Drake Passage. The highest wind speed was 21 m/s which equals to force 9 Bft.

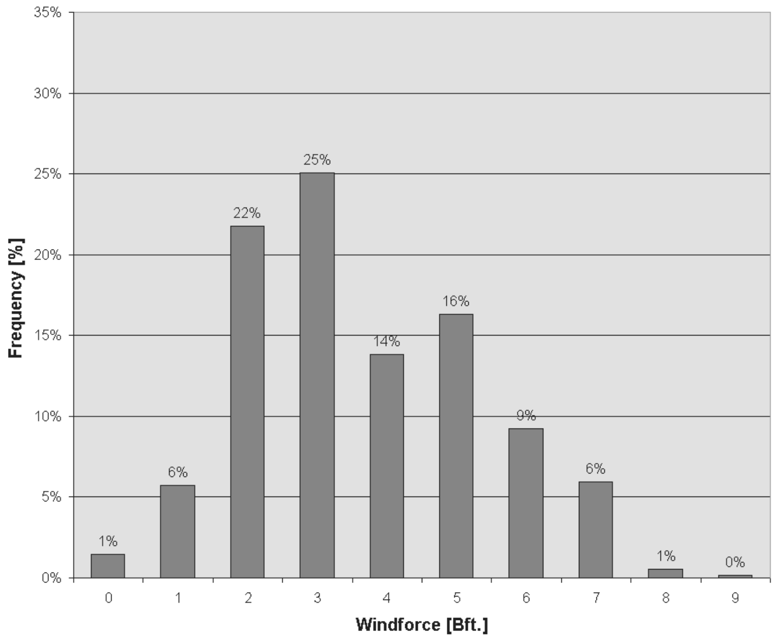


Fig. 1.8 Frequency distribution of wind speed (Bft), 2 Dec ‘06 to 25 Jan ’07 (south of 60°S).

## 1.4 OUTREACH

Gauthier Chapelle[1], Julian Gutt[2], Jan Seiler[2]

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### Objectives

As one main contributor to the CAML program, the *Polarstern* expedition to the Larsen area was a major event to open and illustrate the International Polar Year 2007-2008. As the first expedition focussing on the biological impacts of the Larsen Ice Shelf collapse, ANT-XXIII/8 offered a unique opportunity to communicate the link between climate change and Antarctic biodiversity. Also, the CCAMLR part of the cruise could illustrate the importance of mid to long term monitoring of Antarctic marine living resources to determine appropriate conservation measures.

The wider aim of the various partners involved (AWI, CAML, IPF and the Cousteau Society), was to help to raise the level of perceptions and attitudes around the value and the use of this world’s last almost unspoiled wilderness for the heritage of future generations. More specifically, the objective was to reflect the work of an international scientific team at sea.

### Work at sea

Our time was divided between filming, taking pictures, interviewing scientists, and writing. In particular, most of the scientific activities have been recorded with video and still cameras. These include deployment and recovery of various scientific sampling gears, work on deck, in the cooling containers, wet and dry labs. Landscape and the fauna surrounding the vessel (birds and mammals) were also documented as much as possible.

The outreach team participated in six helicopter flights. These flights allowed filming RV *Polarstern* steaming as well as the refuelling of *Neumayer Station*, the Emperor penguin rookery in Atka Bay, the new coast-line of Larsen B and the Larsen C ice-shelf.

In order to keep pace with the recent digital revolution in television footage was taken with a High Definition Video (HDV) camera. This material will be used for future portfolio to present the scientific work of the AWI and IPF. At times, two cameras were used to accomplish seamless transitions of one scene from different angles of view. Footage was immediately edited onboard RV *Polarstern*. German, French and English were the main working languages for the written work.

**Output**

26 hours of video footage have been filmed. They were first used to produce 24 one-minute video clips and put online on www.cousteau.org/caml.org thanks to a partnership between the AWI, the Cousteau Society and Google-Video. The web site was well-advertised on the home pages of Google-Video France, UK and Germany. The rest of the video footage as well as several thousands of still pictures are available for the PR department. Together with other videos and pictures produced by the scientists themselves, they will provide the basis for planned or potential events, like press conferences after the return to Europe, exhibitions or publications directed to the scientific or more general audience.

An important part of the written information produced by the team was used on news websites. Eight articles were written for the news section (in French and English) of the Cousteau website on various scientific topics (www.cousteau.org), while 21 issues were produced for the slightly younger community of the Educapoles and Cousteaukids blog on www.educapoles.org and www.cousteaukids.org (in French and English). Both web sites also received seven picture galleries. Some of the few figures available revealed that about 21,000 people visited the Educapoles web site in January, with a mean of 8 pages viewed.

The chief scientist’s nine weekly reports were usually published in German and English on the AWI website, but also in French on the Cousteau and IPF (www.polarfoundation.org) websites. Interviews with K.-H. Kock and J. Gutt, the leaders of the CCAMLR and CAML respectively, sub-programs appeared on the scientific website of the IPF (www.sciencepoles.org).

19 dedicated issues (in German and English) were also sent to the blog section of the German IPY web site www.polarjahr.de. About four of them were placed at www.ipy.org/index.php?/ipy/content/ipyblogs/. These 19 issues covered the main scientific topics and findings of the expedition, beside some aspects of the life on board *Polarstern*. Another important web result was the five releases for the European Community Research news agency "Eurekalert" (www.eurekalert.org), insuring a rapid spreading of news treated on other web sites. Finally, articles were published on the web sites of "Der Spiegel" and "Frankfurter Allgemeine Zeitung".

Eight phone interviews were realized for the German and Belgian media, either for radio programs or newspaper articles. It is in these two countries that most of the written press coverage took place. Articles were published in several different German newspapers or magazines, and in eight in Belgium, including four of them in the most important French-speaking daily newspaper. Eight press releases were done by the Cousteau Society, including one taken by AFP (Agence France-Presse), and a twelve-pages article about the expedition was published in their "Calypso- Log" magazine (30,000 copies in the US). The Russian and Czech written press were also touched, with one article for each country. A general article about the expedition has also been requested by RDT-Info, the magazine of the European DG Research. Finally, following a press release about the cold seep clams findings at Larsen B, J. Gutt was interviewed by a journalist from the international Reuters press agency.

An extensive press release prepared after the end of the expedition by the AWI communication-department (A. Dummermuth) and distributed with the support of the "Census of Marine Life" office in Rhode Island, U.S.A. (T. Collins and D. Crist) yielded in worldwide approx. 180 articles in journals ranging from "Times", "Nature", and "Zeit" to "Bild" and "U.S. today", more than 350 web pages and approx. 15 radio- and TV-interviews reporting about the expedition and its scientific success.

# 2 SCIENTIFIC REPORTS

## 2.1 "CENSUS OF ANTARCTIC MARINE LIFE (CAML)" AND RELATED TOPICS

### 2.1.1 MEGABENTHIC COMMUNITY ECOLOGY - LIFE UNDER ICE-SHELVES

Julian Gutt[1], Harald Bohlmann[2], Werner Dimmler[3], Gesche Kohlberg[1], Stephanie Langner[1], Jan Seiler[1]

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#### Objectives

The main objective of this subproject is exactly in line with the two major subprojects of the CAML related topics: benthic ecological processes under the former Larsen A/B and cold seep biology under the former Larsen B Ice Shelf. The specific aspects of this sub-project were to focus on the mega-epibenthos and apply non-invasive methods mainly by a video-equipped remotely operated vehicle (ROV). The reasons for this decision are three-fold, firstly, only this way the mega-epibenthos can be quantitatively surveyed on both types of sediments, soft and hard, in a comparative way. Secondly, in Antarctica the megabenthos plays the dominant role in most regions in comparison with the infauna. Thirdly, climate related ecological long-term processes such as iceberg scouring can be best detected using a quantitative method with a high spatial resolution, which means that the video footage provides discrete information for each single metre on a transect. The same holds true for the search for seep spots. The results can be compared with those from the "normal" high latitude shelf in the eastern Weddell Sea, e.g. from expeditions ANT-XIII/3, ANT-XV/3, ANT-XXI/4. In order to evaluate the uniqueness or normality of the findings from the Larsen area and to test general ecological hypotheses, e.g. on the ecological background of very rare species, two core stations north of this area at Dundee Island and Snow Hill Island were investigated.

#### Work at sea

The ROV (“Cherokee” owned by MARUM/RCOM, University of Bremen) was deployed 18 times in total: One test-station at the South Shetland Islands without scientific results, 10 times in the Larsen B area ("B_South", "B_West", "B_Seep", B_North") and 3 times at Larsen A ("A_North" and "A_South"), and 4 times in the reference area near Dundee Island and Snow Hill Island (“DI” and SHI”). Each cast lasted approx. 100 min representing an averaged length of almost 1 km. As a consequence, a total length of approx. 15 km sea-floor was videographed. Assuming an average strip width of 0.8m and an average speed of the ship and ROV, respectively, the total area covered during all casts was 12,000 $m^2$. In addition a total of approx. 3500 photographs have been made primarily for a better identification of organisms depicted in the videos.

### Preliminary results

Unexpectedly, the observations at station "B_South" showed at water depths >100m bedrock colonized by a very specific sessile fauna with hydrocorals, being the most obvious animal group (Fig. 2.1). A few patches of scraped rock, due to iceberg scouring were found. At the same spot but at a greater water depth the sediment was composed of smaller grain sizes and stones. The megafauna was very poor.

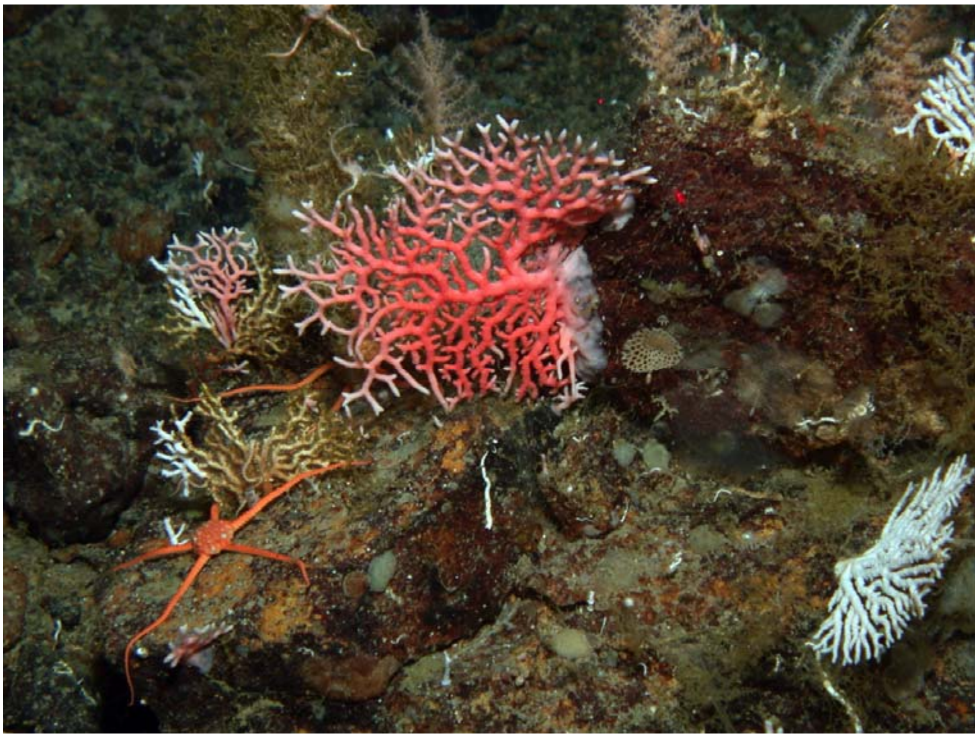

Fig. 2.1 True hard bottom community at “B_South”. © AWI/MARUM, Univ. Bremen.

At "B_West" soft sediments with few icebergs scour marks, few stalked crinoids, and very few intermediate sized hexactinellid sponges were most conspicuous. At "B_North" and "A_South" numerous ascidians especially in shallow water depths, may represent first pioneer organisms, with massive growth (Fig 2.2).

At "B_Seep" core-station the seep was found with patches of shells of cf *Calyptogena*. The identification was based on material obtained with the Agassiz trawl and multibox corer. Some of these approx. 30cm large patches are distributed only over a relatively small area. At station "A_North" very close to the steep rocky coast but close to the Drygalski Glacier the sediment was obviously very fine and colonized by many infaunal polychaetes. Among the observed mobile animals mysids resting on the sediment and euphausids in the water column only few decimetres above the bottom were quite abundant. The station with maybe the highest megabenthic diversity in the Larsen area was "A_South" surveyed during two casts. This station is not far from "B_North", the sediment was very diverse. Consequently, different species of solitary ascidians were also abundant at this station. In addition, numbers of hexactinellid sponges including juveniles were higher compared to other stations in the area. Various cnidarians and various echinoderms contributed considerably to the relatively high species richness.

Fig. 2.2 Ascidians were frequent at “B_North” and “A_South”. © AWI/MARUM, Univ. Bremen.

The reference stations at Dundee Island and Snow Hill Island were both surveyed twice. At the shallower replicate at approx. 100m the benthos showed, based on a comparison with the eastern Weddell Sea, various stages of recolonization after iceberg scouring covering the entire area. This corresponds very well with the high number of grounded and floating icebergs observed in the area. At the deeper replicate (approx. 200m) the local diversity was higher, especially various cnidarians, echinoderms, bryozoans, demosponges and hemichordates contributed to this variety. In the eastern Weddell Sea hexactinellid sponges were good indicators for areas without iceberg disturbance but were extremely rare in the vicinity of both reference stations.

ROV footage and underwater photographs contributed considerably to the efficient outreach program on board and will contribute to similar public relation activities in the future.

### 2.1.2 MACROBENTHIC COMMUNITIES - ASTEROID AND POLYCHAETE DIVERSITY

Americo Montiel[1], Laura Alonso-Sáez[2], Harald Bohlmann[3], Pablo López-González[4], Elisabet P. Sañé Schepisi[2]

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[4] University of Sevilla, Spain

**Objectives**

Macrobenthic communities in the Larsen A/B area. Studies of recolonization processes in benthic communities after ice disturbance are scarce in Antarctic areas. The recent collapse of two huge pieces of continental ice shelf, Larsen A and B, created large ice-free areas. This presents a unique opportunity to study the structure of macrobenthic communities in shelf areas having been covered by permanent ice for hundreds to thousands of years, to compare these communities with other shelf communities from areas being covered by seasonal sea ice and to follow changes in the biodiversity after the disintegration. Since 1986, studies with multibox corers (MG) contribute to our understanding of distribution, diversity and recolonization patterns of macrobenthic organisms in high Antarctic shelf areas, such as Auståsen and Kapp Norvegia on the south-eastern Weddell Sea shelf. The main objectives were

- to complement former benthos studies of the EASIZ and LAMPOS expeditions with a study in a new and pristine Antarctic area, which until 2002 (Larsen B) and 1995 (Larsen A) has been covered by thick and permanent ice, thus allowing comparisons with former work, and
- to enlarge the quantitative benthos data base for the Weddell Sea obtained during several previous *Polarstern* cruises (*e.g.* EASIZ, LAMPOS and BENDEX expeditions).

Polychaete and asteroid diversity. Polychaetes and asteroids are important components of the Antarctic benthos. They contribute considerably to the overall biodiversity, occurring with 645 polychaete and 108 asteroid species. The species are widely distributed in the Weddell Sea, along the Antarctic Peninsula and up to the Magellan area. They seem to be successfully adapted to extreme environmental conditions, such as austral cooling and the last maximum glaciations in South America. Recently, morphological and taxonomical results have shown the presence of species–complexes, i.e., groups of species with slight morphological differences; this may suggest occurring in cryptic and/or sibling species. The combination of molecular-genetics and the traditional taxonomical approaches has produced substantial progress in Antarctic science, although such studies are lacking in polychaetes and asteroids.

The main objectives of this project were:

- to collect as many polychaete and asteroid species as possible in order to initiate a bank of key species to be fixed and prepared for genetic analyses.
- to combine this molecular approach with traditional taxonomic work in order to obtain further insights into the similarity/dissimilarity of the community structure and species distribution of polychaetes and asteroids in high and subantarctic waters.

### Work at sea

During ANT-XXIII/8, the multi-grab (MG) with attached underwater and digital cameras was successfully deployed on the eastern Peninsula shelf in the Larsen A and B areas. A total of 74 cores from 10 stations were obtained, covering a depth range from 202 to 850m depth. Besides the benthic samples, additional samples for sediment analyses and digital photos and videos were taken for better evaluation of the communities and habitats in these areas. For the first time, two 70W Xenon Lamps and a UV Flash (45) were used to improve digital photos from a Kongsberg 3.2 Mp digital camera.

All quantitative samples obtained were sieved on 500 micron screens and preserved in 10% formalin - sea water solution, buffered with borax. Further sorting of the benthic samples will take place at the home lab of the Alfred Wegener Institute for Polar and Marine Research (AWI), Bremerhaven, Germany. Sediment analyses will be done in the Institut de Ciènces del Mar, CSIC Barcelona, Spain.

A census of polychaetes and asteroids was collected from the by-catch of 31 bottom (BT) and 4 Agassiz trawls (AGT), taken on the shelf areas of Elephant, South Shetland and Joinville Islands in water depths between 94 to 353m. For the determination of the asteroids we used the “Fauna der Antarktis” and the catalogue of the British Antarctic Survey. The polychaete determinations were performed using “the interactive identification guide”. The similarity among the three groups of islands was analysed with PRIMER software based on presence/absence data of the polychaetes and asteroids in the catches. Specimens of both groups were preserved in 10% buffered formalin - sea water solution for later taxonomical and stomach content analyses. Additional specimens were preserved in 96% ethanol or frozen at -30 °C for genetic/molecular studies, for biomass estimations and size distribution measurements.

**Preliminary results**

Macrobenthos communities in the Larsen A & B areas. More than 85% of the total samples reached core length > 20cm depth, which will be considered for the further quantitative analysis in the AWI (Fig 2.3). Our preliminary descriptions of the surface sediment composition and the visible macrofauna base on 274 UW-pictures and 3 hours of UW-video material. Most of the stations showed a high frequency of big sized stones in a matrix of silt and clay, except in the station 722-2, which was dominated by silt and very well sorted sediment, which decreased the efficiency of the gear to only 4 corer samples. The faunal composition was dominated by 3 species of holothurians and several species of ophiuroids. Sponges were only observed at one station in Larsen A and one in Larsen B (Table 2.1).

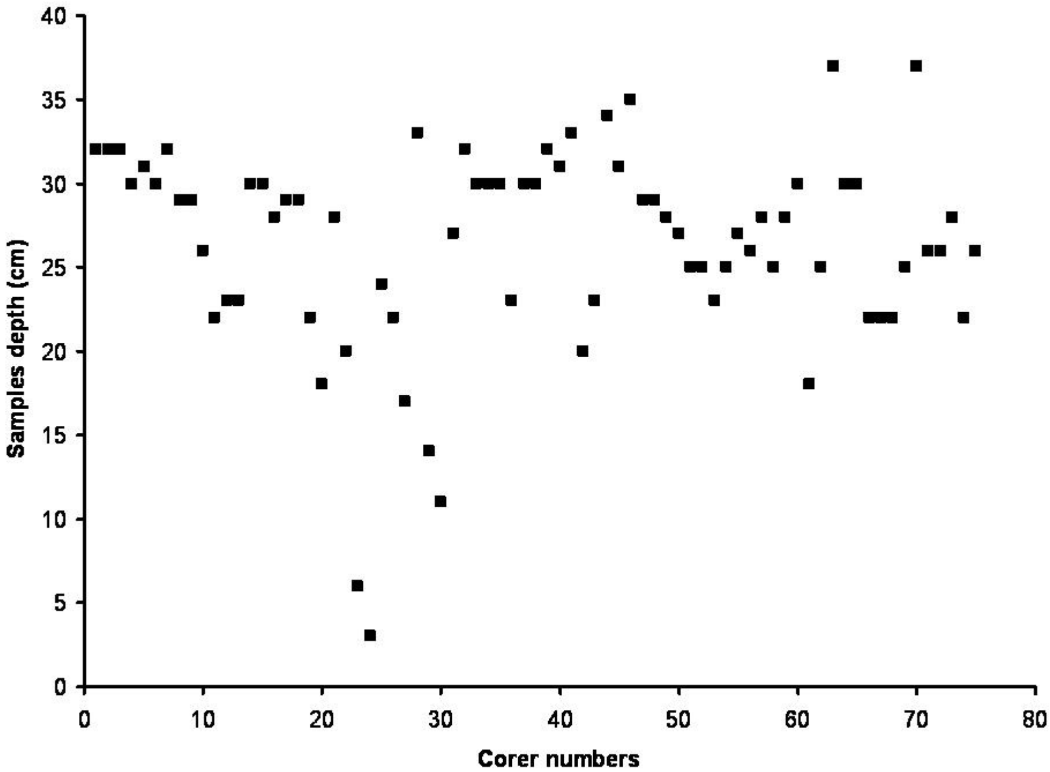


Fig 2.3 Penetrations depth of the corer samples from the MG in Larsen A and B area.

At the Larsen "B_Seep" station (709), one complete shell and several fragments of the genus *Calyptogena*, three specimens of holothurians and two different specimens of ophiuroids were collected. The shells of *Calyptogena* sp. will serve for growth analyses to be performed by O. Heilmayer, AWI.

Table 2.1 List of stations, numbers of corers and photographs per station. Information on sediments and occurrence of macrobenthic organisms bases on the UW-photographs (* = samples for granulometry analysis).

| Station | corer | Photogr. | Sediment | Macrobenthos |
|---|---|---|---|---|
| PS 693-3 | 4 | 34 | gravel & clay | Octocorallia / Ascidiacea / Bryozoa |
| PS 700-1 | 9 * | 19 | stone & clay | Ophiuroidea / Serpulidae |
| PS 701-1 | 9 * | 14 | gravel & clay | Ophiuroidea / Porifera / Crinoidea |
| PS 703-4 | 6 * | 19 | clay & stone | Ophiuroidea / Holothuroidea / Asteroidea |
| PS 704-1 | 7 * | 31 | clay & stone | Holothuroidea / Ophiuroidea |
| PS 706-3 | 9 * | 42 | clay & stone | Holothuroidea / Ophiuroidea |
| PS 709-6 | 9 * | 22 | clay & stone | Holothuroidea / Ophiuroidea / Echiuridae |
| PS 715-3 | 9 * | 25 | gravel & clay | Holothuroidea / Ophiuroidea |
| PS 718-7 | 4 * | 23 | gravel & clay | Holothuroidea / Ophiuroidea |
| PS 722-2 | 4 * | 23 | silt & clay | Ophiuroidea / Ascidiacea |
| PS 725-4 | 9 * | 22 | gravel & clay | Ascidiacea / Porifera / Crinoidea |

Comparison of the macrofauna communities in Larsen A and B suggests at a first glance that in general the shallow stations in both areas were very similar of sediment environment and macrofaunal inventories. However, this has to be confirmed after more detailed sorting of samples and analysis of data.

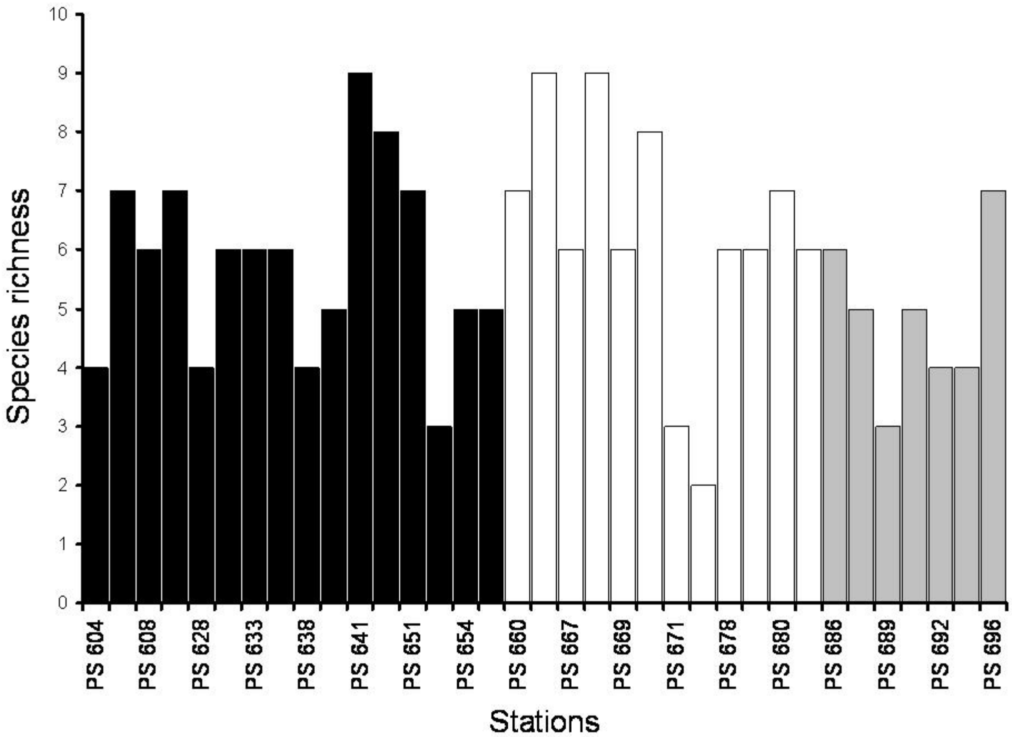


Fig. 2.4 Species richness per catch at the Antarctic Peninsula. Columns in black: Elephant Island, in white: South Shetland Islands and in grey: Joinville Island.

Polychaete and asteroid diversity. The species richness in both groups varied between 2 and 9 species per trawl. The most diverse stations were 641-1, 666-1 and 668-1 with 9 species per trawl. All other stations showed less than 7 species per trawl (Fig 2.4). The species richness of the both taxonomical groups was slightly higher in the South Shetland area as compared to the Elephant and Joinville Islands. In comparison with previous findings obtained by the same methods species richness in polychaetes was lower than the reported information from the Peninsula area. Nevertheless, as in the EASIZ I, II, and III expeditions, *Laetmonice producta* was the most frequent polychaete occurring at 66% of all stations, followed by *Aglaophamus macroura* and *Maldane sarsi* occurring at 20 and 11%, respectively.

A total of 21 asteroid species were found seven of which remained undetermined, whereas nine polychaete species were determined (Table 2.2). The most frequent asteroids species was *Notasterias armata* (23%), followed by *Diplasterias brucei* (23%), *Cryptaster turqueti* and *Labidiaster annulatus*. The remaining species constituted less than 14% to asteroid diversity. Although biomass was not considered in this study, a big catch (3.5kg) of *L. annulatus* and the presence of some large specimens of *L. magnificus* (1.5 kg) are worth mentioning.

Table 2.2 Preliminary list of identified polychaete and asteroid species from 35 catches of bottom trawl and AGT. The percentages of frequency of occurrence in all samples are included.

| Asteroids | Frequency (%) | Polychaetes | Frequency (%) |
|---|---|---|---|
| *Notasterias armata* | 66 | *Laetmonice producta* | 66 |
| *Diplasterias brucei* | 57 | *Aglaophamus macroura* | 20 |
| *Bathybiaster loripes* | 54 | *Malde sarsi* | 11 |
| *Cryptaster turqueti* | 43 | *Pista spinifera* | 9 |
| *Labidiaster annulatus* | 43 | *Paraonuphis* sp. | 6 |
| *Odontaster validus* | 37 | *Hartmothoe* sp. | 6 |
| *Acodontaster conspicuus* | 20 | *Barrukia* sp. | 6 |
| *Leptychaster magnificus* | 17 | *Ophelina* sp. | 3 |
| *Psilaster charcoti* | 14 | *Perkinsiana* sp. | 3 |
| *Porania antarctica glabra* | 14 | | |
| *Perknotaster fuscus* | 14 | | |
| Asteroidea indet. 5 | 14 | | |
| *Cuenotaster involutus* | 11 | | |
| *Odontaster meridionalis* | 6 | | |
| *Crossaster fuscus* | 6 | | |
| *Pteraster affinis* | 6 | | |
| Asteroidea indet. 3 | 6 | | |
| Asteroidea indet. 4 | 6 | | |
| Asteroidea indet. 7 | 6 | | |
| *Luidia* sp. | 3 | | |
| Asteroidea indet. 6 | 3 | | |

According to ANOSIM analysis slight significant differences exist among the three groups of islands (R = 0.235; P = 0.001). These have to be confirmed after more detailed analyses of the biological and environmental data sets obtained.

## 2.1.3 BENTHIC-PELAGIC COUPLING IN POORLY KNOWN POLAR ENVIRONMENTS

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### Introduction and objectives

The environmental differences at the sea surface and close to the seabed inspire interesting questions about how the pelagic and benthic ecosystems work and connect between each other, especially in polar conditions where seasonality is intense in the upper layers of the water column and more constant in the benthic realm.

Previous studies on the high-latitude Weddell Sea continental shelf have shown that the particles exported from the sea ice and the upper layers of the water column settle onto the seabed and constitute a reservoir of nutritive sediment or “food bank” (also described as “green mats”), which fuels the benthic fauna even during the dark winter. Lipids have been identified as an important link in this trophic chain; however, their trajectory throughout this path has not been fully tracked and it may provide important information on the velocity an intensity of the pelagic-benthic coupling.

The interdisciplinary ICM/US group has the aim of assembling several compartments of the pelagic and benthic systems by combining information from climate, sea ice, settling particulate matter (e.g., plankton detritus, lithogenic debris), the chemical and physical characteristics of the water (e.g., dissolved nutrients, S‰, TºC, current velocity and direction, turbidity), and sediment columns (e.g., grain size, organic contents) and benthic fauna studies. The idea is to produce a comprehensive benthic-pelagic coupling interpretation of a poorly known ecosystem such as the recently opened area beneath the former Larsen A and B ice shelves. This approach will be complemented with studies on bacterial abundances and growth in sediment and water, detection of biodiversity boundaries in the distribution of benthic cnidarians and pycnogonids and dispersal capacities and genetic variability within and among different populations of known hexactinellid sponges.

Special interest will be given to the biochemistry of particles collected from sea ice, the water and sediment columns as tracers of pelagic-benthic coupling paths complemented with $^{14}C$ analyses.

## Work at sea

Ice: Sea ice was collected in the eastern Weddell Sea, whilst iceberg ice was only collected at the Larsen B area. Total and organic carbon, nitrogen, biogenic silica, nutrients and biochemical variables (protein, lipid, carbohydrates, chlorophyll, EHAA, THAA) will be measured to quantify available organic matter. Fatty acids and stable isotopes ($^{13}C$ and $^{15}N$) in them will be used to estimate energy transfer from one link to the other in the trophic chain. Selected samples will be photographed with optic an electronic microscopes. Lipid contents in sea ice were measured on board.

Water column: In total, 47 CTD casts were performed in the surveyed regions. CTD profiles include salinity and temperature. Water sampling depths were typically 5m above the seabed (or the deepest possible depth), just below the thermocline and 5m below sea surface. The same set of variables to be analyzed in Barcelona in sea-ice samples will be measured in the seston collected by filtering the sea water samples. Lipid contents of selected stations were measured on board.

Sedimentation: A conical SMT 234 (K.U.M. Meerestechnik, Kiel) sediment trap was moored at 65°57.91'S, 60°18.65'W, 50m above the seabed (mas) coupled to a current meter Anderaa RCM9 located 40 mas. These instruments worked for approximately nine days. The sampling period of each single sediment trap collector was three days, whereas the current meter performed a measure of current velocity and direction each 60 min. Total mass fluxes and its principal constituents (lithogenics, organic and inorganic carbon, nitrogen, biogenic silica, $^{210}Pb$ and $^{14}C$) will be measured in sediment traps samples to estimate the transport intensity of organic matter to the seabed.

Sediment: Eight sediment cores ranging from 6 to 42cm long were recovered with a 10cm-diameter multicorer. All sediment cores were subsampled on board in slices 0.5cm to 2cm thick to measure in each of them carbon, nitrogen, biogenic silica, $^{14}C$, pigments and biochemical variables. In addition, $^{14}C$ and $^{210}Pb$ activities will be measured to calculate sedimentation rates and burial budgets for several variables. Grain size will also be measured to analyze the sedimentary dynamics in each zone and the availability of sediment for benthos as a potential food source.

Prokaryotes: 28 sea water samples throughout the water column (including surface, below the thermocline and close to the sea floor) and in the 5cm-long water column above the sediment-water interface were taken from the eastern Weddell Sea and Larsen A and B core stations to measure prokaryotic biomass and growth with flow cytometry. The aim of this effort is to estimate the availability of organic carbon to higher trophic levels through the microbial loop. Some samples were also fixed and filtered for counting prokaryotes by epifluorescence microscopy to calibrate flow cytometry data. Additionally, in Larsen A and B (a total of 5 stations) samples were filtered for subsequent bacterial DNA extraction, to explore changes in bacterial diversity in this area. Two more stations were sampled outside Larsen (Dundee and Snow Hill Islands) to compare prokaryotic assemblage structure among these zones.

In six stations, samples were taken at surface (from the CTD rosette) and on the water layer covering the sediment recovered by the multicorer. The objective was to analyze the increase of prokaryotic abundance through 10-day incubations and determine the net (in presence of predators) or gross (in the absence of predators) prokaryotic growth rates. Two different treatments were applied to remove or inactivate prokaryotic predators and allow the observation of total changes in prokaryotic abundance: 1) filtration and 2) addition of the eukaryotic inhibitor cycloheximide. The use of the antibiotic instead of filtration could be crucial especially in samples close to the sediment due to the high particle content, since filtration can also remove many prokaryotes attached to particles. Replicate samples of each treatment (unfiltered, filtered and cycloheximide-treated) were incubated at *in situ* temperature, and samples for prokaryotic abundance determination were taken daily. A total of 890 samples for flow cytometry analysis and 50 filters for epifluorescence microscopy were taken during these experiments. The comparison of the increase in prokaryotic biomass in unfiltered samples (with the presence of predators) and in filtered or cycloheximide-treated samples (with the absence or inactivation of predators) will allow estimating the impact of grazing upon prokaryotes. Finally, the comparison of surface sea water and that overlying the sediment will enable to analyze to which extent the supply of nutrients by sediment resuspension can enhance prokaryotic growth.

**Preliminary results**

CTD casts showed two distinct water masses at all stations except that in the eastern Weddell Sea, where the water column was homogenized. The thermocline was shallower at the Larsen “B_West” core-station. The water in the eastern Weddell Sea was colder and saltier than in the rest of the stations. Current meter measurements 40 meters above the seabed (mas) showed that at the Larsen “B_South” station, diurnal tides are the most evident feature in a short scale (9-day) experiment. The average current velocity increased throughout the sampling period describing what it could be a 15-day spring-neap tide period as occurs in the eastern Weddell Sea. Discrete velocity values varied between 1 and 32cm $s^{-1}$. Highest velocities occurred when the current flowed toward the North. The magnitude of the measured currents suggest that resuspension of sediment is feasible.

## 2.1.4 ECOLOGICAL DIVERSITY OF ANTARCTIC ECHINOIDS

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**Objectives**

The objectives of this study were to investigate the ecological diversity of echinoids collected on the shelves of the South Shetland Islands, Joinville Island and the Larsen embayments at different structural and functional levels. Three complementary aspects were examined in order to characterise the echinoid biodiversity in relation to particular environmental conditions (e.g. ice shelf collapse). (1) The first aspect dealt with the systematics and the spatial distribution (depth and geography) of the specimens collected. (2) The second aspect was to characterise the ectosymbiotic fauna associated with cidaroid echinoids, in which spines are used as microhabitats and ecological niches. The objective was to examine the potential effect of these ectosymbionts on local biodiversity in a given environment. (3) The third objective was to characterise the food and feeding behaviour of different species in two families, the Cidaridae and the Echinidae, respectively known as carnivorous and omnivorous echinoids. This trophic study implied the analysis of the gut content, of C & N isotopes, of lipids and the characterisation of the bacterial microflora. The expected results should contribute to determine the influence of food resources on the distribution of echinoid species as well as the potential response of these species to environmental changes in relation to their trophic categories.

## Work at sea

Echinoid biodiversity. The sampling of echinoids was undertaken by means of a bottom trawl, of two Agassiz trawls (large and small) and of a Rauschert dredge. Most of the specimens were fixed with denatured 96% ethanol. Some specimens were fixed separately with pure ethanol for further genetic analyses.

Cidaroids and their ectosymbionts. An estimation of the local diversity of the encrusted sessile fauna was realised by the examination of the stones collected with the Agassiz trawl. A sub-sample of stones was randomly selected, in which the level of encrustation was determined and the size of stones was measured. The comparison between the epizoans present on stones and the ectosymbionts encrusted on cidaroids was undertaken for the specimens collected with Agassiz trawls only. Cidaroids with ectosymbionts were fixed separately with pure ethanol. Representative specimens of epizoans encrusted on stones were fixed with denatured 96% ethanol.

Trophic analysis. Specimens of eurybathyal species were cut opened and gut pellets were picked up at the beginning and at the end of the digestive tract. Samples of gut pellets were both frozen at -27°C and fixed with pure ethanol. Pieces of muscle and gonads were cut off and frozen at -27°C. Whenever possible pieces of sea-weed were frozen for isotopic calibrating of upcoming analyses.

## Preliminary results

Echinoid biodiversity. A total of 1137 specimens of echinoids were sampled at 38 stations from 90m to 850m deep at all the localities investigated during the cruise (Table 2.3). 22 species which belong to five different families could be identified on board. This is a little more than one fourth of the total echinoid diversity recorded in the entire Antarctic so far. The sampled echinoid fauna is dominated by the Cidaridae (eight species) and the Schizasteridae (nine species), which are the two most diversified families in the Antarctic. They represent 77% of the species collected during the cruise. However, in terms of abundance, the Schizasteridae and the Cidaridae represent 10% and 37%, respectively of the collected specimens only. The most abundant echinoids are the two species *Sterechinus antarcticus* and *S. neumayeri* (family Echinidae) that represent 51% of the specimens collected. A sampling bias was noticed due to the type of trawl operating. Indeed, first results show that Agassiz trawls collected two times more specimens of Schizasteridae (with an average value of 4 specimens per trawl) and of Echinidae (33 specimens per trawl) than the bottom trawl (with respectively 2.4 specimens and 15 specimens per trawl). On the contrary, the two types of trawl collected exactly the same average quantity of Cidaridae (namely an average of 9.5 specimens per trawl). Therefore, it appears that the bottom trawl tends to under-sample both Schizasteridae and Echinidae compared to the Cidaridae.

The two families Urechinidae and Pourtalesiidae are weakly represented, in terms of abundance and diversity (Table 2.3). These families are mainly present in deep waters that were not investigated during the cruise. Among the 22 species collected, the three following ones might constitute new records in the Antarctic: *Cidaris* sp. 1, *Aporocidaris* sp. and *Cystocrepis* sp. Contrasting with the general echinoid diversity observed in the Antarctic Peninsula, shallow stations in the Larsen A and B areas yielded only three species of echinoids, sampled either on rocky or muddy substrates: *Sterechinus antarcticus* and *S. neumayeri* which are present at all the stations and more sporadically the cidaroid *Notocidaris mortenseni*. Larsen embayments showed a very low diversity compared to the 33 species known from the Weddell Sea. A possible explanation for such a low diversity could be that most echinoids from the Weddell Sea are direct developers that brood their young and accordingly they are supposed to present low dispersion capabilities.

On the contrary, the three species found in Larsen A and B do not brood their young and data from literature suggest that all of them are indirect developers. This is an advantage for pioneer species and might have permitted a fast dispersion into the Larsen area. Moreover, this observation is consistent with the wide Antarctic distribution of these species. The so-called “B_Seep” station in the deep Crane Trough of Larsen B yielded specimens of *S. antarcticus* as well as two species of the deep-sea family Pourtalesiidae: the species *Pourtalesia debilis*, already known from deep stations of the Antarctic continental shelf, and a broken specimen that shows strong affinities with the genus *Cystocrepis*, which is only known in deep waters off the coasts of South and North America. Members of the family Pourtalesiidae are considered as indirect developers with demersal larvae, so that their presence in the Crane Trough may be related to capabilities for fast dispersion, like species encountered in shallow stations.

Table 2.3 Echinoids collected during ANT-XXIII/8. Underlined numbers indicate stations where specimens were sampled for trophic analysis; (*) indicate where stones and cidarids were sampled for the comparative study of the sessile fauna.

| Species | Stations |
|---|---|
| **Cidaridae** | |
| *Notocidaris mortenseni* | 603-5*, 604-1, 609-1, 654-6*, 702-9*, 710-5*, 721-2*, 725-6* |
| *Ctenocidaris perrieri* | 603-5* |
| *Ctenocidaris gigantea* | 603-5*, 604-1, 608-1, 609-1, 651-1, 689-3* |
| *Ctenocidaris* sp. | 604-1, 605-3*, 608-1, 609-1, 627-1, 642-1*, 650-1, 651-1, 652-1, 654-3*, 654-6*, 689-3*, 697-1, 728-2 |
| *Aporocidaris milleri* | 651-1, 652-1, 653-1, 697-1 |
| *Aporocidaris* sp. | 637-1, 650-1, 651-1, 652-1, 653-1, 654-3*, 654-6*, 661-2 |
| *Cidaris* sp. 1 | 661-2, 663-1 |
| *Cidaris* sp. 2 | 604-1, 609-1 |
| **Echinidae** | |
| *Sterechinus antarcticus* | 654-6, 668-1, 685-1, 687-1, 689-3, 697-1, 700-2, 700-4, 702-9, 703-2, 710-5, 710-6, 711-7, 721-2, 725-6 |
| *Sterechinus neumayeri* | 721-2, 722-4, 725-6, 726-1, 726-4, 728-2 |
| *Sterechinus* sp. | 603-5, 604-1, 652-1, 653-1 |
| **Urechinidae** | |
| *Antrechinus mortenseni* | 653-1, 654-6, 661-2, 689-3, 697-1 |
| **Pourtalesiidae** | |
| *Pourtalesia debilis* | 711-7 |
| *Cystocrepis* sp. | 711-7 |
| **Schizasteridae** | |
| *Amphipneustes similis* | 604-1, 605-3, 606-1, 608-1, 609-1, 614-3, 627-1, 654-6, 661-2, 687-1, 689-3 |
| *Amphipneustes lorioli* | 637-1, 654-6, 689-3, 697-1, 726-4, 728-2 |
| *Amphipneustes bifidus* | 603-5 |
| *Tripylus reductus* | 728-2 |
| *Abatus cavernosus* | 614-3, 642-1, 654-3, 680-5, 689-3 |
| *Abatus bidens* | 614-3, 728,2 |
| *Abatus elongatus* | 637-1, 654-6, 687-1, 728-2 |
| *Abatus curvidens* | 680-5 |
| *Brachysternaster chesheri* | 606-1, 608-1, 697-1 |

Cidaroids and their ectosymbionts. Ranging from 137m to 854m deep, either on rocky or muddy substrates, 14 stations were investigated with the Agassiz trawl, including eastern Weddell Sea (1 station), the South Shetlands and Joinville Island (6 stations) as well as Dundee Island and Larsen A & B areas (7 stations). First observations show that the density of encrustation by epizoans and the species richness of those epizoans are highly variable both on stones and cidaroids. Moreover, very first results suggest that variations on cidaroids and on stones are independent. Ectosymbionts were found encrusted on the spines of five species of cidaroids, namely *Ctenocidaris perrieri, C. gigantea*, *C.* sp., *Notocidaris mortenseni* and *Aporocidaris* sp. According to the preliminary results, the species richness of epizoans encrusted on stones seems to be more important than that one of ectosymbionts fixed on cidaroids. However, the spines of cidaroids are in part encrusted by a particular sessile fauna (mainly holothurians, bivalves and colonial ascidians), that was not found encrusted on stones, and that would participate to increase the local species richness, independently of the rocky or muddy nature of the bottom. This is consistent with previous observations realised in the Antarctic deep waters (expedition ANT-XXII/3). The symbiotic holothurians, bivalves and ascidians usually found on the spines of cidaroids were not present in the specimens of *N. mortenseni* collected at Larsen A and B. The absence of these ectosymbionts does not seem to be counterbalanced by the abundance of other groups (like bryozoans, hydrozoans or polychaetes), so that species richness of ectosymbionts is low in the Larsen areas. These results suggest a direct or indirect influence of the environment on certain ectosymbionts.

Trophic analyses. Specimens of two species of omnivorous echinoids (Echinidae) and four species of carnivorous echinoids (Cidaridae) were collected for trophic analyses, at stations of contrasting water depths (from -163m – 458m) and latitudinal positions (from 61°04.27'S to 65°57.85'S, see Table 2.3). The specimens were collected on both sides of the Antarctic Peninsula, off the coasts of the South Shetland Islands and Joinville Island (West Peninsula) as well as off Snow Hill Island and in the Larsen A & B areas (East side), that is in different biogeographical areas and environmental conditions. Hence, after completion in laboratory, trophic analyses should contribute to test the effect of factors such as biogeography, depth and latitude on food resources and feeding behaviours in echinoids. Along with previous data (expedition BENTART'06), these results are expected to give an overview for the entire Antarctic Peninsula. More specifically, the specimens sampled at different depths in Larsen B are expected to give interesting results relative to food resources of pioneer species of different trophic categories (known as omnivorous and carnivorous) in a newly colonised area.

## 2.1.5 DIVERSITY OF SPONGES WEST AND EAST OF THE ANTARCTIC PENINSULA

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### Objectives

The main purpose of this expedition project was the investigation of diversity and abundance of the sponge fauna in the formerly ice-shelf covered Larsen A and B areas compared to the “normal” shelf fauna found e.g. in the eastern Weddell Sea and adjacent areas. Furthermore, to discover possible ecological gradients between reference sites of the Larsen areas and to investigate genetic distances within hexactinellid taxa on the shelf compared to the deep-sea. Key questions: How do abundance, diversity, and individual body sizes of sponges respond to permanent ice cover? Are bottom types a controlling factor for sponge diversity in the Larsen A and B areas? Which kinds of faunal associations exist?

Working hypothesis: “Areas under permanent ice covering will reveal higher proportions of deep-sea sponges than the surroundings because these taxa are generally better adapted to life under difficult conditions, such as food limitation. The body size of deep-sea sponges is generally smaller than that of shallow water species: dwarfism can be expected among the Demospongiae and Calcarea” (from the expedition programme Nr. 77, pp. 29-30).

Table 2.4 Species numbers of main sponge taxa collected during the CCAMLR-fisheries-programme by BT, and during the night by the small AGT. Only BT hauls, in which the sponges were sorted out by the author personally, are listed. However, the total species numbers (bottom line) include all sponge species observed in BT or AGT during this period. AGT no. 5 and 6 did not contain any sponges. (AGT= Agassiz trawl, BT = bottom trawl).

| Taxa | Hexactinellida | Demospongiae | | | | | |
|---|---|---|---|---|---|---|---|
| | Rossellidae | Astro-phorida | Spiropho-rida | Hadromerida | | Poecillo-sclerida | others |
| Station no. | | | Tetillidae | Latruncu-liidae | others | | |
| 603, AGT1 | 12 | 1 | 1 | | | 3 | 1 |
| 605, AGT2+3 | | | | | | 1 | 4 |
| 605, 606, BT | 2 | | 1 | | | 4 | 2 |
| 608, BT | 8 | | 1 | 1 | | 3 | 5 |
| 614, AGT4 | | | 1 | 1 | | 2 | 5 |
| 617, 621, BT | | | | 1 | | 2 | 5 |
| 629, 637, BT | 2 | | 1 | | | 1 | 2 |
| 639-642, 644, 646, BT | | | 1 | | | 3 | |
| 647, 650, BT | 4 | | 1 | 1 | 1 | | 1 |
| 651, 654, BT | 4 | | 2 | | 1 | 3 | 4 |
| 654, AGT7+8 | 5 | | 2 | 1 | 2 | 2 | 4 |
| 660-664, BT | 3 | | 1 | | 1 | 4 | 3 |
| 680,AGT9+10 | 1 | | 1 | | | | |
| 690, 693, BT | 5 | | | | | 2 | 1 |
| 695, 697, BT | 5 | | | | | | |
| Σ | 14 | 1 | 3 | 2 | 3 | 18 | 26 |

## Work at sea

All sponges from the Agassiz trawl (AGT) and a representative selection from the bottom trawl (BT) were sampled, in order to include all species collected. The sponges were photographically documented, and samples were fixed for different investigation methods, such as skeletal (spicula) preparations, histology, electron microscope and/or molecular biology. At the Larsen A and B stations, as a semi-quantitative approach, all sponges (along with organisms collected by other working groups) from the AGT catches, or from a subsample comprising two baskets, were evaluated quantitatively: All specimens were collected, photographed, total wet weight of each species was measured, and the sponges were fixed for later taxonomic determination. As many spicula preparations as possible (120 all together) were made and studied on board in order to make a first evaluation of the taxonomic composition of the fauna as a whole. Additionally, the ROV photos taken in the Larsen A and B areas and at the reference stations were studied carefully to find sponges and any other relevant information; the results were incorporated in the general evaluation of the entire sponge fauna.

### Preliminary Results

Most shelf regions of the Weddell Sea, Elephant Island, and the South Shetland Islands are largely dominated by sponges, often in terms of both biomass and their ecological role as habitat for other animals. According to preliminary identifications and cautious estimates, a total of 102 sponge species were collected from the catches of this expedition. For Porifera (and for megabenthos in general), this can be considered a high species diversity. The numbers of collected sponge species within higher taxa in the main research areas is shown in Tables 2.4 – 2.6. However, the diversity at the species level, as well as higher taxonomic levels, is very different between the three sponge classes: 83 species belong to the class Demospongiae, 18 species to the class Hexactinellida and only 1 species to the class Calcarea. The Demospongiae thus account for, by far, the most species and higher taxa as well: According to the first evaluation, seven demospongid orders are represented within the collections of this expedition. Thus, the diversity of Demospongiae is comparable to that of the deep Weddell Sea (Janussen & Tendal in press), or even slightly higher.

Table 2.5 Species numbers of main sponge taxa collected at the stations in the Larsen A and B areas (GKG = giant box core, RD = Rauschert dredge).

| Taxa | Hexactinellida Rossellidae | Calcarea Calcinea | Demospongiae Hadromerida | | Poecilosclerida | | others |
|---|---|---|---|---|---|---|---|
| Station no. | | | Polyma-stiidae | others | Clado-rhiszidae | others | |
| 700-2, BT | 1 | | | | | 1 | 1 |
| 700-4, AGT11 | 1 | | | | | | 1 |
| 702-3, GKG | | | 1 | | | | |
| 702-9, AGT12 | 4 | 1 | | 1 | 1 | 2 | 1 |
| 702-9, RD | 3 | | | | | | |
| 703-2, BT | 1 | | | | | | |
| 703-3; AGT13 | 1 | | 1 | | | | |
| 710-5, AGT14 | 1 | | 1 | | | | |
| 710-6, BT | 1 | | | | | | |
| 711, AGT15 | | | | | | | 1 |
| 715-1, BT | | | | | | 1 | |
| 716-1, AGT16 | 2 | | | | | 1 | |
| 721-2, AGT 17 | 3 | | | | 1 | 1 | 3 |
| 722-4, AGT18 | | | | | | 1 | |
| 725-5, GKG | | | | | | | 3 |
| 725-6, AGT19 | 4 | | | | | | 3 |
| Σ | 12 | 1 | 4 | 1 | 2 | 6 | 13 |

Although it is not possible at this stage to give a list of families and genera collected, it is obvious that the Poecilosclerida are best represented within the collected sponge taxa Hadromerida, Halichondrida and Spirophorida follow far behind. The Astrophorida are represented by only one species collected once, at the eastern Weddell Sea station (# 603-5). The Hexactinellida, 18 species, show only moderate diversity, although at some stations (e. g. # 603-5) they are very dominant in terms of biomass, mainly because of the “giant”-sized *Rossella* specimens. However, most of the spectacular Antarctic shelf fauna of “giant” Hexactinellida is composed of only 5-6 rossellid species. Calcareous sponges are almost absent from the collected sponge fauna. Only one species, represented by two very small specimens, were caught at the Larsen “B_South” station (# 702-3).

Table 2.6 Species numbers of main sponge taxa collected from the reference stations at Snow Hill and Dundee Island (# 726 and # 728).

| Taxa | Hexactinellida | Calcarea | Demospongiae | | | | |
|---|---|---|---|---|---|---|---|
| | Rossellidae | Calcinea | Hadromerida | | Poecilosclerida | | others |
| Station no. | | | Polyma-stiidae | others | Clado-rhiszidae | others | |
| 726-2, RD | 1 | | | 1 | | | 3 |
| 726-4, AGT20 | 1 | | | 1 | | 3 | 7 |
| 728-2, AGT21 | 4 | | | | | 2 | 9 |
| Σ | 6 | | | 2 | | 5 | 3 |

## Discussion and possible implications

It is a commonly observed feature that even at small geographic scales the occurrence of sponge species is pronouncedly patchy. During this expedition, the stations produced very different sponge assemblages, some of which appear to be characteristic of certain types of environments. At localities in the Weddell Sea (# 603-5, West of Atka Bay) and the South Shetland Islands we found a Hexactinellida-dominated sponge community consisting of numerous very large and also smaller *Rossella* spp., whereas comparably few Demospongiae were observed. Another common assemblage, which we found at many stations around Elephant Island (e. g. #604-4 and 605-1, 50-285 m), consists of a few very large *Rossella* specimens and rather abundant massive or fan-shaped Demospongiae, mainly belonging to the taxa Poecilosclerida and Halichondrida. Another sponge association, which we typically found on soft bottoms, is to a large degree, sometimes exclusively, composed of Tetillidae, represented by two to three species of *Tetilla* and two species of *Cinachyra*. These sponges either possess long root tufts or are mud stickers without special root spicules, sitting with the basal part of their bodies directly buried in the sediment. Also some Hexactinellida and smaller Rossellidae with root tufts of pentactine and diactine spicules (young specimens of the *Rossella* cf. *racovitzae* species complex?), are typical pioneer colonizers of muddy soft bottoms. At higher taxonomic levels the diversity of the Hexactinellida on the shelf is considerably lower than in the deep Weddell Sea, where at least 5 families occur (Janussen *et al.* 2004).

Contrary to this, the Hexactinellida of the "normal" Weddell Sea shelf are represented almost exclusively by the family Rossellidae and to a minor part by the Euplectellidae.

Table 2.7 Sponges collected in the deep-sea during ANDEEP I-III and on the shelf during ANT-XXIII/8 (preliminary identifications). The figures give the numbers of localities and by which gear each taxon was collected during the two research programmes: CCAMLR fisheries, including the night programme, and CAML/EBA benthos programme.

| ANDEEP I-III and ANT-XXIII/8 | Elephant Isl. South Shetland Isl. Joinville Isl. | Larsen A & B | Snow Hill & Dundee Islands |
|---|---|---|---|
| Hexactinellida, Rossellidae, *Rossella* spp. | about 100 hauls, BT + AGT | 7 hauls, BT + AGT *Rossella* spp. + *Caulophacus* sp. (!) | In 3 hauls, AGT *Rossella* spp |
| Euplectellidae: | | (?) 1 haul, BT | |
| Demospongiae, Spirophonida, Tetillidae: *Cinachyra* + *Tetilla* spp. | 22 hauls, BT + AGT | | 1 haul, AGT |
| Hadromerida:*Latrunculia* | 5 hauls, BT + AGT | 1 haul, AGT | |
| *Rhizaxinella* | | (?) 1 haul, AGT | |
| Polymastiidae: *Tentorium* | 2 hauls, BT + AGT | | |
| *Polymastia* cf. *invaginata* | | 2 hauls, GKG + AGT | |
| Poecilosclerida: *Mycale* | 5 hauls, BT + AGT | | 1 haul, AGT |
| *Myxilla* + *Isodictya* | 6 hauls, BT + AGT | 2 hauls, BT + AGT | 1 haul, AGT |
| Cladorhizidae: | | | |
| *Chondrocladia* 2 sp. | | 2 hauls , AGT | |
| Others: *Tedania* cf. *tantula* | | | 1 haul, AGT |
| Calcarea:*Clathrina* (?) | | 1 haul, AGT | |
| All together: 28 | 10 | 11 | 7 |

Compared to the deep-sea sponge fauna collected during the ANDEEP expeditions, there is considerable overlap in taxonomic composition. In the material from this expedition, so far 16 species preliminarily identified are also part of the ANDEEP I-III collection (a preliminary list of common species is given in Table 2.7). Some of these species, such as *Rossella* spp., several Hadromeridae (e. g. *Polymastia*), Poecilosclerida (e. g. *Mycale acerata*, *Myxilla mollis*) and others (*Tedania* cf. *tantula*) are obviously eurybathic in the Antarctic Ocean, with a depth range from about 100m down to about 3000m. These wide depth ranges in the Antarctic Ocean are known also from the literature (e. g. Barthel & Tendal 1990). Eurybath species typically comprise a major part of the sponge fauna around the South Shetland, Elephant and Joinville Islands, but they were found only in small numbers in the Larsen A and B area. Compared with the deep Weddell Sea, the Hadromerida is a rather rare taxon in the present collection; e.g. *Tentorium papillatum* a sponge fairly commonly found in the ANDEEP catches, was taken during this expedition only at one locality (# 654, 240–350m). *Polymastia invaginata* may be called a “character sponge” of the Weddell Sea. According to literature, it is found commonly especially in the eastern Weddell Sea, and it was collected on many ANDEEP stations as well, sometimes in large numbers and down to at least 5000m depth (Janussen & Tendal, in press). During the present expedition, it was collected only 3 times, and all specimens were very small (juvenile), and had apparently settled at the Larsen B shelf only recently.

The sponge association found in the Larsen B area is much impoverished in both diversity and abundance compared to the “normal” Weddell Sea shelf. In the view of the two reference stations (# 725, # 726) this becomes especially obvious; it puts the Larsen B fauna into perspective and exhibits the severe limitations which still act on this extreme environment. Furthermore, the sponge association collected at Larsen B shows several characteristics of deep-sea fauna. At the Larsen “B_South” station (# 702-9, 200 m), which was by far the most diverse station of the Larsen B area, we collected: The hexactinellid genus *Caulophacus*, which was found as isolated stalks of 6 specimens, is a very characteristic abyssal sponge in the deep Southern Ocean (Janussen *et al.* 2004). The same is true for a species of the carnivore demosponge family Cladorhizidae (probably *Chondrocladia* spp.), which was collected at Larsen B. To some extend also *Rhizaxinella* sp. (part of the ANDEEP-fauna, to be described) is more or less a deep-water species, which was probably collected once at Larsen B. We consider the fact that several specimens of each of these taxa were taken, only at Larsen A and B, as confirmation of the working hypothesis that the Larsen Shelf was colonized at least to some degree by deep-sea taxa. This is probably due to the fact that these sponges are better adapted to life under limited and inconsistent input of suspended nutrients compared to the usual condition on the Antarctic shelf. Furthermore, at least two of the very abundant holothurian species collected on Larsen B are deep-sea species (reported by J. Gutt, this volume). Also at least one abyssal species of irregular echinoids was collected at Larsen B (reported by T. Saucède, this volume).

The poor catches of Calcarea are a surprise, since calcareous sponges according to literature are well known from shallow depths of the Southern Ocean, and during ANDEEP they were discovered also in the deep Weddell Sea, including the abyssal plain at depths of more than 4000m (Janussen *et al.* 2003). The fact that Calcarea were caught only once at the Larsen “B_South” station (# 702-9), and that these were very small specimens might indicate that on the Antarctic shelf Calcarea are more or less restricted to water depths shallower than our working depths (which was below 100m). This would contradict the hypothesis launched by D. Janussen earlier that the Calcarea have invaded the Antarctic deep-sea from the shelf. Instead it rather indicates their invasion into the deep Southern Ocean via abyssal routes from other deep-sea regions.

All together, the faunal differences between the Larsen B area and the "normal" Weddell Sea and the South Shetland, Elephant, and Joinville Islands are significant. According to our findings, the Larsen B area is less densely populated by sessile animals, and sponges are not very abundant. The occurrence of sessile animals is controlled, at least to some degree, by bottom type and the availability of substrates, such as stones. As could be observed by the ROV, e.g. at Larsen "B_North" station (#716), solitary stalked ascidians grew on almost every rock available. Also the hexactinellid sponges collected were found to contain smaller stones incorporated in their basal root tufts, serving as an anchor. Demosponges observed by ROV at Larsen "B_Seep" station (# 706-2) in the vicinity of the former cold seep had obviously settled on the dead shells of *Calyptogena* sp. The considerable body size of the sponges growing on these shells indicates that the cold seep activity feeding these bivalves ought to have ceased several years ago. But also other factors, such as the sedimentation, play an important role for the local distribution of benthic animals. Especially lack of suitable hard substrates and large amounts of mud create an environment unfavourable for these sessile suspension feeders.

At Larsen A the sponges appeared to be more abundant and diverse, and also larger hexactinellids (up to ca. 50cm high) were observed on the ROV-photos. Station #725 was characterized by sandy-rocky bottom and many sessile animals, including sponges, of which 10 species were collected. Compared with the extreme environment of Larsen B, in terms of sponges the Larsen A area shows more similarity with a "normal" Weddell Sea Shelf fauna. Compared to other Weddell Sea areas, the sponges at Larsen A and B are generally smaller in body size. However, ROV photos revealed that large sponges do occur; most were seen at Larsen A, but a few also at Larsen B. At station # 686-1 (Larsen "B_South" station) *Rossella* cf. *racovitzae* and several other *Rossella* spp. were photographed, many of them were 40-50cm high. This considerable size proves that these sponges have been thriving there for a longer time, before the shelf ice at Larsen B disintegrated. Nevertheless, the Larsen B shelf area, even more so than the "normal" Southern Ocean, was, and probably still is, an extreme environment.

**First conclusions**

- At both Larsen A and B mostly smaller sponges, some obviously juvenile, were found. Part of the sponge fauna, especially in the Larsen B area, appears to be young and probably settled after the disintegration of shelf ice cover.
- The sponge association in the Larsen B area is impoverished in both in diversity and abundance compared with the Eastern Weddell Sea, the fisheries stations and the reference locations. An exception was station Larsen "B_South" with 13 species, including 1 species of calcareous sponges, the only one found during this expedition.
- Sponge fauna observed at Larsen A was richer, more like a "normal" shelf fauna.

- Larsen A and B sponge fauna showed characteristics of deep-sea fauna, at least 2 abyssal species.• Bottom types play an important role for sponge abundance and diversity.

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## 2.1.6 SYSTEMATIC AND ECOLOGICAL DIVERSITY OF AMPHIPODS

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### Introduction

Knowledge of the rich amphipod fauna of the Antarctic shelf ecosystem is still scanty and deserves extensive further studies, both in morphological and molecular systematics. Too little is known about the colour pattern of live animals, despite it is often a very useful identification tool in field conditions. The geographical and ecological distribution of many species is still poorly known as a result of the patchiness of previous samplings. Filling such gaps is a prerequisite for assessing the impact of the global warming expected to occur in the coming decennia, since species with a restricted distribution are more vulnerable than others. On the other hand, the various ecological roles (such as commensalism and necrophagy) played by the diverse Antarctic amphipod species are insufficiently understood and require more thorough investigations. Amphipod taxocoenoses present under ice-shelves are virtually unknown, since in normal conditions they are almost completely out of reach. The recent collapsing of the former Larsen A and B ice-shelves offers a unique opportunity to study them.

### Objectives

- To document the faunistical, zoogeographical and ecological traits of the amphipod taxocoenoses of the Western Weddell Sea and the northern islands of the Antarctic Peninsula.

- To discover new species of various families, and to collect material for taxonomical revisions and phylogenetic studies of selected higher taxa (e.g. Lysianassoidea and Liljeborgiidae).
- To extract DNA of the aforementioned taxa for future sequencing of genes (such as the 16S, 18S and the COI) useful for detecting cryptic species and for studying phylogeographical issues.
- To contribute by taxonomical + photographic material and distributional + ecological data to the preparation of the "Synopses of Antarctic Amphipods" edited by De Broyer *et al.* and to expand the "Ant'Phipoda" Antarctic amphipod database.
- To discover new symbioses and to document them by photographs.
- To compare the scavenger guilds (amphipods and isopods) from different areas, depths and biotopes by the use of baited traps.

**Work at Sea**

Material has been collected with Rauschert dredge, Agassiz trawl, bottom trawl and baited traps in the vicinity of the South Shetland Islands, including Elephant and King George Islands, of Joinville Island, at the NE tip of the Antarctic Peninsula (western Weddell Sea: off Dundee and Snow Hill Islands), in the Larsen A and B areas and at a single station in the eastern Weddell Sea. Specimens have been sorted out on board. Most of them have been identified and photographed before fixation. For symbiotic species, *in situ* photographs were made whenever possible. Photographs were carried out with a Nikon 'Coolpix 4500' and a Canon 'Powershot S3 IS' digital cameras mounted on a tripod Cullmann 'Video 3200' and using a Euromex fiber optic light source EK-1. The proportion of different species in amphipod traps (Amphipoda and also Isopoda) has been assessed when time was available. DNA extraction has been carried out for selected taxa (*Eusirus* spp, Liljeborgiidae, Lysianassoidea, Oedicerotidae).

**Preliminary results**

Systematics. 147 taxa have been sorted out and identified to the family, genus or species level (Table 2.8) and 134 species have been photographed. DNA extraction has been carried out for 36 species and whenever possible specimens from different stations have been extracted. 18 amphipods are considered as probable new species. The most difficult groups have not yet been examined; hence the number of new species in the material could be higher. Several probable new species are large and sometimes spectacular, and some are locally not uncommon. For example, it was a surprise to find a new giant *Eusirus* species of the group *perdentatus* (caught in baited traps immersed at 830m depth) and a large and spectacular new *Epimeria* close to *E. reoproi* (Fig. 2.7). *Rhachotropis antarcticus* sensu lato was represented by two colour morphs: one with a bright red and one with a purplish red colour pattern. *Maxilliphimedia longipes* was also represented by a brown and a red morph. The systematic status of these colour morphs requires further investigations. Antarctic *Leucothoe* of the complex *spinicarpa* have a colour pattern with reddish brown mottling, which is not the case in specimens from Northern Norway seen by the first author, which have a uniform whitish colour. This suggests that *L. spinicarpa* is not a cosmopolite species as often claimed in literature but a complex of closely related species. Beside *Echiniphimedia imparidentata* sensu stricto, two forms close but not identical to the type (one specimen of each form) have been collected (Fig. 2.5). They could be new species. Furthermore the hedgehog-like *E. hodgsoni* sensu lato was represented in the samples by two morphotypes (with spines of different length and slenderness). They are possibly separate species. Still in the genus *Echiniphimedia*, the material collected includes a form similar to *E. scotti* but also showing differences with illustrations from literature (posterior dorsal spines more numerous and more slender). Beside the common lysianassoid *Waldekia obesa*, two species with a similar yellowish colour pattern were found. None of them had a tooth-like urosomal process, and one of them exhibited a tooth pointing laterally on the coxa of the fifth pereiopod. They are likely to be new species. In the samples, the genus *Lepidepecreoides* was represented by two species of similar size. One corresponds to *L. xenopus* as illustrated by Lowry & Stoddart (2002), while the second has a much longer posterior spur on the basis of the fifth pereiopod and the anterior segments of its body are dorsally humped. It is interpreted as a probable new species. The single specimen of the genus *Shackletonia* (a rarely recorded genus) is probably new (De Broyer, pers. comm.). The single specimen referred to the genus *Liouvillea* collected during the cruise has no dorsal teeth as in *L. oculata*, so it is likely to be a new species. Finally a totally aberrant stenothoid with a *Stegosaurus*-like dorsal crest probably belongs to a new species if not to a new genus.

Range extensions. All data from the Larsen area are new records and many species are recorded for the first time from the waters surrounding Elephant and Joinville Islands and the tip of the Antarctic Peninsula (Table 2.8). Whilst most range extensions are not very important, a few species: *Echiniphimedia imparidentata, E. waegelei*, *Gainella chelata*, *Liljeborgia quadridentata*, *Tiron antarcticus*, *Tryphosella macropareia* have been found in stations widely separate from previously known localities.

Symbioses. Sponges prove to be a habitat of predilection for many amphipods. A tiny yellow stegocephalid (*Andaniotes* or *Glorandaniotes* sp.) was found in large number inside desmosponges. Three lysianassoids were also found inside sponges: *Aristias antarcticus*, *Gainella chelata* and *Orchomenyx* sp 1. *Alexandrella dentata* was found amongst large grey hexactinellid sponges at St 725-6 (it was the only amphipod found at this station). Its colour perfectly mimicked those sponges; hence it is interpreted as a probable sponge associate. Young *Chosroes decoratus* have been found in large number on the surface of various species of corticated sponges. It was possible to document photographically that one of the *Echiniphimedia* cplx *imparidentata* discovered during the campaign dig holes into giant candle-like sponges (cf *Homaxinella* sp) and that juveniles of an unidentified more spiny representative of the same genus sometimes cluster on the same sponge species (Fig. 2.5). The lysianassoid *Orchomenyx* sp 2 (which is remarkably close to *O*. sp 1) has been found inside huge solitary ascidians. Large lysianassoids of the genus *Adeliella* have been found inside the body cavity of holothurians from the Larsen B. No such association was known between holothurians and lysianassoids.

<u>Remarkable amphipod taxocoenoses.</u> A few stations hosted amphipod taxocoenoses of an exceptional faunistical composition, with numerous and often unusual species: St 654-6 and 654-7 (Elephant Island), community with abundant epifauna dominated by *Flustra*-like bryozoans; St 726-1 ("SHI", N of James Ross Island), community with rich epifauna including stalked and slender-branched sponges; St 702-9 and 721-2 (Larsen "S_South"), community dominated by pink and white hydrocorals (stony bottom).

<u>Traps.</u> Thousands of crustaceans (mostly lysianassoid amphipods) have been collected in baited traps. Although the diversity per catch was always low, the specific composition varied significantly with areas, depth and even between a priori similar stations. Most species found in traps were not collected with trawls and dredges. The species found in the traps have been separated and whenever possible identified (Table 2.8). Several species locally common in the traps could not be identified on board and are potentially new ones. The number of individuals per species has been counted when time was available:

- Elephant Island, St 625-3, 257m depth, 8 traps sorted: 3106 crustaceans; 3.0% of *Abyssorchomene plebs*, 11.7% of *Orchomenopsis* sp 'orange-coloured', 70.0% of cf *Uristes* sp, 5.9% of *Natatolana intermedia* (Isopoda), 9.0% of *N. oculata* (Isopoda).
- Larsen B ("B_South", SE margin of former ice-shelf), St 698-1, 390m, 2 traps sorted: 875 crustaceans; 91.0% of *Abyssorchomene plebs*, 2.6% of *A. rossi*, 0.1% of *Parschisturella carinata*, 0.3% of *Tryphosella murrayi*, 4.3% of lysianassoid 'cup-eyed', 0.1% of *Natatolana intermedia*. A single *Waldekia obesa* was found in a third trap which has not been fully sorted.
- Larsen B ("B_West", within former ice-shelf), St 705-1, 310m, 4 traps sorted: 173 crustaceans; 99.4% of *Abyssorchomene plebs* (mostly tiny juveniles), 0.6% of *Abyssorchomene scotianensis*.
- Larsen B ("B_Seep", within former ice-shelf), St 706-7/706-8, 850m, 3 traps sorted: 127 crustaceans; 13.4% of *Abyssorchomene plebs*, 86.6% of *Abyssorchomene scotianensis*.
- Larsen B ("B_North", within former ice-shelf), St 713-1, 301m, 2 traps sorted: 4864 crustaceans (4460 in one trap); 99.94% of *Abyssorchomene plebs*, 0.04% of *Tryphosella murrayi*, 0.02% of *Abyssorchomene scotianensis*.

<u>Amphipods of the Larsen area.</u> The general impression was that the amphipod diversity within the Larsen A was low (only 11 species were found), but only a very few stations were sampled. At the SE margin of the Larsen B

former iceshelf ("B_South", St 702-9 and 721-2), the amphipod diversity was high (27 species were found). On the other hand deeper into the Larsen B embayment (B_West", "B_Seep", "B_North"), trawling, dredging and trapping operations indicated (1) that the diversity of amphipods was remarkably low (only 4 species were collected) and (2) that their abundance was locally much reduced. The holothurian-dominated mud community was particularly poor in amphipods, since several trawling operations on such bottoms did not yield a single specimen. The trapping operations suggest a very patchy distribution of scavenger amphipods in the Larsen B embayment. There were only 43 specimens per trap at St 705-1, 42 specimens per trap at St 706-7 and 706-8, but no less than 2432 specimens per trap at St 713-1.

Table 2.8 List of species (provisional identifications) per area, with indications of those which were photographed and for which DNA extractions were carried out. Species indicated by "!" are possibly or probably new for science. Records followed by 'T' between brackets consist of material collected in baited traps. Records followed by a star are important range extensions. Areas: Elephant Island (EI): St 604 to 654; King George Island (KGI): St 660-681; N of Joinville Island (JI): St 683-700; South of the Antarctic Sound, Snow Hill Island (SHI): St 728; Dundee island (DI): St 726; Larsen A (LA): St 722-725; Western Larsen B (WLB): St 703, 705, 706, 713, 718; SE margin of Larsen B (ELB): St 698, 700, 702, 721; Akta Bay (AB), St 603.

| AREAS + TASKS | EI | KGI | JI | SHI | DI | LA | WLB | ELB | AB | Ph. | DNA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ACANTHONOTOZOMELIDAE | | | | | | | | | | | |
| *Acanthonotozomoides* sp | | | | | | | | X | | | |
| AMATHILLOPSIDAE | | | | | | | | | | | |
| *Parepimeria crenulata* | | | X | | X | | | | | + | |
| *Parepimeria* cf *minor* | | | | | X | | | | | + | |
| ! *Parepimeria* sp aff *major* | | | | | | | | X | | + | |
| cf *Parepimeria* sp | | | | | X | | | | | + | |
| AMPELISCIDAE | | | | | | | | | | | |
| *Ampelisca* spp | | | | | | | | | | | |
| (mostly *A. richardsoni*) | X | X | X | X | X | | | | X | + | |
| *Haploops securiger* | X | X | | X | X | | | | | + | |
| CAPRELLIDEA | | | | | | | | | | | |
| *Aeginoides gaussi* | | | | | | | | X | | + | |
| *Phtisica* sp. | X | | | | | | | | | | |
| COROPHIOIDEA | | | | | | | | | | | |
| (excl CAPRELLIDEA) | | | | | | | | | | | |
| Corophioid | | | | | | | | | | | |
| 'large; basally-red antennae' | X | X | | | | | | | | + | |
| Corophioid | | | | | | | | | | | |
| 'small; transversally striped' | X | | | | | | | | | + | |
| *Gammaropsis* sp 1 | X | | | | | | | | X | | |
| *Gammaropsis* sp 2 | | | | | X | | | | | + | |
| *Haplocheira* sp | | | | X | | | | | | + | |
| Isaeidae n det 'mottled' | | | X | | | | | | | + | |
| Ischyroceridae | | | | | | | | | | | |
| n det 'from hydroids' | | X | | | | | | | | + | |
| Ischyroceridae n det 'yellow' | | | X | | X | | | | | + | |
| cf *Ischyrocerus* sp | | | | | X | | | | | + | |
| *Jassa* cf *goniomera* | X | | | | | | | | | + | |
| *Jassa* sp 'large and setose' | | | | | X | | | | | + | |

| AREAS + TASKS | EI | KGI | JI | SHI | DI | LA | WLB | ELB | AB | Ph. | DNA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Pseuderichtonius* spp | X | | X | | | X | | X | | + | |
| DEXAMINIDAE | | | | | | | | | | | |
| *Paradexamine fissicauda* | | X | | | | | | | | + | |
| *Polycheria* sp | | | | X | | | | | | + | |
| EPIMERIIDAE | | | | | | | | | | | |
| *Epimeria anabellae* | | | | | | | | | X | | |
| *Epimeria georgiana* | X | | X | | X | | | | | + | |
| *Epimeria grandirostris* | X | | | | | | | | | + | |
| *Epimeria macrodonta* | X | | X | X | X | X | | X | X | + | |
| *Epimeria oxicarinata* | X | | | | | | | | | + | |
| *Epimeria pulchra* | X | | | X | | | | | | + | |
| *Epimeria reoproi* | X | | | | | | | | | + | |
| *Epimeria robusta* | | X | | | | | | | X | + | |
| *Epimeria similis* | X | X | | | | | | | | + | |
| ! *Epimeria* sp aff *reoproi* | X | X | | X | | | | | | + | |
| *Epimeriella* cf *scabrosa* | | | | | | | | | | | |
| '4 dorsal teeth' | | | | | | X* | | | | + | |
| *Epimeriella walkeri* | | | | | | | | | X | + | |
| EUSIROIDEA | | | | | | | | | | | |
| *Atylopsis* sp | | | | | | | | | X | | |
| *Chosroes decoratus* | X | X | | | | | | | | + | |
| *Eusirus* cplx *antarcticus* | | | | | | | | | | | |
| 'ring spots' | X | | X | X | | | | X | X | + | + |
| *Eusirus* cplx *antarcticus* | | | | | | | | | | | |
| 'no ring spots' | | | X | X | | | | X | X | + | + |
| *Eusirus cplx antarcticus* | | | | | | | | | | | |
| 'pure white' | | | | X | | | | | | + | |
| *Eusirus giganteus* | X | X | X | | | | | X | | + | |
| *Eusirus microps* | | X | | | | | | | | + | |
| *Eusirus perdentatus* | X | X | X | X | X | | | X | | + | + |
| *Eusirus propeperdentatus* | | X | | | | | | | | + | |
| ! *Eusirus* sp cplx *perdentatus* | | | X(T) | | | | | | | + | + |
| ! *Liouvillea* sp 'no teeth on back' | | | X | | | | | | | + | |
| *Oradarea impressicauda* | | | X | | | | | | | + | |
| *Oradarea tridentata* | | | | | X | | | | | + | |
| *Oradarea* sp 'orange-coloured' | X | | | | | | | | | + | |
| *Paramoera/Pontogenia* sp | X | | | | | | | | | + | |
| *Rhachotropis antarctica* | X | X | | | X | | X | | X | + | |
| ! *Rhachotropis* aff *antarctica* | X | | X | | | | | | | + | |
| *Rhachotropis schellenbergi* | | | | | X | X | | X | | + | |
| *Schraderia gracilis* | | | X | | | | | | X | + | |
| IPHIMEDIIDAE | | | | | | | | | | | |
| *Anchiphimedia dorsalis* | X | | | | | | | | | + | |
| *Echiniphimedia echinata* | | | | X | X | | | | X | + | |
| ! *E. cplx hodgsoni*' "*stout spines*' | | | X | | | | | | X | + | |
| *E.* cplx *hodgsoni* | | | | | | | | | | | |
| 'long slender spines' | X | | | | | | | | | + | |
| *Echiniphimedia imparidentata* | | | | | X* | | | | | + | |
| ! *Echiniphimedia* sp 1 | | | | | | | | | | | |
| aff imparidentata | | | X | | | | | | | + | |
| ! *Echiniphimedia* sp 2 | | | | | | | | | | | |
| aff imparidentata | | | X | | | | | | | + | |
| ! *Echiniphimedia* aff *scotti* | | | | | X | | | | | + | |
| *Echiniphimedia waegelei* | | | X* | | | | | | X | + | |
| *Gnathiphimedia mandibularis* | | X | | | | | | | X | + | |
| *Gnathiphimedia sexdentata* | | | X | X | X | X | | | X | + | |
| *Iphimediella bransfieldi* | | | | | | | | | X | + | |

| AREAS + TASKS | EI | KGI | JI | SHI | DI | LA | WLB | ELB | AB | Ph. | DNA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Iphimediella cyclogena* | | | | X | | | | X | X | + | |
| *Iphimediella margueritei* | | | X | X | X | X | | | | + | |
| *Iphimediella microdentata* | | | | | | | | | X | + | |
| *Iphimediella rigida* | | | | X | X | | | | X | + | |
| *Iphimediella ruffoi* | | | | | | | | | X | + | |
| *Iphimediella serrata* | X | | X | X | | | | | | + | |
| ! *Iphimediella* sp 'small & white' | | | X | | | | | | | + | |
| *Maxilliphimedia longipes* 'brown' | X | X | | | X | | | | | + | |
| *Maxilliphimedia longipes* 'red' | | X | | | | | | | | + | |
| *Pariphimedia integricauda* | X | | | | | | | | | + | |
| *Stegopanoplea joubini* | | | X | X | X | | | | | + | |
| LEPECHINELLIDAE | | | | | | | | | | | |
| *Lepechinella cetrata* | X | | | | | | | | | + | |
| LEUCOTHOIDAE | | | | | | | | | | | |
| *Leucothoe* cplx *spinicarpa* 'mottled' | | | | | X | | | | X | + | |
| LILJEBORGIIDAE | | | | | | | | | | | |
| ! *Liljebordia* sp 1 | | | | | | | | | X* | + | + |
| ! *Liljeborgia* sp 2 'small sp; 'big black eyes' | | | | X | | | | | | + | |
| *Liljeborgia georgian* 'brown Gn1-2' | X | | | | X | | | | | + | + |
| *Liljeborgia* *georgiana* 'purple Gn1-2' | X | | | | | X | | X | | + | + |
| *Liljeborgia quadridentata* | X* | | | | | | | | | + | + |
| LYSIANASSOIDEA | | | | | | | | | | | |
| *Abyssorchomene plebs* | X(T) | | X(T) | | | | X(T) | X(T) | | + | + |
| *Abyssorchomene rossi* | | | | | | | | X(T) | | + | + |
| Abyssorchomene scotianensis | | | | | | | X(T) | | | + | + |
| *Adeliella* sp 'from holothurians' | | | | | | | | X | | + | + |
| *Aristias antarcticus* 'from sponges' | | X | | | X | | | | | + | + |
| *Cheirimedon crenipalmatus* | X(T) | | | | | | | | | + | + |
| *Eurythenes gryllus* | | | X(T) | | | | | | | + | |
| *Gainella chelata* 'from sponges' | | | X* | | | | | | | | |
| *Hippomedon* spp | X | | X | | | | | | | + | + |
| *Hirondellea antarctica* | | | | | | | | | X | + | + |
| *Kerguelenia* sp | X | | | | | | | | | | + |
| *Lepidepecreella* sp | | | | | X | | | | | + | |
| *Lepidepecreoides xenopus* | X | | | | | | | | | + | + |
| ! *Lepidepecreoides* sp | X | | X | | | | | | | + | |
| *Orchomenella acanthurus* | X | | | X | X | | | | X | + | + |
| *Orchomenella pinguides* | X | | X | | X | | | | X | + | |
| *Orchomenopsis cavimanus* | | | X(T) | | | | | | | + | + |
| *Orchomenopsis* sp 'orange-coloured' | X(T) | | | | | | | | | + | + |
| *Orchomenyx* sp 1 'from sponges' | X | | | | | | | | | + | + |
| *Orchomenyx* sp 2 'from tunicates' | | | X | | | | | | | + | + |
| *Parschisturella carinata* | | | X(T) | | | | | X(T) | | + | |
| ! *Shackletonia* sp | X | | | | | | | | | + | + |
| cf *Stomacontion* sp | X | | | | | | | | | | + |
| *Tryphosella intermedia* | | | | | | | | | X | | |
| *Tryphosella macropareia* | X* | | | | | | | | | | |
| *Tryphosella murrayi* | | | | | | | X(T) | X(T) | X | + | + |
| *Tryphosella* sp aff *murrayi* | X | | | | | | | | | | |
| *Uristes adarei* | | | | | | | | | X | + | + |
| *Uristes gigas* | | | | | | | | | X | + | |
| ! cf *Uristes* sp | X(T) | | | | | | | | | + | + |
| *Waldekia obesa* | X | | X | X | X | | | X | X | + | + |

| AREAS + TASKS | EI | KGI | JI | SHI | DI | LA | WLB | ELB | AB | Ph. | DNA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ! *Waldekia*-like sp 1 '5th-coxa toothed' | X | | | | | | | | | + | + |
| ! *Waldekia*-like sp 2 'no urosomal tooth' | X | | | | | | | | | + | + |
| Lysio n det 'cup-eyed' | | | | | | X | | X(T) | | + | + |
| Lysio n det 'pink body; white eyes' | | X | | | | | | | | + | |
| Lysio n det 'small & yellow; white eyes' | X | | | | | | | | | + | + |
| Lysio n det 'white body; red eye' | | | | | | | | X | | + | |
| MELITIDAE | | | | | | | | | | | |
| *Paraceradocus gibber* | X | X | X | X | | | | | X | + | |
| MELPHIDIPPIDAE | | | | | | | | | | | |
| *Melphidippa antarctica* | X | | X | | X | | | | | + | |
| ODIIDAE | | | | | | | | | | | |
| *Antarctodius antarcticus* | X | | | | X | | | | | + | |
| OEDICEROTIDAE | | | | | | | | | | | |
| *Monoculodes* sp 'red eye' | | X | X | X | X | | | | | + | + |
| *Monoculodes* sp 'white eye' | | | | | X | | | | | + | |
| *Oediceroides calmani* | X | X | X | | X | | | | | + | + |
| *Oediceroides lavilhei* | X | X | | | | | | | | + | + |
| Gen.? Sp.? | | | X | | | | | | | + | |
| PAGETINIDAE | | | | | | | | | | | |
| *Pagetina antarctica* | | | X | | X | X | | | | + | |
| PARDALISCIDAE | | | | | | | | | | | |
| *Nicippe* sp | X | | | | | | | | | + | |
| *Pardalisca* sp | | | | | | | | X | X | + | |
| PHOXOCEPHALIDAE | | | | | | | | | | | |
| Sp 'yellow; black eyes' | | | | | | | | | X | + | |
| *Pseudharpinia* sp | X | X | | X | X | | | X | | + | |
| Sp 'whitish; small white eyes' | | | X | | X | | | X | | + | |
| Sp 'whitish; big black eyes' | | | X | X | | | | | | | |
| PODOCERIDAE | | | | | | | | | | | |
| *Neoxenodice* sp | | | | | X | | | | | + | |
| *Podocerus septemcarinatus* | X | | X | X | X | X | | | | + | |
| SEBIDAE | | | | | | | | | | | |
| *Seba* sp | | | | | | | | X | | | |
| STEGOCEPHALIDAE | | | | | | | | | | | |
| *(Glor)andaniotes* sp from sponges | X | | | | | | | | X | + | |
| STENOTHOIDAE | | | | | | | | | | | |
| Stenothoidae n det, various spp | X | | X | X | X | | | X | X | + | |
| ! Strange crested sp | | | | | | | | X | | + | |
| STILIPEDIDAE | | | | | | | | | | | |
| *Alexandrella dentata* | | | | | | X | | | | + | |
| *Bathypanoplea schellenbergi* | X | X | | | | | | | | + | |
| SYNOPIIDAE | | | | | | | | | | | |
| *Syrrhoe nodulosa* | X | | | X | X | | | X | | + | |
| *Tiron antarcticus* | X* | | | | | | | | | + | |
| UROTHOIDAE | | | | | | | | | | | |
| *Urothoe* sp | X | | | X | | | | | | + | |

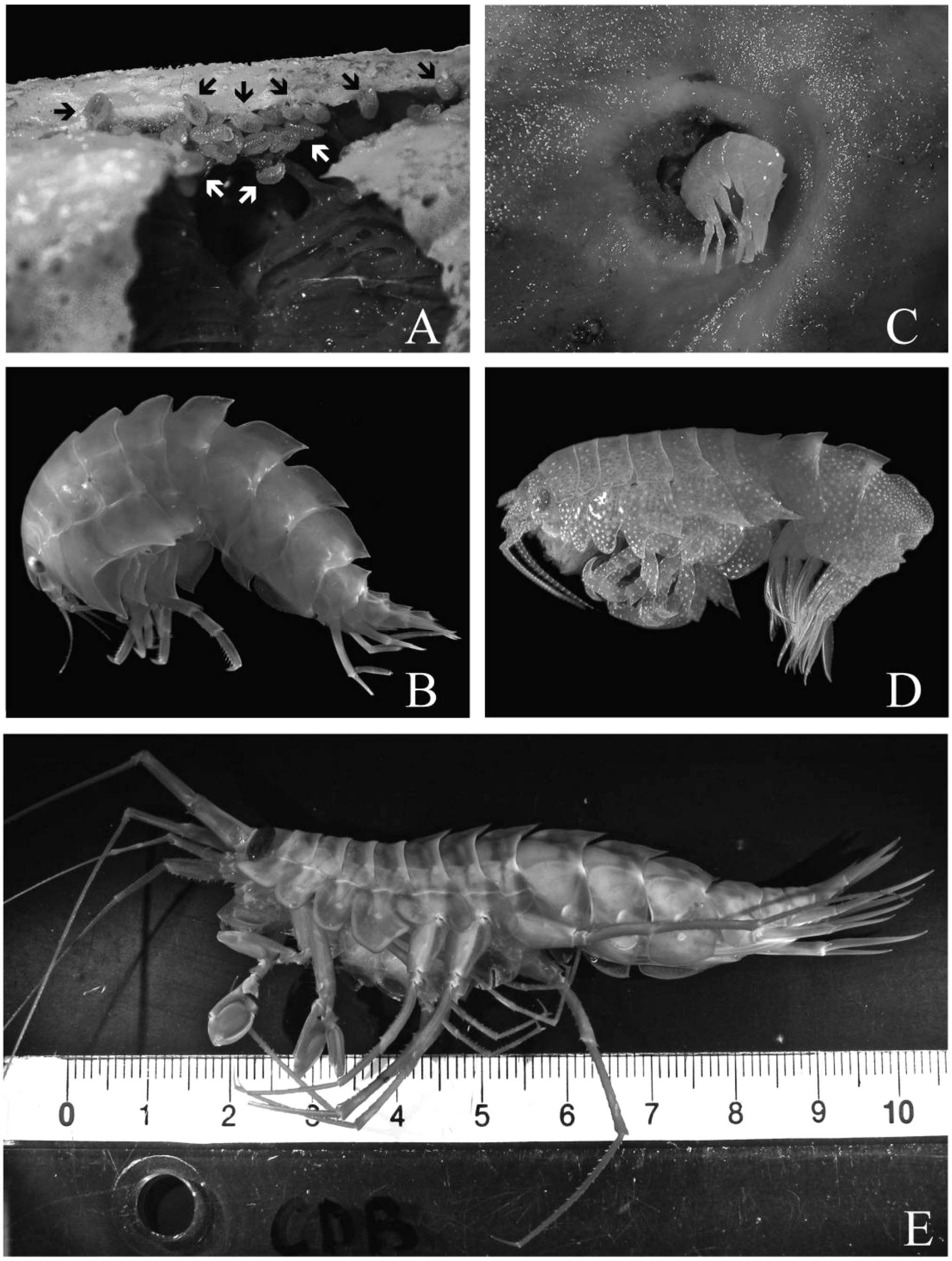


Fig. 2.5 Some amphipods. A, group of juvenile *Echiniphimedia* sp on a candle-like sponge (cf *Homaxinella* sp), st. 668-1; B, *Epimeria* sp aff *reoproi*, st. 605-5; C, *Echiniphimedia* sp 1 aff *imparidentata* in a hole of a candle-like sponge (cf *Homaxinella* sp.), presumably dug by the amphipod itself, st. 668-1; D, *Echiniphimedia* sp 2 aff *imparidentata*, st. 678-1. E, *Eusirus* sp cplx *perdentatus*, baited trap, st. 683-1/684-1.

## Reference

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## 2.1.7 DIVERSITY OF ANTHOZOANS AND PYCNOGONIDS

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### Objectives

Anthozoans (Cnidaria) are one of the major components in benthic sessile communities in terms of both abundance and diversity, offering a good substratum (e.g. refuge, feeding) to many other benthic mobile animal groups such as crustaceans, polychaetes, and echinoderms. Furthermore, the Antarctic cnidarian fauna is still poorly known, present knowledge being estimated to encompass no more than 50 % of all species. Most of the genera and species included in ealier *Polarstern* cruise reports were described in the 90's, and several undescribed genera and species are being described continuously. Morphological variability is not always known or understood and molecular studies are considered another potentially source of characters.

Pycnogonids (Cheliceriformes, Arthropoda) from Antarctic and Subantarctic waters have been studied more extensively than those from any other world ocean of similar size. More than 250 species are currently recognized (the 15% of the world fauna), with 70% of endemic species (Southern Ocean). Despite of this, several species have been described based on few or one single specimen and variability is not always known. Some of the old and recently described species have been subsequently considered junior synonymies of other species. For some species, the taxonomic status is relegated to a “species complex”.

Our scientific objectives on board for both taxonomic groups have been:

1. To detect the presence of boundaries in the distribution of the species.
2. To evaluate the potential origin of the fauna according to the known distribution of genera/species in this and other biogeographical areas.
3. To detect undescribed or poorly known species.
4. To sustain the study of reproductive patterns, as well as larval states (this last only in pycnogonids).
5. To continue the bank of tissues usable for molecular studies.

### Work at Sea

Anthozans and pycnogonids were mainly collected by bottom trawl (BT), Agassiz trawl (AGT), and Rauschert dredge (RD). Colonies or individuals were sorted and labelled. Hexacorals were relaxed previous fixation with menthol crystals in cooled lab. When possible, photographs were taken to obtain information about colour patterns of the different species while still alive. Specimens were fixed in formaldehyde for traditional morphological studies (histology, anatomy, etc.); portions or whole specimens were fixed in 96% ethanol or frozen for further molecular analysis.

## Preliminary results

The following preliminary results are from those sampling activities carried out in Elephant Island (EI), South Shetland Islands (SSI) and Joinville area (JV). The sampling effort in these areas was very unequal. In order to compare EI, SSI and JV reducing the effect to the use of different gears, times and number of samples per area, presence/absence data from a set of captures have been selected for providing a preliminary comparative analysis. The following subareas have been considered in order to detect possible boundaries or differential distribution: South-West Elephant Island (SWE), North Elephant Island (NE), North-East South Shetland Island (NESS), North-West South Shetland Island (NWSS), and Joinville area (JV). Each area is characterized by 12-14 BTs.

Anthozoa

In the whole study area, about 1300 colonies or individuals belonging to at least 55 species were collected in 70 BT, 8 AGT, and 1 RD. The number of samples providing anthozoans in these three areas was unequal: 42 BT and 7 AGT from Elephant Island, 17 BT and 1 AGT from South Shetland Islands, and 11 BT and 1 RD from Joinville area. The following comments will try to answer the same items exposed in the above listed scientific objectives:

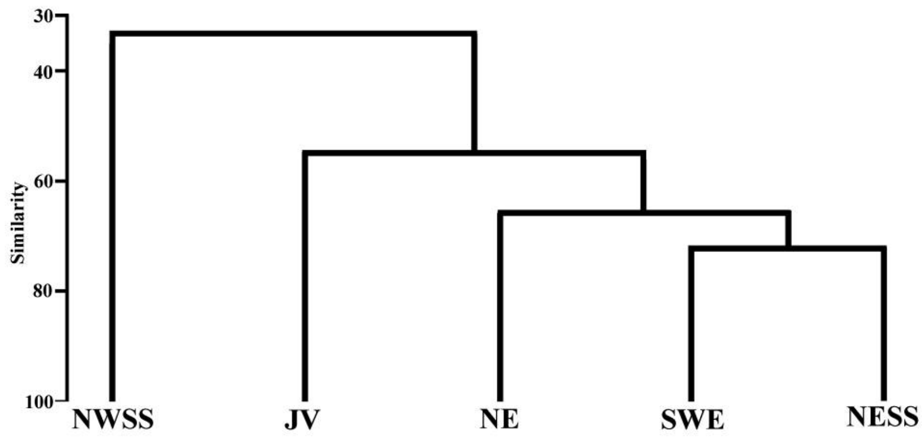


Fig. 2.6 Dendrogram showing the similitude (Bray-Curtis, PRIMER, CLUSTER) among subareas studied according to presence/absence data of anthozoans in Table 2.9.

Table 2.9 Anthozoans present in the subareas: NWSS: North-West South Shetland Islands; JV: Joinville area; NE: North Elephant Island; SWE: South-West Elephant Island; NESS: North-East South Shetland Islands.

| | NWSS | JV | NE | SWE | NESS |
|---|---|---|---|---|---|
| Acontiaria sp. | 0 | 1 | 0 | 0 | 0 |
| *Actinernus* sp. | 1 | 0 | 0 | 0 | 0 |
| *Actiniaria* sp.1 | 0 | 0 | 0 | 1 | 1 |
| Actiniaria sp.2 | 0 | 1 | 1 | 0 | 0 |
| Actiniaria sp.3 | 0 | 0 | 1 | 0 | 0 |
| *Actinostola* sp. | 0 | 1 | 1 | 1 | 0 |
| *Ainigmaptilon antarcticum* | 0 | 1 | 0 | 0 | 0 |
| *Ainigmaption virgularoides* | 1 | 1 | 0 | 0 | 0 |
| *Alcyonium* sp.1 | 0 | 0 | 0 | 0 | 1 |
| *Alcyonium* sp.2 | 0 | 1 | 0 | 0 | 1 |
| *Anthomastus bathyproctus* | 0 | 0 | 0 | 1 | 0 |
| *Anthomastus* sp. | 0 | 0 | 0 | 1 | 1 |
| *Arntzia gracilis* | 1 | 1 | 1 | 1 | 1 |
| *Aulactinia* sp. | 0 | 0 | 1 | 1 | 1 |
| *Bolocera* sp. | 1 | 0 | 0 | 0 | 0 |
| *Caryophyllia* sp. | 0 | 0 | 0 | 1 | 0 |
| Ceriantharia sp. | 1 | 0 | 0 | 0 | 0 |
| *Clavularia* sp. | 0 | 1 | 1 | 0 | 0 |
| *Corallimorphus profundus* | 0 | 0 | 0 | 1 | 0 |
| *Corallimorphus rigidus* | 0 | 0 | 0 | 0 | 1 |
| Chrysogorgiidae sp. | 0 | 1 | 0 | 0 | 0 |
| *Dactylanthus antarcticus* | 0 | 0 | 1 | 0 | 0 |
| *Dasystenella acanthine* | 0 | 1 | 0 | 1 | 1 |
| *Epiactis georgiana* | 0 | 0 | 1 | 1 | 1 |
| *Fannyella* n.sp. | 0 | 1 | 0 | 0 | 0 |
| *Fannyella rossii* | 0 | 0 | 1 | 0 | 1 |
| *Fannyella* sp. | 0 | 1 | 0 | 0 | 1 |
| *Flabellum impemsum* | 0 | 1 | 1 | 1 | 1 |
| *Gardineria antarctica* | 0 | 0 | 0 | 1 | 0 |
| *Glyphoperidium bursa* | 0 | 1 | 1 | 1 | 0 |
| *Hormathia* sp. | 1 | 1 | 1 | 1 | 1 |
| *Hormosoma* sp. | 0 | 0 | 1 | 1 | 1 |
| *Isosicyonis alba* | 0 | 1 | 0 | 0 | 0 |
| *Isosicyonis* n. sp. | 0 | 1 | 0 | 0 | 0 |
| *Isosicyonis* sp.1 | 1 | 1 | 1 | 1 | 1 |
| *Malacobelemnon* n. sp. | 0 | 0 | 1 | 0 | 0 |
| *Parazoanthus* sp. | 0 | 0 | 0 | 1 | 0 |
| *Primnoella* cf *antarctica* | 0 | 0 | 0 | 1 | 0 |
| *Primnoella* sp.1 | 0 | 0 | 0 | 1 | 0 |
| *Primnoella* sp.2 | 0 | 1 | 1 | 1 | 1 |
| *Primnoisis* sp. | 0 | 1 | 0 | 0 | 0 |
| *Stephanauge* sp. | 1 | 0 | 0 | 0 | 0 |
| *Stephanthus antarcticum* | 0 | 1 | 0 | 0 | 0 |
| *Stomphia sellaginella* | 1 | 1 | 1 | 1 | 1 |
| *Stomphia* sp. | 1 | 1 | 1 | 1 | 1 |
| *Thouarella* sp.1 | 0 | 1 | 1 | 1 | 1 |
| *Thouarella* sp.2 | 0 | 1 | 1 | 1 | 1 |
| *Thouarella* sp.3 | 0 | 1 | 1 | 1 | 1 |
| *Umbellula lindhali* | 0 | 0 | 1 | 1 | 1 |
| *Umbellula magniflora* | 1 | 1 | 0 | 1 | 1 |
| Σ | 11 | 27 | 22 | 27 | 23 |

1.- According to the subareas above selected, a matrix of 50 anthozoans species per the five considered subareas was produced (Table 2.9) and clustered using PRIMER (CLUSTER, Fig. 2.8). The higher similitude is that between NESS and SWE (sharing 18 species), this group is closely related with NE (sharing the three subareas 14 species), this group is related with JV (sharing the four subareas 10 species), and the less connected in the analysis is NWSS (having only 5 species in the five subareas). The separation of the north-western South Shetland Islands is also reflected in the number of species collected (see Table 2.9), having the minimum in the study (11 species), ranging the other four subareas between 22 and 27.

2.- Some of the 55 anthozoan species collected can be commented (according to the current knowledge about species and genera distribution) in order to discuss their possible origin. Both *Umbellula* species, *U. magniflora* and *U. linhdali*, were present in the area in relatively shallow waters. This genus is typical of deep-sea bottoms from the surrounding oceans, and can be considered a deep-sea immigrant in Antarctica. A similar case is that of the genus *Corallimorphus*, both species *C. profundus* and *C. rigidus*, can be considered deep-sea immigrants in Antarctic waters. Indeed, this is the second Antarctic report of *C. rigidus* (being the first one during ANDEEP-3 cruise). The single specimen collected of the sea pen genus *Malacobelemnon* (see item 3) is currently only related with South Australia continental shelf. In the present cruise it was collected in 137-154 meters depth, and previous known records of this material come from shallowest areas, between 15 and 30 meters depth (López-González, unpublished data). This is the shallowest Antarctic pennatulacean species, and it origin could be traced when Antarctic and Australian continental shelf were in contact. Many of the remaining anthozoan species belong to currently considered endemic genera, thus, the possible origin of these taxa could be much more diverse and obscure to be treated in the present report.

3.- In the present cruise, material belonging to three new species of the genera *Isosicyonis*, *Fannyella*, and *Malacobelemnon* have been collected, the description of these species were already started before the cruise, and this new material will complement the bathymetric and geographical information previously known. In addition, new specimens of some recently described species have been collected, *Hormathia armata* Rodríguez & López-González, 2001, and *Stephanathus antarcticum* Rodríguez & López-González, 2003. For the last one, only six specimens were known, in this cruise we have collected additional six specimens, and it has been possible to register the colour pattern of the living animals, no previously known. Other material will be very useful for different generic and species revision currently in process.

4.- Three anthozoan species were abundant enough for comparative studies about their reproductive patterns in Antarctica, *Anthomasthus bathyproctus* Bayer, 1996, *Flabellum impemsum* Squires, 1962, and *Epiactis georgiana* Carlgren, 1927. The former species was collected in similar abundance in other *Polarstern* cruises carried out in early and late summer, thus the comparative study of these samples could give us important information about the reproductive strategy of this species. The reproductive data of *F. impemsum* will be compared with other deep-sea, temperate and tropical solitary scleractinian. The reproductive cycle of the external brooding sea anemone *E. georgiana* has been study (Rodríguez, unpublished data) from an anatomical point of view. The present cruise offered the opportunity to fix parental and young individuals for DNA and alloenzyme analyses in order to known their sexual or asexual origin.

5.- In total, 60 samples of octocorals and 80 samples of hexacorals have been fixed in ethanol 96% for further molecular analyses. In addition, 53 hexacoral individual belonging to target species have been also frozen for alloenzyme studies.

Pycnogonida

In the whole study area, about 2200 specimens belonging to at least 18 species were collected in 76 BT, 12 AGT, and 4 RD hauls. The number of samples providing pycnogonids in these three areas was unequal: 44 BT, and 9AGT, and 3 RD from Elephant Island, 21 BT and 2 AGT from South Shetland Islands, and 11 BT, 1 AGT and 1 RD from Joinville area.

Table 2.10 Pycnogonids present in the subareas: NWSS: North-West South Shetland Islands; JV: Joinville area; NE: North Elephant Island; SWE: South-West Elephant Island; NESS: North-East South Shetland Islands.

| | NWSS | JV | NE | SWE | ESS |
|---|---|---|---|---|---|
| *Achelia* sp. | 1 | 1 | 1 | 1 | 1 |
| *Ammothea* sp.1 | 1 | 1 | 1 | 1 | 1 |
| *Ammothea* sp.2 | 0 | 0 | 1 | 1 | 1 |
| *Ammothea* sp.3 | 1 | 0 | 1 | 1 | 1 |
| *Colossendeis megalonyx* | 1 | 1 | 1 | 1 | 1 |
| *Colossendeis scotti* | 1 | 1 | 1 | 1 | 1 |
| *Colossendeis* sp.1 | 1 | 1 | 1 | 1 | 1 |
| *Colossendeis* sp.2 | 1 | 0 | 0 | 1 | 1 |
| *Colossendeis* sp.3 | 1 | 0 | 1 | 1 | 1 |
| *Colossendeis* sp.4 | 1 | 1 | 0 | 0 | 0 |
| *Colossendeis willsoni* | 0 | 0 | 0 | 1 | 1 |
| *Decolopoda australis* | 1 | 1 | 1 | 1 | 1 |
| *Dodecolopoda mawsoni* | 0 | 0 | 1 | 0 | 0 |
| *Nymphon* sp.1 | 1 | 1 | 1 | 1 | 1 |
| *Nymphon* sp.2 | 0 | 0 | 0 | 1 | 0 |
| *Pallenopsis* sp. | 1 | 1 | 1 | 1 | 0 |
| *Pentanymphon charcoti* | 0 | 0 | 1 | 0 | 0 |
| *Pycnogonum* sp. | 0 | 0 | 0 | 1 | 0 |
| Σ | 12 | 9 | 13 | 15 | 12 |

The following comments will try to answer the same items exposed in the above listed scientific objectives:

1.- According to the selected subareas, a matrix of 18 pycnogonid species per the five considered subareas was produced (Table 2.10) and clustered using PRIMER (CLUSTER, Fig. 2.7). All five subareas show a relative high similitude (~75%), and split in two groups, one of then including NWSS and JV (~86%), and the other clustering NE and SWE+ESS (~79%). The most similar subareas were SWE and ESS (~89%, sharing 12 species). In this case is JV the subarea with a lower number of species (9 species), ranging the other four subareas between 12 and 15.

2.- According to the current knowledge of Antarctic pycnogonid fauna and the high degree of endemism reported for some authors, it is very tentative to discuss about the origin of the Antarctic pycnogonid fauna. Large members of the family Colossendeidae are usually related with deep-sea fauna. However, several of the species collected can be only identified on board at generic level awaiting further SEM comparative studies and genera like *Colossendeis*, *Ammothea* and *Achelia* are well represented in faunas of surrounding seas. Thus, for the moment, this kind of discussions should wait until these and other collections of this area could be studied at home.

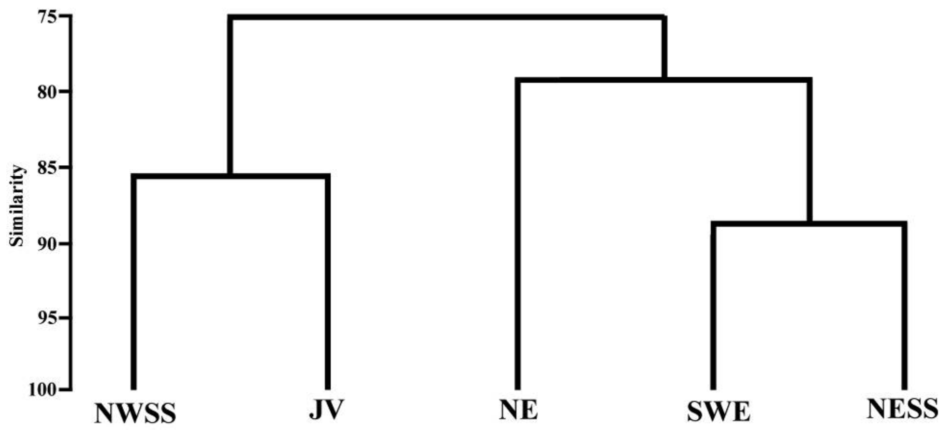


Fig. 2.7 Dendrogram showing the similitude (Bray-Curtis, PRIMER, CLUSTER) among subareas studied according to the presence/absence of pycnogonids in Table 2.10.

3.- In the present cruise, material belonging to three new species of the three genera present in Antarctica of the family Colossendeidae (*Colossendeis*, *Decolopoda* and *Dodecolopoda*). *Colossendeis* (8 legs) is one of the most speciose Antarctic genera, however, *Decolopoda* (10 legs) and specially *Dodecolopoda* (12 legs) are considered scarce and rare, respectively. Indeed, in 1995 no more than five or six specimens of *Dodecolopoda mawsoni*

Calman & Gordon 1933 were recorded in the literature; in this cruise we have collected one single specimen. The material of these three genera will be used to study the internal evolution in the family using SEM and DNA characters, the first one already used in the *Colossendeis* species from the Ross Sea (Cano & López-González, submitted). Moreover, the study of the polymery in pycnogonids is still an open matter. According to most specialists, there are only seven polymeric pycnogonids in 6 genera of three families; five have 10 legs, while two have 12 legs. In this cruise we have collected four polymeric species, three with 10 legs, and one with 12 legs. From all of them we have material preserved for DNA analyses.

Antarctic species of the family Pycnogonidae are also considered rare. In this cruise we had the opportunity to collect a single specimen of the rare species *Pentapycnon charcoti* Bouvier, 1910. In the last important study of this family from 1995, only 14 specimens of *P. charcoti* were known. The genus *Pallenopsis* is currently in a restive taxonomic position between those specialists including it in Phoxichilidiidae and those who wish to keep it among the many Callipallenidae genera. Specimens of this genus collected during this cruise and fixed for DNA studies could give some light to this taxonomic problem. Other problems, as the *Colossendeis megalonyx* complex will be studied with the material collected in this cruise. Specimens of this complex were especially abundant in Elephant and South Shetland Islands.

4.- Reproductive aspects are some of the most interesting research fields in pycnogonids. In most of the known pycnogonids families (except for the Colossendeidae), female transfer egg masses to the male, which are attached by cement glands to a specialized pair of appendages, the ovigers. In these masses larvae hatch but maintain attached during a different period (including moults) in the different groups. Only scarce observations exist on larval developments, very rare in Antarctic species. Our current knowledge on the larval development of Pycnogonida is based on no more than 30 species; there are more than 1200 described species, most of them very incompletely.

During the ANT-XXIII/8 cruise we have put special attention to the recollection of males with egg masses in advanced state of development, in which larvae in different state of development were observed. Some genera like *Ammothea* have few records in the literature, while others like *Pallenopsis* and *Pentapycnon* are completely unknown. The type of larval development and parental care in this group seems to be very adaptative, and this kind of information is of special interest in Antarctic waters as is being studied in other benthic groups in relation to dispersal capabilities.

5.- In total, 80 samples of pycnogonids have been fixed in ethanol 96% for further molecular analyses. In addition, 137 individuals belonging to target species have been also frozen for alloenzyme studies.

## 2.1.8 GENETIC VARIABILITY OF ANTARCTIC BENTHIC CRUSTACEANS (ISOPODA & DECAPODA)

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### Objectives

Molecular studies have shown that there is astonishingly high species diversity for many taxa in the Southern Ocean. Our knowledge on the identity, diversity, and distribution of modern species in the Southern Ocean continues to grow; however, our understanding of what led to the high number of species in the first place is less comprehensive. Common adaptations to life at high latitudes in Antarctic taxa (e.g. few descendants, no pelagic distributional stages, and low mobility of adults) can be assumed to facilitate the possibility of speciation. Our working hypothesis is that the genetic connectivity between populations is low as a consequence of abiotic and biotic conditions prevailing on the Antarctic shelf. The disintegration of the Larsen A/B ice shelf that made benthic habitat available for colonization for a known time provides a unique opportunity to separate the influence of time and space on the distribution of genetic variation.

With the help of mitochondrial and microsatellite markers the geneflow between geographically separated populations of appropriate species will be analyzed.

### Work at sea

Material was collected by hand-sorting from all trawled gear and baited traps. Samples were placed in pre-chilled ethanol 96% as fast as possible to avoid DNA degradation by enzymatic activity and were then stored at –5 °C. All further steps such as proper determination of species, DNA sequencing, phylogenetic analysis, and development of microsatellites will take place in the working group of C. Held at the Alfred Wegener Institute, Bremerhaven, Germany.

### Preliminary results

In total, 1355 isopods were collected during the expedition with the Agassiz trawl, the bottom trawl and other gears like the Rauschert dredge. Most Serolidae were found in bottom trawls, while most Asellota could be found in the Rauschert dredge. 34 specimens were sampled close to the Atka Bay, 1582 specimen were collected at Elephant Island and the Western side of the South Shetland Islands, while 260 specimens were collected at the Eastern part of the South Shetlands as well as North of Joinville Island. In the Larsen B area 180 animals were collected while in the Larsen A region only 17 specimens of different taxa could be collected. At the reference station Snow Hill Island 78 specimens and at Dundee Island 121 were collected in the

Agassiz trawl. Table 2.11 shows a preliminary list of the species which were found and identified during while at sea. At least 29 different species of isopods and 3 different species of decapods were found, 5 of them belonging to the Serolidae, 10 to the Antarcturidae. In addition, 8 different species of the Asellota and 3 different species of *Natatolana* could be identified. For a collaborating working group two large pantopods were collected and amputated legs were preserved in RNA-later.

An overview of sampled animals is provided in Table 2.12. For sampling sites see Figs 1.2 and 1.3. Highest numbers of Serolidae of the species *Ceratoserolis dinae* and *C. trilobitoides* were found at the western regions of the South Shetlands. The high number of *Natatolana intermediata* was due to a catch from fish traps. In Larsen A two different species of *Ceratoserolis* sp. were found including a single *Cuspidoserolis* sp. There was no difference in the amount of collected Antarcturidae between Larsen A and Larsen B while *Natatolana* sp. was only abundant in the Larsen B area.

Isopod species determined so far: Asellota: *Ianthopsis nasicornis* Vanhöffen, 1914; *Sursumura robustissima*; Aegidae: *Aega antarctica*; Antarcturidae: *Antarcturus hodgsoni, A. horridus*; Serolidae: *Serolella bouvieri* (Richardson, 1906), *Frontoserolis waegelei*, *Ceratoserolis dinae, C. trilobitoides* (Eights, 1833); Valvifera: *Glyptonotus antarcticus* Eights, 1853; Cymothoidea: *Natatolana albinota* Vanhöffen, 1914, *N. intermedia, N. oculata, Gnathia antarctica* (Studer, 1884).

Table 2.11 List of identified isopod families and species.

| Suborder | Family | Species |
|---|---|---|
| Asellota | Ianthopsidae | *Ianthopsis nasicornis* |
| | | *Ianthopsis* sp. |
| | Janiridae | |
| | Munnopsidae | *Sursumura robustissima* |
| | Stenetriidae | *Stenetrium* sp. |
| "Flabellifera" | Aegidae | *Aega antarctica* |
| | Cirolanidae | *Natatolana albinota* |
| | | *Natatolana intermedia* |
| | | *Natatolana oculata* |
| | Gnathiidae | *Gnathia* sp. |
| | Serolidae | *Ceratoserolis dinae* |
| | | *Ceratoserolis trilobitoides* |
| | | *Cuspidoserolis sp.* |
| | | *Serolella bouveri* |
| | | *Frontoserolis waegelei* |
| Valvifera | Antarcturidae | *Antarcturus* sp. |
| | | *Antarcturus hodgsoni* |
| | | *Antarcturus horridus* |
| | | *Dolichiscus* sp. |
| | | *Fissarcturus* sp. |
| | | *Septemserolis* sp. |
| | Chaetiliidae | *Glyptonotus antarcticus* |
| | Idoteidae | *Edotia* sp. |

Table 2.12 Isopod and decapod candidates for geneflow studies.

| | | N° of collected individuals | West of the South Shetlands | East of the South Shetland Islands/ North of Joinville Island | Larsen A | Larsen B | Snow Hill and Dundee Islands |
|---|---|---|---|---|---|---|---|
| ISOPODA | | | | | | | |
| Serolidae | | | | | | | |
| | *Ceratoserolis dinae* | 286 | 121 | 164 | | | |
| | *C. trilobitoides* | 278 | 84 | 188 | | 1 | 5 |
| | *Ceratoserolis* sp. | 7 | | 4 | 1 | | |
| | *Cuspidoserolis* sp. | | | | 1 | | |
| | Serolis sp. | 50 | 39 | 11 | | | |
| | *Serolella bouveri* | | 19 | 4 | | | |
| Antarcturidae | | 123 | 17 | 64 | 12 | 15 | 15 |
| | *A. horridus* | | | | 2 | | |
| Aegidae | *Aega antarctica* | 32 | 19 | 10 | | | |
| Cirolanidae | | 346 | | | | | |
| | *Natatolana* cf. *albinota* | 5 | 2 | | | 3 | |
| | *N.* cf. *intermedia* | 196 | 194 | | | 2 | |
| | *N. oculata* | 45 | 45 | | | | |
| | *Natatolana* sp. | 65 | 62 | 2 | | 1 | |
| Asellota | | 218 | 41 | 112 | 1 | | 8 |
| DECAPODA | | 393 | | | | | |
| | *Chorismus antarcticus* | 169 | | 64 | | | 102 |
| | Decapoda indet. | 7 | 7 | | | | |
| | *Notocrangon antarcticus* | 217 | 43 | | 5 | 126 | 43 |

## 2.1.9 RECRUITMENT IN PERACARID CRUSTACEANS

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### Objective

The objective of this project was to observe reproductive stages of benthic peracarids, primarily amphipods and isopods, and to compare the results from data already collected by K. Conlan (unpublished) in the McMurdo coast. The hypothesis was that the observed peracarid reproductive strategies would be less synchronized than those of the McMurdo area due to the less seasonal nature of primary production in this study area.

### Work at sea

A total of 219 amphipods and isopods were collected with both the Agassiz and bottom trawls performed at 13 stations at Elephant and Joinville Island as well as the South Shetland Islands. Only brooding females were collected. A few eggs were removed and staged from each individual. A voucher collection of peracarid species was preserved. Taxonomic identification will take place at the Canadian Museum of Nature.

### Preliminary results

Reproduction is not entirely random (Fig. 2.8); the strong bias towards the primary egg stages indicates that there are some breeding cycles in the peracarids. Further taxonomic studies will determine if the reproductive cycle of some species is more dependent on seasonal changes than others are.

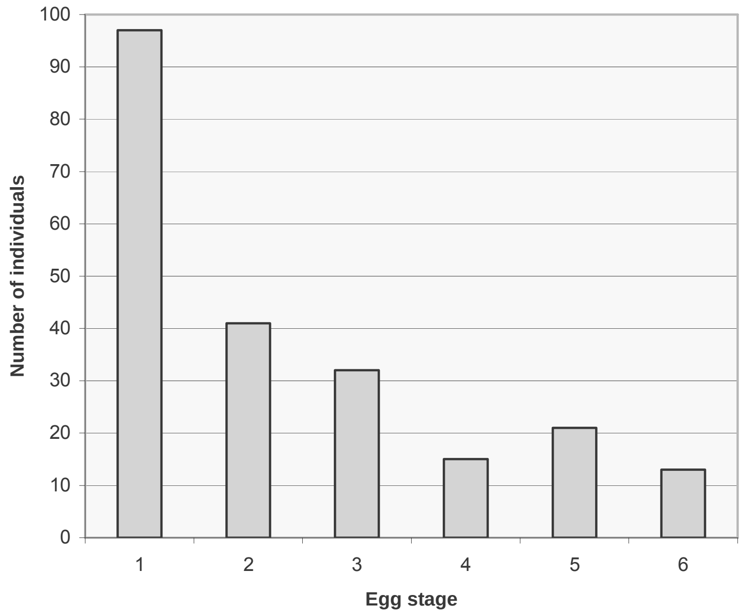


Fig. 2.8 Egg stage distribution of collected individuals (note: egg stage 6 is the category in which hatched juveniles are still confined to the brood pouch).

## 2.1.10 THE DEMERSAL FISH FAUNA OF THE WESTERN WEDDELL SEA

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### Objective

The aim of our survey was to study the composition of the demersal fish fauna in an area hitherto inaccessible to trawling and collect information on reproduction and food and feeding of all fish species.

## Work at sea

ANT-XXIII/8 offered the first opportunity to conduct a limited bottom trawl programme in front of the remnants of the ice shelves of Larsen A and B. Four catches with a 140' bottom trawl (see Kock et al., this volume) and 6 catches with an Agassiz trawl (frame size: 3 x 1 m) were analyzed with respect to their finfish composition (Fig. 2.9).

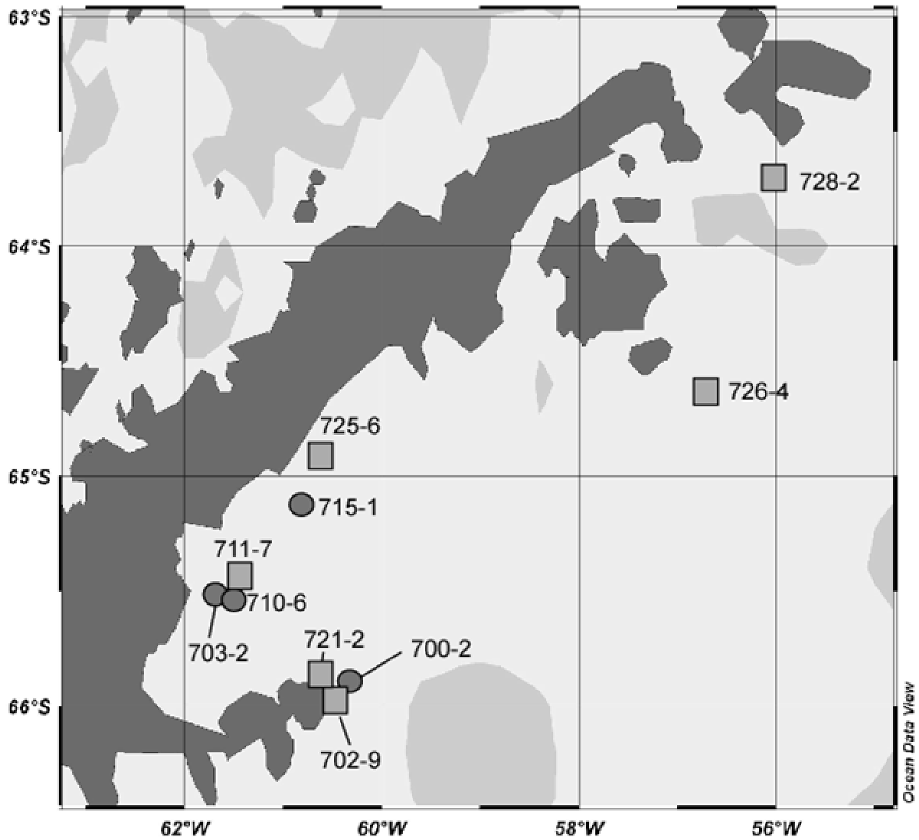


Fig. 2.9 Fish catches east of the Antarctic Peninsula; quadrates: AGT, circles: BT.

## Preliminary results

Fish catches were small and did not exceed a few kg/tow. 22 species were observed in our catches (Table 2.13). *Pleuragramma antarcticum*, *Trematomus scotti* and *T. eulepidotus* were the most abundant species. Several individuals of two low – Antarctic species, *Lepidonotothen larseni* und *Gobionotothen gibberifrons*, were caught off Larsen B. ROV observations confirmed that the spiny ice fish *Chaenodraco wilsoni* are guarding their eggs. The species inventory of the western Weddell Sea is likely to be still far from being complete given the limited number of hauls we were able to carry out. A detailed analysis on the reproductive state of the species and their food composition will be conducted in the home laboratory in Hamburg.

Table 2.13 Species composition of finfish in 4 bottom and 7 Agassiz trawl hauls in the Larsen A and B areas.

| | |
|---|---|
| Artedidraconidae | *Artedidraco orianae* |
| | *Artedidraco skottsbergi* |
| Bathydraconidae | *Bathydraco antarcticus* |
| | *Gymnodraco acuticeps* |
| | *Cygnodraco mawsoni* |
| | *Prionodraco evansii* |
| Channichthyidae | *Chaenodraco wilsoni* |
| | *Chionodraco myersi* |
| | *Dacodraco hunteri* |
| | *Neopagetopsis ionah* |
| | *Pagetopsis maculatus* |
| | *Pagetopsis macropterus* |
| Nototheniidae | *Gobionotothen gibberifrons* |
| | *Lepidonotothen larseni* |
| | *Pagothenia borchgrevinki* |
| | *Pleuragramma antarcticum* |
| | *Trematomus bernacchii* |
| | *T. eulepidotus* |
| | *T. hansoni* |
| | *T. loennbergii* |
| | *T. pennelli* |
| | *T. scotti* |

## 2.1.11 MEIOFAUNAL COMMUNITIES IN THE LARSEN A/B AREA AND WEST OF THE ANTARCTIC PENINSULA

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### Objectives

Animals that are smaller than 1mm, but which are retained on a sieve with a mesh size of 32µm, are termed meiofauna, and this faunal compartment is important in Antarctic benthic ecosystems. Not only are meiofaunal organisms decomposers of detritus; by their often high densities they also bear a high potential as a food source for larger organisms. Hence, they constitute an important ecological link between micro- and macro-organisms. In comparison with temperate areas such as the NE Atlantic (Vincx *et al*., 1994 and the references therein), studies on meiofauna community structure at higher latitudes are scarce. Moreover, the number of studies dealing with Antarctic meiobenthos is still very limited (Dahms *et al.* 1990, Herman & Dahms 1992; Vanhove *et al.* 1998; Fabiano & Danovaro, 1999; Vanhove *et al*., 1999; Lee *et al.* 2001a, 2001b; Ingels *et al.* 2004).

The recent collapse of the Larsen A and B ice shelves literally uncovered entirely unknown benthic communities. To characterize these communities, and to compare them with those not recently covered by ice-shelves, is a major objective of our study. In this respect, the results will complement former EASIZ programmes. Within the BIANZO II-project (BIodiversity of three representative groups of the ANtarctic ZOobenthos: *Coping with change*), the characterization of the Antarctic zoobenthos and its adaptations to a changing environment are key topics. Our sampling in the formerly ice-covered Larsen B area clearly contributes to both, as the collapse of a large ice-sheet can be regarded as the result of our changing global environment.

Differences in meiofaunal diversity between stations (1) outside the formerly ice-shelf covered area, (2) within the former ice-shelf covered as well as (3) stations near the former ice-shelf edge will be analysed and the observed patterns will be discussed according to diversity models (e.g. productivity-diversity relationship). Comparisons of these probably oligotrophic shallow-water environments with other oligotrophic areas (e.g. ANDEEP samples from the Antarctic deep sea) are of particular interest in this respect.

An active cold seep was recently discovered in the Larsen B area by Domack (2005). This provided the opportunity to study a spot of high productivity within an oligotrophic environment, and to compare meiofaunal assemblages of both. The Marine Biology Section of Ghent University is involved in a Belgian national project dealing with cold-seep-associated benthos. With regard to this project, it is our aim to investigate (1) the factors structuring biological distribution (different spatial scales) in seeps, (2) the trophic position of the meiobenthos, (3) adaptations of the meiofauna to this extreme environment and (4) the origin of seep-related species.

Those environmental factors correlating strongest with meiofaunal major taxa abundance, as well as nematode and harpacticoid family, genera, and species diversity, are to be unravelled. Furthermore, small scale vs. large scale diversity differences in the study area can be analysed thanks to a high number of replicates at each station. The results could enhance our knowledge about regional-scale meiofaunal colonisation in general, and in addition help to understand the resilience of Antarctic marine benthic ecosystems.

### Work at sea

Meiofauna was sampled quantitatively with a multicorer. The MUC6 (inner diameter of the cores: 57 mm) was used for reasons of comparability, since the same type of gear has been deployed on most other Antarctic expeditions (EASIZ, ANDEEP).

Table 2.14 Meiofauna quantitative and/or qualitative sampling stations with (MUC6: 57mm inner diameter). EI=Elephant Island, KGI=King George Island.

| Area | gear | Drop no. | Latitude (S) | Longitude (W) | Depth (m) | Comment |
|---|---|---|---|---|---|---|
| EI | MUC6 | 609-5 | 61° 09.03' | 54° 32.28' | 410 | |
| | MUC6 | 609-7 | 61° 07.99' | 54° 31.15' | 412 | |
| | MUC6 | 609-8 | 61° 08.04' | 54° 31.36' | 400 | |
| | BT | 661-2 | 61° 39.29' | 57° 02.89' | 467 | washed |
| | | | 61° 49.57' | 57° 04.75' | 466 | sponges |
| KGI | MUC6 | 675-4 | 61° 53.14' | 59° 48.36' | 343 | |
| | MUC6 | 675-5 | 61° 53.27' | 59° 48.24' | 334 | |
| | MUC6 | 675-6 | 61° 53.22' | 59° 48.29' | 337 | |
| | BT | 697-1 | 63° 13.85' | 59° 06.30' | 329 | washed |
| | | | 63° 15.38' | 59° 03.94' | 408 | sponges |
| B_South | MUC6 | 700-8 | 65° 54.98' | 60° 20.54' | 422 | |
| | MUC6 | 700-9 | 65° 54.95' | 60° 20.88' | 417 | |
| | BT | 701-2 | 63° 13.85' | 59° 06.30' | 329 | washed |
| | | | 63° 15.38' | 59° 03.94' | 408 | sponges |
| | MUC6 | 702-4 | 65° 55.12' | 60° 19.96' | 427 | |
| | MUC6 | 702-7 | 65° 54.49' | 60° 21.37' | 405 | |
| | MUC6 | 702-8 | 65° 54.95' | 60° 20.95' | 410 | |
| B_West | MUC6 | 703-9 (failed) | 65° 32.98' | 61° 37.09' | 286 | |
| | MUC6 | 703-10 (failed) | 65° 32.98' | 61° 37.09' | 285 | |
| B_Seep | MUC6 | 706-5 | 65° 26.09' | 61° 26.48' | 819 | |
| | MUC6 | 706-6 | 65° 26.10' | 61° 26.53' | 820 | |
| | MUC6 | 709-5 | 65° 26.09' | 61° 26.51' | 819 | |
| | MG | 709-6 | 65° 26.10' | 61° 26.53' | 815 | washed clams |
| | MUC6 | 709-7 | 65° 26.07' | 61° 26.48' | 818 | |
| | MUC6 | 709-8 | 65° 26.07' | 61° 26.49' | 818 | |
| B_West | MUC6 | 710-2 | 65° 33.03' | 61° 36.98' | 277 | |
| | MUC6 | 710-3 | 65° 33.04' | 61° 37.18' | 281 | |
| | MUC6 | 710-7 | 65° 33.03' | 61° 37.01' | 275 | |
| | MUC6 | 710-8 | 65° 33.03' | 61° 37.00' | 283 | |
| | MUC6 | 710-9 | 65° 33.07' | 61° 37.06' | 288 | |
| B_North | MUC6 | 715-2 | 65° 6.39' | 60° 45.04' | 308 | |
| | MUC6 | 715-4 | 65° 6.44' | 60° 45.07' | 307 | |
| | MUC6 | 718-1 | 65° 6.33' | 60° 45.17' | 306 | |
| | MUC6 | 718-3 | 65° 6.43' | 60° 44.93' | 303 | |
| | MUC6 | 718-4 (failed) | 65° 6.41' | 60° 45.16' | 303 | |
| | MUC6 | 718-5 | 65° 6.40' | 60° 45.60' | 304 | |
| | MUC6 | 721-1 (failed) | 65° 55.51' | 60° 37.79' | 345 | |
| | MUC6 | 721-3 (failed) | 65° 55.49' | 60° 37.77' | 355 | |
| | MUC6 | 721-4 | 65° 55.55' | 60° 37.77' | 370 | |
| A_North | MUC6 | 722-3 (failed) | 64° 41.30' | 60° 31.92' | 254 | |
| A_South | MUC6 | 723-1 | 64° 56.07' | 60° 38.57' | 242 | |
| | MUC6 | 723-2 | 64° 56.06' | 60° 38.58' | 242 | |
| | MUC6 | 725-7 | 64° 56.01' | 60° 38.69' | 232 | |
| | MUC6 | 725-8 (failed) | 64° 56.04' | 60° 38.64' | 242 | |
| | MUC6 | 725-9 | 64° 56.04' | 60° 38.93' | 242 | |

Multicorer sampling took place in different areas around the Antarctic Peninsula: one station was sampled east of Elephant Island, at a depth of 430m, and another one was located west of King George Island, at a depth of 350m. However, sampling intensity was highest in the Larsen B area, with the MUC6 being deployed here at four core stations (B_South, B_Seep, B_West, B_North), each of which was differently exposed to the former ice-shelf.

At each station, 5 replicates (deployments) were taken. A fifth, additional station yielded only one successful haul. At all stations, samplings were taken at depths between 250-450m, except for the seep station, which was much deeper (approx. 800m).

For comparison, a station with one limited and three successful deployments was sampled in the inner Larsen A area (A_South). In total, the MUC6 was deployed 38 times, of which 31 hauls provided material suitable for meiofauna analysis. An overview is given in Table 2.14.

The collected sediment cores were split up in different slices, depending on the nature of further processing. The first community core (co) was sliced into the fractions "above-standing water", 0-1cm (which also contains the above-standing water close to the sediment surface, 1-2cm, 2-3cm, 3-4cm, 4-5cm, 5-10cm (if available), and 10-15cm (if available). Optionally, the first 5cm from one or more additional community cores ($co^2$, $co^3$, $co^4$) were collected together with a few centimetres of the above-standing water. All community samplings were fixed with 7% formalin. One additional core was sliced into a 0-5cm (plus a few cm of water) and 5-10cm layer and fixed with acetone for further molecular analysis. All the sea water used for rinsing was sieved beforehand with a 32µm mesh size sieve in order to avoid contamination with pelagic meiofauna. Furthermore, three cores were processed for further analysis of environmental factors (en: pigments, C/N, sediment granulometry), stable isotopes (si), and fatty acids (fa). These sediment cores were sliced into the layers "above-standing water" (5cm water), 0-0.5cm, 0.5-1cm, 1-2cm, 2-3cm, 3-4cm, 4-5cm, 5-10cm (if available), and 10-15cm (if available). These samples are kept frozen at -30°C.

Most of these samplings are shared between DZMB (Harpacticoida) and UGent (Nematoda). All cores will be stored, sorted and processed at UGent, except for the additional community cores $co^2$, $co^3$ and $co^4$, which will be stored, sorted and processed at DZMB. The material sorted at the DZMB will be made available to other institutes for systematic, biogeographic and other analyses on request. Harpacticoid copepods will remain at the DZMB for further investigation.

Additional, qualitative meiofauna samplings were obtained by sieving (fraction 1mm-32µm) rinse water from sponges obtained by other gears (Table 2.15), as well as by washing and sieving sediment from bulk MUC6 cores. These samplings were fixated with either ethanol 70 % or formalin 7% and partly investigated at major taxon level on board.

Table 2.15 Major taxa distribution in some investigated qualitative samplings (p = partim; spo = sponges rinsed with sea water, sieved with 32µm).

| Region | King George Island | Joinville Island |
|---|---|---|
| Gear<br>Sampling<br>Station | BT<br>spo (6 spp.)<br>661-2 | BT<br>spo (1 sp.)<br>697-1 |
| Diatoms | + | + |
| Foraminifera | + | + |
| Nematoda | > 300 | > 300 |
| Kinorhyncha | 2 | 5 |
| Bivalvia | 1 | |
| Annelida | 7 | + |
| Acari | 1 | |
| Ostracoda | 2 | 20 |
| Copepoda (adults, copepodids): | 115 | 150 |
| Calanoida | | + |
| Cyclopoida | + | + |
| Siphonostomatoida: | + | + |
| cf. Entomolepidae | 8 | |
| cf. Antotrogidae | 4 | |
| Harpacticoida: | 71 (~ 30 spp.) | 83 (~ 20 spp.) |
| cf. Ameiridae | + | + |
| cf. Cletodidae | + | |
| cf. Diosaccidae | + | |
| Ectinosomatidae | 3 | 4 |
| cf. Harpacticidae | + | |
| Paramesochridae | + | |
| cf. Tisbidae | + | + |
| Nauplii | > 5 | > 50 |
| Amphipoda: | | |
| Sebidae (*Seba* sp., det. d`Udekem d`Acoz) | | 3 |
| Cladocera | 2 | |
| Other | + | + |

## Preliminary results and discussion

Even though the five MUC replicates of each Larsen B station were taken at approximately the same position, the structure of the sediment (colour, texture, depth of sulphidic layer in station B_Seep) was often quite different between replicates and sometimes even within a single haul. This observed high local and small-scale heterogeneity and patchiness of the Antarctic benthic environment stresses the importance of taking many replicates. With less than 5 replicates, the environmental heterogeneity would certainly not have been covered adequately. A nice example of this heterogeneity could be found in station B_Seep. The proximity of an inactive, sediment-covered cold seep and its associated megafauna (dead clam patches) could successfully be sampled with the MUC6 during the expedition. Only in three of the five replicates at this station, the deeper sediment layers were clearly blue-grey and sulphidic, separated from the oxic surface layers by a distinct horizon. This horizon occurred at a depth of 3 to 5cm in one replicate, between 7 and 10cm in another and between 15 and 25cm in the third. These preliminary findings already reflect a high patchiness of this ‘cold seep’ environment.

Preliminary community results are available only for two qualitative samplings from sponges (Table 2.15). The first sampling (King George Island) was obtained by rinsing one specimen of 6 different sponge species, the second one by rinsing material from one big sponge fragment (*Rossella*). The total sponge volume was comparable for both cases. A higher diversity in the first sample was reflected at least in a higher harpacticoid species richness (30 vs 20 species), which was roughly estimated on board of the vessel.

Nematodes turned out to be the dominating meiofaunal major taxon in the collected sponges. This is not surprising, since this taxon is already known to dominate the benthic meiofauna in Antarctic deep-sea and shallow-water multicorer, multibox corer, and giant box corer samples (e.g. Dahms *et al.* 1990, Gutzmann *et al.* 2004, Herman & Dahms 1992, Lee *et al.* 2001a, 2001b, Vanhove *et al.* 1995, 1998).

Copepods were relatively abundant in the investigated sponges as well, even though they did not reach the same level of dominance as nematodes. This finding is consistent with results from the literature sources mentioned above. Less abundant taxa in the samplings were Ostracoda, Kinorhyncha, Bivalvia, Polychaeta, Amphipoda, Cladocera, and Halacarida.

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## 2.1.12 A COMPARISON OF BENTHIC RESPIRATION RATES

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### Objective

One objective of this cruise was to contribute to the understanding of the carbon pathway of the western Weddell Sea with benthic respiration analysis. Measuring the rate at which the benthic community uses oxygen provides an indicator of benthic activity. In the benthos, oxygen is used by bacteria, meiofauna and macrofauna in biological processes. This study focused on the community respiration as a whole as well as that of macrofauna. Collaboration with another researcher may provide insight into the bacterial abundance and possibly into the contribution of bacteria to the overall oxygen demand of the benthic layer.

The break-up of the Larsen Ice Shelves provides the opportunity to study the initial stages of recolonization in the high Antarctic with respect to the benthic carbon pathway. The hypothesis for this project was modified during the course of the cruise. The proposed hypothesis now is that the benthic respiration rate of communities in the Larsen A and B areas are influenced by the length of time since the area was last covered by an ice shelf.

### Work at Sea

One box core sample was taken at each of the five Larsen stations listed in Table 2.16. The cores were only used if they reached the deck largely undisturbed. The boxes were subsampled to collect the following: three Carbon, Hydrogen and Nitrogen (CHN) cores, three pigment cores and one grain size core, as well as three or four benthic incubation cores. Water overlying the sediment in the box was siphoned off for use later with the respirations. The CHN samples, each of approximately 10ml, were frozen immediately and stored at -20°C. The pigment cores, 6cm in diameter and 10cm deep, were processed 1cm depth at a time. Each centimetre of sediment was divided for chlorophyll a analysis on board and HPLC analysis at the Museum. For some stations, a reference sediment sample was also taken for further analysis with a standardized fluorometer. Chlorophyll a (chl a) samples were placed in 50ml Falcon tubes and frozen at -20°C. After 48 hours, the samples were allowed to thaw and 20ml of 100% acetone was added to each tube. The samples were shaken periodically and kept at 0°C over the following 48 hours after which they were centrifuged at 3800 rpm for 10 minutes. A volume of 4ml of the supernatant was pipetted off and analysed for chlorophyll a concentration with a portable fluorometer. After the chlorophyll a concentration was measured, two drops of 10% HCL was added to measure the pheophytin effect and the fluorescence was measured again. Due to time and supply constraints, only two sets of chlorophyll samples were analyzed. The grain size core was also processed per centimetre to a depth of 10cm. Samples were frozen at -20°C.

Table 2.16 Position and water depth of stations sampled.

| Station | Latitude | Longitude | Depth (m) |
|---|---|---|---|
| B_South (702-3) | 65° 55.12' S | 60° 19.82' W | 446 |
| B_West (703-11) | 65° 33.01' S | 61° 37.06' W | 298 |
| B_Seep (711-6) | 65° 27.54' S | 61° 26.03' W | 792 |
| B_North (718-2) | 65° 06.45' S | 60° 45.20' W | 319 |
| A_South (725-5) | 64° 55.58' S | 60° 37.05' W | 283 |

Benthic community incubations were run in 12-13cm diameter cores. Cores were chosen randomly from box core while water was still overlying the sediment so as to minimize disturbance to the surface sediment. The cores were topped up with water from the boxcore and kept in a cool container with a mean temperature of 0°C. The water was aerated to increase the dissolved oxygen level to 100% before the cores were sealed. The incubation tops housed a magnetic motor system that circulated the water within the incubations. Dissolved oxygen levels were measured with a YSI 5000 DO Meter. DO levels were measured at the start and every 6-9 hours afterwards until the DO level reached 75-80% of the original concentration. Once the desired oxygen depletion occurred, the incubation was sieved with a 0.4mm sieve. Animals from the incubations were preserved in a 6% formalin-seawater solution buffered with borax. Taxonomic identification will take place at the Canadian Museum of Nature, as will biomass measurements of wet and ash free dry weight. A second set of incubations containing only bottom water were run concurrently with each set of community incubations so as to account for the respiration of bacteria in the overlying water of the community incubations.

### Preliminary results

Preliminary results show little difference between average respiration rates from each station (Fig. 2.10). However, adjustments must be made to compensate for the contributions of bacterial in the overlying water as well as the abundance of macrofauna contained in each incubation core.

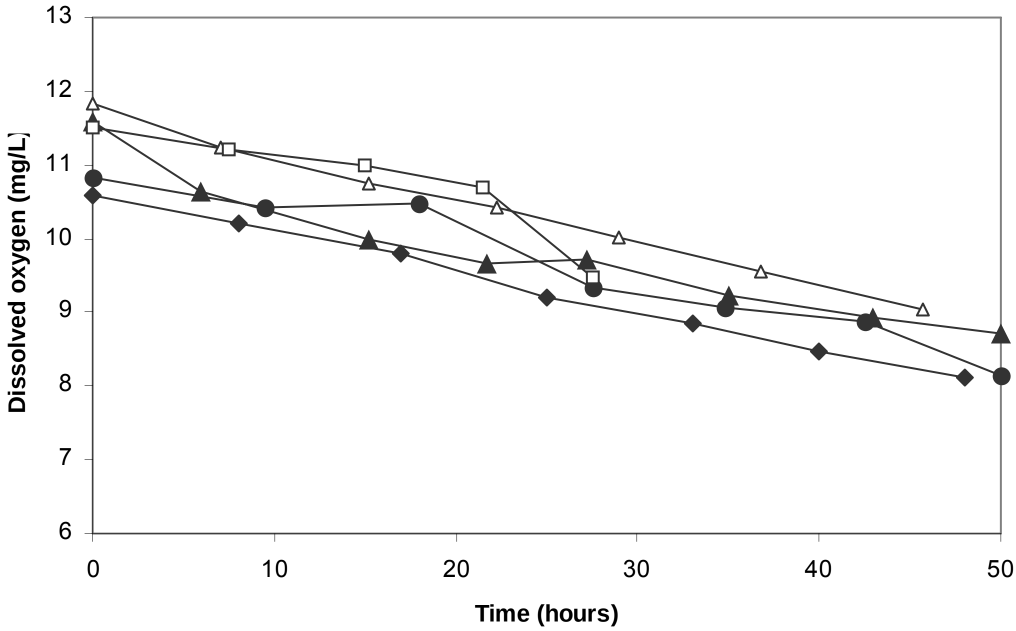


Fig. 2.10 Average dissolved oxygen depletion rates (note: the sudden drop in dissolved oxygen for A_South was caused by a technical malfunction and not by natural processes). Filled circle: B_South, filled triangle: B_West, filled diamond: B_Seep, open triangle: B_North, open square: A_South.

Preliminary analyses of chl a concentrations between the stations B_South and B_West showed a significant increase of primary production capacity at B_South, the station least recently covered by ice. Processing of the other three sets of pigment data will add to the carbon cycle picture revealed by the respiration cores. Further analyses will illustrate the oxygen demand per square meter for the five areas samples as well as give insight into the overall carbon pathway in the Larsen A and B areas.

## 2.1.13 FOOD WEB AND ENERGY FLOW

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### Objectives

In high latitude marine systems, food availability is strongly seasonal and spatially patchy, whereas the temperature dependence of biochemical processes causes a general slowdown of metabolism. In general, the short phytoplankton summer bloom does not seem to be an obvious limiting factor for macrobenthic species richness or biomass and present life forms in high Antarctic shelf areas, which are relatively well investigated. Studying trophic limitations and resilience of the ecosystem in areas affected by recent large-scale calving events of the Larsen Ice Shelf provide excellent conditions to acquire additional data of existing theories how communities can exist under Antarctic conditions. The crucial point of this project is to compare the structure of Larsen Shelf food web, which is most likely fuelled by lateral food convection with recent findings for the high-Antarctic Weddell Sea food web.

Rationale:
(i) Biochemical biomarkers such as stable isotope and lipid compositions will provide temporally integrated signatures of trophic relationships. Stable isotope ratios ($^{14/15}$N, $^{12/13}$C) in organic matter change with the passing of N and C through the food web owing to selectivity of enzymes for one of the isotopes. Hence, stable isotope ratios can be used to determine the relative trophic position of taxa/groups within the community.

(ii) Metabolic activity of important benthic taxa: Energy budgets will be constructed for dominant ectotherms to get further information about the energy flow within the trophic system. The standard metabolic rate of an organism reflects the overall energy flow through this organism, because
Consumption = Production + Respiration + Excretion. Therefore information on oxygen consumption of major components adds to the knowledge of energy flow through the whole system. These data will be used to construct balanced flow models of Antarctic communities using the ECOPATH/ECOSIM software.

### Work at sea

For stable isotope analysis, invertebrates and fishes were collected from bottom trawls, Agassiz trawls, dredges and baited traps. Small organisms were sampled completely, while from macro-and megafaunal specimens' body wall pieces or muscle tissue samples were taken for analysis. All samples were rinsed with distilled water and frozen at -30°C until further analysis of stable isotope ratios (N, C) at home. For later validation of the taxonomy reference animals were preserved in 70% ethanol.

Animals for metabolism measurements were transferred immediately after the haul to a cooling container. They were maintained in aerated aquaria with a flow system at environmental temperatures. For respiration experiments only animals without any damage, which showed normal escape behaviour after tactile stimulus were used. Oxygen consumption rates of unfed (deprived of food for at least 3 days), unstressed and inactive animals were used as a proxy of standard metabolic rate. Oxygen content was assessed using a modified intermitted flow system and oxygen microoptodes connected to a Microx TX 3–array (® PreSens GmbH, Neuweiler, Germany). Measurement started after over night acclimatization and after closing the system from the surrounding seawater. Water was continuously circulated by a peristaltic pump (Masterflex Model L/S) and the decrease in oxygen content from 100 to about 80% oxygen was recorded for each chamber. Immediately after the end of each experiment water samples were taken for a later measurement of ammonium content. Thereafter animals were frozen at -30°C for dry mass measurements at home.

Table 2.17 Major taxa sampled for stable isotope analysis by area.

| Major Taxon | South Shetlands/ Elephant Island | Larsen A + B |
|---|---|---|
| Algae | 3 | 0 |
| Porifera | 7 | 0 |
| Cnidaria | 59 | 12 |
| Bryozoa | 17 | 0 |
| Brachiopoda | 28 | 0 |
| Sipuncula | 0 | 5 |
| Plathelminthes | 2 | 0 |
| Nemertea | 4 | 2 |
| Echiura | 8 | 8 |
| Mollusca | 173 | 32 |
| Annelida | 25 | 13 |
| Crustacea | 64 | 8 |
| Echinodermata | 15 | 54 |
| Tunicata | 23 | 61 |
| Priapulida | 0 | 1 |
| Hemichordata | 8 | 5 |
| Aves | 8 | 0 |
| Pisces | 76 | 11 |
| Mammalia | 1 | 0 |
| | 521 | 212 |

### Preliminary results

In total we collected 733 stable isotope samples from organisms from the area of the Antarctic Peninsula. 521 samples belonging to 17 taxa were collected at the South Shetland Island and Elephant Island shelf, 212 samples belonging to 12 taxa in the Larsen A/B area (Table 2.17). The slightly lower taxa number of the Larsen A/B area was due to ”poorer” species richness. At most stations communities were dominated by holothurians and fast growing ascidians.

Table 2.18 List of animals used for respiration measurements.

| Taxon | Species | N | |
|---|---|---|---|
| Isopoda | *Natatolana* spp. | 12 | Σ=45 |
| | *Natatolana albinota* | 3 | |
| | *Glyptonotus* spp. | 15 | |
| | *Ceratoserolis* spp. | 15 | |
| Amphipoda | *Epimeria georgiana* | 9 | Σ=36 |
| | *Maxilliphimedia longipes* | 3 | |
| | *Paraceradocus gibber* | 9 | |
| | *Eusirus properdentatus* | 3 | |
| | *Eurythenes grillus* | 12 | |
| Decapoda | *Notocrangon antarcticus* | 12 | Σ=12 |
| Bivalvia | *Yoldia eightsii* | 9 | Σ=9 |
| Holothuroidea | *Bathyplotes* sp. | 3 | Σ=3 |
| | | 105 | |

In total we performed 35 respiration experiments and could determine the standard metabolic rate of 105 animals belonging to 5 taxonomic groups. All animals used for respiration experiments (Table 2.18) took the transfer from the aquarium to the respiration chambers apparently well. The final data analysis is still pending and will be finished at home.

## 2.1.14 COLD SEEP BIVALVES

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### Objectives

Cold seeps, though much cooler than vents, also have regions of very low oxygen and high hydrogen sulphide, as well as other potentially harmful substances such as crude oil and supersaturated brine. Specially adapted animals not only tolerate these conditions, they often thrive under them. In most cases this tolerance is due to a combination of physiological and behavioural adaptations that allow animals to avoid the extremes of their habitats and yet benefit from the chemoautotrophic production characteristic of this environment. The recent discovery of a vast ecosystem beneath the collapsed Larsen B Ice Shelf is the first cold-seep described on the Antarctic shelf. The nearly pristine conditions - which have been undisturbed for more than 10,000 years - can serve as a baseline for probing other cold seeps.

Within the Larsen B shelf area large assemblages of cold seep bivalves have been reported. Clams around seep mounds rely on sulphide-oxidizing endosymbionts. In some of these species individuals may be able to attain a maximum age oft several decades or even beyond 100 years. Thus, physical and chemical properties of the shell of such specimens may reflect environmental conditions during lifetime, which can be accessed via proxies such as shell growth increments, stable isotope ratios and trace element concentrations.

### Work at sea

Potential seep sites were scanned with video-equipped gear (ROV and MG) to localize and observe clams spots. Trawls and corers were used to sample clams. All shells were prepared for further measurements of bivalve growth (shell increments, stable isotopes) and variability in methane outflow (trace elements) at the AWI. No work with life animals (e.g. respiration experiments, measurement of heart beat rates) could be done.

## Preliminary results

Clams could be observed at four stations: two ROV (706-1, 706-2) and two stations with the camera-equipped multibox corer (706-3 and 709-6). The distribution of clams seems to be very patchy. Only dead clams could be observed. We were able to recover shells and shell fragments (see Fig. 2.11) with MG (709-6) and Agassiz trawl (711-7). The recovered shells belong to the family Vesicomyidae (genus *Calyptogena*). However, a detailed taxonomic classification will be done at the AWI. A 20cm sediment layer covered the shells from the MG, giving evidence for an inactivity of the cold seep.

Fig. 2.11 Dead shell of cf *Calyptogena* recovered with the video-equipped multibox corer at "B_Seep" (709-6).

## 2.1.15 BIOGEOCHEMISTRY OF A COLD SEEP IN THE LARSEN B AREA AND OF MARINE SHELF SEDIMENTS

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### Introduction

Ocean margin research of the last decade has provided evidence for a variety of fascinating ecosystems associated with fluid, gas and mud escape structures. These so called cold seeps are colonized by enormous biomasses of bacterial mats, chemosynthetic fauna and a variety of associated animals. Cold seep systems bear a variety of microhabitats such as surface and subsurface sediments, carbonate precipitates and symbiotic megafauna like tubeworm aggregations and bivalve beds. Subsurface seep sediments harbour a great diversity of hydrocarbon degrading communities of anaerobic bacteria and archaea along fluid and gas escape pathways. The seep-related micro and mega fauna thrive on and shape gradients of electron donors such as methane and sulphide as well as electron acceptors such as oxygen and sulphate. Furthermore, the metabolic products (e.g., bicarbonate and sulphide) of seep-microbes provide the base of the food web thereby fuelling the vast amount of biomass that is typically found at many seeps. In this context, specialised, symbiotic archaea and sulphate reducing bacteria mediating the anaerobic oxidation of methane (AOM) with sulphate are of particular importance (Boetius *et al.*, 2000) because the activity of these communities reduces the efflux of methane to the hydro- and potentially to the atmosphere where it strongly contributes to the green house effect. However, the activity of AOM communities is regulated by the availability of methane and sulphate, which in return is regulated by the fluid and/or gas flux as well as bioirrigation activities (Niemann *et al.*, 2006). Deceasing and low-activity seeps may therefore appear inconspicuous because reduced molecules like methane and sulphide are consumed subsurface, while surface sediments are comparable to non-seep sediments in adjacent areas.

In the last few years, vast areas of the Larsen B ice shelf broke off and a large area formerly covered by ice became accessible to scientists. Subsequent videographic surveys of the sea floor in the trough of the Evans Glacier (~830m water depth) gave indications for hydrocarbon seepage and associated chemosynthetic fauna (Domack et al., 2005). Only very few studies on seeps in Antarctic waters were conducted so far, and nothing is known about the extension, biogeochemistry, associated organisms and methane source of the potential Larsen B seep. Furthermore, Antarctic waters are isolated from the world oceans because of the circumpolar currents. This makes a potential seep in the Larsen B area particularly interesting for biogeochemistry, microbiology and biogeography.

Little is furthermore known about biogeochemical processes in Antarctic shelf sediments and the effect of ice cover. The recent break-off of the Larsen B ice shelf gives thus the opportunity to study the effects of ice cover and to compare these to sediments in open waters outside the Larsen area and – as a result of the expedition track – to the South Shetland Islands and Elephant Island.

### Objectives

<u>Larsen B Seep.</u> For seep-related studies, the aim of the expedition is (1) to characterize and to quantify biogeochemical reactions and transport processes in cold seep related sediments and across the sediment-water interface (especially methane, sulphate, bicarbonate and acetate). This will be accomplished by radiotracer incubations and flux calculations of pore water constituents. (2) The reconstruction of methane flux variation and (3) the migration of the sulphate-methane transition zone over time will be assed by investigations of authigenic minerals formed in these sediments – particularly

barite, carbonates and iron sulphides – which have a high potential to trace past fluctuations of redox fronts. (4) The biodiversity of seep microbes and megafauna will be investigated by lipid biomarker, DNA and fluorescence in situ hybridisation (FISH) analyses.

Biogeochemistry of ice covered versus open water Antarctic shelf sediments. To assess the effect of ice cover, the second aim was to qualify and quantify biogeochemical processes and related microbes in shelf sediments in waters recently covered by the Larsen B ice shelf and to compare these to sediments covered by open waters outside this area. Biogeochemical reactions and related organisms will be qualified and quantified with the same approach as described above (i.e. 1 and 4).

## Work at sea

The first objective was to locate seep areas by videographic investigations with the remotely operated vehicle (ROV) Cherokee and by echosounder surveys. Subsequently, sediments of interest were recovered with a video-guided multicorer (MUC) as well as with a gravity corer (GC). After recovery, sediment samples were transferred into a cold room and maintained at about in situ temperature (0.5 °C). Within a few hours after recovery, sediment cores were sectioned and further processed for pore water extraction and radio tracer incubations as well as for lipid biomarker, DNA and FISH fixations. Pore water extractions were carried out with rhizones (capillary filters) and samples for solid phase and mineralogical analyses were frozen at -20°C. Sediments for methane oxidation, methanogenesis and sulphate reduction rates were incubated in acrylic core liners or glass tubes with $^{14}C$-methane, bicarbonate and acetate, and $^{35}S$-sulphate, respectively. Sediments for lipid biomarker and DNA analyses were frozen at -20°C. Samples for FISH were fixed in formalin-seawater and Ethanol-PBS solution. Sediment samples for enrichment cultures were collected in Duran bottles and maintained at ~2°C. Additionally, subsamples for the analysis of foraminifera were stored under an argon atmosphere at -20°C. Methane concentrations will be determined from syringe samples fixed with $NaCl$-$NaN_3$ solution in septum vials. Shell fragments of clams were collected from MUC-cores and stored in plastic bags for taxonomic determination. In addition to sediment samples, water column samples above the potential Larsen B seep were collected with a CTD rosette and will be analysed for methane concentrations.

Pore water analyses of Eh, pH, alkalinity and iron ($Fe^{2+}$) were carried out during the cruise. Sulphide, sulphate, chloride, ammonium, phosphate, methane, DIC and $\delta^{13}C$ of DIC and methane as well as solid phases will be analysed at the AWI and/or MARUM or MPI. Methane oxidation, methanogenesis and sulphate reduction rate samples as well as lipid biomarker, DNA and FISH samples will be further processed and analysed at the MPI.

Table 2.19 Sediment cores sampled for biogeochemical parameters. Core length and sampling intervals (cm) are indicated (sampl. depth/interv.). Anaerobic oxidation of methane (AOM), sulphate reduction (SR), bicarbonate (Bicarb.) turnover, fluorescence in situ hybridisation (FISH), multicorer (MUC), gravity corer (GC). Depth of sulphide front determined by smell. Brackets indicate a very faint smell of sulphide. EI: Elephant Island, KGI: King George Island.

| Location Device | Stn. | Core (cm) | AOM, SR | Bicarb. turnover | Acetate turnover | FISH DNA | Bio-marker | Life sedim. | Sul-phide |
|---|---|---|---|---|---|---|---|---|---|
| **E of EI** | | | | | | | | | |
| MUC | 609-3 | 26 | 0-26/2 | 0-26/2 | 0-26/2 | 0-26/2 | 0-26/2 | | |
| **W of EI** | | | | | | | | | |
| MUC | 636-1 | 10 | 0-10/2 | 0-10/2 | 0-10/2 | 0-10/2 | 0-10/2 | | |
| **W of KGI** | | | | | | | | | |
| MUC | 675-3 | 22 | 0-22/2 | 0-22/2 | 0-22/2 | 0-22/2 | 0-22/2 | | |
| **B_South** | | | | | | | | | |
| MUC | 700-6 | 28 | 0-28/4 | 0-28/4 | 0-28/4 | 0-28/4 | 0-20 | 0-10, 10-25 | |
| GC | 702-6 | 160 | 0-150/10 | 0-150/10 | 0-150/10 | 0-150/10 | 0-150/10 | | |
| **B_West** | | | | | | | | | |
| MUC | 703-6 | 28 | 0-28/4 | 0-28/4 | 0-28/4 | 0-28/4 | 0-28/4 | 10-20 | |
| GC | 710-4 | 55 | 0-50/10 | 0-50/10 | 0-50/10 | 0-50/10 | 0-50/10 | | (> 55) |
| **B_Seep** | | | | | | | | | |
| MUC (in clam patch) | 709-3 | 26 | 0-26/2 | 0-24/2 | 0-24/2 | 0-18/2 | 0-18/2 | anoxic bulk | >34 |
| GC | 706-4 | 115 | 0-110/10 | 0-110/10 | 0-110/10 | 0-110/10 | 0-110/10 | 0-40, 40-75 | >14 |
| GC | 711-3 | 75 | 0-70/10 | 0-70/10 | 0-70/10 | 0-70/10 | | | >20 |
| GC | 711-4 | 100 | 0-90/10 | 0-90/10 | 0-90/10 | 0-90/10 | | | >20 |
| MUC (close to clam p.) | 711-8 | 26 | | | | 0-26/2 | 0-26/2 | anoxic bulk | >8 |
| GC (ca. 1 nm away from clams | 711-5 | 105 | 0-100/20 | 0-100/20 | 0-100/20 | 0-100/20 | | | (>30) |

## Preliminary results

The majority of samples taken during cruise M66-2b were preserved for subsequent biological and/or chemical analysis in the home laboratory. Hence, most results were not available at the end of the cruise. A total of 14 stations (7 MUC's, 6 GC's and 1 CTD) were sampled during cruise ANT-XXIII/8 for radio-tracer incubations, FISH, DNA, biomarker and enrichment cultures (Table 2.19) as well as for methane, sulphate, sulphide, volatile fatty acid, bicarbonate, pH, EH, alkalinity, iron, phosphate, ammonium, trace metals and solid phase analyses (Tab. 2.20, 2.21).

Table 2.20 Sediments sampled for various geochemical parameters. Sampled core length and sampling intervals (cm) are indicated (sampl. depth/interv.). Pore water (PW). A detailed list of pore water constituents that were/will be measured are provided in Table 2.21. For abbreviations of locations see legend of Table 2.19.

| Location<br>Device | Station | Core length (cm) | PW | Methane | Solid phase | pH<br>EH |
|---|---|---|---|---|---|---|
| **E of EI** | | | | | | |
| MUC | 609-3 | 26 | 0-26/1 | 0-26/2 | 0-26/2 | 0-26/2 |
| **W of EI** | | | | | | |
| MUC | 636-1 | 10 | 0-10/1 | 0-10/2 | 0-10/2 | |
| **W of KGI** | | | | | | |
| MUC | 675-3 | 22 | 0-22/1 | 0-22/2 | 0-22/2 | |
| **B_South** | | | | | | |
| MUC | 700-6 | 28 | 0-28/1 | 0-28/2 | 0-28/2 | 0-28/2 |
| GC | 702-6 | 160 | 0-150/20 | 0-150/10 | 0-150/10 | 0-150/10 |
| **B_West** | | | | | | |
| MUC | 703-6 | 28 | 0-28/1 | 0-28/4 | 0-28/2 | 0-28/2 |
| GC | 710-4 | 55 | 0-50/20 | 0-50/10 | 0-50/10 | 0-50/10 |
| **B_Seep** | | | | | | |
| MUC (in clam patch) | 709-3 | 26 | 0-26/1 | 0-24/2 | 0-24/2 | 0-18/2 |
| GC | 706-4 | 115 | 0-110/20 | 0-110/10 | 0-110/10 | 0-110/10 |
| GC | 711-3 | 75 | 0-70/20 | 0-70/10<br>x | 0-70/10 | 0-70/10 |
| GC | 711-4 | 100 | | | | |
| MUC (close to clam p.) | 711-8 | 26 | 0-90/20<br>26/2 | 0-90/10 | 0-90/10 | 0-90/10 |
| GC (ca. 1 nm away from clam patches) | 711-5 | 105 | 0-100/20 | 0-100/10 | 0-100/10 | |

The sediments retrieved from Elephant Island and the South Shetland Islands comprised pelagic sediments at the surface and olive green to greyish suboxic sediments below. Generally, the sediments from this region were a matrix of silt with gravel and occasional drop stones of presumably glacial origin. In contrast, sediments from the Larsen area (B_South and B_West core-stations) comprised pelagic yellowish sediments in the upper 50cm and coarse gravel inclusions below. Occasionally drop stones were found throughout the cores. Comparable to the South Shetlands and Elephant Island, the gravel and drop stones are most likely of a glacial origin. The bright colour of surface sediments directly indicates a low content of organic carbon most likely related to low sedimentation rates of organic matter.

During cruise ANT-XXIII/8, a ROV dive in ~830m water depth along the video transect of Domack and co-workers (2005) in the trough of the Evans Glacier revealed 4-8 patches (ca. 0.5m across) of dead bivalve shells in an area of about 50 × 50m. The shells probably belong to *Calyptogena* sp., a clam that is typically found at cold seeps. These clams harbour endosymbiotic, thiotrophic bacteria in their gills. The role of the clam is to provide the symbionts with sulphide. In return, the symbionts oxidise the sulphide and thereby provide their host with metabolic products. Subsequent MUC and GC coring provided evidence that subsurface sediments (>10cm below sea floor) are sulphidic. Considering the low input of organic matter in this region, sulphate reduction coupled to the degradation of organic matter appears unlikely. Instead, AOM fuelled by a methane source from deep below seems more likely. However, a second ROV dive, perpendicular to the first transect, crossing the area of the clam patches did not show any further, potentially seep-related features such as gas ebullition, thiotrophic bacterial mats reduced surface sediments or other symbiotic megafauna organisms.

As a first conclusion, the clam beds give evidence that the seep activity in the Larsen B area was substantially higher in the past. However, with respect to our observations, the seep activity at present appears to decline or is in a transient state of low activity.

Table 2.21 Pore water constituents that were/will be analysed. × denotes if the parameter was/will be measured. Abbreviations: hydrogen sulphide ($HS^-$), volatile fatty acids (VFA), iron II ($Fe^{2+}$), phosphate ($PO_4^{3-}$), ammonium ($NH_4^+$), bicarbonate (DIC), trace metals (tr. met.), alkalinity (alkal.).

| Station | $HS^-$ | $SO_4^{2-}$ $Cl^-$ | VFA | $Fe^{2+}$ | $PO_4^{3-}$ | $NH^{4+}$ | DIC | tr. met. | alkal. |
|---|---|---|---|---|---|---|---|---|---|
| 609-3 | x | x | x | x | x | x | x | | x |
| 636-1 | x | x | x | x | x | x | x | | x |
| 675-3 | x | x | x | x | x | x | x | x | x |
| 700-6 | x | x | x | | | x | x | | x |
| 702-6 | x | x | | x | x | x | | x | |
| 703-6 | x | x | x | x | x | x | x | | x |
| 710-4 | x | x | | x | x | x | x | x | x |
| 709-3 | x | x | | x | x | x | x | | x |
| 706-4 | x | x | x | x | x | x | x | x | x |
| 711-3 | x | x | | x | x | x | x | | x |
| 711-4 | x | x | | x | x | x | | x | x |
| 711-8 | x | x | x | x | x | x | | | x |
| 711-5 | x | x | | x | x | x | x | | x |

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## 2.1.16 BATHYMETRY

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### Objectives

High-precision three-dimensional depth measurements using a multibeam sonar system were performed in order to provide information about the seafloor topography, which are strongly needed as geodatabase in marine geosciences. The area east of the Antarctic Peninsula is only sparsely surveyed by hydrographic survey and research vessels. Older data collected in ice covered oceans often suffer from low quality and bad navigation.

The multibeam data measured on the transit from Cape Town to the Antarctic Peninsula and back to Punta Arenas as well as the data surveyed in working areas around the Antarctic Peninsula will supplement the existing bathymetric database. With the new data, existing charts like GEBCO (General Bathymetric Charts of the Oceans) and IBCSO (International Bathymetric Chart of the Southern Ocean) will be updated.

The main scientific bathymetric work was performed in the area of the former Larsen A and Larsen B Ice Shelves and in front of the Crane Glacier, where the existence of a mud volcano on the sea floor was presumed. Detailed surveys were performed in areas of interest for the compilation of large scale maps which are used for the visualisation and interpretation of scientific observations and measurements by other groups.

### Work at sea

The multibeam sonar system Hydrosweep was operated most of the time during the transits from Cape Town to the working areas and along the route to Punta Arenas. However, because of regulations decreed for this expedition by the German Umweltbundesamt (UBA, Federal Environmental Agency), Hydrosweep had to be switched off during stationary work and in occasion of close whale approaches to *Polarstern*.

Calibration. As consequence to the partly replacement of the Hydrosweep transducer arrays in Cape Town, it was indispensable to perform a roll and pitch bias calibration. This calibration is needed for the determination of the effective biases for the roll and pitch values, measured by the Marine Inertial Navigation Systems (MINS). *Polarstern* is equipped with two platforms, MINS 1 and 2. The roll and pitch biases are a measure in degrees of the angle difference between the apparent horizon defined by the inertial system and the athwartships and alongships alignment of the ship's multibeam transducer arrays. These offsets should be measured not only after a transducer replacement but should be periodically verified. The correction of the current roll and pitch bias values are measured by taking two sets of multibeam data over a planar seafloor by sailing a straight route and its reciprocal course. The two different data sets are fit to planes (mean slope). The angle difference between the two mean slopes makes the double difference of the roll and pitch offsets. These values are applied as corrections to the current roll and pitch measurements of the MINS.

Operation of Hydrosweep and post-processing. Main task during this cruise was to operate the Hydrosweep-System according to the scientific program in cooperation with other scientific projects. In this manner, also smaller boxed surveys had to be planned to cover the entire area and to maintain the hydrographic standards and regulations to achieve quality data. The collected multibeam data were analysed and post-processed for most of the data. Working maps were prepared for immediate interdisciplinary use during the expedition.

Hydrosweep was operated using the 90° aperture angle and 59 hardbeam mode. The sound velocity correction was ascertained by the Hydrosweep cross fan calibration processes most of the time. While in operation, Hydrosweep displays the colour coded swath profile of the seafloor topography, an athwartship cross profile, and information about the signal quality in real-time on the screen. Based upon these information scientifically noteworthy regions and suitable locations for the deployment of the different sampling and observation systems may be detected and located in near real-time.

The recorded multibeam data were exported and stored in 8-hour blocks in the internal raw data format SURF. After the navigation control by “Hydromap Offline”, which detects gaps and position errors and conducts a navigation correction, the Hydrosweep data were edited with “CARIS HIPS and SIPS” software. The final processing step comprises the export of the depth data into a plain ASCII-format xyz (longitude, latitude, depth) used for the production of bathymetric maps. All recorded multibeam measurements, including the ship’s position and attitude data were post-processed and quality controlled during the cruise.

Bathymetric survey schedule in the Larsen A/B Ice Shelf. Systematic and areal multibeam surveys in the main operation area of the former Larsen A/B Ice Shelves could only be realised at night. Track planning and data processing was performed during stationary work (biological sampling, ROV operations, etc.) and during daytime. Due to the UBA regulations, the operation of the multibeam system Hydrosweep was permitted for 120 hours in total.

The preparation of precise large scale bathymetric maps of the surrounding area of marine biological sampling stations requires a detailed planning and organisation. In several cases special areal surveys with parallel ship tracks (mattresses) were pre-planned in order to cover the largest possible area. Whenever practicable, profiles with 10% swath overlap were established. In some shallow water regions (< 500 m) unsurveyed patches remain due to grounded icebergs. The large scale bathymetric maps prepared on board were especially useful for the real-time ROV controlling. The seafloor topography (i.e. the digital terrain model of the seafloor) was displayed on the control screen of the ROV operator.

The main working area at Larsen B was divided into four subareas (“B_South”, “B_West”, “B_Seep”, “B_North”). At Larsen A, two sampling areas (“A_North”, “A_South”) were established. Two additional sampling stations in front of the eastern entrance of the Antarctic Sound, near Dundee and Snow Hill Islands, were surveyed on the transit to Punta Arenas. At each station it was strived to survey the largest possible area.

## Preliminary results

Calibration. The calibration was carried out on the pre-selected profile (start point at 46°40.9' S and 7°28.4' E; end point 46°45.1' S and 7°24.5' E) at 2500m water depth. The area which shows a relatively planar and smooth sea bottom was reached on late 27 November 2006. In order to measure the water sound velocity profile (SVP) needed for the refraction correction of the slant multibeam sonar ranges, a CTD was deployed on 46°39.3' S and 7°30.3' E and lowered to 2400m depth. The actual SVP-data were entered into the Hydrosweep control software. Roll and pitch bias values were set to zero for the first calibration of each MINS.

Table 1.22 Results of the MINS1 and MINS2 calibration.

| | MINS1 | | MINS2 | |
|---|---|---|---|---|
| | roll | pitch | roll | pitch |
| 1$^{st}$ calculation | 0.02 | 0.21 | 0.04 | 0.22 |
| 2$^{nd}$ calculation | 0.03 | 0.24 | 0.03 | 0.25 |

The calibration profile was passed eight times in total. After the first passes in opposite direction, preliminary values for roll and pitch biases for the MINS 1 were determined and entered into the system. A subsequent reciprocal pass was performed to check and validate the primary values. As next step the navigation and attitude input for Hydrosweep was changed to platform MINS2 and the same procedure was performed to measure and verify the roll and pitch biases. The calibration was completed after six hours; the new biases were successfully determined and logged. The results are given in Table 2.22; the final numbers are printed in bold. In this case only small differences between the new and the previous biases were observed.

The bathymetry of the Larsen A/B areas. Four large scale maps of the sea floor topography representing the vicinity of the biological sampling stations "B_South" (Fig. 2.12), "B_West" (Fig. 2.13), "B_Seep" (Fig. 2.14) and "B_North" (Fig. 2.15) were produced in the area of the former Larsen B Ice

Shelf. The bathymetry measured in this area covers 534km². In the region of the Larsen A Ice Shelf an area of 137km$^2$ was mapped, additional 35km² were charted around study areas near Snow Hill and Dundee Islands. The topography of these areas was widely unknown before. All new bathymetric maps compiled during the expedition use a contour line interval of 10m. The maps are available in digital form in colour or in black/white, the latter contain contour lines only.

The first survey on "B_South" was performed within two nights and covers an area of 103km². The depth range in this area is 450m to 100m. The bathymetry of the closely neighboured (10km) working areas "B_West" and "B_Seep" was surveyed within five nights. This area covers approx. 345km² and shows a depth range between 850m and 250m.

The bathymetry of the working area “B_Seep” (Fig. 2.14) reveals two regions of different morphological structures. The eastern part shows a more than 850m deep basin characterized by a relatively smooth surface, possibly formed by glacial abrasion. The western area is more undulated and marked by a distinct SW to NE trending chain of 100m to 200m high moraine-like hillocks (around 65°24’S; 61°37’W) which form a boundary between the two morphologies.

The survey of "B_North" was challenging due to the unfavourable local ice conditions. The shallow water depths between 360m and 190m resulted in relatively small swath coverage and thus only an area of 86km² could be surveyed in two nights.

The vicinity around the sampling areas “A_South” (Fig. 2.16) and “A_North” (Fig. 2.17) were mapped with multibeam. The “A_South” map covers 70km² and show depth ranges from 750m to 140m. The northward extension of the survey in area "A_South" in relation to the bathymetric chart of the *RV Nathaniel B. Palmer* demonstrates that the ice shelf edge has retreated more than 7.5km since 2002, when the survey of *RV Nathaniel B. Palmer* was carried out (Fig. 2.17).

The "A_North" map covers an area of 35km² and shows slopes with a depth range between 1000m and 250m. Depth differences of more than 50m were found at location 64°43.5' S and 60°26' W comparing the bathymetric contours of the *Polarstern* measurements to contours of the bathymetric map compiled by US scientists from multibeam data on *RV Nathaniel B. Palmer* (expedition NBP 0107). As yet, these differences cannot be explained, see Fig. 2.18.

Two special bathymetric surveys in biological reference stations near Dundee and Snow Hill Islands were performed during the transit back to Punta Arenas. Because of the short time available at both sites only a small area of 17km² was covered with multibeam.

<u>Statistics.</u> During the *Polarstern* expedition ANT-XXIII/8, multibeam data along a track distance of (10 750km) (5805 nautical miles) were measured, recorded and post-processed by the bathymetric group. The maximum depth was observed with 6062m at position 64°01.4’ S and 17 °09.6’ W in the Weddell Sea. The minimum depth was recorded with 73m at position 63°39.2’ S and 55°54.4’ W near Dundee Island.

On 17 January 2007 a whale approach to the vessel was observed and reported to the bridge. Hydrosweep was immediately shut down following the UBA regulations. The multibeam operation was resumed when the disappearance of the mammal was reported.

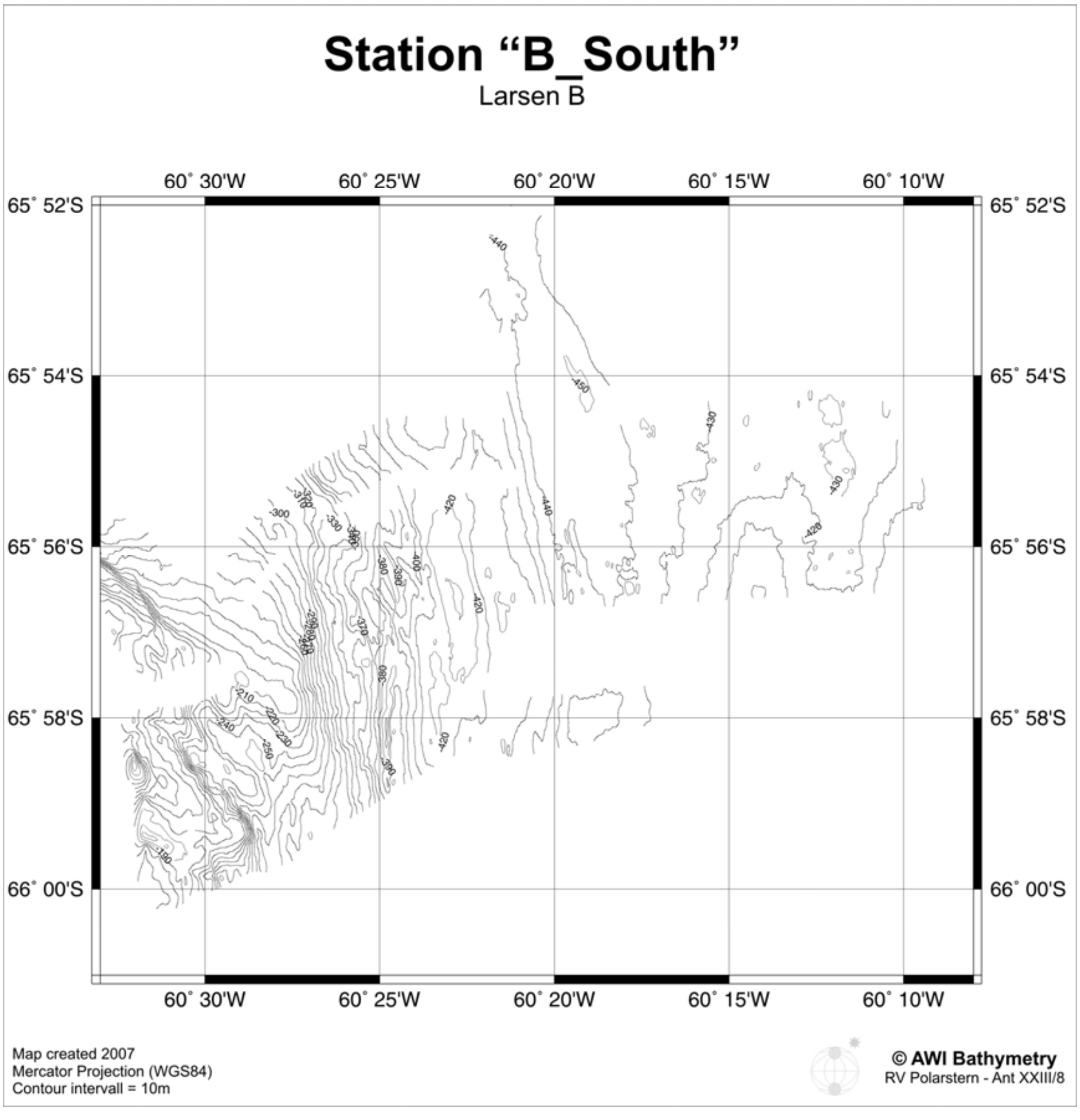


Fig. 2.12 Map of core-station "B_South".

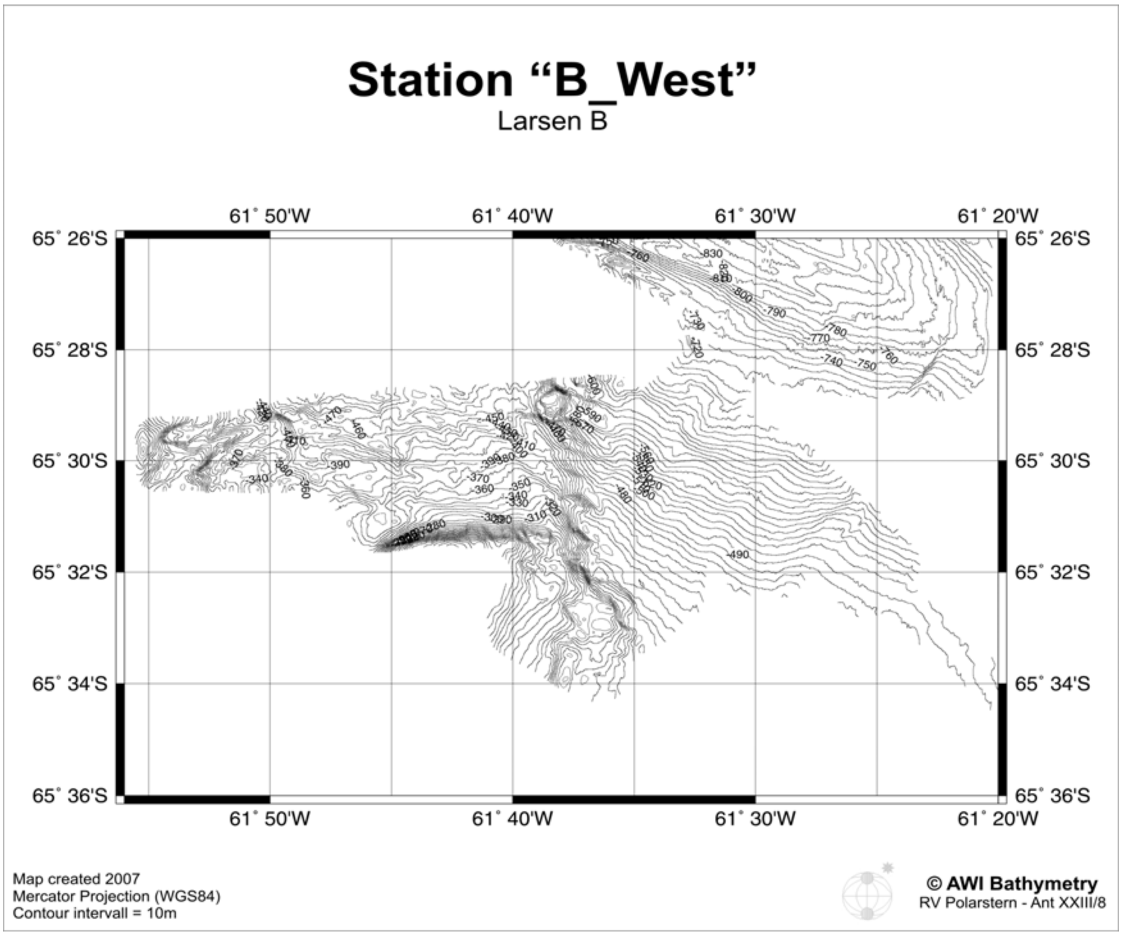


Fig.2.13 Map of core-station "B_West".

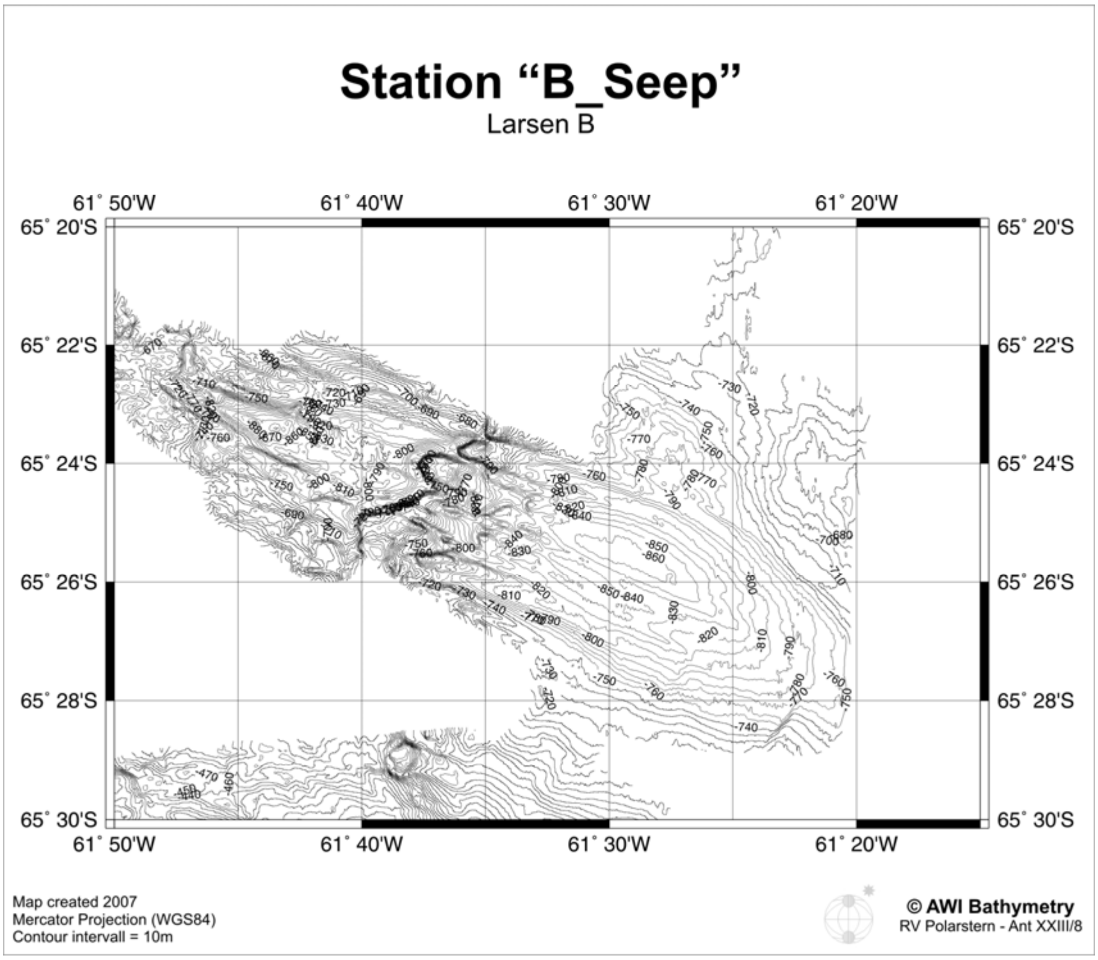


Fig. 2.14 Map of core-station "B_Seep".

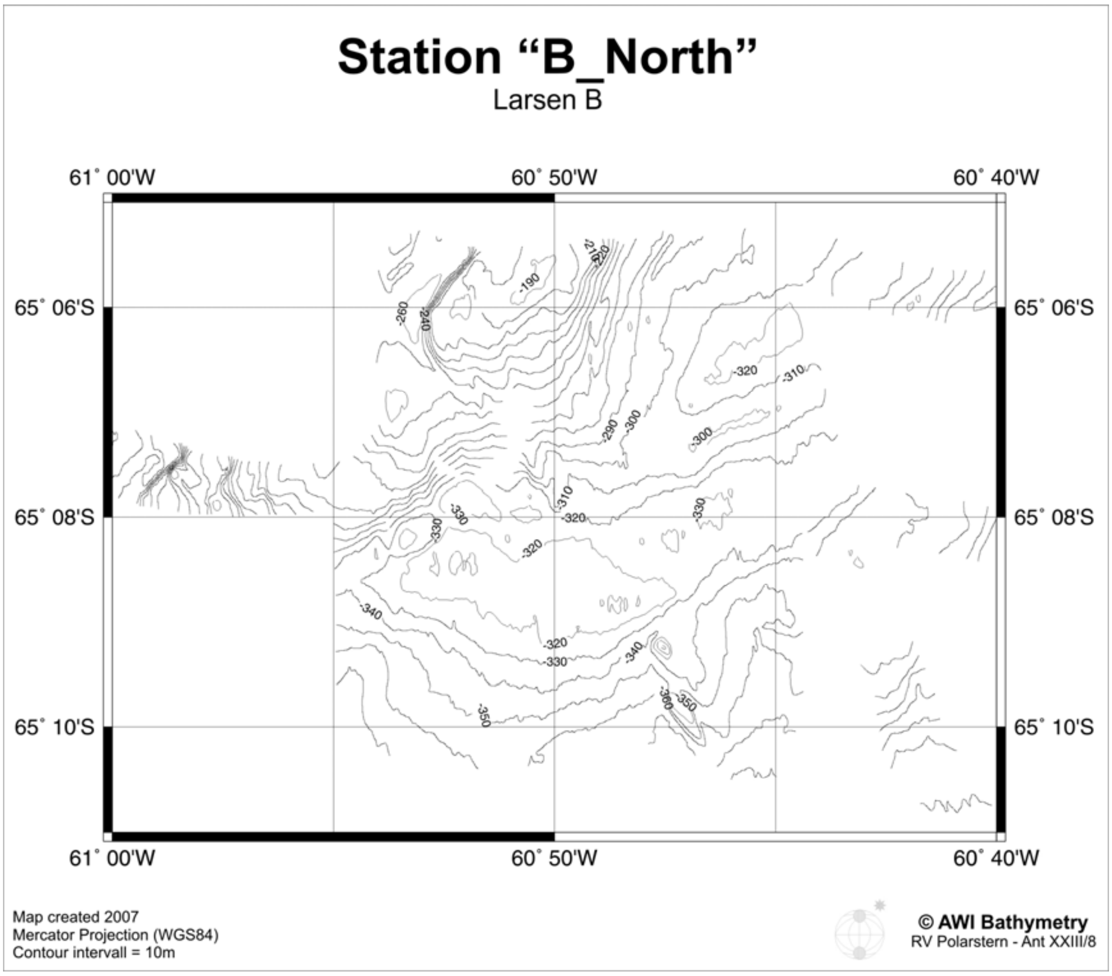


Fig. 2.15 Map of core-station "B_North".

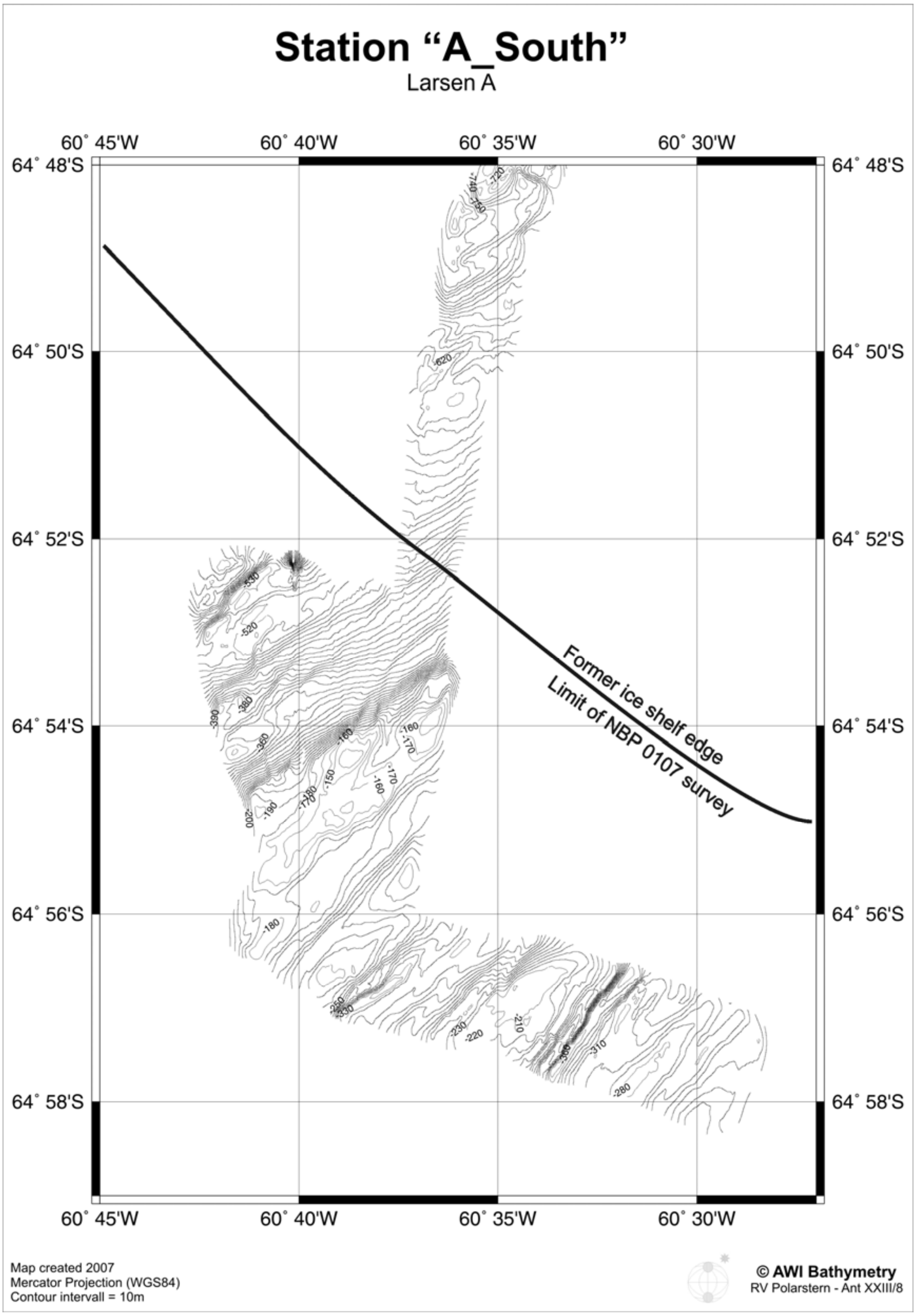


Fig. 2.16 Map of core-station "A_South" (Larsen A).

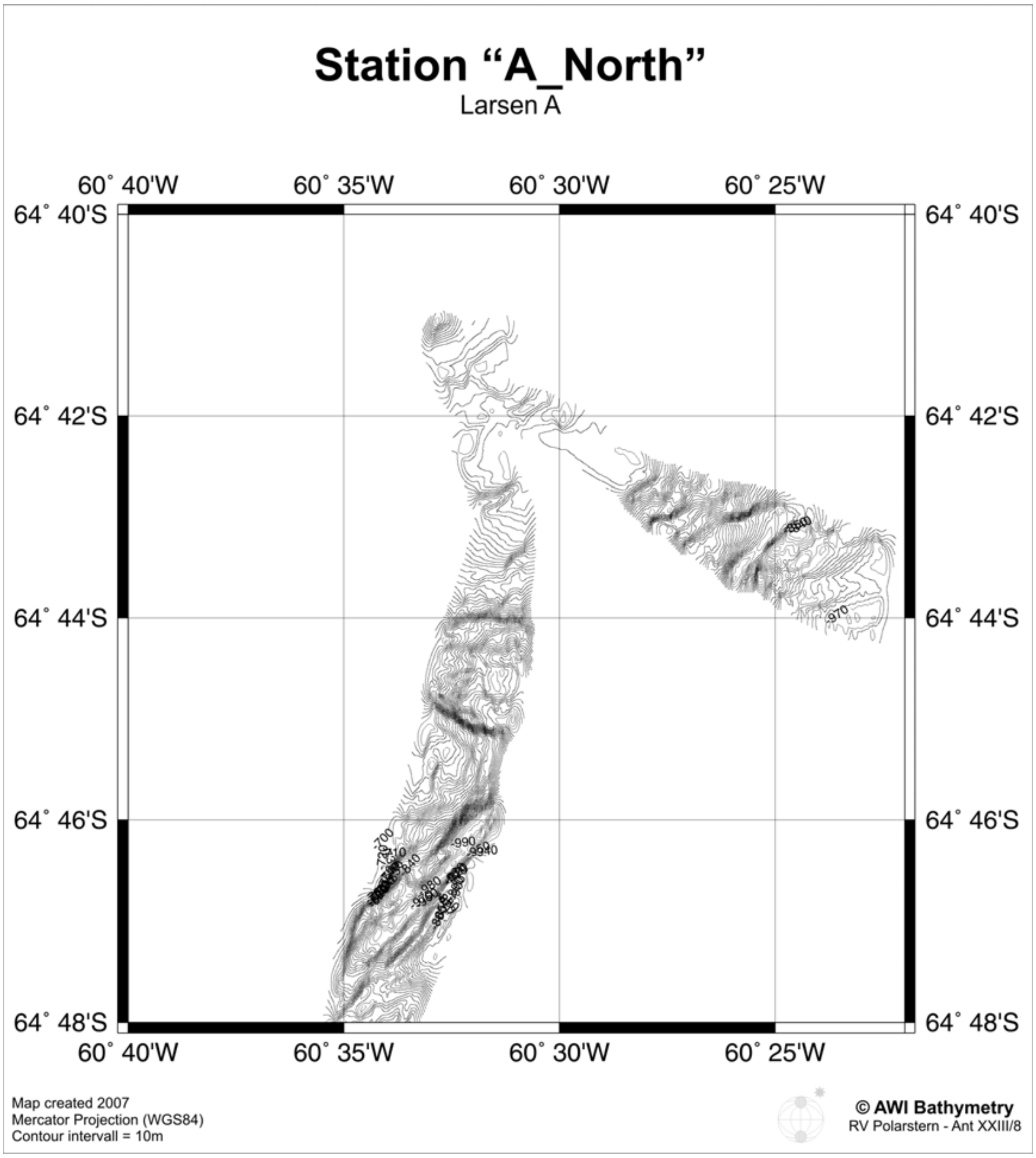


Fig. 2.17 Map of core-station "A_North".

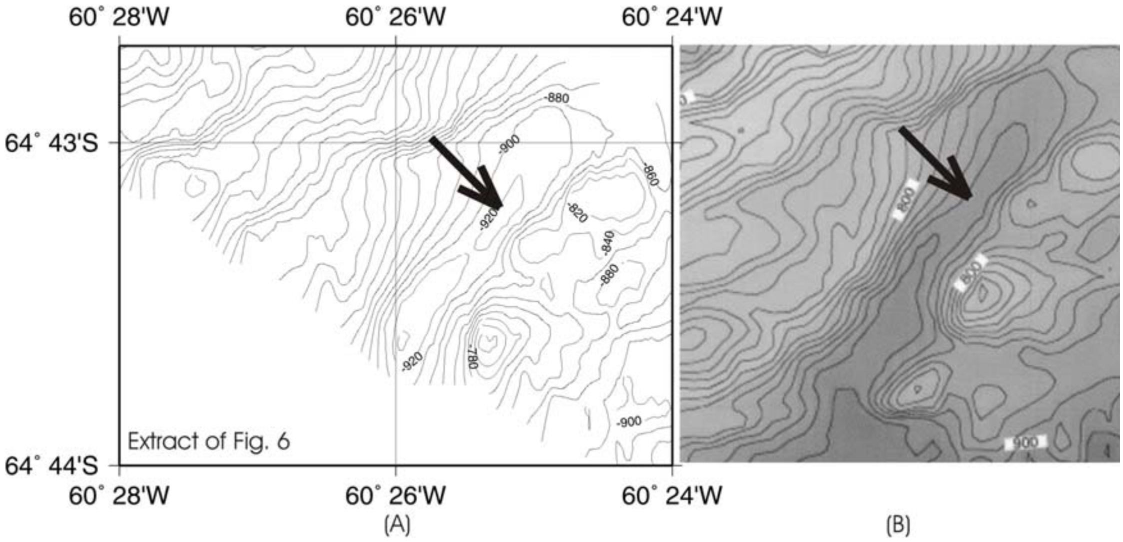


Fig. 2.18 Comparison of the bathymetry from (A) RV *Polarstern* and (B) RV *N. B. Palmer* (contour interval = 20m).

## 2.1.17 ADAPTIVE COMPETENCE OF TELEOSTEI

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### Objectives

There is no doubt that climate change will dramatically affect life of polar animals, which are specially adapted to low, and constant temperatures. In this context, two main objectives were elaborated on this cruise. Based on previous research, we investigated the influence of a rise in temperature on the ventilatory and circulatory performance of Antarctic fish. According to the theory of oxygen limited thermal tolerance, restrictions of the cardiovascular system are one of the key limiting factors of thermal tolerance. Therefore, Laser Doppler flowmetry as a non-invasive technique was used for online investigations on ventilation, circulation and perfusion (micro-circulation) in Antarctic eelpout *Ophtalmolycus amberensis* during an acute temperature rise to 4°C on board of RV *Polarstern*.

The second topic dealt with the question how increasing $CO_2$ concentrations (hypercapnia) will affect lifestyle and behaviour of Antarctic fish. Based on model calculations the current seawater pH is going to drop by 0.5 units by the year 2100 due to increasing $CO_2$ concentrations. This will have serious implications on the acid-base regulation and total energy availability for fish under acidified conditions. In our studies we therefore wanted to compare the sensitivity to hypercapnia of the gill's energy consuming processes like protein and RNA/DNA synthesis, as well as ion regulation between different fish species. A specification on the ability of temperature adaptability of selected fish, cephalopod and crustacean species will be done by molecular analysis of blood and tissue samples.

### Work at sea

Fish caught from bottom or Agassiz trawls were collected and kept at habitat temperatures in the aquarium container on board *Polarstern*. Ventilation, heart rate and blood perfusion levels of different organs of the Antarctic eelpout *Ophtalmolycus amberensis* were measured in vivo by use of Laser Doppler flowmetry (LDF). The effects of an acute temperature rise from -0.5 to 4°C were investigated after at least 12 hours of recovery in the experimental setup. Additionally, first trial measurements of heart rate and blood velocity in two amphipod species were conducted.

Table 2.23 Fish, cephalopod and crustacean species of which tissue and blood samples were taken for molecular analysis.

| Main taxa | Species | Station | N° of individuals |
|---|---|---|---|
| Channichthyidae | *Chaenocephalus aceratus* | 674 | 5 |
| Channichthyidae | *Chianodraco rastrospinosus* | 674 | 5 |
| Channichthyidae | *Champsocephalus gunnari* | 674 | 4 |
| Nototheniidae | *Gobionotothen gibberifrons* | various | 27 |
| Nototheniidae | *Notothenia coriiceps* | from Jubany | 14 |
| Cephalopoda | *Paraledone cornata* | 615 | 1 |
| Cephalopoda | *Megaleledone* sp. | 615, 617 | 3 |
| Cephalopoda | *Megaleledone setebos* | 615, 616, 638, 643, 650, 651, 661, 676, 682, 689 | 12 |
| Cephalopoda | *Paraledone turqueti* | 619, 626, 661, 677, 681, 689 | 7 |
| Cephalopoda | *Paraledone aurata* | 657 | 1 |
| Cephalopoda | *Paraledone aequipillae* | 679, 682, 687, 689 | 5 |
| Crustacea | *Eurythenus grillus* | 683 | 11 |
| Crustacea | *Nothocrangon antarcticus* | 710 | 10 |
| Crustacea | *Eusirius properdentatus* | 683 | 2 |

For experiments addressing the effects of hypercapnia on acid base regulation and tissue energy budget, respiration measurements on isolated and perfused fish gills were performed. Briefly, gills were dissected, connected to perfusion cannulaes, and placed into respiration chambers filled with pre-equilibrated seawater with a partial pressure of 10 000ppm $CO_2$. Oxygen consumption rates were measured by using oxygen microoptodes and flow-through sensors. Specific inhibitors for protein-biosynthesis, RNA/DNA-Synthesis and pH- and ion regulation were applied to investigate the response of the main energy consuming processes to hypercapnic acidosis. Additionally, blood and tissue samples were collected for further molecular analyses as well as for the analysis of biochemical blood properties from Antarctic fishes, cephalopods and decapods.

**Preliminary results**

Table 2.23 summarizes the collected animal species and tissue/blood samples taken for molecular and blood analyses.

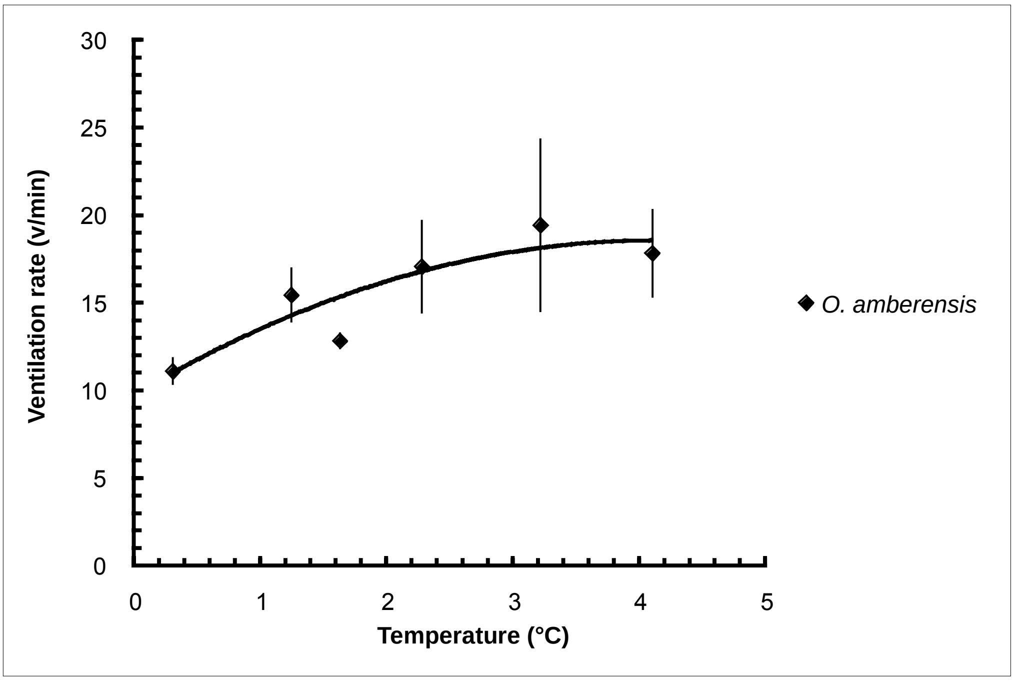


Fig. 2.19 Temperature dependent ventilation rate of *Opthalmolycus amberensis.*

Temperature incubation experiments of the Antarctic eelpout *Ophtalmolycus amberensis*. The Antarctic eelpout *O. amberensis* was used for temperature incubation experiments. Temperature of a water bath was increased up to 4°C over 3 hours and cooled back to control temperature of -0.5-0.0°C, subsequently. The complete experiment time was around 8 to 10 hours. LDF measurements were executed continuously over the duration of the entire experiment.

Fig. 2.19 presents preliminary results on temperature dependent ventilation rates of *Ophtalmolycus amberensis*. First, ventilation rate increased with temperature and levelled off at temperatures around 3°C already. This is in contrast to previous measurements on the closely related Antarctic eelpout *Pachycara brachycephalum*. In these experiments ventilatory effort increased exponentially until temperatures above 10°C. Additionally, some animals of *O. amberensis* died some days after end of the temperature incubation experiments. These preliminary results might indicate that *O. amberensis*, although closely related, is more sensitive to temperature fluctuations than *P. brachycephalum*.

<u>Effects of increased $CO_2$ concentration on energy budget and acid-base regulation.</u> After the addition of metabolic inhibitors, the amount of specific energy consuming processes from two Notothenoids could be determined measuring oxygen consumption rates of gills under these conditions. Fig. 2.20 depicts the cellular energy budget together with the main energy consuming processes from gills from *Gobionotothen gibberifrons* under control conditions in comparison to hypercapnia. Ion regulation, protein synthesis and RNA/DNA synthesis were the main energy consuming processes. Ion regulation and RNA/DNA synthesis were almost doubled under hypercapnic conditions, indicating strong regulation of acid-base regulatory processes. Fig. 2.21 summarizes the results for *Notothenia coriiceps*. It shows a similar picture in comparison to *G. gibberifrons*, except of a much lower increase of RNA/DNA synthesis rates.

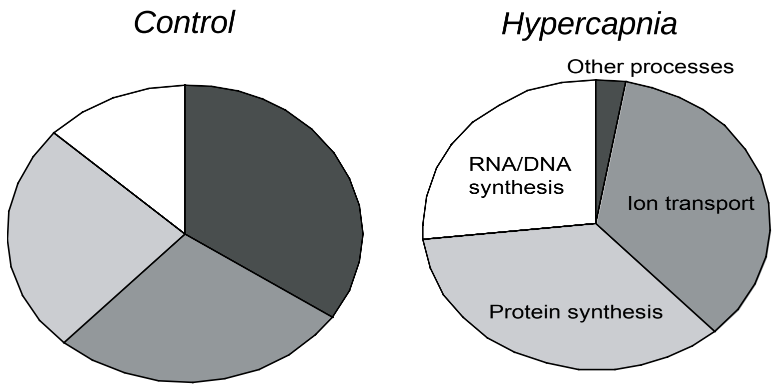


Fig. 2.20 Cellular energy budget of *Gobionotothen gibberifrons.* Used inhibitors were mainly effective on protein synthesis (cycloheximide), RNA/DNA synthesis (actinomycine) and $Na^+$-$K^+$-ATPase (ouabain).

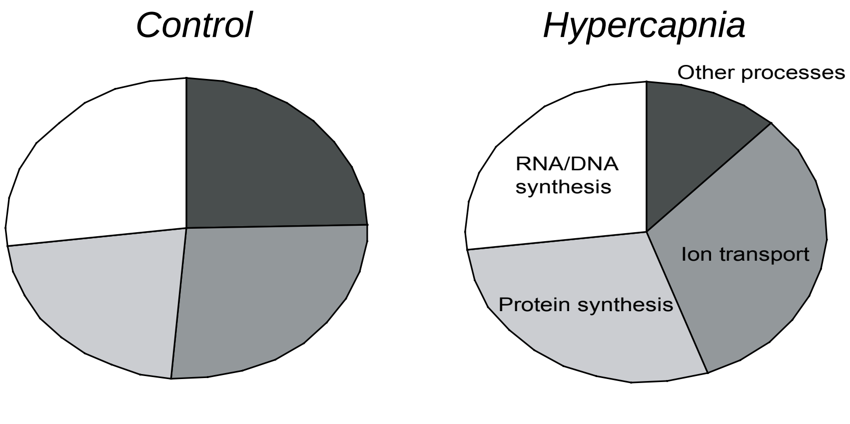


Fig. 2.21 Cellular energy budget of *Notothenia coriiceps.* Used inhibitors were mainly effective on protein synthesis (cycloheximide), RNA/DNA synthesis (actinomycine) and $Na^+$-$K^+$-ATPase (ouabain).

# 2.2 "CONVENTION ON THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES (CCAMLR)" AND RELATED TOPICS

## 2.2.1 THE COMPOSITION; DEMOGRAPHY AND BIOLOGY OF THE DEMERSAL FISH FAUNA IN THE ELEPHANT ISLAND - SOUTH SHETLAND ISLAND REGION AND AT THE TIP OF THE ANTARCTIC PENINSULA

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### Objectives

The aims of the survey were threefold:

- to estimate the biomass of the most abundant fish stocks in CCAMLR Subarea 48.1
- to study the demography of the most abundant fish species, and
- to collect additional information on reproduction and food and feeding of all abundant fish species

### Work at sea

Our survey was based on the same stratified random survey design as utilized during surveys conducted in collaboration with the Southwest Fisheries Science Centre of the National Marine Fisheries Survey of the US in 1998 – 2006 with RV *Yuzhmorgeologiya* and RV *Polarstern*. A total of 85 hauls were carried out around Elephant Island, in a ‘box of 8 x 10 nautical miles west of Elephant Island, off the South Shetland Islands and the tip of the Antarctic Peninsula from 19 December 2006 to 6 January 2007 (Table 2.24).

Table 2.24 Number of hauls conducted around Elephant Island, in a ‘box’ west of Elephant Island, off the South Shetland Islands and at the northern tip of the Antarctic Peninsula.

| Depth stratum (m) | Elephant Island | ‘Box’ | South Shetland Islands | Tip of the Antarctic Peninsula |
|---|---|---|---|---|
| 50 - 100 | 3 | 0 | 1 | 0 |
| 101 - 200 | 13 | 12 | 7 | 2 |
| 201 - 300 | 6 | 7 | 5 | 7 |
| 301 - 400 | 8 | 0 | 4 | 4 |
| 401 - 500 | 2 | 0 | 4 | 0 |

As during previous surveys with RV *Polarstern* in the 1980's, 1990's and in 2002 a 140' (= 42.67m) commercially sized two-panel bottom trawl was used. The width of the trawl was 17–18m between the tips of the upper wings and net height was 3.1–3.4m. Trawling was conducted from 50 to 500m depth. Fishing time was 30 minutes net on the bottom. In order to minimize destruction of benthos communities within the path of the doors and the net and reduce the by–catch of benthos without reducing the catchability of the trawl we used the same ground tackle as in 2002 (Kock, 2002).

More survey effort was concentrated on the 100–400m depth range in order to cater for the higher abundance of fish in this depth zone. The location of fishing stations is provided in Fig. 2.22. Trawling was only conducted during daylight hours.

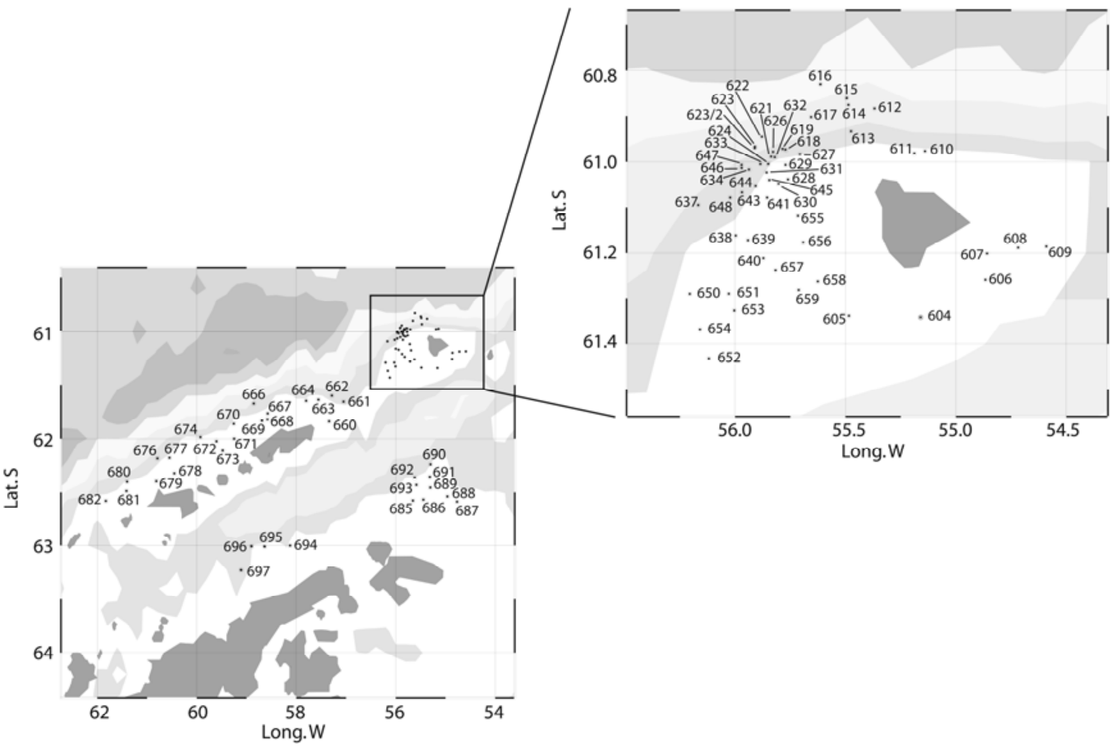


Fig. 2.22 Stations of the fish survey west of the Antarctic Peninsula (CCAMLR).

Catch composition of each tow was recorded in terms of weight and number of individuals per species. The by-catch of benthos was recorded in terms of weight. The qualitative composition of the benthos was noted. At least 49 fish species were caught in the 85 hauls (Table 2.25). Species identification in some genera, such as *Pogonophryne* and *Paraliparis*, was preliminary and still incomplete.

Table 2.25 List of species caught in the course of the bottom trawl survey in the Elephant Island – South Shetland Island region and at the tip of the Antarctic Peninsula.

| Family | Species | Elephant Isl. and the South Shetland Isl. | Tip of the Antarctic Peninsula |
|---|---|---|---|
| Nototheniidae | *Dissostichus mawsoni* | + | + |
| | *Aethotaxis mitopteryx* | + | |
| | *Notothenia rossii* | +++ | + |
| | *N. coriiceps* | +++ | +++ |
| | *Gobionotothen gibberifrons* | +++ | +++ |
| | *Lepidonotothen larseni* | +++ | +++ |
| | *L. nudifrons* | +++ | +++ |
| | *L. squamifrons* | ++ | + |
| | *Trematomus bernacchii* | + | + |
| | *T. eulepidotus* | +++ | +++ |
| | *T. hansoni* | + | + |
| | *T. loennbergii* | | + |
| | *T. scotti* | | + |
| | *Pleuragramma antarcticum* | + | +++ |
| Harpagiferidae | *Harpagifer antarcticus* | + | |
| Artedidraconidae | *Artedidraco skottsbergi* | + | ++ |
| | *Pogonophryne phyllopogon* | + | |
| | *Pogonophryne sp.* | + | + |
| Bathydraconidae | *Parachaenichthys charcoti* | +++ | +++ |
| | *Gerlachea australis* | + | + |
| | *Gymnodraco acuticeps* | ++ | ++ |
| | *Racovitzia glacialis* | | + |
| | *Prionodraco evansii* | | + |
| Channichthyidae | *Champsocephalus gunnari* | +++ | |
| | *Chaenocephalus aceratus* | +++ | |
| | *Pseudochaenichthys georgianus* | +++ | |
| | *Chionodraco rastrospinosus* | +++ | +++ |
| | *Chionodraco myersi* | | + |
| | *Cryodraco antarcticus* | +++ | +++ |
| | *Chaenodraco wilsoni* | + | +++ |
| | *Pagetopsis macropterus* | + | +++ |
| | *Neopagetopsis ionah* | + | + |
| Rajidae | *Bathyraja maccaini* | +++ | +++ |
| | *Bathyraja sp. 2* | +++ | +++ |
| Muraenolepidae | *Muraenolepis microps* | +++ | |
| Gempylidae | *Paradiplospinus gracilis* | + | |
| Myctophidae | *Electrona antarctica* | +++ | |
| | *E. carlsbergi* | ++ | |
| | *Protomyctophum bolini* | + | |
| | *Krefftichthys anderssoni* | + | |
| | *Gymnoscopelus nicholsi* | +++ | |
| | *G. braueri* | + | |
| Anotopteridae | *Anotopterus pharao* | + | |
| Zoardidae | *Ophthalmolycus amberensis* | +++ | |
| | *Pachycara brachycephalum* | +++ | |
| | *Lycodichthys antarcticus* | + | + |
| Liparididae | *Paraliparis sp.* | + | |
| Macrouridae | *Macrourus holotrachys* | + | |
| Carapidae sp. | | + | |

Our catches in the Elephant Island – South Shetland Islands demonstrated that *Notothenia rossii* and *N. coriiceps* were more abundant than during previous cruises while ice fish, such as *Champsocephalus gunnari* and *Chaenocephalus aceratus* were much less common.

No recruitment has been observed in *Gobionotothen gibberifrons* since a number of years while juvenile fish were still common in catches in the area in the 1980's and 1990's. *N. coriiceps* and *G. gibberifrons* were the most abundant nototheniids along the tip of the Antarctic Peninsula while *Chaenodraco wilsoni*, *Chionodraco rastrospinosus* and *Cryodraco antarcticus* were the most common ice fish. The reproductive state of the most abundant fish species is provided in Table 2.26.

Table 2.26 Reproductive state and estimated spawning time in some abundant nototheniids and channichthyids.

| Species | Reproductive state | Estimated start of spawning |
|---|---|---|
| *Champsocephalus gunnari* | First spawners, start of gonad development, older fish more advanced | April |
| *Chaenocephalus aceratus* | Gonad development more advanced than *C. gunnari* | March |
| *Cryodraco antarcticus, Chionodraco rastrospinosus* | Gonad development advanced | February |
| *Chaenodraco wilsoni* | Gonads in regression state | October |
| *Notothenia rossii, Notothenia coriiceps* | Gonad development started | End of April/beginning of March |
| *Gobionotothen gibberifrons* | Gonads in resting stage | August-September |
| *Lepidonotothen nudifrons* | Gonads developing | Early April |
| *Lepidonotothen larseni* | Gonads in resting stage or early stage of development | July - August |

These observations confirmed findings from previous cruises and helped to complete the annual reproductive cycle of the abundant species. Information is now available for the most common species from late November to June.

Food composition. The food composition of the abundant species was analysed in 4483 fish in the Elephant Island – South Shetland Islands – Joinville Island area. An overview of the number of stomachs investigated per species was provided in Table 2.27. Our study confirmed results from previous investigations that krill is paramount for the feeding of many Antarctic fish species.

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Table 2.27 Number of stomachs investigated per species in the Elephant Island – South Shetland Islands – Joinville Island area.

| Species | Elephant Island | South Shetland Islands | Joinville Island |
|---|---|---|---|
| *Aethotaxis mitopteryx* | 55 | | |
| *Artedidraco skottsbergi* | | | 25 |
| *Bathyraja maccaini* | 4 | | 1 |
| *Chaenocephalusaceratus* | 284 | 26 | |
| *Chaenodraco wilsoni* | 1 | 1 | 176 |
| *Champsocephalus gunnari* | 624 | 53 | |
| *Chionodraco myersi* | | | 1 |
| *Chionodraco rastrospinosus* | 81 | 85 | 235 |
| *Cryodraco antarcticus* | 36 | 14 | 61 |
| *Dissostichus mawsoni* | 27 | 6 | 4 |
| *Electrona antarctica* | 2 | 2 | |
| *Gerlachea australis* | 2 | | 2 |
| *Gobinotothen gibberifrons* | 272 | 86 | 396 |
| *Gymnodraco acuticeps* | 3 | 5 | 54 |
| *Krefftichthys anderssoni* | 3 | | |
| *Lepidonotothen larseni* | 149 | 31 | 79 |
| *Lepidonotothen nudifrons* | 34 | 53 | 222 |
| *Lepidonotothen squamifrons* | 81 | 72 | 9 |
| *Muranolepis microps* | 10 | 6 | |
| *Neopagepopsis ionah* | 2 | 1 | 4 |
| *Notothenia coriiceps* | 152 | 92 | 66 |
| *Notothenia rossii* | 226 | 87 | 8 |
| *Ophthalmoclycus amberensis* | 15 | 2 | |
| *Pachycara barchycephalum* | | 1 | |
| *Pagetopsis macropterus* | 2 | | 49 |
| *Parachaenichthys charcoti* | 14 | 2 | 11 |
| *Peuragramma antarcticum* | 1 | 12 | |
| *Pogonophryne phyllopogon* | 1 | | |
| *Prionodryco evansii* | | | 2 |
| *Protomyctophum* sp. | 1 | | |
| *Pseudochaenichthys geogianus* | 8 | 32 | |
| *Racovitzia glacialis* | 4 | | 1 |
| *Trematomus bernacchii* | 6 | | 5 |
| *Tremtomus eulepidotus* | 20 | | 166 |
| *Trematomus hansoni* | 4 | | 32 |
| *Trematomus newnesi* | | | 45 |
| *Trematomus nicolai* | | | 8 |
| *Trematomus scotti* | | | 28 |
| total | 2124 | 669 | 1690 |

## 2.2.2 ANTARCTIC FISH PARASITE FAUNA: LIFE-CYCLE PATTERNS AND GENETIC SPECIES CHARACTERIZATION

Sven Klimpel, Markus W. Busch, Heinrich-Heine-Universität, Düsseldorf, Germany

### Objectives

Parasites are a driving force in the process of evolution and are an integral part of every ecosystem. Parallel to the abiotic environment, and, among other biotic factors, they generate a pressure for selection and adaptation to their hosts, which can result in elimination of genes or in new combination of genes in the host genome. Parasites differ markedly in their degree of host specificity, and the extent to which relationships between hosts are reflected. The host phylogeny and evolutionary adaptation between host and parasite constitute the recruitment and establishment of a parasite in its host. Other biotic and abiotic factors such as feeding ecology, habitat preferences, host age and sex, host physiology and climatic conditions may also influence the relationship between parasite and host.

In fisheries biology, parasitological studies have increasing importance, because they can serve as natural markers for fish stock identification. Moreover, parasites can help to analyse the diet of their hosts, serving as biological indicators of the prey organisms and their origin. Whereas stomach analyses provides detailed information on the immediate trophic relationship at the time of sampling, parasitological studies make it possible to infer previous trophic interactions, thus integrating short-term variability in the food web to make wider relationships more apparent. Helminths are particularly useful for such studies, because their different life-cycle stages are passed through the marine food web until they reach their definitive host. Finally, parasites provide information on habitats and trophic status of the studied hosts within the Antarctic ecosystem.

Parasitological studies in high Antarctic waters have been focused on single parasite species or taxa. Recent studies from the Antarctic Peninsula and the eastern Weddell Sea dealing with some nototheniid and channichthyid fish revealed a highly diverse parasite fauna, reaching over 30 different species in the Antarctic rock cod *Notothenia coriiceps*. The life-cycles of the isolated endohelminths included all kind of teleost and also birds and mammalian hosts. Comparisons between the different Antarctic regions, however, are restricted to a single nematode species (*Pseudoterranova decipiens*), and information on the annual and seasonal variability is completely missing. In addition, within the nematodes, even basic taxonomical questions have not yet been resolved.

The main objective of the present study was the investigation of the parasite fauna of Antarctic fish from the Weddell Sea and the Antarctic Peninsula. Besides the study of a variety of different fish and cephalopod species from the Antarctic ecosystem, also other potential hosts of parasites, such as penguins, have and will be investigated. The results will reveal further information on the life-cycle biology of Antarctic parasites. To study regional differences, fish from the Antarctic Peninsula will be compared with those from the Weddell-Sea in terms of the occurrence of parasitic nematodes, especially belonging to the Anisakidae, such as *Contracaecum osculatum*, *C. radiatum*, *P. decipiens* and the sibling species complex of the genus *Anisakis*. Other parasite groups were collected and fixed for subsequent investigation in Düsseldorf. Fish parasitological data from the Antarctic Peninsula will be compared with a study that based on the ANT-XIV/2 expedition exactly ten years ago.

**Work at sea**

Full details of the field sampling are provided by other participants (i.a. Kock *et al.*, this volume), so only a summary is provided here. Stations were located around the South Shetland Islands, Elephant Island and at the tip of the Antarctic Peninsula in the vicinity of D'Urville – Joinville Islands. All specimens were taken as subsample from the catch, identified to the lowest taxon possible, and measured (total length and total weight). Different fish specimens were either deep frozen for later studies in the fish laboratory on board or for further investigation in the laboratory of the Heinrich Heine University in Düsseldorf. Tissue samples were taken of selected species and fixed in ethanol for genetic studies.

A total of 722 fish specimens were chosen for later dissection in the home laboratory: *Chaenocephalus aceratus*, *Champsocephalus gunnari*, *Electrona antarctica*, *E. carlsbergi*, *Gymnoscopelus braueri*, *G. nicholis*, *Lepidonotothen larseni*, *L. nudifrons*, *Trematomus eulepidotus*, *T. newnesi*, *Macrourus whitsoni*, *Muraenolepis microps* and *Ophthalmolycus amberensis* (Table 2.28). A subsample of 35 specimens of *Gymnoscopelus nicholsi* (Myctophidae) was analysed directly on board.

The presence of metazoan parasites within all organs was studied by using a stereomicroscope. Ectoparasite infestation was examined while the fish was still in a partly frozen state. Inspection included the skin, fins, eyes, nasal cavities, gills and the buccal and branchial cavity. Afterwards, the body cavity and gastrointestinal tract were examined. The stomach contents were removed for examination and food items were identified to the lowest taxon possible. All food items were preserved in 4% formalin for later identification. Prey items found in the mouth cavity of fish was excluded from the diet analysis.

Additionally, 12 young Emperor penguins (*Aptenodytes forsteri*) found dead in the colony were analysed for their stomach items and metazoan parasite fauna. Prior to examination the penguins were measured and weighted. Then, the body cavity was opened and the alimentary tract was removed for further examination. The body weight of each eviscerated penguins was recorded. All organs were separated from the surrounding fat tissue and placed in Petri dishes containing physiological saline solution and were examined for endoparasites using a stereomicroscope. Isolated parasites were fixed in 4% borax-buffered formalin and preserved in 70% ethanol / 5% glycerine or were stored directly in 100% ethanol for later detailed identification and molecular genetic studies. The ecological and parasitological terminology used (e.g. prevalence, mean intensity, etc.) follows the definitions of other authors.

Table 2.28 Sampled fish species with fishing stations and numbers of collected specimens (n).

| Family | Fish species | Station-No. | n |
|---|---|---|---|
| Channichthyidae | *Chaenocephalus aceratus* | 615 | 26 |
| Channichthyidae | *Champsocephalus gunnari* | 606 | 35 |
| Myctophidae | *Electrona antarctica* | 610, 611, 616, 637, 644, 661 | 115 |
| Myctophidae | *Electrona carlsbergi* | 621, 622, 623/2, 637 | 69 |
| Myctophidae | *Gymnoscopelus braueri* | 661, 662 | 7 |
| Myctophidae | *Gymnoscopelus nicholis* | 609, 633, 637, 650, 662, 675, 680 | 200 |
| Nototheniidae | *Lepidonotothen larseni* | 604, 610 | 75 |
| Nototheniidae | *Lepidonotothen nudifrons* | 604 | 40 |
| Nototheniidae | *Trematomus eulepidopus* | 642, 646, 647, 650, 651, 652, 653, 654, 660, 661, 715/1 | 70 |
| Nototheniidae | *Trematomus newnesi* | 685 | 39 |
| Macrouridae | *Macrourus whitsoni* | 616 | 5 |
| Muraenolepididae | *Muraenolepis microps* | 637 | 6 |
| Zoarcidae | *Ophthalmolycus amberensis* | 608 | 35 |
| Other | Cephalopoda | 615, 616, 617, 629, 638, 658 | 6 |

### Preliminary results

Our study continued the research activities of previous investigators on the Antarctic parasite fauna since 1992. The focus of this investigation will be a first comparison of the Antarctic fish parasite composition in fish after one decade. By using modern molecular genetic studies we will identify the distribution of anisakid nematode sibling species in Antarctic waters.

In general, most fishes are parasitized with different hirudineans (leeches) and crustaceans (parasitic copepods) as ectoparasites (Fig. 2.23) and different larval nematodes, such as *Contracaecum osculatum*, *C. radiatum* and *P. decipiens* which were found in the organs of the body cavity, as endoparasites (Fig. 2.24). For the first time, we were able to identify nematode third larval stages of the genus *Anisakis* in the investigated *G. nicholsi*. The identification and differentiation of the larval stages within this genus on morphology only, however, is neither easy nor always possible. Molecular techniques have provided alternative methods for easier parasite identification, because modern molecular analyses have demonstrated that the genus *Anisakis* is a complex of sibling species. These sibling species are morphologically very similar but genetically different and have distinct host preferences and geographical distributions. The specimens of the genus *Anisakis* are considered to follow a pelagic life cycle and undergo four moults before they reach the adult stage. Cetaceans acquire the nematodes by preying on intermediate hosts and serve as final hosts. The nematode eggs are excreted with the faeces of cetaceans and hatch in seawater. Invertebrates (mainly copepods and euphausiids) are thought to be important intermediate hosts and various fish species and cephalopods serve as paratenic hosts, acquiring the specimens through the food web. Therefore, after identification of the *Anisakis* species we shall be able to provide evidence of the distribution of their final hosts, whales, in the area of the investigation.

Fig. 2.23 Head of *Chionodraco rastrospinosus* with leeches parasitized on the eye and preorbital region.

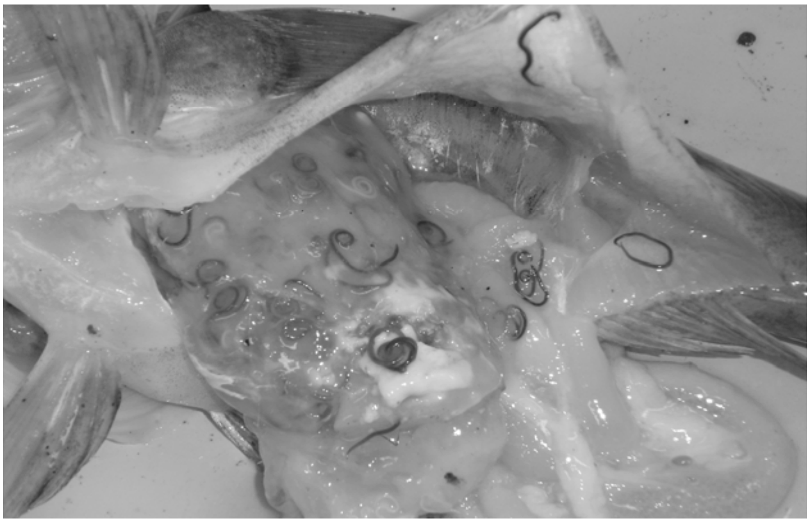

Fig. 2.24 Dissected body cavity of *Chaenocephalus aceratus* with larval nematodes parasitizing different inner organs.

The stomach contents of the Emperor penguins chicks revealed a high number of squid beaks and stones. We found a nematode species with a prevalence (P) of infestation of 41.7% in their stomachs. This nematode species appears to be undescribed. Further morphometrical and molecular analyses in our Institute (Heinrich Heine University, Düsseldorf) will provide unequivocal identification of the parasite.

## 2.2.3 POPULATION GENETICS OF ANTARCTIC NOTOTHENIOID FISH

Erica Bortolotto; Universita di Padova, Italy

### Objective

Population samples of notothenioids collected in the course of the cruise will be used to study the molecular phylogeny of the suborder Notothenioidei and to investigate population genetics of two species, *Chionodraco rastrospinosus* and *Chaenocephalus aceratus*. The samples will be stored at Padova University. In the past, samples were collected in the Elephant Island - South Shetland Islands area in 1996 (*Polarstern* cruise ANT-XIV/2), 1997 (*James Clark Ross* cruise JCR26) and 2002 (*Polarstern* cruise ANT-XIX/3). ANT-XXIII/8 provided a unique opportunity to expand the university's population sample collection of *C. rastrospinosus* and *C. aceratus*, allowing us to improve our genetic analysis of population of these species. Preliminary results for *C. rastrospinosus*, based on microsatellite genotyping provided evidence for significant genetic differentiation between age classes, underpinning the importance of our sampling strategy. Our preliminary results represent the first evidence for genetic heterogeneity between cohorts in an Antarctic fish species, and could have important management implications.

### Work at sea

Tissue samples were collected for DNA extraction from more than 650 individual fish. Information of individual length, weight, sex and gonad size and maturity were recorded for about 500 fish. An appropriate protocol was followed in collaboration with A. De Felice who collected the otoliths of the same individuals. A small slice of muscular tissue including epidermis and scales was cut from each individual. Tissues from *Chionodraco rastrospinosus* were stored in ethanol 96 % while samples from *Chaenocephalus aceratus* were stored in RNA laterTM (Ambion). Tissues from other occasionally sampled species were directly frozen.

### Preliminary results

Table 2.29 shows the number of specimens collected from each species. Samples of *Chionodraco rastrospinosus* were collected in the Elephant Island, Joinville Island and South Shetland Islands areas in numbers sufficient to continue our population genetic studies at Padova University. A large sample of *Chaenocephalus aceratus* was collected near Elephant Island. Based on our preliminary work, this site seems to be a key area where probably genetically different year classes meet. Only off Joinville Island, a small number of *Pleuragramma antarcticum* were collected. This sample is useful for the ongoing population genetics study of this species. Specimens of three other species will complement samples already stored at Padova University for future use or may be available to scientists from other institutions. Finally, population samples of *Euphausia superba* were collected as by-catch from the Elephant Island - South Shetland Islands region and will be used for ongoing studies at Padova University.

Table 2.29 Number of specimens collected for genetic analysis.

| Species | Elephant Island | King George Island | Joinville Island |
|---|---|---|---|
| *Chionodraco rastrospinosus* | 75 | 49 | 79 |
| *Chaenocephalus aceratus* | 115 | 9 | 0 |
| *Champsocephalus gunnari* | 50 | 0 | 0 |
| *Notothenia rossii* | 52 | 32 | 0 |
| *Notothenia coriiceps* | 49 | 71 | 0 |
| *Pleuragramma antarcticum* | 0 | 0 | 35 |

### 2.2.4 AGE AND GROWTH OF ANTARCTIC NOTOTHENIOID FISH

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#### Objective

The composition of the coastal fish fauna around Elephant Island, the South Shetland Islands and Joinville Island is of particular interest for a study focused on age and growth for two main reasons: Firstly, very few data on this topic have been reported to date from this particular Antarctic zone, except for some species that are or have been abundant or have been heavily exploited, such as *Champsocephalus gunnari, Gobionotothen gibberifrons, Notothenia coriiceps* and *Notothenia rossii* (Freytag 1980, Tomo and Barrera-Oro 1986, Barrera-Oro 1988, Kock 1990, Barrera-Oro and Casaux 1992, Barrera-Oro and Casaux 1996). Furthermore, from the faunistic point of view, the ichthyofauna of this area consists of species typical of both the low-Antarctic and the high-Antarctic zones, although the latter are caught in small numbers only (Kock and Stransky, 2000). It is therefore interesting to study longevity and growth rates of species of such different origins in order to compare different life strategies. Moreover, age and growth data collected off the South Shetland Islands on some high-Antarctic fish, such as *Chionodraco rastrospinosus*, *Cryodraco antarcticus, Trematomus eulepidotus and*

*Dissostichus mawsoni*, will be compared with those of similar or the same species occurring in Terra Nova Bay, Ross Sea. The possibility of comparing growth estimates in species with a wide range of distribution, from low to high Antarctic waters, could provide some insight into the relationship between growth rates and environmental conditions. This project is the continuation of work carried out in the same area in 2002 (*Polarstern* ANT-XIX/3). The main aim was to collect data on a multi-annual basis, in order to follow the fish population dynamics and to estimate growth performance in different years.

### Work at sea

For each fish specimen, a set of standard measurements and biological parameters (total length, total weight, sex, stage of maturity) were recorded and stored in a database. After dissection, the pairs of sagittal otoliths were collected, dried and stored in vials. The study of age and growth by means of otolith readings will be carried out in the laboratory in Italy, following the method described in previous publications (Vacchi *et al.* 1992, La Mesa *et al.* 1996, La Mesa *et al.* 2004). In addition, the study will be complemented by the analyses of length frequency distributions and otolith microstructure of juveniles, in order to validate ageing data from annuli counting.

Table 2.30 Collected material.

| Species of interest | Size range (cm) | N° of sampled individuals |
|---|---|---|
| *Chaenodraco wilsoni* | 18-34 | 113 |
| *Parachaenichthys charcoti* | 13-37 | 18 |
| *Dissostichus mawsoni (juvenil/subadult)* | 22-62 | 19 |
| *Pseudochaenichthys georgianus* | 16-57 | 36 |
| *Trematomus eulepidotus* | 13-33 | 101 |
| *Cryodraco antarcticus* | 19-66 | 90 |
| *Notothenia coriiceps* | 34-48 | 131 |
| *Champsocephalus gunnari* | 24-33 | 11 |
| *Chaenocephalus aceratus* | 21-69 | 115 |
| *Chionodraco rastrospinosus* | 14-54 | 122 |

### Preliminary results

Otoliths were collected from ten notothenioid species. Samples of *Chaenocephalus aceratus* and *Chionodraco rastrospinosus* were part of a joint work with E. Bortolotto within the research project 'Population genetics of Antarctic notothenioid fish'. A number of less common and less studied species were selected in addition to common species, with the aim of sampling as far as possible all the families of notothenioids in the area. Collections were made for the species listed in Table 2.30 with size range. For all species except *Notothenia coriiceps* and *Champsocephalus gunnari*, otolith samples were obtained from the whole size range of the fish collected. Only smaller individuals of *N. coriiceps* and *C. gunnari* were considered, with the aim to validate the first year age class by analysing microincrements in the otoliths of juveniles.

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## 2.2.5 RESPONSE OF ANTARCTIC FISHES TO QUATERNARY CLIMATIC CHANGES

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### Objective

The Antarctic and its surrounding ocean are mostly considered as a system isolated from the rest of world due to the existence of the Antarctic Polar Front (APF), which greatly reduces the exchange of surface waters and marine organisms (Kock 1992). Despite some interconnections of marine biota from the north and the south of the APF (Clarke *et al.* 2005, Antezana 1999, Hodgson *et al.* 1997), there is no doubt that evolution in isolation resulted in many cladogenetic events and the formation of endemic taxa (Bargelloni *et al.* 2000, Patarnello *et al.* 1996, Held 2000, Page and Linse 2002, Lorza and Held 2004). These organisms had to cope with freezing water temperatures and the potential eradication of their habitat by ice sheet advances and grounding, which affects the Antarctic ecosystem on a scale much greater than elsewhere on Earth. Especially when it is evident that during glacial maxima the Antarctic ice sheet extended to the continental shelf break and in places was grounded between there and the continent (Hambrey and Barrett 1993) and continental slope ecosystems were further subjected to intense flows of debris pushed by expanding grounded glaciers and ice shelves (Thatje *et al.* 2005). They suggest that benthic biota faced extensive reductions of suitable habitat and was either fragmented into geographically restricted glacial refuges, or escaped to greater depths (Eastman and Clarke 1998). On the other hand, some organisms, especially pelagic feeders, might have experienced population expansions in consequence of the northward expansion of polar habitats during cold climatic phases (Zane *et al.* 2006 and citations therein). Only few studies on demographic histories of Antarctic marine and coastal species have been performed to date, because of the difficulties in obtaining the samples from the areas of interest.

### Work at sea

Samples of muscle or fin tissue have been taken from approximately 1700 specimens belonging to 40 species (Table 2.31). The material was stored in pure ethanol. For a subset of samples, I also preserved the whole body frozen for subsequent parasitological examination. The study shall be accomplished after the arrival of the samples into laboratory, when selected specimens shall be sequenced for their genetic variability in recently identified fast-mutating loci.

### Preliminary results

We previously analysed (manuscript submitted) the variability within samples collected during previous cruises of *Trematomus bernacchi, T. pennelli, T. newnesi* and *Pagothenia borchgrevinki*. We observed striking differences among the studied species. All demographic analyses suggested a recent population expansion in both benthic species (of *T. bernacchi, T. pennelli*) dated by the cyt b locus to the recent deglaciation of the Antarctic shelf, while the population structure of pelagic feeders (*T. newnesi*, *P. borchgrevinki*) either did not deviate from a constant-size model or suggested that the onset of major population expansion by far predated those of the benthic species. Such a pattern was apparent even when comparing previously published data on other Southern Ocean organisms, but we observed considerable heterogeneities within both groups as to the onset of major demographic events and their rates.

We propose that available data do not contradict the hypothesis that Pleistocene ice-sheet expansions significantly reduced the suitable habitat for benthic species, whereas different and less disruptive processes affected pelagic feeders. However, given the asynchronicity of major demographic events observed in different species, more species have to be analysed in order to more precisely assess the role of life history in response to climatic changes. The considerable samples-sizes collected during this cruise of many species with different life histories will most probably allow us to accomplish this study.

Table 2.31 Samples taken during the cruise.

| Species | Locality | | | |
|---|---|---|---|---|
| | Elephant I. | South Shetland Ils. | Joinville I. | Larsen B |
| *Aethotaxis mitopteryx* | 49 | 0 | 0 | 0 |
| *Artedidraco skottsbergi* | 27 | 0 | 0 | 0 |
| *A. orianae* | 0 | 0 | 0 | 1 |
| *Bathydraco antarcticus* | 0 | 0 | 0 | 19 |
| *Bathyraja maccaini* | 18 | 1 | 0 | 0 |
| *Bathyraja* sp. 2 | 7 | 5 | 0 | 0 |
| *Cryodraco antarcticus* | 21 | 14 | 41 | 0 |
| *Dacodraco hunteri* | 0 | 0 | 0 | 1 |
| *Dissostichus mawsoni* | 8 | 2 | 1 | 0 |
| *Electrona antarctica* | 22 | 14 | 0 | 0 |
| *E. carlsbergi* | 4 | 0 | 0 | 0 |
| *Gerlachea australis* | 2 | 0 | 0 | 0 |
| *Gobionotothen gibberifrons* | 62 | 68 | 73 | 0 |
| *Gymnodraco acuticeps* | 3 | 4 | 54 | 0 |
| *Gymnoscopelus nicholsi* | 0 | 33 | 0 | 0 |
| *Chaenocephalus aceratus* | 34 | 0 | 0 | 0 |
| *Chaenodraco wilsoni* | 1 | 1 | 30 | 0 |
| *Champsocephalus gunnari* | 47 | 3 | 0 | 0 |
| *Lepidonotothen larseni* | 57 | 42 | 30 | 0 |
| *L. nudifrons* | 52 | 53 | 51 | 0 |
| *L. squamifrons* | 48 | 36 | 3 | 0 |
| *Lycodichthys antarcticus* | 0 | 4 | 0 | 0 |
| *Muraenolepis microps* | 1 | 6 | 0 | 0 |
| *Neopagetopsis ionah* | 0 | 1 | 0 | 0 |
| *Notolepis coatsi* | 2 | 0 | 0 | 0 |
| *Notothenia coriiceps* | 58 | 65 | 7 | 0 |
| *N. rossii* | 56 | 29 | 0 | 0 |
| *Ophthalmolycus amberensis* | 19 | 2 | 0 | 0 |
| *Pagetopsis macropterus* | 1 | 0 | 26 | 0 |
| *Pachycara brachycephalum* | 1 | 27 | 0 | 0 |
| *Paradiplospinus gracilis* | 1 | 0 | 0 | 0 |
| *Parachaenichthys charcoti* | 14 | 6 | 8 | 0 |
| *Prionodraco evansii* | 0 | 0 | 1 | 1 |
| *Pseudo. georgianus* | 8 | 29 | 0 | 0 |
| *Racovitzia glacialis* | 3 | 0 | 1 | 0 |
| *Trematomus bernacchii* | 5 | 0 | 5 | 0 |
| *T. eulepidotus* | 55 | 2 | 76 | 4 |
| *T. hansoni* | 3 | 2 | 29 | 0 |
| *T. loennbergii* | 1 | 0 | 0 | 1 |
| *T. newnesi* | 0 | 0 | 83 | 0 |
| *T. nicolai* | 0 | 0 | 8 | 0 |
| *T. scotti* | 3 | 0 | 26 | 30 |
| *T. pennellii* | 0 | 0 | 0 | 2 |

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## 2.2.6 STUDIES ON EGGS AND OVARIES OF ANTARCTIC FISHES

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### Objectives

Studies on the oogenesis and the spermatogenesis of Antarctic fishes were carried out only on light microscopical level and on a few species (Butskaya & Faleeva 1987; Calvo *et al*. 1992; Shandikov & Faleeva 1992). A detailed electron microscopical und cytochemical investigation of these events is still lacking. Material was collected during the cruise to work on the following aims:

1. The investigation of the oogenesis from the oogonia until to the ova was carried out by Transmission Electron Microscopy (TEM) on selected species of the families Channichthyidae and Nototheniidae.
2. The analysis of the zona radiata externa (egg envelope) by histo- und cytochemical methods should provide evidence for the presence of attaching substances. The presence or absence of attaching substances would provide evidence, whether the spawned eggs are benthic of pelagic (compare Riehl & Patzner 1998).
3. The formation of the zona radiata until its complete differenciation by TEM. Structure and thickness of the zona provides also information on the mode of spawning and therefore hints on still unknown spawning areas.

### Work at sea

Ovarian tissues were collected from different species (Table 2.32) in order to study oogenesis and formation of the zona radiata. Tissues were preserved in different glutaraldehyde solutions with and without sucrose, in formaldehyde and for special purposes in 70% ethanol. For SEM purposes the material was preserved in buffered glutaraldehyde, formaldehyde or Karnovsky solution. The oocytes were treated with Alcian blue and the PAS method to detect acid and neutral mucopolysaccharides in the zona radiata externa. TEM, SEM and histochemical studies can be carried out only at my Institute in Düsseldorf after this cruise.

Table 2.32 Species collected.

| | for studies on oogenesis, zona radiata and histochemistry | for SEM study |
|---|---|---|
| *Chaenocephalus aceratus* | X | X |
| *Chaenodraco wilsoni* | X | X |
| *Champsocelphalus gunnari* | | X |
| *Chionodraco rastrospinosus* | X | X |
| *Cryodraco antarcticus* | X | X |
| *Gobionotothen gibberifrons* | X | |
| *Lepidonotothen larseni* | X | |
| *Lepidonotothen nudifrons* | X | |
| *Lepidonotothen squamifrons* | X | |
| *Notothenia coriiceps* | X | X |
| *Notothenia rossii* | X | X |
| *Muraenolepis microps* | X | |
| *Ophthalmolycus amberensis* | X | |
| *Parachaenichthys charcoti* | X | |
| *Trematomus hansoni* | X | X |

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## 2.2.6 PERSISTENT ORGANIC POLLUTANTS IN ANTARCTIC BIOTA

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### Objective

The general objective of the project was to identify and study key organisms and specific processes sensitive to subtle environmental changes in Antarctica. Our main aim was to focus on Persistent Organic Pollutants (POP). This would involve the evaluation of matter/energy flows and the xenobiotic contaminant residues in animal tissue along the marine trophic web and in the sediment. Determining POP levels in organisms provides a quantitative indication of the environmental impact caused by contaminants in the Antarctic marine ecosystem. The study area included Elephant Island, the South Shetland Islands and Joinville Island. These areas are of particular interest. They are relatively close to South America as well as to many scientific stations that may inadvertently contribute to the introduction of pollutants into the environment. Samples from these regions will also facilitate a comparison with the Ross Sea region, which is more isolated and may therefore be less affected by the close proximity of anthropogenic sources.

### Work at sea

The samples were collected from bottom trawls, Agassiz trawls and multicorers. Whenever possible, muscle and liver were collected from fish greater than 10cm in length. Fish less than 10cm in length were preserved whole. In addition, a single cephalopod arm, the soft parts of gastropods and whole euphausiids were collected. All samples were frozen.

The species collected were as follows, with the number of specimens collected given in brackets:

Teleostei:

*Aethotaxis mitopterys* (15)
*Chaenocephalus aceratus* (20)
*C. gunnari* (23)

*Chaenodraco wilsoni* (20)
*Chionodraco rastrospinosus* (50)
*Cryodraco antarticus* (25)
*Dissosticum mawsoni* (20)
*Electrona antartica* (35)
*Gerlachea australis* (2)
*Gobionotothen gibberifrons* (30)
*Gymnodraco acuticeps* (15)
*Gymnoscopelus nicholsi* (15)
*Lepidonotothen larseni* (30)
*L. nudifrons* (44)
*L. squamifrons* (30)
*Muraenolepis microps* (10)
*Notothenia rossii* (32)
*N. coriiceps* (50)
*Ophthalmolycus amberensis* (12)
*Parachaenichthys charcoti* (18)
*Pseudochaenichthys georgianus* (25)
*Pleuragramma antarcticum* (15)
*Racovitzia glacialis* (2)
*Trematomus bernacchii* (6)
*T. eulepidotus* (25)
*T. hansoni* (13)
*T. nicolai* (5)
*T. scotti* (10)

Cephalopoda:
*Adelieledone polymorpha* (5)
*Megaleledone setebos* (10)
*Pareledone turqueti* (2)

Gastropoda:
*Harpovoluta charcoti* (62)
Plus two unidentified species whose bodies were preserved whole (25)

Euphausiacea:
*Euphausia superba* (aprox. 1000g)
*E. crystallorophias* (aprox. 500g)

Sediment samples were collected from stations around Elephant Island (n = 3), the South Shetland Islands (n = 3) and from a single station near Joinville Island. This collection covers a wide range of species from both shallow and deep-water habitats as well as eurybathic species. The concentration of bioaccumulation can be related to fish size. Chemical analysis will be carried out at the Department of Environmental Sciences, Siena University using the methodology described by Kannan *et al.* (2001) with some modification.

## Reference

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## 2.2.8 CEPHALOPOD DIVERSITY AND ECOLOGY

Iain Barratt[1], Elaina Jorgensen[2]

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[2] University of Washington & NOAA/NMFS, U.S.A.

### Objectives

As part of the continuing work on the biogeography, taxonomy, life histories and phylogeny of Antarctic cephalopods our primary objectives were to:

1. identify, measure, and sample all cephalopods collected;
2. document morphological and colour variation within species;
3. investigate reproductive strategies; and
4. investigate trophic ecology of the cephalopods of the Southern Ocean.

Table 2.33 Number collected of each species and dorsal mantle length (DML) statistics.

| Species | Male | Female | Total | Ave DML | Min DML | Max DML |
|---|---|---|---|---|---|---|
| *Adelieledone polymorpha* | 125 | 124 | 249 | 43.2 | 13.1 | 80.4 |
| *Benthoctopus levis peninsulae* | 1 | 7 | 8 | 40.5 | 19.6 | 61.0 |
| *Cirroctopus glacialis* | | | 2 | 105.5 | 93.0 | 118.0 |
| *Megaleledone setebos* | 17 | 17 | 34 | 84.5 | 28.6 | 210.0 |
| *Pareledone aequipapillae* | 231 | 165 | 396 | 39.8 | 11.7 | 89.0 |
| *P. albimaculata* | 3 | 3 | 6 | 26.7 | 19.8 | 30.8 |
| *P. aurata* | 4 | 6 | 10 | 57.3 | 39.6 | 78.9 |
| *P. charcoti* | 162 | 58 | 220 | 38.6 | 20.6 | 62.7 |
| *P. cornata* | 77 | 68 | 145 | 41.6 | 14.3 | 73.0 |
| *P. felix* | 47 | 25 | 72 | 40.6 | 15.4 | 73.2 |
| *P. panchroma* | 1 | 2 | 3 | 29.5 | 20.7 | 40.0 |
| *P. serperastrata* | | 3 | 3 | 43.5 | 37.1 | 55.0 |
| *P. turqueti* | 29 | 23 | 52 | 48.8 | 14.2 | 120.0 |

### Work at sea

Each octopus collected was measured (dorsal mantle length and total length), sampled for genetics, dissected to determine maturity, and preserved for future taxonomic work. A subset of these specimens (representatives from all species collected) was weighed for length weight regressions and their ventral mantle lengths recorded. Additional tissue samples and buccal masses were removed and frozen for future stable isotope analysis. Ovaries of all specimens were collected; however, while on board, the length and number of eggs per ovary was determined only for the most mature specimens. Ovary and oviducal gland diameter, and oviduct length were also measured. Photographs were taken of representatives of each species as well as additional specimens that showed colour or morphological variation. All specimen data was recorded in a relational database.

## Preliminary results

A total of 1406 octopuses were collected; 1198 from the bottom trawl and 208 from the Agassiz trawl. Octopuses were present in 83% of the stations sampled. Representatives from two families (Cirroctopodidae and Octopodidae), two individuals of *Cirroctopus glacialis* (Cirroctopodidae) and the rest from 14 species (in four genera) of Octopodidae were sampled (Table 2.33). Six unidentified species of squid were collected from bottom trawls. The octopuses were found throughout the sampled area. However, they were most abundant around Elephant Island (Fig 2.25).

The most abundant and widely distributed species was *Pareledone aequipapillae* (Fig. 2.26). It also occupied the largest range of depths. The least commonly collected species was the cirrate octopus *C. glacialis* and the incirrate octopuses *P. panchroma* and *P. serperastrata*. Distributions for the newly described *Benthoctopus levis peninsulae* and *P. felix* are given (Figs 2.27 & 2.28) as well as those for *Adelieledone polymorpha* (Fig. 2.29).

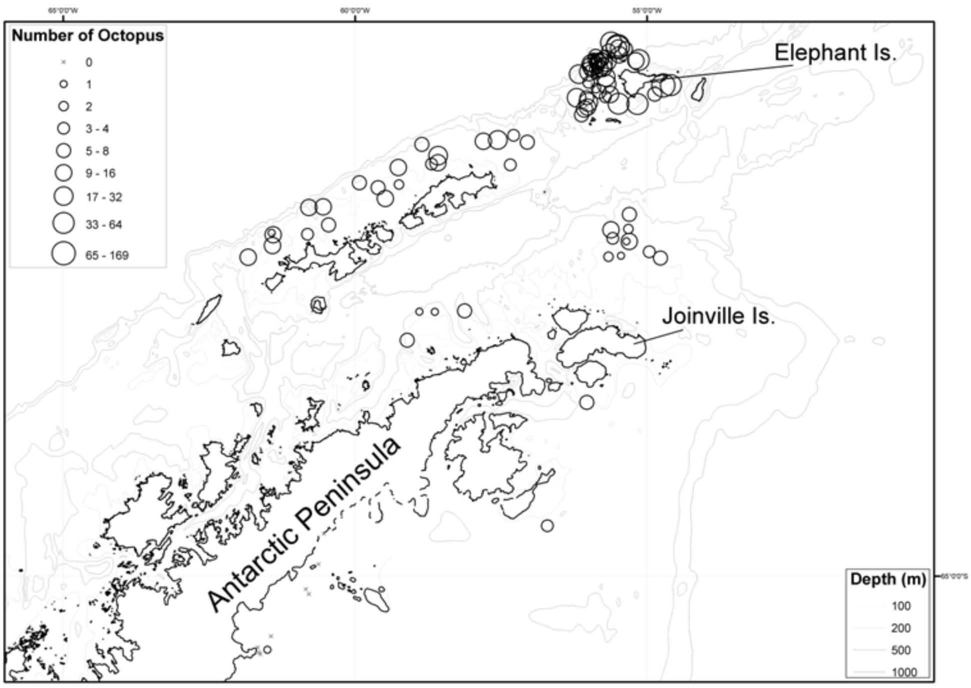


Fig. 2.25a Distribution and relative abundance of all octopuses collected. Stations where octopuses were not collected are represented by an x. First Agassiz trawl near *Neumayer Station* (603-5) not shown, no octopuses were collected.

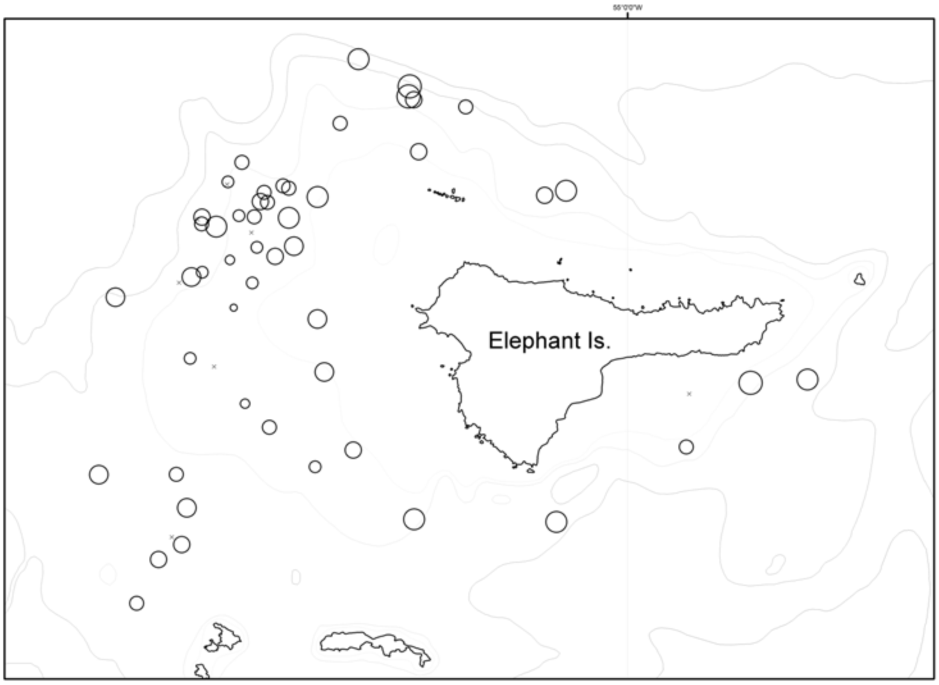


Fig. 2.25b. A close up of the stations near Elephant Island (scale is same as for figure 2.25a).

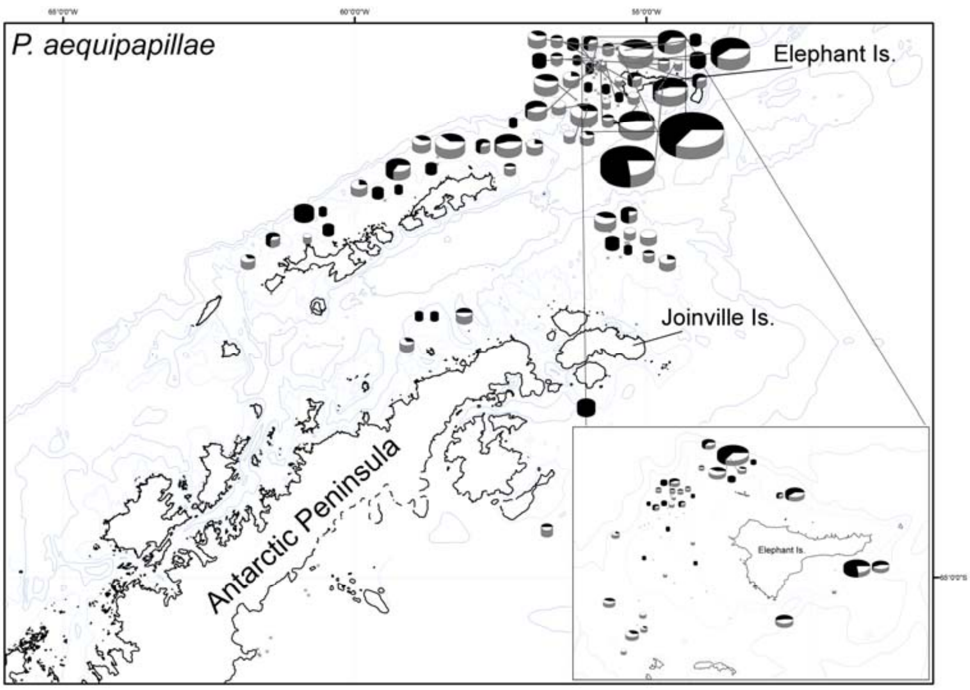


Fig. 2.26 Distribution and abundance of *Pareledone aequipapillae*. Pie charts represent no. of males (black) and females (white) per station. Size of pie chart represents n 30 $min^{-1}$ bottom trawling: largest pie chart symbolizes 62n, smallest a single animal; stations without octopuses represented by an x.

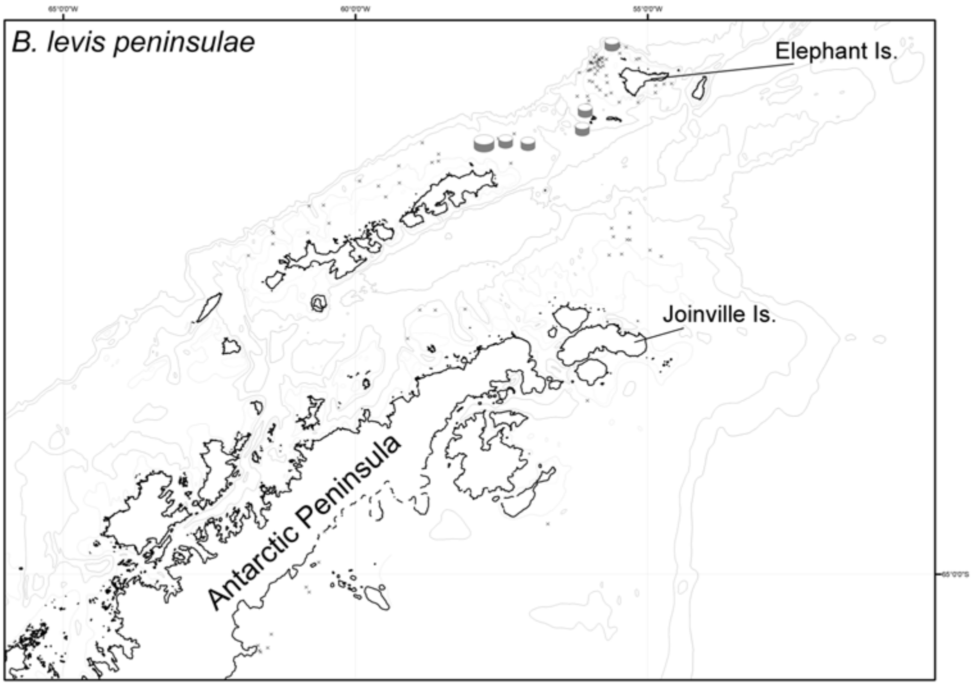


Fig. 2.27 Distribution and relative abundance of *Benthoctopus levis peninsulae*. Pie charts as described in Fig. 2.25 except that largest pie chart represents two animals.

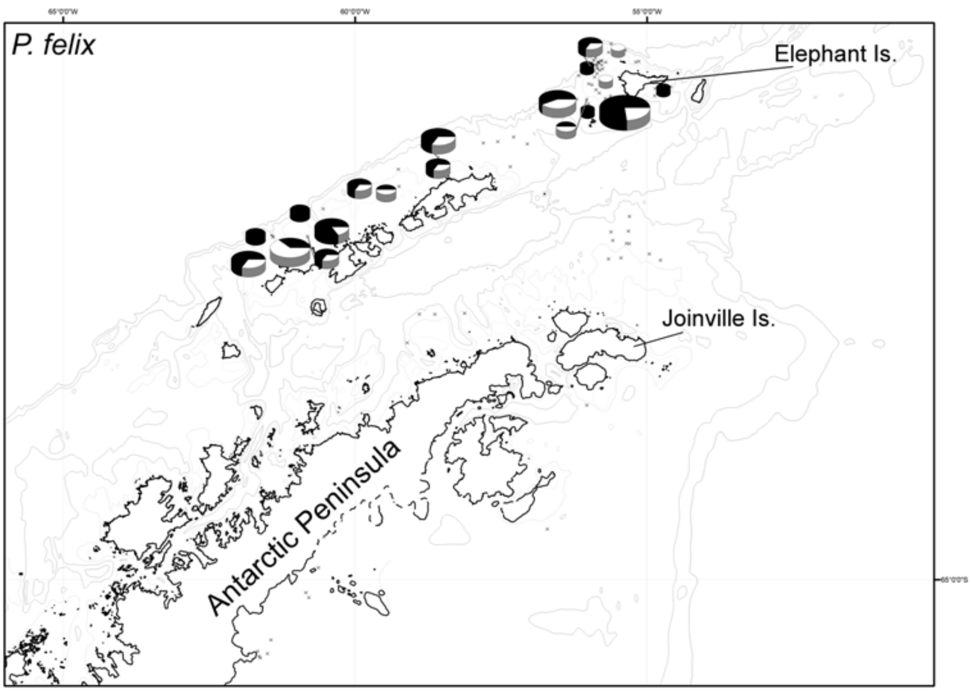


Fig. 2.28 Distribution and relative abundance of *Pareledone felix*. Pie charts are as described in Fig 2.26 except that largest pie chart represents 13 animals.

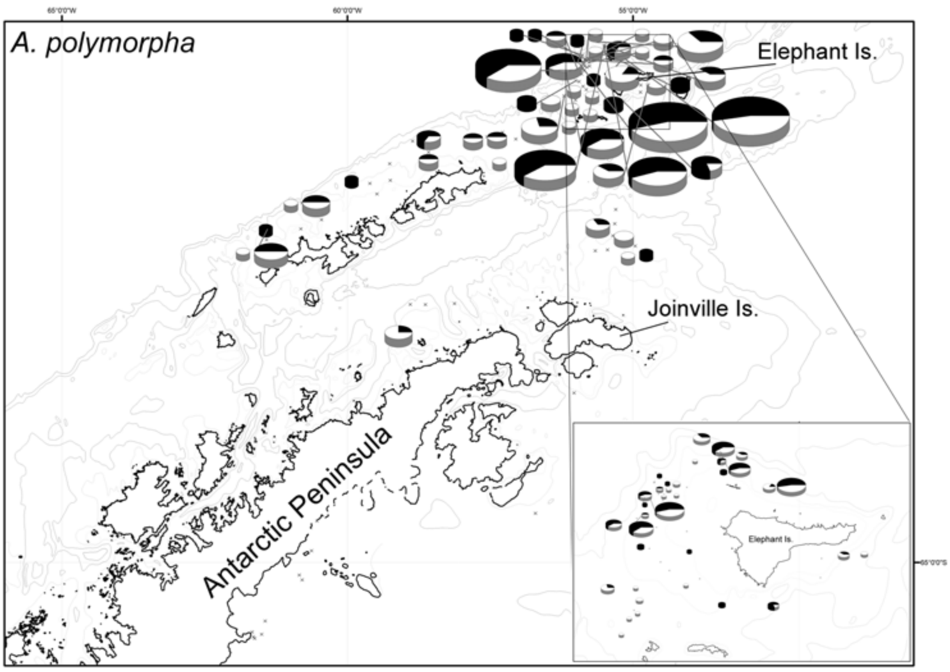


Fig. 2.29 Distribution and relative abundance of *Adelieledone polymorpha*. Pie charts are as described in Fig 2.26 except that largest pie chart represents 35 animals (same for insert).

Most species occupied a broad range of depths (Fig. 2.30) and no correlation was found between depth and species, species abundance, or gender, however, further statistical tests are planned. The two specimens of *Cirroctopus glacialis* were collected at the same location in 487m of water, the deepest station in the Elephant Island area. It is likely that our deepest station is at the shallow end of the depth range for *C. glacialis*, explaining the discrepancy between the numbers of individuals collected during this expedition compared to previous expeditions which sampled many more *C. glacialis*.

In addition to the dorsal mantle length (Table 2.33) and total length recorded for each specimen, ventral mantle length and weight were taken for a subset of all the species collected. The majority of this data will contribute to an existing database on species length weight regressions however the data for *Pareledone felix* is new information so is presented here (Fig. 2.31). A slight difference between male and female length weights is discernible.

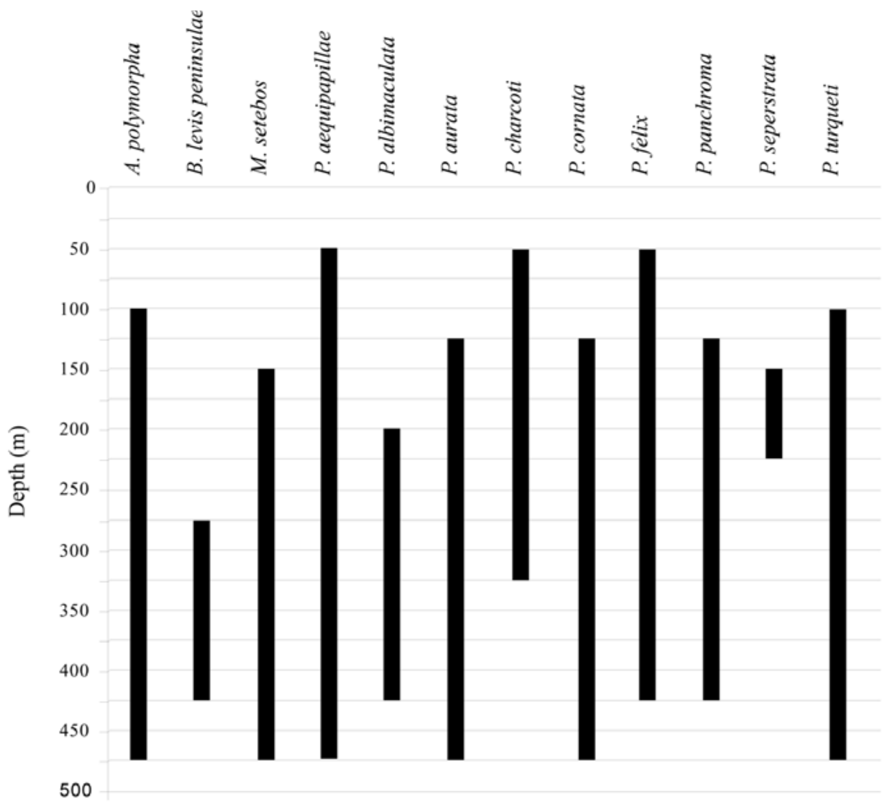


Fig. 2.30 Depth distributions for the all the species collected.

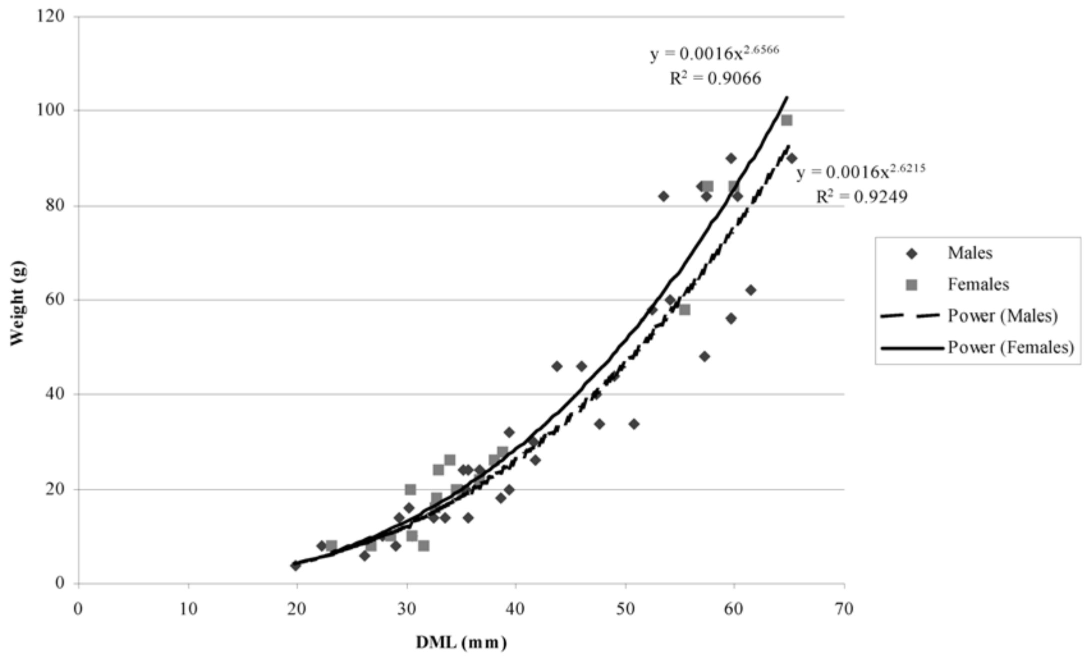


Fig. 2.31 Length weight data for *Pareledone felix*. The upper equation results from the trendline for the data of the females while the lower is that for the males.

Table 2.34 Number of eggs per ovary and minimum and maximum egg length (mm) for nine of the species collected.

| Species | DML | Min Egg Length | Max Egg Length | # Eggs |
|---|---|---|---|---|
| *A. polymorpha* | 80 | 5 | 11 | 117 |
| *M. setebos* | 210 | 15 | 23 | 251 |
| *P. aequipapillae* | 89 | 18 | 22 | 56 |
| *P. aurata* | 77 | 13 | 18 | 38 |
| *P. charcoti* | 49 | 15 | 20 | 45 |
| *P. cornata* | 62 | 15 | 18 | 40 |
| *P. felix* | 72 | 8 | 14 | 48 |
| *P. serperastrata* | 55 | 13 | 16 | 44 |
| *P. turqueti* | 146 | 16 | 22 | 152 |

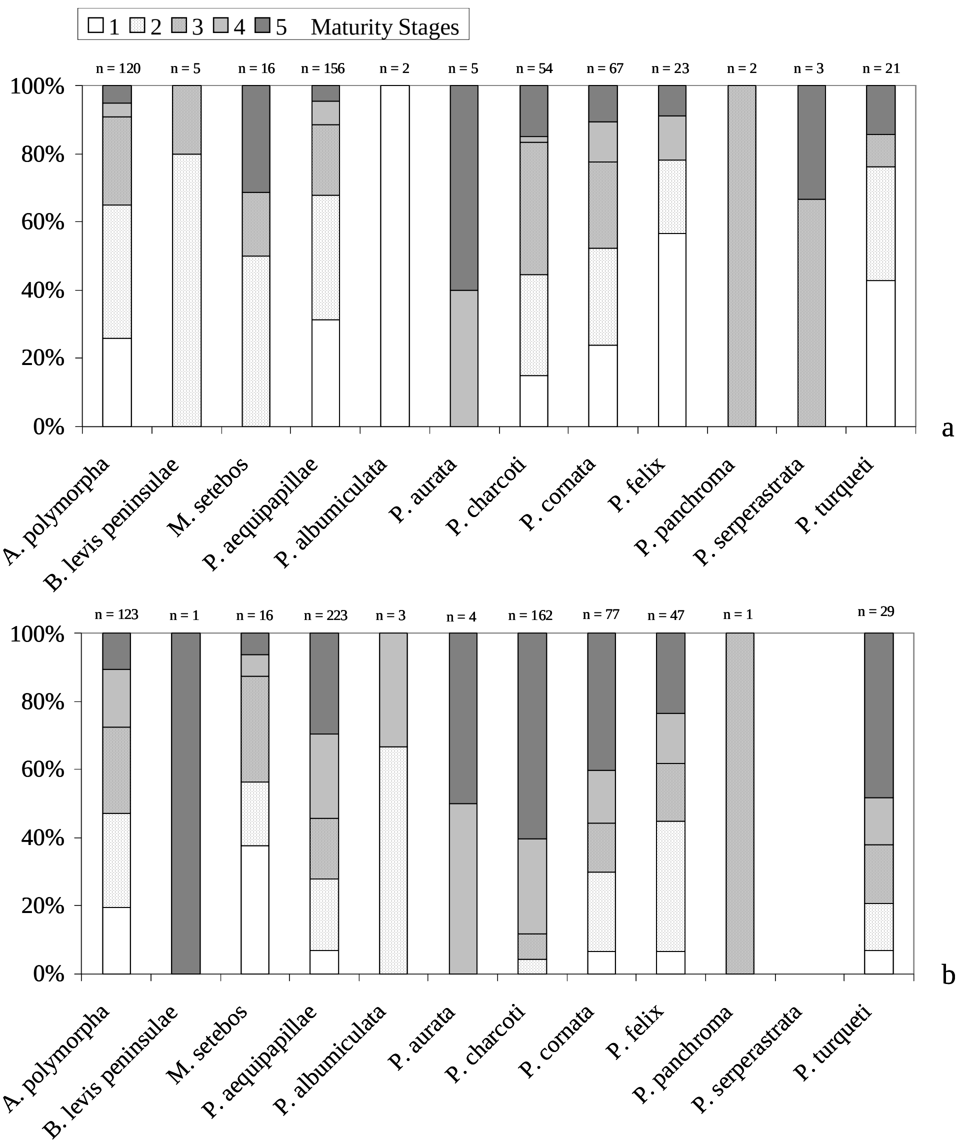


Fig. 2.32 Maturity stages for a) female, b) male octopuses. Stage 5 being the most mature stage. Juveniles and unknown specimens not included.

All of the most mature specimens were characterised by relatively low fecundity and large egg size, which is typical of Antarctic and deep-sea octopuses. The highest numbers and also the longest eggs were present in *Megaleledone setebos* followed by a large specimen of *Pareledone turqueti* (Table 2.34). The very large body size (>100mm) and high number of eggs observed in this specimen of *P. turqueti* were unusual when compared to individuals collected from South Georgia. In contrast, *Adelieledone polymorpha*, which also occurs around South Georgia, appeared to reach a similar body size with similar numbers of eggs. The length and number of developing eggs, with the exception of *P. turqueti*, also appear to be fairly consistent within the *Pareledone* genus. The results from the maturity stages showed that while the majority of females were either immature (stages 1 to 2) or beginning to develop their eggs (stage 3), most males were either approaching maturity (stage 4) or mature (stage 5) in several of the species (*P. cornata*, *P. charcoti*, *P. aequapapillae* and *P. turqueti*) (Fig. 2.32). Interestingly specimens of both sexes of *P. aurata* were at stage 4 or 5 only.

## 2.2.9 HABITAT USE OF MARINE MAMMALS IN ANTARCTIC WATERS

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### Objective

Using aerial surveys to investigate how marine mammal distribution and density relates to the heterogeneity of the marginal ice zone in Antarctic waters.

### Work at sea

Helicopter surveys. Aerial surveys following standard line-transect distance sampling methodology were conducted with a helicopter from board RV *Polarstern*. Flying time during each survey varied from 45 minutes to 3.5 hours. While crossing the Weddell Sea surveys were planned in an "ad-hoc" manner, depending on the position and the course of the *Polarstern* through the ice and weather conditions. For the areas of Elephant Island and Larsen A and B, we were able to conduct a survey along pre-designed transects.

Flights were conducted at 600 feet with a speed of 80 nautical miles per hour. One observer was positioned on the port back side of the helicopter and was observing the area to the side of the helicopter. The second observer was sitting on the port front seat of the helicopter and observed the area to the front, focusing on the transect line. The program VOR was used to store the GPS positions, environmental conditions and information on sightings. A digital tape recorder was used as an audio backup.

During the flight environmental information on sea state, cloud cover, glare, ice coverage in percent and overall sighting conditions was stored. Additionally a web cam was used to record the ice situation in front of the helicopter. Every 30 seconds a picture was taken and stored with the corresponding time in the picture frame. During flights over ice a video camera was attached to the helicopter. It scanned the area directly underneath the helicopter. It was connected to an external microphone which was continuously taping all audio on the helicopter intercom. The pictures of the web cam and the video footage will be analyzed later to estimate floe sizes and ice type.

The following information was collected for each sighting of a marine mammal in the water: species, group size, group composition, behaviour, cue, swimming direction, reaction to the helicopter. The vertical angle of a sighting was taken when abeam the helicopter using an inclinometer. With the known flying height, this will be used to calculate the distance of the sighting to the transect and the searched strip widths for the different species can be estimated post-survey. If a sighting was made and the species or the group size could not be identified, the survey was stopped and the sighting was approached with the helicopter. After identification, the helicopter returned to the transect and the survey was continued (closing mode).

Shipborne surveys. Shipborne surveys were conducted when flights were not possible due to logistical or weather constraints. The observations were made from the bridge scanning the area in front of the vessel and to the port side. The search was done with the naked eye but binoculars were used to identify species and group sizes. During this time the same environmental and sightings information as for the aerial surveys was collected. Additionally, a web cam and a laptop computer were left on the bridge to store pictures of the ice coverage every two minutes. This information will be used at a later time to validate the satellite ice images. Surveys were generally conducted when the *Polarstern* had a speed of at least 7 knots. Some observations were done in lower speed while breaking through ice.

## Preliminary results

Aerial surveys were conducted from 1 December 2006 to 26 January 2007. During this time a total of 58 flights (= 118 hours fight time) covering 9337 nautical miles. During these surveys a total of 128 cetacean sightings with 324 animals were made. Overall, nine different cetacean species were identified. Table 2.35 provides an overview of the number of sightings and animals with respect to the different cetacean species.

The distribution of the different cetacean species was distinct. Only three species were seen in waters covered by ice, mainly in the Weddell Sea and in front of the Larsen A and B area. These were Antarctic minke whale (*Balaenoptera bonaerensis*), Arnoux`s beaked whale (*Berardius arnuxii*) and Killer whale (*Orcinus orca*). During the surveys around Elephant Island, the

South Shetland Islands, in Bransfield Straight and at Larsen A and B the number of species and animals sighted increased considerably. Humpback whales (*Megaptera novaeangliae*) occurred mostly in shallower waters close to the islands. Fin whales (*Balaenoptera physalis*) and Sei whales (*Balaenoptera borealis*) were found over deeper waters and along the slope. Beaked whales were only seen in waters of at least 500m depth.

Table 2.35 Overview of cetacean sightings recorded during aerial surveys (1 December 2006 to 26 January 2007).

| | number sightings | number animals |
|---|---|---|
| Antarctic minke whale | 81 | 180 |
| Sei whale | 1 | 3 |
| Humpback whale | 17 | 37 |
| Fin whale | 10 | 26 |
| unidentified baleen whale | 6 | 12 |
| Killer whale | 5 | 47 |
| Arnoux's beaked whale | 1 | 4 |
| Southern bottlenose whale | 2 | 3 |
| Gray's beaked whale | 1 | 5 |
| Strap-toothed whale | 1 | 3 |
| unidentified beaked whale | 1 | 2 |
| unidentified cetacean | 2 | 2 |
| Σ | 128 | 324 |

From 11 - 22 January 2007, while working in the Larsen A and B in the western Weddell Sea, we were able to fly a detailed survey with systematic tracklines. In addition to cetaceans, pinnipeds and penguins were also recorded. During 28 hours of survey time 2130 nm were covered. The only cetaceans seen were Antarctic minke whale with a total of 20 sightings of 44 animals. Overall 1502 seal sightings were made with 2679 animals. The seal species identified were Crabeater seal (*Lobodon carcinophagus*), Weddell seal (*Leptonychotes weddellii*) and Leopard seal (*Hydrurga leptonyx*). Additionally, 11 sightings of Emperor penguins (*Aptenodytes forsteri*) with 17 individual animals were recorded. For sightings in the Larsen A/B areas, around Ross Island and in the Antarctic Sound see Fig. 2.33.

<u>Shipborne survey.</u> A total of 70 hours were surveyed on effort covering about 630nm. A total of 51 cetacean sightings with 90 animals were made. Most of them were Minke whales.

<u>Photo-identification.</u> Pictures for photo-identification were taken from Humpback whales and Killer whales. A total of 3 undersides of Humpback whale flukes were taken from the helicopter and an additional two whale flukes were photographed from board the *Polarstern*. These will be provided to the Antarctic Humpback whale catalogue.

A total of eight Killer whale sightings were made. During two sightings photos in sufficient quality for photo-identification purposes were taken. These will be made available to the Antarctic Killer whale catalogue and will also be used to identify the types of orca sighted.

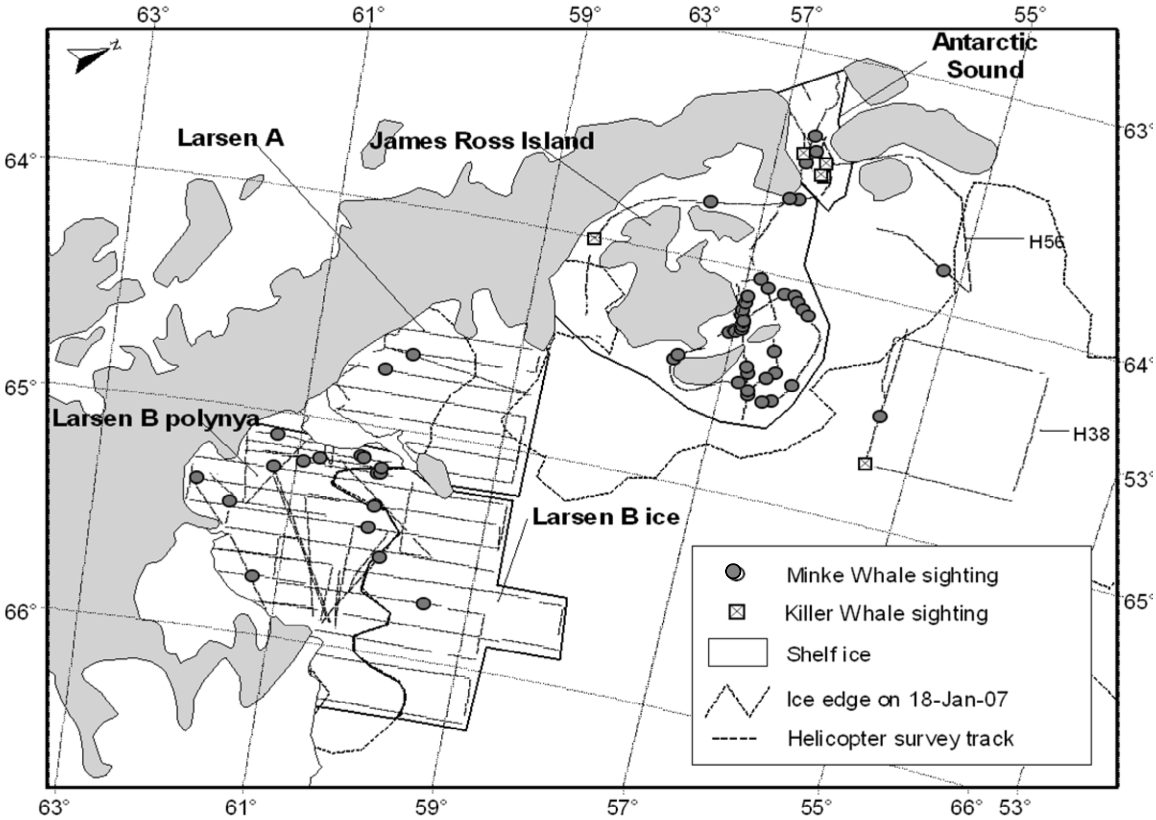


Fig. 2.33 Helicopter surveys in the western Weddell Sea. The ice edge contour from 18 January 2007 indicates the coastal polynyas in the Larsen A and B areas.

Behavioural data. During one flight a pod of orcas was observed while attacking a group of five Minke whales. The behaviour was recorded using a hand-held video camera. Although it is known that Antarctic orcas feed on Minke whales few records of such an encounter exist.

Beaked whales. Using the digital photography from the helicopter it was possible to later identify four beaked whale species seen during the survey on a species level. A group of four Arnoux's beaked whales was sighted close to the ice edge in the northwestern part of the Weddell Sea. Additionally, a total of five sightings of beaked whales were made in the northern area of Elephant Island. One sighting was unidentified, the other sightings were of Southern bottlenose whales (*Hyperoodon planifrons*), Gray's beaked whales (*Mesoplodon grayi*) and Strap-toothed whales (*Mesoplodon layardii*, Fig. 2.34).

Fig. 2.34 Adult male strap-toothed whale, photographed from the helicopter.

## Conclusions

The preliminary analyses shows that the method of helicopter surveys for cetaceans can be highly effective to do non-designed surveys as well as designed surveys. This is especially the case when a research vessel stays in the same area for a few weeks. For the designated surveys around Elephant Island and in the Larsen area distribution patterns and density of some cetacean species could be estimated.

The detailed collection of ice data together with the distance sampling data will be used to model the habitat use of Antarctic cetaceans, in particular the Antarctic minke whale. The use of a digital camera from the helicopter has served as an effective tool to identify beaked whales on a species level. This has allowed us to obtain records of poorly known species, such as the Arnoux`s beaked whale, the Strap-toothed whale and Gray's beaked whale.

The designated survey in the Larsen A and B areas showed that it supported a high density of marine mammals. Additional data on bathymetry as well as on pelagic prey species would help to better understand the observed distribution patterns of seals and cetaceans.

All sightings of marine mammals made during the helicopter and ship surveys will feed into the SCAR-MarBIN database.

# 3 ANNEX

## 3.1 PARTICIPATING INSTITUTIONS

| | |
|---|---|
| AWI | Alfred Wegener Institute for Polar and Marine Research<br>Columbusstr.<br>27568 Bremerhaven, Germany |
| BFAFi | Bundesforschungsanstalt für Fischerei,<br>Institut für Seefischerei<br>Palmaille 9<br>22767 Hamburg, Germany |
| CMN | Canadian Museum of Nature<br>Natural Heritage Building<br>1740 Pink Road, Gatineau,<br>Quebec J9J 3N7, Canada |
| DWD | Deutscher Wetterdienst, Abteilung Seeschifffahrt<br>Bernhard-Nochte-Straße 76<br>20359 Hamburg, Germany |
| FIELAX | FIELAX, Gesellschaft für wissenschaftliche<br>Datenverarbeitung mbH<br>Schifferstr. 10-14<br>27568 Bremerhaven, Germany |
| FIS | Forschungsinstitut und Naturmuseum Senckenberg<br>Senckenberganlage 25<br>60325 Frankfurt, Germany |
| FIS-DZMB | Forschungsinstitut und Naturmuseum Senckenberg<br>Abteilung Deutsches Zentrum für Marine<br>Biodiversitätsforschung,<br>Südstrand 44<br>26382 Wilhelmshaven, Germany |
| FTZ | Forschungs- und Technologiezentrum Westküste,<br>Außenstelle der CAU Kiel<br>Hafentörn 1<br>25761 Büsum, Germany |
| FWUB | Rheinische Friedrich-Wilhelms-Universität Bonn,<br>Adenauerallee 160,<br>53115 Bonn, Germany |
| HHUD | Heinrich-Heine-Universität Düsseldorf<br>Institut für Zoomorphologie, Zellbiologie und Parasitologie<br>Universitätsstraße 1, Geb. 26.03<br>40225 Düsseldorf, Germany |

| | |
|---|---|
| HTA | HeliTransair GmbH<br>Flugplatz<br>63329 Egelsbach, Germany |
| IAPG | Institute of Animal Physiology and Genetics, CAS<br>Rumburská 89<br>277 21 Libéchov, Czech Republic |
| ICM-CSIC | Institut de Ciències del Mar<br>Passeig Marítim de la Barceloneta, 37-49<br>08003, Barcelona, Spain |
| IG-RAS | Institute of Geography, RAS<br>29 Staromonetny Street<br>109017 Moscow, Russian Federation |
| IPF | International Polar Foundation<br>120A Rue des Deux Gares<br>1070 Bruxelles, Belgium |
| IRScNB | Institut royal des Sciences naturelles de Belgique<br>Rue Vautier, 29<br>1000 Brussels, Belgium |
| ISITEC | ISITEC GmbH<br>Stresemannstr. 46<br>27570 Bremerhaven, Germany |
| ISMAR-CNR | Istituto di Scienze Marine,<br>Seziono Pesca Marittima Ancona<br>Largo della Pesca, 1<br>60125 Ancona, Italy |
| LSOB | Southern Scientific Research Institute of<br>Marine Fisheries and Oceanography,<br>2, Sverdlov str.,<br>Kerch, Crimea 98300, Ukraine |
| MPI-BRE | Max Planck Institute for Marine Microbiology<br>Celsiusstraße 1<br>28359 Bremen, Germany |
| NOAA | National Oceanic & Atmospheric Administration<br>National Marine Fisheries Service<br>7600 Sand Point Way NE; Seattle, WA, U.S.A. |
| QUB | Queen’s University, Belfast<br>School of Biological Sciences, Medical Biology Centre<br>97 Lisburn Road<br>Belfast BT9 7BL, United Kingdom |
| UBD | Université de Bourgogne, Biogeosciences<br>6, Bvd Gabriel<br>21000 Dijon, France |

| | |
|---|---|
| UBR | Universität Bremen<br>Bibliothekstr. 1<br>28359 Bremen, Germany |
| UGent | Ghent University, Marine Biology Section<br>Krijgslaan 281 – Building S8<br>9000 Gent, Belgium |
| UMA | Universidad de Magallanes, Instituto de la Patagonia<br>Casilla 113-D<br>Punta Arenas, Chile |
| UNISI | Universita di Siena<br>Dipartimento di Sc. Ambientali “G. Sarfatti”<br>Sezione di Ecologia Applicata<br>Via Mattioli 4<br>53100 Siena, Italy |
| UOL | Carl von Ossietzky Universität Oldenburg<br>Ammerländer Heerstraße 114-118<br>26129 Oldenburg |
| UPA | Università di Padova, Dipartimento di Biologia<br>Via G. Colombo 3,<br>35131 Padua, Italy |
| US | University of Sevilla<br>Reina Mercedes 6<br>41012, Sevilla, Spain |
| UWB | University of Wales Bangor, School of Ocean Sciences<br>Menai Bridge<br>Anglesey, LL59 5AB, United Kingdom |
| UWS | University of Washington<br>Department of Oceanography<br>Box 357940<br>Seattle WA 98195, USA |
| VIGA | Vernadsky Institute of Geochemistry and<br>Analytical Chemistry, RAS<br>19 Kosygin Str, 119991 Moskow, Russia |
| ZFMK | Zoologisches Forschungsinstitut und Museum Alexander Koenig<br>Adenauerallee 160<br>53113 Bonn |

## 3.2 PARTICIPANTS

| | |
|---|---|
| Alonso Saez, Laura | ICM-CSIC |
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| Brauer, Jens | HTA |
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| D'Udekem, Cedric | IRScNB |
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| Langner, Stephanie | AWI (UOL) |
| Lehnert, Linn Sophia | BFAFi (FTZ) |
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| Niemann, Helge | MPI-BRE |
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| Seiler, Jan | AWI (UWB) |
| Umani, Marzia | UNISI |
| Zittier, Zora | AWI |

* disembarked at *Neumayer Station*

## 3.3 SHIP'S CREW

| | |
|---|---|
| Pahl, Uwe | Master |
| Grundmann, Uwe | 1.Offc. |
| Ziemann, Olaf | Ch.Eng. |
| Bratz, Herbert | 2.Offc. |
| Peine, Lutz | 2.Offc. |
| Hering, Igor | 2.Offc. |
| Weiße, Volker | Doctor |
| Koch, Georg | R.Offc. |
| Kotnik, Herbert | 2.Eng. |
| Schnürch, Helmut | 2.Eng |
| Westphal, Henning | 3.Eng |
| Holtz, Hartmut | ElecEng. |
| Rehe, Lars | ELO |
| Schulz, Harry | ELO |
| Fröb, Martin | ELO |
| Feiertag, Thomas | ELO |
| Clasen, Burkhard | Boatsw. |
| Neisner, Winfried | Carpenter |
| Kreis, Reinhard | A.B. |
| Schulze, Ottomar | A.B. |
| Burzan, Gerd-Ekkehard | A.B. |
| Schröder, Norbert | A.B. |
| Moser, Sigfried | A.B. |
| Pousada Martinez, Saturnio | A.B. |
| Hartwig-Labahn, Andreas | A.B. |
| Guse, Hartmut | A.B. |
| Vehlow, Ringo | A.B. |
| Beth, Detlef | Storekeep. |
| Hoppe, Kurt | Mot-man |
| Fritz, Günter | Mot-man |
| Krösche, Eckard | Mot-man |
| Dinse, Horst | Mot-man |
| Watzel, Bernhard | Mot-man |
| Fischer, Matthias | Cook |
| Tupy, Mario | Cooksmate |
| Völske, Thomas | Cooksmate |
| Dinse, Petra | 1.Stwdess |
| Tillmann, Barbara | Stwdss/KS |
| Streit, Christina | 2.Stwdess |
| Deuß, Stefanie | 2.Stwdess |
| Yan, Xiao | 2.Steward |
| Sun, Yong Sheng | 2.Steward |
| Yu, Chung Leung | Laundrym. |

## 3.4 LIST OF GEARS AND INVESTIGATION AREAS

| | |
|---|---|
| AGT | Agassiz trawl |
| ATC | amphipod trap |
| BT | bottom trawl |
| CTD | CTD & rosette |
| EF | ice fishing |
| FTS | foto sledge |
| GKG | giant box corer |
| MG | multibox corer |
| MOR | mooring |
| MUC | multicorer |
| PLA | plankton net |
| RD | Rauschert dredge |
| ROV | remotely operated vehicle |
| TD | drifter |
| TRAPF | fish trap |

| | |
|---|---|
| EWS | Eastern Weddell Sea |
| EI | Elephant Island |
| SSI | South Shetland Islands |
| JI | Joinville Island |
| BS | Bransfield Strait |
| B_South | Larsen B, core-station South |
| B_West | Larsen B, core-station West |
| B_Seep | Larsen B, core-station Seep |
| B_North | Larsen B, core-station North |
| A_North | Larsen A, core-station North |
| A_South | Larsen A, core-station South |
| SHI | Snow Hill Island (Seymour Island) |
| DI | Dundee Island (Paulet Island) |

# 3.5 STATION LIST

| Stn | area | date | time (UTC) | position lat. | position long. | depth (m) | gear | action |
|---|---|---|---|---|---|---|---|---|
| 601-1 | | 27/11 | 06:39 | 45°01.71'S | 08°56.26'E | 4450.7 | TD | deployed |
| 601-1 | | 27/11 | 06:44 | 45°01.72'S | 08°56.09'E | 4454.6 | TD | deployed |
| 602-1 | | 27/11 | 19:59 | 46°39.27'S | 07°30.39'E | 2513.4 | CTD | start cast |
| 602-1 | | 27/11 | 20:41 | 46°39.74'S | 07°30.26'E | 2522.1 | CTD | at depth |
| 602-1 | | 27/11 | 21:19 | 46°40.07'S | 07°29.98'E | 2526.0 | CTD | end cast |
| 603-1 | EWS | 07/12 | 10:46 | 70°31.23'S | 08°47.83'W | 298.8 | CTD | start cast |
| 603-1 | EWS | 07/12 | 11:03 | 70°31.19'S | 08°47.88'W | 299.1 | CTD | end cast |
| 603-1 | EWS | 07/12 | 11:08 | 70°31.16'S | 08°47.92'W | 294.6 | CTD | start cast |
| 603-1 | EWS | 07/12 | 11:19 | 70°31.14'S | 08°47.98'W | 293.4 | CTD | at depth |
| 603-1 | EWS | 07/12 | 11:27 | 70°31.11'S | 08°47.90'W | 295.5 | CTD | end cast |
| 603-2 | EWS | 07/12 | 11:36 | 70°31.16'S | 08°47.74'W | 299.7 | PLA | deployed |
| 603-2 | EWS | 07/12 | 11:57 | 70°31.13'S | 08°47.55'W | 294.0 | PLA | on deck |
| 603-3 | EWS | 07/12 | 11:58 | 70°31.13'S | 08°47.53'W | 293.4 | PLA | deployed |
| 603-3 | EWS | 07/12 | 12:34 | 70°31.19'S | 08°47.12'W | 264.0 | PLA | on deck |
| 603-4 | EWS | 07/12 | 12:56 | 70°30.88'S | 08°49.08'W | 348.3 | EF | start |
| 603-4 | EWS | 07/12 | 13:04 | 70°30.86'S | 08°49.14'W | 353.5 | EF | end |
| 603-5 | EWS | 07/12 | 13:38 | 70°30.99'S | 08°48.08'W | 297.4 | AGT | at bottom |
| 603-5 | EWS | 07/12 | 14:06 | 70°30.40'S | 08°48.13'W | 273.5 | AGT | end trawling |
| 603-6 | EWS | 08/12 | 08:36 | 70°31.42'S | 08°47.27'W | 302.0 | MUC | at bottom |
| 603-6 | EWS | 08/12 | 08:44 | 70°31.41'S | 08°47.25'W | 299.3 | MUC | at bottom |
| 603-6 | EWS | 08/12 | 09:53 | 70°31.36'S | 08°47.54'W | 302.7 | MUC | at bottom |
| 603-6 | EWS | 08/12 | 09:57 | 70°31.35'S | 08°47.54'W | 303.0 | MUC | at bottom |
| 604-1 | EI | 19/12 | 18:42 | 61°20.52'S | 55°09.72'W | 286.1 | BT | start trawling |
| 604-1 | EI | 19/12 | 19:07 | 61°20.11'S | 55°07.26'W | 406.6 | BT | end trawling |
| 604-2 | EI | 19/12 | 20:11 | 61°19.04'S | 55°05.58'W | 430.3 | CTD | start cast |
| 604-2 | EI | 19/12 | 20:30 | 61°18.99'S | 55°05.35'W | 470.5 | CTD | end cast |
| 605-1 | EI | 19/12 | 22:03 | 61°20.35'S | 55°29.16'W | 151.3 | BT | start trawling |
| 605-1 | EI | 19/12 | 22:33 | 61°19.98'S | 55°32.67'W | 145.8 | BT | end trawling |
| 605-2 | EI | 19/12 | 23:14 | 61°20.19'S | 55°31.92'W | 133.9 | CTD | start cast |
| 605-2 | EI | 19/12 | 23:30 | 61°20.22'S | 55°31.61'W | 150.1 | CTD | at depth |
| 605-2 | EI | 19/12 | 23:36 | 61°20.19'S | 55°31.77'W | 142.6 | CTD | end cast |
| 605-3 | EI | 20/12 | 00:09 | 61°20.33'S | 55°31.53'W | 137.4 | AGT | at bottom |
| 605-3 | EI | 20/12 | 00:24 | 61°20.35'S | 55°30.18'W | 154.1 | AGT | off bottom |
| 605-4 | EI | 20/12 | 00:52 | 61°20.19'S | 55°29.91'W | 147.7 | ZNET | at depth |
| 605-5 | EI | 20/12 | 01:54 | 61°20.27'S | 55°30.92'W | 153.4 | AGT | at bottom |
| 605-5 | EI | 20/12 | 02:18 | 61°20.37'S | 55°28.99'W | 152.2 | AGT | off bottom |
| 606-1 | EI | 20/12 | 09:36 | 61°15.58'S | 54°51.95'W | 130.9 | BT | start trawling |
| 606-1 | EI | 20/12 | 10:06 | 61°15.97'S | 54°55.58'W | 173.8 | BT | end trawling |
| 607-1 | EI | 20/12 | 12:08 | 61°12.07'S | 54°51.55'W | 81.1 | BT | start trawling |
| 607-1 | EI | 20/12 | 12:38 | 61°11.81'S | 54°55.11'W | 58.6 | BT | end trawling |
| 608-1 | EI | 20/12 | 16:43 | 61°11.34'S | 54°43.17'W | 293.0 | BT | start trawling |
| 608-1 | EI | 20/12 | 17:14 | 61°11.80'S | 54°40.05'W | 284.2 | BT | end trawling |
| 609-1 | EI | 20/12 | 20:18 | 61°11.13'S | 54°35.39'W | 279.5 | BT | start trawling |
| 609-1 | EI | 20/12 | 20:49 | 61°09.56'S | 54°32.86'W | 355.2 | BT | end trawling |
| 609-2 | EI | 20/12 | 21:51 | 61°09.67'S | 54°33.10'W | 352.5 | CTD | start cast |
| 609-2 | EI | 20/12 | 22:02 | 61°09.61'S | 54°32.91'W | 358.3 | CTD | at depth |
| 609-2 | EI | 20/12 | 22:14 | 61°09.51'S | 54°32.75'W | 360.6 | CTD | end cast |
| 609-3 | EI | 20/12 | 22:52 | 61°09.32'S | 54°32.27'W | 420.2 | MUC | at bottom |

| Stn | area | date | time (UTC) | position lat. | position long. | depth (m) | gear | action |
|---|---|---|---|---|---|---|---|---|
| 609-4 | EI | 20/12 | 23:44 | 61°08.84'S | 54°32.33'W | 417.0 | MUC | at bottom |
| 609-5 | EI | 21/12 | 00:54 | 61°09.03'S | 54°32.28'W | 425.6 | MUC | at bottom |
| 609-6 | EI | 21/12 | 02:10 | 61°08.58'S | 54°31.86'W | 437.0 | RD | start dredg. |
| 609-6 | EI | 21/12 | 02:18 | 61°08.45'S | 54°31.65'W | 442.0 | RD | end dredg. |
| 609-7 | EI | 21/12 | 03:17 | 61°07.99'S | 54°31.15'W | 434.3 | MUC | at bottom |
| 609-8 | EI | 21/12 | 04:07 | 61°08.04'S | 54°31.36'W | 426.3 | MUC | at bottom |
| 610-1 | EI | 21/12 | 09:55 | 60°58.59'S | 55°08.39'W | 286.9 | BT | start trawling |
| 610-1 | EI | 21/12 | 10:25 | 60°58.05'S | 55°05.00'W | 311.7 | BT | end trawling |
| 611-1 | EI | 21/12 | 13:15 | 60°58.90'S | 55°11.31'W | 215.1 | BT | start trawling |
| 611-1 | EI | 21/12 | 13:45 | 60°58.52'S | 55°07.82'W | 297.1 | BT | end trawling |
| 612-1 | EI | 21/12 | 16:16 | 60°53.00'S | 55°22.10'W | 307.9 | BT | start trawling |
| 612-1 | EI | 21/12 | 16:31 | 60°52.61'S | 55°20.53'W | 482.6 | BT | end trawling |
| 613-1 | EI | 21/12 | 18:13 | 60°55.99'S | 55°28.53'W | 112.5 | BT | start trawling |
| 613-1 | EI | 21/12 | 18:45 | 60°55.10'S | 55°25.24'W | 157.1 | BT | end trawling |
| 614-1 | EI | 21/12 | 20:06 | 60°52.52'S | 55°29.21'W | 250.0 | BT | start trawling |
| 614-1 | EI | 21/12 | 20:36 | 60°53.45'S | 55°26.13'W | 244.5 | BT | end trawling |
| 614-2 | EI | 21/12 | 21:33 | 60°54.01'S | 55°24.90'W | 261.7 | CTD | start cast |
| 614-2 | EI | 21/12 | 21:49 | 60°53.87'S | 55°25.40'W | 228.4 | CTD | at depth |
| 614-2 | EI | 21/12 | 21:53 | 60°53.88'S | 55°25.46'W | 223.8 | CTD | end cast |
| 614-3 | EI | 21/12 | 22:56 | 60°52.37'S | 55°29.80'W | 248.0 | AGT | at bottom |
| 614-3 | EI | 21/12 | 23:17 | 60°52.13'S | 55°30.31'W | 258.6 | AGT | off bottom |
| 614-4 | EI | 22/12 | 00:33 | 60°52.85'S | 55°27.51'W | 258.5 | RD | start dredg. |
| 614-4 | EI | 22/12 | 00:46 | 60°52.73'S | 55°27.69'W | 265.4 | RD | end dredg. |
| 614-5 | EI | 22/12 | 01:49 | 60°52.81'S | 55°27.72'W | 258.9 | RD | start dredg. |
| 614-5 | EI | 22/12 | 01:56 | 60°52.71'S | 55°27.83'W | 258.2 | RD | end dredg. |
| 615-1 | EI | 22/12 | 10:03 | 60°51.63'S | 55°29.77'W | 301.1 | BT | start trawling |
| 615-1 | EI | 22/12 | 10:33 | 60°52.35'S | 55°26.45'W | 298.7 | BT | end trawling |
| 616-1 | EI | 22/12 | 12:16 | 60°49.81'S | 55°36.76'W | 486.6 | BT | start trawling |
| 616-1 | EI | 22/12 | 12:46 | 60°49.20'S | 55°40.27'W | 483.9 | BT | end trawling |
| 617-1 | EI | 22/12 | 14:21 | 60°54.09'S | 55°39.29'W | 151.2 | BT | start trawling |
| 617-1 | EI | 22/12 | 14:51 | 60°53.01'S | 55°36.30'W | 176.2 | BT | end trawling |
| 618-1 | EI | 22/12 | 16:38 | 60°58.42'S | 55°46.31'W | 173.7 | BT | start trawling |
| 618-1 | EI | 22/12 | 17:05 | 60°57.41'S | 55°43.80'W | 147.5 | BT | end trawling |
| 619-1 | EI | 22/12 | 18:34 | 60°58.26'S | 55°47.09'W | 200.5 | BT | start trawling |
| 619-1 | EI | 22/12 | 18:57 | 60°57.78'S | 55°45.00'W | 199.9 | BT | end trawling |
| 619-2 | EI | 22/12 | 19:38 | 60°57.16'S | 55°43.68'W | 173.8 | CTD | start cast |
| 619-2 | EI | 22/12 | 19:50 | 60°57.06'S | 55°43.56'W | 175.3 | CTD | at depth |
| 619-2 | EI | 22/12 | 19:57 | 60°56.99'S | 55°43.46'W | 170.3 | CTD | end cast |
| 620-1 | EI | 22/12 | 20:41 | 60°56.24'S | 55°49.17'W | 333.5 | TRAPF | deployed |
| 620-2 | EI | 22/12 | 21:12 | 60°56.38'S | 55°49.47'W | 320.6 | TRAPF | deployed |
| 621-1 | EI | 23/12 | 09:31 | 60°59.31'S | 55°50.20'W | 164.9 | BT | start trawling |
| 621-1 | EI | 23/12 | 10:01 | 60°58.07'S | 55°53.00'W | 196.6 | BT | end trawling |
| 622-1 | EI | 23/12 | 11:45 | 60°56.70'S | 55°52.71'W | 218.4 | BT | start trawling |
| 622-1 | EI | 23/12 | 12:05 | 60°55.93'S | 55°50.79'W | 307.0 | BT | end trawling |
| 622-2 | EI | 23/12 | 12:36 | 60°55.31'S | 55°50.58'W | 629.1 | CTD | start cast |
| 622-2 | EI | 23/12 | 12:52 | 60°55.25'S | 55°50.61'W | 656.0 | CTD | at depth |
| 622-2 | EI | 23/12 | 13:02 | 60°55.22'S | 55°50.68'W | 664.4 | CTD | end cast |
| 623-1 | EI | 23/12 | 13:41 | 60°58.00'S | 55°54.63'W | 209.3 | BT | start trawling |
| 623-1 | EI | 23/12 | 14:11 | 60°59.84'S | 55°54.99'W | 214.0 | BT | end trawling |
| 623-2 | EI | 23/12 | 16:17 | 60°58.16'S | 55°54.74'W | 209.6 | BT | start trawling |

| Stn | area | date | time (UTC) | position lat. | position long. | depth (m) | gear | action |
|---|---|---|---|---|---|---|---|---|
| 623-2 | EI | 23/12 | 16:24 | 60°58.57'S | 55°54.88'W | 205.1 | BT | end trawling |
| 624-1 | EI | 23/12 | 18:59 | 61°00.33'S | 55°51.03'W | 151.3 | BT | start trawling |
| 624-1 | EI | 23/12 | 19:29 | 60°59.12'S | 55°53.75'W | 186.1 | BT | end trawling |
| 624-2 | EI | 23/12 | 19:58 | 60°58.50'S | 55°54.77'W | 197.2 | CTD | start cast |
| 624-2 | EI | 23/12 | 20:08 | 60°58.48'S | 55°54.81'W | 198.3 | CTD | at depth |
| 624-2 | EI | 23/12 | 20:11 | 60°58.48'S | 55°54.85'W | 201.4 | CTD | end cast |
| 625-1 | EI | 23/12 | 22:04 | 60°58.85'S | 55°56.79'W | 321.6 | TRAPF | deployed |
| 625-2 | EI | 23/12 | 22:09 | 60°58.86'S | 55°56.48'W | 282.6 | TRAPF | deployed |
| 625-3 | EI | 23/12 | 22:19 | 60°58.87'S | 55°56.10'W | 257.0 | ATC | deployed |
| 624-3 | EI | 23/12 | 23:20 | 61°00.23'S | 55°58.53'W | 287.2 | AGT | at bottom |
| 624-3 | EI | 23/12 | 23:48 | 61°00.76'S | 55°59.20'W | 319.7 | AGT | off bottom |
| 624-4 | EI | 24/12 | 00:46 | 60°59.98'S | 55°58.19'W | 283.4 | ZNET | at depth |
| 624-5 | EI | 24/12 | 01:34 | 60°59.82'S | 55°57.96'W | 281.4 | ZNET | at depth |
| 624-6 | EI | 24/12 | 02:20 | 60°59.48'S | 55°57.80'W | 298.2 | ZNET | at depth |
| 620-1 | EI | 24/12 | 07:57 | 60°55.95'S | 55°50.85'W | 305.6 | TRAPF | released |
| 620-2 | EI | 24/12 | 07:57 | 60°55.95'S | 55°50.85'W | 305.6 | TRAPF | released |
| 626-1 | EI | 24/12 | 10:27 | 60°58.70'S | 55°49.68'W | 164.2 | BT | start trawling |
| 626-1 | EI | 24/12 | 10:57 | 60°57.26'S | 55°47.97'W | 241.3 | BT | end trawling |
| 627-1 | EI | 24/12 | 12:28 | 60°59.00'S | 55°42.36'W | 102.0 | BT | start trawling |
| 627-1 | EI | 24/12 | 12:58 | 60°57.62'S | 55°40.19'W | 90.6 | BT | end trawling |
| 627-2 | EI | 24/12 | 13:38 | 60°57.41'S | 55°39.88'W | 170.2 | CTD | start cast |
| 627-2 | EI | 24/12 | 13:47 | 60°57.41'S | 55°40.01'W | 93.0 | CTD | at depth |
| 627-2 | EI | 24/12 | 13:49 | 60°57.41'S | 55°40.06'W | 94.3 | CTD | end cast |
| 628-1 | EI | 24/12 | 15:17 | 61°02.28'S | 55°45.61'W | 119.2 | BT | start trawling |
| 628-1 | EI | 24/12 | 15:47 | 61°00.45'S | 55°45.62'W | 159.5 | BT | end trawling |
| 629-1 | EI | 24/12 | 16:46 | 61°00.39'S | 55°46.30'W | 162.0 | BT | start trawling |
| 629-1 | EI | 24/12 | 17:16 | 60°58.60'S | 55°46.76'W | 190.7 | BT | end trawling |
| 629-2 | EI | 24/12 | 17:50 | 60°57.87'S | 55°46.53'W | 196.9 | CTD | start cast |
| 629-2 | EI | 24/12 | 17:58 | 60°57.88'S | 55°46.49'W | 199.4 | CTD | at depth |
| 629-2 | EI | 24/12 | 18:03 | 60°57.90'S | 55°46.49'W | 194.8 | CTD | end cast |
| 630-1 | EI | 25/12 | 11:23 | 61°02.95'S | 55°48.18'W | 123.8 | BT | start trawling |
| 630-1 | EI | 25/12 | 11:53 | 61°04.73'S | 55°49.30'W | 115.0 | BT | end trawling |
| 631-1 | EI | 25/12 | 13:07 | 61°01.37'S | 55°51.41'W | 145.9 | BT | start trawling |
| 631-1 | EI | 25/12 | 13:36 | 61°03.17'S | 55°52.00'W | 161.6 | BT | end trawling |
| 631-2 | EI | 25/12 | 14:04 | 61°03.45'S | 55°52.15'W | 153.5 | CTD | start cast |
| 631-2 | EI | 25/12 | 14:12 | 61°03.28'S | 55°52.19'W | 160.1 | CTD | at depth |
| 631-2 | EI | 25/12 | 14:16 | 61°03.22'S | 55°52.21'W | 161.7 | CTD | end cast |
| 632-1 | EI | 25/12 | 15:34 | 60°59.36'S | 55°49.22'W | 157.9 | BT | start trawling |
| 632-1 | EI | 25/12 | 16:03 | 61°01.02'S | 55°50.64'W | 144.5 | BT | end trawling |
| 633-1 | EI | 25/12 | 17:05 | 61°00.25'S | 55°53.11'W | 168.9 | BT | start trawling |
| 633-1 | EI | 25/12 | 17:35 | 61°02.01'S | 55°54.05'W | 212.8 | BT | end trawling |
| 634-1 | EI | 25/12 | 18:52 | 61°0.98'S | 55°56.23'W | 274.6 | BT | start trawling |
| 634-1 | EI | 25/12 | 19:22 | 61°02.76'S | 55°57.18'W | 278.3 | BT | end trawling |
| 634-2 | EI | 25/12 | 19:52 | 61°03.73'S | 55°57.34'W | 260.1 | CTD | start cast |
| 634-2 | EI | 25/12 | 20:00 | 61°03.72'S | 55°57.21'W | 256.8 | CTD | at depth |
| 634-2 | EI | 25/12 | 20:05 | 61°03.71'S | 55°57.13'W | 254.4 | CTD | end cast |
| 625-1 | EI | 25/12 | 21:10 | 60°58.99'S | 55°56.49'W | 284.5 | TRAPF | released |
| 625-2 | EI | 25/12 | 21:12 | 60°58.99'S | 55°56.42'W | 280.1 | TRAPF | released |
| 625-3 | EI | 25/12 | 21:15 | 60°58.99'S | 55°56.32'W | 274.2 | ATC | released |
| 635-1 | EI | 25/12 | 22:36 | 60°56.99'S | 55°55.36'W | 230.6 | TRAPF | deployed |

| Stn | area | date | time (UTC) | position lat. | position long. | depth (m) | gear | action |
|---|---|---|---|---|---|---|---|---|
| 635-2 | EI | 25/12 | 22:46 | 60°56.66'S | 55°55.20'W | 239.4 | TRAPF | deployed |
| 636-1 | EI | 25/12 | 23:56 | 60°58.58'S | 55°56.74'W | 326.3 | MUC | at bottom |
| 636-2 | EI | 26/12 | 00:27 | 60°58.60'S | 55°56.72'W | 320.3 | MUC | at bottom |
| 636-3 | EI | 26/12 | 00:53 | 60°58.59'S | 55°56.72'W | 322.1 | MUC | at bottom |
| 636-4 | EI | 26/12 | 01:17 | 60°58.58'S | 55°56.79'W | 336.8 | MUC | at bottom |
| 637-1 | EI | 26/12 | 09:55 | 61°05.67'S | 56°10.00'W | 425.4 | BT | start trawling |
| 637-1 | EI | 26/12 | 10:25 | 61°05.92'S | 56°06.43'W | 357.2 | BT | end trawling |
| 638-1 | EI | 26/12 | 11:58 | 61°09.72'S | 55°59.80'W | 148.6 | BT | start trawling |
| 638-1 | EI | 26/12 | 12:28 | 61°09.24'S | 56°03.55'W | 169.9 | BT | end trawling |
| 638-2 | EI | 26/12 | 13:04 | 61°09.28'S | 56°05.37'W | 188.4 | CTD | start cast |
| 638-2 | EI | 26/12 | 13:14 | 61°09.29'S | 56°05.44'W | 191.4 | CTD | |
| 638-2 | EI | 26/12 | 13:18 | 61°09.28'S | 56°05.44'W | 191.7 | CTD | end cast |
| 639-1 | EI | 26/12 | 14:07 | 61°10.27'S | 55°56.52'W | 127.5 | BT | start trawling |
| 639-1 | EI | 26/12 | 14:37 | 61°11.12'S | 55°53.03'W | 126.8 | BT | end trawling |
| 640-1 | EI | 26/12 | 16:16 | 61°12.72'S | 55°52.29'W | 135.9 | BT | start trawling |
| 640-1 | EI | 26/12 | 16:46 | 61°14.37'S | 55°54.22'W | 153.7 | BT | end trawling |
| 641-1 | EI | 26/12 | 18:54 | 61°04.72'S | 55°51.30'W | 125.4 | BT | start trawling |
| 641-1 | EI | 26/12 | 19:24 | 61°06.07'S | 55°54.18'W | 143.2 | BT | end trawling |
| 641-2 | EI | 26/12 | 20:04 | 61°06.64'S | 55°55.51'W | 139.1 | CTD | failure |
| 641-3 | EI | 26/12 | 21:18 | 61°06.36'S | 55°53.84'W | 132.6 | AGT | start trawling |
| 641-3 | EI | 26/12 | 21:33 | 61°06.32'S | 55°53.51'W | 132.8 | AGT | off bottom |
| 641-4 | EI | 26/12 | 22:07 | 61°06.44'S | 55°53.61'W | 133.8 | FTS | at bottom |
| 641-4 | EI | 26/12 | 22:56 | 61°05.93'S | 55°53.80'W | 140.6 | FTS | off bottom |
| 642-1 | EI | 26/12 | 23:54 | 61°04.38'S | 55°59.81'W | 253.6 | AGT | at bottom |
| 642-1 | EI | 27/12 | 00:19 | 61°04.27'S | 55°58.88'W | 254.4 | AGT | off bottom |
| 642-2 | EI | 27/12 | 01:23 | 61°04.28'S | 55°58.93'W | 254.6 | RD | start dredg. |
| 642-2 | EI | 27/12 | 01:36 | 61°04.24'S | 55°59.27'W | 256.9 | RD | end dredg. |
| 643-1 | EI | 27/12 | 09:43 | 61°04.01'S | 55°58.12'W | 260.0 | BT | start trawling |
| 643-1 | EI | 27/12 | 09:57 | 61°04.27'S | 55°59.75'W | 261.3 | BT | fast on b'tm |
| 643-2 | EI | 27/12 | 11:00 | 61°04.38'S | 56°00.35'W | 259.4 | CTD | start cast |
| 643-2 | EI | 27/12 | 11:09 | 61°04.36'S | 56°00.21'W | 256.8 | CTD | at depth |
| 643-2 | EI | 27/12 | 11:16 | 61°04.35'S | 56°00.09'W | 258.4 | CTD | end cast |
| 644-1 | EI | 27/12 | 12:08 | 61°03.19'S | 55°54.36'W | 187.1 | BT | start trawling |
| 644-1 | EI | 27/12 | 12:38 | 61°01.78'S | 55°51.83'W | 149.9 | BT | end trawling |
| 645-1 | EI | 27/12 | 13:38 | 61°02.35'S | 55°50.66'W | 139.6 | BT | start trawling |
| 645-1 | EI | 27/12 | 14:08 | 61°01.42'S | 55°47.29'W | 153.0 | BT | end trawling |
| 646-1 | EI | 27/12 | 15:58 | 61°00.79'S | 55°58.23'W | 314.9 | BT | start trawling |
| 646-1 | EI | 27/12 | 16:28 | 60°59.33'S | 55°56.06'W | 276.9 | BT | end trawling |
| 647-1 | EI | 27/12 | 18:02 | 61°00.35'S | 55°58.17'W | 287.7 | BT | start trawling |
| 647-1 | EI | 27/12 | 18:32 | 60°58.66'S | 55°56.51'W | 281.7 | BT | end trawling |
| 648-1 | EI | 27/12 | 20:21 | 61°04.70'S | 56°01.30'W | 241.0 | BT | start trawling |
| 648-1 | EI | 27/12 | 20:35 | 61°04.10'S | 55°59.70'W | 265.0 | BT | Haker |
| 648-2 | EI | 27/12 | 21:26 | 61°02.75'S | 55°58.49'W | 319.7 | CTD | start cast |
| 648-2 | EI | 27/12 | 21:37 | 61°02.72'S | 55°58.52'W | 314.6 | CTD | at depth |
| 648-2 | EI | 27/12 | 21:43 | 61°02.71'S | 55°58.54'W | 319.0 | CTD | end cast |
| 635-1 | EI | 27/12 | 22:35 | 60°57.14'S | 55°54.74'W | 231.8 | TRAPF | released |
| 635-2 | EI | 27/12 | 22:36 | 60°57.14'S | 55°54.73'W | 232.4 | TRAPF | released |
| 649-1 | EI | 27/12 | 23:52 | 60°58.58'S | 55°56.72'W | 319.8 | GC | at bottom |
| 649-2 | EI | 28/12 | 00:26 | 60°58.57'S | 55°56.58'W | 292.4 | GBG | at bottom |
| 650-1 | EI | 28/12 | 09:46 | 61°17.41'S | 56°12.28'W | 329.9 | BT | start trawling |

| Stn | area | date | time (UTC) | position lat. | position long. | depth (m) | gear | action |
|---|---|---|---|---|---|---|---|---|
| 650-1 | EI | 28/12 | 10:16 | 61°17.03'S | 56°15.73'W | 316.0 | BT | end trawling |
| 651-1 | EI | 28/12 | 12:06 | 61°17.39'S | 56°01.68'W | 290.1 | BT | start trawling |
| 651-1 | EI | 28/12 | 12:36 | 61°17.34'S | 56°05.67'W | 321.3 | BT | end trawling |
| 651-2 | EI | 28/12 | 13:12 | 61°17.42'S | 56°07.04'W | 322.1 | CTD | start cast |
| 651-2 | EI | 28/12 | 13:22 | 61°17.39'S | 56°06.89'W | 321.7 | CTD | at depth |
| 651-2 | EI | 28/12 | 13:29 | 61°17.36'S | 56°06.83'W | 322.3 | CTD | on deck |
| 652-1 | EI | 28/12 | 14:49 | 61°25.87'S | 56°07.10'W | 304.6 | BT | start trawling |
| 652-1 | EI | 28/12 | 15:19 | 61°27.25'S | 56°04.37'W | 280.6 | BT | end trawling |
| 653-1 | EI | 28/12 | 17:32 | 61°19.59'S | 56°00.24'W | 343.5 | BT | start trawling |
| 653-1 | EI | 28/12 | 18:02 | 61°20.80'S | 56°03.14'W | 355.6 | BT | end trawling |
| 654-1 | EI | 28/12 | 19:33 | 61°22.01'S | 56°00.95'W | 352.6 | BT | start trawling |
| 654-1 | EI | 28/12 | 20:03 | 61°20.74'S | 56°04.04'W | 356.2 | BT | end trawling |
| 654-2 | EI | 28/12 | 20:59 | 61°20.09'S | 56°05.88'W | 346.9 | CTD | start cast |
| 654-2 | EI | 28/12 | 21:13 | 61°20.09'S | 56°06.02'W | 350.4 | CTD | at depth |
| 654-2 | EI | 28/12 | 21:20 | 61°20.08'S | 56°06.08'W | 350.7 | CTD | end cast |
| 654-3 | EI | 28/12 | 22:16 | 61°21.52'S | 56°02.28'W | 351.4 | AGT | start trawling |
| 654-3 | EI | 28/12 | 22:58 | 61°20.74'S | 56°03.76'W | 355.0 | AGT | end trawling |
| 654-4 | EI | 28/12 | 23:39 | 61°20.72'S | 56°04.22'W | 356.1 | ZNET | at depth |
| 654-4 | EI | 28/12 | 23:45 | 61°20.81'S | 56°04.20'W | 358.5 | ZNET | at depth |
| 654-5 | EI | 29/12 | 00:59 | 61°21.65'S | 56°03.54'W | 340.6 | ZNET | at depth |
| 654-5 | EI | 29/12 | 01:03 | 61°21.67'S | 56°03.49'W | 342.1 | ZNET | at depth |
| 654-6 | EI | 29/12 | 01:55 | 61°22.80'S | 56°03.84'W | 342.3 | AGT | at bottom |
| 654-6 | EI | 29/12 | 02:43 | 61°23.35'S | 56°04.89'W | 340.5 | AGT | off bottom |
| 654-7 | EI | 29/12 | 03:26 | 61°23.37'S | 56°04.35'W | 344.6 | RD | start dredg. |
| 654-7 | EI | 29/12 | 03:53 | 61°23.94'S | 56°03.79'W | 317.5 | RD | end dredg. |
| 655-1 | EI | 29/12 | 09:36 | 61°07.11'S | 55°42.39'W | 62.0 | BT | start trawling |
| 655-1 | EI | 29/12 | 10:06 | 61°08.66'S | 55°41.02'W | 82.9 | BT | end trawling |
| 656-1 | EI | 29/12 | 11:18 | 61°10.62'S | 55°41.45'W | 89.2 | BT | start trawling |
| 656-1 | EI | 29/12 | 11:48 | 61°12.53'S | 55°41.54'W | 98.4 | BT | end trawling |
| 656-2 | EI | 29/12 | 12:14 | 61°13.13'S | 55°41.69'W | 103.2 | CTD | start cast |
| 656-2 | EI | 29/12 | 12:20 | 61°13.13'S | 55°41.69'W | 102.3 | CTD | at depth |
| 656-2 | EI | 29/12 | 12:24 | 61°13.14'S | 55°41.69'W | 103.7 | CTD | end cast |
| 657-1 | EI | 29/12 | 14:02 | 61°14.28'S | 55°48.96'W | 132.8 | BT | start trawling |
| 657-1 | EI | 29/12 | 14:32 | 61°15.96'S | 55°47.27'W | 145.1 | BT | end trawling |
| 658-1 | EI | 29/12 | 16:25 | 61°15.79'S | 55°37.48'W | 106.5 | BT | start trawling |
| 658-1 | EI | 29/12 | 16:54 | 61°17.56'S | 55°37.50'W | 102.0 | BT | end trawling |
| 659-1 | EI | 29/12 | 17:56 | 61°16.89'S | 55°42.71'W | 136.6 | BT | start trawling |
| 659-1 | EI | 29/12 | 18:18 | 61°18.26'S | 55°42.85'W | 185.3 | BT | end trawling |
| 659-2 | EI | 29/12 | 18:49 | 61°18.80'S | 55°42.57'W | 205.8 | CTD | start cast |
| 659-2 | EI | 29/12 | 18:55 | 61°18.77'S | 55°42.57'W | 205.9 | CTD | at depth |
| 659-2 | EI | 29/12 | 18:59 | 61°18.74'S | 55°42.61'W | 202.4 | CTD | end cast |
| 659-3 | EI | 29/12 | 19:26 | 61°18.51'S | 55°42.96'W | 200.2 | FTS | at bottom |
| 659-3 | EI | 29/12 | 19:55 | 61°18.34'S | 55°43.38'W | 201.9 | FTS | off bottom |
| 659-4 | EI | 29/12 | 20:03 | 61°18.31'S | 55°43.44'W | 201.4 | ZNET | start cast |
| 659-4 | EI | 29/12 | 20:27 | 61°18.27'S | 55°43.53'W | 199.7 | ZNET | at depth |
| 659-4 | EI | 29/12 | 21:03 | 61°18.08'S | 55°43.81'W | 193.2 | ZNET | end cast |
| 659-5 | EI | 29/12 | 21:06 | 61°18.06'S | 55°43.84'W | 195.1 | ZNET | start cast |
| 659-5 | EI | 29/12 | 21:17 | 61°18.01'S | 55°44.04'W | 190.9 | ZNET | at depth |
| 659-5 | EI | 29/12 | 21:37 | 61°17.94'S | 55°44.37'W | 192.7 | ZNET | at depth |
| 659-5 | EI | 29/12 | 21:48 | 61°17.90'S | 55°44.49'W | 193.4 | ZNET | end cast |

| Stn | area | date | time (UTC) | position lat. | position long. | depth (m) | gear | action |
|---|---|---|---|---|---|---|---|---|
| 660-1 | EI | 30/12 | 09:37 | 61°50.40'S | 57°20.28'W | 277.4 | BT | start trawling |
| 660-1 | EI | 30/12 | 10:07 | 61°49.57'S | 57°23.53'W | 282.9 | BT | end trawling |
| 661-1 | SSI | 30/12 | 12:34 | 61°39.74'S | 56°56.30'W | 488.7 | CTD | start cast |
| 661-1 | SSI | 30/12 | 12:47 | 61°39.63'S | 56°55.90'W | 473.5 | CTD | at depth |
| 661-1 | SSI | 30/12 | 13:02 | 61°39.59'S | 56°55.41'W | 473.6 | CTD | end cast |
| 661-2 | SSI | 30/12 | 14:36 | 61°39.29'S | 57°02.89'W | 467.2 | BT | start trawling |
| 661-2 | SSI | 30/12 | 14:51 | 61°39.20'S | 57°04.75'W | 466.0 | BT | end trawling |
| 662-1 | SSI | 30/12 | 16:32 | 61°35.91'S | 57°17.04'W | 425.4 | BT | start trawling |
| 662-1 | SSI | 30/12 | 17:02 | 61°35.41'S | 57°20.60'W | 431.8 | BT | end trawling |
| 663-1 | SSI | 30/12 | 18:31 | 61°38.18'S | 57°33.17'W | 432.0 | BT | start trawling |
| 663-1 | SSI | 30/12 | 19:01 | 61°38.02'S | 57°37.16'W | 434.0 | BT | end trawling |
| 664-1 | SSI | 30/12 | 20:36 | 61°38.86'S | 57°48.04'W | 337.1 | BT | start trawling |
| 664-1 | SSI | 30/12 | 21:04 | 61°38.78'S | 57°51.86'W | 336.0 | BT | end trawling |
| 664-2 | SSI | 30/12 | 21:40 | 61°38.55'S | 57°54.19'W | 334.5 | CTD | start cast |
| 664-2 | SSI | 30/12 | 21:58 | 61°38.51'S | 57°54.31'W | 335.7 | CTD | at depth |
| 664-2 | SSI | 30/12 | 22:04 | 61°38.50'S | 57°54.44'W | 329.6 | CTD | end cast |
| 665-1 | SSI | 31/12 | 00:34 | 61°48.11'S | 57°47.36'W | 188.7 | ROV | at bottom |
| 665-1 | SSI | 31/12 | 01:27 | 61°48.32'S | 57°48.80'W | 241.7 | ROV | off bottom |
| 666-1 | SSI | 31/12 | 09:51 | 61°40.40'S | 58°51.30'W | 370.5 | BT | start trawling |
| 666-1 | SSI | 31/12 | 10:21 | 61°39.22'S | 58°48.61'W | 406.7 | BT | end trawling |
| 667-1 | SSI | 31/12 | 12:25 | 61°45.86'S | 58°34.53'W | 282.2 | BT | start trawling |
| 667-1 | SSI | 31/12 | 12:55 | 61°44.98'S | 58°30.89'W | 287.6 | BT | end trawling |
| 667-2 | SSI | 31/12 | 13:37 | 61°45.20'S | 58°27.79'W | 283.1 | CTD | start cast |
| 667-2 | SSI | 31/12 | 13:46 | 61°45.22'S | 58°27.42'W | 282.0 | CTD | at depth |
| 667-2 | SSI | 31/12 | 13:53 | 61°45.24'S | 58°27.17'W | 283.4 | CTD | end cast |
| 668-1 | SSI | 31/12 | 15:24 | 61°49.32'S | 58°34.74'W | 193.0 | BT | start trawling |
| 668-1 | SSI | 31/12 | 15:54 | 61°50.05'S | 58°30.67'W | 151.6 | BT | end trawling |
| 669-1 | SSI | 31/12 | 17:59 | 61°49.97'S | 58°41.30'W | 208.2 | BT | start trawling |
| 669-1 | SSI | 31/12 | 18:29 | 61°50.01'S | 58°37.29'W | 191.9 | BT | end trawling |
| 670-1 | SSI | 01/01 | 11:27 | 61°51.69'S | 59°15.43'W | 263.0 | BT | start trawling |
| 670-1 | SSI | 01/01 | 11:57 | 61°50.60'S | 59°12.34'W | 270.3 | BT | end trawling |
| 671-1 | SSI | 01/01 | 13:35 | 61°59.98'S | 59°14.78'W | 130.7 | BT | start trawling |
| 671-1 | SSI | 01/01 | 14:05 | 61°60.00'S | 59°10.74'W | 144.3 | BT | end trawling |
| 671-2 | SSI | 01/01 | 14:28 | 62°00.24'S | 59°10.11'W | 136.2 | CTD | start cast |
| 671-2 | SSI | 01/01 | 14:36 | 62°00.28'S | 59°10.17'W | 136.9 | CTD | at depth |
| 671-2 | SSI | 01/01 | 14:40 | 62°00.29'S | 59°10.20'W | 136.0 | CTD | end cast |
| 672-1 | SSI | 01/01 | 16:03 | 62°06.70'S | 59°28.79'W | 94.9 | BT | start trawling |
| 672-1 | SSI | 01/01 | 16:33 | 62°05.23'S | 59°31.09'W | 107.5 | BT | end trawling |
| 673-1 | SSI | 01/01 | 17:25 | 62°01.47'S | 59°36.19'W | 175.6 | BT | start trawling |
| 673-1 | SSI | 01/01 | 17:45 | 62°00.51'S | 59°37.63'W | 178.7 | BT | end trawling |
| 674-1 | SSI | 01/01 | 19:13 | 61°59.10'S | 59°55.57'W | 286.3 | BT | start trawling |
| 674-1 | SSI | 01/01 | 19:43 | 61°57.47'S | 59°57.82'W | 318.1 | BT | end trawling |
| 674-2 | SSI | 01/01 | 20:47 | 61°56.98'S | 59°59.36'W | 330.7 | CTD | start cast |
| 674-2 | SSI | 01/01 | 20:59 | 61°57.00'S | 59°59.53'W | 330.1 | CTD | at depth |
| 674-2 | SSI | 01/01 | 21:05 | 61°57.01'S | 59°59.63'W | 327.8 | CTD | end cast |
| 675-1 | SSI | 01/01 | 22:01 | 61°52.98'S | 59°48.24'W | 358.1 | CTD | start cast |
| 675-1 | SSI | 01/01 | 22:12 | 61°53.05'S | 59°48.33'W | 357.2 | CTD | at depth |
| 675-1 | SSI | 01/01 | 22:21 | 61°53.07'S | 59°48.29'W | 356.9 | CTD | end cast |
| 675-2 | SSI | 01/01 | 22:40 | 61°53.10'S | 59°48.16'W | 356.5 | MUC | at bottom |
| 675-3 | SSI | 01/01 | 23:11 | 61°53.21'S | 59°48.09'W | 347.3 | MUC | at bottom |

| Stn | area | date | time (UTC) | position lat. | position long. | depth (m) | gear | action |
|---|---|---|---|---|---|---|---|---|
| 675-4 | SSI | 01/01 | 23:55 | 61°53.14'S | 59°48.36'W | 355.1 | MUC | at bottom |
| 675-5 | SSI | 02/01 | 00:27 | 61°53.27'S | 59°48.24'W | 345.9 | MUC | at bottom |
| 675-6 | SSI | 02/01 | 00:57 | 61°53.22'S | 59°48.29'W | 350.7 | MUC | at bottom |
| 676-1 | SSI | 02/01 | 10:03 | 62°11.06'S | 60°47.49'W | 418.0 | BT | start trawling |
| 676-1 | SSI | 02/01 | 10:33 | 62°09.65'S | 60°49.56'W | 472.4 | BT | end trawling |
| 677-1 | SSI | 02/01 | 12:00 | 62°10.70'S | 60°32.79'W | 205.4 | BT | start trawling |
| 677-1 | SSI | 02/01 | 12:23 | 62°10.31'S | 60°29.72'W | 200.2 | BT | end trawling |
| 677-2 | SSI | 02/01 | 12:57 | 62°10.00'S | 60°29.06'W | 201.9 | CTD | start cast |
| 677-2 | SSI | 02/01 | 13:12 | 62°10.02'S | 60°29.27'W | 200.5 | CTD | at depth |
| 677-2 | SSI | 02/01 | 13:16 | 62°10.02'S | 60°29.33'W | 201.3 | CTD | end cast |
| 678-1 | SSI | 02/01 | 14:29 | 62°19.36'S | 60°27.10'W | 108.9 | BT | start trawling |
| 678-1 | SSI | 02/01 | 15:02 | 62°20.31'S | 60°31.37'W | 128.8 | BT | end trawling |
| 679-1 | SSI | 02/01 | 16:33 | 62°23.84'S | 60°48.79'W | 87.1 | BT | start trawling |
| 679-1 | SSI | 02/01 | 17:03 | 62°24.26'S | 60°44.77'W | 91.3 | BT | end trawling |
| 680-1 | SSI | 02/01 | 20:40 | 62°24.13'S | 61°24.06'W | 340.6 | BT | start trawling |
| 680-1 | SSI | 02/01 | 21:10 | 62°22.50'S | 61°25.46'W | 336.3 | BT | end trawling |
| 680-2 | SSI | 02/01 | 21:39 | 62°22.15'S | 61°24.36'W | 360.2 | CTD | start cast |
| 680-2 | SSI | 02/01 | 21:49 | 62°22.09'S | 61°24.42'W | 369.8 | CTD | at depth |
| 680-2 | SSI | 02/01 | 21:54 | 62°22.05'S | 61°24.45'W | 368.1 | CTD | end cast |
| 680-3 | SSI | 02/01 | 22:21 | 62°22.90'S | 61°25.68'W | 352.2 | GC | at bottom |
| 680-4 | SSI | 02/01 | 23:09 | 62°24.35'S | 61°23.77'W | | AGT | at bottom |
| 680-4 | SSI | 02/01 | 23:56 | 62°23.71'S | 61°25.05'W | 346.0 | AGT | off bottom |
| 680-5 | SSI | 03/01 | 00:55 | 62°23.37'S | 61°25.58'W | 348.8 | AGT | at bottom |
| 680-5 | SSI | 03/01 | 01:30 | 62°22.75'S | 61°25.97'W | 324.3 | AGT | end trawling |
| 680-6 | SSI | 03/01 | 02:28 | 62°22.74'S | 61°26.41'W | 302.8 | RD | start dredg. |
| 680-6 | SSI | 03/01 | 02:43 | 62°23.05'S | 61°26.55'W | 320.9 | RD | end dredg. |
| 681-1 | SSI | 03/01 | 09:36 | 62°29.27'S | 61°24.79'W | 122.3 | BT | start trawling |
| 681-1 | SSI | 03/01 | 10:03 | 62°28.18'S | 61°22.00'W | 149.6 | BT | end trawling |
| 682-1 | SSI | 03/01 | 12:09 | 62°34.83'S | 61°49.76'W | 176.3 | BT | start trawling |
| 682-1 | SSI | 03/01 | 12:38 | 62°36.65'S | 61°50.77'W | 186.1 | BT | end trawling |
| 682-2 | SSI | 03/01 | 13:08 | 62°37.20'S | 61°51.43'W | 187.0 | CTD | start cast |
| 682-2 | SSI | 03/01 | 13:14 | 62°37.22'S | 61°51.50'W | 187.7 | CTD | at depth |
| 682-2 | SSI | 03/01 | 13:18 | 62°37.24'S | 61°51.58'W | 189.3 | CTD | end cast |
| 683-1 | JI | 04/01 | 02:14 | 62°57.77'S | 57°57.89'W | 839.1 | TRAPF | deployed |
| 684-1 | JI | 04/01 | 02:23 | 62°57.74'S | 57°57.75'W | 822.0 | TRAPF | deployed |
| 685-1 | JI | 04/01 | 10:08 | 62°34.61'S | 55°39.38'W | 159.2 | BT | start trawling |
| 685-1 | JI | 04/01 | 10:38 | 62°35.92'S | 55°36.85'W | 166.4 | BT | end trawling |
| 686-1 | JI | 04/01 | 12:27 | 62°34.12'S | 55°26.66'W | 159.1 | BT | start trawling |
| 686-1 | JI | 04/01 | 12:57 | 62°35.38'S | 55°23.67'W | 149.4 | BT | end trawling |
| 686-2 | JI | 04/01 | 13:21 | 62°35.33'S | 55°22.37'W | 148.5 | CTD | start cast |
| 686-2 | JI | 04/01 | 13:26 | 62°35.28'S | 55°22.37'W | 147.5 | CTD | at depth |
| 686-2 | JI | 04/01 | 13:29 | 62°35.23'S | 55°22.39'W | 148.1 | CTD | end cast |
| 687-1 | JI | 04/01 | 15:59 | 62°35.19'S | 54°45.99'W | 263.0 | BT | start trawling |
| 687-1 | JI | 04/01 | 16:29 | 62°35.95'S | 54°49.77'W | 257.3 | BT | end trawling |
| 688-1 | JI | 04/01 | 18:20 | 62°32.27'S | 54°57.55'W | 275.4 | BT | start trawling |
| 688-1 | JI | 04/01 | 18:50 | 62°33.59'S | 55°0.22'W | 259.2 | BT | end trawling |
| 689-1 | JI | 04/01 | 20:42 | 62°27.28'S | 55°18.23'W | 224.4 | BT | start trawling |
| 689-1 | JI | 04/01 | 21:11 | 62°27.63'S | 55°14.81'W | 229.2 | BT | end trawling |
| 689-2 | JI | 04/01 | 21:47 | 62°27.47'S | 55°13.80'W | 224.4 | CTD | start cast |
| 689-2 | JI | 04/01 | 21:55 | 62°27.49'S | 55°13.94'W | 222.1 | CTD | at depth |

| Stn | area | date | time (UTC) | position lat. | position long. | depth (m) | gear | action |
|---|---|---|---|---|---|---|---|---|
| 689-2 | JI | 04/01 | 21:59 | 62°27.50'S | 55°14.02'W | 224.5 | CTD | end cast |
| 689-3 | JI | 04/01 | 23:01 | 62°27.28'S | 55°20.74'W | 219.6 | AGT | at bottom |
| 689-3 | JI | 04/01 | 23:27 | 62°27.16'S | 55°22.70'W | 212.9 | AGT | off bottom |
| 689-4 | JI | 05/01 | 00:04 | 62°27.23'S | 55°25.40'W | 212.1 | FTS | at bottom |
| 689-4 | JI | 05/01 | 00:33 | 62°27.28'S | 55°26.58'W | 208.2 | FTS | off bottom |
| 689-5 | JI | 05/01 | 01:17 | 62°27.20'S | 55°25.93'W | 211.1 | RD | start dredg. |
| 689-5 | JI | 05/01 | 01:22 | 62°27.22'S | 55°26.19'W | 209.6 | RD | end dredg. |
| 690-1 | JI | 05/01 | 12:14 | 62°14.38'S | 55°17.92'W | 360.0 | BT | start trawling |
| 690-1 | JI | 05/01 | 12:44 | 62°16.29'S | 55°18.55'W | 352.3 | BT | end trawling |
| 691-1 | JI | 05/01 | 14:03 | 62°21.36'S | 55°18.94'W | 314.0 | BT | start trawling |
| 691-1 | JI | 05/01 | 14:32 | 62°23.17'S | 55°17.59'W | 306.5 | BT | end trawling |
| 691-2 | JI | 05/01 | 15:06 | 62°23.41'S | 55°16.07'W | 304.6 | CTD | start cast |
| 691-2 | JI | 05/01 | 15:16 | 62°23.38'S | 55°16.15'W | 304.5 | CTD | at depth |
| 691-2 | JI | 05/01 | 15:21 | 62°23.39'S | 55°16.19'W | 307.4 | CTD | end cast |
| 692-1 | JI | 05/01 | 18:22 | 62°21.76'S | 55°36.96'W | 277.1 | BT | start trawling |
| 692-1 | JI | 05/01 | 18:52 | 62°23.62'S | 55°36.42'W | 263.6 | BT | end trawling |
| 693-1 | JI | 05/01 | 20:07 | 62°25.84'S | 55°35.07'W | 243.0 | BT | start trawling |
| 693-1 | JI | 05/01 | 20:25 | 62°25.87'S | 55°32.62'W | 290.5 | BT | end trawling |
| 693-2 | JI | 05/01 | 21:07 | 62°25.70'S | 55°30.86'W | 281.2 | CTD | start cast |
| 693-2 | JI | 05/01 | 21:14 | 62°25.67'S | 55°30.94'W | 280.5 | CTD | at depth |
| 693-2 | JI | 05/01 | 21:20 | 62°25.65'S | 55°31.02'W | 278.6 | CTD | end cast |
| 693-3 | JI | 05/01 | 21:39 | 62°25.60'S | 55°31.27'W | 277.8 | MG | deployed |
| 693-3 | JI | 05/01 | 22:06 | 62°25.48'S | 55°31.68'W | 274.3 | MG | at bottom |
| 693-3 | JI | 05/01 | 22:16 | 62°25.45'S | 55°31.87'W | 273.3 | MG | on deck |
| 694-1 | BS | 06/01 | 09:45 | 63°00.10'S | 58°07.40'W | 220.0 | BT | start trawling |
| 694-1 | BS | 06/01 | 10:15 | 62°59.96'S | 58°03.51'W | 267.7 | BT | end trawling |
| 695-1 | BS | 06/01 | 13:05 | 63°00.55'S | 58°38.01'W | 269.4 | BT | start trawling |
| 695-1 | BS | 06/01 | 13:34 | 63°00.51'S | 58°34.13'W | 292.6 | BT | end trawling |
| 695-2 | BS | 06/01 | 14:15 | 62°59.82'S | 58°33.39'W | 321.9 | CTD | start cast |
| 695-2 | BS | 06/01 | 14:23 | 62°59.86'S | 58°33.51'W | 318.1 | CTD | at depth |
| 695-2 | BS | 06/01 | 14:29 | 62°59.89'S | 58°33.60'W | 319.7 | CTD | end cast |
| 696-1 | BS | 06/01 | 16:12 | 63°00.50'S | 58°53.82'W | 360.5 | BT | start trawling |
| 696-1 | BS | 06/01 | 16:42 | 63°00.52'S | 58°49.68'W | 361.2 | BT | end trawling |
| 697-1 | BS | 06/01 | 20:00 | 63°13.85'S | 59°06.30'W | 329.1 | BT | start trawling |
| 697-1 | BS | 06/01 | 20:30 | 63°15.38'S | 59°03.94'W | 407.9 | BT | end trawling |
| 697-2 | BS | 06/01 | 21:01 | 63°16.08'S | 59°02.27'W | 344.2 | CTD | start cast |
| 697-2 | BS | 06/01 | 21:10 | 63°16.11'S | 59°01.89'W | 267.1 | CTD | at depth |
| 697-2 | BS | 06/01 | 21:14 | 63°16.12'S | 59°01.71'W | 260.6 | CTD | end cast |
| 683-1 | JI | 07/01 | 00:38 | 62°57.83'S | 57°57.84'W | 838.4 | TRAPF | released |
| 684-1 | JI | 07/01 | 00:41 | 62°57.82'S | 57°57.76'W | 834.9 | TRAPF | released |
| 698-1 | B_South | 11/01 | 08:09 | 65°59.99'S | 60°24.90'W | 383.4 | ATC | deployed |
| 699-1 | B_South | 11/01 | 10:45 | 65°59.01'S | 60°30.00'W | 177.2 | ROV | at bottom |
| 699-1 | B_South | 11/01 | 13:07 | 65°58.61'S | 60°29.96'W | 233.1 | ROV | off bottom |
| 699-2 | B_South | 11/01 | 13:48 | 65°58.59'S | 60°29.94'W | 239.1 | CTD | start cast |
| 699-2 | B_South | 11/01 | 13:55 | 65°58.57'S | 60°29.95'W | 238.5 | CTD | at depth |
| 699-2 | B_South | 11/01 | 14:00 | 65°58.57'S | 60°29.95'W | 238.5 | CTD | end cast |
| 700-1 | B_South | 11/01 | 15:46 | 65°55.15'S | 60°19.68'W | 446.7 | MG | deployed |
| 700-1 | B_South | 11/01 | 16:14 | 65°55.18'S | 60°19.74'W | 446.4 | MG | at bottom |
| 700-1 | B_South | 11/01 | 16:29 | 65°55.20'S | 60°19.77'W | 446.1 | MG | on deck |
| 700-2 | B_South | 11/01 | 17:28 | 65°55.07'S | 60°20.15'W | 445.2 | BT | start trawling |

| Stn | area | date | time (UTC) | position lat. | position long. | depth (m) | gear | action |
|---|---|---|---|---|---|---|---|---|
| 700-2 | B_South | 11/01 | 17:58 | 65°56.88'S | 60°19.42'W | 441.9 | BT | end trawling |
| 700-3 | B_South | 11/01 | 19:27 | 65°57.91'S | 60°18.65'W | 441.9 | MOR | released |
| 700-4 | B_South | 11/01 | 20:11 | 65°55.40'S | 60°19.95'W | 445.8 | AGT | at bottom |
| 700-4 | B_South | 11/01 | 21:05 | 65°56.06'S | 60°20.32'W | 431.4 | AGT | off bottom |
| 700-5 | B_South | 11/01 | 21:51 | 65°55.16'S | 60°19.50'W | 445.5 | CTD | start cast |
| 700-5 | B_South | 11/01 | 22:04 | 65°55.17'S | 60°19.57'W | 445.8 | CTD | at depth |
| 700-5 | B_South | 11/01 | 22:20 | 65°55.17'S | 60°19.66'W | 447.0 | CTD | end cast |
| 700-6 | B_South | 11/01 | 23:45 | 65°55.11'S | 60°20.14'W | 446.1 | MUC | at bottom |
| 700-7 | B_South | 12/01 | 00:19 | 65°55.04'S | 60°20.32'W | 445.8 | MUC | at bottom |
| 700-8 | B_South | 12/01 | 00:48 | 65°54.98'S | 60°20.54'W | 442.8 | MUC | at bottom |
| 700-9 | B_South | 12/01 | 01:21 | 65°54.95'S | 60°20.88'W | 435.3 | MUC | at bottom |
| 701-1 | B_South | 12/01 | 02:06 | 65°56.33'S | 60°25.12'W | 382.8 | MG | at bottom |
| 702-1 | B_South | 12/01 | 09:04 | 65°55.15'S | 60°19.44'W | 444.9 | CTD | start cast |
| 702-1 | B_South | 12/01 | 09:16 | 65°55.18'S | 60°19.47'W | 444.6 | CTD | at depth |
| 702-1 | B_South | 12/01 | 09:28 | 65°55.22'S | 60°19.36'W | 444.3 | CTD | end cast |
| 702-2 | B_South | 12/01 | 09:51 | 65°55.29'S | 60°19.48'W | 446.1 | FTS | at bottom |
| 702-2 | B_South | 12/01 | 10:18 | 65°55.40'S | 60°19.30'W | 445.8 | FTS | off bottom |
| 702-3 | B_South | 12/01 | 10:51 | 65°55.12'S | 60°19.82'W | 445.5 | GKG | at bottom |
| 702-4 | B_South | 12/01 | 11:54 | 65°55.12'S | 60°19.96'W | 445.5 | MUC | at bottom |
| 702-5 | B_South | 12/01 | 13:26 | 65°55.12'S | 60°20.24'W | 445.5 | ROV | at bottom |
| 702-5 | B_South | 12/01 | 15:00 | 65°54.58'S | 60°20.65'W | 444.9 | ROV | off bottom |
| 702-6 | B_South | 12/01 | 16:23 | 65°54.52'S | 60°21.16'W | 429.6 | GC | at bottom |
| 702-7 | B_South | 12/01 | 17:01 | 65°54.49'S | 60°21.37'W | 424.8 | MUC | at bottom |
| 702-8 | B_South | 12/01 | 18:08 | 65°54.95'S | 60°20.95'W | 429.9 | MUC | at bottom |
| 702-9 | B_South | 12/01 | 19:53 | 65°57.85'S | 60°28.42'W | 221.4 | AGT | at bottom |
| 702-9 | B_South | 12/01 | 20:19 | 65°57.42'S | 60°28.12'W | 215.0 | AGT | off bottom |
| 702-10 | B_South | 12/01 | 21:26 | 65°59.09'S | 60°29.89'W | 177.3 | FTS | at bottom |
| 702-10 | B_South | 12/01 | 21:52 | 65°59.04'S | 60°29.74'W | 190.0 | FTS | off bottom |
| 698-1 | B_South | 12/01 | 22:34 | 65°55.96'S | 60°24.69'W | 389.7 | ATC | released |
| 703-1 | B_West | 13/01 | 10:55 | 65°32.57'S | 61°38.61'W | 218.4 | ROV | at bottom |
| 703-1 | B_West | 13/01 | 13:58 | 65°33.03'S | 61°37.00'W | 296.1 | ROV | off bottom |
| 703-2 | B_West | 13/01 | 16:01 | 65°30.81'S | 61°40.06'W | 326.4 | BT | start trawling |
| 703-2 | B_West | 13/01 | 16:31 | 65°30.71'S | 61°44.80'W | 351.6 | BT | end trawling |
| 703-3 | B_West | 13/01 | 18:28 | 65°33.45'S | 61°37.30'W | 319.2 | AGT | at bottom |
| 703-3 | B_West | 13/01 | 19:09 | 65°33.36'S | 61°37.48'W | 318.0 | AGT | off bottom |
| 703-4 | B_West | 13/01 | 20:42 | 65°33.02'S | 61°37.13'W | 296.7 | MG | deployed |
| 703-4 | B_West | 13/01 | 20:55 | 65°33.01'S | 61°37.05'W | 298.5 | MG | at bottom |
| 703-4 | B_West | 13/01 | 21:20 | 65°33.03'S | 61°37.10'W | 296.1 | MG | on deck |
| 703-5 | B_West | 13/01 | 21:54 | 65°33.08'S | 61°37.07'W | 288.0 | CTD | start cast |
| 703-5 | B_West | 13/01 | 22:03 | 65°33.09'S | 61°37.07'W | 279.9 | CTD | at depth |
| 703-5 | B_West | 13/01 | 22:11 | 65°33.10'S | 61°37.07'W | 278.7 | CTD | end cast |
| 703-6 | B_West | 13/01 | 22:28 | 65°33.04'S | 61°37.09'W | 296.1 | MUC | at bottom |
| 703-7 | B_West | 13/01 | 22:50 | 65°32.97'S | 61°37.08'W | 298.2 | MUC | at bottom |
| 703-8 | B_West | 13/01 | 23:24 | 65°33.00'S | 61°37.15'W | 297.0 | MUC | at bottom |
| 703-9 | B_West | 14/01 | 00:06 | 65°32.98'S | 61°37.09'W | 298.2 | MUC | at bottom |
| 703-10 | B_West | 14/01 | 00:39 | 65°32.98'S | 61°37.09'W | 298.2 | MUC | at bottom |
| 703-11 | B_West | 14/01 | 01:25 | 65°33.01'S | 61°37.06'W | 298.2 | GKG | at bottom |
| 704-1 | B_West | 14/01 | 02:12 | 65°30.57'S | 61°41.47'W | 356.7 | MG | deployed |
| 704-1 | B_West | 14/01 | 02:22 | 65°30.58'S | 61°41.50'W | 357.0 | MG | at bottom |
| 704-1 | B_West | 14/01 | 02:57 | 65°30.55'S | 61°41.48'W | 357.3 | MG | on deck |

| Stn | area | date | time (UTC) | position lat. | position long. | depth (m) | gear | action |
|---|---|---|---|---|---|---|---|---|
| 705-1 | B_West | 14/01 | 03:38 | 65°33.34'S | 61°37.37'W | 310.2 | ATC | deployed |
| 706-1 | B_Seep | 14/01 | 12:33 | 65°26.61'S | 61°26.69'W | 827.1 | ROV | at bottom |
| 706-1 | B_Seep | 14/01 | 16:02 | 65°25.82'S | 61°26.38'W | 843.9 | ROV | off bottom |
| 706-2 | B_Seep | 14/01 | 18:17 | 65°25.91'S | 61°27.28'W | 860.7 | ROV | at bottom |
| 706-2 | B_Seep | 14/01 | 21:08 | 65°26.26'S | 61°25.99'W | 840.6 | ROV | off bottom |
| 706-3 | B_Seep | 14/01 | 23:21 | 65°25.92'S | 61°26.29'W | 843.6 | MG | deployed |
| 706-3 | B_Seep | 14/01 | 23:48 | 65°25.90'S | 61°26.27'W | 841.8 | MG | at bottom |
| 706-3 | B_Seep | 15/01 | 00:30 | 65°26.10'S | 61°26.53'W | 849.6 | MG | at bottom |
| 706-3 | B_Seep | 15/01 | 00:56 | 65°26.09'S | 61°26.52'W | 851.1 | MG | on deck |
| 706-4 | B_Seep | 15/01 | 01:24 | 65°26.10'S | 61°26.49'W | 850.5 | GC | at bottom |
| 706-5 | B_Seep | 15/01 | 02:18 | 65°26.09'S | 61°26.48'W | 850.5 | MUC | at bottom |
| 706-6 | B_Seep | 15/01 | 03:15 | 65°26.10'S | 61°26.53'W | 849.9 | MUC | at bottom |
| 706-7 | B_Seep | 15/01 | 03:47 | 65°26.57'S | 61°26.82'W | 828.3 | TRAPF | deployed |
| 706-8 | B_Seep | 15/01 | 03:55 | 65°26.55'S | 61°27.01'W | 828.9 | TRAPF | deployed |
| 707-1 | B_Seep | 15/01 | 09:36 | 65°14.71'S | 61°58.21'W | 594.0 | MOR | start dredg. |
| 707-1 | B_Seep | 15/01 | 11:14 | 65°15.25'S | 61°58.49'W | 613.1 | MOR | end dredg. |
| 708-1 | B_Seep | 15/01 | 11:33 | 65°15.13'S | 61°57.76'W | 602.4 | MOR | start dredg. |
| 708-1 | B_Seep | 15/01 | 13:05 | 65°15.27'S | 61°58.31'W | 614.1 | MOR | end dredg. |
| 709-1 | B_Seep | 15/01 | 15:23 | 65°26.09'S | 61°26.43'W | 849.3 | CTD | start cast |
| 709-1 | B_Seep | 15/01 | 15:40 | 65°26.09'S | 61°26.46'W | 849.7 | CTD | at depth |
| 709-1 | B_Seep | 15/01 | 15:57 | 65°26.09'S | 61°26.49'W | 850.1 | CTD | end cast |
| 709-2 | B_Seep | 15/01 | 16:28 | 65°26.12'S | 61°26.49'W | 847.8 | CTD | start cast |
| 709-2 | B_Seep | 15/01 | 16:47 | 65°26.10'S | 61°26.47'W | 850.5 | CTD | at depth |
| 709-2 | B_Seep | 15/01 | 17:11 | 65°26.11'S | 61°26.43'W | 849.8 | CTD | end cast |
| 709-3 | B_Seep | 15/01 | 17:48 | 65°26.18'S | 61°26.51'W | 849.3 | MUC | at bottom |
| 709-4 | B_Seep | 15/01 | 19:21 | 65°26.10'S | 61°26.05'W | 842.7 | MUC | at bottom |
| 709-5 | B_Seep | 15/01 | 20:11 | 65°26.09'S | 61°26.51'W | 852.0 | MUC | at bottom |
| 709-6 | B_Seep | 15/01 | 21:48 | 65°26.10'S | 61°26.53'W | 850.2 | MG | at bottom |
| 709-7 | B_Seep | 15/01 | 22:43 | 65°26.07'S | 61°26.48'W | 851.1 | MUC | at bottom |
| 709-8 | B_Seep | 15/01 | 23:36 | 65°26.07'S | 61°26.49'W | 850.8 | MUC | at bottom |
| 705-1 | B_West | 16/01 | 00:59 | 65°33.35'S | 61°37.30'W | 308.4 | ATC | released |
| 710-1 | B_West | 16/01 | 09:35 | 65°31.52'S | 61°39.84'W | 137.1 | ROV | at bottom |
| 710-1 | B_West | 16/01 | 11:59 | 65°32.44'S | 61°39.03'W | 209.1 | ROV | off bottom |
| 710-2 | B_West | 16/01 | 12:54 | 65°33.03'S | 61°36.98'W | 293.4 | MUC | at bottom |
| 710-3 | B_West | 16/01 | 13:24 | 65°33.04'S | 61°37.18'W | 283.2 | MUC | at bottom |
| 710-4 | B_West | 16/01 | 14:06 | 65°33.01'S | 61°37.07'W | 297.0 | GC | at bottom |
| 710-5 | B_West | 16/01 | 15:27 | 65°32.86'S | 61°38.33'W | 243.0 | AGT | at bottom |
| 710-5 | B_West | 16/01 | 15:55 | 65°33.08'S | 61°39.09'W | 238.2 | AGT | off bottom |
| 710-6 | B_West | 16/01 | 18:58 | 65°31.80'S | 61°30.08'W | 490.2 | BT | start trawling |
| 710-6 | B_West | 16/01 | 19:28 | 65°31.96'S | 61°34.07'W | 425.8 | BT | end trawling |
| 710-7 | B_West | 16/01 | 22:19 | 65°33.03'S | 61°37.01'W | 298.0 | MUC | at bottom |
| 710-8 | B_West | 16/01 | 22:48 | 65°33.03'S | 61°37.00'W | 297.9 | MUC | at bottom |
| 710-9 | B_West | 16/01 | 23:22 | 65°33.07'S | 61°37.06'W | 297.1 | MUC | at bottom |
| 711-1 | B_Seep | 17/01 | 09:39 | 65°26.09'S | 61°26.52'W | 850.8 | GC | at bottom |
| 711-2 | B_Seep | 17/01 | 10:38 | 65°26.12'S | 61°26.73'W | 852.0 | MUC | at bottom |
| 711-2 | B_Seep | 17/01 | 10:43 | 65°26.11'S | 61°26.73'W | 849.9 | MUC | at bottom |
| 711-3 | B_Seep | 17/01 | 11:43 | 65°26.13'S | 61°28.24'W | 844.2 | GC | at bottom |
| 711-4 | B_Seep | 17/01 | 12:41 | 65°26.14'S | 61°28.28'W | 841.2 | GC | at bottom |
| 711-5 | B_Seep | 17/01 | 13:42 | 65°27.51'S | 61°26.02'W | 794.7 | GC | at bottom |
| 711-6 | B_Seep | 17/01 | 14:34 | 65°27.54'S | 61°26.03'W | 792.3 | GKG | at bottom |

| Stn | area | date | time (UTC) | position lat. | position long. | depth (m) | gear | action |
|---|---|---|---|---|---|---|---|---|
| 711-7 | B_Seep | 17/01 | 16:15 | 65°25.94'S | 61°26.20'W | 840.6 | AGT | at bottom |
| 711-7 | B_Seep | 17/01 | 16:35 | 65°26.15'S | 61°26.73'W | 854.6 | AGT | off bottom |
| 711-8 | B_Seep | 17/01 | 18:27 | 65°26.10'S | 61°26.53'W | 849.9 | MUC | at bottom |
| 706-7 | B_Seep | 17/01 | 19:02 | 65°26.49'S | 61°26.83'W | 833.1 | TRAPF | released |
| 706-8 | B_Seep | 17/01 | 19:03 | 65°26.47'S | 61°26.83'W | 833.7 | TRAPF | released |
| 712-1 | | 17/01 | 22:01 | 65°05.63'S | 61°17.72'W | 779.1 | MOR | start dredg. |
| 712-1 | | 17/01 | 23:26 | 65°05.36'S | 61°18.68'W | 819.3 | MOR | end dredg. |
| 712-2 | | 17/01 | 23:40 | 65°05.42'S | 61°18.27'W | 810.5 | MOR | start dredg. |
| 712-2 | | 18/01 | 01:07 | 65°05.81'S | 61°18.77'W | | MOR | end dredg. |
| 713-1 | B_North | 18/01 | 09:10 | 65°05.56'S | 60°45.60'W | 299.4 | ATC | deployed |
| 714-1 | B_North | 18/01 | 11:00 | 65°05.78'S | 60°50.54'W | 189.3 | ROV | at bottom |
| 714-1 | B_North | 18/01 | 13:47 | 65°06.43'S | 60°48.38'W | 285.6 | ROV | off bottom |
| 714-2 | B_North | 18/01 | 14:30 | 65°06.57'S | 60°48.44'W | 282.8 | CTD | start cast |
| 714-2 | B_North | 18/01 | 14:39 | 65°06.59'S | 60°48.49'W | 282.5 | CTD | at depth |
| 714-2 | B_North | 18/01 | 14:48 | 65°06.60'S | 60°48.46'W | 284.1 | CTD | end cast |
| 715-1 | B_North | 18/01 | 16:14 | 65°07.79'S | 60°47.40'W | 319.5 | BT | start trawling |
| 715-1 | B_North | 18/01 | 16:44 | 65°07.22'S | 60°43.30'W | 320.9 | BT | end trawling |
| 715-2 | B_North | 18/01 | 18:53 | 65°06.39'S | 60°45.04'W | 322.2 | MUC | at bottom |
| 715-3 | B_North | 18/01 | 19:36 | 65°06.46'S | 60°45.17'W | 321.0 | MG | at bottom |
| 715-4 | B_North | 18/01 | 20:13 | 65°06.44'S | 60°45.07'W | 321.6 | MUC | at bottom |
| 715-5 | B_North | 18/01 | 20:57 | 65°06.40'S | 60°45.01'W | 322.8 | MUC | at bottom |
| 716-1 | B_North | 18/01 | 22:07 | 65°05.55'S | 60°50.47'W | 191.7 | AGT | at bottom |
| 716-1 | B_North | 18/01 | 22:32 | 65°05.87'S | 60°50.34'W | 193.5 | AGT | off bottom |
| 717-1 | B_North | 19/01 | 09:51 | 65°09.18'S | 60°46.79'W | 342.6 | ROV | at bottom |
| 717-1 | B_North | 19/01 | 12:18 | 65°09.34'S | 60°48.08'W | 342.0 | ROV | off bottom |
| 718-1 | B_North | 19/01 | 13:33 | 65°06.33'S | 60°45.17'W | 320.7 | MUC | at bottom |
| 718-2 | B_North | 19/01 | 14:18 | 65°06.41'S | 60°44.97'W | 318.9 | GKG | at bottom |
| 718-3 | B_North | 19/01 | 14:51 | 65°06.43'S | 60°44.93'W | 318.5 | MUC | at bottom |
| 718-4 | B_North | 19/01 | 15:18 | 65°06.41'S | 60°45.16'W | 319.5 | MUC | at bottom |
| 718-5 | B_North | 19/01 | 15:37 | 65°06.40'S | 60°45.60'W | 319.8 | MUC | at bottom |
| 718-6 | B_North | 19/01 | 16:07 | 65°06.45'S | 60°45.20'W | 318.6 | GKG | at bottom |
| 718-7 | B_North | 19/01 | 17:14 | 65°08.05'S | 60°45.97'W | 328.2 | MG | at bottom |
| 718-8 | B_North | 19/01 | 18:38 | 65°08.05'S | 60°50.64'W | 330.1 | ROV | at bottom |
| 718-8 | B_North | 19/01 | 20:01 | 65°08.02'S | 60°49.75'W | 324.0 | ROV | off bottom |
| 718-9 | B_North | 19/01 | 21:58 | 65°06.49'S | 60°45.00'W | 318.9 | RD | start dredg. |
| 718-9 | B_North | 19/01 | 22:05 | 65°06.50'S | 60°45.14'W | 319.8 | RD | end dredg. |
| 713-1 | B_North | 19/01 | 22:50 | 65°05.58'S | 60°45.55'W | 301.2 | ATC | released |
| 719-1 | B_South | 20/01 | 09:11 | 65°57.88'S | 60°17.46'W | 433.2 | CTD | start cast |
| 719-1 | B_South | 20/01 | 09:26 | 65°57.86'S | 60°17.46'W | 433.2 | CTD | at depth |
| 719-1 | B_South | 20/01 | 09:38 | 65°57.80'S | 60°17.40'W | 432.6 | CTD | end cast |
| 719-2 | B_South | 20/01 | 09:53 | 65°58.13'S | 60°18.62'W | 442.2 | MOR | released |
| 720-2 | B_South | 20/01 | 14:41 | 65°58.03'S | 60°29.45'W | 232.9 | ROV | at bottom |
| 720-2 | B_South | 20/01 | 17:11 | 65°58.62'S | 60°29.36'W | 228.0 | ROV | off bottom |
| 721-1 | B_South | 20/01 | 18:52 | 65°55.51'S | 60°37.79'W | 381.3 | MUC | at bottom |
| 721-2 | B_South | 20/01 | 19:43 | 65°55.41'S | 60°34.01'W | 294.6 | AGT | at bottom |
| 721-2 | B_South | 20/01 | 20:08 | 65°55.79'S | 60°33.96'W | 298.5 | AGT | off bottom |
| 721-3 | B_South | 20/01 | 20:55 | 65°55.49'S | 60°37.77'W | 376.5 | MUC | at bottom |
| 721-4 | B_South | 20/01 | 21:33 | 65°55.55'S | 60°37.77'W | 381.3 | MUC | at bottom |
| 722-1 | A_North | 21/01 | 14:04 | 64°41.07'S | 60°32.70'W | 157.2 | ROV | at bottom |
| 722-1 | A_North | 21/01 | 16:39 | 64°41.59'S | 60°31.94'W | 293.1 | ROV | off bottom |

| Stn | area | date | time (UTC) | position lat. | position long. | depth (m) | gear | action |
|---|---|---|---|---|---|---|---|---|
| 722-2 | A_North | 21/01 | 17:57 | 64°41.16'S | 60°32.70'W | 202.1 | MG | at bottom |
| 722-3 | A_North | 21/01 | 18:43 | 64°41.30'S | 60°31.92'W | 264.3 | MUC | at bottom |
| 722-4 | A_North | 21/01 | 19:50 | 64°41.53'S | 60°32.03'W | 293.6 | AGT | at bottom |
| 722-4 | A_North | 21/01 | 20:01 | 64°41.35'S | 60°31.74'W | 278.7 | AGT | end trawling |
| 722-5 | A_North | 21/01 | 20:53 | 64°41.41'S | 60°31.94'W | 275.1 | CTD | start cast |
| 722-5 | A_North | 21/01 | 21:02 | 64°41.45'S | 60°31.99'W | 280.5 | CTD | at depth |
| 722-5 | A_North | 21/01 | 21:07 | 64°41.44'S | 60°31.97'W | 279.6 | CTD | end cast |
| 722-6 | A_North | 21/01 | 21:47 | 64°41.35'S | 60°31.81'W | 278.7 | RD | start dredg. |
| 722-6 | A_North | 21/01 | 22:02 | 64°41.24'S | 60°31.64'W | 272.4 | RD | end dredg. |
| 723-1 | A_South | 22/01 | 02:22 | 64°56.07'S | 60°38.57'W | 252.0 | MUC | at bottom |
| 723-2 | A_South | 22/01 | 02:47 | 64°56.06'S | 60°38.58'W | 252.7 | MUC | at bottom |
| 724-1 | A_South | 22/01 | 10:22 | 64°54.90'S | 60°39.15'W | 152.1 | ROV | at bottom |
| 724-1 | A_South | 22/01 | 11:49 | 64°54.52'S | 60°40.00'W | 190.8 | ROV | off bottom |
| 725-1 | A_South | 22/01 | 13:06 | 64°56.86'S | 60°34.70'W | 199.5 | ROV | at bottom |
| 725-1 | A_South | 22/01 | 14:31 | 64°57.21'S | 60°34.23'W | 216.9 | ROV | off bottom |
| 725-2 | A_South | 22/01 | 15:17 | 64°55.73'S | 60°37.23'W | 276.6 | MUC | at bottom |
| 725-3 | A_South | 22/01 | 15:40 | 64°55.63'S | 60°37.20'W | 282.6 | CTD | start cast |
| 725-3 | A_South | 22/01 | 15:49 | 64°55.67'S | 60°37.32'W | 279.6 | CTD | at depth |
| 725-3 | A_South | 22/01 | 15:58 | 64°55.66'S | 60°37.35'W | 280.2 | CTD | end cast |
| 725-4 | A_South | 22/01 | 15:59 | 64°55.67'S | 60°37.36'W | 279.6 | MG | deployed |
| 725-4 | A_South | 22/01 | 16:21 | 64°55.66'S | 60°37.19'W | 279.9 | MG | at bottom |
| 725-4 | A_South | 22/01 | 16:40 | 64°55.65'S | 60°37.13'W | 279.6 | MG | on deck |
| 725-5 | A_South | 22/01 | 16:59 | 64°55.58'S | 60°37.05'W | 282.9 | GKG | at bottom |
| 725-6 | A_South | 22/01 | 17:59 | 64°54.80'S | 60°37.46'W | 206.7 | AGT | at bottom |
| 725-6 | A_South | 22/01 | 18:17 | 64°54.80'S | 60°38.28'W | 154.5 | AGT | off bottom |
| 725-7 | A_South | 22/01 | 19:02 | 64°56.01'S | 60°38.69'W | 246.8 | MUC | at bottom |
| 725-8 | A_South | 22/01 | 19:48 | 64°56.04'S | 60°38.64'W | 253.8 | MUC | at bottom |
| 725-9 | A_South | 22/01 | 20:06 | 64°56.04'S | 60°38.93'W | 240.3 | MUC | at bottom |
| 725-10 | A_South | 22/01 | 20:49 | 64°55.89'S | 60°40.06'W | 191.7 | RD | start dredg. |
| 725-10 | A_South | 22/01 | 21:03 | 64°55.92'S | 60°40.31'W | 188.7 | RD | end dredg. |
| 726-1 | SHI | 23/01 | 15:03 | 64°30.86'S | 56°40.23'W | 196.8 | RD | start dredg. |
| 726-1 | SHI | 23/01 | 15:16 | 64°31.16'S | 56°40.51'W | 198.9 | RD | end dredg. |
| 726-2 | SHI | 23/01 | 16:47 | 64°31.79'S | 56°40.79'W | 204.9 | ROV | at bottom |
| 726-2 | SHI | 23/01 | 17:55 | 64°32.24'S | 56°40.29'W | 213.8 | ROV | off bottom |
| 726-3 | SHI | 23/01 | 19:45 | 64°37.00'S | 56°40.79'W | 306.6 | ROV | at bottom |
| 726-3 | SHI | 23/01 | 20:27 | 64°37.23'S | 56°41.27'W | 304.1 | ROV | off bottom |
| 726-4 | SHI | 23/01 | 22:09 | 64°37.83'S | 56°42.10'W | 291.5 | AGT | at bottom |
| 726-4 | SHI | 23/01 | 22:33 | 64°38.03'S | 56°42.57'W | 291.9 | AGT | off bottom |
| 726-5 | SHI | 23/01 | 23:05 | 64°38.07'S | 56°42.51'W | 295.1 | CTD | start cast |
| 726-5 | SHI | 23/01 | 23:13 | 64°38.11'S | 56°42.54'W | 295.2 | CTD | at depth |
| 726-5 | SHI | 23/01 | 23:22 | 64°38.12'S | 56°42.42'W | 292.2 | CTD | end cast |
| 727-1 | DI | 24/01 | 10:08 | 63°40.21'S | 55°56.70'W | 145.5 | ROV | at bottom |
| 727-1 | DI | 24/01 | 10:48 | 63°40.35'S | 55°57.19'W | 153.6 | ROV | off bottom |
| 728-1 | DI | 24/01 | 12:00 | 63°42.05'S | 56°02.35'W | 289.2 | ROV | at bottom |
| 728-1 | DI | 24/01 | 13:32 | 63°42.41'S | 56°01.70'W | 297.9 | ROV | off bottom |
| 728-2 | DI | 24/01 | 14:19 | 63°42.63'S | 56°01.63'W | 297.9 | AGT | at bottom |
| 728-2 | DI | 24/01 | 14:39 | 63°42.25'S | 56°02.16'W | 292.8 | AGT | off bottom |
| 728-3 | DI | 24/01 | 15:04 | 63°42.13'S | 56°02.43'W | 292.5 | CTD | start cast |
| 728-3 | DI | 24/01 | 15:13 | 63°42.13'S | 56°02.45'W | 291.3 | CTD | at depth |
| 728-3 | DI | 24/01 | 15:20 | 63°42.13'S | 56°02.51'W | 288.9 | CTD | end cast |

| Stn | area | date | time (UTC) | position lat. | position long. | depth (m) | gear | action |
|---|---|---|---|---|---|---|---|---|
| 728-4 | DI | 24/01 | 15:48 | 63°42.10'S | 56°02.88'W | 291.6 | RD | start dredg. |
| 728-4 | DI | 24/01 | 15:56 | 63°42.06'S | 56°03.06'W | 288.6 | RD | start dredg. |
| 728-4 | DI | 24/01 | 16:07 | 63°42.04'S | 56°03.56'W | 292.8 | RD | end dredg. |
| 729-1 | | 26/01 | 09:07 | 59°42.18'S | 59°10.93'W | 2073.0 | TD | deployed |
| 729-2 | | 27/01 | 22:44 | 56°00.22'S | 62°25.17'W | 4031.2 | TD | deployed |

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