The Expedition ANTARCTIC-XXIII/2

of the Research Vessel Polarstern in 2005/2006

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with contributions of the participants

ANT-XXIII/2

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Cape Town - Lazarev Sea - Punta Arenas

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1. EXPEDITION ANT-XXIII/2: FAHRTVERLAUF UND ZUSAMMENFASSUNG

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Wissenschaftliches Programm

Während der Forschungsreise ANT-XXIII/2 diente FS *Polarstern* dazu, sowohl ein umfangreiches marines Messprogramm durchzuführen als auch die Neumayer-Station und wissenschaftliche Expeditionen auf dem antarktischen Kontinent mit Personal und Material zu versorgen.

Der Hauptteil des marinen Forschungsprogramms war der vom BMBF geförderten Lazarewsee Krill Studie (LAKRIS), einem deutschen Beitrag zu SO-GLOBEC, gewidmet.

SO-GLOBEC (Southern Ocean Global Ocean Ecosystems Dynamics) ist ein internationales und multidisziplinäres Forschungsprogramm, welches darauf abzielt, Struktur und Funktionsweise des marinen Ökosystems und seine Abhängigkeiten vom physikalischen Umfeld besser verstehen, um darauf aufbauend Fähigkeiten zur Vorhersage von Reaktionen des Ökosystems auf Klimaänderungen zu entwickeln. Für den Südlichen Ozean liegt im Zentrum des Interesses dabei der Krill (*Euphausia superba*), der eine Schlüsselart im Nahrungsnetz darstellt, und dessen Reproduktion, Rekrutierung und Überlebensraten in Abhängigkeit von physikalischen und biologischen Faktoren.

Ein Großteil unserer Kenntnisse über den antarktische Krill stammt aus nur wenigen Regionen, wie beispielsweise des relativ gut untersuchten Schelfs um die Antarktische Halbinsel. Es zeichnet sich aber mehr und mehr ab, dass die Überlebensstrategien von Krill für die verschiedenen Jahreszeiten regional unterschiedlich sind. Unsere Kenntnisse darüber lassen sich also nicht unbedingt von einer Region auf andere übertragen. Das LAKRIS Projekt hat deswegen unter anderem den Zweck, bestehende internationale Messprogramme im Rahmen von SO-GLOBEC und CCAMLR (Convention for the Conservation of Antarctic Marine Living resources) auf der Westseite der Antarktischen Halbinsel, im Südantillenmeer und im Sektor südwestlichen des indischen Ozean durch Untersuchungen in der Lazarewsee zu ergänzen.

Innerhalb der großen, die Antarktis umkreisenden Stromsysteme scheint es ein erhöhtes Krill-Vorkommen in dem Sektor zu geben, dessen Westseite durch das Schelf westlich der Antarktischen Halbinsel und dessen Ostseite durch den Greenwich-Meridian bzw. die Lazarewsee markiert ist. Ob sich dieses Vorkommen aus nur einem oder verschiedenen Beständen von Krill zusammensetzt und ob ein

Austausch von Individuen mit anderen Vorkommen im Südlichen Ozean stattfindet, wird zur Zeit intensiv diskutiert. Besonders Studien an der bisher wenig untersuchten Ostseite des Vorkommens können hier sehr aufschlussreich sein.

Die Lazarewsee wird dabei als mögliches Einfallstor für Krill ins Weddellmeer vermutet. Entlang des 0°-Meridians kommt Krill von 50°S bis zum antarktischen Kontinent bei 70°S vor. Dies ist die größte meridionale Krillverbreitung rund um Antarktika. Nördlich von 60°S ist Krill dem Einfluss des ostwärts fließenden Zirkumpolarstroms ausgesetzt. Krill auf 0° Länge befindet sich somit stromab der großen Bestände im Südantillenmeer und spiegelt somit den Laicherfolg dort wieder. Südlich von 60°S, im Einflussbereich des westwärts fließenden Südastes des östlichen Weddellwirbels, gibt es nur wenig Information über laichenden Krill und das Auftreten von Larven. Wenn jedoch der Weddellwirbel die Quelle der hohen Krill-Konzentrationen im Südantillenmeer ist, sollten mit den in der Lazarewsee sich westwärts bewegenden Wassermassen größere Mengen von Krill-Larven in das System eintragen, um die großen Bestände im nordwestlichen Ausstrom aus dem Weddellmeer aufrecht zu erhalten.

Das LAKRIS-Verbundprojekt setzt sich aus 5 Teilprojekten mit folgenden Forschungsthemen zusammen:

- Saisonale und zwischenjährliche Variabilität des demographischen Aufbaus von Krill-Beständen in den hohen Breiten der Lazarewsee
- Horizontale und vertikale Verteilungen von Krill und Zooplankton
- Einflüsse von Wassermassen- Zirkulation und Meereis auf das Vorkommen von Zooplankton und Krill
- Saisonale Dynamik des physiologischen Zustandes von Krill mit besonderer Beachtung der Larven-Stadien
- Saisonale Lipid-Dynamik und energetische Anpassungen von *Euphausia superba*, insbesondere der Jugend- und Erwachsenen-Stadien

Die umfangreichen Untersuchungen von Krill wurden während ANT-XXIII/2 ergänzt durch weitere Projekte, die ihr Augenmerk auf andere Gattungen von Zooplankton wie pelagische Tunikate (Salpen), Chaetognathen (Pfeilwürmer) und Pteropoden (Flügelschnecken) richteten. Die zentrale Frage, der sich diese Projekte widmeten, war, welchen Fraßdruck diese Zooplankton-Grupppen ausübten und welchen Fluss von biogener Materie durch das Nahrungsnetz sie bewirkten. Eine weitere Studie befasste sich mit den benthischen Suspensionsfressern, welche zum Austausch zwischen Wassersäule und Meeresboden auf dem antarktischen Schelf beitragen.

Verschiedene andere während der Forschungsfahrt durchgeführte Projekte hatten keinen speziellen regionalen Bezug zur Lazarewsee. Dazu gehörten:

- Die Aufzeichnung von Sichtungen von Walen und anderen Großtieren wie Robben, Pinguinen und Seevögeln, ergänzt von umfangreichen Meereisdaten, durch Beobachter der internationalen Walfangkommission IWC (International Whaling Commission)
- Die Erprobung schiffs-basierter automatischer Überwachung von marinen Säugetieren mittels passiver Akustik und Infrarot-Optik

- Eine Studie des Auftretens und der Verteilung bathypelagischen Planktons, insbesondere pelagischer Arten der Mysiden und Polychaeten, als Beitrag zum Biodiversitäts-Zensus CeDAMar (Census of the BioDiversity of the Abyssal Marine Life)
- Eine Untersuchung der Adaptationsfähigkeiten und der Ökologie antarktischer Bodenfische
- Das Absetzen einer Unterwasser-Messstation (MABEL genannt) auf dem Meeresboden

Fahrtverlauf

Der Fahrtabschnitt begann mit dem Auslaufen von FS *Polarstern* von Kapstadt in Südafrika um 1 Uhr morgens am 20. November 2005. Um die Neumayer-Station und Expeditionen auf dem antarktischen Kontinent so früh wie möglich während der Südsommer-Saison zu versorgen, nahm FS *Polarstern* fast direkten Kurs auf Neumayer. Nur solche Forschungsarbeiten, die an Positionen entlang der ersten Strecke nach Süden lagen und wenig Zeit beanspruchten, wurden noch vor Erreichen der antarktischen Küste durchgeführt.

Die marine Akustikgruppe brachte ihren Streamer zur Aufzeichnung von Unterwasserlauten von Meeressäugern bereits wenige Stunden nach dem Auslaufen von Kapstadt aus. Der Streamer umfasste fünfzehn Hydrophone, die, integriert in ein 600 m langes Kabel, hinter dem Schiff her geschleppt wurden. Das andere System zur Erfassung mariner Säugetiere war, basierend auf zwei Infrarot-Kameras, auf dem Krähennest des Schiffes montiert und ermöglichte, im näheren Umfeld des Schiffes die Wärmeausstrahlung von Walblas zu erfassen. Der Hydrophon-Streamer wurde beim Erreichen der nördlichsten Front des Antarktischen Zirkumpolarstroms (ACC) eingeholt, um stattdessen einen kontinuierlichen Plankton-Rekorder (Continuous Plankton Recorder, CPR) auszusetzen, der mit normaler Schiffsgeschwindigkeit geschleppt oberflächennah Plankton-Proben sammelt. Der Einsatz des CPR erfolgte als Beitrag zu multinationalen Unterfangen mit dem Ziel, eine Datenbasis zu schaffen, die zirkumpolar die biographische Zonierung des ACC dokumentiert.

Auf dem Weg von Kapstadt nach Neumayer wurde die Fahrt bei der Bouvet-Insel wie geplant unterbrochen, um mit beköderten Fischfallen und dem Agassiz-Grundschleppnetz subantarktische Aalmuttern (Zoarcide) und Notothenioide zu fangen. Die gefangenen Fische wurden für Untersuchungen der Adaptationsfähigkeiten und Ökologie kalt-stenothermaler Teleostei verwandt. Dieses Projekt wurde nach der Versorgung der Neumayer-Station durch Anwendung der gleichen Methoden in den hochantarktischen Gewässern der Atka-Bucht fortgesetzt. Lebende Exemplare benthischer Organismen wie Schwämme und Seescheiden aus dem Beifang des Agassiz-Grundschleppnetzes wurden in Fütterungsexperimenten in den Aquarien an Bord benutzt, um mehr über die Nahrung dieser Suspensionfresser zu erfahren und um abschätzen zu können, welchen Einfluss sie haben auf mikrobielle Stoffumsetzungen und Wassereigenschaften in der Bodengrenzschicht. Noch zwei weitere Mal wurde die Fahrt nach Neumayer unterbrochen: In Nähe der subantarktischen Front und in Nähe der antarktischen Polarfront, und zwar um mittels des tief geschleppten RMT (Rectangular Midwater Trawl) bathypelagisches Plankton zu fangen. Die Probennahme für dieses Projekt wurde im weiteren Verlauf der Fahrt mit tiefen RMT-Schleppzügen in der Lazarewsee und vor der Neumayer-Station fortgesetzt. Beeinträchtigt wurden unsere Messungen auf dem Weg zur Neumayer-Station durch drei Stürme, die unseren Fahrtroute über den ACC querten.

Eine kurze Phase guten Wetters nutzend wurde die Neumayer-Station zwischen dem 2. und 3. Dezember 2005 pünktlich und zügig versorgt. Dabei wurden insgesamt 30 Container, 200.000 Liter Treibstoff, zwei Kettenfahrzeuge und eine große Menge anderen Geräts entladen. 10 Container wurden an Bord umgestaut und ein Container mit Rückfracht von der Station wurde geladen. Sieben Wissenschaftler verließen das Schiff bei Neumayer, um Arbeiten im Umfeld der Station oder im Zusammenhang mit Expeditionen auf dem Kontinent durchzuführen.

Nach Ablaufen von der Neumayer-Station wurde zunächst das italienische Observatorium namens MABEL auf dem Meeresboden abgesetzt. MABEL ist dafür geschaffen, mehrjährige multidisziplinäre Daten-Zeitreihen zu sammeln. Als nächstes und ebenfalls noch vor Beginn des Messprogramms für LAKRIS, wurden physikalischen Kalibrationsmessungen für das Zooplankton-Echolot (Simrad EK60) im Kiel von FS *Polarstern* durchgeführt.

Das aus 85 hydrographischen Stationen bestehende Messgitter für die Lazarewsee Krill-Studie LAKRIS wurde im Zeitraum 6. Dezember 2005 - 2. Januar 2006 komplett abgearbeitet. An jeder Station wurde die CTD-Sonde zur Aufzeichnung vertikaler Temperatur-, Salinitäts- und Dichtprofile eingesetzt. Ebenfalls an jeder Station kam - bis auf zwei Ausnahmen wegen schlechten Wetters - ein Standard-RMT-Schleppnetz zum Einsatz. An nahezu jeder zweiten Station wurde das Multinetz eingesetzt und an - im Schnitt - jeder dritten Station wurde das RMT ein zusätzlichen zweites Mal geschleppt, um lebende Organismen für Laborversuche zu fangen. Gelegentlich wurden noch weitere Netze wie das sogenannte WP2 und das Bongo gefahren. Durch den Einsatz der verschiedenen Netze gelang es, eine genügende Anzahl von lebenden Tieren für Experimente in Aquarien an Bord zu fangen. Allerdings mussten wegen der insgesamt knapp bemessenen Schiffszeit für den Fahrabschnitt Abstriche an vielen Stationen Abstriche gemacht werden hinsichtlich der Tiefe, bis zu der die CTD-Sonde gefiert wurde. An drei Stationen wurden ozeanographischen Verankerungen erfolgreich geborgen und nach Auslesen der gemessenen Daten und Batterie-Wechseln bei den Messinstrumenten wieder ausgelegt.

Zusätzlich wurden außerhalb der nationalen Hoheitsgebiete und Wirtschaftszonen quasi-kontinuierlich Messdaten mit dem Thermosalinograph, dem akustischen Doppler-Strömungsprofiler (ADCP) und dem Zooplankton-Echolot im Schiffskiel aufgezeichnet. Und immer wenn das Schiff bei Tageslicht fuhr, wurden durch Beobachter, die von der internationalen Walfangkommission (IWC) gesandt waren, Sichtungen von Walen und anderen Warmblütern wie Robben, Pinguinen und Seevögeln notiert. Die Beobachter vom IWC registrierten außerdem eine Reihe von Parametern zur Beschreibung der Meereisverhältnisse.

Das umfangreiche und vielfältige Expeditionsprogramm konnte fast vollständig erledigt werden. Zum insgesamt großen Erfolg des Fahrtabschnittes hat Vielerlei beigetragen: Die Einsatzfreude und die zupackende Art der gesamten Mannschaft, eine gute logistische Vorbereitung, verlässliche Wettervorhersagen, eine vertrauensvolle Zusammenarbeit von Schiffsführung und Fahrtleitung und nicht zuletzt der Enthusiasmus der Wissenschaftler, der selbst lange Phasen harter Arbeit überdauerte. Die Reise endete pünktlich am 12. Januar 2006 um 8 Uhr morgens in Punta Arenas, Chile.

Zusammenfassung

Nach unserem ersten Eindruck haben wir auf dieser Reise einen Datensatz gewonnen, aus dem wir viele neue oder erweiterte Erkenntnisse ziehen können: Erkenntnisse hinsichtlich des Entstehens der eisfreien Wasseroberfläche über der Maud-Kuppe, hinsichtlich des Einstroms von Wärme in das Weddellmeer, hinsichtlich des Transportes von Zooplankton und hinsichtlich des Lebenszyklus' von Krill. Hinsichtlich der Dominanz von Arten in der Zooplankton-Gesellschaft zeichnet sich ein ganz neues Bild ab. Die Lehrmeinung, dass – abhängig von Eisbedeckung und Wassertemperatur - entweder die Krillart *Euphausia superba* oder aus der Gruppe der Salpen die Art *Salpa thompsoni* vorherrscht, lässt sich nach unseren vorläufigen Ergebnissen nicht bestätigen. Auf Seiten der Garnelenartigen war es nicht *Euphausia superba* sondern eine andere Krillart, die am häufigsten vorkam, und Salpen traten so gut wir gar nicht auf. Stattdessen fanden wir relativ viel gelatinöses Zooplankton wie Quallen und Rippenquallen sowie Staatsquallen und Krebsartige wie Flohkrebse und Ruderfußkrebse als auch Flügelschnecken und Pfeilwürmer – insgesamt eine große Artenvielfalt. Dass Salpen kaum auftraten, kann zum einen im Zusammenhang mit zwischenjährlichen Änderungen biologischen Ursprungs stehen, zum anderen aber auch daran liegen, dass sich diese Tierart jetzt im antarktischen Frühsommer noch nicht maximal vermehrt hatte. Sowohl die Möglichkeit zwischenjährlicher als auch die Möglichkeit jahreszeitlicher Veränderung bedingt, dass ein zu einem bestimmten Zeitpunkt festgestelltes starkes oder vernachlässigbares Auftreten einer Art nicht sogleich als Indiz von Klimawandel interpretiert werden kann. Jahreszeitlich Veränderungen zu dokumentieren, ist ein wesentliches Anliegen unserer Lazarewsee-Krill-Studie LAKRIS, in deren Rahmen mehrere Reisen zu verschiedenen Jahreszeiten im gleichen Seegebiet durchgeführt werden. Dass auch ein Klimawandel Veränderungen im Artengefüge nach sich ziehen kann und auch wird, bleibt jedoch unbestritten. Welche aber genau, wird sich erst präzisieren lassen, wenn wir unseren neu gewonnen Datensatz vor dem Hintergrund schon existierender Daten analysiert haben.

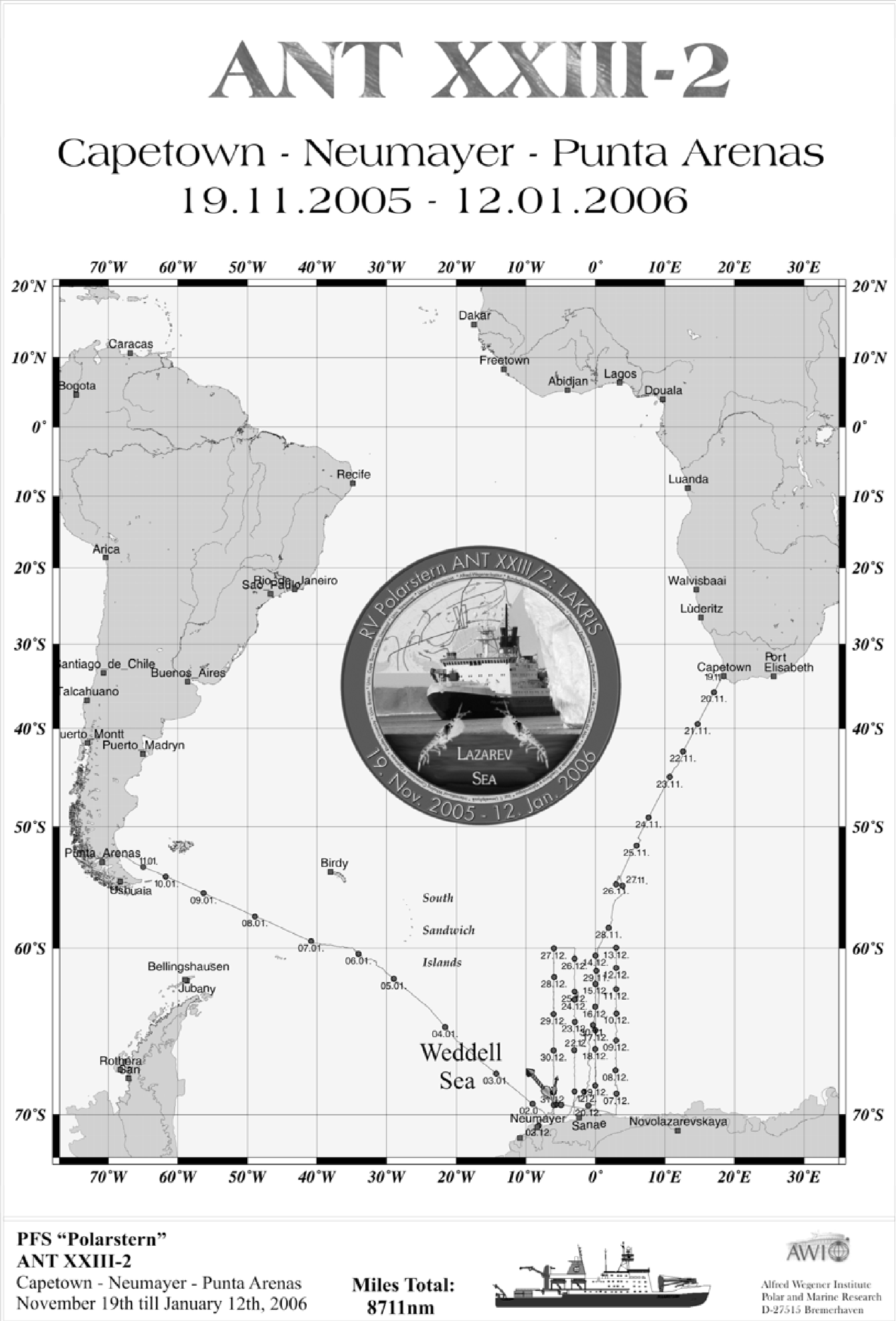


Abb. 1: Fahrtroute der FS Polarstern während der Expedition ANT-XXIII/2
Fig. 1: Track of RV Polarstern during the expedition ANT-XXIII/2

CRUISE NARRATIVE AND SUMMARY

Scientific Programme
During cruise ANT-XXIII/2 RV *Polarstern* served to support an extensive marine research programme as well as to supply the Neumayer base and scientific expeditions on the Antarctic continent with personnel and material.

The major marine research programme of this cruise was devoted to the BMBF (German Ministry for Education and Research)-funded Lazarev Sea Krill Study (LAKRIS), which constitutes a contribution to SO-GLOBEC.

The Southern Ocean Global Ocean Ecosystems Dynamics (SO-GLOBEC) programme is an international, multidisciplinary effort to advance the understanding of the structure and the functioning of the ocean ecosystem and its response to physical forcing, so that a capability can be developed to forecast the response of the ecosystem to climate change. In the Southern Ocean, the focus is on understanding the physical and biological factors that influence the growth, reproduction, recruitment and survival of Antarctic krill (Euphausia superba), a key species in the food web.

Much of the knowledge of Antarctic krill comes from a few regions, such as the much-studied Antarctic Peninsula shelf. But it is becoming increasingly clear that the seasonal survival mechanisms of krill are variable, so neither the local environment, nor the response of krill to it, can be extrapolated easily to a wider area. The LAKRIS project will complement the existing international research activities within SO-GLOBEC and CCAMLR (Convention for the Conservation of Antarctic Marine Living resources) along the west Antarctic Peninsula, in the Scotia Sea and in the Southwest Indian Ocean Sector by investigations in the Lazarev Sea.

Within the great current systems encircling Antarctica, there is a hotspot of krill density within a sector defined roughly by the west of the Antarctic Peninsula and the Greenwich Meridian (i.e. the Lazarev Sea). Whether this hotspot itself contains one or several “stocks” of krill and whether these are connected with those in the rest of the Southern Ocean are currently topics of intense debate. Understanding krill survival at the seldom-studied eastern extremity of this hotspot may provide some clues in this puzzle.

The Lazarev Sea has been suggested to be the gateway through which the krill population enters the Weddell Gyre. At the 0° meridian krill distribution ranges from approximately 50°S to the Antarctic continent at 70°S - the widest latitudinal range throughout their entire circumpolar distribution. North of 60°S, krill are under the influence of the eastward-flowing Antarctic Circumpolar Current. They are thus downstream of the extensive Scotia Sea populations and reflect spawning success there. But south of 60°S, within the westwards flowing counter currents of the

Lazarev Sea, there is little information on krill spawning and larval occurrence. If, however, the Weddell gyre is the source of high krill densities in the Scotia Sea, then the westward moving water masses of the Lazarev Sea should seed substantial amounts of krill larvae into the system to sustain the large population observed at the northern outflow of the Weddell Gyre.

The LAKRIS-project is divided in 5 subprojects with the following topics:

- Seasonal and interannual variability in krill demography of high latitude krill stocks in the Lazarev Sea
- Horizontal and vertical distribution of krill and zooplankton
- Effects of water mass circulation and sea ice on the abundance of zooplankton
- Seasonal dynamics of physiological conditions of krill with emphasis on the larvae stages
- Seasonal lipid dynamics and energetic adaptations of Euphausia superba, with emphasis on juvenile and adult stages

The extensive study of krill during cruise ANT-XXIII/2 was complemented by further projects, which focussed on other zooplankton genera such as pelagic tunicates (salps), chaetognaths (arrow worms) and pteropods (flapping snails). The central question addressed by these projects is the grazing impact exerted and the flow of biogenic matter through the food chain and water column accomplished by those groups of zooplankton. A further study was dedicated to the various benthic suspension feeders, which contribute to the pelago-benthic coupling on the Antarctic shelf.

Several other research projects conducted during the cruise but had no regional focus on the Lazarev Sea. Such projects were:

- Cetacean sightings and records of other wildlife such as seals, penguins and seabirds, complemented by a suite of sea ice data, by observers from the International Whaling Commission (IWC)
- A marine mammal automated surveillance, aimed at establishing ship-based detection methods based on passive acoustics and infrared optics
- A study of the occurrence and distribution of bathypelagic plankton, in particular pelagic species of Mysidacea and Polychaeta, aimed at contributing to the Census of the BioDiversity of the Abyssal Marine Life (CeDAMar)
- A study of the adaptive competence and ecology of Antarctic bottom fish
- The deployment of a seafloor observatory named MABEL

Itinerary

The cruise started with RV *Polarstern* sailing from Cape Town, South Africa, at 1 a.m. on 20 November, 2005. In order to supply the Neumayer base and continental expeditions as early as possible in the Antarctic summer season, we headed almost straight towards Neumayer base after departure from Cape Town. Only such marine research that was planned at locations, which lay en route the initial way south, was conducted before reaching the Antarctic continent.

The marine acoustics group deployed their streamer for detecting mammal sound underwater just a few hours after departure from Cape Town. The streamer contained fifteen hydrophones integrated into a 600 m long cable towed behind the ship. The other system used for automated surveillance of marine mammals was based on two infrared cameras, which were mounted at the crow's nest to monitor the regions next to the ship for infrared signatures of whale spouts. When reaching the northernmost front of the Antarctic Circumpolar Current (ACC) the hydrophone streamer was retrieved for the sake of deploying the so-called Continuous Plankton Recorder (CPR), which allows to sample near-surface zooplankton while the ship cruises at normal speed. The CPR data will be used in an international effort to build a circumpolar data base for studies of the biogeographic zonation of the ACC.

En route the way from Cape Town to Neumayer we stopped, as planned, at Bouvet Island, where we deployed baited bottom traps and Agassiz trawls to catch sub-Antarctic eelpouts (zoarcids) and Notothenioidei. The so-caught fish are used in a study of the adaptive competence and ecology of cold-stenothermal Teleostei. The project was continued after servicing Neumayer with the same methods in the high Antarctic waters of the Atka Bay. Specimens of living benthic organisms such as sponges or ascidians, which were taken with the Agassiz trawls as bycatch, were incubated in feeding experiments aboard to study the diet of these suspension feeders and to elucidate the impact they have on the microbial loop and the water characteristics of the bottom layers. Two other stops were made in the vicinity of the sub-Antarctic as well as Antarctic frontal systems for deep-sea deployments of the RMT (Rectangular Midwater Trawl) to catch bathypelagic plankton. Sampling for this project was continued later during the cruise with net hols in the Lazarev Sea and off Neumayer Station. Three gales that passed the course of RV *Polarstern* while crossing the ACC interfered with our measurements en route to Neumayer.

Using a short period of calm weather, the Neumayer base was supplied punctually and efficiently from the 2nd to the 3rd of December, 2005. In total 30 containers, 200 000 litres of fuel, two tracked vehicles and much other equipment was unloaded. 10 containers were repositioned on board and one container of returned freight from the Station was loaded. Seven of the scientists disembarked to conduct research work associated with the Base.

After leaving the Neumayer base the Italian seafloor observatory named MABEL, which is designed for multidisciplinary, long-term missions in the polar environment, was successfully deployed. Next, and before starting with station work for the LAKRIS study, the zooplankton echosounder (Simrad EK60) of RV *Polarstern* was physically calibrated.

The grid of 85 stations for the Lazarev Sea Krill Study LAKRIS was completely worked during the period 6 December 2005 - 2 January 2006. At each station the CTD and, with two exceptions due to bad weather, the standard RMT were deployed. At almost every other station the Multinet was used and at every third station a second RMT trawl was made to catch living organisms. Occasionally further nets such as the so-called WP2 and the Bongo were deployed in addition. A sufficient number of creatures was caught alive in the various nets to successfully conduct many different experiments on board. However, because of overall constraints of ship time assigned for the cruise, the depth to which the CTD was lowered had to be restricted at many stations. At three of the grid stations oceanographic moorings were successfully recovered and re-deployed.

When outside of national exclusive zones, quasi-continuous measurements were made with the thermosalinograph, the acoustic Doppler current profiler (ADCP) and the zooplankton echosounder mounted in the keel of the ship. And while the ship was steaming, cetacean sightings and records of other wildlife such as seals, penguins and seabirds were contributed by observers sent by the International Whaling Commission (IWC). The IWC observers also recorded a suite of sea ice data.

The comprehensive and multifarious expedition programme was thus almost completely fulfilled: The overall great success of the cruise is due to many contributions, such as the enthusiasm and energy of the whole crew, a good logistic preparation, reliable weather forecasts, a honest cooperation between the ship's command and the scientific lead, and last but not least the good mood of the scientific party maintained even during periods of continued hard work. The cruise ended on schedule the 12 of January, 2006, at 8 a.m. in Punta Arenas, Chile.

Summary
The first impression of the data we have collected this cruise is that they will lead to new or deepened understanding of many processes: regarding the origin of the ice-free water over Maud Rise, regarding the heat transport into the Weddell Sea, regarding the transport of zooplankton and regarding the life-cycle of krill. Regarding the dominance of species in the zooplankton community there are signs of a new picture. The textbook view that – depending on ice cover and water temperature – either the krill species *Euphausia superba* or from the salps the species *Salpa thompsoni* dominates, cannot be confirmed from our preliminary results. Amongst the crustaceans it was not *Euphausia superba* but another krill species, which was dominant, and salps were hardly present at all. Instead we found large numbers of gelatinous zooplankton such as jellyfish, ctenophores, as well as siphonophores, and crustaceans such as amphipods and copepods as well as pteropods and arrow worms – in all a considerable biodiversity. That salps were hardly present could be due to the interannual variability of biological processes, or that these creatures had not yet reproduced to reach their maximum numbers this early in the Antarctic summer. Both the possibilities of interannual and of seasonal variability mean that the plentiful or scarce occurrence of a species cannot be interpreted immediately as a sign of climate change. Documenting the seasonal variability is a core aim of our Lazarev Sea Krill Study Programme, within which several cruises in the same sea area at different seasons will be carried out. That climate change could also lead to a change in the species composition of the zooplankton community remains nevertheless a possibility. Whether this is true or not will only become apparent when we have been able to analyse our newly acquired dataset and compare it to the background of datasets already in existence.

2. WEATHER CONDITIONS

Andreas Kresling
DWD Deutscher Wetterdienst

After departure from Cape Town RV *Polarstern* crossed soon the axis of the zonally orientated subtropical high. Already just before reaching 40°S the famous “roaring forties” were entered. Before the sea ice limit at 58°S was reached three gale centres crossed the course of RV *Polarstern*. The first one one came from west on 21 November along 50°S. The second one, coming from northwest, started in subtropical regions. It affected RV *Polarstern* during the night from 22 to 23 November with westerly gales Bft 9 und waves up to 8 m. Again the third one was a severe gale centre, in its centre a pressure of 952 hPa was sustained. It crossed the route of RV *Polarstern* near Bouvet-Island. The winds reached Bft 10. After leaving the shelter of the island wind sea and swell of 8 m affected the ship.

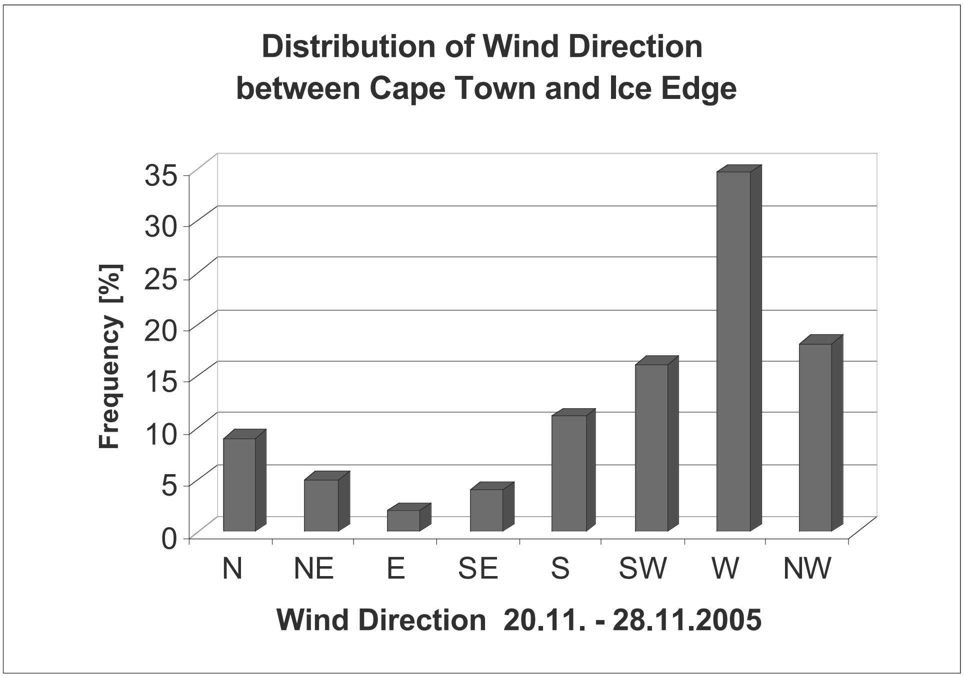
The distribution of wind direction and of wind force between Cape Town and the ice edge at 58 deg South are illustrated in the figure (see figure 2.1). Winds from southwest to northwest prevailed. Wind force 5 Bft and more was dominant.

The weather conditions on the route to Neumayer Station across drift sea ice was relatively calm. Mainly a weak high pressure ridge or a small high determined wind and weather. Sometimes it was absolutely calm. In the “ice port” (Atka-Bight) on 2 and 3 December the conditions of wind and weather were favourable, the wind did not exceed Bft 5, neither snow drift, blowing snow nor white-out have been observed.

The weather conditions during the four transects in the LAKRIS-area were relatively calm too. The frontal zone was situated mainly north of about 60 - 62°S. Therefore RV *Polarstern* was on the southern side of lows and gale centres, passing to east. For several days a weak high pressure zone or a small high caused only light winds. The only gale hit RV *Polarstern* on the 8 and 9 December during transect 1 at the front side of a storm centre in the Weddell Sea, which became stationary and then weakened slowly. At Neumayer Station that storm centre caused easterly winds up to Bft 10 - 11 with heavy blowing snow conditions from 8 to 13 December. From the mentioned storm centre outgoing secondary lows reached RV *Polarstern* from time to time. Although the sea ice was, outgoing from the Maud Rise (centered at near 65°S, 03°E), considerably reduced, no higher wind sea was generated in the huge polynya. But in transect 4 (60 – 70°S, 6°W) open ocean conditions in the former sea ice covered area caused higher wind sea in the begin of the new year, as the wind reached Bft 6 - 7 from southeast.

The distribution of wind direction and of wind force from Neumayer Station until the end of LAKRIS are illustrated in the figure 2.2. Winds from north to east and wind force 5 Bft and less were dominant.

On the way back to Punta Arenas RV *Polarstern* encountered packed multi year sea ice ridges at the northern ice edge until about 59.5°S, 40°W. Thereafter a gale centre with high swell up to 5 m was passed. In the Magellan Strait approaching Punta Arenas near gale force winds with severe gusts were forecast.



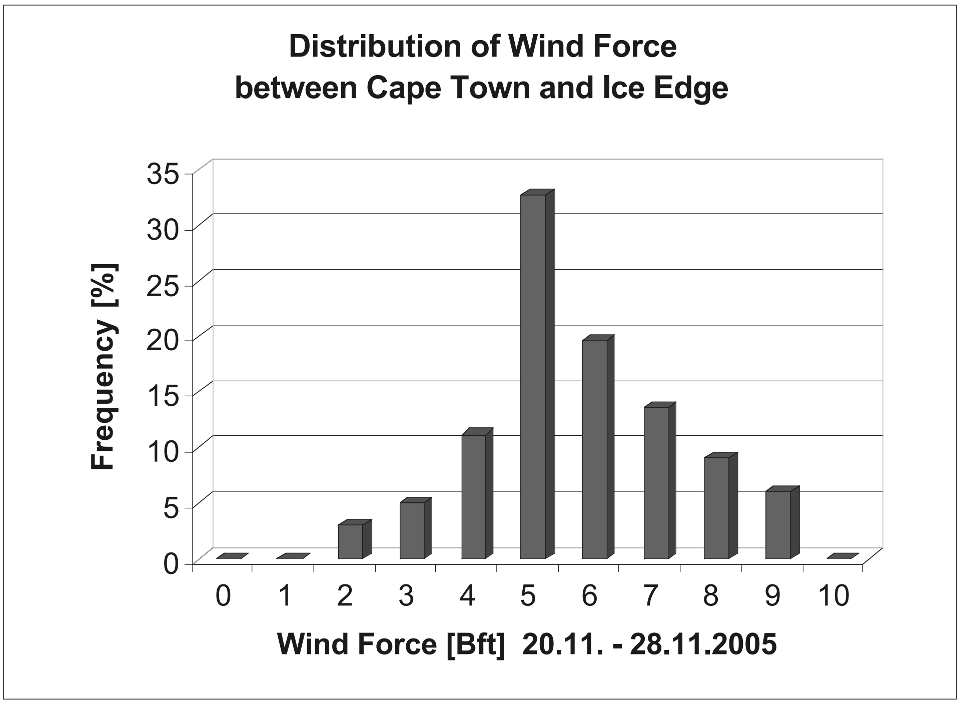
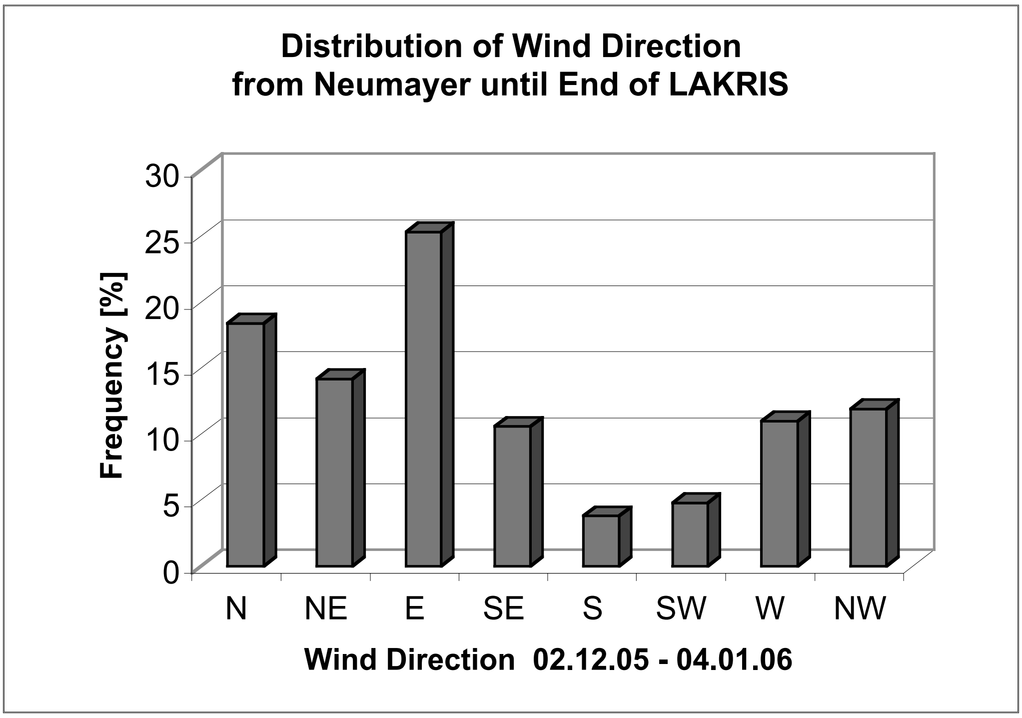


Fig. 2.1: Wind between Cape Town and the ice edge



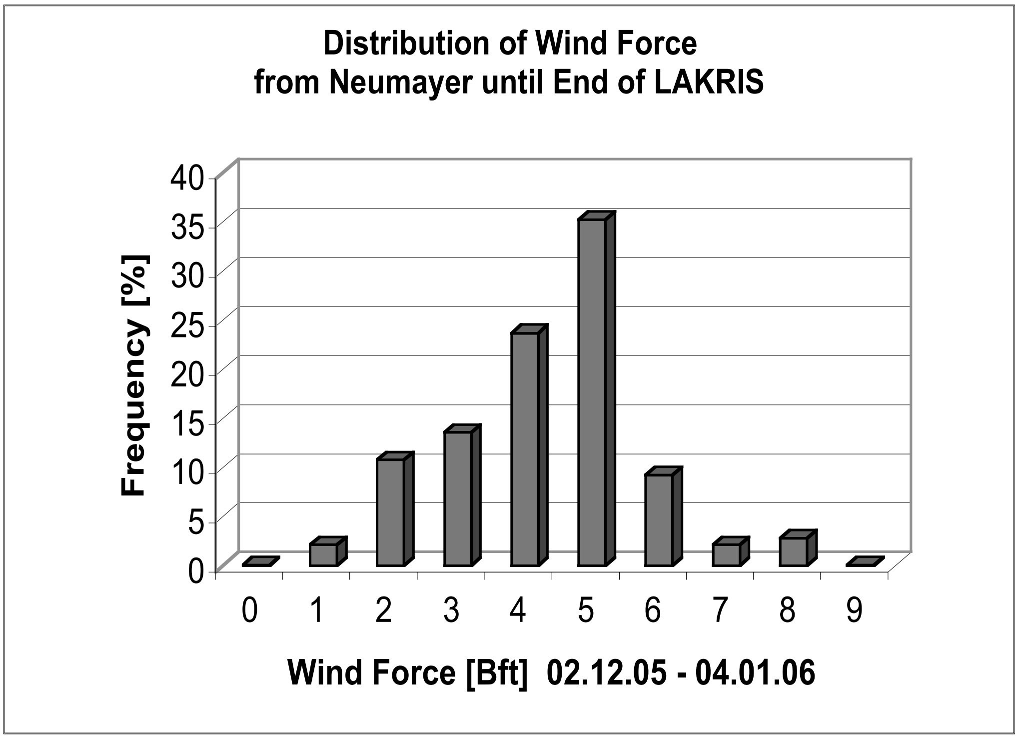


Fig. 2.2: Wind from Neumayer *until End of LAKRIS*

3. SEASONAL AND INTERANNUAL VARIABILITY IN KRILL DEMOGRAPHY OF HIGH LATITUDE KRILL STOCKS IN THE LAZAREV SEA - LAKRIS SUBPROJECT 1

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Objectives

Investigations on Antarctic krill have a long history starting with the early 'Discovery' studies in the 1920/30ies. These historic studies concentrated on krill distribution and basic biology. Although these studies covered most of the Antarctic Ocean, the circum-polar data were collected over a time period of many years and research effort was not spread evenly across the Southern Ocean. Especially regions with heavy sea-ice conditions were less adequately sampled. Recent studies concentrate more on quantitative aspects of krill stock abundance, with the aim to develop a proper management of this living resource. Research effort concentrated in the Southwest Atlantic (Antarctic Peninsula and South Georgia) and Prydz Bay area in the Indian Ocean, probably because areas like the Lazarev Sea are remote and sea-ice conditions make access difficult during most times of the year. However, the Lazarev Sea is thought to be the doorway to the Weddell Sea and possibly the entrance of the krill population into the Weddell Gyre. Despite the collection of some krill data in the Lazarev Sea by the 'Discovery' research, this region of the Southeast Atlantic was hardly ever studied in great detail. Few results of more recent research (1980ies to 90ies) indicated variable conditions for the krill and salp population. A first standardized survey had been carried out in this area as a pilot study to the LAKRIS Project in autumn 2004.

The South Atlantic sector of the Antarctic – especially the Antarctic Peninsula region - is not only known as the area where krill is most abundant, it is also thought to represent the most productive spawning area of the circum-Antarctic krill populations. These ideas have been developed since the early 'Discovery' expeditions, which show the Scotia Sea as a seasonally important area for the occurrence of krill larvae. This idea was in principle confirmed during the international FIBEX expedition in 1982 and the CCAMLR Survey 2000. These surveys showed a large amount of krill larvae in the western part of the Atlantic sector.

On the other hand, a limited number of data from the Discovery expeditions indicate that these larval concentrations move further to the east with the progressing season. In autumn to early winter krill furcilia larvae had spread at latitudes from 50 to 60°S as far as 20°E. Around the 0-degree meridian in the Southeast Atlantic krill distribution ranges from approximately 50°S to the Antarctic continent at 70°S, which is the widest latitudinal coverage in the species circum-Antarctic distribution. The northern part north of 60°S is under the influence of the eastward flowing "northern branch of the Weddell Gyre" and is therefore downstream of the Scotia Sea krill population and reflecting spawning success there. However, little information on krill spawning and larval occurrence is available from the southern part of this broad latitudinal krill habitat, i.e. the Lazarev Sea. Few records were given on reproductive females or larvae in the Discovery Reports, probably because of the difficult access to this high latitude area, which also shows the widest extent of seasonal pack-ice around Antarctica. If, however, the Weddell Gyre is the source of high krill densities in the Scotia Sea, then the westward moving water masses of the Lazarev Sea should seed substantial amounts of krill larvae into the system to sustain the large population observed at the northern outflow of the Weddell Gyre.

The description of krill demographic parameters and the investigation of population dynamics of the stock were the major focus of the krill net sampling programme to the Lazarev Sea in early summer 2005. In order to answer basic questions on krill demography and population dynamics, regular surveys are essential to develop a meaningful monitoring programme and finally a proper management strategy of the krill stocks. There are two primary objectives for the RMT net sampling programme:

- to validate and identify acoustic targets, confirming which targets can be considered as krill and obtaining krill length-frequency data for target strength estimation,
- to describe krill demography and large scale distribution patterns of size groups and maturity stages.

LAKRIS addresses several of the questions that have to be answered:

1. How do timing and intensity of spawning events relate to successful reproduction of krill?
2. Which key factors trigger krill larval survival and subsequently recruitment ?
3. Can we detect significant inter-annual variation in reproductive and recruitment success ?
4. Is krill recruitment success or failure related to stock size or density ?
5. Are there geographical variations in krill distribution patterns, density or growth and mortality rates ?
6. Are there long-term trends or cycles in stock biomass?

These questions are of complex nature and require a large amount of data collected in a standardised way to allow direct comparisons between data sets.

Work at sea

Material and Methods

The LAKRIS survey was carried out during the period 6 December 2005 to 1 January 2006. Standard net tows were carried out each 30 nautical miles along four north-south transects (see chart Fig. 3.1). These transect were located at 6°S, 3°W, 0° and 3°E between 60°S and the Antarctic Continent at approximately 70°S. During this cruise the survey grid was modified from the grid covered during the 2004 season to include the Maud Rise area in the east and to have a more complete coverage of the northern area between 60° and 62° S where relatively high krill concentration seemed to occur in 2004.

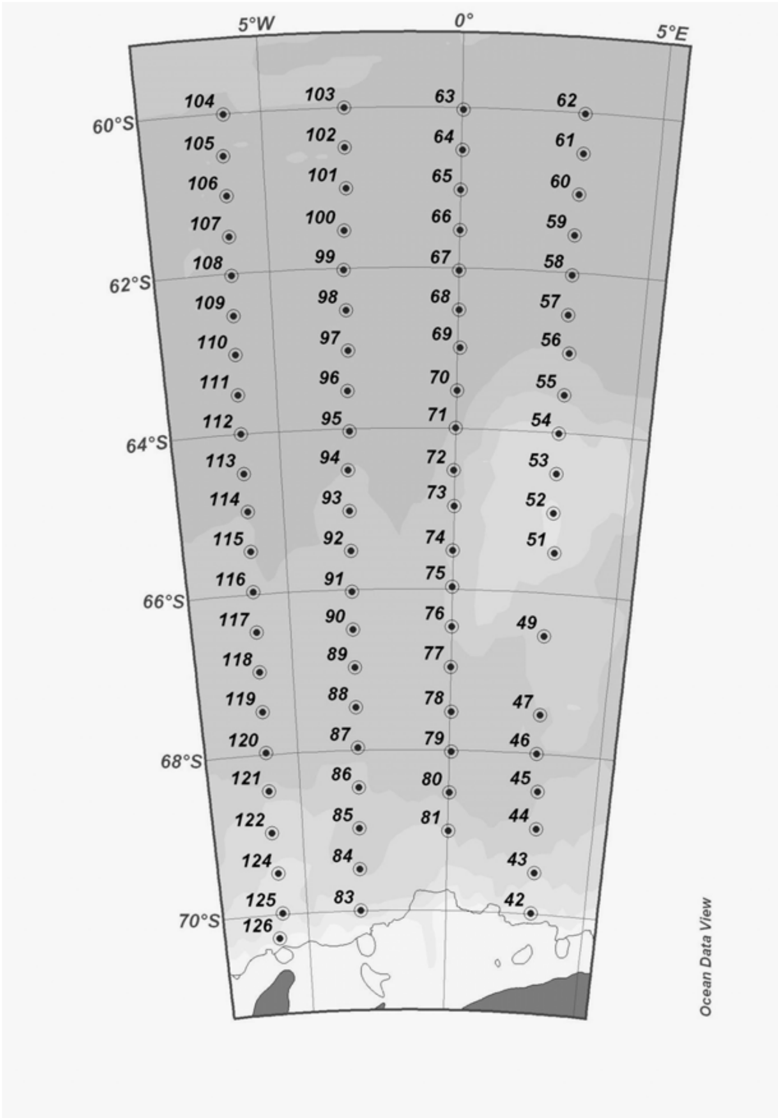

Fig. 3.1: RMT station grid in the Lazarev Sea carried out in December 2004 including bathymetric depth contours. A deep and narrow continental shelf and an extensive deep-sea ocean basin characterize the area.

Experience gained through participation in other international programmes like BIOMASS has shown that standardization of equipment and methods is one of the most crucial steps for any successful work during the field sampling period and later analytical work. The following net sampling protocols set out the procedures so that carrying out the Lazarev Krill Survey 2005 we could collect comparable high quality data sets that will facilitate comparisons with the 2004 of the LAKRIS pilot study and other long-term databases from the Antarctic Peninsula. The CCAMLR (Convention on the Conservation of Antarctic Marine Living Resources) Working Group recommended the use of a standard type of net to avoid potential variation in catchability and selectivity of nets during krill centred survey activities. The most appropriate type of net presently available is the RMT8+1 (Rectangular Midwater Trawl), with a mesh size of 4.5 mm. This net was used as the standard net for target and random hauls in the Lazarev Sea survey. At each station a quantitative standard double oblique tow was conducted from the surface down to 200 m. Such a depth range is considered to be the best compromise between the time available for sampling and the likely vertical depth range of krill. During the hauls ship's speed was maintained at 2.5 ± 0.5 knots. A constant winch speed of 0.5 m/sec was maintained during paying out and 0.3 m/sec during hauling. The net mouth angle is 8 m^2 and remarkably constant during hauling within the speed ranges given above.

A total of 81 RMT stations were carried out during the cruise. A double oblique net tow was carried out routinely at all stations, except for two stations where net hauls were cancelled due to bad weather conditions and one station due to very heavy sea ice conditions. The total time of the net haul from surface to bottom to surface was approximately 40 minutes. The use of a real-time time-depth-recorder (TDR) is essential to maintain a smooth net trajectory and control the track of the net and the maximum fishing depth. Calibrated flowmeters were used to give a measure of net speed during the haul as well as the total distance travelled. The flowmeter was mounted outside the net opening to avoid clogging which may reduce the efficiency. The dependence of mouth angle to the vertical of net speed has been investigated for the RMT system. The average filtered water volume of a standard net tow was approximately 25,000 m^3 (see station list Table 3.1).

Immediately after the tow the volume of the gelatinous fraction of the sample was measured. Samples were sorted for Antarctic krill and other euphausiid species as well as salp species. These data were collected quantitatively from the RMT 8. However, if the sample size was larger than one litre then a representative subsample was analysed. Krill and other euphausiids were stored in 4 % formalin-seawater solution for later length measurements and maturity stage analyses.

Krill was caught at 71 stations and these yielded a total number of 9,792 krill. Of these a representative sample of 2,250 krill was measured a staged. Length measurements were taken from representative sub-samples with a minimum of 150 specimens. Length measurements and detailed maturity stages were identified from 6,974 krill specimens. We used the Discovery method for *E. superba*, i.e. total length from the anterior margin of the eye to the tip of the telson (Mauchline, 1980a). The standard unit is given in mm below, with an accuracy of 1 mm size classes. All measurements were done by one person to remove observer variation. Additional information were collected for sex and maturity stages of euphausiids according to the classification established by Makarov and Denys (1981). These measurements served the interpretation of the success of the current reproductive season and the status of the spawning stock, but as well give us some indication on the survival rate of recruits in the population spawned in the previous year.

Tab. 3.1: RTM Station list

Station	Date	Latitude ddmmss	Longitude dddmmss	Bottom Depth (m)	filt Vol m^3 RMT 8	filt Vol m^3 RMT 1
42	20051206	695924S	0030530E	906	20439	1277
43	20051207	692906S	0030548E	2117	19858	1241
44	20051207	685618S	0030330E	2400	19227	1202
45	20051207	682824S	0030142E	4068	24499	1531
46	20051208	680012S	0025424E	4558	19599	1225
47	20051208	673118S	0025524E	4561	26577	1661
49	20051209	663218S	0025254E	3740	23304	1457
51	20051209	652954S	0030136E	2600	30231	1889
52	20051210	650024S	0025512E	2413	23195	1450
53	20051210	643054S	0025548E	2142	31231	1952
54	20051210	640048S	0025512E	2200	27593	1725
55	20051210	633154S	0025936E	4669	35384	2212
56	20051211	630024S	0030324E	5371	27955	1747
57	20051211	623148S	0025724E	5200	23377	1461
58	20051211	620154S	0025942E	5200	27968	1748
59	20051212	613212S	0025936E	5384	24299	1519
60	20051212	610142S	0030148E	5396	26358	1647
61	20051212	603054S	0030454E	5390	24233	1515
62	20051213	600100S	0030318E	5374	30180	1886
63	20051214	600148S	0000154E	5358	24840	1553
64	20051214	603201S	0000212E	5371	20869	1304
65	20051214	610136S	0000000E	5386	32723	2045
66	20051214	613148S	0000036E	5388	28063	1754
67	20051215	620203S	0000012E	5373	29676	1855
68	20051215	623136S	0000118E	5349	23475	1467
69	20051215	625936S	0000430E	5308	28153	1760
70	20051216	633148S	0000130E	5246	25658	1604
71	20051216	635942S	0000100E	5207	28805	1800
72	20051216	613124S	0000130W	4642	28921	1808
73	20051217	645754S	0000018E	3733	28142	1759
74	20051217	653112S	0000054W	3922	20864	1304
75	20051217	655806S	0000006W	3500	19826	1239
76	20051218	662806S	0000030E	4544	21859	1366
77	20051218	665800S	0000006W	4711	17915	1120
78	20051218	673124S	0000242E	4645	28546	1784
79	20051219	690112S	0000430E	4519	17218	1076
80	20051219	683148S	0000218E	4278	29412	1838
81	20051219	690030S	0000136E	3362	32065	2004
83	20051220	700000S	0030324W	2341	29066	1817
84	20051221	692848S	0030354W		30645	1915
85	20051221	685824S	0030142W	3689	34515	2157
86	20051221	682800S	0030018W	4114	24742	1546
87	20051221	675806S	0030048W	4125	29866	1867
88	20051222	672803S	0030230W	4316	28607	1788
89	20051222	665818S	0030206W	4460	30027	1877
90	20051222	662954S	0030336W	4458	24470	1529
91	20051222	660148S	0030306W	4811	33499	2094
92	20051223	653118S	0030248W	4951	27630	1727

Station	Date	Latitude ddmmss	Longitude dddmmss	Bottom Depth (m)	filt Vol m^3 RMT 8	filt Vol m^3 RMT 1
93	20051223	650118S	0030318W	3282	32855	2053
94	20051223	643106S	0030442W	3462	29637	1852
95	20051224	640206S	0030002W	5203	27847	1740
96	20051224	633148S	0030124W	5231	25162	1573
97	20051225	630154S	0025854W	5285	28055	1753
98	20051225	623130S	0030024W	5322	28607	1788
99	20051225	620130S	0030248W	5348	25460	1591
100	20051226	613205S	0030006W	5348	21954	1372
101	20051226	610030S	0025506W	4822	22601	1413
102	20051226	603000S	0025618W	5370	25661	1604
103	20051226	600006S	0025536W	5295	26176	1636
104	20051227	600036S	0055503W	4105	21355	1335
105	20051227	603206S	0060006W	4906	26923	1683
106	20051227	610148S	0055836W	5318	22868	1429
107	20051228	613218S	0055954W	5301	22453	1403
108	20051228	620130S	0060030W	5290	25846	1615
109	20051228	633136S	0060212W	5317	22876	1430
110	20051228	630048S	0060330W	5278	25679	1605
111	20051229	633048S	0060348W	5269	22382	1399
112	20051229	690012S	0060406W	5238	27395	1712
113	20051229	642942S	0060418W	5192	28121	1758
114	20051229	645812S	0060230W	5121	27567	1723
115	20051229	652806S	0060218W	5006	23856	1491
116	20051230	655824S	0060324W	4936	26112	1632
117	20051230	662830S	0060236W	4869	24325	1520
118	20051230	665824S	0060242W	4865	25661	1604
119	20051230	672800S	0060248W	4836	27372	1711
120	20051231	675842S	0060254W	4745	23412	1463
121	20051231	682718S	0060306W	5075	25444	1590
122	20051231	685836S	0060336W	2588	25289	1581
124	20060101	692918S	0055604W	2350	21455	1341
125	20060101	695906S	0055318W	2066	30613	1913
126	20060101	701754S	0060436W	224	25568	1598

Preliminary Results

Distribution and Abundance

The Lazarev Sea is located in the high-latitude part *of E. superba's* range, directly adjacent to the Antarctic continent. The shelf is very narrow and across the survey area the bathymetry is usually deeper than 4,000 m. The net sampling programme took part during a period of the opening of a polynya in the oceanic part of the survey grid. This lead to progressively changing ice conditions during the survey. Under these circumstances 71 samples out of a total of 81 contained krill in varying quantities. The largest catch yielded 2,580 krill equivalent to 930 grams (30 kg or 94,000 specimens in 2004) in a standard haul at one of the southern stations of the 3°E transect (see Fig. 3.2a). The main krill concentrations occurred in the northern-eastern part between 61° and 64°S (Fig. 3.2a). Krill was caught in open water as well as in ice-covered areas. Stations with very few or no krill were scattered randomly across the area. However, the poorest catches were obtained in the south-western sector south of 66°S. Figure 3.2b shows the krill distribution by weight, and it is obvious that the areas of high numerical krill abundance in the central area lost their importance, because of the small size of krill in this area (see below).

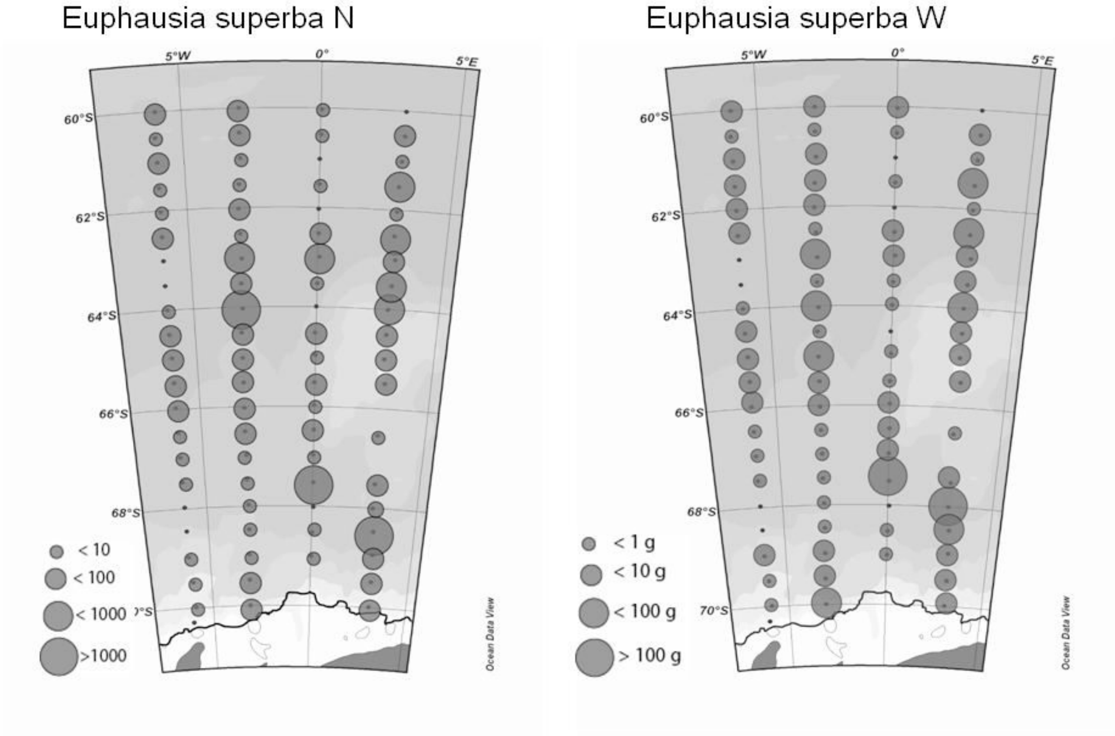

Fig. 3.2a/2b: Euphausiacea distribution in the Lazarev Sea in December 2005
(Numbers per RMT 8 tow)
Numerical abundance of E. superba
Weight of krill sample for each station

Krill abundance estimates for the current Lazarev survey results in roughly 5 krill 1,000 m^{-3} or 0.2 gram m^{-2}. Mean weight and area numerical densities for the Lazarev Sea survey in 2004 were 31.1 krill 1,000 m^{-3} and 6.2 g m^{-2}, respectively. This is a drop of almost one order of magnitude between the years.

Although the 2005 density figures have to be calculated in more detail from standardized catch numbers, the dimension of the low krill abundance in 2005 already becomes visible. Furthermore, it should be noted that the numerical densities for a survey in the Elephant Island area (Antarctic Peninsula) in 2004 were 51 krill 1,000 m^{-3}. Even this relatively high krill density was below the long-term average for the Antarctic Peninsula region and was a substantial drop since the high level of the 2001 and 2002 season. However, it is unclear, whether we are simply observing regional effects between Elephant Island and the Lazarev Sea or if we look at indication for seasonal developments in stock size caused by immigration and emigration. Finally it could also be that interannual changes might cause such dramatic fluctuations in stock size, and indications exist for this when analyzing the length and age composition of the population (see below). Certainly further data are needed from different seasons of the year (and that is why LAKRIS will have its next survey in winter 2006) and possibly from the same season of a different year to account for interannual variability.

Other Euphausiacea

The ice-krill Euphausia *crystallorophias* is an endemic species of the neritic Antarctic coastal zone. Therefore, it was not surprising to find this species exclusively at the narrow shelf and the slope stations of the continent (Fig. 3.2d). Numbers were relatively low not exceeding 250 specimens for a single RMT tow. Abundance was highest in the eastern part of the station grid. The adult population was in the spawning stage, which was to be expected, because the species is thought to have its main spawning season in December. A large number of early *Calyptopis larvae* in the samples confirmed these findings.

During the 2004 the species *E. frigida* was found at most of the stations north of 62°S. During this cruise not a single specimen was encountered in our samples. If this is an indication for a seasonal shift in distribution of the species or an interannual decrease in population size cannot be answered at this stage.

Another species frequently found in Antarctic waters is Thysanoessa macrura. This species occurred at all stations of the survey grid in fairly high numbers. Average number per tow was about 25 specimens per 1,000 m^3, which outnumbers the density of *E. superba* five times. However, due to its relatively small size the biomass density was only slightly higher than that for Antarctic krill (1.3 g m^{-2}). Distribution of the species was relatively uniform (Fig. 3.2c), with only slightly higher amounts at stations north of 66°S. Density of Thysanoessa macrura was about ten times higher than observed in the area in autumn 2004.

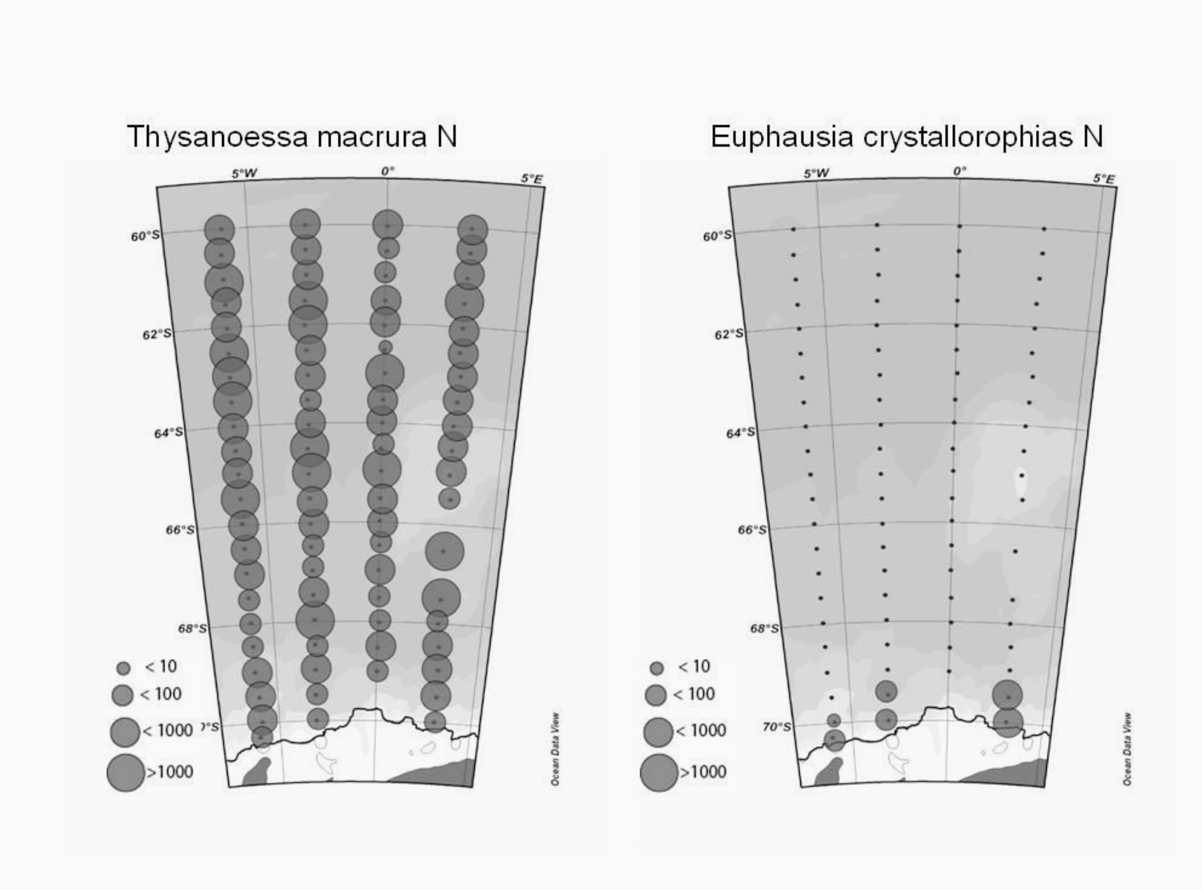

Fig. 3.2c/2d: Euphausiacea distribution in the Lazarev Sea in December 2005
(Numbers per RMT 8 tow)
Numerical abundance of Thysanoessa macrura
Numerical abundance of E. crystallorophias

Size and Maturity composition

Size distribution of the Antarctic krill *Euphausia superba* was not uniform across the survey area. In figure 3.3a stations are grouped according to their similarity in length frequency distributions. The so-called cluster 1 located in the more central area of the station grid represents the smallest fraction of the krill population. These juvenile krill were of a modal size of 17 to 18 mm (Fig. 3.3b), which is relatively small for the season compared to other areas such as the Antarctic Peninsula region.

Cluster 2 represents slightly larger krill mainly to the north and northwest of cluster 1 krill. The length distribution is again unimodal, with a modal size around 20 to 21 mm, which is the usual size of age-class 1+ in other areas at this time of the year. South of 67°S we predominately found medium to large sized immature and adult krill (Fig. 3.3a). Cluster 3 made up most of the stations, with krill size classes ranging mainly between 27 and 37 mm (Fig. 3.3b). Some scattered stations in the south as well as in the northern part of the survey area belonged to a different cluster with larger mostly adult krill. The size ranges between 30 and 45 mm. However almost no specimens in the entire population were larger than 50 mm, as they regularly occur in the Scotia Sea region.

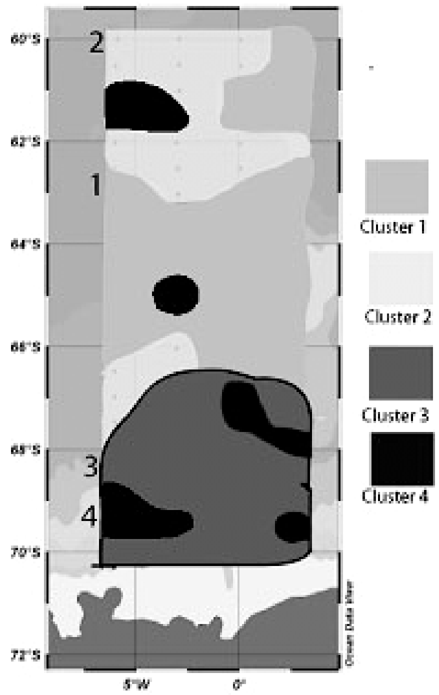

Fig. 3.3a: Spatial distribution of different groupings of size classes of E. superba in the Lazarev Sea in December 2005

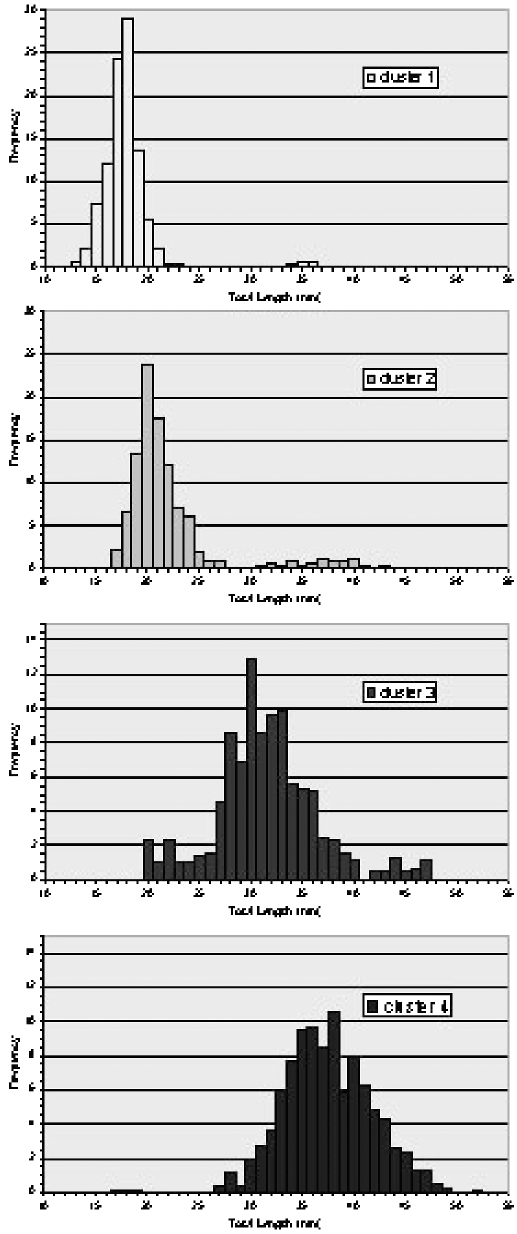

Fig. 3.3b: Length frequency distributions of Antarctic krill in the various clusters

Figures 3.4a and b summarize the composite length and maturity composition across the entire survey area. From these figures it is obvious that the krill population in early summer 2005 was dominated by a large fraction of one-year-old juvenile krill. More than 50 % of the population consisted of this size and age group, indicating a relatively strong 2005 year-class in the Lazarev Sea (if we set the birthday for the 1st of January 2005). On the other hand, the length frequency distribution show a gap in size classes around 30 mm where a modal size of the two-year-old krill should be expected at this time of the year. This probably indicates a failure of the 2004 year-class. The conclusion would be that recruitment success of krill in the Lazarev Sea shows large interannual variation. However, a more detailed analysis of the quantitative data and a comparison with other surveys from different seasons is required before this hypothesis can be confirmed.

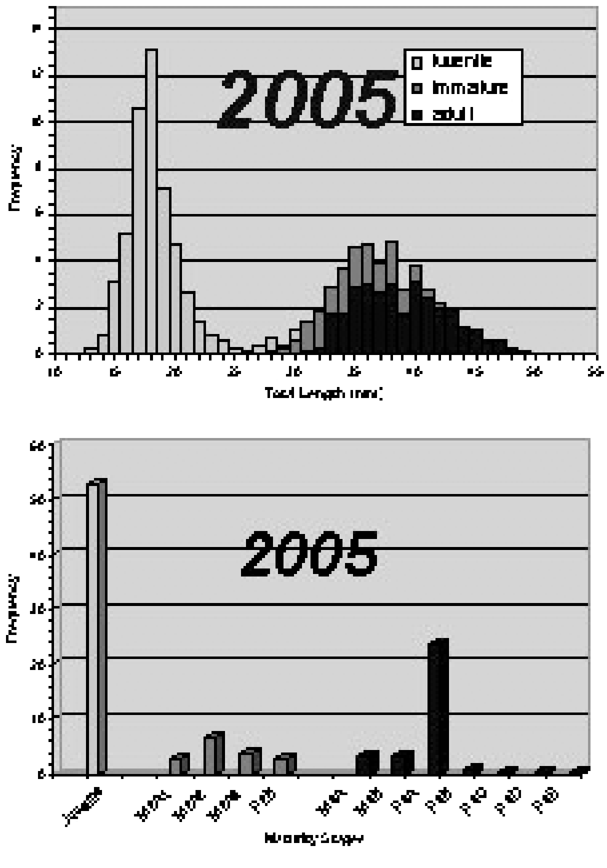

Fig. 3.4: a) Composite length frequency distribution of Antarctic krill for the entire survey area
b) Maturity stage composition of Antarctic krill for the entire survey area; stage are juvenile, male and female stage 2 = immature; stages 3a = prespawning, 3b = fully mature, 3c,d = gravid, 3e = spent.

Finally, figure 3.4b shows one interesting aspect according to the current spawning season of krill in the Lazarev Sea in 2005/06. Despite the great dominance of female maturity stage 3a (per-spawning), we also found spermatophore-bearing females as well as females in advanced spawning conditions and even the first spent animals. Adult males also showed the occurrence of well-developed spermatophores. These observations were confirmed by the finding of the very first (scattered single specimens) Calyptopis larvae of Antarctic krill from mid December onwards. In the past it was thought that the spawning season of *E. superba* is much later in the high Antarctic latitudes, which are ice-covered for much longer than e.g. in the Scotia Sea. According to this hypothesis spawning may occur in more northern latitudes from late November to early December, but the high latitude krill should start spawning not before January or even February. Although the number of spawning animals was still low during our survey, their occurrence indicate, that spawning can occur much earlier in the Lazarev Sea than expected and even at times when the area is still covered by sea-ice.

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4. HORIZONTAL AND VERTICAL DISTRIBUTION OF KRILL AND ZOOPLANKTON - LAKRIS SUBPROJECT 2

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Peter Loes Harbou, Ulrich Bathmann (not on board)

Objectives

Since the early assessments by the Discovery expeditions between 1930 and 1960 we know about the spacious distribution of substantial stocks of *Euphausia superba*.

Commencing with the BIOMASS programme, the determination of krill catch quota by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) is based on acoustic stock assessments. Compared with, for example, the Antarctic Peninsula area, there is only rare information about the development in krill stock in the Antarctic waters to the east of 20 ° E during the last decades.

Whereas the LAKRIS Project is focused on the population dynamics and physiology of *Euphausia superba* in total, the subproject TP 2 also treats the biology and distribution of other planktonic animals, like other crustacean, salps, chaetognaths and pteropods.

Work at sea

Continuous acoustic survey

To survey the spatial distribution of *Euphausia surperba* and other planktonic animals, including possible prey organisms of krill, in relation to hydrography, a continuous multifrequency acoustic survey has been carried out using a Simrad EK60 scientific echosounder at frequencies 38, 70, 120 and 200 kHz. Before starting the survey a physical calibration of the echosounder was done, using different standard copper spheres with known target strength lowered beneath the single transducers to determine their acoustical properties.

Sampling has been carried out and processing of acoustic data will be carried out in accordance to the CCMLAR standard procedures. Additional data analysis will be performed, using e. g. different scattering models and discrimination methods, to account for current difficulties in interpretation of acoustic measurements.

To a preliminary data exploration, using the difference in backscattering strength at different frequencies, we have to discriminate between distinct areas along the transects marked by clear shifts in backscattering signatures. A joined data analysis of the results of RMT (Rectangular Midwater Trawl) and Multinet hauls, hydrographic and acoustic measurements will be carried out to address the causes of these pattern in animal distribution.

Net hauls
For qualitative and quantitative estimate of zooplankton individuals per m^2 and m^2, the water column down to 350 m was sampled at 5 standard depth intervals (0-25, 25-80, 80-150, 150-250 and 250-350 m) with a Multi-Net (200 µm mesh size) at 41 stations along four transects (Fig. 4.1).

These samples, and additionally a half split of RMT 1 (1 m^2 net opening) samples (s. Siegel et al.), were fixed with buffered formaldehyde up to a final concentration of 4 %, to preserve animals for later identification and counting.

Additionally, there were two Multi-Net hauls down to 1,000 m in order to sample deep living crustacean, which were immediately deep frozen and stored at - 80°C for later analysis of their gut content. No results are available yet concerning the net samples.

Salps
Salps were collected quantitatively from the available nets, standard RMT-8 (8 m^2 net opening) and live RMT-8, within 20 minutes of arrival on deck. The standard RMT was deployed between 200 m and 0 m water depth with a trawling time of approximately 15 minutes, while the live RMT was trawled between 20 m and 0 m water depth for about 20 minutes. The length of each individual was noted and half of the available animals were packed separately in tin foil and frozen at -80°C. The pigment distribution in the gut of these individuals will be measured at the AWI using HPLC (high pressure liquid chromatography) to determine the food composition in the respective trawling areas. The second half and all animals from the 0°W transect were made available to Brian Hunt and Leigh Gurney (see section 10) for fluorescence measurements of the gut content. Both data sets will be compared later on.

In addition, seawater was sampled at every station that contained salps to compare the salp HPLC data with the pigment distribution of the phytoplankton in the surrounding waters. The water was taken from 20 m depth using the Niskin bottles of the CTD. This depth usually held the transmission minimum which is an indicator for the phytoplankton maximum. For each station two replicates of 0.5 to 2.0 l of seawater, dependent on the transmission values, were filled into dark PE-bottles and filtered onto GF/F glass microfibre filters (Whatman, 25 mm diameter). Exposure to light was avoided. The filters were folded, packed into sterile Corning vials and frozen at -80°C. They will be analysed at the AWI using HPLC and fluorometry.

Preliminary results
With the exception of one day, salps were caught exclusively at night (20:00 to 08:00 UTC) during the four weeks of sampling. In total, 154 individuals from 21 stations were frozen for HPLC analysis. Of these, 9 individuals were *Salpa thomsoni* and the remaining 145 *Ihlea racovitzai*. Solitary as well as aggregate forms were found of each species. The abundance ranged from 1 to 3 individuals *S. thompsoni* and 1 to 19 individuals *I. racovitzai* per station. The size distribution ranged from 0.8 cm to 9.8 cm for *S. thompsoni* and 0.8 cm to 7.0 cm for *I. racovitzai*. With the exception of

station 58 (3°E transect) and 121 (6°W transect) where both species were found together, each species occurred separately.

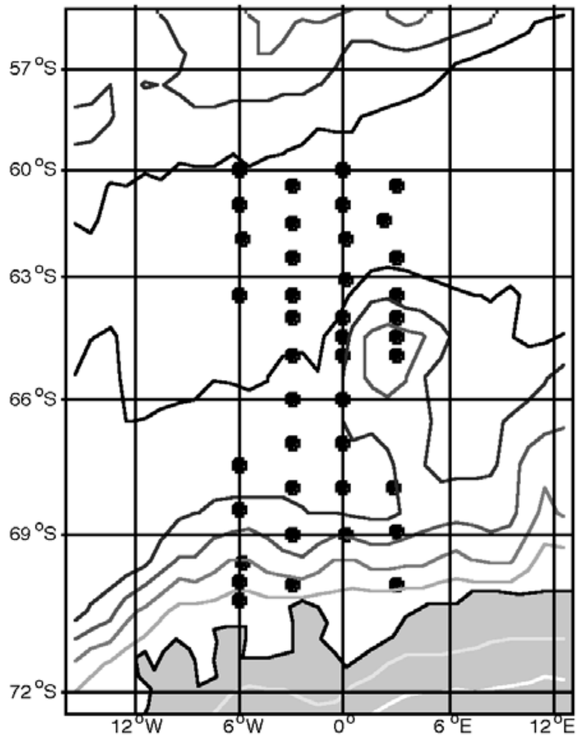

Fig. 4.1: Stations at which multi-net hauls were carried out (black dots). Gray coloured isolines mark the bottom elevation at 1,000 m intervals.

5. OCEANOGRAPHY

5.1 Effects of water mass circulation and sea ice on the abundance of zooplankton in the Lazarev Sea - LAKRIS subproject 3

Volker Strass[1)], Boris Cisewski[1)], Linda Gerull[1)], Juliane Otto[1)], Ulrike Poppe[1)], Harry Leach[2)], Harald Rohr[3)]

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Monika Rhein, University of Bremen (not on board)

Objectives

This subproject of LAKRIS is aimed at identifying relationships between the physical environment and the abundance of zooplankton. Special emphasis is put on the possible role of the Weddell Gyre circulation in closing the life cycle of krill. The data base for this study is collected by shipboard observations to map spatial distributions and by moored instruments to reveal temporal variations. Shipboard measurements have been made at a regular grid of hydrographic stations as well as from the moving ship using the vessel-mounted ADCP (Acoustical Doppler Current Profiler) and the thermosalinograph. The spatial physical data comprise the horizontal and vertical distributions of temperature, salinity, density and light transmission as well as the current vectors. The same variables, except of light transmission, are also recorded as Eulerian time series by moored instruments. Biological data consisting of estimates of phytoplankton particulate organic carbon are derived from the optical light transmission measurements, and biological data consisting of estimates of zooplankton abundance are derived from the acoustic backscatter amplitude measurements taken with both the vessel-mounted and moored ADCPs.

5.2 Hydrographic station work with CTD and water bottle sampling

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Work at sea

The vertical profiles of temperature, salinity and density were derived from measurements made by lowering a CTD (Conductivity, Temperature and Depth) sonde at hydrographic stations. The CTD used was of type Sea-Bird Electronics SBE 911plus, supplemented by an oxygen sensor type SBE 43 and a transmissiometer type Wet Labs C-Star (660 nm wavelength). The CTD was mounted with a multi-bottle water sampler type Sea-Bird SBE 32 Carousel holding 24 12-litre bottles. The performance of the water sampler was controlled by use of a laboratory standards thermometer of type SBE 35. Salinity derived from the CTD measurements will later be re-calibrated by comparison to salinity samples, taken from the water bottles, which were analyzed by use of a Guildline-Autosal-8400A salinometer to an accuracy generally better than 0.001 units on the practical salinity scale, adjusted to IAPSO Standard Seawater. The temperature sensor was calibrated at the factory to an accuracy better than 0.001 °C prior to the cruise. After the cruise the CTD sensors were sent to the manufacturer for re-calibration. The CTD data at present are thus to be considered preliminary, subject to a later correction for a possible temporal drift.

The water bottles also served to supply several other working groups on board with samples. Water samples have, for instance, been analyzed for the concentrations of oxygen, chlorophyll, particulate organic carbon and plant nutrients.

All together, 87 CTD casts were made. Of these, 45 extended to full ocean depth while the others were limited mostly to the upper 1,000 m of the water column. Except of the first and the last, all CTD stations (see Table 5.2.1) were organized in a regular grid, made up of four meridional sections running between 60°S and 70°S along 3°E, 0°E, 3°W and 6°W. The distance between stations along the meridional sections was nominally 30 nm. The station positions are portrayed Fig. 5.2.1, together with the two-dimensional horizontal distributions of temperature and salinity at 200 m depth.

Tab. 5.2.1: CTD Stations

Station	Cast	Latitude	Longitude	Water depth [m]	Altim. bottom dist. [m]	Pmax [dbar]	Start	at depth	Stop
40	2	69 24,29 S	5 32,05 W	1884		1145	04/12/05 17:30	04/12/05 17:52	04/12/05 18:11
40	3	69 24,27 S	5 31,81 W	1884	9	1853	04/12/05 19:27	04/12/05 20:03	04/12/05 20:50
42	3	69 59,41 S	2 57,34 E	504	14	495	06/12/05 21:10	06/12/05 21:28	06/12/05 21:54
43	3	69 29,87 S	2 59,86 E	2312	13	2291	07/12/05 04:16	07/12/05 05:02	07/12/05 05:52
44	3	68 56,94 S	3 2,32 E	3777	16,5	3776	07/12/05 11:55	07/12/05 13:06	07/12/05 14:15
45	3	68 30,27 S	2 50,40 E	4179	9,5	4206	07/12/05 21:30	07/12/05 22:50	08/12/05 00:07
46	3	67 57,58 S	2 55,13 E	4559	10	4598	08/12/05 05:25	08/12/05 07:03	08/12/05 08:54
47	3	67 30,06 S	3 0,25 E	4561	8,5	4602	08/12/05 14:47	08/12/05 16:15	08/12/05 17:34
48	1	67 0,17 S	2 59,81 E	3261	12,5	3256	08/12/05 21:27	08/12/05 22:34	08/12/05 23:40
49	1	66 30,19 S	3 0,12 E	3742	7,5	3757	09/12/05 03:33	09/12/05 04:44	09/12/05 05:48
50	1	66 0,14 S	3 0,18 E	3496	7	3517	09/12/05 12:11	09/12/05 13:18	09/12/05 14:27
51	1	65 29,91 S	3 0,53 E	2613	12	2595	09/12/05 18:00	09/12/05 18:50	09/12/05 19:42
52	2	64 59,79 S	2 59,23 E	2416	13,5	2386	10/12/05 01:05	10/12/05 01:51	10/12/05 02:47
53	3	64 29,91 S	3 4,56 E	2146	13,5	2113	10/12/05 08:58	10/12/05 09:43	10/12/05 10:25

Station	Cast	Latitude	Longitude	Water depth [m]	Altim. bottom dist. [m]	Pmax [dbar]	Start	at depth	Stop
54	3	63 59,99 S	3 0,43 E	2832	17	2806	10/12/05 15:46	10/12/05 16:34	10/12/05 17:30
55	2	63 29,06 S	2 58,20 E	4726	15	4772	10/12/05 23:23	11/12/05 00:45	11/12/05 02:01
56	3	63 0,17 S	2 57,84 E	5369	11,5	5447	11/12/05 07:50	11/12/05 09:19	11/12/05 10:42
57	2	62 30,34 S	3 0,28 E	5323	15	5397	11/12/05 14:50	11/12/05 16:18	11/12/05 17:52
58	3	61 58,48 S	2 58,46 E	5389	14	5465	12/12/05 00:11	12/12/05 01:45	12/12/05 03:12
59	2	61 29,83 S	3 0,93 E	5384	11,5	5461	12/12/05 07:22	12/12/05 08:54	12/12/05 10:21
60	2	61 0,22 S	3 0,08 E	5401	10,5	5479	12/12/05 15:20	12/12/05 16:54	12/12/05 18:21
61	2	60 28,87 S	3 3,23 E	5390	17	5465	12/12/05 23:26	13/12/05 01:05	13/12/05 02:28
62	2	59 59,01 S	3 2,64 E	5379	12	5452	13/12/05 07:40	13/12/05 09:20	13/12/05 10:40
63	2	60 0,21 S	0 0,22 E	5354	14	5428	14/12/05 03:54	14/12/05 05:30	14/12/05 06:55
64	2	60 30,46 S	0 0,84 E	5370		1002	14/12/05 12:09	14/12/05 12:32	14/12/05 12:56
65	2	60 59,02 S	0 0,61 W	5386		1001	14/12/05 17:30	14/12/05 17:52	14/12/05 18:23
66	2	61 29,69 S	0 0,21 E	5389		1001	14/12/05 23:55	15/12/05 00:18	15/12/05 00:44
67	2	61 59,62 S	0 2,88 E	5372	10,5	5451	15/12/05 05:14	15/12/05 06:28	15/12/05 08:11
68	2	62 30,04 S	0 0,06 W	5344		1001	15/12/05 13:48	15/12/05 14:08	15/12/05 14:37
69	2	63 1,69 S	0 2,60 E	5309		1002	15/12/05 18:52	15/12/05 19:14	15/12/05 19:38
70	2	63 29,62 S	0 0,69 W	5245		1016	16/12/05 01:05	16/12/05 01:28	16/12/05 01:53
71	4	63 59,96 S	0 0,06 E	5200	9,5	5274	16/12/05 15:53	16/12/05 17:22	16/12/05 18:46
72	2	64 29,69 S	0 0,06 E	4658		1001	17/12/05 00:20	17/12/05 00:39	17/12/05 01:02
73	3	65 0,02 S	0 0,37 E	3733		1001	17/12/05 07:54	17/12/05 08:20	17/12/05 08:55
74	2	65 29,97 S	0 0,75 E	3880	6,5	3936	17/12/05 13:44	17/12/05 14:52	17/12/05 16:02
75	2	66 0,40 S	0 1,24 W	3464		1001	17/12/05 21:41	17/12/05 22:01	17/12/05 22:24
76	2	66 30,50 S	0 2,98 E	4555	9,5	4598	18/12/05 03:14	18/12/05 04:32	18/12/05 05:47
77	3	67 0,52 S	0 0,05 E	4711		1001	18/12/05 16:06	18/12/05 16:46	18/12/05 17:08
78	3	67 30,08 S	0 3,35 W	4643		1002	18/12/05 23:08	18/12/05 23:28	18/12/05 23:58
79	2	67 59,92 S	0 0,08 E	4518	9	4556	19/12/05 03:54	19/12/05 05:14	19/12/05 06:31
80	2	68 30,23 S	0 2,08 W	4278		1001	19/12/05 11:24	19/12/05 11:44	19/12/05 12:10
81	3	69 0,33 S	0 4,62 E	3363	14	3353	19/12/05 20:30	19/12/05 21:32	19/12/05 22:35
82	1	69 29,92 S	0 1,40 W	1534	10	1501	20/12/05 06:29	20/12/05 07:03	20/12/05 07:41

Station	Cast	Latitude	Longitude	Water depth [m]	Altim. bottom dist. [m]	Pmax [dbar]	Start	at depth	Stop
83	3	70 0,81 S	3 3,02 W	2331	16	2413	20/12/05 20:03	20/12/05 20:53	20/12/05 21:40
84	2	69 30,02 S	3 1,88 W	2972		1003	21/12/05 03:40	21/12/05 04:00	21/12/05 04:31
85	2	69 0,79 S	3 0,87 W	3688		1001	21/12/05 09:25	21/12/05 09:49	21/12/05 10:11
86	2	68 29,93 S	3 0,03 W	4115		1001	21/12/05 14:54	21/12/05 15:15	21/12/05 15:44
87	2	67 60,00 S	3 0,09 W	4125	15	4151	21/12/05 19:43	21/12/05 20:53	21/12/05 22:09
88	2	67 30,16 S	3 0,12 W	4318		1001	22/12/05 03:26	22/12/05 03:47	22/12/05 04:22
89	2	67 0,01 S	2 57,58 W	4460		1002	22/12/05 08:13	22/12/05 08:36	22/12/05 09:00
90	2	66 29,84 S	2 59,30 W	4458		1001	22/12/05 13:30	22/12/05 13:51	22/12/05 14:17
91	3	65 59,40 S	2 58,19 W	4829	9,5	4900	22/12/05 18:19	22/12/05 19:41	22/12/05 21:01
92	3	65 29,45 S	2 58,80 W	4951		1001	23/12/05 01:50	23/12/05 02:11	23/12/05 02:35
93	3	64 59,63 S	2 58,90 W	5088		1001	23/12/05 06:45	23/12/05 07:07	23/12/05 07:37
94	3	64 29,67 S	3 0,70 W	3458		1001	23/12/05 21:00	23/12/05 21:24	23/12/05 21:48
95	2	63 60,00 S	3 0,04 W	5203	14	5270	24/12/05 02:06	24/12/05 03:34	24/12/05 05:01
96	2	63 30,04 S	3 0,35 W	5230		1001	24/12/05 10:31	24/12/05 10:54	24/12/05 11:16
97	2	63 0,11 S	3 0,75 W	5284		1002	25/12/05 10:57	25/12/05 11:20	25/12/05 11:43
98	2	62 29,64 S	2 59,95 W	5322		1001	25/12/05 15:50	25/12/05 16:11	25/12/05 16:35
99	2	61 59,55 S	3 1,43 W	5348	14	5424	25/12/05 20:52	25/12/05 22:29	25/12/05 23:54
100	2	61 30,55 S	2 59,87 W	5347		1001	26/12/05 03:31	26/12/05 03:51	26/12/05 04:17
101	2	60 59,47 S	2 57,69 W	4822		1003	26/12/05 09:37	26/12/05 10:02	26/12/05 10:34
102	2	60 30,07 S	3 0,29 W	5307		1001	26/12/05 14:25	26/12/05 14:45	26/12/05 15:11
103	2	60 0,62 S	2 59,14 W	5282	22	5361	26/12/05 19:45	26/12/05 21:17	26/12/05 22:42
104	3	60 0,72 S	5 58,48 W	4097	16,5	4122	27/12/05 09:23	27/12/05 10:34	27/12/05 11:47
105	2	60 30,45 S	6 1,04 W	4806		1003	27/12/05 17:06	27/12/05 17:27	27/12/05 17:52
106	3	60 59,63 S	5 59,09 W	5318		1002	27/12/05 22:06	27/12/05 22:30	27/12/05 23:03
107	2	61 30,42 S	6 0,21 W	5300		1001	28/12/05 03:59	28/12/05 04:12	28/12/05 04:35
108	2	61 59,70 S	5 57,69 W	5285	27	5374	28/12/05 08:24	28/12/05 09:34	28/12/05 11:22
109	2	62 30,58 S	5 59,35 W	5318		1002	28/12/05 16:08	28/12/05 16:30	28/12/05 16:52
110	2	62 59,80 S	6 0,05 W	5278		1008	28/12/05 20:34	28/12/05 20:57	28/12/05 21:23
111	2	63 29,92 S	5 59,83 W	5268		1002	29/12/05 01:10	29/12/05 01:31	29/12/05 02:00

Station	Cast	Latitude	Longitude	Water depth [m]	Altim. bottom dist. [m]	Pmax [dbar]	Start	at depth	Stop
112	2	64 0,15 S	5 59,26 W	5234	8	5311	29/12/05 07:00	29/12/05 08:29	29/12/05 09:52
113	3	64 30,14 S	5 58,20 W	5192		1002	29/12/05 14:09	29/12/05 14:31	29/12/05 14:58
114	2	64 59,66 S	5 59,61 W	5121		1001	29/12/05 18:40	29/12/05 19:00	29/12/05 19:33
115	2	65 30,00 S	5 59,95 W	5006		1002	29/12/05 23:12	29/12/05 23:35	30/12/05 00:20
116	2	66 0,01 S	6 0,08 W	4936	9	4994	30/12/05 04:05	30/12/05 05:29	30/12/05 06:46
117	2	66 29,90 S	6 1,36 W	4871		1041	30/12/05 10:35	30/12/05 11:00	30/12/05 11:24
118	2	67 0,00 S	6 0,13 W	4866		1002	30/12/05 15:12	30/12/05 15:34	30/12/05 16:05
119	2	67 29,60 S	5 59,80 W	4836		1004	30/12/05 19:47	30/12/05 20:10	30/12/05 20:42
120	2	67 59,95 S	5 59,90 W	4744	14	4791	31/12/05 01:28	31/12/05 02:45	31/12/05 04:09
121	2	68 28,90 S	6 1,14 W	3479		1001	31/12/05 08:15	31/12/05 08:40	31/12/05 09:04
122	3	69 0,67 S	5 59,29 W	2611	8	2589	31/12/05 14:06	31/12/05 18:23	31/12/05 19:13
124	2	69 30,74 S	5 59,05 W	2353	14	2316	01/01/06 11:30	01/01/06 12:16	01/01/06 13:08
125	2	69 57,20 S	5 59,29 W	2071	6,5	2043	01/01/06 18:28	01/01/06 19:07	01/01/06 19:50
126	2	70 19,70 S	6 8,53 W	244	15	226	02/01/06 00:14	02/01/06 00:22	02/01/06 00:43
130	1	67 20,57 S	15 57,70 W	4951		1001	03/01/06 18:39	03/01/06 18:58	03/01/06 19:17

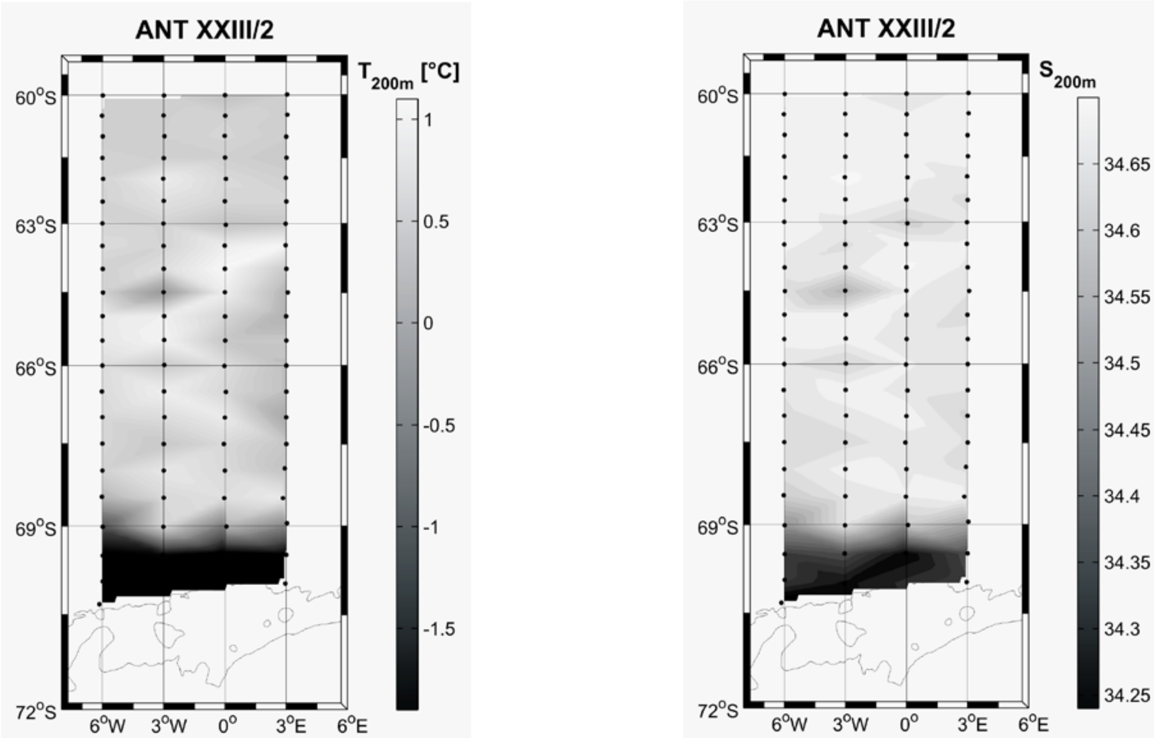

Fig. 5.2.1: The horizontal distributions of temperature and salinity at 200 m depth in the LAKRIS area as measured during ANT-XXIII/2. The dots indicate the CTD station positions.

5.3 Underway measurements of currents and echo backscatter with the vessel-mounted acoustic Doppler current profiler

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Vertical profiles of ocean currents down to roughly 300 m depth were measured with a Vessel Mounted Acoustic Doppler Current Profiler (Ocean Surveyor; manufacture of RDI, 150 kHz nominal frequency), installed at the ship's hull behind an acoustically transparent plastic window for ice protection. The transducer emits/receives the acoustic signals from its flat face, which is composed of an array of about 1,000 ceramic elements, covered in urethane. These elements are arranged in a fixed pattern and are each wired to transmit a specific signal, identified by its phase. The phase shift, with which the ceramic elements emit their acoustic signals, is arranged in a way such that the signals interfere to form beams in four distinct directions, slanted at 30 degrees from the vertical. The transducer also records the echoes returned from particles in suspension in the water. Echoes reflected by particles moving relative to the VM-ADCP return with a change in frequency. The ADCP measures this change, the so-called Doppler shift, as a function of depth to obtain water velocity at a maximum of 128 depthlevels. The instrument settings for this cruise were chosen to give a vertical resolution of current measurements of 4 m in 80 depth bins, a temporal resolution of 2 min for short time averages. Determination of the velocity components in geographical coordinates, however, requires that the attitude of the ADCP transducer head, its tilt, heading and motion is also known. Attitude variables of the VM-ADCP were taken from the ship's navigation system.

In addition, the ADCP will be used detector for zooplankton abundanc evaluating the echo amplit Calibration data for the ADCP vel and echo amplitude measurements obtained during the cruise, but have not completely been evaluated; there the VM-ADCP current measurem shown in figure 5.3.1 have to considered as preliminary. Processi the VM-ADCP data was done using CODAS software package (develope E. Firing and colleagues, SOE Hawaii).

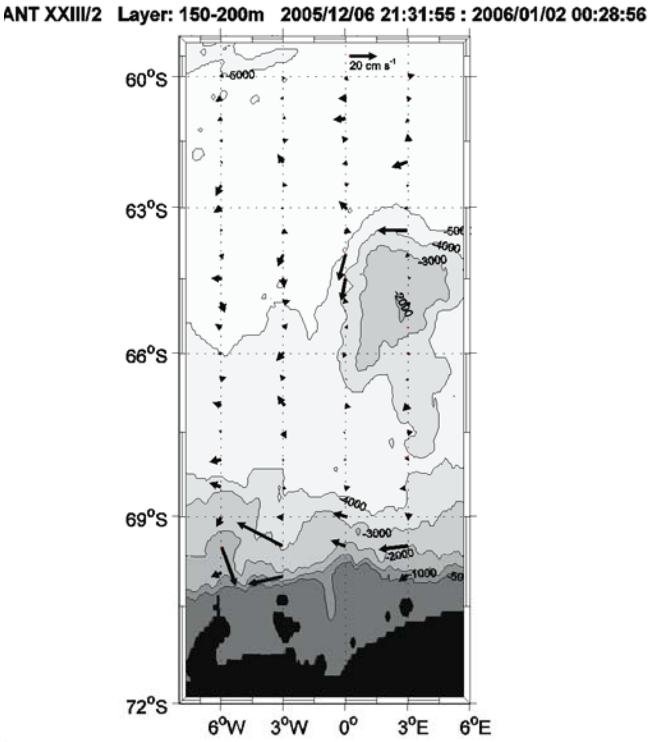

Fig. 5.3.1: Horizontal currents in the depth range 150 - 200 m measured with the VM-ADCP. The vectors show the highest velocities within the Antarctic Coastal Current and a probably topographically trapped west/southwest circulation around Maud Rise.

5.4 Time series measurements from moored instruments

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[2)]Optimare

For our project ADCPs are also employed in their self-contained version, used to collect longer-term time series data. Three instruments of that kind were recovered and redeployed with oceanographic moorings distributed along the 0° meridian. The recovered moorings had been deployed roughly 10 months before, in February 2005. In those moorings ADCPs are being used together with other conventional current meters and temperature/salinity recorders, and also with Upward Looking Sonars (ULSs) for the measurement of ice thickness. From the combination of ADCPs with ULSs we hope to be able to obtain estimates of sea ice drift and transports. Our moored ADCPs are of type Work-Horse Long-Ranger, manufactured by RD Instruments, San Diego, California. They have been acoustically calibrated by BAE Systems, Austin, Texas, prior to deployment to allow to obtain absolute data of mean volume backscatter, which is used as an indicator of zooplankton abundance.

Some basic information about the moorings recovered and deployed is provided in Tables 5.4.1 and 5.4.2. Figure 5.4.1 shows the schematic drawing of one of the moorings for an example.

During our mooring work we took care of visually inspecting the vicinity of the ship for the presence of whales. When a whale was sighted, as was the case with a minke whale during recovery of mooring AWI 229, acoustic devices used for the purpose of mooring location and release were immediately switched off. The whale observations were carried out by two professional observers aboard working for the International Whaling commission (IWC).

Tab. 5.4.1: Moorings recovered

Mooring ID	Latitude Longitude	Water Depth (m)	Date	Instruments	Instrument SN	Depth (m)
AWI 229-6	63° 57.16' S 00° 00.37' W	5200	16.12.2005	ULS SBE37PuP3 SBE37 ADCP SBE37Pu SBE37Pu SBE37Pu SBE37P3 AVT SQ AVT SBE37 AVT	57 1236 240 0825 435 436 438 248 9769 W1-2 9188 439 9770	147 200 300 380 400 500 600 700 700 1814 2002 5153 5154
AWI 231-6	66° 30.66' S 00° 01.91' W	4540	18.12.2005	ULS SBE37PuP3 SBE37 ADCP SBE37 SBE37 SBE37 SBE37P3 AVTPC AVT SQ SBE37 AVT	56 1237 216 3813 224 227 229 242 10928 9391 W2-2 231 9180	151 200 300 353 400 500 600 700 700 1802 1900 4493 4494
AWI 232-7	68° 59.75' S 00° 00.11' W	3370	19.02.2005	ULS ADCP AVTPC AVT SBE37 AVT	47 5373 10927 9186 230 6854	151 375 752 1808 3313 3314

Tab. 5.4.2: Mooring Deployments

Mooring ID Water Depth	Latitude Longitude	Date	Releaser Transponder	Instruments	Instrument SN	Planned Instrument Depth (m)
AWI 229-7 5200m	63° 57.17' S 00° 00.17' W	16.12.2005	RT 861 (SN456) AR 661 (SN540) ET 861G (SN 389)	ULS SBE 37 3500m SBE 37 ADCP SBE 37 SBE 37 SBE 37 SBE 37 10000psi A-RCM8 VTP20MPa Sound Source W1-c A-RCM8 VT SBE 37 A-RCM8 VT	49 2611 2386 5848 1605 2388 2389 1564 9997 29 9185 215 9187	153 200 300 350 400 500 600 700 703 811 2003 5153 5154
AWI 231-7 4540m	66° 30.67' S 00° 01.90' W	18.12.2005	RT 861 (SN372) RT 661 (SN302) ET 861G (SN385)	ULS SBE 37 3500m SBE 37 ADCP SBE 37 SBE 37 SBE 37 SBE 37 3000psi A-RCM8 VTP20MPa Sound Source W2-c A-RCM8 VT(P blind) SBE 37 A-RCM8 VT	41 249 2382 6240 2383 2384 2385 2235 9212 30 9184 214 9194	149 193 293 353 393 493 593 692 698 806 1803 4493 4494
AWI 232-8 3370m	68° 59.75' S 00° 00.16' W	19.12.2005	RT 861 (SN247) AR 661 (SN453) ET 861G (SN 250)	ULS ADCP A-RCM7 VTP 14 MPa A-RCM8 VT SBE 37 A-RCM8 VT	50 3813 10492 6856 211 9179	151 248 752 1808 3313 3314

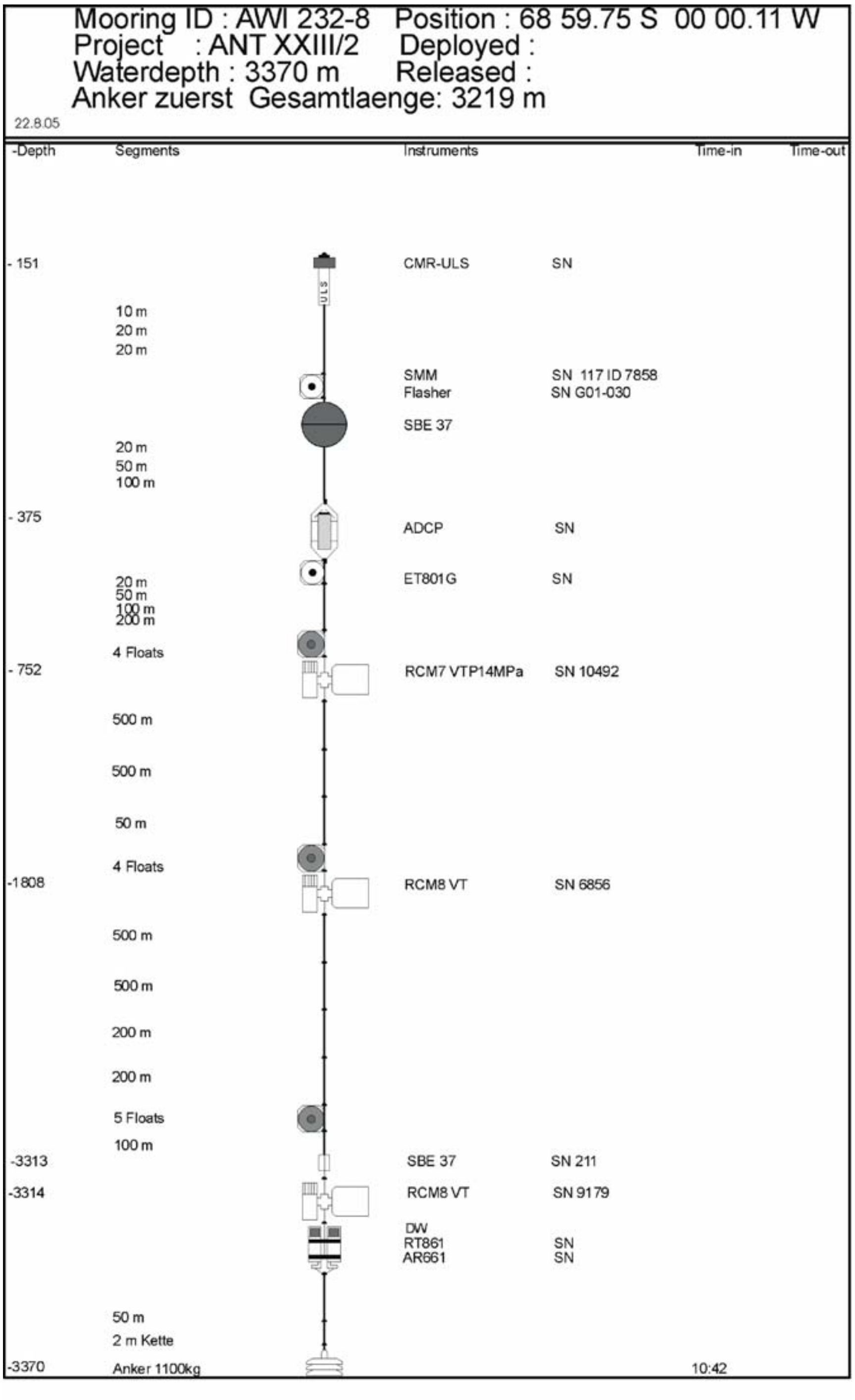

Fig. 5.4.1: Schematic drawing of mooring AWI 232-8

6. SEASONAL DYNAMICS OF PHYSIOLOGICAL CONDITIONS OF KRILL WITH EMPHASIS ON THE LARVAE STAGES - LAKRIS SUBPROJECT 4

Bettina Meyer[1)], Lutz Auerswald[2)], Bettina Fach[1)], Veronica Fuentes[1)], Andreas Hayden[1)], Carsten Pape[1)], Susanne Spahic[1)]

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Objectives

The goal of the project is to characterise the physiological condition of krill during different seasons to get a better understanding of how the different ontogenetic stages of krill survive Antarctic winter. The extent of sea ice and the success of overwintering are major factors that dictate condition, recruitment and population size of Antarctic krill. Suggested survival mechanisms of adult krill fall into two categories: firstly, non-feeding strategies, and secondly, switching to alternative food sources. The non-feeding strategies include utilisation of stored lipids, reduction in metabolic rate and shrinkage in size. Feeding strategies involve switching to ice algae, zooplankton or sea bed detritus.

All of these overwintering mechanisms have been observed at different times and places, but their relative importance remains unclear. Additionally, the mechanisms differ with ontogeny, with larval krill having a greater requirement to feed than adults.
The aim of the cruise was to estimate the physiological condition of krill in austral spring, early summer by measuring their

a) Length, dry mass, elemental (carbon, nitrogen) and biochemical (protein, lipids, carbohydrates) composition
b) Metabolic rates (oxygen consumption and ammonium production) and activity of metabolic enzymes
c) Moulting, growth and mortality rates
d) Feeding rates
e) Melatonin concentration

and to estimate the importance of zooplankton as food source for juvenile krill.

Work at sea

A) and b) Elemental, biochemical composition and metabolic rates

Freshly caught animals were frozen in liquid nitrogen and stored at -80°C for measuring length, dry mass, elemental (carbon, nitrogen) and biochemical (protein, lipids, carbohydrates) composition and activity of metabolic enzymes (malat dehydrogenase, citrat sythase) at the AWI.

For metabolic rate measurements freshly caught juvenile and adult krill were incubated for 24 h in sealed 2.5 l bottles (1 adult, 5 juveniles per bottle) equipped with micro optodes. Oxygen uptake rates were measured after 24 h using the Winkler technique by taking 50 ml sub-samples in Winkler bottles (3 replicates per bottle) and by online data collection via micro optodes. The ammonium excretion rates were measured photometrically, using the method of Solarzano.

The respiration rates of juveniles and adults (per dry mass) were calculated onboard by using a length/mass regression and C conversion from the literature that derived from a former cruise in the Lazarev Sea (ANT-XIII/3, see Atkinson et al. 2002: $\log_{10}$ (DM mg) = 3.25 $\log_{10}$ (length mm) - 3.18, n = 31, R^2 = 0.98, and C = 52 % of DM). The results were in the range of well fed animals during summer with an average of 0.6 µl O_2 mg DM^{-1} h^{-1} and 2.0 µl O_2 mg DM^{-1} h^{-1} for juveniles and adults, respectively (Fig. 6.1). The O:N ratios, calculated from the measured oxygen uptake and ammonium excretion rates, showed a decrease with dry mass (Fig. 6.2), demonstrating the metabolic substrate used by both stages. It seems that juveniles have a more lipid-based metabolism (O:N ratio > 20), whereas metabolism of adults is more protein-dominated (O:N ratio < 20).

In addition to oxygen determinations based on the classical Winkler technique we tried to establish the use of micro optodes, a method for online oxygen determination based on optical sensors. The comparison between oxygen uptake rates measured either by the Winkler method or by micro optodes shows a significant correlation (Fig. 6.3). The function for the linear regression equals f(x) = 0.99 + 3.73 (R^2 = 0.99) indicating that both methods give highly similar values. Therefore, mirco optodes show the potential to substitute the time consuming Winkler method during future experiments.

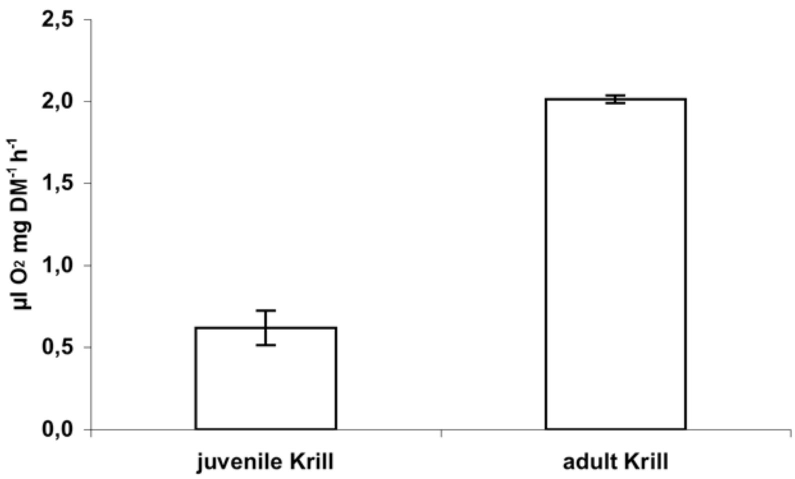

Fig. 6.1: Oxygen uptake rates of freshly caught juvenile and adult krill

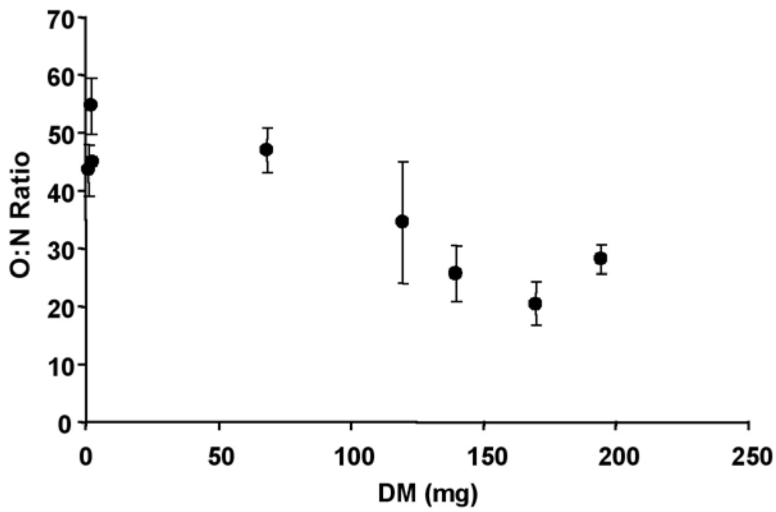

Fig. 6 2: O:N ratio of freshly caught juvenile and adult krill

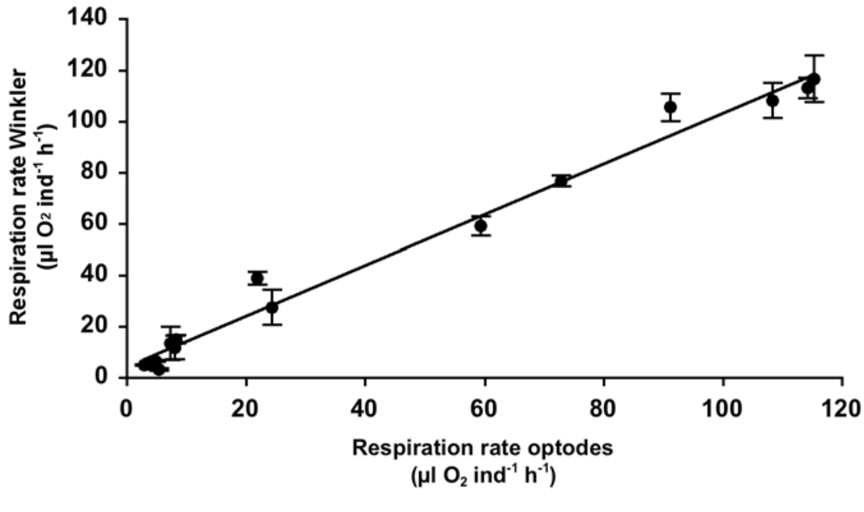

Fig. 6. 3: Correlation between respiration rates determined by the Winkler method or by micro optodes

c) Moulting, growth and mortality rates of juvenile and adult krill

We conducted 6 moulting experiments, 4 with adult krill and 2 with juveniles (Table 6.1). Experiments were run for 5 days, with adults and juveniles placed individually in 2 and 0.5 l beakers, respectively, of surface seawater. The animals were controlled twice a day (morning and evening) for exuvia. The animal and its exuvia were frozen. At the AWI, the mean difference in length of the uropod of moulted exoskeletons and the postmolt animals will be measured to determine growth per intermoult period as a percentage of the initial length. The duration of the intermoult period (IMP) was calculated from the total number of individuals moulted in the experiments (N_{moult}), the total number of animals incubated ($N_{incubated}$, and the duration of the experiments (t): IMP = (t $N_{incubated}$)/ N_{moult}. Dead krill and those that moulted during the course of the incubations were removed but were still included in the total number incubated ($N_{incubated}$). Combining growth data with moulting frequency will provide an estimate of growth rates of juveniles and adults in our working area. Growth is highly influenced by food concentration and quality. Juvenile krill showed an intermoult period between 20 and 26 days, which is similar to summer values off South Georgia whereas adult krill had a high variability in IMP ranged between 26 to 51 days (Arnold et al. 2004). IMPs of > 40 days are known from previous winter studies.

Tab. 6.1: Summary of moulting rate experiments

Station	stage	Number of animals	Daily mortality	IMP
PS69/044	adults	24	0.8%	30
PS69/046	adults	130	1.3%	43
PS69/047	adults	44	3.0%	26
PS69/053	juveniles	27	2.5%	20
PS69/092	adults	102	0.0%	51
PS69/094	juveniles	129	0.6%	26

d) Feeding rates

The incubation technique was used for juvenile krill. The food medium (natural seawater enriched with phytoplankton and microzooplankton) was transferred through silicon tubing to 2.4 litre bottles. The experiments comprised of 2 to 5 replicate bottles (4 to 6 juvenile krill each) and 3 controls without animals. The Chla concentration in the experiments ranged from 0.2 to 13 µg Chla l^{-1}.

The provisional clearance rate was calculated on a carbon base using a C:Chl*a* ratio of 50 and length/mass regression and C conversion from the literature derived from a previous cruise in the study area (ANT-XIII/3, see point a and b above, Atkinson et al. 2002) The length of juvenile krill ranged from 11.0 to 15.6 mm (average 13.4 mm) on the first transect (e.g. station PS69/069, 15.12.05) and from 14.9 and 20.0 mm (average 17.1 mm) on the third transect (e.g. station PS 69/094, 23.12.05). The daily ration (DR) of juvenile krill increased with food availability and ranged from 0.1 to 8.0 % body C d^{-1} using a food concentration of between 50 and 750 µg C l^{-1} (Fig.

6.4). The estimated DRs are near the range of those measured off South Georgia during summer (Atkinson et al. 2002).

A main objective of the feeding experiments was to determine the importance of zooplankton as food source for the juveniles, since in winter these could be a significant alternative source of energy. The animals were incubated in filtered seawater enriched with natural phytoplankton concentrate and a specific amount of copepods (*Calanoides acutus* CII-CIV, *Metridia gerlachii* CIII-CIV, *Oncaea* sp., *Oithona* sp., *Ctenocalanus citer*, copepod nauplii). The copepods were collected using a 100 µm mesh net with a 20 litre closed cod end, towed vertically from 100 m to the surface at 0.2 m sec^{-1} (for detail see Giesecke section 11). The experiments are summarised in Table 6.2. The uneaten food items were preserved at the end of each 24 h experiment for comparison with ungrazed controls or initials. The preserved samples will be analysed at the AWI.

Tab. 6.2: Summary of incubation experiments with juvenile krill fed solely on phytoplankton (culture, natural composition in the water column =NC, ice biota) and phytoplankton mixtures enriched with copepods or filtered seawater (FSW) enriched with copepods

Experiments with phytoplankton	Date	Chl*a* (µg l^{-1})	Phyto–plankton	Number of incubation bottles	Number of juvenile krill per bottle
1	12.12.05	2.5	culture	3	5
2	15.12.05	6.4	culture	2	5
3	19.12.05	0.8	culture	6	3-5
4	21.12.05	3.0	culture	3	2-5
5	23.12.05	4.0	NC	6	4
6	26.12.05	12.8	NC	6	4
7	28.12.05	3.3	NC	3	4
8	02.01.06	15.1	Ice biota	3	3-5
9	04.01.06	11.4	Ice biota	3	4
10	08.01.06	20.4	Ice biota	3	3

Experiments with phytoplankton and copepods	Date	Chl*a* (µg l^{-1})	Number of copepods	Number incubation bottles	Number juvenile krill per bottle
1	10.12.05	3.6	460	5	6
2	12.12.05	1.4	282	2	5
3	15.12.05	0.0 (FSW)	299	3	5
4	21.12.05	1.3	414	3	4
6	28.12.05	3.2	370	3	3-4

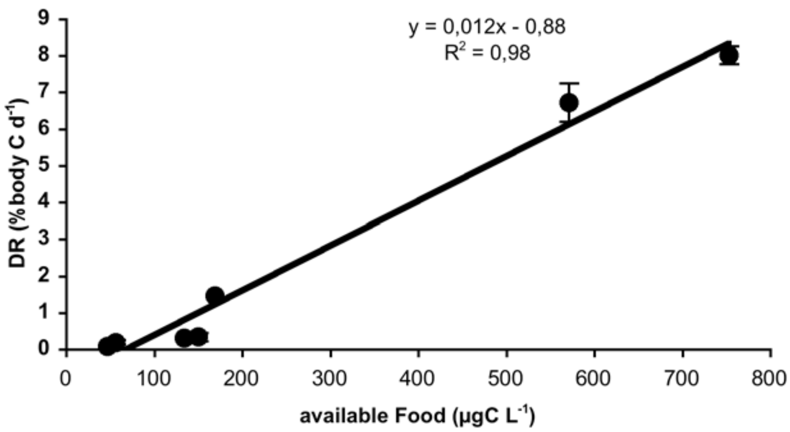

Fig. 6. 4: Dependence of daily ration (DR) of juvenile krill on food availability

e) Melatonin concentration

It has been documented that the feeding activity and metabolic rates of adult krill are reduced during autumn in comparison with summer values. Our working hypothesis is that melatonin (N-acetyl-5-methoxytryptamine) production in the animal may change seasonally in correspondence with metabolic activity and therefore function as a transducer for seasonal responses. Melatonin has been detected in the eye stalks of numerous crustacean species but its role and mechanism of action in physiology are still unclear. In contrast, it is well known from such diverse groups as dinoflagellates and vertebrates that melatonin is involved in the regulation of various daily and seasonal shifts in physiology and behaviour.

Our general aim is to detect if melatonin is present in *E. superba*. If so, we would like to evaluate weather melatonin concentration cycles in parallel with seasonal metabolic activity pattern in krill.

Therefore, freshly caught adult krill was frozen immediately in liquid nitrogen and stored at -80°C for analysis of melatonin concentration at AWI. Haemolymph samples were taken before freezing from some of the animals in order to correlate the melatonin concentration within the eye stalks and their body fluid. In addition to direct measurements, we aim to determine the activity of one of the key enzymes of melatonin synthesis, N-acetyltransferase, in samples from different seasons.

f) Starvation experiment

The aim of the experiment was to estimate the starvation tolerance of juvenile and adult krill by monitoring their DM, elemental (C,N) and biochemical composition (protein, lipid, lipid classes, carbohydrates) and metabolic rates (oxygen uptake and ammonium excretion rates). Freshly caught juvenile (100) and adult krill (90) was kept individually in 2 l and 0.5 l bottles, respectively, filled with filtered seawater. The animals were checked daily for exuvia and mortality. Every fourth day, 3 adult krill and 12 juveniles were used to measure metabolic rates (see b) above) and were frozen for analysing the different components (see above) at the AWI.

During the starvation experiment, oxygen uptake rates of adult krill decreased from 43 µl O_2 mg DM^{-1} h^{-1} in freshly caught animals to 15 after 14 days of starvation and remained almost constant until the end of the experiment (Fig. 6.5). At the beginning of the experiment, adult krill showed an O:N ratio of 48 which decreased to approximately 12 after 10 days of starvation and remained constant until the end of the experiment (3 weeks of starvation). An O:N ratio of between 3 and 16 indicates a protein dominated metabolism, whereas a ratio greater than 24 shows that lipids are preferentially catabolised (Fig. 6.5).

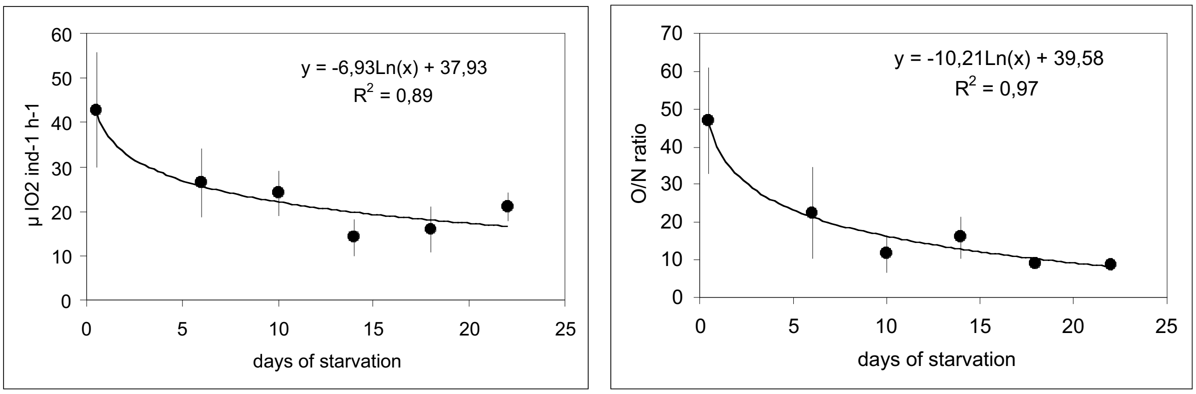

Fig. 6.5: Oxygen uptake rates (left) and O:N ratio (right) of adult krill during starvation.

References

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Arnold KH, Shreeve RS, Atkinson A, Clarke A 2004. Growth rates of Antarctic krill, /Euphausia superba/: Comparison of the instantaneous growth rate method with nitrogen and phosphorus stoichiometry. Limol. Oceanogr. 49: 2152-2161

7. POTENTIAL KRILL ALLERGENS

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Alfred-Wegener-Institut
Andreas Lopata (not on board)

Currently, the main commercial use of krill is as feed for aquaculture. Only a small proportion is used for human consumption. In future, however, krill will most likely be caught for high quality chemical, pharmaceutical and health products but also as a protein source for human consumption. Due to its close proximity to the catching grounds of krill and its fishing interests, South Africa has an excellent position to benefit most from this rich natural source. Krill carries the risk, however, of containing proteins allergenic to humans as it is well known from other crustacean species. Allergy to crustaceans is one of the most common food allergies. So far, no research has been conducted in this regard on krill, although exposure to crustaceans can cause life-threatening reactions in allergic individuals. No crustacean species investigated so far has been found free of allergens.

The present study was designed, therefore, to investigate the allergic potential of krill in comparison with other crustacean species. To achieve these aims, it is planned 1) to extract, purify and elucidate the molecular structure of potential allergens from Antarctic krill during different seasons and physiological conditions and 2) to propose the right policies for public and occupational health to avoid problems currently experienced, for example in the lobster industry.

During the present cruise in late spring, early summer with RV *Polarstern*, samples of krill material (whole animals and body parts) were collected to study the role of tropomyosin, the muscle protein responsible for allergenicity in other crustacean species. In addition, haemolymph samples were collected from stressed krill (freshly caught, starved) to investigate stress proteins as a potential cause of allergy. Corresponding samples from krill will be collected during the Antarctic winter in 2006.

8. SEASONAL LIPID DYNAMICS AND ENERGETIC ADAPTATIONS OF EUPHAUSIA SUPERBA, WITH EMPHASIS ON JUVENILE AND ADULT STAGES - LAKRIS SUBPROJECT 5

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8.1 Energetics and feeding ecology of Antarctic euphausiids: comparative lipid analyses of *Euphausia superba*, *E. crystallorophias* and *Thysanoessa macrura*

Objectives

Our study aimed at characterising the physiological condition and feeding behaviour of krill at the end of the critical overwintering period and at the onset of the again very energy demanding reproductive season by means of lipid analyses. Lipid content and lipid class composition indicate the amount and type of energy reserves present and comparison with autumn data allow estimates of the relative importance of lipids for the overwintering of krill. Particular emphasis was laid on the collection of all developmental and maturity stages present at this time of year in order to characterise the role of lipids during gonad maturation and mating as well as during larval development.

The fatty acid composition reflects the animals' feeding histories integrated over several weeks and is thus an important supplement to the classical gut content analyses providing short-term trophic information. Several feeding experiments were carried out to verify the potential of specific fatty acids as trophic markers in Antarctic euphausiids. Additionally, krill were kept in filtered seawater in order to monitor the catabolism of lipids during starvation, to elucidate whether the neutral and polar lipid classes are equally mobilised and whether essential fatty acids are conserved.

The three euphausiid species sampled are characterised by marked differences in their life cycles. Unlike the other Antarctic euphausiids, E. superba does not rely on internal reserves for fuelling reproduction but is dependent on external sources making use of the summer phytoplankton bloom. These differences are mirrored in the species' lipid compositions with E. superba not relying on wax esters for lipid storage. Hence, comparative analyses shall help to better understand the ecophysiological advantages of different lipid compositions.

Another central topic to be addressed during this cruise was the accumulation of lecithin, which may attain exceptionally high levels in polar euphausiids. The physiological significance of this unusual phenomenon is still unknown. The identification of the position of these lecithin stores in the krill body (i.e. proximity to certain organs) and their ultrastructure, as well as a potential selective utilisation or conservation of this reserve under controlled feeding and starvation conditions may provide information on the ecophysiological role of this membrane lipid. Accordingly, the lipid-rich organs (i.e. gonads, hepatopancreas) of mature specimens of the three euphausiid species were dissected and either frozen in super-cooled hexane for cryosectioning and histochemical analyses or preserved in glutaraldehyde/paraformaldehyde for transmission electron microscopy (TEM).

Methods and accomplishments
Zooplankton was sampled by RMT 1+8 hauls (mesh size 330 and 4,500 µm, respectively, 25 l closed cod-end) in the upper 40-50 m. Thus, the animals were obtained in good condition. Additionally, intact animals were taken from big catches with the standard RMT (double oblique tows to 200 m depth). Krill larvae were obtained from hand-towed nets (55 µm mesh size, 30 m depth) or from vertical WP-2 net hauls with a 28 l closed cod-end (200 µm mesh size, 100 m depth). Sampling was performed between 06.12.2005 and 02.01.2006.

In total, 208 samples of *E. superba*, 108 of *T. macrura* and 55 of *E. crystallorophias* were collected for field measurements. Live krill were immediately sorted, staged, rinsed with deionised water and frozen in glass vials at -80°C or dissected for histochemistry and TEM.

Tab. 8.1: List of experiments. S-H-F= feeding on *Scripsiella* followed by starvation and subsequent feeding on *F. cylindrus*, F-H-S= feeding on *F. cylindrus* followed by starvation and subsequent feeding on *Scripsiella*.

E. superba				
Station	**Number of krill**	**Stage**	**Food**	**Duration (d)**
44	17	Immature, adult	*Scripsiella sp.*	16
45	17	Immature, adult	*F. cylindrus*	17
46	20	Juvenile	*F. cylindrus*	17
46	43	Juvenile	*S-H-F*	17
46	20	Immature, adult	starvation	25
46	25	Immature, adult	*Calanoides acutus*	30
47	21	Juvenile	*F-H-S*	17
95	40	Juvenile (1+)	starvation	14
E. crystallorophias				
Station	**Number of krill**	**Stage**	**Food**	**Duration (d)**
42	11	Immature, adult	*F. cylindrus*	15
42	11	Immature, adult	*Scripsiella sp.*	15
T. macrura				
Station	**Number of krill**	**Stage**	**Food**	**Duration (d)**
113	20	Adult	starvation	15

Controlled feeding experiments were carried out with monoalgal cultures of the Antarctic ice diatom *Fragilariopsis cylindrus*, with a temperate dinoflagellate of the genus Scripsiella or with late copepodiites of *Calanoides acutus* (Table 8.1). Krill were transferred to 15 and 20 L aquaria with filtered seawater and acclimated 24 hours for defaecation. Every day, krill were transferred to new aquaria with filtered seawater and algae (approx. 300 - 400 mg C/L) or copepods (6.6-10.9, ind./L, average carbon content will be determined in the home lab) were added. Sub-samples were taken every four to seven days. Krill in poor condition were removed, staged, rinsed with deionised water and frozen in glass vials at -80° C. Food samples were regularly taken for later analysis of fatty acid composition. Additionally, faecal strings were isolated and frozen in dichloromethane/methanol (2:1 by volume) under nitrogen atmosphere at -80° C for subsequent lipid analyses. Food uptake was not quantified in the algal experiments, and monitored by counting of copepods. On average, 5.2 copepods (range 2.5-11) were eaten per day by each krill.

In the home laboratory, dry mass of field and experimental samples will be measured after lyophilisation and total lipid content, lipid classes and fatty acid compositions will be determined for all samples.

8.2 Lipid metabolism of *Clione* antarctica as related to its only prey *Limacina helicina*

Clione antarctica, like its Arctic congener *C. limacina*, is characterised by a very unusual lipid composition. It is the only planktonic animal utilising diacylglycerolethers (DAGE) as storage lipid. Furthermore, its lipids comprise high percentages of odd-chain fatty acids that are characteristic for prokaryotes. *C. antarctica* is monophagous and feeds solely upon the thecosome pteropod *Limacina helicina*. The latter, however does not contain the unusual lipids and fatty acids and hence, these compounds have to be synthesised by *C. antarctica de novo*. The ecophysiological significance of DAGE storage combined with odd-chain fatty acids remains speculative. Biosynthesis of DAGE is believed to be an evolutionarily rather ancient feature and - the lipid droplets being situated directly underneath the integument - they possibly act as a biocide.

A total of 65 live pteropod samples were collected with the standard RMT (see above), total length and shell diameter were measured for *C. antarctica* (9 - 26 mm) and *L. helicina* (2 - 6 mm), respectively, the animals were rinsed with deionised water and frozen at -80°C. In collaboration with Marco Böer from the AWI, dry mass, lipid content, lipid class and fatty acid compositions will be determined in the home laboratory.

8.3 Metabolic enzyme activities of Antarctic copepods in comparison with temperate and Arctic species

Ten specimens of the herbivorous copepod species *Calanoides acutus, Calanus propinquus, Rhincalanus gigas* and of the carnivorous *Pareuchaeta antarctica* were collected, rinsed with deionised water and frozen at -80° C. In the home laboratory, the activity of various metabolic enzymes will be determined. These analyses will be carried out by Tobias Kreibich from the AWI. The results will be compared to respective data from Arctic and temperate species in order to detect potential latitudinal differences.

9. DISTRIBUTION OF CHLOROPHYLL A IN THE LAZAREV SEA

Bettina Fach[1)], Gesine Schmidt[1)], Lutz Auerswald[2)], Andreas Hayden[1)], Regine Herrmann[1)], Sönke Hohn[1)], Sören Krägefsky[1)], Bettina Meyer[1)]

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Introduction

The aim of this cruise was to determine krill abundance and perform different physiological experiments. As phytoplankton is the main food source for krill, as well as relates to nutrient distribution and flux, its concentration is a basic parameter for most experiments and measurements during this cruise. Chlorophyll a is a pigment in phytoplankton and its concentration is proportional to the phytoplankton biomass. Therefore it is used as a tracer which is easy to measure.

Materials and methods

Chlorophyll a was measured at every CTD station. Water was taken at discrete depths (5 m, 20 m, 30 m, 50 m, 100 m and 200 m) from Niskin bottles of the CTD rosette and filtered onto GF/F glass microfibre filters (Whatman, 25 mm diameter), which were placed in plastic tubes filled with 10 ml of 90 % aqueous aceton and stored in a -80° C freezer. After chlorophyll a extraction for at least 24 hours, the plastic tubes were centrifuged (700 g) for 5 min. The supernatant was used to measure Chl a with a Turner 700D fluorometer (see Wright et al. 1997).

Preliminary results and discussion

In all transects high chlorophyll a values were found in the Coastal Current area at approximately 70°S. In this area elevated chlorophyll values extended down to 200 m while north of this area they are found within the upper 100 m. Elevated chlorophyll a values extended from 67°S to 65°S, which represents the Maud Rise area along the 0°W transect. Slightly higher chlorophyll a values in comparison to the surrounding water were also found at 64°S in the 3°E transect, east of Maud Rise.

In both the 3°W and the 6°W transect (Fig. 9.2) high chlorophyll values were found between 62°S and 60°S with values extending up to the 4.15 µg/ml at 3°W and 4.7 µg/ml at 6°W. This may be due to a later sampling time of about 3 weeks in comparison to the first transect and with it increased water temperatures and melted sea ice. In the 3°W and 6°W transects the chlorophyll maximum between 66°S and 65°S is found in deeper layers, between 20 and 50 m depth.

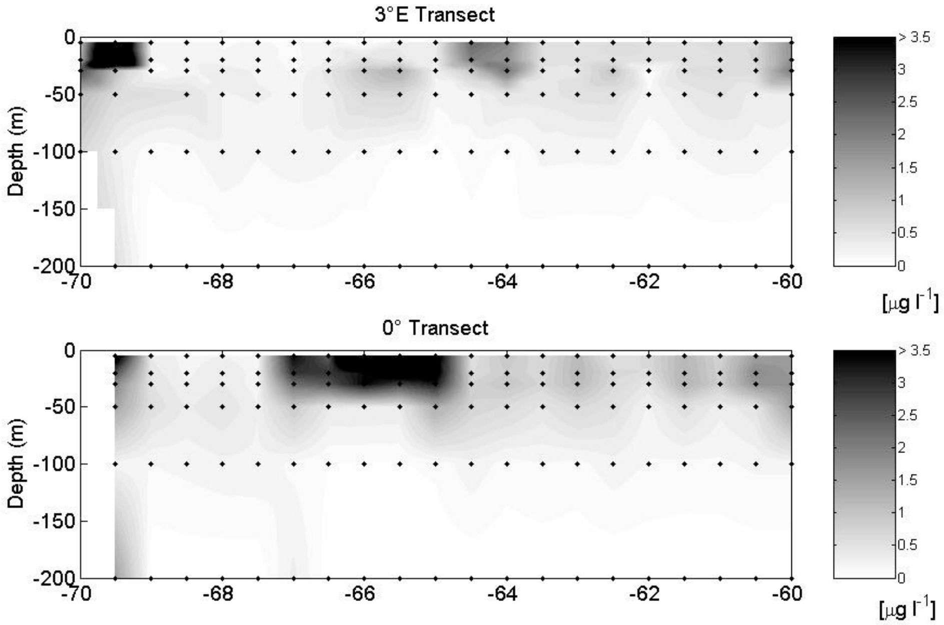

Fig. 9.1: Chlorophyll a concentrations along the station grid at 3°E and 0°W in µl l^{-1}.

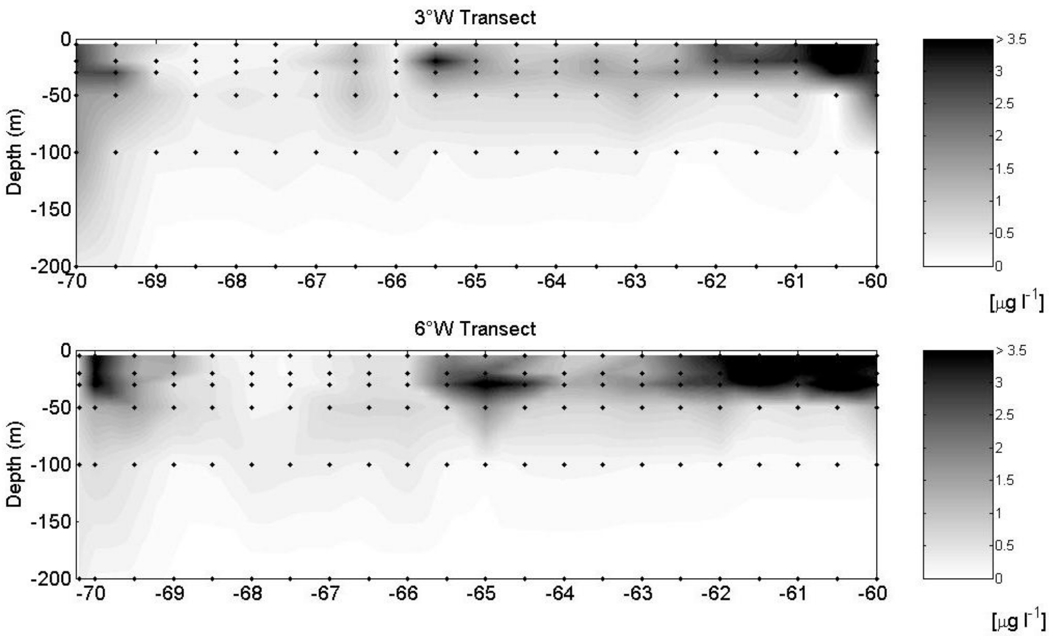

Fig. 9.2: Chlorophyll a concentrations along the station grid at 3°W and 6°W in µl l^{-1}.

Reference

Wright S. W., S. W. Jeffrey, and R. F. C. Mantoura. 1997. Evaluation of methods and solvents for pigments extraction, p. 261-282. *In* S. W. Jeffrey, R. F. C. Mantoura and S. W. Wright [eds.], Phytoplankton pigments in oceanography. UNESCO Publishing.

10. BIOLOGY OF PELAGIC TUNICATES IN THE LAZAREV SEA

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Objectives

Pelagic tunicates, particularly *Salpa thompsoni* but including *Ihlea racovitzai*, are important components of the Southern Ocean zooplankton. Their capacity for rapid population growth together with high grazing rates means that they can consume a significant amount of primary production, while their large, fast sinking faecal pellets may contribute substantially to the transfer of biogenic carbon to the sea floor. A recent study by Atkinson et al. (2004) has demonstrated a southward shift in the distributional range of *S. thompsoni*. This shift is possibly related to ocean and climate warming, coupled with a reduction in sea ice extent, making the latitudes south of 60°S more favourable for salps. A corresponding decline in the biomass of *Euphausia superba* (Antarctic krill) has important implications for the functioning and trophic dynamics of the high Antarctic ecosystem.

Work at sea

This cruise formed part of an ongoing study of salp distribution, population structure and feeding intensity in the Lazarev Sea, a region close to the ecophysiological limits of *S. thompsoni*. Salps were collected whenever they occurred during a grid of double oblique RMT8 net tows between 0 and 200 m. Additional salps were collected opportunistically from mesopelgaic tows (1,000 - 3,500 m) conducted both during the grid survey and in the vicinity of Bouvet Island (~ 51°S). Immediately after capture the stomachs of 3-15 salps, representative of the size range, were dissected out and placed in 8 ml of 90 % acetone for gut pigment extraction in darkness at -20° C for at least 24 hours. Approximately 5 – 10 salps were frozen for later HPLC analysis. The size and developmental stage of all aggregate and solitary stages was determined with exception of specimens frozen for HPLC where processing time was necessarily short. Special attention was paid to abnormalities in the embryo development of aggregate *S. thompsoni*. In addition to salps, the contribution of other gelatinous plankton in terms of density and wet volume was recorded for every standard RMT8 net tow during the grid.

Distribution and abundance of Salps and other gelatinous plankton

Salpa thompsoni occurred at only 14 % of the stations, substantially lower than the 57 % recorded during April 2004 for the same survey area. Conversely, *Ihlea racovitzai* occurred at relatively high frequency (51 %), comparable to levels recorded during April 2004. Densities at stations where specimens were caught ranged from 11.16 to 0.03 ind.1000 m^{-3} (mean = 1.34 ind.1000 m^{-3}) for *S. thompsoni* and 2.04 to 0.04 ind.1,000 m^{-3} (mean = 0.44 ind.1,000 m^{-3}) for *I. racovitzai* (Fig. 10.1). *Salpa thompsoni* occurred principally in the north east and south west of the survey area, while *I. racovitzai* was more widely distributed, but with maximum densities north of ~ 65°S.

Six other gelatinous groups made major contributions to the total volume of animals sampled. *Diphyes antarctica* was a ubiquitous component of all catches and had an average sample volume of 8.83 ml.1,000 m^{-3} (Fig. 10.1). Lowest densities of this species were recorded at the southern most stations where it appeared to be replaced by *Pyrostephos vanhoeffeni*. Ctenophores were also widely distributed and contributed on average 12.9 ml.1,000 m^{-3} to total sample volume. Two species of scyphomedusae were collected during the survey, *Periphylla periphylla* and *Desmonema* sp. The former occurred predominantly on the 3°E and 0°E transects and the latter on the 3°W and 6°W transects.

Salp size and stage structure
Salpa thompsoni population structure was dominated by aggregate forms, with solitaries contributing 14 % to the total specimens collected during the Lazarev Sea grid survey (Fig. 10.2). The aggregate population was comprised predominantly of individuals 11–15 mm in length, and this was reflected by the stage structure of the population with > 75% of specimens being Stage 0 (Fig. 10.3). The population structure of salps collected from Bouvet Island (~ 51°S) was in a more advanced state with a larger average size and all developmental stages occurring. However, the ratio of solitaries / aggregates was similar to the Lazarev Sea, contributing 11 % to total densities. Notably, the Bouvet Island *S. thompsoni* population was more similar to that observed in April 2004 from the Lazarev Sea, reflecting a delayed seasonal development for this species in the south.

Ihlea racovitzai collected during the survey were all solitary animals. This species was dominated by animals 15 – 25 mm in length, ~ 20 mm smaller than the most frequently occurring size class in April 2004.

Feeding dynamics
Due to small number of *Salpa thompsoni* collected, the majority of animals were frozen, as this provides the most options for future analysis (HPLC, CN, stage structure, stable isotope). Gut fluorescence data are therefore too few for presentation at this stage. Greater than 90 *I. racovitzai* were processed for gut fluoresence from both day and night samples (Fig. 10.4). Day-time values were relatively well correlated with salp length and reached 1.1 mg.individual^{-1}. Night-time values reached 2.6 mg.individual^{-1} but were poorly correlated with salp size. It is probable that the high degree of variation observed at night was due to variation in water column chlorophyll a biomass, and this will be investigated at a later stage.

Concluding remarks
The timing of this study provided insight into the late spring gelatinous community of the Lazarev Sea. Siphonophores and ctenophores represented the major component of total community volume. Salps however, particularly *S. thompsoni*, were not abundant. The population of *S. thompsoni* sampled during the survey appeared to be at the very early stages of its seasonal development. By comparison, the *S. thompsoni* from the vicinity of Bouvet Island had a larger average size as well as a more advanced stage structure, and were more similar to the Lazarev Sea population sampled in late summer (April) 2004. The third component of this study will be

undertaken in June/July 2006, providing insight into the winter communities in the region.

Additional studies
In addition to the gelatinous data collected during the survey, macrozooplankton (RMT8) and mesozooplankton (RMT1) samples were collected from the 0°E and 6°W transects for community structure analysis. These data will be combined with data from previous surveys for analysis of interannual variation in the Lazarev Sea.

Fish samples, predominantly myctophids, were collected whenever they occurred during the survey. One third of fish were preserved in formalin for gut content analysis, while the remaining 2/3 were frozen at -80° C for genetic and stable isotope analysis.

Finally, ~ 800 samples of individual animals were taken opportunistically from benthic Agassiz trawls, deepwater RMT trawls (1,000 – 3,500 m), and standard RMTs and either dried or frozen for stable isotope analysis. Specifically collections were taken from Bouvet Island (~ 51°S), the Antarctic continental shelf, and from stations at 60°S, 65°S and 70°S during the grid survey. These samples will be used for trophic studies, with an emphasis on bentho-pelagic coupling, and latitudinal isotope gradients.

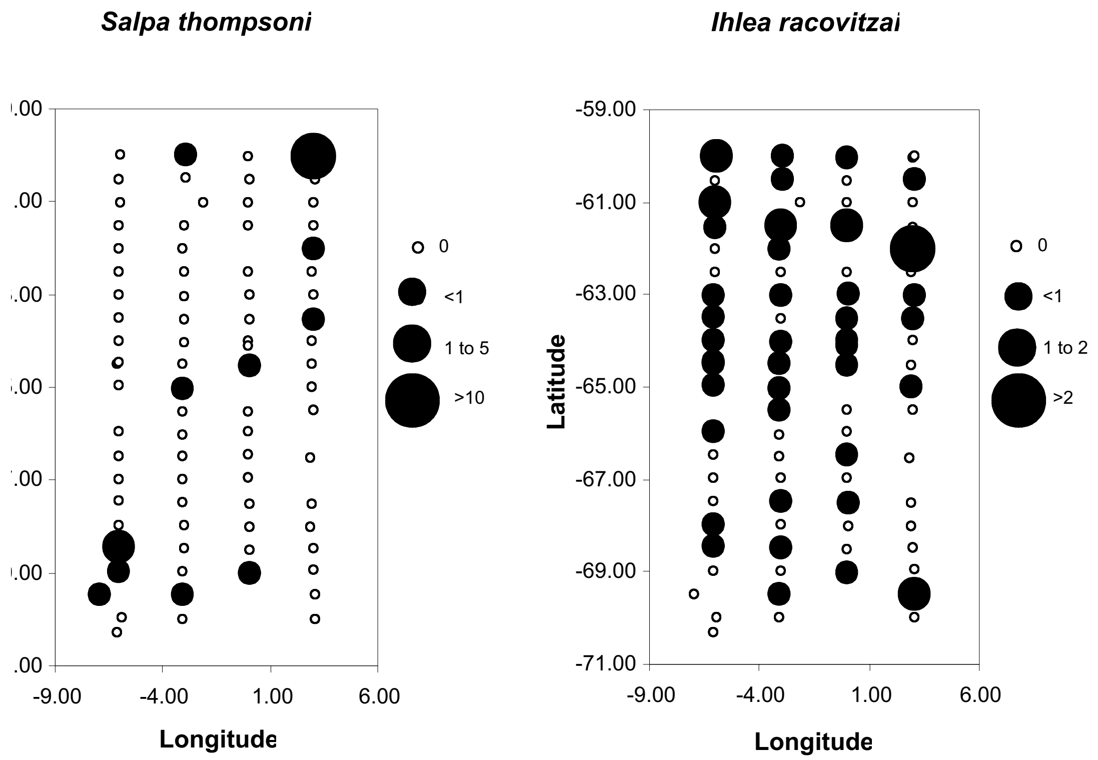


Fig. 10.1: Spatial distribution of Salp thompsoni and Ihlea racovitzai in the Lazarev Sea during December 2005. Bubble size is scaled by salp densities.

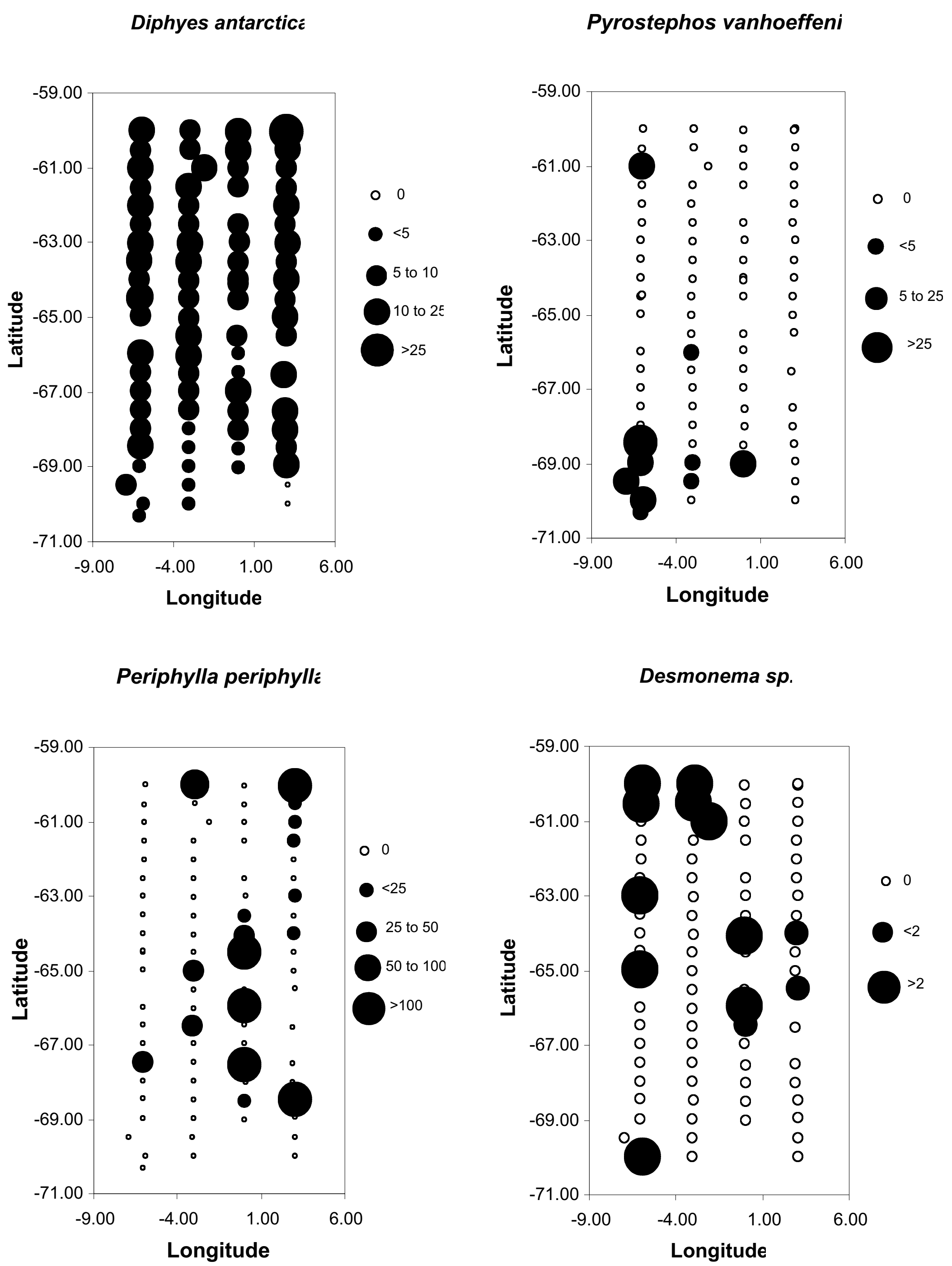
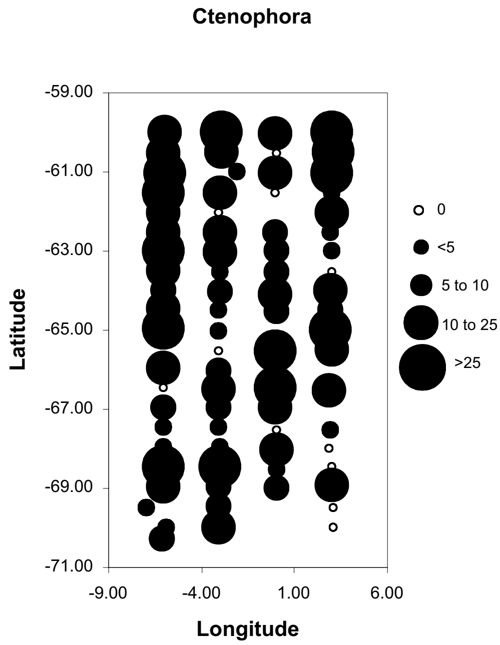


Fig. 10.1 continued: Spatial distribution of Diphyes antarctica, Pyrostephos vanhoeffeni, Periphylla periphylla and Desmonema sp. in the Lazarev Sea during December 2005. Bubble size is scaled by volume.1000 m^{-3}.

Fig. 10.1 continued: Spatial distribution of Ctenophores in the Lazarev Sea during December 2005. Bubble size is scaled by volume 1,000 m^{-3}.



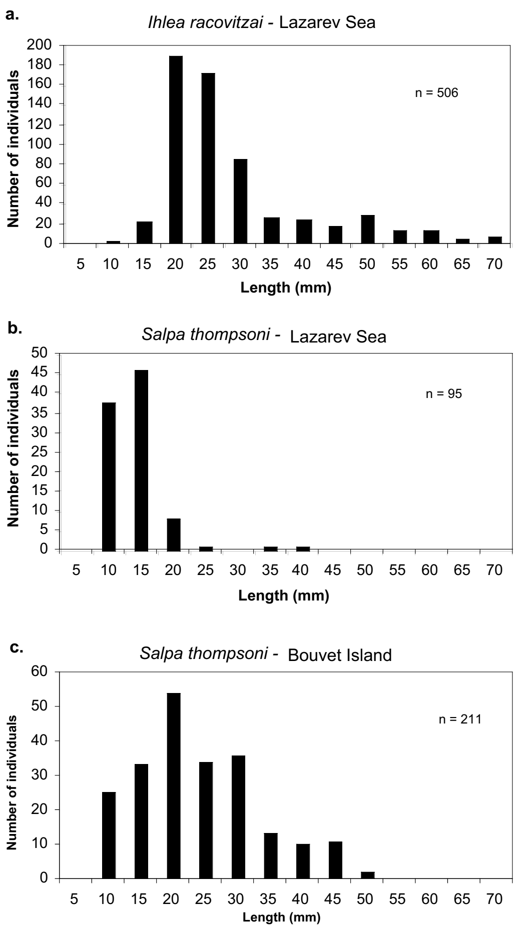


Fig. 10.2: Length frequency distribution of a. Ihlea racovitzai and Salpa thompsoni in the Lazarev Sea, and c. Salpa thompsoni in the vicinity of Bouvet Island (~ 51°S)

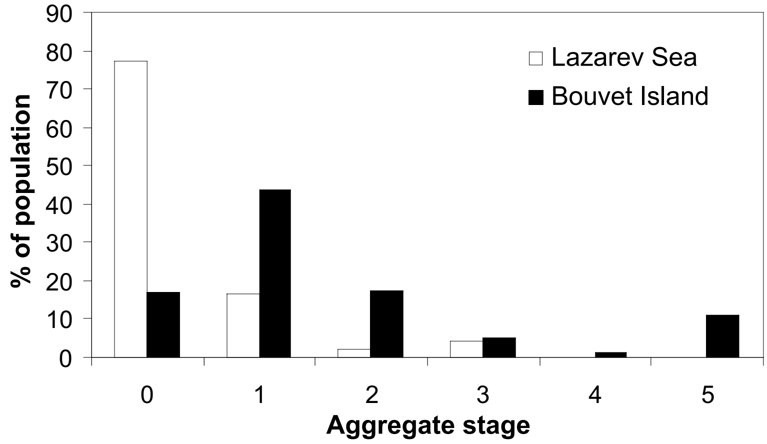


Fig. 10.3: Stage structure of aggregate Salpa thompsoni *collected from the Lazarev Sea and the vicinity of Bouvet Island (November / December 2005)*

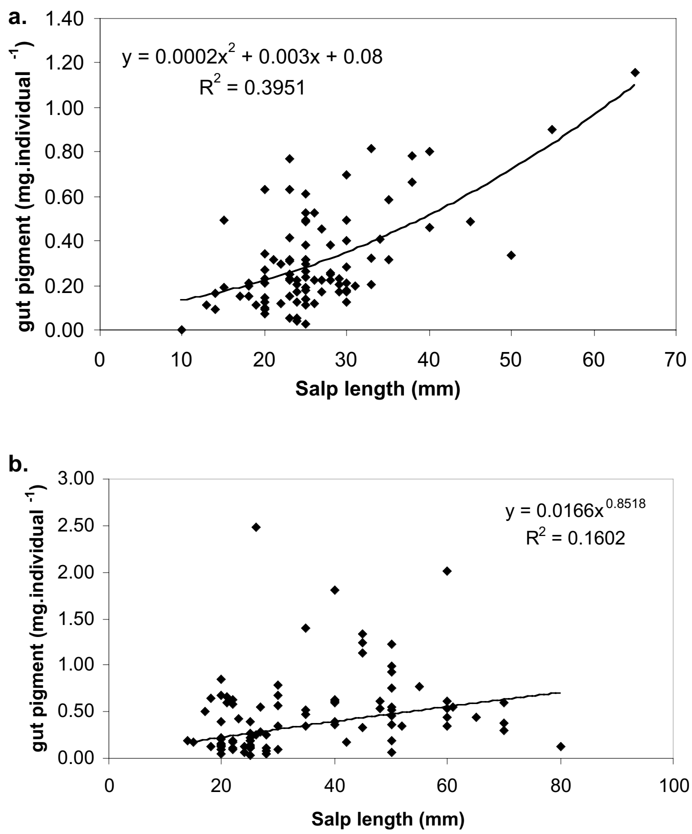


Fig. 10.4: Gut pigment content of Ihlea racovitzai *from a. day and b. night samples in the Lazarev Sea (December 2005)*

Reference

Atkinson, A., Siegel, V., Pakhomov, E.A., Rothery, P., 2004. Long-term decline in krill stock and increase in salps within the Southern Ocean. Nature 432, 100-103.

11. TROPHIC ECOLOGY OF CHAETOGNATHS AND THEIR CONTRIBUTION TO THE VERTICAL CARBON FLUX IN THE LAZAREV SEA

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Introduction
Chaetognaths are known as the mayor zooplankton predators in the Southern Ocean due to their great abundance which generally ranges from 30 to 90 % of the total biomass of all other carnivores (Pakhomov et al 1999). They contribute more than 60 % to the total predation impact of other carnivorous zooplankton and therefore are considered one of the key species in the Antarctic planktonic food web.

Copepods form the basis of chaetognath diets, so predation impact and the role of these predators on population dynamics of copepods can be very significant.

The most abundant chaetognath species in the Antarctic waters are *Eukrohnia hamata, Sagitta gazellae and S. marri* attaining 90 to 95 % of total chaetognath abundance. Previous work on the trophic impact of these species has been carried out in more detail way by Øresland (1995) and Froneman et al. (1998) in the Gerlache Strait and off Marion Island, respectively. They established predation impacts by analyzing gut contents of individuals; however, they may have overestimated their feeding rate by assuming a digestion time (DT) from an organism living at higher temperatures (6^{o} C).

Objectives
Taking into account the great abundance of chaetognaths and the presence of larger animals in the Southern Ocean it has been suggested that chaetognaths could play an important role in sedimentation of secondary production via fecal pellets (Dilling & Alldredge 1993).

The aim of this study is to improve the knowledge of feeding rate estimates of Antarctic chaetognaths species by estimating their digestion time and to study their possible effects on the modification of the vertical fluxes of particulates.

Work at sea
Material and Methods
Life chaetognaths for experiments were collected in a total of 18 net hauls during the cruise by using a special net equipped with a large cod end (ca 28 l). Net hauls were usually preformed from 150 to 0 m depth. A total of 80 chaetognaths (*E. hamata* and *S. marri*) were incubated *in situ* conditions and fed with copepods ranging from 500 to 2,000 µm carapace length. To estimate DT, chaetognaths were observed every hour to determine the moment when they captured their prey and were then

observed until they defecated. Fecal pellets of chaetognaths were collected, measured and used to estimate sinking velocities. *Sagitta gazellae* usually occur in greater depths so that they could not be collected with this net. Therefore, I used chaetognaths collected by an RMT net (deployed from 0 - 350 m) for experiments (n ~ 70). Some *S. gazellae* in good condition were also incubated to measure metabolic rates. Oxygen uptake rates were simultaneously measured using the Winkler technique and Mycro Optodes. The ammonium excretion rates were measured by means of photometicly method.

On two occasions, some *Oikopleura* sp. (Appendicularia) were collected in good condition (with their houses intact) so that I could perform some experiments to establish fecal pellet and house production rates. The data of fecal pellet sinking rates of *Oikopleura* sp. were used to compare them with those obtained from chaetognaths.

Preliminary Results and Discussion

Digestion Time experiments

Of the ca 150 experiments done with chaetognaths to estimate DT, I obtained nine values of DT for three of the most abundant species (Table 11.1). In general, the DT estimates are similar in the different species, and also similar to those reported for *S. elegans* at the same temperature (Feigenbaum 1982). They are lower, however, than the assumed in previous works in Antarctica (ca. 15 hours) which lead to an underestimation of ca. 20 % of the predation impact of chaetognaths in the Southern Ocean.

Tab. 11.1: Digestion Time (min) and Standard Deviation of the most abundant chaetognath species

Specie	Mean DT	S.D.
E. hamata	660	--
S. marri	613	47
S. gazellae	660	180

Contribution to vertical carbon flux

Sinking rates of fecal pellets ranged from 33 to 700 m day^{-1} (mean of 230 m day^{-1}). These high sinking rates suggest that chaetognaths could contribute significantly to the sedimentation of secondary production. As it can be observed in figure 11.1, chaetognath fecal pellets have a lower sinking rate compared with pellets of *Oikopleura* sp. of the same volume. This suggests that the fecal pellet of the latter is denser than those of *S. gazellae*. Density differences may result from differences in content and packaging. The results of sinking rates of *S. gazellae* are similar to the measured by Dilling and Alldredge (1993) and confirm the hypothesis that chaetognath fecal pellet may play a significant role in the carbon budget. It is also noteworthy that 30% of the pellets collected from *S. gazellae* did not sink, remaining neutrally buoyant or floating to the surface. The presence of floating pellets seems to be related to the food ingested by the chaetognath and not by the size of the pellet

(Fig. 11.2). Pellets of *E. hamata* and *S. marri* could not be recovered to be used to measure sinking rates since they always got stuck to the glass pipettes.

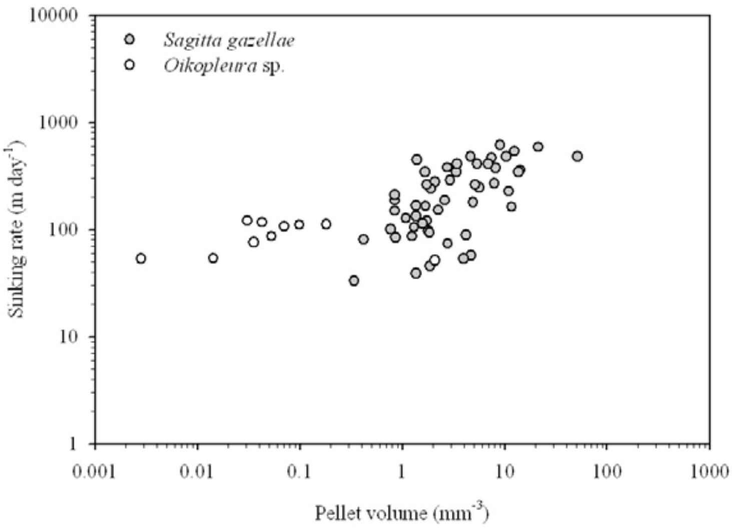

Fig. 11.1: Sinking rates of chaetognath fecal pellets from Dilling and Alldredge (1993), **+** *fecal pellets of copepod, nauplii, euphausiids, pteropods and salps from Bruland and Silver (1981). Grey and white dots from data collected on this cruise*

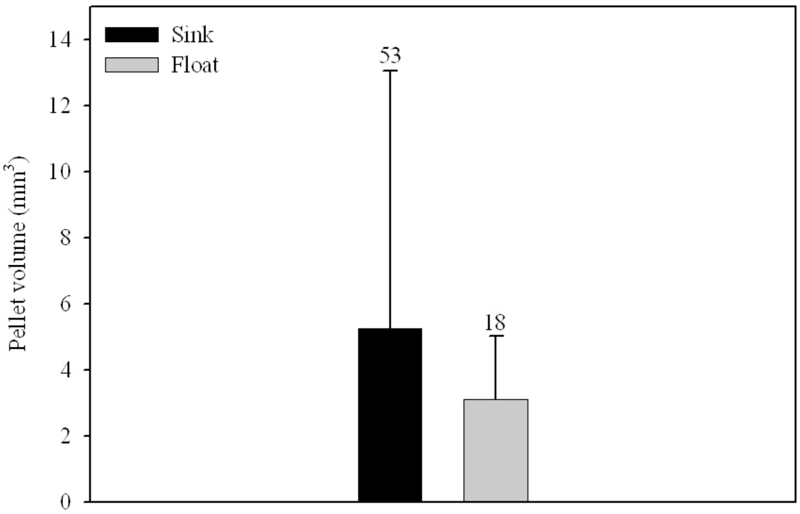

Fig. 11.2: Relationship of volume and sinking property of Sagitta gazellae fecal pellets. (Numbers above the bars correspond to the number of measurements)

Metabolic rates

The respiration rates of *S. gazellae* were in a range of 0.136 to 0.075 µl O_2 mg DW^{1} h^{-1} (Fig. 11.3), which is similar to the results obtained for *Euphausia superba* larvae (caliyptopes and furcilla) (Meyer et al 2005). It is expected that the metabolic rates of chaetognaths are lower than organisms of the same biomass since they are relatively passive swimmers. They usually move only short distances to escape predators or to attack their prey. *Sagitta gazellae* seems to have special buoyancy adaptations by reducing their musculature (the chief component of the trunk). This helps them to maintain buoyancy close to neutral in contrast to other species that must swim in order to maintain their position in the water column.

The values of ammonium excretion rates and oxygen consumption rates are relatively similar except for the experiment 4 where there is a high ammonium excretion rate and low oxygen consumption related to the DW of *S. gazellae* (Figs. 11.3 and 11.4). This reflects the poor physiological condition of one of the animals, which died during the experiment.

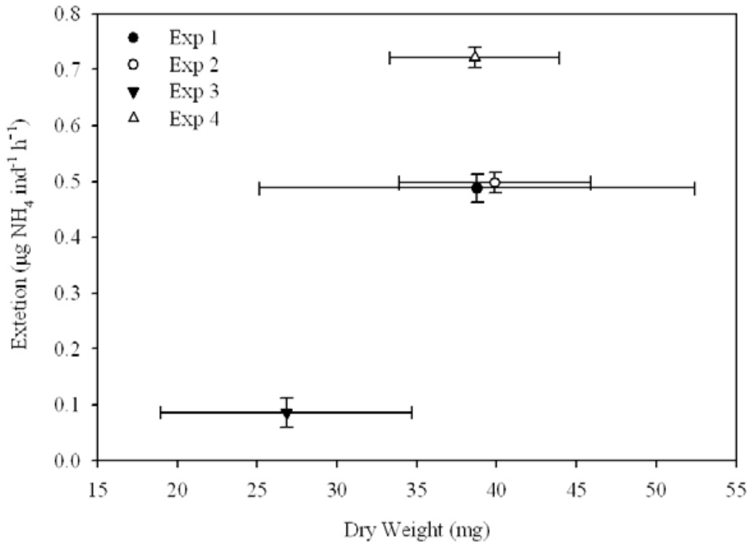

Fig. 11.3: Ammonium excretion of Sagitta gazellae *in relation to their dry weight (mg)*

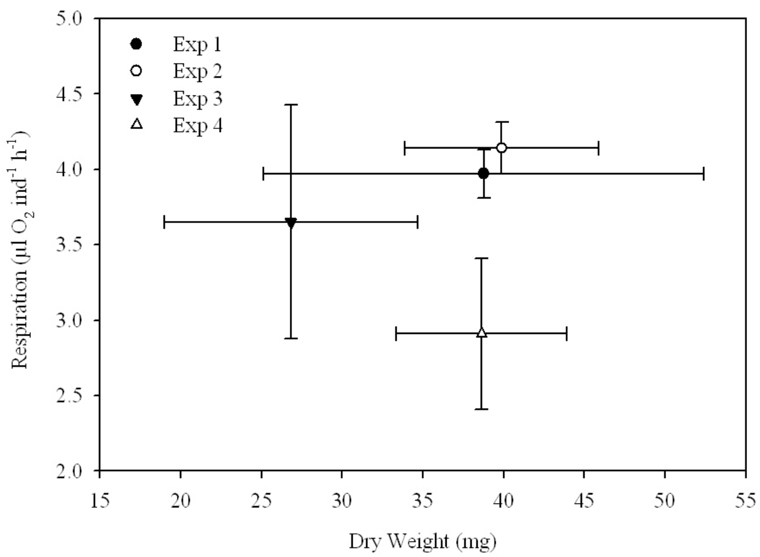

Fig. 11.4: Oxygen uptake rates of Sagitta gazellae *in relation to their dry weight (mg)*

The exertion rates are also similar to juvenile stages of krill (see Meyer et al. in this section) however due to values are close of the measurement limit of the equipment the results should be considered with caution.

Further work will include analysis of chaetognaths collected by the Multinet on this cruise and relate their abundance and distribution to oceanographic conditions. I also will perform gut content analysis of the most abundant chaetognath species in order to determine predation impact on the copepod community. Chaetognaths and the fecal pellets they produced were frozen and will be used to determine carbon content and density. In addition a total of 93 chaetognaths where measured and frozen in order to estimate dry weight and carbon content.

I would like to thank Volker Strass for his support during the cruise, to Bettina Meyer Carsten Pape and Veronica Fuentes for allowing and helping me to perform estimations of ammonium excretion and oxygen consumption rates. I am also grateful to the great crew of RV *Polarstern*.

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Meyer B., Spahic S., Fuentes V., Guerra C. & Teschke M. (2005). Survival strategies of Euphausia superba in Autumn. Berichte zur Polar und Meeresforschung, 500: 166-169.

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12. THE ECOLOGY OF THECOSOME PTEROPODS IN THE LAZAREV SEA

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Ulrich Bathmann (not on board)

Objectives

The dominant thecosome pteropods in the high Antarctic are *Limacina helicina* and *Clio sulcata*. Although they have often been recorded in high numbers, very little data exists on the biology of these organisms in the Southern Ocean. Recent studies, however, indicate that both *Clio sulcata* and *Limacina* spp. can contribute quite substantially to total zooplankton grazing impact. Thecosome pteropods also form a link with the higher trophic levels, being a major food item of certain fish species, marine mammals and sea birds, as well as a number of carnivorous zooplankton species. In addition to transferring carbon to higher trophic levels, thecosome pteropods also contribute to the removal of carbon from the photic zone through the sinking of empty shells of dead individuals and also the sinking of abandoned mucous webs.

The aims of the present study were to determine the spatial distribution patterns, size structure, and the trophodynamics of the dominant thecosome pteropods in the Lazarev Sea during austral spring, 2005.

Work at sea

Methods

Thecosome pteropods were collected at each station from the standard oblique RMT-8 tows (0 - 200 m) for counting. In order to determine the size structure of dominant thecosome pteropod, animals collected from the standard oblique RMT-1 tow (0 - 200 m) will be counted and measured at a later stage. Pteropods collected in the multinet will be counted and measured in order to determine the vertical distribution patterns of the dominant species.

In order to determine the trophodynamics of the dominant thecosome pteropods in the region, the grazing impact was estimated using the gut fluorescence technique. Animals in good condition were immediately placed in 90 % acetone and stored at -20°C for over 24 hours. Pigments were measured fluorometrically using a Turner Fluorometer.

In addition to this, thecosome pteropods of various sizes were frozen at -80°C for later lipid and stable isotope composition analyses. These analyses will be used to determine the trophic position and diet of both *Clio sulcata* and *Limacina helicina*.

Preliminary results

Observations of thecosome pteropod numbers from the standard RMT-8 catches suggest that *Clio sulcata* was most abundant in the stations north of 65.5°S (up to 10 ind. 1,000 m^{-3}, Mean = 1.7 ind. 1000 m^{-3}, Std. Dev. = 2.5 ind. 1000 m^{-3}) (Fig. 12.1), while *Limacina helicina* made the greatest contribution to total pteropod numbers south of 68.5°S (up to 31.5 ind. 1000 m^{-3}, Mean = 1.3 ind. 1000 m^{-3}, Std. Dev. = 3.9 ind. 1,000 m^{-3}) (Fig. 12.1). Between 65.5 and 68.5°S, pteropods were almost absent. Further abundance and size structure results are not yet available.

During the survey we encountered, at numerous stations particularly in the northern parts of the survey area, what are described by van der Spoel as 'aberrant' individuals of *Clio sulcata*. These individuals apparently represent resting stages that are able to develop into normal adults during favourable environmental conditions. The change in morphology begins with loss of pigmentation and change in shape of the posterior region of an adult, afterwhich the anterior body region (including the mouthparts, gut and wings) detaches from the posterior region and swims out of the shell. These shell-less asexual individuals are referred to as 'primary specimens' by van der Spoel. The remaining posterior region is known as the 'metamorphosed specimen' or the 'aberrant' individual. The 'aberrants' develop two neomorphic wings before schizogamy occurs. They contain both male and female reproductive organs and lack mouthparts and a gut. Histological studies suggest that they are capable of self-fertilization, but this has not yet been proven.

Gut pigment contents for *Clio sulcata* were very high, ranging from 31.2 ng(pigm)ind^{-1} (body length < 5 mm) to 15501.9 ng(pigm)ind^{-1} (body length = 15 mm) (Fig. 12.2). Greatest values in gut pigment content for *Clio sulcata* were observed at 70°S (Fig. 12.3) and corresponded with a phytoplankton bloom as well as with the largest individuals collected. Gut pigment content for *Limacina helicina* ranged from < 1 ng(pigm)ind^{-1} (shell diameter < 1 mm) to 3162.2 ng(pigm)ind^{-1} (shell diameter = 5 mm) (Fig. 12.2). Greatest values in gut pigment content for *Limacina helicina* were observed at stations between 60 and 62°S, corresponding with the larger individuals collected for gut fluorescence (Fig. 12.3). No diel variability in gut pigment content was observed for either *Clio sulcata* or *Limacina helicina*.

Results of lipid and stable isotope composition are not yet available but the following table provides an indication of the samples collected.

Table 12.1: Samples collected and frozen at -80°C for lipid and stable isotope analyses. Measurements of *Limacina helicina* are of shell diameter and those of *Clio sulcata* are of body length, from oral to aboral ends.

	Southern Stations (67-70°S)		**Middle Stations (63.5-66.5°S)**		**Northern Stations (63-60°S)**	
	Lipids	**Isotopes**	**Lipids**	**Isotopes**	**Lipids**	**Isotopes**
***L. helicina* (<2mm)**	165	159	25	28	11	11
***L. helicina* (2-4mm)**	32	40	21	23	35	28
***L. helicina* (>4mm)**	3	5	20	18	27	38
***C. sulcata* (<10mm)**	6	5	26	29	20	20
***C. sulcata* (10-15mm)**	12	14	82	59	20	30
***C. sulcata* (>15mm)**	25	26	38	33	48	47

Conclusion

Total pteropod numbers were not very high, typically contributing an average of 1.3 ind. 1,000 m^{-3} and 1.7 ind. 1000 m^{-3} for *Limacina helicina* and *Clio sulcata*, respectively. However, a maximum value of 31.5 ind. 1,000 m^{-3} was recorded for *Limacina helicina* at 68.5°S. *Clio sulcata* reached maximum values (around 10 ind. 1,000 m^{-3}) at stations further north, between 63.5 and 60°S. Results from the RMT-1 and multinet samples will allow for better understanding of pteropod size stucture and vertical distribution patterns in the region.

Gut pigment contents for both species were very high, indicating that they are potentially important grazers in the community. Due to the fragile nature of these animals, gut evacuation rate and gut pigment degradation experiments could not be conducted, and therefore these variables will need to be assumed when calculating the daily ingestion rates of both species.

With the results of the lipid and stable isotope analyses we will be able to determine the trophic positions of various size classes of both species, as well as their diets.

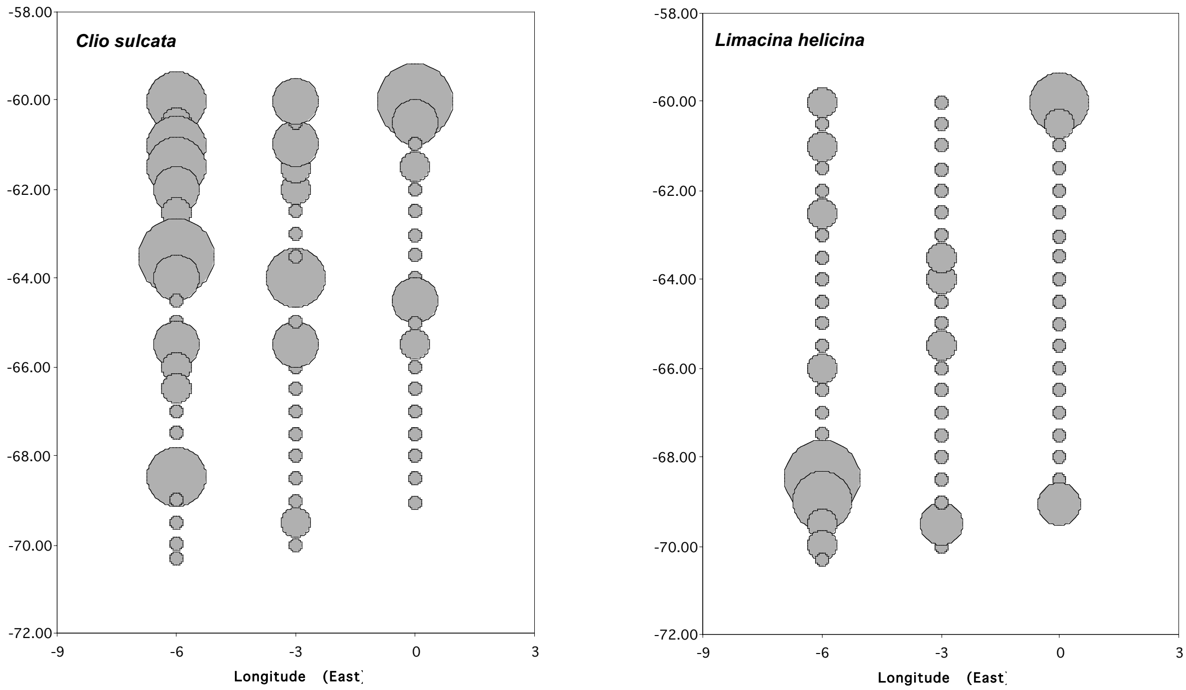
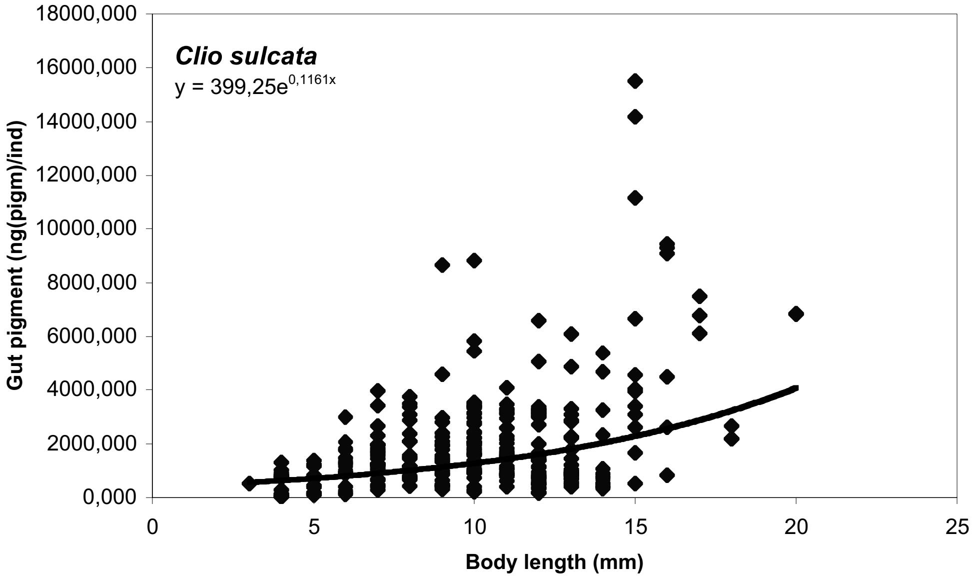


Fig. 12.1: Distribution patterns of Clio sulcata and Limacina helicina on three of the transects in the Lazarev Sea, during austral spring 2005. In the key in the centre, 1 < 1 ind. 1000 m^{-3}, 2 = 1 – 2 ind. 1000 m^{-3}, 3 = 2 – 5 ind. 1000 m^{-3}, 4 = 5 – 10 ind. 1000 m^{-3}, 5 > 10 ind. 1000 m^{-3}.



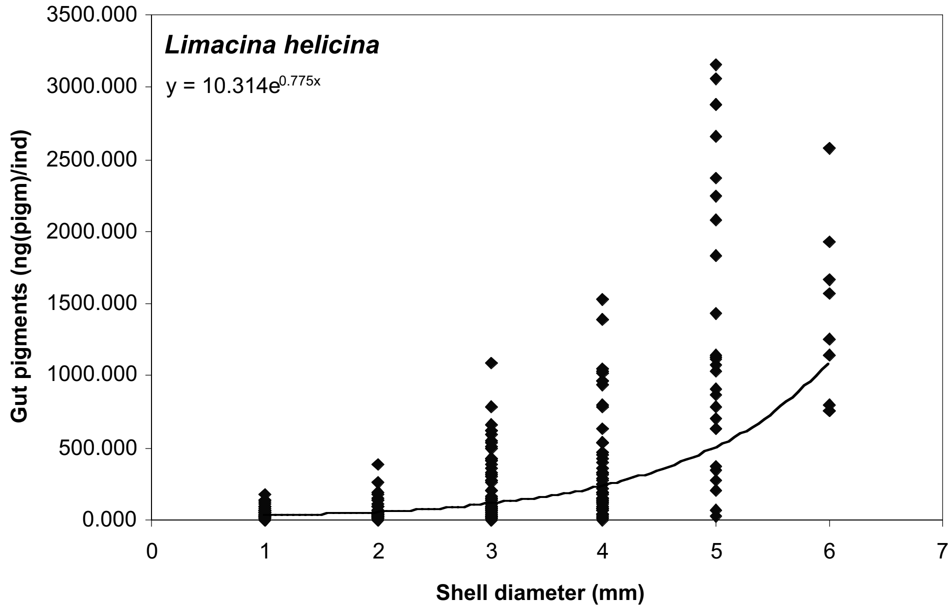
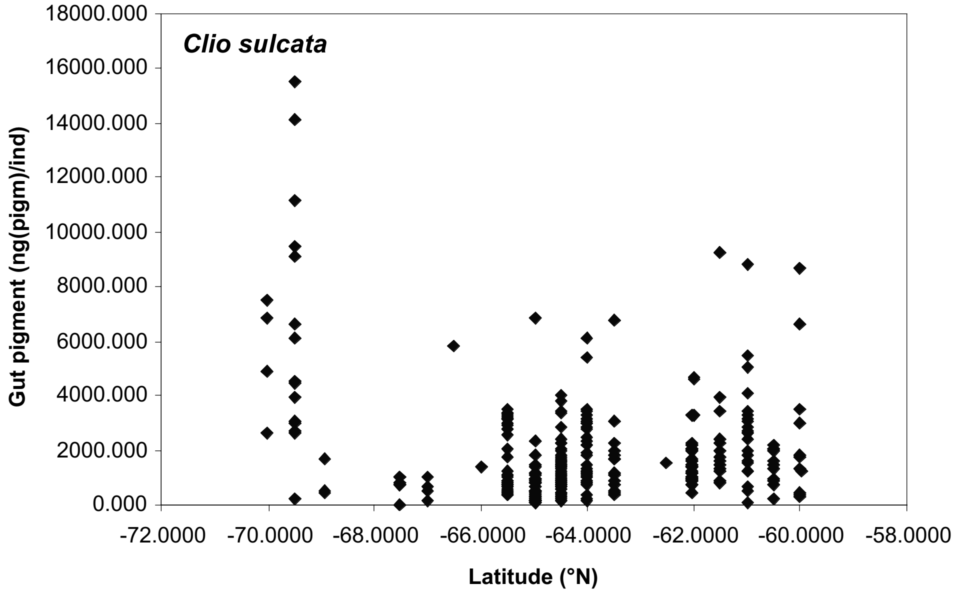


Fig. 12.2: Change in gut pigment contents of Clio sulcata and Limacina helicina with increasing size. Size of C. sulcata measured from oral end to aboral end, while that of L. helicina is a measure of the shell diameter.



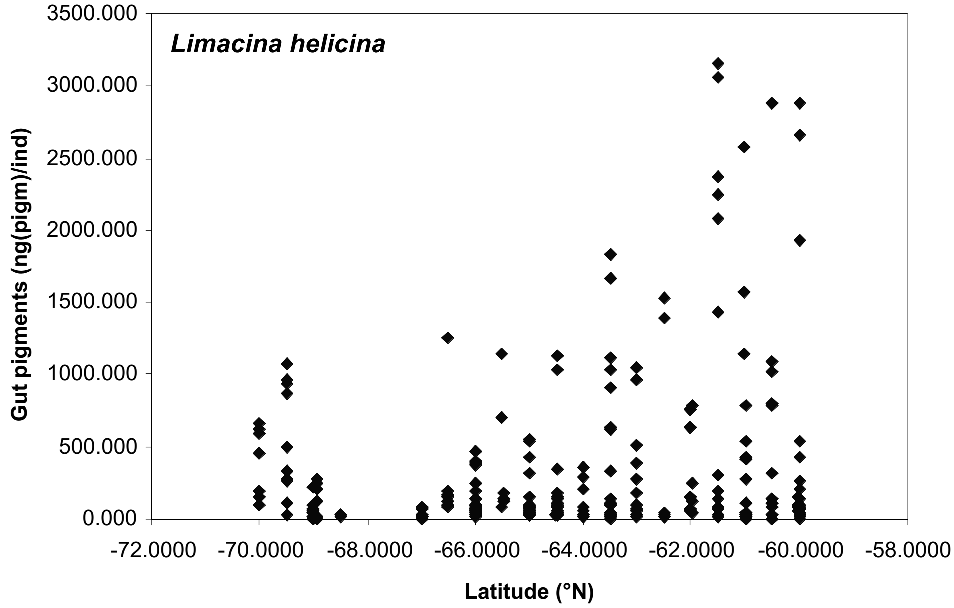


Fig. 12.3: Gut pigment contents of Clio sulcata and Limacina helicina with change in latitude, in the Lazarev Sea, austral spring 2005

13. BENTHOPELAGIC COUPLING UNDER AUSTRAL SPRING CONDITIONS

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Objectives

In most of the Antarctic shelf areas, the seafloor is covered by a so-called "bio-carpet", which consists of very well developed, diverse and of high biomass benthic communities. These communities are mainly dominated - regarding abundance and biomass - by sessile suspension feeders such as sponges, ascidians and gorgonians. They form extensive three-dimensional structures which cover large areas of the seafloor. Our questions regarding these rich benthic communities focus on different but also related aspects:

1) Which and how are the water column parameters which facilitate the development of these communities?
2) Are the water column conditions and processes much different between shelf and more oceanic areas?
3) How do these communities of benthic suspension feeders change water column properties near the seafloor, in aspects regarding matter remineralisation and in affecting the microbial loop?
4) Are there differences in feeding among the different seasons of the year? Which are the differences in water column parameters in these seasons?

To try to answer this questions, during the present cruise ANT-XXIII/2 we have tried a multidisciplinary approach, which can be subdivided in two different types of work on board RV *Polarstern*: water column analysis and feeding experiments with living benthic organisms. The main stations chosen *a priori* for water column analysis were the most near the shelf ice edge ones and some oceanic ones, for comparison. A large number of stations were also chosen in order to have a more complete data set of water column characteristics in the area at this time of the year (Table 13.1).

Work at sea

Water column characteristics

Water column analyses will provide information on the qualitative and quantitative changes of sinking matter, as a wide set of parameters covering biogeochemical, biochemical and biological aspects of the water properties have been taken into account.

A total of 44 stations were chosen within the grid area, where CTD casts were performed and water was taken at selected depths from the attached Niskin bottles for further analysis.

Samples have been taken for particulate organic carbon, nitrogen and phosphorus, Total carbon and nitrogen, biogenic silica, lipids, proteins and carbohydrates, dissolved organic carbon and nitrogen and dissolved inorganic nutrients (ammonium, phosphate, nitrite, nitrate and silicate), bacterial abundance and production analysis, chlorophyll and fractionate chlorophyll analysis and phytoplankton community determination.

For particulate organic matter analysis, water was collected from the Niskin bottles at the selected depths of each station, and was then filtered using GF/F precombusted (450º C, 5 h) filters for the different parameters. 3 Pseudo-replicates were taken for biochemical analysis. The amount of water filtered for each sample depended on the station and water availability. Filters were immediately deep-frozen in liquid nitrogen and afterwards transferred to a -27º C freezer to be processed later on in the home lab.

Chlorophyll a and phaeophytin samples were filtered through precombusted GF/F filters and frozen immediately for further analysis on board, after being kept overnight in acetone and at cold temperature and being afterwards analysed following Strickland and Parsons (1972). Phaeophytin was as well analysed after acidification of the samples. Fractionate chlorophyll samples were filtered through 10 µm filters, and processed in the same way.

Particulate organic carbon and nitrogen content will be determined with an elemental analyser (Carlo Erba). Proteins will be processed following the Lowry method (Lowry et al., 1951). Total particulate carbohydrate concentration will be measured according to Dubois et al. (1956), and extraction and quantification of total lipids will be performed according to the method of Barnes and Blastock (1973).

Biogenic silica was filtered through 47 mm nitrocellulose filters, then dried at least for 24 h and 40º C and sorted for further analysis.

For each particulate organic matter parameter, a blanc filter was also considered and kept.

Dissolved organic carbon and nitrogen samples were gently syringe-filtered through precombusted GF/F filters, and kept in glass corning tubes which had been also previously precombusted (450º C, 5 h). Three replicates were taken at each depth, and a low percentage of sulphuric acid was added to them before sealing. They will be kept at 4º C in the dark until analysis using a Shimadzu® TOC Analyser is performed.

Three replicates for each dissolved inorganic nutrient samples were taken at each depth, by gently syringe-filtering them. A volume of approx. 50 ml of filtered water was frozen at -20º C for further analysis of all dissolved inorganic nutrients in Barcelona using a Bran-Luebbe®.III Autoanalyser. Samples for nitrite, ammonium and phosphate were analysed manually on board, using colorimetric methods and a Shimadzu® spectrophotometer (Solorzano, 1969).

Triplicate samples for bacterial abundance and biomass samples were fixed and deep-frozen in liquid nitrogen and then transferred to the -27ºC freezer for further analysis. In all, 660 samples were taken for this analysis. They will be processed using flow citometry following Gasol and del Giorgio, 2000.

For analysis of bacterial heterotrophic production and activity, five samples were collected at each depth, and were incubated with titriated-leucine on board using the Kirchman, (1993) method. Some of them were analysed on board, and other remain prepared for further analysis in Barcelona. A total of 1,100 samples – including replicates - have been taken.

250 ml samples for phytoplankton community determination were taken at selected depths, and were fixed with buffered formaldehyde. At chosen stations, 100 ml samples were fixed with sodium azide for determination of phytoplankton viability.

Preliminary results

The concentrations of ammonia along the grid stations varied between 0.14 and 0.37 µmol/L. Generally, highest ammonia concentrations were found at surface layers. Thus, vertical profiles showed slightly more reduced surface layers in comparison to the more oxidised deep ones.

Nitrite concentrations ranged between 0.03 and 0.16 µmol/L, and did not present clear patterns along the vertical profiles. A more accurate analysis of the data will be done in Barcelona to see if nitrite concentrations can be related to nitrification processes.

Concentrations, though, of both ammonia and nitrite, are in the range of those found in this area at this time of the year by other authors (e.g. Scharek, 1991).

Some of the grid stations have been selected for graphic representation of ammonia and nitrite profiles along relatively shallow depths (Fig.13.1).

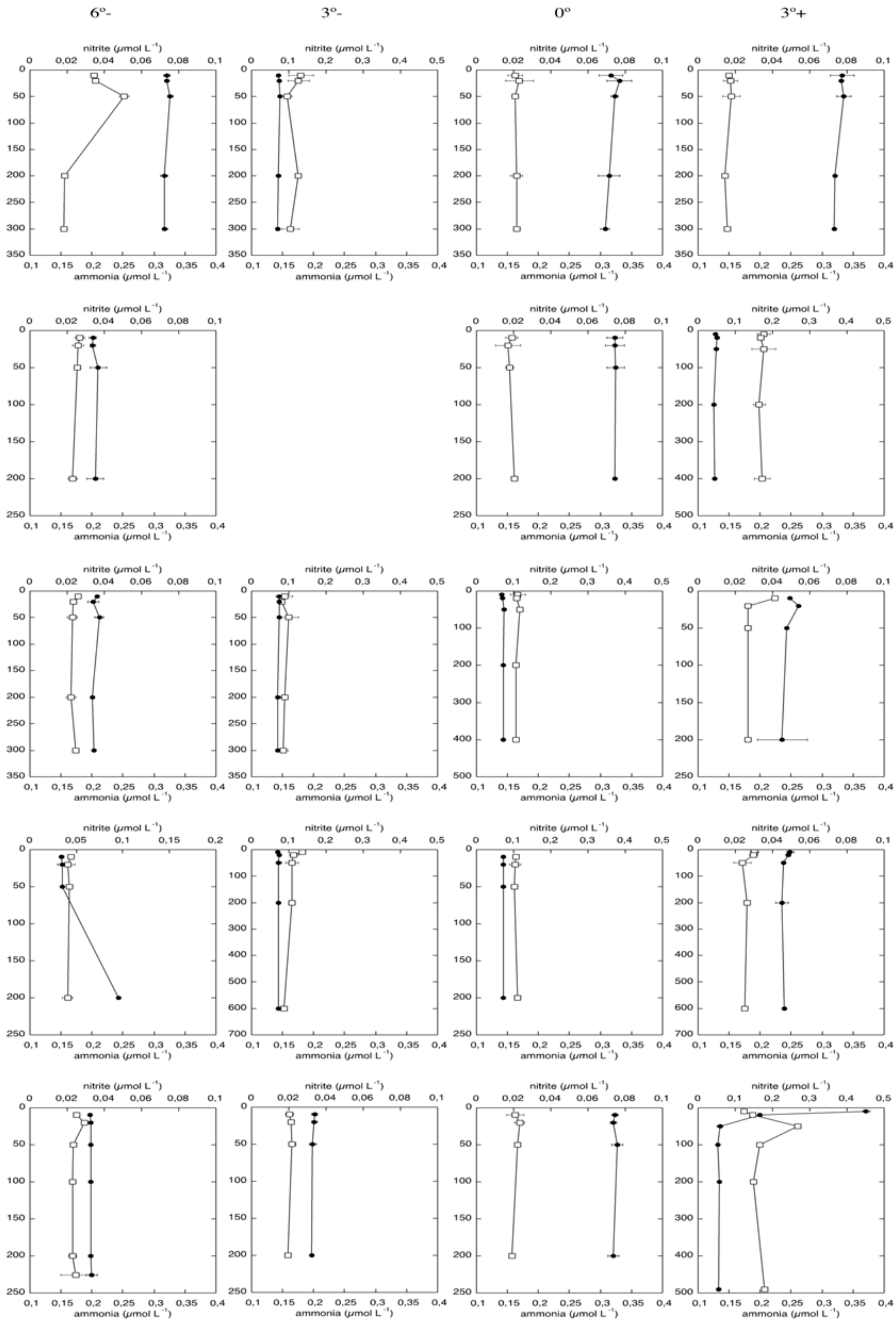

Fig. 13.1: Ammonia and nitrite concentrations (µmol/L) in longitudinal transects at different selected latitudes, including shelf (69º 59' S) and shelf break (69º 29' S), south of Maud Rise (65º 30' S), Maud Rise (64º 59' S) and the most oceanic areas (50º 59' S)

Feeding experiments with filter feeders

During the ANT-XXIII/2 cruise, feeding experiments had been carried out with several living benthic organisms, which were mainly sponges or ascidians, as they are the most representative groups in benthic communities of the Antarctic shelf. The main goal of these experiments was to study the diet of these suspension feeders during the antarctic spring conditions, and to elucidate the impact they have on the microbial loop and the biogeochemical characteristics of bottom water layers.

Specimens were collected using an Agassiz trawl. Animals were kept in a cool container, in oxygenated aquaria filled with non-filtered seawater at -1º C, until the experiments began.

Predation on the fine fraction of the plankton (picoplankton and microplankton) was to be assessed by the use of flow incubation chambers in the cool container. The potential prey items in this fine fraction included bacteria, ciliates, eukaryotic picoplankton and phytoplankton (diatoms and dinoflagellates).

The plexiglass incubation chambers held an average of 4.5 l water in volume. Each chamber was connected to a pump which recirculated the sea water with a speed of approximately 5 l/min. For each set of experiments, one incubation chamber was used as control. Predation will be further calculated by the decrease in prey concentration that is expected in the experimental chamber relative to the control one.

Normally, three sets of experiments and one control for those three were developed in each experimental set.

A total of 24 experiments were performed, in 17 of which a single specimen was used. For the other 7 experiments some of the animals were put together in order to better evaluate the community effect of these organisms in the water layers.

When the animals looked in good condition to start the experiment (e.g. osculum completely open, polips open), the incubation chambers were closed, and initial water samples were collected in each chamber for analysis of dissolved inorganic nutrients and dissolved organic carbon and nitrogen, particulate organic carbon and chlorophyll a, bacterial abundance and heterotrophic production and micro-zooplankton communities. Incubations lasted for 6 hours, during which repeated samples for bacterial abundance and production, as well as for dissolved organic carbon and nitrogen and inorganic nutrient analysis were taken. After the 6 hours, final samples were also collected for particulate organic carbon, chlorophyll a and microzooplankton community determination. Both to determine bacterial activity, abundance and biomass, samples were also taken at the time when the organisms were placed in the chambers to serve as reference to detect possible changes in the water of the chambers during the time before the experiment began.

The quantification of heterotrophic bacteria and picoeukaryotes will be done by the analysis of the 2 ml water samples collected and preserved for flow cytometry by standard protocols (Gasol and del Giorgio, 2000), stored in liquid nitrogen and after that at -27º C. Samples will be then unfrozen, stained with SYTO 13 (molecular probes) at 1.6 µM diluted in DMS), let 15 minutes to settle in the dark and run through a flow cytometer. Samples will be analyzed by using a bench machine FACScalibur of Becton and Dickinson with a laser emitting at 488 nm. They will be run at low speed (approx. 12 µL/min) and data will be then acquired in a log mode until some 10,000 are counted. Bacteria are detected by their signature in a plot of Side Scatter (SSC) vs. FL1 (green fluorescence). The settings are adapted to each sample, as the populations and their fluorescence may notably change from sample to sample.

To quantify both cyliates and phytoplankton, aliquotes of 250 ml from the initial and final water samples were preserved with lugol, which was at a final concentration of approx. 1,2 % in the samples. Subsamples of 100 ml will be allowed to settle, and will be then observed through an inverted microscope using the Utermöhl technique Dominant groups of diatoms and dinoflagellates will be quantified in this study. From each subsample, the diameters of 20 individuals of the most common diatom and dinoflagellate groups will be measured, and the volumes will be estimated from their geometric shape.

Water samples of 10 ml were syringe-filtered and fixed with sulphuric acid for further analysis of the variation of dissolved organic carbon (DOC) and nitrogen (DON). Samples were then kept at 4º C, and preserved from the light.

Water samples of 300 ml were filtered in order to analyse Chl a and particulate organic carbon (POC) concentrations both at the beginning and end of the experiments. Filters were then frozen in liquid nitrogen and preserved at -27º C. Analysis of chlorphyll data was performed on board.

Samples of 50 ml of water at initial, half and final times were filtered and frozen for further analysis of dissolved inorganic nutrients (ammonia, nitrite, nitrate, phosphate, silicates).

All specimens used in the experiments were afterwards labelled and frozen at -27º C in order to further determine their dry weight in the home lab.

Outreach project

According to the policy of our group and in order to explain the scientific research that was going on in Antarctica on board RV *Polarstern* during the ANT-XXIII/2 cruise, texts, photos and videos were also prepared for our web page in Spain. Texts and photos were sent by email to our colleagues at the ICM and were published in the web at real time (www.icm.csic.es/icmdivulga). Videos will be edited and published once we arrive in Spain. Some of the exposed topics were suggested by students of the schools which, as well as in past years, participate in the project by asking questions and being answered per e-mail by the scientists on board RV *Polarstern*.

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Tab. 13.1: Summary of stations where benthic suspension feeders or CTD-rosette water samples were taken during ANT-XXIII/2

Station	Position Latitude	Position Longitude	Depth (m)	Gear
PS69/033-1	54° 22.02' S	3° 18.16' E	0.0	AGT
PS69/033-2	54° 29.78' S	3° 13.31' E	272.4	AGT
PS69/033-3	54° 31.25' S	3° 12.40' E	345.6	AGT
PS69/033-4	54° 36.52' S	3° 12.81' E	546.8	AGT
PS69/039-1	70° 24.49' S	8° 12.52' W	568.8	AGT
PS69/039-2	70° 28.02' S	8° 9.12' W	372.4	AGT
PS69/039-3	70° 28.84' S	8° 9.90' W	315.2	AGT
PS69/042-3	69° 59.39' S	2° 57.42' E	520.8	CTD
PS69/043-3	69° 29.86' S	2° 59.86' E	2258.4	CTD/RO
PS69/046-3	67° 57.58' S	2° 55.13' E	4558.4	CTD/RO
PS69/047-3	67° 30.06' S	3° 0.33' E	4561.2	CTD/RO
PS69/050-1	66° 0.16' S	3° 0.17' E	3505.2	CTD/RO
PS69/051-1	65° 29.91' S	3° 0.53' E	2631.6	CTD/RO
PS69/052-2	64° 59.79' S	2° 59.23' E	2413.2	CTD/RO
PS69/054-3	63° 59.98' S	3° 0.45' E	2833.6	CTD/RO
PS69/056-3	63° 0.18' S	2° 57.93' E	5369.2	CTD/RO
PS69/057-2	62° 30.35' S	3° 0.28' E	5252.4	CTD/RO
PS69/059-2	61° 29.84' S	3° 0.90' E	5383.6	CTD/RO
PS69/060-2	61° 0.24' S	2° 59.87' E	5396.4	CTD/RO
PS69/062-2	59° 59.01' S	3° 2.64' E	5375.2	CTD/RO

Station	Position Latitude	Position Longitude	Depth (m)	Gear
PS69/063-2	60° 0.20' S	0° 0.21' E	5364.8	CTD/RO
PS69/065-2	60° 59.24' S	0° 0.57' W	5385.6	CTD/RO
PS69/067-2	61° 59.62' S	0° 2.84' E	5372.4	CTD/RO
PS69/068-2	62° 30.06' S	0° 0.03' W	5349.2	CTD/RO
PS69/071-4	63° 59.96' S	0° 0.04' E	5200.8	CTD/RO
PS69/073-3	64° 59.95' S	0° 0.29' E	3733.2	CTD/RO
PS69/074-2	65° 29.96' S	0° 0.75' E	3951.2	CTD/RO
PS69/078-3	67° 30.09' S	0° 3.30' W	4643.6	CTD/RO
PS69/079-2	67° 59.92' S	0° 0.14' E	4518.4	CTD/RO
PS69/082-1	69° 29.92' S	0° 1.39' W	1536.0	CTD/RO
PS69/083-3	70° 0.81' S	3° 0.06' W	2341.2	CTD/RO
PS69/084-2	69° 29.98' S	3° 2.03' W		CTD/RO
PS69/087-2	68° 0.00' S	3° 0.13' W	4132.0	CTD/RO
PS69/088-2	67° 30.18' S	3° 0.14' W	4316.4	CTD/RO
PS69/091-3	65° 59.40' S	2° 58.21' W	4821.2	CTD/RO
PS69/093-3	64° 59.63' S	2° 58.90' W		CTD/RO
PS69/095-2	63° 59.98' S	3° 0.04' W	3607.2	CTD/RO
PS69/099-2	61° 59.55' S	3° 1.43' W	5348.0	CTD/RO
PS69/101-2	60° 59.46' S	2° 57.67' W	4819.6	CTD/RO
PS69/103-2	60° 0.61' S	2° 59.21' W	5296.4	CTD/RO
PS69/104-3	60° 0.71' S	5° 58.48' W	4110.8	CTD/RO
PS69/106-3	60° 59.63' S	5° 59.10' W	5318.0	CTD/RO
PS69/108-2	61° 59.70' S	5° 57.68' W	5290.4	CTD/RO
PS69/112-2	64° 0.14' S	5° 59.27' W	5238.4	CTD/RO
PS69/114-2	64° 59.66' S	5° 59.60' W	5120.8	CTD/RO
PS69/115-2	65° 29.99' S	5° 59.94' W	5006.0	CTD/RO
PS69/119-2	67° 29.60' S	5° 59.79' W	4836.0	CTD/RO
PS69/120-2	67° 59.95' S	6° 0.07' W	4744.8	CTD/RO
PS69/124-2	69° 30.73' S	5° 59.08' W	2350.8	CTD/RO
PS69/125-2	69° 57.20' S	5° 59.28' W	2066.0	CTD/RO
PS69/126-2	70° 19.70' S	6° 8.54' W	248.8	CTD/RO

14. NEAR-SURFACE ZOOPLANKTON SAMPLING BY USE OF THE CONTINUOUS PLANKTON RECORDER – CPR

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Objectives

The aim of this study is to take zooplankton samples at the surface by the use of the continuous plankton recorder (CPR). Because of increasing changes in the environment such as global warming and its effect on the unique ecosystem of Antarctica and its surrounding water masses there is a necessity of regular examinations in this area. This CPR-project should make a contribution to the "Southern Ocean Continuous Plankton Recorder (SO-CPR) survey" about the stocktaking of biodiversity and its variability in zooplankton. It is to examine and understand the effects both naturally and humanly induced changes on the zooplankton and therefore on higher trophical levels in the foodchain. They are very sensitive to changes in its environment such as a change in temperature, salinity, water quality, and currents. Because of their rapid responses, short life spans and fast growth rates zooplankton are very good biological indicators.

The CPR has been deployed in the Southern Ocean since 1991 by the Australian Antarctic Division (AAD) in Tasmania / Australia (including Japan since 1999 and Germany since 2004) to examine the zooplankton distribution with special references on:

- biodiversity und distribution of zooplankton including different larval stages of krill (Euphausia)
- seasonal, annual and long-time-variations in abundance, species composition and distribution of zooplankton
- variability in abundance and development of krill-larvae, which are produced every year.

Other conventional sampling methods take up a great deal of ship time and strongly depend on the position where they are taken. This leads to problems due to the patchiness of plankton. The CPR on the other hand takes samples syntactically. That means it does not require any ship time and that it can be towed 100 m aft of the ship for up to 500 nm without any interruptions.

Work at sea

To determine the temporal variability in zooplankton distribution, Brian Hunt and I deployed the CPR within the different water masses in the Southern Ocean between 44°S and 57°S. They are of interest because they can be a physical barrier for the plankton distribution. Most species occur in more then one water mass. That means they have a core region with a decreasing abundance north- and southwards, while some species are unique to one water mass.

The samples were taken on two transects during the expedition ANT-XXIII/2 on the research vessel *RV Polarstern*. On the first transect the CPR was deployed twice: the first tow after leaving Cape Town started at 44°S down to 51°S, the second one from 51°S to 57°S (see Table 14.1) where we reached the first fishing station. The second transect began after we were out of the last ice-field on the way from the last grid-station to Punta Arenas. CPR 3 started at 59°S 39°W and ended at 56°S 53°W. The fourth and last one was only about 90 nm from 56°S 53°W to 55°S 56°W.

Tab. 14.1: The dates, times, position the four CPR-samples were taken. The table includes also the distance per tow [nm] and the average ship speed per tow [kn].

Sample no.	Date	Time UTC	Position	Distance [nm]	Average ship speed [kn]
1	23/11/2005	8:47	44° 42,033`S 10° 59,913`E	434	10,9
2	25/11/2005	05:31	51° 15,728`S 06° 26,562`E	229	7,7
3	07/11/2006	9:33	59°38,635`S 39°59,985`W	469,26	11,4
4	09/01/2006	0:02	56°26,734`S 53°39,585`W	91,152	11

In addition to the samples I measured the chlorophyll a content of the surface waters every 30` latitude on the first and every 4h on the second transect (see Fig. 14.1 and Fig. 14.2). Other abiotic data like temperature and salinity were taken from the on-board PODAS-system.

The first sampling failed due to a loosened locking tab despite severe tightening, so that the net didn't wind up. But the other four CPR-tows were taken successfully with a total distance of 789 nm.

The samples will be analysed back at the laboratory at AWI in Bremerhaven, Germany.

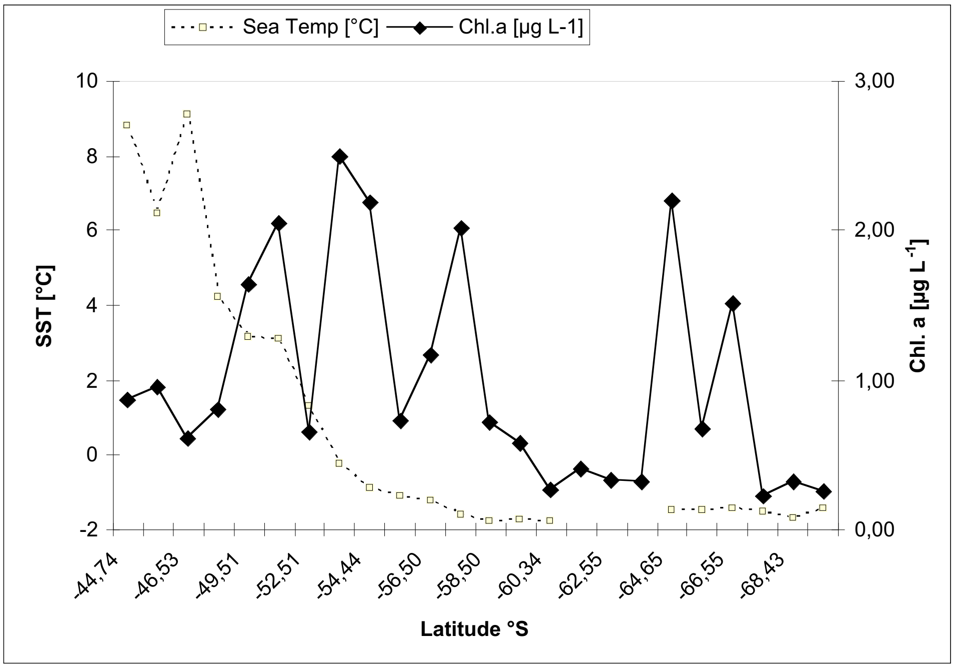

Fig. 14.1: The sea surface temperature (SST) [°C] and the chl. a [µg.L-1] along the first transect from Cape town to Neumayer Station

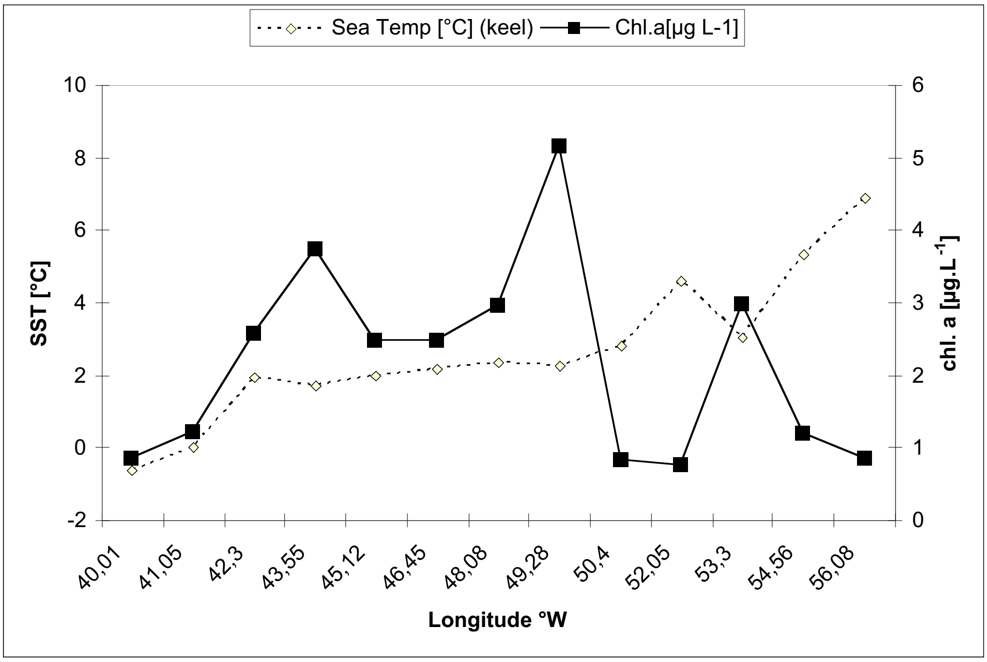

Fig. 14.2: The sea surface temperature (SST) [°C] and the chl. a [µg.L^{-1}] along the second transect from Antarctica to Punta Arenas

15. BATHYPELAGIC PLANKTON

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Objectives
Due to the scarcity of research activities, very little is known about occurrence and distribution of Antarctic bathypelagic plankton, that means plankton living in more than 1,000 m water depth. The main focus of the present study of Antarctic bathypelagic zooplankton was on larger crustaceans like decapods, mysids and amphipods as well as polychaetes.

The "Bathypelagic Plankton" project was planned as a pilot study to a more detailed investigation under the umbrella of CeDAMar (Census of the Biodiversity of the Abyssal Marine Life).

Work at sea
Method
A large plankton net (Rectangular Midwater Trawl, RMT), equipped with a depth sensor was used to catch bathypelagic samples in the following way:

The net was lowered to the desired depth as quickly as possible (pay out at 0.5 m/s), at the same time the ship speed had to be slow (1.5 knots) in order to accelerate the sinking process of the net. Once at depth the ship speed was accelerated to optimal fishing condition (2.5 kn) with the effect that the net came up. Then the hauling process was started (0.3 m/s) until the net reached 1,050 m depth. At that stage the ship speed was again reduced, causing a slightly sinking of the net, and the hauling was accelerated (up to 0.5 m/s). At that time the wire length was reduced to a point so that the net was retrieved almost vertically, which allowed minimum impact of the upper 1,000 m water column on the sample composition.

Immediately after the deep-sea haul a second haul was carried out to fish the upper 1,000 m in the "normal way", that means: pay out with 0.5 m/s and ship speed 1.5 kn, heave with 0.3 m/s and ship speed 2.5 kn.

Both net samples will be compared. Are the catches different from each other? The species exclusively occurring in the deep hauls are regarded as bathypelagic ones.

This complicated method was necessary because the multiple RMT, which could fish in stratified layers, was not suitably equipped for water depths of more than 500 m.

At the following locations bathypelagic plankton sampling was carried out (see also map in Fig. 15.1):

1) North of Bouvet Island, 51°S 06° E, sampling depth: 3,200 m, water depth: 3,738 m, fishing in the Lower Circumpolar Deep Water (LCDW) of the Antarctic Circumpolar Current (ACC); the 1,000 m sample fishing in the ACC and Antarctic Intermediate Water.

2) Close to southern Bovet Isl., 55°S 06° E, sampling depth: 2,429 m, water depth: 2,860 m, fishing the LCDW; the 1,000 m sample fishing the Weddell Front and the Winter Water (WW).

3) 59°S 03° E, sampling depth: 3,120 m, water depth: 5,398 m, fishing the Weddell Sea Deep Water/ Antarctic Bottom Water (WSDW/AABW) and the Warm Deep Water (WDW); the 1,000 m sample fishing the WDW and the WW.

4) 65°S 03° W, sampling depth: 3,003 m, water depth: 3,270 m, fishing the WSDW/AABW and WDW; the 1,000 m sample fishing the WDW and WW.

5) 69°S 09° W, sampling depth: 3,200 m, water depth: 3,738 m, fishing the WSDW/AABW, the WDW and the Coastal Current (CC); the 1,000 m sample fishing the CC.

The following taxa were sorted from the samples for taxonomic purposes:

Crustacea like decapods, mysids, euphausiids, amphipods and giant pelagic ostracods (genus Gigantocypris), fixed in 96 % cooled (-30° C) ethanol, to be prepared for additional molecular genetic analyses. All other taxa were fixed in 4 % formalin/seawater solution:

Fishes (except myctophids), jelly fishes and squids. The rest samples with the polychaetes and chaetognaths will be sorted in the laboratory on land. Squids were also sorted routinely from the standard RMT samples (0 to 200 m).

Whenever possible, photos of the Crustacea were taken to document the colour of the living animals.

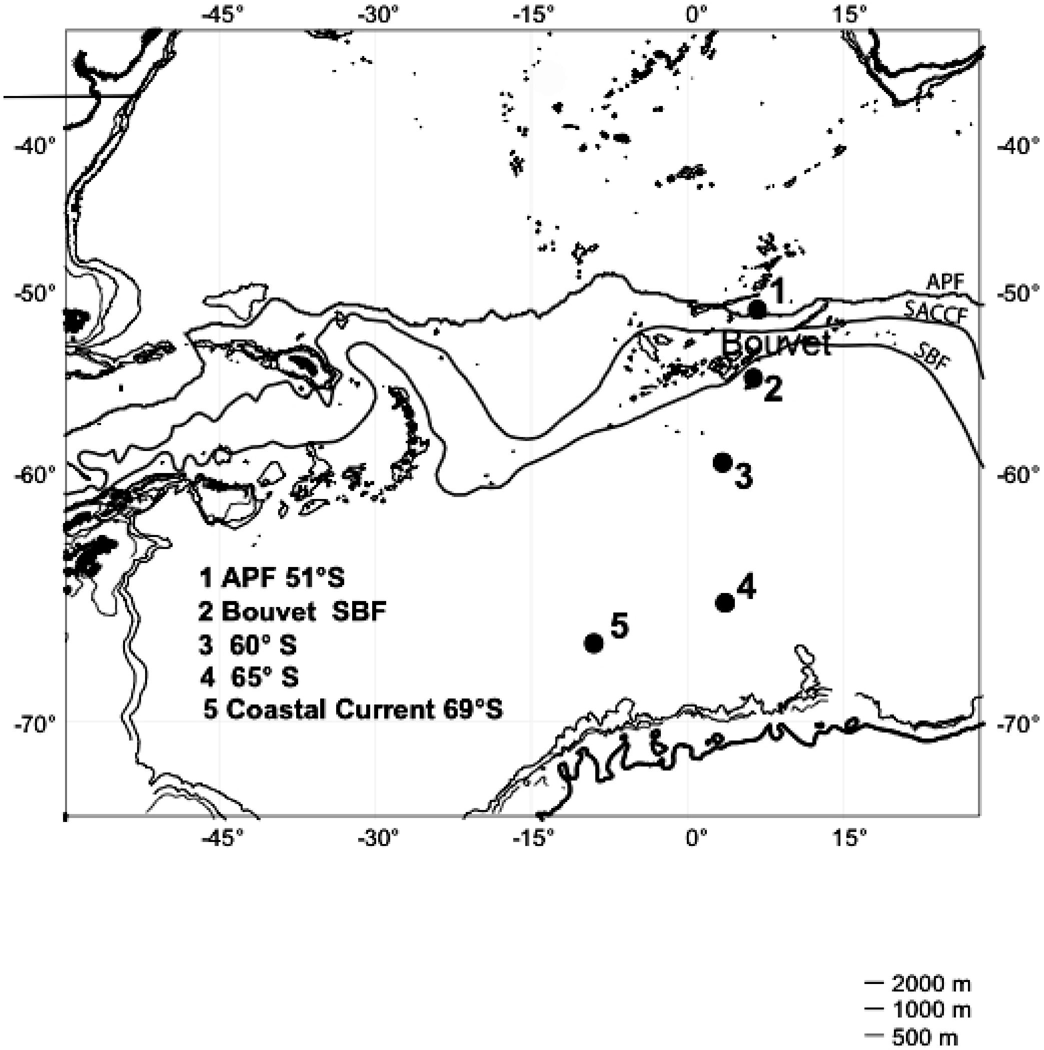

Fig. 15.1: Study area in the Lazarev Sea and position of RMT deep-sea stations. APF: Polar Front; SACCF: Southern Antarctic Circumpolar Current Front; SBF: Southern Boundary of ACCF.

16. SEA ICE, CETACEAN, SEAL AND BIRD DIVERSITY

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Fig. 16.1: Minke whale
Photo by Kelly Asmus

Introduction
Commencing in the austral summer of 1999-2000, cetacean research programmes have been conducted aboard multidisciplinary research vessels of many nations in Antarctic waters, including CCAMLR 2000, Southern Ocean GLOBEC 12001-3, UK, Australia, USA and Germany. These programmes have been facilitated by the International Whaling Commission (Asmus & Dolman, 2004; Thiele & Glasgow, 2004).

This report focuses on the LAKRIS ANT-XXIII/2 voyage aboard the German *RV Polarstern* during 19 November 2005 until 12 January 2006, austral spring and summer. Two International Whaling Commission cetacean observers collected visual data on wildlife distribution, with particular focus on cetaceans, and ice habitat information, in the form of sea ice data collection, relating to wildlife in the Lazarev Sea - Weddell Sea area of Antarctic waters. Our understanding of cetacean populations at local, regional and circum-Antarctic scales is an important means of contributing to the objectives of the IWC Southern Ocean Sanctuary.

Objectives
The main objective of this research is to determine the relationships between cetacean species, with particular attention to minke whales, and their sea ice habitat. Sea ice within Antarctic waters is a highly diverse habitat for a range of species, the observers on this voyage recorded these species and the habitat they were found in, for post-voyage analysis of data to extrapolate trends or patterns in abundance. Few

voyages into sea ice have attempted to determine the extent to which sea ice can be classified in an ecologically significant way, with particular attention to habitat where whale sightings were recorded. The aim is to relate the patchiness of cetacean distribution within the ice to the heterogeneity of ice habitat.

Voyage ANT-XXIII/2 (LAKRIS) provided a platform for two IWC observers to conduct visual surveys for wildlife in conjunction with sea ice data collection using a relatively new logging programme and photographic system in the Lazarev-Weddell Seas area. A range of habitat was surveyed including shelf, shelf slope, off slope deep waters and the area over Maud Rise through a variety of sea ice concentrations and types. The data from this and several other similar voyages conducted in this area, Ross Sea, Antarctic Peninsula and East Antarctica will be used to test the relationship between cetaceans and sea ice, including determining the level of complexity of sea ice that is ecologically important as habitat (for example, Thiele et. al. 2004, Asmus & Dolman, 2004).

Work at sea

Methods

Visual monitoring

Visual surveys for cetaceans and other wildlife were conducted by one to two observers during daylight hours from the bridge (height, 22.5 metres from sea level) of the RV *Polarstern* throughout the voyage from Cape Town, South Africa to Punta Arenas, Chile (19 November 2005 to 12 January 2006). Sightings of birds and marine mammals were recorded on a laptop-based version of the logging programme (Logger[1]) specially adapted for use in the Antarctic. This programme allows for the entry of Antarctic cetacean, seal, penguin and flying bird species and a full suite of ASPeCt Sea Ice Data Fields, downloading the information directly into a Microsoft Access database.

Sea ice observations

Sea ice images were collected every 10 minutes while steaming and every 30 minutes while travelling slowly and were discontinued while stopped at station. All images were taken from the same point on the port side of the bridge and were classified at the time of capture to ensure more accurate estimates of thickness and snow types. Classifications were made out to 1 kilometre from directly ahead of the bow to abeam of port side; the same side of the ship was used throughout each survey as per ASPeCt protocols. A single observer classified photographs. Whale habitat was captured on digital still cameras; each observer had their own camera and sea ice classifications were taken at the time of the cetacean sightings. A Nikon Coolpix camera was used to collect sea ice photographs.

[1] These data were collected using software (Logger 2000 and Sea Ice Logger) developed by the International Fund for Animal Welfare (IFAW) to promote non-lethal and non-invasive research (http://www.ifaw.org)

Photo-identification

Opportunistic photo-identification was undertaken from the bridge of the ship using the IWC observers' SLR digital cameras with up to 300 mm zoom capacity.

Results

A total of just over 264 hours and over 388 hours of effort were conducted during the voyage. This means the actual time on effort by both observers was 388 hours covering 264 hours between them. 61 cetacean sightings of 100 animals were recorded during this time (see Table 16.1) with another 22 off effort or incidental sightings of 30 animals[2] (see Table 16.2). Only common names are shown in the tables. The most common cetacean species for this voyage were minke whales, *Balaenoptera acutorostrata bonaerensis* and killer whales, *Orcinus orca*.

Tab. 16.1: Total on effort[3] cetacean sightings encountered during the ANT-XXIII/2 Antarctic voyage

			No. Animals		
Species code	**Species name**	**No. Sightings**	**Best no.**	**Low no.**	**High no.**
9	Unid. whale	4	7	6	10
10	Orca	5	12	11	17
61	Like southern bottlenose whale	1	2	2	2
63	Unid. small whale	3	3	3	4
64	Unid. large baleen whale	2	2	2	4
67	Unid. large whale	4	9	8	10
76	Unid. small cetacean	1	1	1	1
91	Undetermined minke	34	56	56	67
92	Like minke	7	8	8	15
	Total	*61*	*100*	*97*	*130*

Tab. 16.2: Incidental or off effort cetacean sightings

Species	No. Sightings	No. Animals
Minke	4	5
Like minke	12	16
Like fin	1	2
Like humpback	1	1
Like orca	2	3
Unid. Small whale	2	3
Total	*22*	*30*

[2] 'Off effort or incidental sightings' are whale sightings that were seen by people other than the whale observers or seen by the whale observers while not on effort.
[3] On effort refers to the time that either one or both whale observers were present on the bridge and able to record the sighting in the logging programme used for this voyage; Logger 2000.

The results of the sightings are displayed in figures 16.1 to 16.3

A total of 1,168 sightings were recorded of 'other wildlife' which encompasses all seal, penguin and flying sea bird sightings recorded during 'on effort' time during the voyage. This total includes 218 sightings of 314 seals, 166 sightings of 476 penguins, and 783 sightings of 2,463 flying birds. The species encountered can be found in the tables below (see Tables 16.3, 16.4 and 16.5).

Of particular interest were 3 Ross seals with pups on the 28 - 29 November on transit to Neumayer Station. Two crabeater seals were also seen with pups and several juvenile crabeater seals were recorded. On two occasions, unidentified seal pups were seen alone on ice floes.

Tab. 16.3: Flying sea bird species recorded during the ANT-XXIII/2

			No. Animals		
Species Code	**Species Name**	**Sightings**	**Best no.**	**Low no.**	**High no.**
8	Flock of travelling birds	2	65	60	70
9	Flock of feeding birds	2	25	20	30
49	Prion spp.	23	109	97	137
50	Giant petrel	42	44	44	44
51	Wilson's storm petrel	17	19	19	19
55	Black-browed albatross	5	5	5	5
57	Shy albatross	1	1	1	2
58	Wandering albatross	6	6	6	7
59	Great skua	1	1	1	1
61	Antarctic skua	3	5	5	5
63	Snow petrel	199	338	333	356
64	Antarctic petrel	301	1248	1301	1228
67	Grey headed albatross	1	1	1	1
73	Sooty albatross	2	2	2	2
74	Light mantled sooty albatross	3	4	4	4
78	Cape petrel	74	173	172	180
79	Blue petrel	29	57	57	67
80	Southern fulmar	20	31	31	35
82	Kerguelen petrel	2	2	2	2
83	Petrel spp.	14	25	22	27
85	Storm petrel spp.	7	14	14	16
89	Gull spp.	1	1	1	1
92	Tern spp.	28	287	282	304
	Total	*783*	*2463*	*2480*	*2543*

Tab. 16.4: Seal sightings recorded during the ANT-XXIII/2

			No. Animals		
Species Code	**Species Name**	**Sightings**	**Best no.**	**Low no.**	**High no.**
1	Fur seal	2	3	3	3
2	Crabeater seal	114	167	166	168
4	Leopard seal	2	3	3	3
5	Weddell seal	3	3	3	3
6	Unidentified phocid	90	128	128	130
7	Ross seal	7	10	10	10
	Total	*218*	*314*	*313*	*317*

Tab. 16.5: Penguin sightings recorded during the ANT-XXIII/2

			No. Animals		
Species Code	**Species Name**	**Sightings**	**Best no.**	**Low no.**	**High no.**
12	Adelie penguin	45	111	111	113
17	Unidentified penguin	27	96	88	123
22	Emperor penguin	69	125	125	125
24	Chinstrap penguin	25	144	141	165
	Total	*166*	*476*	*465*	*526*

Over 900 sea ice classifications were made during the voyage from sea ice images when ice was present within the 1 kilometre area in front and to the port beam of the ship. The ice was assessed in regards to its thickness, size, shape and concentration and this data will be analysed post voyage.

Acknowledgements
We would like to thank the Captain, officers, crew and scientists aboard the RV *Polarstern* during the AXTXXIII/2 LAKRIS voyage for their assistance, generosity and friendship.

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Thiele, D. Chester, E. and Asmus, K. 2004. Antarctic Sea Ice: measuring complexity as it relates to habitat for minke whales. *J. Cetacean Res. Manage. SC/56/E23*

Thiele, D. and Glasgow, D. 2004. Cetacean and Wildlife Diversity Cruise Summary. NBP04-02, AnSlope 2.

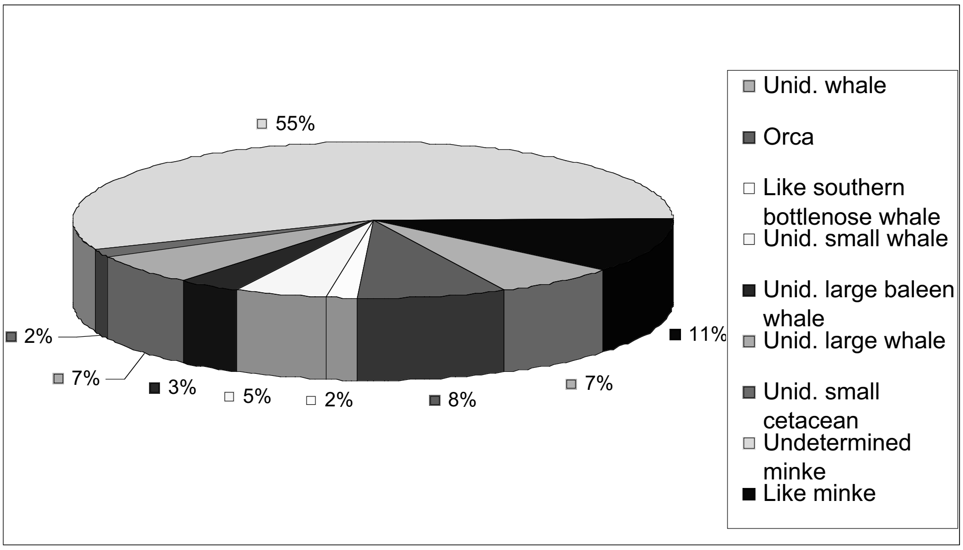

Fig. 16.1: Proportions of total species for ANT-XXIII/2, November 2005-January 2006

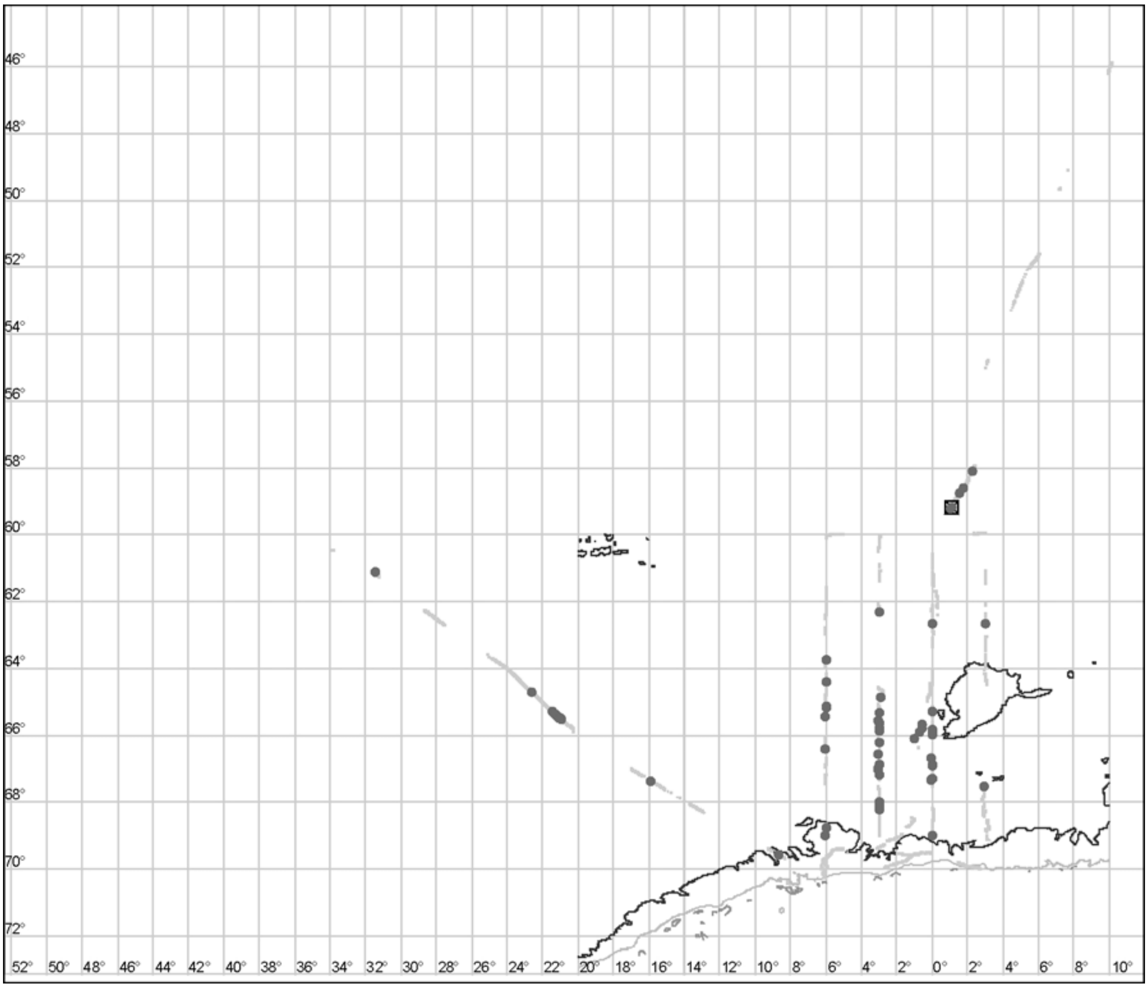

Fig. 16.2 : All cetacean sightings from ANT-XXIII/2 until 6 January 2006

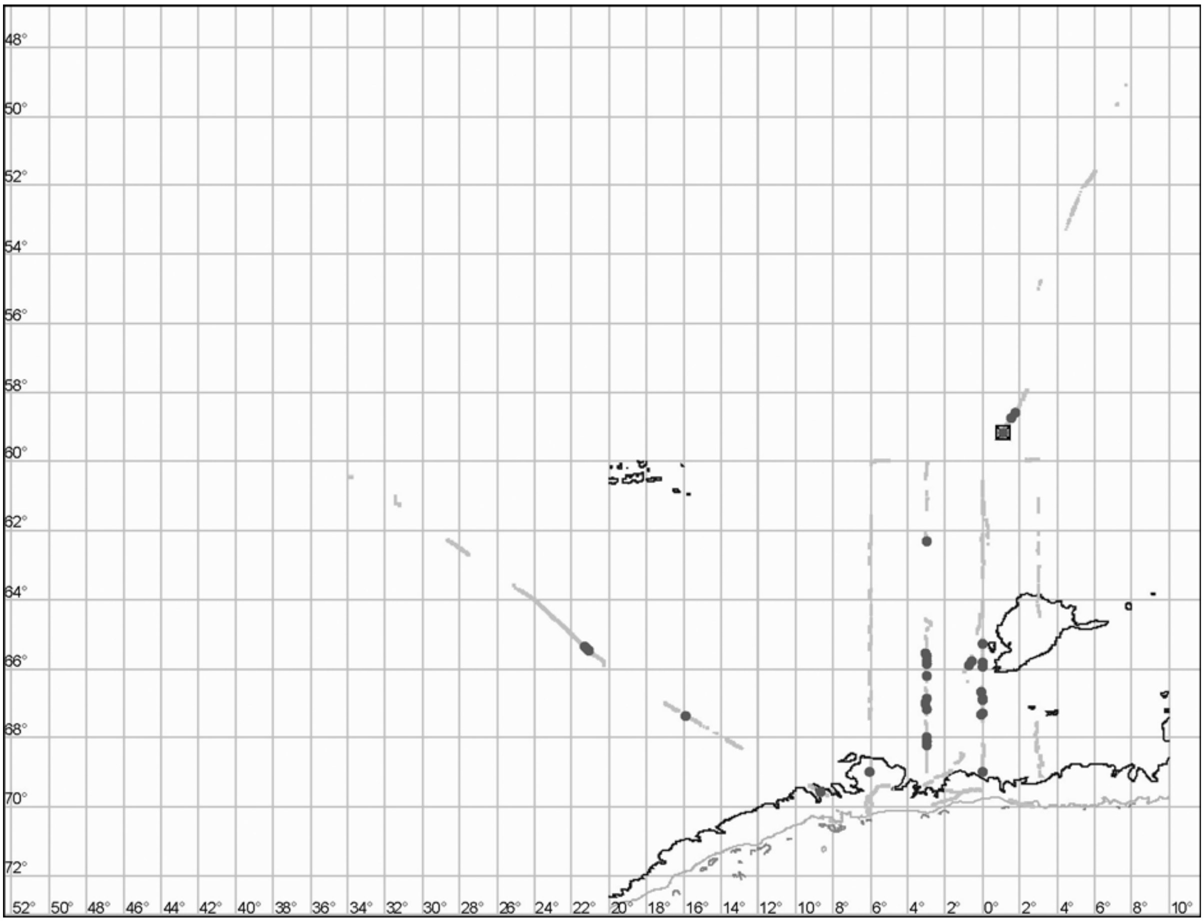

Fig. 16.3: Minke whale (Balaenoptera acutorostrata bonaerensis) sightings from ANTXXIII/2 until 6 January 2006

17. MARINE MAMMAL AUTOMATED PERIMETER SURVEILLANCE (MAPS)

Holger Klinck[1)] and Olaf Boebel[2)]
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[2)]Alfred-Wegener-Institut

Objectives

Ship based detection of marine mammals has a broad range of applications. Ecologists with focus on marine mammal abundances and migratory patterns are interested in effective methods for conducting a census of marine mammals. On the other hand users of hydroacoustic instruments (e.g. scientific sonars) are interested to most effectively implement reliable mitigation methods if adverse reactions of marine mammals to the ship's presence may be apprehended.

MAPS combines a passive hydroacoustic system (towed linear hydrophone array) and an optical system (visual and infrared cameras) to achieve highest possible detection rates. While the acoustic system is build to detect submerged marine mammals by their underwater vocalizations, the infrared system is detecting whales resting on the surface by their warm blow standing out against the cold Antarctic environment.

During the ANT-XXIII/2 expedition the MAPS system was operated during the transit from Cape Town, South Africa to Neumayer Station, Antarctica. The work focused on the installation of new camera housings for the infrared and visual cameras in the crow's nest of RV *Polarstern*.

Work at sea

Passive Acoustic Streamer: Three 10 meter long, oil (ISOPAR M) filled streamer sections, each containing 5 hydrophones, were towed at a distance of 200, 500 and 600 meters behind the ship (Fig. 17.1). They were connected by a steel armed tow cable containing 48 wires. The hydrophone separation within each group was 1.2 meters. Hydrophone sensitivity, including a 20 dB preamplifier, was -184 dB re 1 V / 1 µPa, the frequency response 20 Hz to 200 kHz (3 dB points). The streamer was deployed using a 10 kN, IP 67 protected Nyblad winch, certified to -50°C and equipped with a slip ring for continuous connection to the electronics in the lab. The winch maintained a hauling speed of 1 m/s, independently of the ship's speed. Deployment and recovery of the streamer lasted about 10 minutes each and required one scientist and one member of the crew. The analogue signals were conditioned by a 16 channel KEMO VBF40 filter/amplifier with programmable high/low-pass settings from 1 Hz to 256 kHz and gains from -20 dB to 90 dB. A studio sound device, RME Fireface, continuously recorded 6 selected channels at full bandwidth (192 kHz sampling rate and 24 bit resolution) to a disc using the ASIORecorder - an recording software developed in cooperation with the University of Kaiserslautern. Data rate was about 12 GB per hour. Data was stored in one minute blocks as 'wav' files on exchangeable 500 GB external hard discs, which could each host about 41 hours of uncompressed audio data. For monitoring purposes several channels could be mixed and processed for optimal human perceptibility with Bose NoiseCancelling™ headphones. The free available software Ishmael running on a second computer was used to visualize the acoustic data online. The streamer's maximum operating depth is 60 meters, while its survival depth reads 120 meters. As the actual depth, measured by depth gauges in each streamer segment, was speed dependent (Fig. 17.2) the system had to be recovered when RV *Polarstern* slowed down below a speed of 5 knots. The streamer was deployed regularly between stations during cruising for a total of 734 nm and 66 hours, respectively (Tab. 17.1). It was also used under ice-covered conditions as long as RV *Polarstern* could cruise with at least 5 knots. During these occasions it was towed several times across ice floes without any damage.

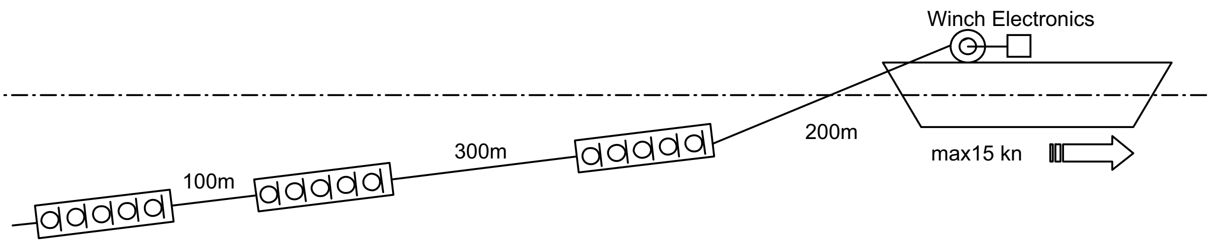

Fig. 17.1: Schematic drawing of the acoustic streamer

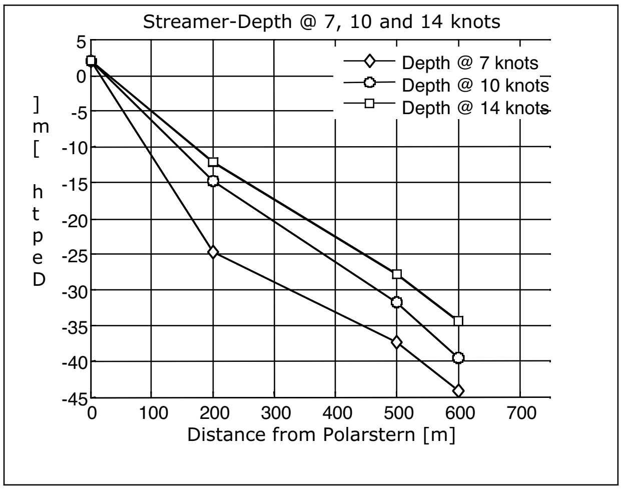

Fig. 17.2: Streamer depth as a function of tow speed. The markers at zero distance indicate the height of RV Polarstern's working deck

Tab. 17.1: Streamer Deployments during ANT-XXIII/2 (November 2005)

Deployment			Recovery			Hours	Miles
1: 20.11. 01:19	34° 04,59' S	18° 10,46' E	21.11. 13:36	39° 24,70' S	14° 42,87' E	36:17	357,5
2: 28.11. 15:16	58° 51,71' S	01° 23,85' E	28.11. 17:29	59° 10,25' S	01° 06,61' E	02:13	20,6
3: 29.11. 08:02	61° 09,08' S	00° 06,81' E	29.11. 12:24	61° 37,29' S	00° 09,64' E	04:22	28,2
					Total:	**42:52**	**406,3**

Infrared Cameras: During the ANT-XXIII/2 expedition, a new camera housing was installed under the roof of the crow's nest of RV *Polarstern* (see Fig. 17.3). The housing had been developed by Erich Dunker, head of the AWI workshop in Bremerhaven. After the mechanical and electrical installation was finished, the cameras were implemented in the data acquisition system and the whole system was rebooted.

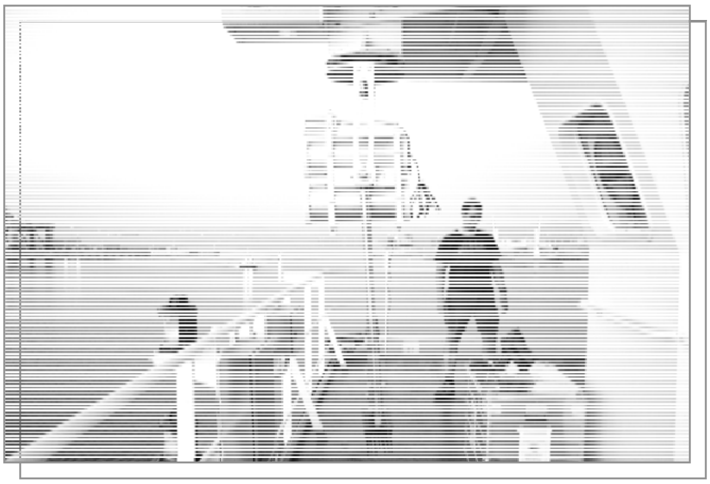

Fig. 17.3: Camera housing for 2 infrared and 1 visual cameras (small housing on top)

One FLIR ThermoVision A40 infrared (IR) camera with a spatial coverage of 24° and a resolution of 320 x 240 pixels at 25 frames per second was used for the detection of whale spouts. The camera is connected to a PCs in the "wissenschaftlicher Arbeitsraum" via an optical FireWire link, where the image stream is displayed and the pictures and movies are stored. The computer based system is running quasi continuously. Some interruptions occurred, mainly resulting from system crashes due to software problems. The IR image data stream was fed into a Matlab based software, designed to automatically detect whale blows (developed in cooperation with the University of Chemnitz).

Preliminary Results

The acoustic streamer was deployed 3 times (see Table 17.1). The acoustic system worked flawlessly. During the first transect, close to the African continent, three sperm whales were detected by their typical clicks. No vocalizations were detected during the subsequent, very short transects 2 and 3. The acoustic data were stored on LTO2 tapes for further analyses at AWI in Bremerhaven.

After alteration of the camera system, the IR camera (24°) and a visual camera were operating continuously. The data acquisition system, however, failed regularly due to a software problem, which became fixed after the cruise. No whale spouts were detected by the automatic detection algorithm, in agreement with sparse visual whale sightings during the transit from the African to the Antarctic continent. Those animals visually sighted, passed RV *Polarstern* athwartship and outside the field of view of the camera system.

18. ADAPTIVE COMPETENCE AND ECOLOGY OF ANTARCTIC BOTTOM FISH

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Objectives

Temperature largely affects poikilothermal marine animals and thus determines their biogeography. Latitudinal distribution of fish populations is thus mainly defined by their tolerance towards temperature, i.e. eurythermal fish inhabit wider latitudinal ranges than stenothermal species. In polar fishes, temperature adaptability differs between high Antarctic and subantarctic animals. Members of the family *Zoarcidae* inhabit temperate, subpolar and polar waters, and thus represent a model system for the study of temperature adaptation versus acclimatisation. Our recent studies suggest that Antarctic *Zoarcidae* avoid the extreme cold high Antarctic waters, thereby possessing higher tolerance against warmer temperatures. On the other hand *Notothenioidei* represent the most important and most specialized fish group in the Southern Ocean, occupying all available habitats. Comparative physiological, biochemical and molecular studies of sub-polar species from Bouvet Island and species from the Eastern Weddell Sea as well as from the Antarctic Peninsula should give an insight into universal principles of thermal adaptation strategies at higher phylogenetic levels. Collecting live animals for the continuous work at the AWI was one major aim of the cruise. During the cruise we have taken a close look on the major cellular energy demanding and providing processes. Ion and pH regulation as a result of active and passive processes across the membranes are very sensitive to temperature changes. Different strategies in the relation of active and passive fractions are discussed for cold-adapted and temperate species. In gills, a close relationship between ion regulation and energy demand becomes visible, as the main ion pump, the Na^+/K^+ ATPase, is located in the mitochondrial-rich chloride cells. Therefore, the capacities of key enzymes for ion regulation should be linked to aerobic capacities in different species along the latitudinal cline. The second approach will focus on genomic techniques to identify differentially expressed genes within the latitudinal cline and new candidate genes with so far unknown functions, which contribute to thermal plasticity. Therefore, samples from freshly captured fish have been taken for further analyses at the AWI. DNA extraction and subsequent analyses should give further insight into phylogenetic relationships of high- and subantarctic fauna. Catch composition of the subantarctic Agassiz trawls will be compared with high Antarctic catches from the Eastern Weddell Sea.

Work at sea

The entire programme had been performed during ANT-XXIII/2 and ANT-XXIII/3. On the current leg animals were collected by means of baited bottom traps and Agassiz trawls in different depths at Bouvet Island and close to the Atka Bay near Neumayer

Station. First the fish were kept alive in the aquarium container for further experimentation or delivery to Bremerhaven. Due to problems with the cooling system of the aquarium container most fish from Neumayer Station were used directly for getting molecular and biochemical samples. Therefore, acclimation of fish to higher temperatures could not be performed. A small portion of the fish (mostly *Artedidraco spec.*) was still alive and was sent to Bremerhaven after the next leg. All specimens were identified according to the appropriate literature, measured and weighed. For later DNA analyses muscle samples were taken and frozen in liquid nitrogen, the respective specimens were frozen at -30 °C for detailed species determination and further ecological analyses at the AWI.

Fish were anaesthetized with MS-222 (0.3 g/l) before being killed. Samples from blood, liver gills, heart, brain, muscles and if possible kidney were quickly removed and frozen instantaneously in liquid nitrogen. The samples were kept at -80 °C for later molecular genetic, biochemical and physiological studies at the AWI.

On board RV *Polarstern* our physiological programme focused mainly on the capacity and temperature sensitivity of a number of key enzymes in energy metabolism. Extractions of membrane proteins, namely Na^+/K^+ ATPase and the mitochondrial F_1F_O ATPase, from different tissues were optimized for maximum activities and stability in several species. The success of the protein enrichment in membrane preparations was determined in relation to crude extracts and cytosolic fractions. For processing large sample numbers a microplate based ATPase test using inorganic phosphate determination by malachite green reagents (Henkel et al. 1988) was established for both ATPases and compared with the common optical-enzymatic test.

In parallel, we have begun to determine serum osmolality in the respective specimens to elucidate the relation to the ion transport capacities. This work for all samples will be completed at the AWI. This dataset will be completed by determination of specific mRNA expression and protein quantification by means of antibodies at the AWI.

The mRNA samples will be further analysed for differentially expressed genes at the institute. Thereby, we hope to identify various strategies of energetic and thermal adaptations in these species along the latitudinal cline and the underlying molecular mechanisms.

Preliminary results

Agassiz trawls (AGT) and fish traps

At Bouvet Island 4 Agassiz trawls at about 100, 200, 350 and 550 metres have been performed at nearly the same positions as on ANT-XXI/2. Again, the nototheniid *Lepidonotothen larseni* was highly abundant in all hauls (Fig. 18.1A). Some *Lepidonotothen kempi* were found at higher depths. Besides only notothenioid fish were caught and no Zoarcidae. Due to the bad weather conditions the baited fish traps have been deployed at the lee site of the Island at low depths of 100 and 400 metres. No fish were caught.

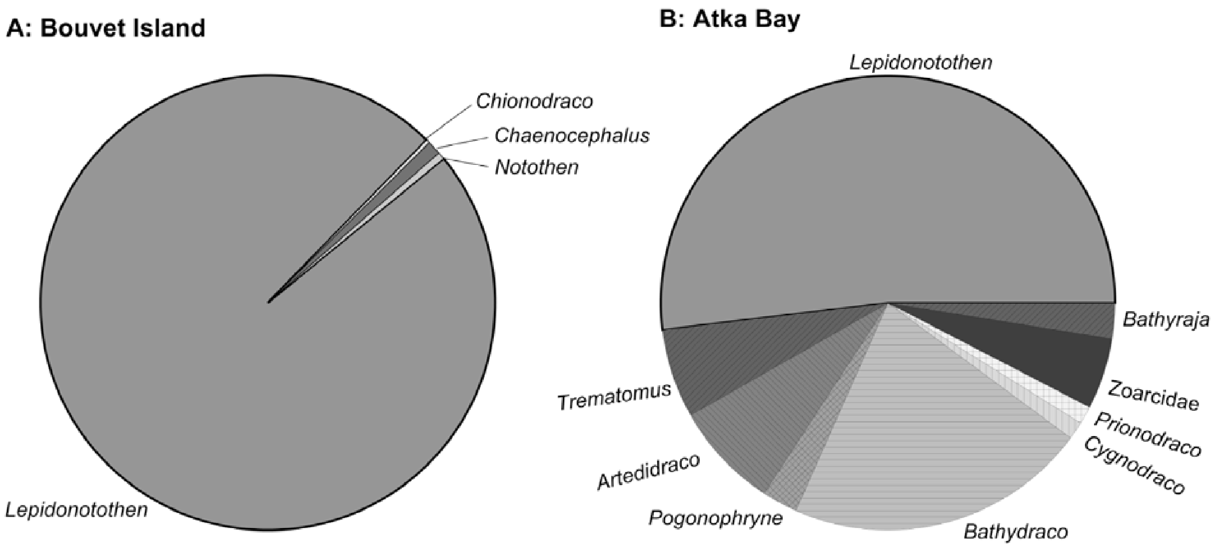

Fig. 18.1.A and B: Dominance of individuals (%) from different genera caught with Agassiz trawls at Bouvet Island and Atka Bay. The plots summarize the hauls from different depths (Bouvet Island: 100, 200, 350, 550 m; Atka Bay: 300, 400, 600 m).

Three AGTs were performed directly out of the Atka Bay due to very limited time, where no comparative data from earlier expeditions exist. Most fish of good quality were caught at 600 metres, whereas at 400 and 300 metres the AGTs were dominated by the typical species-rich communities of the upper slope with less fish. The species composition is shown in figure 18.1B. The fish fauna was clearly dominated by *Notothenioidei* (about 90 %), and only few *Zoarcidae* and *Rajidae* were caught. The composition of the ichtyofauna in the high Antarctic waters was clearly related to water depths. A detailed analysis of the species distribution along the slope was performed after return to Bremerhaven.

Since the last attempts on ANT-XXI/2 to catch eelpouts in these extreme cold waters of the shelf failed, we used new traps especially designed for deeper waters on this cruise. One baited fish trap was deployed at 1,000 metres for 36 hours, one for comparison at 400 metres. Whereas in the 400 m trap only amphipods were present, three *Muraenolepis spec.* and one *Paraliapris spec.* were caught at 1,000 metres.

Physiological and biochemical analyses

During the cruise we characterised the capacity for active ion regulation in gills of different species. The temperature-dependent activity of membrane preparations is shown in the Arrhenius plot (Fig. 18.2A). A twofold difference in maximum activities was found at all assay temperatures between *Muraenolepis spec.* and the sub-Antarctic *L. larseni*. *Cygnodraco mawsoni*, caught on the upper slope (300 m) at Atka Bay showed similar low activities. A first analysis of serum osmolality indicates a relationship between high capacities and lower osmolality (data not shown). Clearly, these results will have to be confirmed at the AWI. Despite these differences in ion transport capacities, the thermal behaviour of the enzyme was similar in all investigated species. No significant differences in activation energies could be detected so far (Fig. 18.2A).

In parallel the oligomycin-sensitive F_1F_O ATPase was determined. These capacities were very similar to the Na^+/K^+ ATPase with the same differences between the investigated species (data not shown).

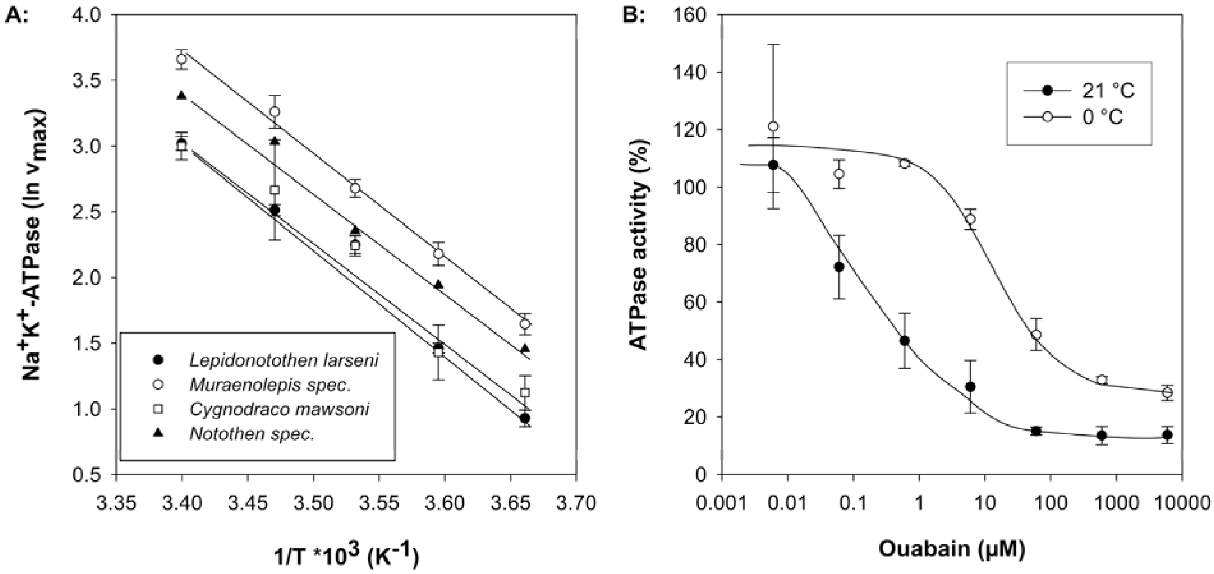

Fig. 18.2A and B: Kinetic properties of Na^+/K^+ ATPase in gills from different fish species

***A:** Arrhenius plot of maximum Na^+/K^+ ATPase activity (v_{max}: µmol/(h*mg protein) in Lepidonotothen larseni (Bouvet Island), Muraenolepis spec., Cygnodraco mawsoni and Notothen spec. (all Atka Bay). The ouabain-sensitive ATPase activity was determined in membrane preparations of the respective tissues at 0, 5, 10, 15 and 21 °C. Values are means ± SEM (n = 2 - 5).*

***B:** Temperature dependent inhibition of maximum Na^+/K^+ ATPase by ouabain. Maximum ATPase activities in the presence of different ouabain concentrations from 0 to 6 mM were determined in gills membrane preparations of L. larseni at 0 and 21 °C. The percentage of the remaining ATPase activity (= ouabain-insensitive activity) is plotted against the ouabain concentration for determination of .K_i values.*

In another set of experiments the sensitivity of Na^+/K^+ ATPase against ouabain was tested in some species. So far we found differences in K_i (50 % inhibition) between different species in the order of one magnitude (data not shown). Surprisingly, the temperature related sensitivity was remarkably different in *L. larseni* (Fig. 18.2B): At 0 °C assay temperature about 250fold more ouabain was necessary for the same inhibition. This difference may be difficult to explain by simple diffusion limitations due to the low temperature. Further measurements in different species will be performed at the AWI to elucidate this interesting behaviour.

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19. MABEL: MULTIDISCIPLINARY ANTARCTIC BENTHIC LABORATORY

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Istituto Nazionale di Geofisica e Vulcanologia, Roma, Italia

Introduction

The deep sea plays a key role in global climate changes and is strategic for the Geodynamics studies. The Scientific Community needs to extend the existing land-based network of permanent observatories into ocean basins, especially at abyssal depths, poorly explored. These needs have forced the industry to develop both marine intervention system and the auxiliary systems for sea monitoring ocean environment is a sort of buffer system and allows to face different scientific fields than on land. Moreover, the study of the oceans is of growing importance in respect to evaluate Global Change. Efforts have been made worldwide for direct monitoring of the seafloor. Since 1995 the European Commission has supported and funded the GEOSTAR (GEophysical and Oceanographic STation for Abyssal Research, Beranzoli et al, 2000, Favali et al., 2002) project that developed a new concept of seafloor observatory, focusing on modularity, manageability and flexibility for long-term continuous multidisciplinary monitoring. Since 1998 the technological evolution in the GEOSTAR prototypes has led to the deployment of a networked system in Southern Tyrrhenian Sea at the base of the Marsili volcanic seamount (over 3,300 m w.d.) in December 2003 to obtain geophysical, oceanographic and geochemical data for more than a year. Relative low cost observatories, they are user configurable, quite easily managed by an infrastructure ad hoc developed, MODUS the vehicle for easy and precise deposition and recovery using normal research vessels. From this experience, a first step toward Antarctic observation was made with the Italian PNRA MABEL (Multidisciplinary Antarctic BEnthic Laboratory, Calcara et al., 2001) project. Derived from GEOSTAR concepts, this project is adapting and developing a new observatory for its deposition in collaboration with the Alfred Wegener Institute in an area located northward the German Antarctic station Neumayer.

For one year it will conduct continuous monitoring on geophysical, oceanographic and chemical measurements at different sampling rate.

Continuous recording of multidisciplinary parameters will constitute a first multidisciplinary data bank of polar deep sea environment; tectonic features, oceanographic parameters, and chemico-physical parameters will be recorded for a year. Their data will serve each discipline; tectonic studies for first studies on crustal behaviour and properties, for investigating any active tectonic feature; oceanographic and chemical data will depict evolution of water masses, their behaviour in the deepest water state, near to the sea bottom, with physical, chemical and thermodynamic distinct point of view. The overall data could also be useful in pointing out eventual crustal contribution.

The deposition mission will be conducted without the aid of MODUS vehicle, in order to overcome difficulties in respect to costs and handling procedures of shipborne interfaces. MABEL will in fact will be deposited with a new procedure based on acoustic bidirectional link and for release command.

MABEL deposition mission

For this deposition mission, commercial instruments and custom service packs and home made instruments were tested both in Hamburgische Schiffsversuchsanstalt (HSVA) in July 2002 (Cenedese et al., 2004) and in dedicated labs in Pordenone (Italy) in 2005. Some parts of the DACS as well some parts of experimental chemical analyser have already been tested and used in a former Antarctic cruise (Calcara, 2003).

Scientific payload is composed by:

Instrument	Frequency sampling
Three component broad band seismometer	100 Hz per channel
Falmouth 3 axial single point current meter	2 Hz
Sea Bird CTD SBE 16	1 sample/hour
Alphatrack light transmissometer	1 sample/hour
pH and Eh autocalibrating analyser	1 meas/2 days
McLane Water sampler	1 sample/8 days

Service and communication devices are summarised as follows:

- Data Acquisition and Control System (DACS)
- Central High Percision Rubidium Clock
- Attitude observatory control
- 12 VDC and 24 VDC Battery Vessel
- Acoustic link for command and data transmission.

Deposition mission started at Cape Town on 19 November, 2005. During the transfer MABEL observatory was mounted in the laboratory of RV *Polarstern* in all its parts, and some dry tests were conducted. After this test the station software was uploaded with all the mission parameters.

On 4 December, a morpho-bathymetric survey for sea bottom mapping was conducted.

Three parallel lines were executed with Hydrosweep and Parasound systems, for a coverage of about 80 km length and 9 km wide in order to observe morphology and first sediment strata and for final choice of the deposition site.

Deposition site was fixed 69°24.274S 3°31.776 W on a flat area, with an average depth of 1,880 m.
On the evening of the same day final mounting of structural parts of MABEL was carried out on the work deck: cone, feet, and bumpers.
On 22.58 UTC MABEL entered the water surface.

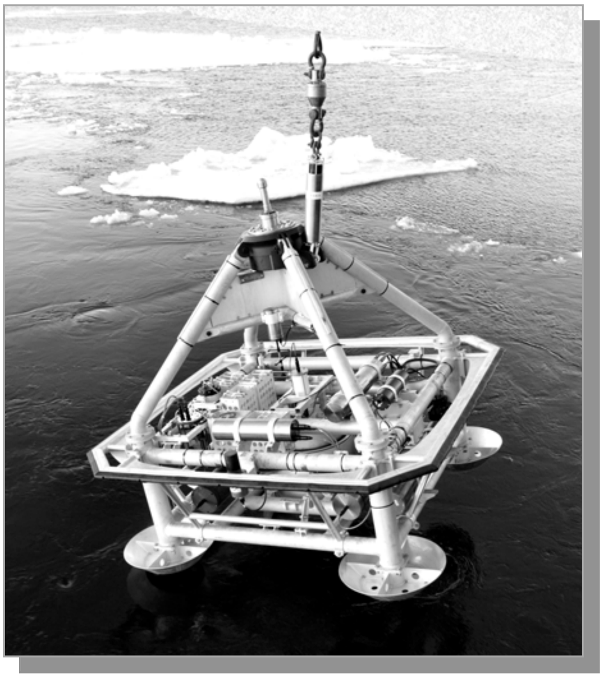

Fig 19.1: MABEL starts its descent (photo by Petra Demmler)

Eight pull buoys were linked to the first meters of the cable in order to have a vertical position of the cable in the parts closer to MABEL station. At the first foreseen 200 meters the descent stops and acoustic command were sent. Unfortunately, station responded with water detect alarm, so it was immediately recovered to the deck.

An accurate inspection in the DACS, from where the alarm was originated, revealed micro drops of water due to condensation of water vapour. So, the DACS was closed again in controlled environment: 0°C and low humidity lab.

On 5 December at 2.19 h MABEL submerged again. Also this time eight pull buoys were linked to the cable after the first 35 meter, each of them spacing 3 meters.

At 200 meter the propeller's noise made it impossible to observe the acoustic link: the station was lowered down to 500 meter.

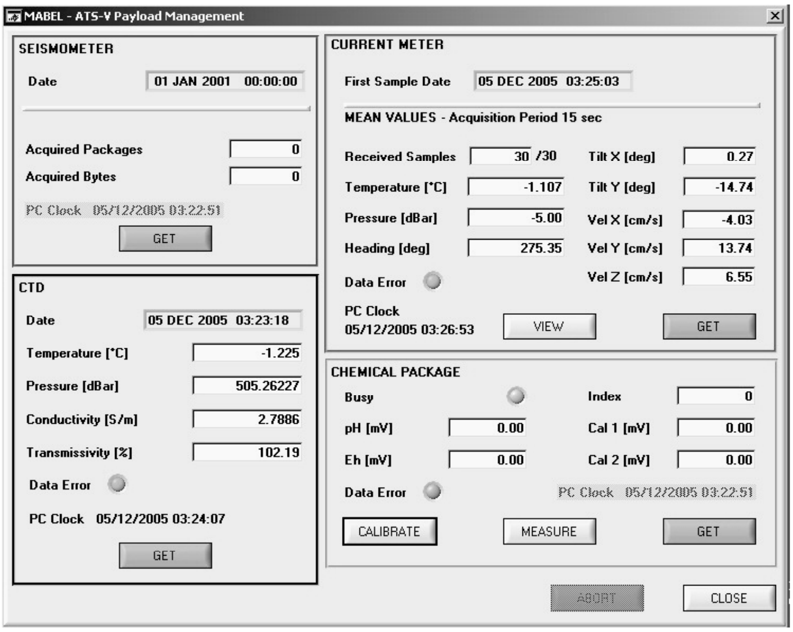

Fig. 19.2:
Data summary at 500 m

Link shows good data and overall good functionality in all parts. The same happened again on 1,000 meters.

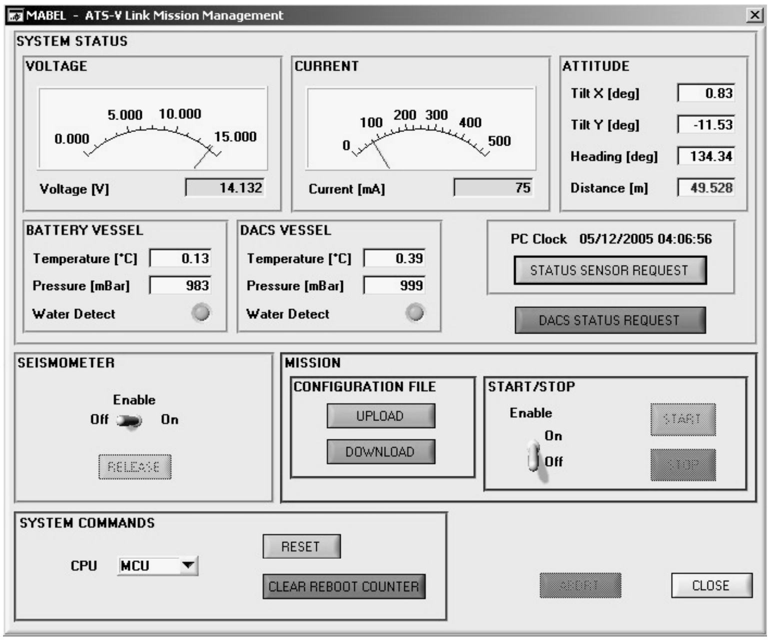

Fig. 19.3:
Status summary at 1,000 m

Down at 1,000 meters the acoustic was unsuccessful due to the noise propellers, but it was decided to prosecute without telemetry.

Descent operation were followed also with SIMRAD echosounder, settled with the proper frequency.

When the data indicated that MABEL depth was in the proximity of the sea bottom, the rope speed was lowered to the minimum (0.1 m/sec).

At 05.32 touch down at a depth of 1,874 instead of 1,884.6 meters was indicated by the SIMRAD echosounder. Rope tension of 1,9 kN. Lat 69°24,295'S Long 5° 32.220'W, heading 88.8°. 20 meters more rope were released.

05.33. First release impulse.
05.34. Second release impulse.
05.35. Third release impulse.
05.38. Rope recovery. MABEL, the first multidisciplinary deep sea observatory ever deployed in polar areas, was successfully deployed. The mission started automatically on 6 December 2005, 16.00 UTC with the seismometer release, allowing it to be coupled directly with the sea bottom, and with other instruments acquisition. The data recording will last up to 31 December 2006, when the station will automatically end acquisition and all instruments will shut down to a standby position. Data will be stored in the DACS on dedicated hard disks.

MABEL Data

On 1 January 2006, four average hourly data of MABEL pertaining to four different mission days were recovered with acoustic modem. Interrogation of the station with acoustic modem demonstrates the overall validity of the system, also in its service parts, e.g. acoustic link and data transmission.

Below an extract of some data retrieved by MABEL is presented:

Data acquired on 10/12/2005 00.00.00

		CTD		Chemical Package	
P (dbar)	C (S/m)	T (°C)	Transmissiometer (%)	pH	Eh (mV)
1870,29	2,97	0,126	102,16	no acquisition day	

Data acquired on 11/12/2005 00.00.00

		CTD		Chemical Package	
P (dbar)	C (S/m)	T (°C)	Transmissiometer (%)	pH	Eh (mV)
1870,25	2,97	0,128	102,19	7,91	2622

Data acquired on 15/12/2005 00.00.00

		CTD		Chemical Package	
P (dbar)	C (S/m)	T (°C)	Transmissiometer (%)	pH	Eh (mV)
1870,31	2,97	0,133	102,22	7,95	2623

Data acquired on 16/12/2005 00.00.00

		CTD		Chemical Package	
P (dbar)	C (S/m)	T (°C)	Transmissiometer (%)	pH	Eh (mV)
1870,36	2,97	0,126	102,10	no acquisition day	

Due to the acoustic nature of the data transmission, current meter and seismometer data cannot be presented.

Water characterisation close to MABEL site

The mission continues with the chemical characterisation of various strata of the water column, with a grid surrounding MABEL site with full depth casts. Every cast provides generally four depths: bottom, bottom -100, around 2000 m.w.d. (if applicable), 5 meters.

On board analyses are:

pH, Eh, HCO -, Fe2- and NH .

A summary is shown below:

Station	Date	Coordinates		Bottom Depth	Depth Bottle	pH	Eh	HCO_3^- (meq/L)	NH_4^+ (ppm)
69/81	**19/12/2005**	69° 0,238'S	0° 2,466'W	3352	3352	n.d.	n.d.	2,75	<0,005
					3252	n.d.	n.d.	2,75	<0,005
					2000	n.d.	n.d.	2,625	<0,005
					5	n.d.	n.d.	2,625	<0,005
69/82	**20/12/2005**	69°29,874'S	0°2,297'W	1501	1501	n.d.	170,4	2,625	<0,005
					1401	n.d.	167	2,75	<0,005
					5	n.d.	164,3	2,625	<0,005
69/83	**20/12/2005**	70°0,942' S	3° 3,377'W	2392	2392	7,856	223,3	2,625	<0,005
					2292	7,884	215,5	2,625	<0,005
					1000	7,891	216,2	2,625	<0,005
					5	8,038	216,6	2,75	<0,005
69/87	**21/12/2005**	67°59.520 'S	2° 59.811'W	4150	4150	7,936	219,2	2,75	<0,005
					4050	7,929	215	2,625	<0,005
					2000	7,958	212,2	2,75	<0,005
					5	8,023	210,2	2,75	<0,005
69/91	**22/12/2005**	65°59.696' S	2°59.314'W	4899	4899	n.d	218,9	2,75	<0,005
					4800	n.d	220,9	2,625	<0,005
					2000	n.d	222,3	2,75	<0,005
					5	n.d	223,3	2,75	<0,005
69/116	**30/12/2005**	65°59.859' S	6° 0.902' W	4912	4993	8,02	168,7	2,75	<0,005
					4900	8,054	167	2,75	<0,005
					2000	7,902	167,9	2,625	<0,005
					5	7,951	168	2,625	<0,005
69/120	**31/12/2005**	67°59.716 'S	5°59.748 'W	4790	4790	8,12	204	2,75	<0,005
					4590	8,11	206	2,625	<0,005

Station	Date	Coordinates		Bottom Depth	Depth Bottle	pH	Eh	HCO_3^- (meq/L)	NH_4^+ (ppm)
					2000	8,15	203,2	2,625	<0,005
					5	8,11	203,1	2,625	<0,005
69/122	**31/12/2005**	69°1.415' S	6°1.147' W	2596	2586	7,986	211,4	2,75	<0,005
					2486	7,875	212	2,75	<0,005
					1500	7,763	221,1	2,625	<0,005
					5	7,914	225,3	2,625	<0,005
69/124	**01/01/2006**	69° 31.693' S	5° 56,918'W	2350	2315	7,743	216,4	2,75	<0,005
					2215	7,698	212	2,75	<0,005
					1000	7,652	212	2,75	<0,005
					5	8,528	211,7	2,625	<0,005
69/125	**01/01/2006**	69° 59.875' S	5° 59.117'W	2040	2040	8,174	264,4	2,75	< 0,005
					1940	8,021	253	2,75	< 0,005
					1000	7,856	247,1	2,75	< 0,005
					5	7,870	242,7	2,625	0,0134
69/126	**01/01/2006**	70°19.725'S	6°8.253'W	240	226	8,292	225	2,75	<0,005
					126	8,253	227,5	2,625	<0,005
					75	8,376	225,4	2,75	0,0077
					5	8,242	225	2,75	0,0103

Starting from station 69/116, pH values are directly measured at 0 degrees in a controlled atmosphere container, while the former were measured with temperature correction. The corresponding values are referred to 0 degrees. At the station 69/124 the value of surface pH (in red) seems too high, after a complete chemical analyses it will be better understood.

Normal and acidified water samples for laboratory analyses were taken, for cations, anions and trace metals analyses.

Reduced Fe values were always below detection limit, even if three (bottom) samples showed values above blank, but below the lowest standard.

Conclusion

The first deep sea observatory ever deployed in polar areas has been installed. The continuous recording and acquisition of several parameters will allow to focus on tectonic features, structures and eventual local activity, also with the integration of the seismometer data collected both on MABEL observatory and Neumayer "on-land" seismometers. Studies on temporal distribution of metals like iron and other components, the variability of pH values also seeking possible variations also due to summer and winter stage, on current variations and water masses features in proximity of sea bottom.

Its successfull installation is the first step toward the IPY programme POLENET*), which envisages the placing of another station into the Arctic Ocean on a sector of Gakkel Ridge, which is one of the slowest spreading ridges. At that location the AMORE expedition had discovered extreme and unknown hydrothermal activities.

MABEL complete data will be available only after MABEL recovery.
Water samples collected will be analysed in on shore labs. The data will be analysed, integrated and compared also with CTD data, in order to depict different chemical characteristics, finding out eventual stratification and clustering, to be eventually related to different water masses origin and history.

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APPENDIX

A.1 PARTICIPATING INSTITUTIONS

A.2 CRUISE PARTICIPANTS

A.3 SHIP'S CREW

A.4 STATION LIST

A.1 PARTICIPATING INSTITUTIONS

	Adresse /Address
AWI	Alfred-Wegener-Institut für Polar- und Meeresforschung in der Helmholtz-Gemeinschaft Postfach 12 01 61 27515 Bremerhaven /Germany
BFA Fisch	Bundesforschungsanstalt für Fischerei Institut für Seefischerei Palmaille 9, D-22767 Hamburg / Germany
DWD	Deutscher Wetterdienst Geschäftsfeld Seeschifffahrt Bernhard-Nocht Str. 76 20359 Hamburg / Germany
DZMB	Deutsches Zentrum für marine Biodiversität Biozentrum Grindel und Zoologisches Museum Martin-Luther-King-Platz 3 20146 Hamburg / Germany
HeliTransair	HeliTransair GmbH Am Flugplatz 63329 Egelsbach /Germany
Laeisz	Reederei F. Laeisz (Bremerhaven) GmbH Brückenstrasse 25 27568 Bremerhaven / Germany
ICM-CSIC	Institut de Ciencies del Mar Passeig Maritim de la Barcelonetta 37-49 08003 Barcelona / Spain
INGV	Istituto Nazionale di Geofisica e Vulcanologia Via di Vigna Murata 605 00143 Roma / Italy
IUP	Institut für Umweltphysik, Universität Bremen - FB1 Postfach 330440 D-28334 Bremen / Germany

	Adresse /Address
IWC	Whale Ecology Group- Southern Ocean, School of Ecology and Environment Deakin University P.O. Box 423 Warrnambool / Australia
Optimare	Optimare Sensorsyteme AG Am Luneort 15A 27572 Bremerhaven / Germany
Rhodes University	Dept. of Zoology and Entomology Rhodes University Box 94 Grahamstown 6140 / South Africa
University Bremen	Marine Zoologie Universität Bremen Postfach 33 04 40 28334 Bremen / Germany
University Cape Town	Zoology Department University of Cape Town Rondebosch 7701 / South Africa
Universidad de Concepcion	Departamento de Oceanografia Cabina 9 Casilla 160-C Universidad de Concepcion Concepcion / Chile
University Liverpool	Department of Earth and Ocean Sciences University of Liverpool 4 Brownlow Street Liverpool, L69 3GP / United Kingdom
University Vancouver	University of British Columbia Department of Earth and Ocean Science 6339 Stores Road Vancouver, B.C. / Canada V6T 1Z4

A.2 CRUISE PARTICIPANTS

Name	Vorname/ First Name	Institut/ Institute	Beruf / Profession
Asmus	Kelly	IWC	Scientist
Auerswald	Lutz	University Cape Town	Biologist
Bernard	Kim Sarah	Rhodes University	Student
Brauer	Jens	HeliTransair	Mechanic
Boebel	Olaf	AWI	Scientist
Boebel	Tobias	Optimare	Scientist
Broglio	Elisabetta	ICM-CSIC	Biologist
Büchner	Jürgen	HeliTransair	Pilot
Calcara	Massimo	INGV	Scientist
Capua	Carmine	INGV	Scientist
Cisewski	Boris	AWI	Oceanographer
Demmler	Petra		Journalist
Fach	Bettina	AWI	Oceanographer
Federowitz	Marcus	HeliTransair	Pilot
Fuentes	Verónica	AWI	Biologist
Gerull	Linda	AWI	Student
Giesecke Astorga	Claudio R.	Universidad de Concepcion	Biologist
Glasgow	Debra	IWC	Biologist
Gurney	Leigh	University Vancouver	Biologist
Haraldsson	Matilda	BFA Fisch	Student
Hayden	Andreas	AWI	Student
Herrmann	Regine	AWI	Student
Hohn	Sönke	AWI	Biologist
Homs-Ramirez	Patricia	ICM-CSIC	Biologist
Hunt	Brian	University Vancouver	Biologist
Jennings	Michael E.	Rhodes University	Student
Klinck	Holger	AWI	Scientist
Koschnick	Nils	AWI	Technician
Krägefsky	Sören	AWI	Biologist
Kresling	Andreas	DWD	Meteorologist
Leach	Harry	University Liverpool	Scientist

Name	Vorname/ First Name	Institut/ Institute	Beruf / Profession
Lo Bue	Nadia	INGV Rome	Scientist
Loes	Peter	AWI	Engineer
Lucassen	Magnus	AWI	Scientist
Meyer	Bettina	AWI	Biologist
Mühlenhard-Siegel	Ute	DZMB Hamburg	Biologist
Otto	Juliane	AWI	Student
Pape	Carsten	AWI	Biologist
Poppe	Ulrike	AWI	Student
Riedel	Sven	AWI	Geophysicist
Rohr	Harald	Optimare	Physicist
Schmidt	Gesine	AWI	Student
Schukat	Anna	University Bremen	Student
Siegel	Volker	BFA Fisch	Biologist
Sonnabend	Hartmut	DWD	Technician
Spahic	Susanne	AWI	Technician
Steinhage	Daniel	AWI	Geophysicist
Strass	Volker	AWI	Oceanographer
Stübing	Dorothea	University Bremen	Biologist
Vendrell	Begona	ICM-CSIC	Biologist
Vortkamp	Martina	BFA Fisch	Technician
Witt	Ralf	AWI	Mechanic
Wittmann	Astrid	AWI	Student
Ziffer	Albert	AWI	Mechanic

A.3 SHIP'S CREW

No.	Name	Rank
01.	Schwarze, Stefan	Master
02.	Spielke, Steffen	1.Offc.
03.	Farysch, Bernd	Ch. Eng.
04.	Fallei, Holger	2.Offc./L.
05.	Niehusen, Frank	2.Offc.
06.	Peine, Lutz	2.Offc.
07.	Kohlberg, Eberhard	Doctor
08.	Hecht, Andreas	R.Offc.
09.	Minzlaff, Hans-Ulrich	2.Eng.
10.	Sümnicht, Stefan	3.Eng.
11.	Westphal, Henning	3.Eng.
12.	Scholz, Manfred	Elec Eng.
13.	Muhle, Helmut	Electron.
14.	Nasis, Ilias	Electron.
15.	Schulz, Harry	Elec.Tech
16.	Verhoeven, Roger	Electron.
17.	Loidl, Reiner	Boatsw.
18.	Reise, Lutz	Carpenter
19.	Bäcker, Andreas	A.B.
20.	Guse, Hartmut	A.B.
21.	Hagemann, Manfred	A.B.
22.	Heyne, Roland	A.B.
23.	Martens, Ernst-Uwe	A.B.
24.	Schmidt, Uwe	A.B.
25.	Vehlow, Ringo	A.B.
26.	Wende, Uwe	A.B.
27.	Winkler, Michael	A.B.
28.	Preußner, Jörg	Storek.
29.	Elsner, Klaus	Mot-man
30.	Grafe, Jens	Mot-man
31.	Hartmann, Ernst-Uwe	Mot-man
32.	Ipsen, Michael	Mot-man
33.	Voy, Bernd	Mot-man
34.	Müller-Homburg, R.-D.	Cook
35.	Silinski, Frank	Cooksmate
36.	Völske, Thomas	Cooksmate
37.	Jürgens, Monika	1.Stwdess
38.	Wöckener, Martina	Stwdss/Kr
39.	Czyborra, Bärbel	2.Stwdess
40.	Gaude, Hans-Jürgen	2.Steward
41.	Huang, Wu-Mei	2.Steward
42.	Möller, Wolfgang	2.Stwdard
43.	Silinski, Carmen	2.Stwdess.
44.	Yu, Kwok Yuen	Laundrym.

A.4 Station List

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/028-1	20.11.05	01:10	34° 3.03' S	18° 11.43' E	118.0	STR
PS69/028-1	21.11.05	13:47	39° 42.04' S	14° 31.18' E	4684.0	STR
PS69/029-1	23.11.05	08:47	44° 41.95' S	10° 59.94' E	4705.2	CPR
PS69/029-1	24.11.05	23:05	51° 0.14' S	6° 7.25' E	3827.2	CPR
PS69/029-1	24.11.05	23:10	51° 0.34' S	6° 7.20' E	3818.4	CPR
PS69/030-1	24.11.05	23:37	51° 0.59' S	6° 7.58' E	3834.0	RMT
PS69/030-1	25.11.05	02:22	51° 3.86' S	6° 13.09' E	3795.6	RMT
PS69/030-1	25.11.05	02:29	51° 4.11' S	6° 13.48' E	3819.6	RMT
PS69/030-1	25.11.05	06:32	51° 10.74' S	6° 22.84' E	3781.6	RMT
PS69/030-2	25.11.05	06:35	51° 10.80' S	6° 22.70' E	3779.2	RMT
PS69/030-2	25.11.05	07:30	51° 12.22' S	6° 24.47' E	3794.8	RMT
PS69/030-2	25.11.05	07:35	51° 12.38' S	6° 24.68' E	3796.4	RMT
PS69/030-2	25.11.05	09:05	51° 15.48' S	6° 26.52' E	3692.0	RMT
PS69/031-1	25.11.05	09:17	51° 15.72' S	6° 26.56' E	3684.8	CPR
PS69/031-1	26.11.05	01:01	54° 21.79' S	3° 38.27' E	0.0	CPR
PS69/031-1	26.11.05	01:11	54° 23.47' S	3° 36.97' E	0.0	CPR
PS69/032-1	26.11.05	01:42	54° 25.05' S	3° 31.57' E	0.0	TRAPF
PS69/032-2	26.11.05	02:05	54° 25.14' S	3° 29.02' E	0.0	TRAPF
PS69/033-1	26.11.05	03:09	54° 22.42' S	3° 16.78' E	0.0	AGT
PS69/033-1	26.11.05	03:16	54° 22.06' S	3° 17.30' E	0.0	AGT
PS69/033-1	26.11.05	03:25	54° 22.04' S	3° 17.66' E	0.0	AGT
PS69/033-1	26.11.05	03:35	54° 21.99' S	3° 18.00' E	0.0	AGT
PS69/033-1	26.11.05	03:40	54° 22.00' S	3° 18.08' E	0.0	AGT
PS69/033-1	26.11.05	03:41	54° 22.01' S	3° 18.09' E	0.0	AGT
PS69/033-1	26.11.05	03:46	54° 22.02' S	3° 18.16' E	0.0	AGT
PS69/033-2	26.11.05	05:00	54° 30.50' S	3° 14.16' E	252.8	AGT
PS69/033-2	26.11.05	05:10	54° 30.02' S	3° 14.31' E	238.8	AGT
PS69/033-2	26.11.05	05:14	54° 29.92' S	3° 14.11' E	243.6	AGT
PS69/033-2	26.11.05	05:24	54° 29.85' S	3° 13.64' E	263.6	AGT
PS69/033-2	26.11.05	05:30	54° 29.81' S	3° 13.41' E	270.4	AGT
PS69/033-2	26.11.05	05:35	54° 29.78' S	3° 13.31' E	272.4	AGT
PS69/033-3	26.11.05	06:30	54° 31.80' S	3° 13.45' E	444.8	AGT
PS69/033-3	26.11.05	06:38	54° 31.40' S	3° 13.23' E	354.0	AGT
PS69/033-3	26.11.05	06:43	54° 31.34' S	3° 12.96' E	350.4	AGT
PS69/033-3	26.11.05	06:53	54° 31.28' S	3° 12.51' E	350.4	AGT
PS69/033-3	26.11.05	06:58	54° 31.26' S	3° 12.40' E	347.2	AGT
PS69/033-3	26.11.05	07:07	54° 31.25' S	3° 12.40' E	345.6	AGT
PS69/033-4	26.11.05	08:21	54° 37.13' S	3° 11.36' E	540.4	AGT
PS69/033-4	26.11.05	08:35	54° 36.76' S	3° 12.02' E	542.4	AGT
PS69/033-4	26.11.05	08:40	54° 36.68' S	3° 12.20' E	543.6	AGT
PS69/033-4	26.11.05	08:51	54° 36.58' S	3° 12.49' E	542.0	AGT
PS69/033-4	26.11.05	08:52	54° 36.57' S	3° 12.52' E	544.8	AGT
PS69/033-4	26.11.05	09:11	54° 36.52' S	3° 12.81' E	546.8	AGT
PS69/034-1	26.11.05	12:25	55° 2.28' S	2° 58.89' E	2748.0	RMT
PS69/034-1	26.11.05	14:32	54° 59.61' S	2° 56.69' E	2863.0	RMT
PS69/034-1	26.11.05	14:39	54° 59.36' S	2° 56.35' E	2889.0	RMT
PS69/034-1	26.11.05	15:50	54° 56.99' S	2° 53.10' E	3034.0	RMT
PS69/034-1	26.11.05	17:38	54° 54.72' S	2° 49.61' E	3196.0	RMT
PS69/034-2	26.11.05	17:44	54° 54.63' S	2° 49.47' E	3199.0	RMT
PS69/034-2	26.11.05	18:36	54° 53.59' S	2° 48.03' E	3155.6	RMT
PS69/034-2	26.11.05	18:43	54° 53.35' S	2° 47.75' E	3151.2	RMT
PS69/034-2	26.11.05	20:08	54° 50.50' S	2° 44.25' E	3010.8	RMT
PS69/034-3	26.11.05	20:28	54° 50.55' S	2° 44.15' E	3017.2	WP-2 BUCKET

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/034-3	26.11.05	20:39	54° 50.59' S	2° 44.03' E	3015.6	WP-2 BUCKET
PS69/034-3	26.11.05	20:42	54° 50.61' S	2° 44.01' E	3014.0	WP-2 BUCKET
PS69/034-3	26.11.05	20:57	54° 50.67' S	2° 43.93' E	3019.6	WP-2 BUCKET
PS69/032-2	27.11.05	04:59	54° 25.03' S	3° 29.30' E	185.2	TRAPF
PS69/032-2	27.11.05	05:03	54° 25.00' S	3° 29.33' E	183.2	TRAPF
PS69/032-2	27.11.05	05:24	54° 25.18' S	3° 29.05' E	178.0	TRAPF
PS69/032-2	27.11.05	05:29	54° 25.03' S	3° 29.44' E	190.0	TRAPF
PS69/032-2	27.11.05	05:42	54° 24.83' S	3° 29.17' E	167.6	TRAPF
PS69/032-1	27.11.05	06:07	54° 25.12' S	3° 31.70' E	376.8	TRAPF
PS69/032-1	27.11.05	06:08	54° 25.11' S	3° 31.68' E	379.2	TRAPF
PS69/032-1	27.11.05	06:16	54° 24.96' S	3° 31.99' E	466.0	TRAPF
PS69/032-1	27.11.05	06:25	54° 24.84' S	3° 31.68' E	0.0	TRAPF
PS69/035-1	27.11.05	06:46	54° 24.54' S	3° 30.73' E	222.0	CPR
PS69/035-1	28.11.05	06:51	57° 35.89' S	2° 20.03' E	0.0	CPR
PS69/035-1	28.11.05	06:59	57° 37.01' S	2° 19.77' E	4006.4	CPR
PS69/036-1	28.11.05	09:44	58° 5.61' S	2° 14.89' E	0.0	STR
PS69/036-1	28.11.05	17:17	59° 8.73' S	1° 8.33' E	999999.0	STR
PS69/037-1	29.11.05	08:25	61° 11.43' S	0° 6.20' E	0.0	STR
PS69/037-1	29.11.05	12:43	61° 39.38' S	0° 10.58' E	0.0	STR
PS69/038-1	02.12.05	06:05	70° 19.59' S	8° 8.80' W	984.0	TRAPF
PS69/038-2	02.12.05	07:06	70° 27.69' S	8° 9.93' W	400.8	TRAPF
PS69/038-2	03.12.05	16:55	70° 27.68' S	8° 10.19' W	396.8	TRAPF
PS69/038-2	03.12.05	16:56	70° 27.67' S	8° 10.19' W	397.6	TRAPF
PS69/038-2	03.12.05	17:03	70° 27.68' S	8° 10.49' W	396.8	TRAPF
PS69/038-2	03.12.05	17:14	70° 27.79' S	8° 10.48' W	388.8	TRAPF
PS69/038-1	03.12.05	18:13	70° 19.55' S	8° 9.12' W	1065.6	TRAPF
PS69/038-1	03.12.05	18:22	70° 19.58' S	8° 9.00' W	1030.4	TRAPF
PS69/038-1	03.12.05	18:22	70° 19.58' S	8° 9.00' W	1030.4	TRAPF
PS69/038-1	03.12.05	19:05	70° 19.68' S	8° 9.51' W	1010.4	TRAPF
PS69/039-1	03.12.05	19:55	70° 23.64' S	8° 14.47' W	596.0	AGT
PS69/039-1	03.12.05	20:11	70° 23.76' S	8° 12.67' W	598.8	AGT
PS69/039-1	03.12.05	20:30	70° 24.02' S	8° 12.13' W	588.8	AGT
PS69/039-1	03.12.05	20:40	70° 24.19' S	8° 12.00' W	592.0	AGT
PS69/039-1	03.12.05	20:40	70° 24.19' S	8° 12.00' W	592.0	AGT
PS69/039-1	03.12.05	21:00	70° 24.37' S	8° 12.35' W	572.8	AGT
PS69/039-1	03.12.05	21:16	70° 24.49' S	8° 12.52' W	568.8	AGT
PS69/039-2	03.12.05	22:04	70° 27.43' S	8° 12.71' W	403.6	AGT
PS69/039-2	03.12.05	22:19	70° 27.64' S	8° 10.55' W	403.2	AGT
PS69/039-2	03.12.05	22:30	70° 27.73' S	8° 9.90' W	394.4	AGT
PS69/039-2	03.12.05	22:40	70° 27.83' S	8° 9.45' W	388.4	AGT
PS69/039-2	03.12.05	22:40	70° 27.83' S	8° 9.45' W	388.4	AGT
PS69/039-2	03.12.05	22:55	70° 27.92' S	8° 9.31' W	380.0	AGT
PS69/039-2	03.12.05	23:07	70° 28.02' S	8° 9.12' W	372.4	AGT
PS69/039-3	03.12.05	23:59	70° 28.64' S	8° 12.68' W	320.0	AGT
PS69/039-3	04.12.05	00:10	70° 28.73' S	8° 11.06' W	321.2	AGT
PS69/039-3	04.12.05	00:16	70° 28.76' S	8° 10.72' W	320.8	AGT
PS69/039-3	04.12.05	00:26	70° 28.80' S	8° 10.23' W	318.0	AGT
PS69/039-3	04.12.05	00:26	70° 28.80' S	8° 10.23' W	318.0	AGT
PS69/039-3	04.12.05	00:37	70° 28.81' S	8° 10.21' W	333.6	AGT
PS69/039-3	04.12.05	00:47	70° 28.84' S	8° 9.90' W	315.2	AGT
PS69/040-1	04.12.05	12:45	69° 24.28' S	5° 35.26' W	1885.6	HS_PS
PS69/040-1	04.12.05	16:50	69° 25.43' S	5° 22.69' W	1826.4	HS_PS
PS69/040-2	04.12.05	17:27	69° 24.28' S	5° 32.07' W	1884.0	CTD/RO
PS69/040-2	04.12.05	17:52	69° 24.27' S	5° 32.05' W	1884.4	CTD/RO
PS69/040-2	04.12.05	18:13	69° 24.36' S	5° 32.43' W	1884.0	CTD/RO

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/040-3	04.12.05	19:26	69° 24.26' S	5° 31.78' W	1884.8	CTD/RO
PS69/040-3	04.12.05	20:02	69° 24.30' S	5° 31.76' W	1884.4	CTD/RO
PS69/040-3	04.12.05	20:49	69° 24.37' S	5° 31.74' W	1883.6	CTD/RO
PS69/040-4	04.12.05	22:58	69° 23.53' S	5° 35.09' W	1898.0	MOR
PS69/040-4	04.12.05	23:44	69° 23.58' S	5° 34.65' W	1897.2	MOR
PS69/040-4	05.12.05	00:13	69° 23.59' S	5° 34.47' W	1896.8	MOR
PS69/040-4	05.12.05	02:18	69° 23.72' S	5° 33.52' W	1893.2	MOR
PS69/040-4	05.12.05	02:43	69° 23.75' S	5° 33.37' W	1892.8	MOR
PS69/040-4	05.12.05	02:50	69° 23.79' S	5° 33.29' W	1892.4	MOR
PS69/040-4	05.12.05	03:10	69° 23.68' S	5° 33.61' W	1894.0	MOR
PS69/040-4	05.12.05	03:21	69° 23.71' S	5° 33.45' W	1893.6	MOR
PS69/040-4	05.12.05	03:32	69° 23.70' S	5° 33.69' W	1894.0	MOR
PS69/040-4	05.12.05	03:59	69° 24.12' S	5° 32.48' W	1887.2	MOR
PS69/040-4	05.12.05	04:20	69° 24.11' S	5° 32.85' W	1887.6	MOR
PS69/040-4	05.12.05	04:48	69° 24.23' S	5° 32.15' W	0.0	MOR
PS69/040-4	05.12.05	04:59	69° 24.26' S	5° 32.37' W	1885.6	MOR
PS69/040-4	05.12.05	05:07	69° 24.26' S	5° 32.28' W	1885.6	MOR
PS69/040-4	05.12.05	05:20	69° 24.27' S	5° 32.52' W	1885.6	MOR
PS69/040-4	05.12.05	05:30	69° 24.28' S	5° 32.24' W	1885.2	MOR
PS69/040-4	05.12.05	05:32	69° 24.29' S	5° 32.20' W	1885.2	MOR
PS69/040-4	05.12.05	05:33	69° 24.29' S	5° 32.19' W	1885.2	MOR
PS69/040-4	05.12.05	05:46	69° 24.31' S	5° 32.27' W	1884.8	MOR
PS69/040-4	05.12.05	06:30	69° 24.64' S	5° 31.85' W	1879.6	MOR
PS69/040-4	05.12.05	06:33	69° 24.68' S	5° 31.87' W	1879.2	MOR
PS69/041-1	05.12.05	11:31	69° 31.22' S	4° 56.39' W	0.0	CAL
PS69/041-1	05.12.05	18:40	69° 28.70' S	4° 54.59' W	0.0	CAL
PS69/041-1	05.12.05	19:59	69° 28.55' S	4° 54.73' W	0.0	CAL
PS69/041-1	05.12.05	21:34	69° 28.50' S	4° 55.25' W	0.0	CAL
PS69/041-1	05.12.05	23:26	69° 28.44' S	4° 55.03' W	0.0	CAL
PS69/041-1	06.12.05	00:58	69° 28.20' S	4° 54.42' W	0.0	CAL
PS69/041-1	06.12.05	01:41	69° 27.74' S	4° 53.91' W	0.0	CAL
PS69/042-1	06.12.05	19:46	69° 59.48' S	3° 5.64' E	912.4	RMT
PS69/042-1	06.12.05	20:00	69° 59.39' S	3° 4.29' E	858.0	RMT
PS69/042-1	06.12.05	20:25	69° 59.41' S	3° 0.82' E	654.8	RMT
PS69/042-2	06.12.05	20:33	69° 59.38' S	3° 0.22' E	634.0	RMT
PS69/042-2	06.12.05	20:37	69° 59.37' S	2° 59.90' E	616.8	RMT
PS69/042-2	06.12.05	20:45	69° 59.40' S	2° 58.80' E	552.8	RMT
PS69/042-2	06.12.05	20:50	69° 59.43' S	2° 58.10' E	517.6	RMT
PS69/042-2	06.12.05	20:50	69° 59.43' S	2° 58.10' E	517.6	RMT
PS69/042-2	06.12.05	20:58	69° 59.43' S	2° 57.35' E	507.6	RMT
PS69/042-3	06.12.05	21:15	69° 59.39' S	2° 57.42' E	520.8	CTD
PS69/042-4	06.12.05	21:27	69° 59.42' S	2° 57.47' E	510.0	HN
PS69/042-3	06.12.05	21:29	69° 59.43' S	2° 57.46' E	506.8	CTD
PS69/042-4	06.12.05	21:30	69° 59.44' S	2° 57.46' E	504.8	HN
PS69/042-5	06.12.05	21:34	69° 59.47' S	2° 57.47' E	498.0	HN
PS69/042-5	06.12.05	21:37	69° 59.48' S	2° 57.49' E	494.0	HN
PS69/042-6	06.12.05	21:40	69° 59.49' S	2° 57.53' E	492.8	HN
PS69/042-6	06.12.05	21:43	69° 59.49' S	2° 57.57' E	492.8	HN
PS69/042-3	06.12.05	21:54	69° 59.54' S	2° 57.61' E	484.4	CTD
PS69/042-7	06.12.05	22:07	69° 59.59' S	2° 57.69' E	477.6	MN
PS69/042-7	06.12.05	22:21	69° 59.64' S	2° 57.73' E	474.0	MN
PS69/042-7	06.12.05	22:21	69° 59.64' S	2° 57.73' E	474.0	MN
PS69/042-7	06.12.05	22:48	69° 59.73' S	2° 57.90' E	472.0	MN
PS69/042-8	06.12.05	23:00	69° 59.78' S	2° 57.93' E	469.2	WP-2 BUCKET
PS69/042-8	06.12.05	23:11	69° 59.83' S	2° 57.98' E	462.4	WP-2 BUCKET

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/042-8	06.12.05	23:11	69° 59.83' S	2° 57.98' E	462.4	WP-2 BUCKET
PS69/042-8	06.12.05	23:30	69° 59.91' S	2° 58.10' E	458.0	WP-2 BUCKET
PS69/043-1	07.12.05	02:47	69° 29.08' S	3° 5.13' E	0.0	RMT
PS69/043-1	07.12.05	03:02	69° 29.34' S	3° 3.53' E	0.0	RMT
PS69/043-1	07.12.05	03:32	69° 29.79' S	3° 0.72' E	2168.4	RMT
PS69/043-2	07.12.05	03:38	69° 29.83' S	3° 0.40' E	2217.6	RMT
PS69/043-2	07.12.05	03:44	69° 29.92' S	2° 59.75' E	2263.2	RMT
PS69/043-2	07.12.05	03:48	69° 29.98' S	2° 59.32' E	2329.6	RMT
PS69/043-2	07.12.05	03:49	69° 30.00' S	2° 59.19' E	2333.2	RMT
PS69/043-2	07.12.05	03:51	69° 30.02' S	2° 58.97' E	2346.4	RMT
PS69/043-2	07.12.05	03:53	69° 30.04' S	2° 58.74' E	2349.2	RMT
PS69/043-2	07.12.05	03:53	69° 30.04' S	2° 58.74' E	2349.2	RMT
PS69/043-2	07.12.05	04:02	69° 30.09' S	2° 58.17' E	2286.4	RMT
PS69/043-3	07.12.05	04:17	69° 29.86' S	2° 59.86' E	2258.4	CTD/RO
PS69/043-3	07.12.05	05:01	69° 29.90' S	2° 59.45' E	2312.0	CTD/RO
PS69/043-3	07.12.05	05:51	69° 29.92' S	2° 58.28' E	2316.0	CTD/RO
PS69/044-1	07.12.05	10:01	68° 56.46' S	3° 3.47' E	0.0	RMT
PS69/044-1	07.12.05	10:14	68° 56.98' S	3° 2.88' E	0.0	RMT
PS69/044-1	07.12.05	10:39	68° 57.95' S	3° 2.29' E	0.0	RMT
PS69/044-2	07.12.05	11:09	68° 56.52' S	3° 3.18' E	0.0	RMT
PS69/044-2	07.12.05	11:12	68° 56.62' S	3° 3.10' E	0.0	RMT
PS69/044-2	07.12.05	11:22	68° 57.02' S	3° 2.77' E	0.0	RMT
PS69/044-2	07.12.05	11:22	68° 57.02' S	3° 2.77' E	0.0	RMT
PS69/044-2	07.12.05	11:29	68° 57.22' S	3° 2.68' E	0.0	RMT
PS69/044-3	07.12.05	11:52	68° 56.94' S	3° 2.32' E	0.0	CTD
PS69/044-3	07.12.05	13:06	68° 56.86' S	3° 2.67' E	3776.8	CTD
PS69/044-3	07.12.05	14:15	68° 56.84' S	3° 3.39' E	0.0	CTD
PS69/044-4	07.12.05	14:28	68° 56.83' S	3° 3.55' E	0.0	MN
PS69/044-4	07.12.05	14:41	68° 56.86' S	3° 3.59' E	0.0	MN
PS69/044-4	07.12.05	14:42	68° 56.87' S	3° 3.59' E	0.0	MN
PS69/044-4	07.12.05	15:10	68° 56.98' S	3° 3.50' E	0.0	MN
PS69/044-5	07.12.05	15:42	68° 54.87' S	3° 5.52' E	0.0	EF
PS69/044-5	07.12.05	15:58	68° 54.83' S	3° 5.74' E	0.0	EF
PS69/045-1	07.12.05	19:29	68° 28.43' S	3° 2.00' E	0.0	RMT
PS69/045-1	07.12.05	19:46	68° 28.80' S	3° 0.14' E	4066.0	RMT
PS69/045-1	07.12.05	20:16	68° 29.41' S	2° 57.03' E	4142.8	RMT
PS69/045-2	07.12.05	20:24	68° 29.39' S	2° 57.12' E	4149.2	RMT
PS69/045-2	07.12.05	20:28	68° 29.51' S	2° 56.90' E	4132.0	RMT
PS69/045-2	07.12.05	20:33	68° 29.70' S	2° 56.54' E	4119.2	RMT
PS69/045-2	07.12.05	20:35	68° 29.76' S	2° 56.38' E	4122.4	RMT
PS69/045-2	07.12.05	20:38	68° 29.84' S	2° 56.17' E	4121.6	RMT
PS69/045-2	07.12.05	20:39	68° 29.87' S	2° 56.09' E	4118.0	RMT
PS69/045-2	07.12.05	20:50	68° 30.06' S	2° 55.71' E	4112.4	RMT
PS69/045-3	07.12.05	21:30	68° 30.27' S	2° 50.37' E	4178.0	CTD
PS69/045-3	07.12.05	22:50	68° 30.23' S	2° 50.40' E	4179.2	CTD
PS69/045-3	08.12.05	00:09	68° 30.36' S	2° 50.43' E	0.0	CTD
PS69/046-1	08.12.05	04:02	68° 0.20' S	2° 54.30' E	0.0	RMT
PS69/046-1	08.12.05	04:16	67° 59.79' S	2° 55.06' E	0.0	RMT
PS69/046-1	08.12.05	04:43	67° 58.77' S	2° 54.88' E	4178.0	RMT
PS69/046-2	08.12.05	04:51	67° 58.65' S	2° 54.92' E	0.0	RMT
PS69/046-2	08.12.05	04:56	67° 58.45' S	2° 55.03' E	0.0	RMT
PS69/046-2	08.12.05	05:03	67° 58.25' S	2° 55.14' E	0.0	RMT
PS69/046-2	08.12.05	05:08	67° 58.09' S	2° 55.20' E	0.0	RMT
PS69/046-2	08.12.05	05:12	67° 58.00' S	2° 55.24' E	4551.2	RMT
PS69/046-3	08.12.05	05:25	67° 57.58' S	2° 55.13' E	4558.4	CTD/RO

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/046-3	08.12.05	07:03	67° 57.51' S	2° 55.22' E	4559.2	CTD/RO
PS69/046-3	08.12.05	08:56	67° 57.89' S	2° 54.23' E	0.0	CTD/RO
PS69/046-4	08.12.05	09:21	67° 58.42' S	2° 53.95' E	0.0	MN
PS69/046-4	08.12.05	09:33	67° 58.42' S	2° 53.92' E	0.0	MN
PS69/046-4	08.12.05	09:36	67° 58.44' S	2° 53.88' E	0.0	MN
PS69/046-4	08.12.05	10:01	67° 58.57' S	2° 53.59' E	0.0	MN
PS69/047-1	08.12.05	13:20	67° 31.31' S	2° 55.45' E	0.0	RMT
PS69/047-1	08.12.05	13:37	67° 30.86' S	2° 56.96' E	0.0	RMT
PS69/047-1	08.12.05	14:09	67° 30.18' S	2° 59.46' E	0.0	RMT
PS69/047-2	08.12.05	14:13	67° 30.16' S	2° 59.55' E	0.0	RMT
PS69/047-2	08.12.05	14:18	67° 30.05' S	2° 59.88' E	0.0	RMT
PS69/047-2	08.12.05	14:23	67° 29.95' S	3° 0.20' E	0.0	RMT
PS69/047-2	08.12.05	14:23	67° 29.95' S	3° 0.20' E	0.0	RMT
PS69/047-2	08.12.05	14:25	67° 29.91' S	3° 0.33' E	0.0	RMT
PS69/047-2	08.12.05	14:28	67° 29.85' S	3° 0.58' E	0.0	RMT
PS69/047-2	08.12.05	14:28	67° 29.85' S	3° 0.58' E	0.0	RMT
PS69/047-2	08.12.05	14:33	67° 29.82' S	3° 0.84' E	0.0	RMT
PS69/047-3	08.12.05	14:48	67° 30.06' S	3° 0.33' E	4561.2	CTD/RO
PS69/047-4	08.12.05	14:53	67° 30.06' S	3° 0.35' E	4561.2	HN
PS69/047-4	08.12.05	15:01	67° 30.05' S	3° 0.32' E	4561.2	HN
PS69/047-3	08.12.05	16:14	67° 30.04' S	2° 59.91' E	4560.8	CTD/RO
PS69/047-3	08.12.05	17:33	67° 30.80' S	2° 57.82' E	4561.0	CTD/RO
PS69/048-1	08.12.05	21:28	67° 0.17' S	2° 59.81' E	3294.8	CTD
PS69/048-1	08.12.05	22:34	67° 0.36' S	2° 59.92' E	3261.2	CTD
PS69/048-1	08.12.05	23:41	67° 0.30' S	2° 59.97' E	0.0	CTD
PS69/049-1	09.12.05	03:33	66° 30.21' S	3° 0.13' E	3774.8	CTD/RO
PS69/049-1	09.12.05	04:45	66° 30.46' S	2° 59.64' E	3742.0	CTD/RO
PS69/049-1	09.12.05	05:48	66° 30.67' S	2° 58.91' E	3740.0	CTD/RO
PS69/049-2	09.12.05	07:27	66° 32.28' S	2° 52.87' E	0.0	RMT
PS69/049-2	09.12.05	07:42	66° 31.97' S	2° 54.27' E	0.0	RMT
PS69/049-2	09.12.05	08:12	66° 31.49' S	2° 56.05' E	0.0	RMT
PS69/050-1	09.12.05	12:12	66° 0.16' S	3° 0.17' E	3505.2	CTD/RO
PS69/050-1	09.12.05	13:19	65° 59.97' S	3° 0.44' E	3483.2	CTD/RO
PS69/050-1	09.12.05	14:27	65° 59.93' S	3° 0.05' E	0.0	CTD/RO
PS69/051-1	09.12.05	17:59	65° 29.91' S	3° 0.53' E	2631.6	CTD/RO
PS69/051-1	09.12.05	18:50	65° 30.04' S	3° 0.82' E	2614.0	CTD/RO
PS69/051-1	09.12.05	19:43	65° 29.96' S	3° 1.20' E	2614.0	CTD/RO
PS69/051-2	09.12.05	20:01	65° 29.94' S	3° 1.56' E	0.0	RMT
PS69/051-2	09.12.05	20:19	65° 29.76' S	3° 3.36' E	0.0	RMT
PS69/051-2	09.12.05	20:52	65° 29.47' S	3° 6.29' E	0.0	RMT
PS69/052-1	10.12.05	00:03	65° 0.27' S	2° 55.47' E	0.0	RMT
PS69/052-1	10.12.05	00:19	65° 0.08' S	2° 56.85' E	0.0	RMT
PS69/052-1	10.12.05	00:47	64° 59.75' S	2° 59.23' E	0.0	RMT
PS69/052-2	10.12.05	01:04	64° 59.79' S	2° 59.23' E	2413.2	CTD/RO
PS69/052-2	10.12.05	01:52	64° 59.82' S	2° 59.37' E	2416.0	CTD/RO
PS69/052-2	10.12.05	02:47	64° 59.70' S	3° 0.03' E	0.0	CTD/RO
PS69/052-3	10.12.05	02:58	64° 59.68' S	3° 0.17' E	0.0	MN
PS69/052-3	10.12.05	03:11	64° 59.69' S	3° 0.19' E	0.0	MN
PS69/052-3	10.12.05	03:38	64° 59.70' S	3° 0.37' E	0.0	MN
PS69/052-4	10.12.05	04:01	64° 59.78' S	3° 0.32' E	0.0	WP-2 BUCKET
PS69/052-4	10.12.05	04:07	64° 59.79' S	3° 0.32' E	0.0	WP-2 BUCKET
PS69/052-4	10.12.05	04:21	64° 59.83' S	3° 0.34' E	2416.0	WP-2 BUCKET
PS69/053-1	10.12.05	07:20	64° 30.94' S	2° 56.31' E	0.0	RMT
PS69/053-1	10.12.05	07:38	64° 30.91' S	2° 58.41' E	0.0	RMT
PS69/053-1	10.12.05	08:15	64° 30.37' S	3° 2.14' E	2134.8	RMT

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/053-2	10.12.05	08:21	64° 30.30' S	3° 2.54' E	2136.0	RMT
PS69/053-2	10.12.05	08:25	64° 30.23' S	3° 2.91' E	2137.6	RMT
PS69/053-2	10.12.05	08:29	64° 30.17' S	3° 3.25' E	2138.8	RMT
PS69/053-2	10.12.05	08:29	64° 30.17' S	3° 3.25' E	2138.8	RMT
PS69/053-2	10.12.05	08:33	64° 30.10' S	3° 3.59' E	2140.0	RMT
PS69/053-2	10.12.05	08:42	64° 30.00' S	3° 4.22' E	2142.0	RMT
PS69/053-3	10.12.05	08:58	64° 29.91' S	3° 4.55' E	2143.2	CTD
PS69/053-3	10.12.05	09:43	64° 29.71' S	3° 4.71' E	2146.4	CTD
PS69/053-3	10.12.05	10:26	64° 29.56' S	3° 4.80' E	2148.4	CTD
PS69/053-4	10.12.05	10:33	64° 29.55' S	3° 4.75' E	0.0	MN
PS69/053-4	10.12.05	10:48	64° 29.51' S	3° 4.67' E	0.0	MN
PS69/053-4	10.12.05	10:48	64° 29.51' S	3° 4.67' E	0.0	MN
PS69/053-4	10.12.05	11:13	64° 29.40' S	3° 4.61' E	0.0	MN
PS69/054-1	10.12.05	14:06	64° 0.85' S	2° 55.16' E	0.0	RMT
PS69/054-1	10.12.05	14:24	64° 0.72' S	2° 56.72' E	0.0	RMT
PS69/054-1	10.12.05	14:56	64° 0.16' S	2° 59.27' E	0.0	RMT
PS69/054-2	10.12.05	15:01	64° 0.14' S	2° 59.40' E	0.0	RMT
PS69/054-2	10.12.05	15:07	64° 0.06' S	2° 59.80' E	0.0	RMT
PS69/054-2	10.12.05	15:12	64° 0.01' S	3° 0.11' E	0.0	RMT
PS69/054-2	10.12.05	15:15	63° 59.98' S	3° 0.31' E	0.0	RMT
PS69/054-2	10.12.05	15:19	63° 59.95' S	3° 0.61' E	0.0	RMT
PS69/054-2	10.12.05	15:19	63° 59.95' S	3° 0.61' E	0.0	RMT
PS69/054-2	10.12.05	15:26	63° 59.94' S	3° 1.06' E	0.0	RMT
PS69/054-3	10.12.05	15:46	63° 59.98' S	3° 0.45' E	2833.6	CTD/RO
PS69/054-3	10.12.05	16:36	63° 60.00' S	3° 0.68' E	2832.4	CTD/RO
PS69/054-3	10.12.05	17:31	64° 0.07' S	3° 0.94' E	0.0	CTD/RO
PS69/054-4	10.12.05	17:37	64° 0.07' S	3° 0.99' E	0.0	MN
PS69/054-4	10.12.05	17:51	64° 0.08' S	3° 1.08' E	0.0	MN
PS69/054-4	10.12.05	18:17	64° 0.08' S	3° 1.15' E	1.0	MN
PS69/054-5	10.12.05	18:30	64° 0.08' S	3° 1.17' E	0.0	WP-2 BUCKET
PS69/054-5	10.12.05	18:36	64° 0.08' S	3° 1.19' E	0.0	WP-2 BUCKET
PS69/054-5	10.12.05	18:46	64° 0.09' S	3° 1.22' E	0.0	WP-2 BUCKET
PS69/055-1	10.12.05	22:06	63° 31.98' S	2° 59.69' E	0.0	RMT
PS69/055-1	10.12.05	22:27	63° 30.98' S	2° 59.39' E	4681.6	RMT
PS69/055-1	10.12.05	23:05	63° 29.15' S	2° 58.74' E	4738.4	RMT
PS69/055-2	10.12.05	23:24	63° 29.06' S	2° 58.20' E	4739.6	CTD
PS69/055-2	11.12.05	00:47	63° 29.31' S	2° 57.82' E	4727.6	CTD
PS69/055-2	11.12.05	02:02	63° 29.56' S	2° 57.54' E	0.0	CTD
PS69/055-3	11.12.05	02:24	63° 30.06' S	2° 58.72' E	0.0	MN
PS69/055-3	11.12.05	02:36	63° 30.07' S	2° 58.72' E	0.0	MN
PS69/055-3	11.12.05	02:37	63° 30.06' S	2° 58.73' E	0.0	MN
PS69/055-3	11.12.05	03:03	63° 30.08' S	2° 58.59' E	0.0	MN
PS69/056-1	11.12.05	06:15	63° 0.44' S	3° 3.61' E	0.0	RMT
PS69/056-1	11.12.05	06:34	63° 0.48' S	3° 1.68' E	0.0	RMT
PS69/056-1	11.12.05	07:07	63° 0.41' S	2° 58.71' E	0.0	RMT
PS69/056-2	11.12.05	07:15	63° 0.36' S	2° 58.44' E	0.0	RMT
PS69/056-2	11.12.05	07:20	63° 0.26' S	2° 58.07' E	0.0	RMT
PS69/056-2	11.12.05	07:25	63° 0.14' S	2° 57.69' E	0.0	RMT
PS69/056-2	11.12.05	07:35	63° 0.05' S	2° 56.98' E	0.0	RMT
PS69/056-3	11.12.05	07:50	63° 0.18' S	2° 57.93' E	5369.2	CTD/RO
PS69/056-3	11.12.05	09:20	63° 0.20' S	2° 57.78' E	5369.2	CTD/RO
PS69/056-3	11.12.05	10:44	63° 0.03' S	2° 57.59' E	0.0	CTD/RO
PS69/057-1	11.12.05	13:43	62° 31.89' S	2° 57.11' E	0.0	RMT
PS69/057-1	11.12.05	14:03	62° 31.27' S	2° 58.32' E	0.0	RMT
PS69/057-1	11.12.05	14:29	62° 30.46' S	2° 59.69' E	0.0	RMT

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/057-2	11.12.05	14:50	62° 30.35' S	3° 0.28' E	5252.4	CTD/RO
PS69/057-2	11.12.05	16:17	62° 30.24' S	2° 59.20' E	5327.6	CTD/RO
PS69/057-2	11.12.05	17:51	62° 30.61' S	2° 58.64' E	0.0	CTD/RO
PS69/057-3	11.12.05	17:59	62° 30.93' S	2° 58.31' E	0.0	MN
PS69/057-3	11.12.05	18:13	62° 31.01' S	2° 58.28' E	0.0	MN
PS69/057-3	11.12.05	18:36	62° 31.19' S	2° 58.20' E	0.0	MN
PS69/058-1	11.12.05	22:33	62° 2.01' S	2° 59.75' E	0.0	RMT
PS69/058-1	11.12.05	22:50	62° 1.26' S	2° 59.66' E	0.0	RMT
PS69/058-1	11.12.05	23:24	61° 59.69' S	2° 59.33' E	0.0	RMT
PS69/058-2	11.12.05	23:30	61° 59.52' S	2° 59.28' E	0.0	RMT
PS69/058-2	11.12.05	23:34	61° 59.35' S	2° 59.23' E	0.0	RMT
PS69/058-2	11.12.05	23:43	61° 58.97' S	2° 59.12' E	0.0	RMT
PS69/058-2	11.12.05	23:44	61° 58.93' S	2° 59.11' E	0.0	RMT
PS69/058-2	11.12.05	23:53	61° 58.62' S	2° 59.02' E	0.0	RMT
PS69/058-3	12.12.05	00:12	61° 58.47' S	2° 58.43' E	5389.6	CTD/RO
PS69/058-3	12.12.05	01:45	61° 58.43' S	2° 57.27' E	5389.2	CTD/RO
PS69/058-3	12.12.05	03:15	61° 58.64' S	2° 55.68' E	0.0	CTD/RO
PS69/059-1	12.12.05	06:19	61° 32.09' S	2° 59.75' E	0.0	RMT
PS69/059-1	12.12.05	06:35	61° 31.59' S	3° 0.52' E	0.0	RMT
PS69/059-1	12.12.05	07:03	61° 30.69' S	3° 2.03' E	0.0	RMT
PS69/059-2	12.12.05	07:20	61° 29.84' S	3° 0.90' E	5383.6	CTD/RO
PS69/059-2	12.12.05	08:54	61° 29.95' S	3° 1.41' E	5384.0	CTD/RO
PS69/059-2	12.12.05	10:23	61° 29.71' S	3° 2.16' E	5384.0	CTD/RO
PS69/059-3	12.12.05	10:32	61° 29.67' S	3° 2.24' E	0.0	MN
PS69/059-3	12.12.05	10:47	61° 29.62' S	3° 2.32' E	0.0	MN
PS69/059-3	12.12.05	10:48	61° 29.62' S	3° 2.32' E	0.0	MN
PS69/059-3	12.12.05	11:14	0° 0.00' N	0° 0.00' E	0.0	MN
PS69/060-1	12.12.05	14:18	61° 1.75' S	3° 1.85' E	0.0	RMT
PS69/060-1	12.12.05	14:34	61° 1.10' S	3° 1.24' E	0.0	RMT
PS69/060-1	12.12.05	15:05	60° 59.93' S	2° 59.76' E	0.0	RMT
PS69/060-2	12.12.05	15:21	61° 0.24' S	2° 59.87' E	5396.4	CTD/RO
PS69/060-3	12.12.05	15:29	61° 0.30' S	2° 59.88' E	5397.2	HN
PS69/060-3	12.12.05	15:37	61° 0.32' S	2° 59.93' E	5396.8	HN
PS69/060-2	12.12.05	16:54	61° 0.75' S	3° 0.51' E	5401.2	CTD/RO
PS69/060-2	12.12.05	18:21	61° 1.42' S	3° 1.37' E	0.0	CTD/RO
PS69/060-4	12.12.05	18:28	61° 1.49' S	3° 1.45' E	0.0	WP-2 BUCKET
PS69/060-4	12.12.05	18:36	61° 1.55' S	3° 1.56' E	0.0	WP-2 BUCKET
PS69/060-4	12.12.05	18:46	61° 1.58' S	3° 1.61' E	0.0	WP-2 BUCKET
PS69/061-1	12.12.05	22:18	60° 30.97' S	3° 5.00' E	0.0	RMT
PS69/061-1	12.12.05	22:35	60° 30.39' S	3° 4.16' E	0.0	RMT
PS69/061-1	12.12.05	23:06	60° 29.45' S	3° 2.87' E	0.0	RMT
PS69/061-2	12.12.05	23:26	60° 28.87' S	3° 3.19' E	0.0	CTD
PS69/061-2	13.12.05	01:05	60° 29.08' S	3° 3.29' E	5390.4	CTD
PS69/061-2	13.12.05	02:28	60° 29.46' S	3° 2.69' E	0.0	CTD
PS69/061-3	13.12.05	02:40	60° 29.46' S	3° 2.55' E	0.0	MN
PS69/061-3	13.12.05	02:53	60° 29.43' S	3° 2.53' E	0.0	MN
PS69/061-3	13.12.05	03:20	60° 29.37' S	3° 2.55' E	0.0	MN
PS69/062-1	13.12.05	06:34	60° 1.07' S	3° 3.31' E	0.0	RMT
PS69/062-1	13.12.05	06:52	60° 0.33' S	3° 2.83' E	0.0	RMT
PS69/062-1	13.12.05	07:25	59° 58.94' S	3° 2.49' E	0.0	RMT
PS69/062-2	13.12.05	07:39	59° 59.01' S	3° 2.64' E	5375.2	CTD/RO
PS69/062-2	13.12.05	09:10	59° 59.06' S	3° 2.25' E	5376.4	CTD/RO
PS69/062-2	13.12.05	10:41	59° 58.95' S	3° 1.89' E	0.0	CTD/RO
PS69/062-3	13.12.05	10:51	59° 58.82' S	3° 1.79' E	0.0	RMT
PS69/062-3	13.12.05	13:49	59° 57.70' S	2° 52.26' E	5398.8	RMT

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/062-3	13.12.05	16:24	59° 57.46' S	2° 38.96' E	0.0	RMT
PS69/062-3	13.12.05	18:20	59° 57.97' S	2° 32.91' E	0.0	RMT
PS69/062-4	13.12.05	18:24	59° 58.01' S	2° 32.72' E	0.0	RMT
PS69/062-4	13.12.05	19:19	59° 58.18' S	2° 29.65' E	0.0	RMT
PS69/062-4	13.12.05	20:50	59° 58.37' S	2° 22.91' E	0.0	RMT
PS69/063-1	14.12.05	02:53	60° 1.75' S	0° 1.85' E	0.0	RMT
PS69/063-1	14.12.05	03:10	60° 1.16' S	0° 1.19' E	0.0	RMT
PS69/063-1	14.12.05	03:40	60° 0.17' S	0° 0.21' E	0.0	RMT
PS69/063-2	14.12.05	03:52	60° 0.20' S	0° 0.21' E	5364.8	CTD/RO
PS69/063-2	14.12.05	05:30	60° 0.53' S	0° 0.27' W	5354.8	CTD/RO
PS69/063-2	14.12.05	06:56	60° 0.79' S	0° 0.32' W	0.0	CTD/RO
PS69/063-3	14.12.05	07:06	60° 0.78' S	0° 0.36' W	0.0	MN
PS69/063-3	14.12.05	07:22	60° 0.77' S	0° 0.42' W	0.0	MN
PS69/063-3	14.12.05	07:48	60° 0.74' S	0° 0.53' W	0.0	MN
PS69/063-4	14.12.05	08:00	60° 0.75' S	0° 0.56' W	0.0	WP-2 BUCKET
PS69/063-4	14.12.05	08:05	60° 0.75' S	0° 0.58' W	0.0	WP-2 BUCKET
PS69/063-4	14.12.05	08:05	60° 0.75' S	0° 0.58' W	0.0	WP-2 BUCKET
PS69/063-4	14.12.05	08:15	60° 0.75' S	0° 0.61' W	0.0	WP-2 BUCKET
PS69/064-1	14.12.05	11:14	60° 32.01' S	0° 2.19' E	0.0	RMT
PS69/064-1	14.12.05	11:28	60° 31.52' S	0° 1.78' E	0.0	RMT
PS69/064-1	14.12.05	11:56	60° 30.54' S	0° 0.89' E	0.0	RMT
PS69/064-2	14.12.05	12:09	60° 30.39' S	0° 0.81' E	5370.0	CTD/RO
PS69/064-2	14.12.05	12:33	60° 30.35' S	0° 0.81' E	5370.0	CTD/RO
PS69/064-2	14.12.05	12:57	60° 30.24' S	0° 0.61' E	0.0	CTD/RO
PS69/065-1	14.12.05	16:19	61° 1.72' S	0° 0.01' E	0.0	RMT
PS69/065-1	14.12.05	16:40	61° 0.71' S	0° 0.07' W	0.0	RMT
PS69/065-1	14.12.05	17:16	60° 59.07' S	0° 0.57' W	0.0	RMT
PS69/065-2	14.12.05	17:28	60° 59.24' S	0° 0.57' W	5385.6	CTD/RO
PS69/065-2	14.12.05	17:52	60° 59.19' S	0° 0.77' W	0.0	CTD/RO
PS69/065-2	14.12.05	18:23	60° 59.34' S	0° 0.98' W	0.0	CTD/RO
PS69/065-3	14.12.05	18:32	60° 59.43' S	0° 1.03' W	0.0	MN
PS69/065-3	14.12.05	18:51	60° 59.42' S	0° 1.20' W	0.0	MN
PS69/065-3	14.12.05	19:16	60° 59.46' S	0° 1.39' W	0.0	MN
PS69/066-1	14.12.05	22:47	61° 31.91' S	0° 0.61' E	0.0	RMT
PS69/066-1	14.12.05	23:06	61° 31.09' S	0° 0.51' E	0.0	RMT
PS69/066-1	14.12.05	23:43	61° 29.64' S	0° 0.47' E	0.0	RMT
PS69/066-2	14.12.05	23:56	61° 29.64' S	0° 0.21' E	0.0	CTD/RO
PS69/066-2	15.12.05	00:18	61° 29.71' S	0° 0.19' E	5389.2	CTD/RO
PS69/066-2	15.12.05	00:44	61° 29.70' S	0° 0.11' E	5388.4	CTD/RO
PS69/067-1	15.12.05	04:07	62° 1.91' S	0° 0.37' E	0.0	RMT
PS69/067-1	15.12.05	04:24	62° 1.15' S	0° 0.25' E	0.0	RMT
PS69/067-1	15.12.05	05:00	61° 59.74' S	0° 2.00' E	0.0	RMT
PS69/067-2	15.12.05	05:13	61° 59.62' S	0° 2.84' E	5372.4	CTD/RO
PS69/067-2	15.12.05	06:48	61° 59.40' S	0° 3.17' E	5372.0	CTD/RO
PS69/067-2	15.12.05	08:11	61° 59.38' S	0° 3.21' E	0.0	CTD/RO
PS69/067-3	15.12.05	08:25	61° 59.69' S	0° 3.37' E	0.0	MN
PS69/067-3	15.12.05	08:43	61° 59.62' S	0° 3.36' E	0.0	MN
PS69/067-3	15.12.05	08:43	61° 59.62' S	0° 3.36' E	0.0	MN
PS69/067-3	15.12.05	09:04	61° 59.57' S	0° 3.36' E	0.0	MN
PS69/068-1	15.12.05	12:49	62° 31.63' S	0° 1.32' E	0.0	RMT
PS69/068-1	15.12.05	13:05	62° 31.05' S	0° 0.76' E	0.0	RMT
PS69/068-1	15.12.05	13:33	62° 29.98' S	0° 0.17' W	0.0	RMT
PS69/068-2	15.12.05	13:48	62° 30.06' S	0° 0.03' W	5349.2	CTD/RO
PS69/068-2	15.12.05	14:08	62° 30.17' S	0° 0.07' E	5349.2	CTD/RO
PS69/068-2	15.12.05	14:37	62° 30.30' S	0° 0.46' E	0.0	CTD/RO

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/069-1	15.12.05	17:45	62° 59.62' S	0° 4.61' E	0.0	RMT
PS69/069-1	15.12.05	18:02	63° 0.22' S	0° 3.69' E	0.0	RMT
PS69/069-1	15.12.05	18:37	63° 1.59' S	0° 2.89' E	0.0	RMT
PS69/069-2	15.12.05	18:51	63° 1.62' S	0° 2.60' E	5308.8	CTD/RO
PS69/069-2	15.12.05	19:14	63° 1.59' S	0° 2.93' E	0.0	CTD/RO
PS69/069-2	15.12.05	19:39	63° 1.42' S	0° 2.96' E	0.0	CTD/RO
PS69/069-3	15.12.05	19:48	63° 1.36' S	0° 2.98' E	0.0	MN
PS69/069-3	15.12.05	20:00	63° 1.30' S	0° 3.03' E	0.0	MN
PS69/069-3	15.12.05	20:02	63° 1.29' S	0° 3.04' E	0.0	MN
PS69/069-3	15.12.05	20:25	63° 1.17' S	0° 3.13' E	0.0	MN
PS69/070-1	16.12.05	00:01	63° 31.82' S	0° 1.53' E	0.0	RMT
PS69/070-1	16.12.05	00:18	63° 31.21' S	0° 0.76' E	0.0	RMT
PS69/070-1	16.12.05	00:49	63° 30.01' S	0° 0.44' W	0.0	RMT
PS69/070-2	16.12.05	01:05	63° 29.62' S	0° 0.69' W	5246.0	CTD/RO
PS69/070-2	16.12.05	01:28	63° 29.55' S	0° 0.83' W	5245.6	CTD/RO
PS69/070-2	16.12.05	01:54	63° 29.56' S	0° 0.92' W	0.0	CTD/RO
PS69/071-1	16.12.05	04:59	63° 59.75' S	0° 0.82' E	0.0	RMT
PS69/071-1	16.12.05	05:17	63° 59.73' S	0° 1.02' W	0.0	RMT
PS69/071-1	16.12.05	05:51	63° 59.61' S	0° 4.42' W	0.0	RMT
PS69/071-2	16.12.05	06:52	63° 57.25' S	0° 0.15' W	0.0	MOR
PS69/071-2	16.12.05	07:18	63° 57.43' S	0° 0.02' W	0.0	MOR
PS69/071-2	16.12.05	07:25	63° 57.45' S	0° 0.08' E	0.0	MOR
PS69/071-2	16.12.05	07:32	63° 57.42' S	0° 0.13' E	0.0	MOR
PS69/071-2	16.12.05	07:51	63° 57.36' S	0° 0.19' E	0.0	MOR
PS69/071-2	16.12.05	08:06	63° 57.45' S	0° 0.05' E	0.0	MOR
PS69/071-2	16.12.05	08:21	63° 57.78' S	0° 0.13' W	5207.6	MOR
PS69/071-2	16.12.05	08:38	63° 58.16' S	0° 0.22' W	0.0	MOR
PS69/071-2	16.12.05	08:45	63° 57.87' S	0° 0.04' W	0.0	MOR
PS69/071-2	16.12.05	09:12	63° 57.44' S	0° 0.26' W	0.0	MOR
PS69/071-2	16.12.05	09:16	63° 57.46' S	0° 0.21' W	0.0	MOR
PS69/071-2	16.12.05	09:25	63° 57.53' S	0° 0.27' W	0.0	MOR
PS69/071-2	16.12.05	09:30	63° 57.56' S	0° 0.24' W	0.0	MOR
PS69/071-2	16.12.05	09:33	63° 57.56' S	0° 0.19' W	0.0	MOR
PS69/071-2	16.12.05	09:37	63° 57.57' S	0° 0.11' W	0.0	MOR
PS69/071-2	16.12.05	09:42	63° 57.58' S	0° 0.05' W	0.0	MOR
PS69/071-2	16.12.05	09:48	63° 57.60' S	0° 0.00' E	0.0	MOR
PS69/071-2	16.12.05	10:04	63° 57.67' S	0° 0.02' E	0.0	MOR
PS69/071-2	16.12.05	10:07	63° 57.69' S	0° 0.02' E	0.0	MOR
PS69/071-2	16.12.05	10:32	63° 57.82' S	0° 0.10' E	0.0	MOR
PS69/071-2	16.12.05	10:59	63° 57.96' S	0° 0.21' E	0.0	MOR
PS69/071-2	16.12.05	11:05	63° 58.00' S	0° 0.18' E	0.0	MOR
PS69/071-3	16.12.05	12:10	63° 57.20' S	0° 0.34' W	5208.4	MOR
PS69/071-3	16.12.05	12:19	63° 57.18' S	0° 0.38' W	5208.4	MOR
PS69/071-3	16.12.05	12:23	63° 57.17' S	0° 0.35' W	5208.4	MOR
PS69/071-3	16.12.05	13:05	63° 57.18' S	0° 0.34' W	5208.0	MOR
PS69/071-3	16.12.05	13:40	63° 57.15' S	0° 0.26' W	5210.0	MOR
PS69/071-3	16.12.05	14:09	63° 57.13' S	0° 0.15' W	5208.0	MOR
PS69/071-3	16.12.05	14:14	63° 57.16' S	0° 0.14' W	5208.4	MOR
PS69/071-3	16.12.05	14:20	63° 57.18' S	0° 0.11' W	5208.0	MOR
PS69/071-3	16.12.05	14:24	63° 57.17' S	0° 0.09' W	5207.6	MOR
PS69/071-3	16.12.05	14:30	63° 57.13' S	0° 0.12' W	5208.0	MOR
PS69/071-3	16.12.05	14:34	63° 57.14' S	0° 0.14' W	5208.0	MOR
PS69/071-3	16.12.05	14:45	63° 57.16' S	0° 0.24' W	5208.0	MOR
PS69/071-3	16.12.05	14:51	63° 57.16' S	0° 0.30' W	5208.4	MOR
PS69/071-3	16.12.05	14:56	63° 57.17' S	0° 0.35' W	5208.4	MOR

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/071-3	16.12.05	15:00	63° 57.17' S	0° 0.36' W	5208.4	MOR
PS69/071-3	16.12.05	15:03	63° 57.17' S	0° 0.36' W	5208.4	MOR
PS69/071-3	16.12.05	15:09	63° 57.17' S	0° 0.36' W	5208.4	MOR
PS69/071-3	16.12.05	15:14	63° 57.17' S	0° 0.36' W	5209.2	MOR
PS69/071-3	16.12.05	15:15	63° 57.17' S	0° 0.36' W	5209.2	MOR
PS69/071-3	16.12.05	15:15	63° 57.17' S	0° 0.36' W	5209.2	MOR
PS69/071-3	16.12.05	15:16	63° 57.17' S	0° 0.37' W	5209.2	MOR
PS69/071-3	16.12.05	15:18	63° 57.17' S	0° 0.38' W	5209.2	MOR
PS69/071-4	16.12.05	15:53	63° 59.96' S	0° 0.04' E	5200.8	CTD/RO
PS69/071-4	16.12.05	17:22	64° 0.13' S	0° 0.24' W	5200.8	CTD/RO
PS69/071-4	16.12.05	18:46	64° 0.66' S	0° 0.58' W	0.0	CTD/RO
PS69/071-5	16.12.05	18:57	64° 1.02' S	0° 0.46' W	0.0	MN
PS69/071-5	16.12.05	19:08	64° 1.10' S	0° 0.48' W	0.0	MN
PS69/071-5	16.12.05	19:31	64° 1.15' S	0° 0.63' W	0.0	MN
PS69/071-5	16.12.05	19:41	64° 1.25' S	0° 0.11' W	0.0	WP-2 BUCKET
PS69/071-5	16.12.05	19:49	64° 1.35' S	0° 0.06' W	0.0	WP-2 BUCKET
PS69/071-5	16.12.05	20:07	64° 1.47' S	0° 0.18' E	0.0	WP-2 BUCKET
PS69/072-1	16.12.05	23:09	64° 31.42' S	0° 1.57' W	0.0	RMT
PS69/072-1	16.12.05	23:27	64° 30.80' S	0° 0.94' W	0.0	RMT
PS69/072-1	17.12.05	00:01	64° 29.67' S	0° 0.10' E	0.0	RMT
PS69/072-2	17.12.05	00:20	64° 29.74' S	0° 0.02' E	4645.6	CTD/RO
PS69/072-2	17.12.05	00:46	64° 29.84' S	0° 0.01' E	0.0	CTD/RO
PS69/072-2	17.12.05	01:03	64° 29.90' S	0° 0.00' W	0.0	CTD/RO
PS69/072-3	17.12.05	01:15	64° 29.96' S	0° 0.03' W	0.0	MN
PS69/072-3	17.12.05	01:49	64° 30.12' S	0° 0.08' W	0.0	MN
PS69/072-3	17.12.05	01:50	64° 30.13' S	0° 0.08' W	0.0	MN
PS69/072-3	17.12.05	02:57	64° 30.49' S	0° 0.19' E	0.0	MN
PS69/072-4	17.12.05	03:06	64° 30.55' S	0° 0.20' E	0.0	BONGO
PS69/072-4	17.12.05	03:15	64° 30.62' S	0° 0.19' E	0.0	BONGO
PS69/072-4	17.12.05	03:32	64° 30.77' S	0° 0.15' E	0.0	BONGO
PS69/073-1	17.12.05	06:16	64° 58.02' S	0° 0.19' E	0.0	RMT
PS69/073-1	17.12.05	06:35	64° 58.78' S	0° 0.74' W	0.0	RMT
PS69/073-1	17.12.05	07:04	65° 0.07' S	0° 1.08' W	0.0	RMT
PS69/073-2	17.12.05	07:13	65° 0.41' S	0° 0.74' W	0.0	RMT
PS69/073-2	17.12.05	07:20	65° 0.36' S	0° 0.07' W	0.0	RMT
PS69/073-2	17.12.05	07:24	65° 0.34' S	0° 0.28' E	0.0	RMT
PS69/073-2	17.12.05	07:28	65° 0.33' S	0° 0.57' E	0.0	RMT
PS69/073-2	17.12.05	07:30	65° 0.32' S	0° 0.70' E	0.0	RMT
PS69/073-2	17.12.05	07:38	65° 0.30' S	0° 1.17' E	0.0	RMT
PS69/073-3	17.12.05	07:52	64° 59.95' S	0° 0.29' E	3733.2	CTD/RO
PS69/073-3	17.12.05	08:19	64° 59.84' S	0° 0.11' E	3733.2	CTD/RO
PS69/073-3	17.12.05	08:51	64° 59.82' S	0° 0.04' W	0.0	CTD/RO
PS69/073-4	17.12.05	08:59	64° 59.81' S	0° 0.04' W	0.0	MN
PS69/073-4	17.12.05	09:11	64° 59.79' S	0° 0.05' W	0.0	MN
PS69/073-4	17.12.05	09:12	64° 59.79' S	0° 0.05' W	0.0	MN
PS69/073-4	17.12.05	09:36	64° 59.77' S	0° 0.01' W	0.0	MN
PS69/074-1	17.12.05	12:49	65° 31.19' S	0° 0.91' W	0.0	RMT
PS69/074-1	17.12.05	13:04	65° 30.66' S	0° 0.29' W	0.0	RMT
PS69/074-1	17.12.05	13:30	65° 29.82' S	0° 0.80' E	0.0	RMT
PS69/074-2	17.12.05	13:44	65° 29.96' S	0° 0.75' E	3951.2	CTD/RO
PS69/074-2	17.12.05	14:53	65° 29.84' S	0° 1.51' E	3880.0	CTD/RO
PS69/074-2	17.12.05	16:03	65° 29.87' S	0° 2.02' E	0.0	CTD/RO
PS69/075-1	17.12.05	18:54	65° 58.07' S	0° 0.16' W	0.0	RMT
PS69/075-1	17.12.05	19:11	65° 58.81' S	0° 0.39' W	0.0	RMT
PS69/075-1	17.12.05	19:44	66° 0.20' S	0° 0.78' W	0.0	RMT

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/075-2	17.12.05	21:42	66° 0.41' S	0° 1.27' W	3459.2	CTD
PS69/075-2	17.12.05	22:01	66° 0.44' S	0° 1.37' W	3463.6	CTD
PS69/075-2	17.12.05	22:24	66° 0.47' S	0° 1.39' W	0.0	CTD
PS69/075-3	17.12.05	22:33	66° 0.48' S	0° 1.41' W	0.0	MN
PS69/075-3	17.12.05	22:44	66° 0.50' S	0° 1.45' W	0.0	MN
PS69/075-3	17.12.05	22:45	66° 0.50' S	0° 1.45' W	0.0	MN
PS69/075-3	17.12.05	23:11	66° 0.56' S	0° 1.46' W	0.0	MN
PS69/076-1	18.12.05	02:02	66° 28.08' S	0° 0.50' E	0.0	RMT
PS69/076-1	18.12.05	02:23	66° 28.94' S	0° 1.33' E	0.0	RMT
PS69/076-1	18.12.05	02:57	66° 30.25' S	0° 2.66' E	0.0	RMT
PS69/076-2	18.12.05	03:14	66° 30.50' S	0° 2.98' E	4544.8	CTD/RO
PS69/076-2	18.12.05	04:32	66° 30.72' S	0° 3.19' E	4555.2	CTD/RO
PS69/076-2	18.12.05	05:48	66° 30.75' S	0° 3.15' E	0.0	CTD/RO
PS69/076-3	18.12.05	06:38	66° 30.77' S	0° 2.16' W	0.0	MOR
PS69/076-3	18.12.05	06:47	66° 30.76' S	0° 2.14' W	0.0	MOR
PS69/076-3	18.12.05	06:55	66° 30.70' S	0° 2.17' W	0.0	MOR
PS69/076-3	18.12.05	06:57	66° 30.70' S	0° 2.17' W	0.0	MOR
PS69/076-3	18.12.05	07:09	66° 30.83' S	0° 2.20' W	0.0	MOR
PS69/076-3	18.12.05	07:18	66° 30.63' S	0° 1.99' W	0.0	MOR
PS69/076-3	18.12.05	07:29	66° 30.63' S	0° 2.11' W	0.0	MOR
PS69/076-3	18.12.05	07:31	66° 30.64' S	0° 2.12' W	0.0	MOR
PS69/076-3	18.12.05	07:34	66° 30.65' S	0° 2.21' W	0.0	MOR
PS69/076-3	18.12.05	07:38	66° 30.65' S	0° 2.28' W	0.0	MOR
PS69/076-3	18.12.05	07:42	66° 30.65' S	0° 2.35' W	0.0	MOR
PS69/076-3	18.12.05	07:45	66° 30.64' S	0° 2.41' W	0.0	MOR
PS69/076-3	18.12.05	08:05	66° 30.66' S	0° 2.38' W	0.0	MOR
PS69/076-3	18.12.05	08:09	66° 30.63' S	0° 2.37' W	0.0	MOR
PS69/076-3	18.12.05	08:14	66° 30.61' S	0° 2.39' W	0.0	MOR
PS69/076-3	18.12.05	08:39	66° 30.60' S	0° 2.57' W	0.0	MOR
PS69/076-3	18.12.05	09:00	66° 30.64' S	0° 2.71' W	0.0	MOR
PS69/076-3	18.12.05	09:05	66° 30.63' S	0° 2.75' W	0.0	MOR
PS69/076-4	18.12.05	09:23	66° 30.66' S	0° 2.20' W	4568.0	MOR
PS69/076-4	18.12.05	09:33	66° 30.67' S	0° 2.08' W	4564.4	MOR
PS69/076-4	18.12.05	09:38	66° 30.68' S	0° 2.06' W	4564.0	MOR
PS69/076-4	18.12.05	10:04	66° 30.67' S	0° 1.93' W	4558.4	MOR
PS69/076-4	18.12.05	10:45	66° 30.67' S	0° 1.77' W	4552.4	MOR
PS69/076-4	18.12.05	11:09	66° 30.64' S	0° 1.69' W	4550.4	MOR
PS69/076-4	18.12.05	11:13	66° 30.64' S	0° 1.68' W	4547.2	MOR
PS69/076-4	18.12.05	11:21	66° 30.63' S	0° 1.68' W	4548.0	MOR
PS69/076-4	18.12.05	11:24	66° 30.64' S	0° 1.69' W	4547.2	MOR
PS69/076-4	18.12.05	11:27	66° 30.65' S	0° 1.70' W	4550.8	MOR
PS69/076-4	18.12.05	11:31	66° 30.66' S	0° 1.73' W	4548.8	MOR
PS69/076-4	18.12.05	11:35	66° 30.64' S	0° 1.75' W	4550.4	MOR
PS69/076-4	18.12.05	11:40	66° 30.64' S	0° 1.77' W	4551.2	MOR
PS69/076-4	18.12.05	11:42	66° 30.64' S	0° 1.79' W	4552.0	MOR
PS69/076-4	18.12.05	11:48	66° 30.64' S	0° 1.83' W	4553.6	MOR
PS69/076-4	18.12.05	11:52	66° 30.65' S	0° 1.85' W	4555.2	MOR
PS69/076-4	18.12.05	11:55	66° 30.66' S	0° 1.87' W	4555.2	MOR
PS69/076-4	18.12.05	12:03	66° 30.68' S	0° 1.91' W	4558.4	MOR
PS69/076-4	18.12.05	12:06	66° 30.67' S	0° 1.90' W	4556.8	MOR
PS69/076-4	18.12.05	12:06	66° 30.67' S	0° 1.90' W	4556.8	MOR
PS69/076-4	18.12.05	12:07	66° 30.67' S	0° 1.89' W	4557.2	MOR
PS69/076-4	18.12.05	12:07	66° 30.67' S	0° 1.89' W	4557.2	MOR
PS69/077-1	18.12.05	14:40	66° 57.95' S	0° 0.14' W	0.0	RMT
PS69/077-1	18.12.05	14:58	66° 58.72' S	0° 0.05' W	0.0	RMT

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/077-1	18.12.05	15:29	67° 0.02' S	0° 0.07' E	0.0	RMT
PS69/077-2	18.12.05	15:31	67° 0.05' S	0° 0.08' E	0.0	RMT
PS69/077-2	18.12.05	15:37	67° 0.22' S	0° 0.09' E	0.0	RMT
PS69/077-2	18.12.05	15:41	67° 0.36' S	0° 0.10' E	0.0	RMT
PS69/077-2	18.12.05	15:42	67° 0.39' S	0° 0.10' E	0.0	RMT
PS69/077-2	18.12.05	15:47	67° 0.56' S	0° 0.10' E	0.0	RMT
PS69/077-2	18.12.05	15:52	67° 0.70' S	0° 0.11' E	0.0	RMT
PS69/077-3	18.12.05	16:23	67° 0.43' S	0° 0.15' E	4711.6	CTD/RO
PS69/077-3	18.12.05	16:46	67° 0.51' S	0° 0.29' E	0.0	CTD/RO
PS69/077-3	18.12.05	17:08	67° 0.47' S	0° 0.26' E	0.0	CTD/RO
PS69/077-4	18.12.05	17:14	67° 0.49' S	0° 0.30' E	0.0	MN
PS69/077-4	18.12.05	17:27	67° 0.57' S	0° 0.39' E	0.0	MN
PS69/077-4	18.12.05	17:52	67° 0.62' S	0° 0.42' E	0.0	MN
PS69/077-5	18.12.05	18:06	67° 0.67' S	0° 0.25' E	0.0	WP-2 BUCKET
PS69/077-5	18.12.05	18:13	67° 0.66' S	0° 0.19' E	0.0	WP-2 BUCKET
PS69/077-5	18.12.05	18:26	67° 0.62' S	0° 0.23' E	0.0	WP-2 BUCKET
PS69/078-1	18.12.05	21:33	67° 31.45' S	0° 2.90' E	0.0	RMT
PS69/078-1	18.12.05	21:52	67° 31.06' S	0° 1.06' E	0.0	RMT
PS69/078-1	18.12.05	22:25	67° 30.40' S	0° 1.86' W	0.0	RMT
PS69/078-2	18.12.05	22:31	67° 30.33' S	0° 2.16' W	0.0	RMT
PS69/078-2	18.12.05	22:35	67° 30.27' S	0° 2.45' W	0.0	RMT
PS69/078-2	18.12.05	22:41	67° 30.17' S	0° 2.92' W	0.0	RMT
PS69/078-2	18.12.05	22:41	67° 30.17' S	0° 2.92' W	0.0	RMT
PS69/078-2	18.12.05	22:46	67° 30.09' S	0° 3.31' W	0.0	RMT
PS69/078-2	18.12.05	22:49	67° 30.04' S	0° 3.54' W	0.0	RMT
PS69/078-2	18.12.05	22:49	67° 30.04' S	0° 3.54' W	0.0	RMT
PS69/078-2	18.12.05	22:56	67° 29.96' S	0° 3.91' W	0.0	RMT
PS69/078-3	18.12.05	23:09	67° 30.09' S	0° 3.30' W	4643.6	CTD/RO
PS69/078-3	18.12.05	23:28	67° 30.13' S	0° 3.21' W	4643.6	CTD/RO
PS69/078-3	19.12.05	00:01	67° 30.17' S	0° 3.09' W	0.0	CTD/RO
PS69/079-1	19.12.05	02:49	68° 1.32' S	0° 4.57' E	0.0	RMT
PS69/079-1	19.12.05	03:07	68° 0.81' S	0° 3.08' E	0.0	RMT
PS69/079-1	19.12.05	03:37	67° 59.99' S	0° 0.55' E	0.0	RMT
PS69/079-2	19.12.05	03:46	67° 59.92' S	0° 0.14' E	0.0	CTD/RO
PS69/079-2	19.12.05	05:17	67° 59.98' S	0° 0.67' W	4518.4	CTD/RO
PS69/079-2	19.12.05	06:31	68° 0.08' S	0° 0.37' W	0.0	CTD/RO
PS69/079-3	19.12.05	06:40	68° 0.07' S	0° 0.35' W	0.0	MN
PS69/079-3	19.12.05	06:54	68° 0.05' S	0° 0.34' W	0.0	MN
PS69/079-3	19.12.05	07:25	68° 0.42' S	0° 0.57' W	0.0	MN
PS69/080-1	19.12.05	10:17	68° 31.83' S	0° 2.45' E	0.0	RMT
PS69/080-1	19.12.05	10:35	68° 31.30' S	0° 0.71' E	0.0	RMT
PS69/080-1	19.12.05	11:09	68° 30.23' S	0° 2.09' W	0.0	RMT
PS69/080-2	19.12.05	11:24	68° 30.23' S	0° 2.08' W	0.0	CTD/RO
PS69/080-2	19.12.05	11:45	68° 30.22' S	0° 2.04' W	4278.0	CTD/RO
PS69/080-2	19.12.05	12:11	68° 30.22' S	0° 2.20' W	0.0	CTD/RO
PS69/081-1	19.12.05	15:33	68° 59.42' S	0° 0.60' W	0.0	MOR
PS69/081-1	19.12.05	15:38	68° 59.45' S	0° 0.58' W	0.0	MOR
PS69/081-1	19.12.05	15:41	68° 59.46' S	0° 0.58' W	0.0	MOR
PS69/081-1	19.12.05	16:06	68° 59.81' S	0° 0.28' W	0.0	MOR
PS69/081-1	19.12.05	16:17	68° 59.90' S	0° 0.21' W	0.0	MOR
PS69/081-1	19.12.05	16:26	68° 59.95' S	0° 0.11' W	0.0	MOR
PS69/081-1	19.12.05	16:41	68° 59.96' S	0° 0.19' W	0.0	MOR
PS69/081-1	19.12.05	17:03	68° 59.93' S	0° 0.04' W	0.0	MOR
PS69/081-1	19.12.05	17:11	68° 59.91' S	0° 0.11' E	0.0	MOR
PS69/081-2	19.12.05	18:01	68° 59.73' S	0° 0.13' W	0.0	MOR

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/081-2	19.12.05	18:12	68° 59.72' S	0° 0.15' W	0.0	MOR
PS69/081-2	19.12.05	18:17	68° 59.73' S	0° 0.07' W	3427.2	MOR
PS69/081-2	19.12.05	18:53	68° 59.75' S	0° 0.08' W	3425.2	MOR
PS69/081-2	19.12.05	19:15	68° 59.73' S	0° 0.26' W	3420.8	MOR
PS69/081-2	19.12.05	19:30	68° 59.73' S	0° 0.19' W	3423.6	MOR
PS69/081-2	19.12.05	19:38	68° 59.75' S	0° 0.13' W	3424.0	MOR
PS69/081-2	19.12.05	19:45	68° 59.75' S	0° 0.13' W	3424.0	MOR
PS69/081-2	19.12.05	19:55	68° 59.75' S	0° 0.14' W	3424.0	MOR
PS69/081-2	19.12.05	20:00	68° 59.75' S	0° 0.16' W	3423.2	MOR
PS69/081-3	19.12.05	20:30	69° 0.33' S	0° 4.63' E	3348.8	CTD/RO
PS69/081-4	19.12.05	21:02	69° 0.30' S	0° 4.19' E	3357.2	HN
PS69/081-4	19.12.05	21:05	69° 0.30' S	0° 4.19' E	3357.2	HN
PS69/081-5	19.12.05	21:08	69° 0.30' S	0° 4.19' E	3357.2	HN
PS69/081-5	19.12.05	21:12	69° 0.30' S	0° 4.16' E	3357.6	HN
PS69/081-6	19.12.05	21:13	69° 0.30' S	0° 4.15' E	3357.6	HN
PS69/081-6	19.12.05	21:17	69° 0.30' S	0° 4.09' E	3358.4	HN
PS69/081-3	19.12.05	21:32	69° 0.31' S	0° 3.81' E	3362.8	CTD/RO
PS69/081-3	19.12.05	22:36	69° 0.24' S	0° 2.43' E	0.0	CTD/RO
PS69/081-7	19.12.05	22:45	69° 0.22' S	0° 2.25' E	0.0	MN
PS69/081-7	19.12.05	22:57	69° 0.21' S	0° 2.04' E	0.0	MN
PS69/081-7	19.12.05	23:03	69° 0.22' S	0° 1.94' E	0.0	MN
PS69/081-7	19.12.05	23:29	69° 0.23' S	0° 1.50' E	0.0	MN
PS69/081-8	19.12.05	23:42	69° 0.53' S	0° 1.60' E	0.0	RMT
PS69/081-8	20.12.05	00:02	69° 1.54' S	0° 1.86' E	0.0	RMT
PS69/081-8	20.12.05	00:34	69° 2.77' S	0° 3.08' E	0.0	RMT
PS69/082-1	20.12.05	06:29	69° 29.92' S	0° 1.39' W	1536.0	CTD/RO
PS69/082-1	20.12.05	07:03	69° 29.90' S	0° 1.80' W	1534.8	CTD/RO
PS69/082-1	20.12.05	07:43	69° 29.88' S	0° 2.27' W	1532.4	CTD/RO
PS69/082-2	20.12.05	07:51	69° 29.87' S	0° 2.36' W	0.0	WP-2 BUCKET
PS69/082-2	20.12.05	07:58	69° 29.86' S	0° 2.44' W	0.0	WP-2 BUCKET
PS69/082-2	20.12.05	08:10	69° 29.85' S	0° 2.58' W	0.0	WP-2 BUCKET
PS69/083-1	20.12.05	18:30	70° 0.09' S	3° 3.51' W	0.0	RMT
PS69/083-1	20.12.05	18:46	70° 0.46' S	3° 2.23' W	0.0	RMT
PS69/083-1	20.12.05	19:20	70° 1.05' S	2° 59.83' W	0.0	RMT
PS69/083-2	20.12.05	19:22	70° 1.05' S	2° 59.87' W	0.0	RMT
PS69/083-2	20.12.05	19:29	70° 1.06' S	2° 59.79' W	0.0	RMT
PS69/083-2	20.12.05	19:34	70° 1.10' S	2° 59.46' W	0.0	RMT
PS69/083-2	20.12.05	19:36	70° 1.13' S	2° 59.35' W	0.0	RMT
PS69/083-2	20.12.05	19:39	70° 1.16' S	2° 59.17' W	0.0	RMT
PS69/083-2	20.12.05	19:47	70° 1.22' S	2° 58.88' W	0.0	RMT
PS69/083-3	20.12.05	20:05	70° 0.81' S	3° 0.06' W	2341.2	CTD/RO
PS69/083-3	20.12.05	20:53	70° 0.84' S	3° 1.83' W	1531.2	CTD/RO
PS69/083-3	20.12.05	21:42	70° 0.93' S	3° 3.20' W	0.0	CTD/RO
PS69/083-4	20.12.05	21:49	70° 0.94' S	3° 3.42' W	0.0	MN
PS69/083-4	20.12.05	22:01	70° 0.96' S	3° 3.76' W	0.0	MN
PS69/083-4	20.12.05	22:03	70° 0.97' S	3° 3.81' W	0.0	MN
PS69/083-4	20.12.05	22:29	70° 1.02' S	3° 4.59' W	0.0	MN
PS69/084-1	21.12.05	02:33	69° 28.85' S	3° 3.97' W	0.0	RMT
PS69/084-1	21.12.05	02:54	69° 29.44' S	3° 2.56' W	0.0	RMT
PS69/084-1	21.12.05	03:29	69° 30.18' S	3° 1.50' W	0.0	RMT
PS69/084-2	21.12.05	03:41	69° 29.98' S	3° 2.03' W	0.0	CTD/RO
PS69/084-2	21.12.05	04:00	69° 29.81' S	3° 2.86' W	0.0	CTD/RO
PS69/084-2	21.12.05	04:31	69° 29.65' S	3° 4.19' W	0.0	CTD/RO
PS69/085-1	21.12.05	08:14	68° 58.22' S	3° 1.76' W	0.0	RMT
PS69/085-1	21.12.05	08:33	68° 59.14' S	3° 1.40' W	0.0	RMT

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/085-1	21.12.05	09:12	69° 0.79' S	3° 0.76' W	0.0	RMT
PS69/085-2	21.12.05	09:26	69° 0.79' S	3° 0.86' W	0.0	CTD/RO
PS69/085-2	21.12.05	09:49	69° 0.76' S	3° 0.69' W	3689.6	CTD/RO
PS69/085-2	21.12.05	10:13	69° 0.72' S	3° 0.50' W	0.0	CTD/RO
PS69/085-3	21.12.05	10:20	69° 0.73' S	3° 0.44' W	0.0	MN
PS69/085-3	21.12.05	10:31	69° 0.73' S	3° 0.34' W	0.0	MN
PS69/085-3	21.12.05	10:32	69° 0.73' S	3° 0.33' W	0.0	MN
PS69/085-3	21.12.05	10:55	69° 0.72' S	3° 0.16' W	0.0	MN
PS69/086-1	21.12.05	13:55	68° 27.99' S	3° 0.36' W	0.0	RMT
PS69/086-1	21.12.05	14:12	68° 28.69' S	3° 0.21' W	0.0	RMT
PS69/086-1	21.12.05	14:40	68° 29.81' S	3° 0.01' W	0.0	RMT
PS69/086-2	21.12.05	14:55	68° 29.97' S	3° 0.09' W	4114.0	CTD/RO
PS69/086-2	21.12.05	15:15	68° 30.08' S	3° 0.05' W	4115.2	CTD/RO
PS69/086-3	21.12.05	15:22	68° 30.11' S	3° 0.05' W	0.0	HN
PS69/086-3	21.12.05	15:31	68° 30.17' S	3° 0.00' W	0.0	HN
PS69/086-2	21.12.05	15:44	68° 30.27' S	2° 59.89' W	0.0	CTD/RO
PS69/087-1	21.12.05	18:37	67° 58.20' S	3° 0.92' W	0.0	RMT
PS69/087-1	21.12.05	18:54	67° 58.93' S	3° 1.15' W	0.0	RMT
PS69/087-1	21.12.05	19:28	68° 0.34' S	3° 1.20' W	0.0	RMT
PS69/087-2	21.12.05	19:43	68° 0.00' S	3° 0.13' W	4132.0	CTD/RO
PS69/087-2	21.12.05	20:53	67° 59.74' S	2° 59.84' W	4125.6	CTD/RO
PS69/087-2	21.12.05	22:10	67° 59.51' S	2° 59.82' W	0.0	CTD/RO
PS69/087-3	21.12.05	22:18	67° 59.49' S	2° 59.88' W	0.0	MN
PS69/087-3	21.12.05	22:33	67° 59.45' S	2° 59.97' W	0.0	MN
PS69/087-3	21.12.05	22:35	67° 59.45' S	2° 59.96' W	0.0	MN
PS69/087-3	21.12.05	23:02	67° 59.43' S	2° 59.94' W	0.0	MN
PS69/087-4	21.12.05	23:11	67° 59.43' S	2° 59.93' W	0.0	WP-2 BUCKET
PS69/087-4	21.12.05	23:17	67° 59.44' S	2° 59.90' W	0.0	WP-2 BUCKET
PS69/087-4	21.12.05	23:18	67° 59.44' S	2° 59.89' W	0.0	WP-2 BUCKET
PS69/087-4	21.12.05	23:31	67° 59.45' S	2° 59.83' W	0.0	WP-2 BUCKET
PS69/088-1	22.12.05	02:18	67° 28.14' S	3° 1.46' W	0.0	RMT
PS69/088-1	22.12.05	02:37	67° 28.96' S	3° 0.81' W	0.0	RMT
PS69/088-1	22.12.05	03:09	67° 30.28' S	2° 59.84' W	0.0	RMT
PS69/088-2	22.12.05	03:27	67° 30.18' S	3° 0.14' W	4316.4	CTD/RO
PS69/088-2	22.12.05	03:48	67° 30.25' S	3° 0.26' W	4318.4	CTD/RO
PS69/088-2	22.12.05	04:21	67° 30.40' S	3° 0.22' W	0.0	CTD/RO
PS69/089-1	22.12.05	07:09	66° 58.36' S	3° 2.15' W	0.0	RMT
PS69/089-1	22.12.05	07:27	66° 58.87' S	3° 0.69' W	0.0	RMT
PS69/089-1	22.12.05	07:59	66° 59.84' S	2° 58.13' W	0.0	RMT
PS69/089-2	22.12.05	08:14	67° 0.00' S	2° 57.56' W	4460.4	CTD/RO
PS69/089-2	22.12.05	08:37	66° 59.92' S	2° 57.55' W	4460.8	CTD/RO
PS69/089-2	22.12.05	09:01	66° 59.88' S	2° 57.51' W	0.0	CTD/RO
PS69/089-3	22.12.05	09:08	66° 59.87' S	2° 57.52' W	0.0	MN
PS69/089-3	22.12.05	09:20	66° 59.85' S	2° 57.55' W	0.0	MN
PS69/089-3	22.12.05	09:20	66° 59.85' S	2° 57.55' W	0.0	MN
PS69/089-3	22.12.05	09:44	66° 59.82' S	2° 57.61' W	0.0	MN
PS69/090-1	22.12.05	12:32	66° 29.99' S	3° 3.65' W	0.0	RMT
PS69/090-1	22.12.05	12:48	66° 29.94' S	3° 2.04' W	0.0	RMT
PS69/090-1	22.12.05	13:16	66° 29.85' S	2° 59.35' W	0.0	RMT
PS69/090-2	22.12.05	13:26	66° 29.84' S	2° 59.33' W	0.0	CTD/RO
PS69/090-3	22.12.05	13:51	66° 29.78' S	2° 59.36' W	4458.4	HN
PS69/090-2	22.12.05	13:51	66° 29.78' S	2° 59.36' W	4458.4	CTD/RO
PS69/090-3	22.12.05	14:01	66° 29.72' S	2° 59.53' W	0.0	HN
PS69/090-2	22.12.05	14:18	66° 29.64' S	2° 59.91' W	0.0	CTD/RO
PS69/091-1	22.12.05	16:46	66° 1.81' S	3° 3.18' W	0.0	RMT

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/091-1	22.12.05	17:05	66° 1.09' S	3° 1.71' W	0.0	RMT
PS69/091-1	22.12.05	17:40	65° 59.95' S	2° 59.35' W	0.0	RMT
PS69/091-2	22.12.05	17:47	65° 59.88' S	2° 59.22' W	0.0	RMT
PS69/091-2	22.12.05	17:49	65° 59.83' S	2° 59.11' W	0.0	RMT
PS69/091-2	22.12.05	17:54	65° 59.70' S	2° 58.81' W	0.0	RMT
PS69/091-2	22.12.05	17:56	65° 59.65' S	2° 58.71' W	0.0	RMT
PS69/091-2	22.12.05	18:01	65° 59.54' S	2° 58.45' W	0.0	RMT
PS69/091-2	22.12.05	18:07	65° 59.43' S	2° 58.25' W	0.0	RMT
PS69/091-3	22.12.05	18:19	65° 59.40' S	2° 58.21' W	0.0	CTD/RO
PS69/091-4	22.12.05	18:36	65° 59.38' S	2° 58.21' W	4808.8	HN
PS69/091-4	22.12.05	18:45	65° 59.35' S	2° 58.23' W	4811.2	HN
PS69/091-3	22.12.05	19:42	65° 59.58' S	2° 58.81' W	4821.2	CTD/RO
PS69/091-3	22.12.05	21:03	65° 59.69' S	2° 59.32' W	0.0	CTD/RO
PS69/091-5	22.12.05	21:09	65° 59.68' S	2° 59.32' W	0.0	MN
PS69/091-5	22.12.05	21:22	65° 59.63' S	2° 59.28' W	0.0	MN
PS69/091-5	22.12.05	21:22	65° 59.63' S	2° 59.28' W	0.0	MN
PS69/091-5	22.12.05	21:45	65° 59.67' S	2° 59.48' W	0.0	MN
PS69/092-1	23.12.05	00:19	65° 31.29' S	3° 2.86' W	0.0	RMT
PS69/092-1	23.12.05	00:36	65° 30.79' S	3° 1.63' W	0.0	RMT
PS69/092-1	23.12.05	01:07	65° 29.85' S	2° 59.78' W	0.0	RMT
PS69/092-2	23.12.05	01:14	65° 29.85' S	2° 59.74' W	0.0	RMT
PS69/092-2	23.12.05	01:19	65° 29.77' S	2° 59.56' W	0.0	RMT
PS69/092-2	23.12.05	01:22	65° 29.69' S	2° 59.41' W	0.0	RMT
PS69/092-2	23.12.05	01:25	65° 29.62' S	2° 59.26' W	0.0	RMT
PS69/092-2	23.12.05	01:31	65° 29.47' S	2° 58.95' W	0.0	RMT
PS69/092-2	23.12.05	01:37	65° 29.40' S	2° 58.78' W	0.0	RMT
PS69/092-3	23.12.05	01:51	65° 29.46' S	2° 58.80' W	0.0	CTD/RO
PS69/092-3	23.12.05	02:11	65° 29.48' S	2° 58.68' W	4951.6	CTD/RO
PS69/092-3	23.12.05	02:36	65° 29.35' S	2° 58.31' W	0.0	CTD/RO
PS69/093-1	23.12.05	05:10	65° 1.30' S	3° 3.35' W	0.0	RMT
PS69/093-1	23.12.05	05:29	65° 0.72' S	3° 1.84' W	0.0	RMT
PS69/093-1	23.12.05	06:07	64° 59.66' S	2° 59.13' W	0.0	RMT
PS69/093-2	23.12.05	06:11	64° 59.65' S	2° 59.08' W	0.0	RMT
PS69/093-2	23.12.05	06:14	64° 59.59' S	2° 58.91' W	0.0	RMT
PS69/093-2	23.12.05	06:17	64° 59.52' S	2° 58.73' W	0.0	RMT
PS69/093-2	23.12.05	06:20	64° 59.46' S	2° 58.55' W	0.0	RMT
PS69/093-2	23.12.05	06:25	64° 59.34' S	2° 58.26' W	0.0	RMT
PS69/093-2	23.12.05	06:30	64° 59.29' S	2° 58.12' W	0.0	RMT
PS69/093-3	23.12.05	06:44	64° 59.63' S	2° 58.90' W	0.0	CTD/RO
PS69/093-3	23.12.05	07:07	64° 59.72' S	2° 59.11' W	0.0	CTD/RO
PS69/093-3	23.12.05	07:37	64° 59.75' S	2° 59.21' W	0.0	CTD/RO
PS69/093-4	23.12.05	07:45	64° 59.76' S	2° 59.24' W	0.0	MN
PS69/093-4	23.12.05	07:58	64° 59.79' S	2° 59.30' W	0.0	MN
PS69/093-4	23.12.05	07:59	64° 59.79' S	2° 59.31' W	0.0	MN
PS69/093-4	23.12.05	08:21	64° 59.81' S	2° 59.42' W	0.0	MN
PS69/093-5	23.12.05	08:34	64° 59.69' S	2° 59.19' W	0.0	RMT
PS69/093-5	23.12.05	11:19	64° 54.86' S	2° 58.50' W	3280.8	RMT
PS69/093-5	23.12.05	11:21	64° 54.79' S	2° 58.49' W	3283.2	RMT
PS69/093-5	23.12.05	15:18	64° 48.33' S	2° 49.81' W	0.0	RMT
PS69/093-5	23.12.05	15:23	64° 48.30' S	2° 49.61' W	0.0	RMT
PS69/093-5	23.12.05	16:11	64° 47.75' S	2° 47.05' W	0.0	RMT
PS69/093-5	23.12.05	17:38	64° 46.09' S	2° 39.43' W	0.0	RMT
PS69/094-1	23.12.05	19:34	64° 31.12' S	3° 4.76' W	0.0	RMT
PS69/094-1	23.12.05	19:51	64° 30.62' S	3° 3.51' W	0.0	RMT
PS69/094-1	23.12.05	20:21	64° 29.80' S	3° 1.36' W	0.0	RMT

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/094-2	23.12.05	20:26	64° 29.74' S	3° 1.17' W	0.0	RMT
PS69/094-2	23.12.05	20:29	64° 29.67' S	3° 0.98' W	0.0	RMT
PS69/094-2	23.12.05	20:32	64° 29.61' S	3° 0.80' W	0.0	RMT
PS69/094-2	23.12.05	20:32	64° 29.61' S	3° 0.80' W	0.0	RMT
PS69/094-2	23.12.05	20:35	64° 29.55' S	3° 0.64' W	0.0	RMT
PS69/094-2	23.12.05	20:36	64° 29.54' S	3° 0.59' W	0.0	RMT
PS69/094-2	23.12.05	20:42	64° 29.43' S	3° 0.28' W	0.0	RMT
PS69/094-2	23.12.05	20:47	64° 29.40' S	3° 0.13' W	0.0	RMT
PS69/094-3	23.12.05	21:01	64° 29.68' S	3° 0.70' W	3462.0	CTD/RO
PS69/094-3	23.12.05	21:24	64° 29.73' S	3° 0.85' W	3474.0	CTD/RO
PS69/094-3	23.12.05	21:49	64° 29.82' S	3° 0.93' W	0.0	CTD/RO
PS69/095-1	24.12.05	01:03	64° 2.02' S	3° 0.08' W	0.0	RMT
PS69/095-1	24.12.05	01:21	64° 1.39' S	3° 0.13' W	0.0	RMT
PS69/095-1	24.12.05	01:54	64° 0.23' S	3° 0.08' W	0.0	RMT
PS69/095-2	24.12.05	02:07	63° 59.98' S	3° 0.04' W	3607.2	CTD/RO
PS69/095-3	24.12.05	02:51	64° 0.10' S	3° 0.21' W	5203.2	HN
PS69/095-3	24.12.05	03:09	64° 0.11' S	3° 0.28' W	5203.2	HN
PS69/095-2	24.12.05	03:34	64° 0.23' S	3° 0.43' W	5203.6	CTD/RO
PS69/095-2	24.12.05	05:01	64° 0.92' S	3° 0.86' W	0.0	CTD/RO
PS69/095-4	24.12.05	05:08	64° 0.98' S	3° 0.91' W	0.0	MN
PS69/095-4	24.12.05	05:21	64° 0.96' S	3° 0.91' W	0.0	MN
PS69/095-4	24.12.05	05:45	64° 0.91' S	3° 0.90' W	0.0	MN
PS69/095-5	24.12.05	05:52	64° 0.89' S	3° 0.91' W	0.0	WP-2 BUCKET
PS69/095-5	24.12.05	06:05	64° 0.87' S	3° 0.95' W	0.0	WP-2 BUCKET
PS69/095-5	24.12.05	06:18	64° 0.84' S	3° 1.00' W	0.0	WP-2 BUCKET
PS69/096-1	24.12.05	09:37	63° 31.80' S	3° 1.37' W	0.0	RMT
PS69/096-1	24.12.05	09:54	63° 31.15' S	3° 0.82' W	0.0	RMT
PS69/096-1	24.12.05	10:22	63° 30.09' S	3° 0.30' W	0.0	RMT
PS69/096-2	24.12.05	10:32	63° 30.04' S	3° 0.35' W	5230.4	CTD/RO
PS69/096-2	24.12.05	10:54	63° 30.00' S	3° 0.46' W	5230.8	CTD/RO
PS69/096-2	24.12.05	11:18	63° 30.00' S	3° 0.58' W	0.0	CTD/RO
PS69/096-3	24.12.05	11:25	63° 29.92' S	3° 0.53' W	0.0	RMT
PS69/096-3	24.12.05	12:22	63° 28.20' S	2° 59.82' W	0.0	RMT
PS69/096-3	24.12.05	13:19	63° 26.65' S	2° 59.93' W	0.0	RMT
PS69/096-4	24.12.05	13:37	63° 26.71' S	2° 59.88' W	0.0	MN
PS69/096-4	24.12.05	14:09	63° 26.88' S	2° 59.76' W	0.0	MN
PS69/096-4	24.12.05	15:11	63° 27.16' S	2° 59.56' W	0.0	MN
PS69/096-5	24.12.05	18:29	63° 0.49' S	3° 0.26' W	0.0	CAL
PS69/096-5	24.12.05	19:05	62° 59.98' S	2° 49.88' W	0.0	CAL
PS69/096-5	24.12.05	21:26	63° 19.70' S	2° 49.00' W	0.0	CAL
PS69/096-5	24.12.05	22:00	63° 19.96' S	2° 38.88' W	0.0	CAL
PS69/096-5	25.12.05	00:24	63° 0.39' S	2° 38.15' W	0.0	CAL
PS69/096-5	25.12.05	01:03	63° 0.05' S	2° 27.23' W	0.0	CAL
PS69/096-5	25.12.05	03:00	63° 16.49' S	2° 26.94' W	0.0	CAL
PS69/096-5	25.12.05	05:06	63° 20.04' S	2° 58.92' W	0.0	CAL
PS69/096-5	25.12.05	05:42	63° 15.44' S	2° 59.95' W	0.0	CAL
PS69/096-5	25.12.05	06:50	63° 14.93' S	2° 39.12' W	0.0	CAL
PS69/096-5	25.12.05	07:26	63° 10.39' S	2° 38.65' W	0.0	CAL
PS69/096-5	25.12.05	08:01	63° 10.18' S	2° 48.24' W	0.0	CAL
PS69/096-5	25.12.05	08:39	63° 5.34' S	2° 49.31' W	0.0	CAL
PS69/096-5	25.12.05	09:13	63° 5.23' S	2° 58.91' W	0.0	CAL
PS69/096-5	25.12.05	09:48	63° 2.23' S	2° 58.74' W	0.0	CAL
PS69/097-1	25.12.05	09:56	63° 2.01' S	2° 58.85' W	0.0	RMT
PS69/097-1	25.12.05	10:14	63° 1.30' S	2° 59.57' W	0.0	RMT
PS69/097-1	25.12.05	10:46	63° 0.12' S	3° 0.68' W	0.0	RMT

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/097-2	25.12.05	10:58	63° 0.11' S	3° 0.75' W	0.0	CTD/RO
PS69/097-2	25.12.05	11:20	63° 0.17' S	3° 0.85' W	5284.8	CTD/RO
PS69/097-2	25.12.05	11:44	63° 0.24' S	3° 1.11' W	0.0	CTD/RO
PS69/098-1	25.12.05	14:47	62° 31.66' S	3° 0.43' W	0.0	RMT
PS69/098-1	25.12.05	15:06	62° 30.93' S	3° 0.23' W	0.0	RMT
PS69/098-1	25.12.05	15:38	62° 29.69' S	2° 59.93' W	0.0	RMT
PS69/098-2	25.12.05	15:50	62° 29.68' S	2° 59.93' W	5323.2	CTD/RO
PS69/098-3	25.12.05	16:10	62° 29.62' S	2° 59.94' W	5322.8	HN
PS69/098-2	25.12.05	16:12	62° 29.60' S	2° 59.96' W	5323.2	CTD/RO
PS69/098-3	25.12.05	16:24	62° 29.60' S	2° 59.93' W	5322.8	HN
PS69/098-2	25.12.05	16:34	62° 29.63' S	2° 59.86' W	0.0	CTD/RO
PS69/098-4	25.12.05	16:39	62° 29.65' S	2° 59.82' W	0.0	MN
PS69/098-4	25.12.05	16:54	62° 29.70' S	2° 59.72' W	0.0	MN
PS69/098-4	25.12.05	17:21	62° 29.73' S	2° 59.51' W	0.0	MN
PS69/099-1	25.12.05	19:55	62° 1.63' S	3° 2.92' W	0.0	RMT
PS69/099-1	25.12.05	20:12	62° 0.89' S	3° 2.37' W	0.0	RMT
PS69/099-1	25.12.05	20:42	61° 59.62' S	3° 1.46' W	0.0	RMT
PS69/099-2	25.12.05	20:55	61° 59.55' S	3° 1.43' W	5348.0	CTD/RO
PS69/099-2	25.12.05	22:29	61° 59.61' S	3° 1.62' W	5348.8	CTD/RO
PS69/099-2	25.12.05	23:55	61° 59.91' S	3° 2.74' W	0.0	CTD/RO
PS69/100-1	26.12.05	02:37	61° 32.03' S	3° 0.16' W	0.0	RMT
PS69/100-1	26.12.05	02:53	61° 31.45' S	3° 0.21' W	0.0	RMT
PS69/100-1	26.12.05	03:19	61° 30.53' S	3° 0.04' W	5348.0	RMT
PS69/100-2	26.12.05	03:31	61° 30.59' S	2° 59.89' W	5348.0	CTD/RO
PS69/100-2	26.12.05	03:52	61° 30.57' S	2° 59.73' W	5347.6	CTD/RO
PS69/100-2	26.12.05	04:18	61° 30.49' S	2° 59.47' W	0.0	CTD/RO
PS69/100-3	26.12.05	04:33	61° 30.42' S	2° 59.34' W	0.0	MN
PS69/100-3	26.12.05	04:44	61° 30.38' S	2° 59.25' W	0.0	MN
PS69/100-3	26.12.05	05:10	61° 30.29' S	2° 59.03' W	0.0	MN
PS69/100-4	26.12.05	05:20	61° 30.25' S	2° 58.96' W	0.0	WP-2 BUCKET
PS69/100-4	26.12.05	05:31	61° 30.20' S	2° 58.87' W	0.0	WP-2 BUCKET
PS69/100-4	26.12.05	05:48	61° 30.09' S	2° 58.76' W	0.0	WP-2 BUCKET
PS69/101-1	26.12.05	08:41	61° 0.50' S	2° 55.10' W	0.0	RMT
PS69/101-1	26.12.05	08:58	61° 0.17' S	2° 56.11' W	0.0	RMT
PS69/101-1	26.12.05	09:27	60° 59.50' S	2° 57.96' W	0.0	RMT
PS69/101-2	26.12.05	09:39	60° 59.46' S	2° 57.67' W	0.0	CTD/RO
PS69/101-2	26.12.05	10:03	60° 59.40' S	2° 57.67' W	4819.6	CTD/RO
PS69/101-2	26.12.05	10:36	60° 59.32' S	2° 57.83' W	0.0	CTD/RO
PS69/102-1	26.12.05	13:25	60° 30.07' S	2° 56.32' W	0.0	RMT
PS69/102-1	26.12.05	13:43	60° 29.99' S	2° 57.88' W	0.0	RMT
PS69/102-1	26.12.05	14:13	60° 30.03' S	3° 0.33' W	0.0	RMT
PS69/102-2	26.12.05	14:25	60° 30.10' S	3° 0.25' W	0.0	CTD/RO
PS69/102-2	26.12.05	14:45	60° 30.19' S	3° 0.44' W	5368.0	CTD/RO
PS69/102-3	26.12.05	14:49	60° 30.21' S	3° 0.45' W	0.0	HN
PS69/102-3	26.12.05	15:05	60° 30.27' S	3° 0.50' W	0.0	HN
PS69/102-2	26.12.05	15:11	60° 30.30' S	3° 0.58' W	0.0	CTD/RO
PS69/102-4	26.12.05	15:17	60° 30.33' S	3° 0.66' W	0.0	MN
PS69/102-4	26.12.05	15:28	60° 30.38' S	3° 0.75' W	0.0	MN
PS69/102-4	26.12.05	15:28	60° 30.38' S	3° 0.75' W	0.0	MN
PS69/102-4	26.12.05	15:50	60° 30.47' S	3° 1.04' W	0.0	MN
PS69/103-1	26.12.05	18:45	60° 0.18' S	2° 55.61' W	0.0	RMT
PS69/103-1	26.12.05	19:02	60° 0.31' S	2° 57.05' W	0.0	RMT
PS69/103-1	26.12.05	19:31	60° 0.51' S	2° 59.37' W	0.0	RMT
PS69/103-2	26.12.05	19:44	60° 0.61' S	2° 59.21' W	5296.4	CTD/RO
PS69/103-2	26.12.05	21:17	60° 0.95' S	2° 59.44' W	5280.8	CTD/RO

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/103-2	26.12.05	22:44	60° 0.88' S	2° 59.60' W	0.0	CTD/RO
PS69/104-1	27.12.05	07:00	60° 0.55' S	5° 55.18' W	0.0	RMT
PS69/104-1	27.12.05	07:17	60° 0.50' S	5° 56.37' W	0.0	RMT
PS69/104-1	27.12.05	07:41	60° 0.37' S	5° 58.01' W	0.0	RMT
PS69/104-2	27.12.05	08:10	60° 0.51' S	5° 55.02' W	4553.6	EF
PS69/104-2	27.12.05	08:59	60° 0.68' S	5° 54.01' W	4718.0	EF
PS69/104-3	27.12.05	09:24	60° 0.71' S	5° 58.48' W	4110.8	CTD/RO
PS69/104-3	27.12.05	10:34	60° 0.38' S	5° 58.25' W	4097.2	CTD/RO
PS69/104-3	27.12.05	11:48	60° 0.24' S	5° 57.97' W	0.0	CTD/RO
PS69/104-4	27.12.05	11:55	60° 0.24' S	5° 57.96' W	0.0	MN
PS69/104-4	27.12.05	12:07	60° 0.21' S	5° 57.99' W	0.0	MN
PS69/104-4	27.12.05	12:08	60° 0.21' S	5° 57.99' W	0.0	MN
PS69/104-4	27.12.05	12:30	60° 0.19' S	5° 58.04' W	0.0	MN
PS69/104-4	27.12.05	12:40	60° 0.12' S	5° 58.15' W	0.0	WP-2 BUCKET
PS69/104-4	27.12.05	12:48	60° 0.07' S	5° 58.22' W	0.0	WP-2 BUCKET
PS69/104-4	27.12.05	12:48	60° 0.07' S	5° 58.22' W	0.0	WP-2 BUCKET
PS69/104-4	27.12.05	13:04	60° 0.04' S	5° 58.28' W	0.0	WP-2 BUCKET
PS69/105-1	27.12.05	16:04	60° 32.17' S	6° 0.04' W	0.0	RMT
PS69/105-1	27.12.05	16:20	60° 31.57' S	6° 0.47' W	0.0	RMT
PS69/105-1	27.12.05	16:51	60° 30.55' S	6° 1.26' W	0.0	RMT
PS69/105-2	27.12.05	17:07	60° 30.45' S	6° 1.04' W	0.0	CTD/RO
PS69/105-3	27.12.05	17:26	60° 30.69' S	6° 0.84' W	4830.0	HN
PS69/105-2	27.12.05	17:27	60° 30.69' S	6° 0.83' W	4874.0	CTD/RO
PS69/105-3	27.12.05	17:34	60° 30.73' S	6° 0.77' W	4832.8	HN
PS69/105-2	27.12.05	17:52	60° 30.82' S	6° 0.59' W	0.0	CTD/RO
PS69/106-1	27.12.05	20:42	61° 1.89' S	5° 58.67' W	0.0	RMT
PS69/106-1	27.12.05	20:57	61° 1.26' S	5° 58.90' W	0.0	RMT
PS69/106-1	27.12.05	21:24	61° 0.21' S	5° 59.23' W	0.0	RMT
PS69/106-2	27.12.05	21:30	61° 0.14' S	5° 59.20' W	0.0	RMT
PS69/106-2	27.12.05	21:34	60° 59.99' S	5° 59.26' W	0.0	RMT
PS69/106-2	27.12.05	21:37	60° 59.87' S	5° 59.31' W	0.0	RMT
PS69/106-2	27.12.05	21:39	60° 59.79' S	5° 59.34' W	0.0	RMT
PS69/106-2	27.12.05	21:42	60° 59.68' S	5° 59.39' W	0.0	RMT
PS69/106-2	27.12.05	21:43	60° 59.65' S	5° 59.41' W	0.0	RMT
PS69/106-2	27.12.05	21:46	60° 59.56' S	5° 59.44' W	0.0	RMT
PS69/106-2	27.12.05	21:51	60° 59.50' S	5° 59.42' W	0.0	RMT
PS69/106-3	27.12.05	22:07	60° 59.63' S	5° 59.10' W	5318.0	CTD/RO
PS69/106-3	27.12.05	22:31	60° 59.64' S	5° 58.85' W	5317.6	CTD/RO
PS69/106-3	27.12.05	23:05	60° 59.60' S	5° 58.61' W	0.0	CTD/RO
PS69/106-3	27.12.05	23:15	60° 59.65' S	5° 58.49' W	0.0	MN
PS69/106-3	27.12.05	23:28	60° 59.65' S	5° 58.44' W	0.0	MN
PS69/106-3	27.12.05	23:28	60° 59.65' S	5° 58.44' W	0.0	MN
PS69/106-3	27.12.05	23:54	60° 59.61' S	5° 58.46' W	0.0	MN
PS69/107-1	28.12.05	02:55	61° 32.12' S	6° 0.00' W	0.0	RMT
PS69/107-1	28.12.05	03:12	61° 31.45' S	6° 0.13' W	0.0	RMT
PS69/107-1	28.12.05	03:37	61° 30.46' S	6° 0.22' W	0.0	RMT
PS69/107-2	28.12.05	03:51	61° 30.40' S	6° 0.19' W	0.0	CTD/RO
PS69/107-2	28.12.05	04:12	61° 30.45' S	6° 0.21' W	5300.8	CTD/RO
PS69/107-2	28.12.05	04:39	61° 30.54' S	6° 0.05' W	5300.8	CTD/RO
PS69/108-1	28.12.05	07:20	62° 1.52' S	6° 0.61' W	0.0	RMT
PS69/108-1	28.12.05	07:41	62° 0.69' S	5° 59.48' W	0.0	RMT
PS69/108-1	28.12.05	08:11	61° 59.70' S	5° 57.98' W	0.0	RMT
PS69/108-2	28.12.05	08:25	61° 59.70' S	5° 57.68' W	5290.4	CTD/RO
PS69/108-2	28.12.05	09:57	61° 59.60' S	5° 56.57' W	5284.4	CTD/RO
PS69/108-2	28.12.05	11:24	61° 59.53' S	5° 56.06' W	0.0	CTD/RO

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/108-3	28.12.05	11:30	61° 59.52' S	5° 56.04' W	0.0	MN
PS69/108-3	28.12.05	11:42	61° 59.50' S	5° 56.01' W	0.0	MN
PS69/108-3	28.12.05	11:42	61° 59.50' S	5° 56.01' W	0.0	MN
PS69/108-3	28.12.05	12:07	61° 59.50' S	5° 56.02' W	0.0	MN
PS69/109-1	28.12.05	15:07	62° 31.67' S	6° 2.70' W	0.0	RMT
PS69/109-1	28.12.05	15:25	62° 31.19' S	6° 1.27' W	0.0	RMT
PS69/109-1	28.12.05	15:54	62° 30.52' S	5° 59.55' W	0.0	RMT
PS69/109-2	28.12.05	16:10	62° 30.59' S	5° 59.37' W	5317.6	CTD/RO
PS69/109-3	28.12.05	16:27	62° 30.78' S	5° 59.58' W	5318.0	HN
PS69/109-2	28.12.05	16:30	62° 30.79' S	5° 59.60' W	5318.0	CTD/RO
PS69/109-3	28.12.05	16:41	62° 30.85' S	5° 59.61' W	0.0	HN
PS69/109-2	28.12.05	16:56	62° 30.99' S	5° 59.66' W	0.0	CTD/RO
PS69/110-1	28.12.05	19:30	63° 0.87' S	6° 3.95' W	0.0	RMT
PS69/110-1	28.12.05	19:50	63° 0.28' S	6° 2.32' W	0.0	RMT
PS69/110-1	28.12.05	20:22	62° 59.76' S	6° 0.06' W	0.0	RMT
PS69/110-2	28.12.05	20:35	62° 59.80' S	6° 0.05' W	5278.8	CTD/RO
PS69/110-2	28.12.05	20:57	62° 59.81' S	5° 59.97' W	5278.8	CTD/RO
PS69/110-2	28.12.05	21:25	62° 59.77' S	5° 59.84' W	0.0	CTD/RO
PS69/111-1	29.12.05	00:11	63° 30.83' S	6° 3.72' W	0.0	RMT
PS69/111-1	29.12.05	00:27	63° 30.16' S	6° 2.56' W	0.0	RMT
PS69/111-1	29.12.05	00:56	63° 29.88' S	6° 0.05' W	0.0	RMT
PS69/111-2	29.12.05	01:10	63° 29.97' S	5° 59.82' W	0.0	CTD/RO
PS69/111-2	29.12.05	01:31	63° 30.00' S	5° 59.79' W	5269.2	CTD/RO
PS69/111-2	29.12.05	02:00	63° 29.98' S	5° 59.75' W	5269.6	CTD/RO
PS69/111-3	29.12.05	02:07	63° 29.98' S	5° 59.73' W	0.0	MN
PS69/111-3	29.12.05	02:19	63° 29.98' S	5° 59.74' W	0.0	MN
PS69/111-3	29.12.05	02:20	63° 29.98' S	5° 59.74' W	0.0	MN
PS69/111-3	29.12.05	02:49	63° 29.95' S	5° 59.71' W	0.0	MN
PS69/111-4	29.12.05	02:55	63° 29.96' S	5° 59.69' W	0.0	WP-2 BUCKET
PS69/111-4	29.12.05	03:02	63° 29.99' S	5° 59.69' W	0.0	WP-2 BUCKET
PS69/111-4	29.12.05	03:03	63° 29.99' S	5° 59.69' W	0.0	WP-2 BUCKET
PS69/111-4	29.12.05	03:17	63° 29.99' S	5° 59.62' W	0.0	WP-2 BUCKET
PS69/112-1	29.12.05	05:56	64° 0.28' S	6° 3.57' W	0.0	RMT
PS69/112-1	29.12.05	06:11	64° 0.04' S	6° 2.57' W	0.0	RMT
PS69/112-1	29.12.05	06:45	64° 0.20' S	5° 59.54' W	0.0	RMT
PS69/112-2	29.12.05	06:58	64° 0.14' S	5° 59.27' W	5238.4	CTD/RO
PS69/112-2	29.12.05	08:29	64° 0.37' S	5° 59.27' W	5233.6	CTD/RO
PS69/112-2	29.12.05	09:52	64° 0.42' S	5° 58.84' W	0.0	CTD/RO
PS69/113-1	29.12.05	12:40	64° 29.73' S	6° 4.40' W	0.0	RMT
PS69/113-1	29.12.05	12:58	64° 29.91' S	6° 2.71' W	0.0	RMT
PS69/113-1	29.12.05	13:33	64° 30.13' S	5° 59.56' W	0.0	RMT
PS69/113-1	29.12.05	13:36	64° 30.13' S	5° 59.38' W	0.0	RMT
PS69/113-1	29.12.05	13:39	64° 30.13' S	5° 59.17' W	0.0	RMT
PS69/113-1	29.12.05	13:47	64° 30.16' S	5° 58.61' W	0.0	RMT
PS69/113-1	29.12.05	13:48	64° 30.16' S	5° 58.53' W	0.0	RMT
PS69/113-1	29.12.05	13:50	64° 30.16' S	5° 58.38' W	0.0	RMT
PS69/113-1	29.12.05	13:54	64° 30.16' S	5° 58.14' W	0.0	RMT
PS69/113-2	29.12.05	14:09	64° 30.14' S	5° 58.33' W	0.0	CTD/RO
PS69/113-2	29.12.05	14:31	64° 30.08' S	5° 58.21' W	5192.4	CTD/RO
PS69/113-3	29.12.05	14:38	64° 30.06' S	5° 58.17' W	5192.4	HN
PS69/113-3	29.12.05	14:51	64° 30.02' S	5° 58.11' W	0.0	HN
PS69/113-2	29.12.05	15:00	64° 30.00' S	5° 58.05' W	0.0	CTD/RO
PS69/114-1	29.12.05	17:36	64° 58.52' S	6° 3.00' W	0.0	RMT
PS69/114-1	29.12.05	17:53	64° 58.60' S	6° 1.36' W	0.0	RMT
PS69/114-1	29.12.05	18:25	64° 59.66' S	5° 59.49' W	0.0	RMT

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/114-2	29.12.05	18:39	64° 59.66' S	5° 59.60' W	5120.8	CTD/RO
PS69/114-2	29.12.05	19:01	64° 59.58' S	5° 59.86' W	5121.2	CTD/RO
PS69/114-3	29.12.05	19:14	64° 59.52' S	6° 0.03' W	0.0	HN
PS69/114-3	29.12.05	19:24	64° 59.48' S	6° 0.17' W	0.0	HN
PS69/114-2	29.12.05	19:30	64° 59.45' S	6° 0.25' W	0.0	CTD/RO
PS69/115-1	29.12.05	22:13	65° 28.15' S	6° 2.44' W	0.0	RMT
PS69/115-1	29.12.05	22:29	65° 28.68' S	6° 1.68' W	0.0	RMT
PS69/115-1	29.12.05	22:58	65° 29.61' S	6° 0.30' W	0.0	RMT
PS69/115-2	29.12.05	23:12	65° 29.99' S	5° 59.94' W	0.0	CTD/RO
PS69/115-2	29.12.05	23:36	65° 29.94' S	6° 0.08' W	5006.0	CTD/RO
PS69/115-2	30.12.05	00:22	65° 29.87' S	6° 0.10' W	0.0	CTD/RO
PS69/116-1	30.12.05	03:00	65° 58.45' S	6° 3.37' W	0.0	RMT
PS69/116-1	30.12.05	03:18	65° 59.00' S	6° 2.18' W	0.0	RMT
PS69/116-1	30.12.05	03:49	65° 59.92' S	6° 0.13' W	0.0	RMT
PS69/116-2	30.12.05	04:06	66° 0.01' S	6° 0.08' W	4935.6	CTD/RO
PS69/116-2	30.12.05	05:29	66° 0.01' S	6° 0.60' W	4936.0	CTD/RO
PS69/116-2	30.12.05	06:47	65° 59.86' S	6° 0.90' W	0.0	CTD/RO
PS69/117-1	30.12.05	09:36	66° 28.64' S	6° 2.68' W	0.0	RMT
PS69/117-1	30.12.05	09:53	66° 29.00' S	6° 2.39' W	0.0	RMT
PS69/117-1	30.12.05	10:22	66° 29.96' S	6° 1.14' W	0.0	RMT
PS69/117-2	30.12.05	10:37	66° 29.91' S	6° 1.36' W	4870.4	CTD/RO
PS69/117-2	30.12.05	11:00	66° 29.87' S	6° 1.56' W	4870.4	CTD/RO
PS69/117-2	30.12.05	11:25	66° 29.83' S	6° 1.82' W	0.0	CTD/RO
PS69/118-1	30.12.05	14:12	66° 58.45' S	6° 2.77' W	0.0	RMT
PS69/118-1	30.12.05	14:30	66° 59.05' S	6° 1.84' W	0.0	RMT
PS69/118-1	30.12.05	14:59	67° 0.01' S	6° 0.00' W	0.0	RMT
PS69/118-2	30.12.05	15:11	67° 0.03' S	6° 0.21' W	4866.0	CTD/RO
PS69/118-2	30.12.05	15:34	67° 0.02' S	6° 0.18' W	4866.0	CTD/RO
PS69/118-3	30.12.05	15:34	67° 0.02' S	6° 0.18' W	4866.0	HN
PS69/118-3	30.12.05	15:53	67° 0.01' S	6° 0.09' W	0.0	HN
PS69/118-2	30.12.05	16:05	67° 0.04' S	6° 0.09' W	0.0	CTD/RO
PS69/119-1	30.12.05	18:48	67° 28.11' S	6° 2.77' W	0.0	RMT
PS69/119-1	30.12.05	19:03	67° 28.63' S	6° 1.62' W	0.0	RMT
PS69/119-1	30.12.05	19:40	67° 29.62' S	5° 59.64' W	0.0	RMT
PS69/119-2	30.12.05	19:48	67° 29.60' S	5° 59.79' W	4836.0	CTD/RO
PS69/119-3	30.12.05	19:56	67° 29.59' S	5° 59.89' W	4835.6	HN
PS69/119-3	30.12.05	20:08	67° 29.61' S	6° 0.00' W	4836.4	HN
PS69/119-2	30.12.05	20:10	67° 29.61' S	6° 0.01' W	4835.2	CTD/RO
PS69/119-2	30.12.05	20:43	67° 29.74' S	6° 0.04' W	0.0	CTD/RO
PS69/119-4	30.12.05	20:59	67° 29.85' S	6° 0.26' W	0.0	MN
PS69/119-4	30.12.05	21:12	67° 29.84' S	6° 0.29' W	0.0	MN
PS69/119-4	30.12.05	21:13	67° 29.84' S	6° 0.29' W	0.0	MN
PS69/119-4	30.12.05	21:38	67° 29.73' S	6° 0.31' W	0.0	MN
PS69/120-1	31.12.05	00:30	67° 58.75' S	6° 2.95' W	0.0	RMT
PS69/120-1	31.12.05	00:47	67° 59.20' S	6° 1.67' W	0.0	RMT
PS69/120-1	31.12.05	01:13	67° 59.94' S	5° 59.78' W	0.0	RMT
PS69/120-2	31.12.05	01:28	67° 59.95' S	6° 0.07' W	4744.8	CTD/RO
PS69/120-2	31.12.05	02:46	67° 59.81' S	6° 0.00' W	4744.0	CTD/RO
PS69/120-2	31.12.05	04:11	67° 59.71' S	5° 59.79' W	0.0	CTD/RO
PS69/120-3	31.12.05	04:16	67° 59.71' S	5° 59.75' W	0.0	WP-2 BUCKET
PS69/120-3	31.12.05	04:26	67° 59.73' S	5° 59.95' W	0.0	WP-2 BUCKET
PS69/120-3	31.12.05	04:39	67° 59.74' S	6° 0.43' W	0.0	WP-2 BUCKET
PS69/121-1	31.12.05	07:14	68° 27.35' S	6° 3.37' W	0.0	RMT
PS69/121-1	31.12.05	07:31	68° 27.90' S	6° 2.49' W	0.0	RMT
PS69/121-1	31.12.05	08:02	68° 28.90' S	6° 0.98' W	0.0	RMT

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/121-2	31.12.05	08:16	68° 28.90' S	6° 1.14' W	5476.0	CTD/RO
PS69/121-2	31.12.05	08:40	68° 28.84' S	6° 1.25' W	3479.6	CTD/RO
PS69/121-2	31.12.05	09:05	68° 28.81' S	6° 1.03' W	0.0	CTD/RO
PS69/121-3	31.12.05	09:13	68° 28.88' S	6° 1.05' W	0.0	MN
PS69/121-3	31.12.05	09:26	68° 28.85' S	6° 1.02' W	0.0	MN
PS69/121-3	31.12.05	09:48	68° 28.70' S	6° 0.70' W	0.0	MN
PS69/122-1	31.12.05	12:34	68° 58.60' S	6° 3.76' W	0.0	RMT
PS69/122-1	31.12.05	12:52	68° 59.19' S	6° 2.24' W	0.0	RMT
PS69/122-1	31.12.05	13:22	69° 0.06' S	5° 59.85' W	0.0	RMT
PS69/122-2	31.12.05	13:28	69° 0.11' S	5° 59.84' W	0.0	RMT
PS69/122-2	31.12.05	13:32	69° 0.18' S	5° 59.79' W	0.0	RMT
PS69/122-2	31.12.05	13:37	69° 0.33' S	5° 59.53' W	0.0	RMT
PS69/122-2	31.12.05	13:40	69° 0.42' S	5° 59.38' W	0.0	RMT
PS69/122-2	31.12.05	13:51	69° 0.68' S	5° 59.01' W	0.0	RMT
PS69/122-3	31.12.05	14:06	69° 0.68' S	5° 59.26' W	2588.4	CTD/RO
PS69/122-3	31.12.05	14:47	69° 0.68' S	5° 58.89' W	2591.6	CTD/RO
PS69/122-4	31.12.05	14:58	69° 0.66' S	5° 58.84' W	2592.0	HN
PS69/122-4	31.12.05	15:18	69° 0.61' S	5° 58.64' W	2594.0	HN
PS69/122-3	31.12.05	18:20	69° 1.21' S	6° 0.85' W	2611.6	CTD/RO
PS69/122-3	31.12.05	18:23	69° 1.22' S	6° 0.88' W	2612.0	CTD/RO
PS69/122-3	31.12.05	19:14	69° 1.42' S	6° 1.15' W	0.0	CTD/RO
PS69/122-5	31.12.05	19:19	69° 1.60' S	6° 1.13' W	0.0	CAL
PS69/122-5	31.12.05	22:10	69° 29.74' S	5° 59.90' W	0.0	CAL
PS69/122-5	31.12.05	22:45	69° 29.88' S	5° 45.86' W	0.0	CAL
PS69/122-5	01.01.06	00:22	69° 15.56' S	5° 45.82' W	0.0	CAL
PS69/122-5	01.01.06	00:50	69° 14.92' S	5° 35.92' W	0.0	CAL
PS69/122-5	01.01.06	03:25	69° 29.92' S	5° 18.40' W	0.0	CAL
PS69/122-5	01.01.06	05:03	69° 15.37' S	5° 17.05' W	0.0	CAL
PS69/122-5	01.01.06	06:15	69° 14.94' S	5° 45.40' W	0.0	CAL
PS69/122-5	01.01.06	07:19	69° 23.92' S	5° 45.39' W	0.0	CAL
PS69/122-5	01.01.06	07:53	69° 24.00' S	5° 32.43' W	0.0	CAL
PS69/123-1	01.01.06	08:17	69° 24.26' S	5° 32.11' W	0.0	HYDRO
PS69/123-1	01.01.06	08:21	69° 24.26' S	5° 32.12' W	0.0	HYDRO
PS69/123-1	01.01.06	08:58	69° 23.98' S	5° 31.06' W	0.0	HYDRO
PS69/123-1	01.01.06	09:05	69° 23.81' S	5° 31.05' W	0.0	HYDRO
PS69/124-1	01.01.06	10:32	69° 29.37' S	5° 56.11' W	0.0	RMT
PS69/124-1	01.01.06	10:47	69° 29.82' S	5° 57.31' W	0.0	RMT
PS69/124-1	01.01.06	11:15	69° 30.60' S	5° 59.55' W	0.0	RMT
PS69/124-2	01.01.06	11:30	69° 30.73' S	5° 59.08' W	2350.8	CTD/RO
PS69/124-2	01.01.06	12:16	69° 31.14' S	5° 57.77' W	2353.2	CTD/RO
PS69/124-2	01.01.06	13:08	69° 31.69' S	5° 56.98' W	0.0	CTD/RO
PS69/124-3	01.01.06	13:17	69° 31.67' S	5° 56.59' W	0.0	MN
PS69/124-3	01.01.06	13:31	69° 31.77' S	5° 56.50' W	0.0	MN
PS69/124-3	01.01.06	13:32	69° 31.78' S	5° 56.50' W	0.0	MN
PS69/124-3	01.01.06	13:56	69° 31.94' S	5° 56.32' W	0.0	MN
PS69/124-4	01.01.06	14:07	69° 32.02' S	5° 56.24' W	0.0	WP-2 BUCKET
PS69/124-4	01.01.06	14:16	69° 32.08' S	5° 56.16' W	0.0	WP-2 BUCKET
PS69/124-4	01.01.06	14:16	69° 32.08' S	5° 56.16' W	0.0	WP-2 BUCKET
PS69/124-4	01.01.06	14:29	69° 32.21' S	5° 56.24' W	0.0	WP-2 BUCKET
PS69/125-1	01.01.06	17:20	69° 59.20' S	5° 53.29' W	0.0	RMT
PS69/125-1	01.01.06	17:40	69° 58.59' S	5° 55.16' W	0.0	RMT
PS69/125-1	01.01.06	18:12	69° 57.64' S	5° 58.06' W	0.0	RMT
PS69/125-2	01.01.06	18:28	69° 57.20' S	5° 59.28' W	2066.0	CTD/RO
PS69/125-2	01.01.06	19:07	69° 57.00' S	5° 59.11' W	2071.2	CTD/RO
PS69/125-2	01.01.06	19:50	69° 56.88' S	5° 59.11' W	0.0	CTD/RO

Station	Date	Time	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
PS69/125-3	01.01.06	19:56	69° 56.87' S	5° 59.16' W	0.0	MN
PS69/125-3	01.01.06	20:08	69° 56.91' S	5° 59.49' W	0.0	MN
PS69/125-3	01.01.06	20:09	69° 56.91' S	5° 59.53' W	0.0	MN
PS69/125-3	01.01.06	20:32	69° 56.96' S	5° 59.96' W	0.0	MN
PS69/126-1	01.01.06	23:12	70° 17.92' S	6° 4.54' W	224.0	RMT
PS69/126-1	01.01.06	23:30	70° 18.49' S	6° 6.10' W	240.8	RMT
PS69/126-1	02.01.06	00:00	70° 19.46' S	6° 8.40' W	270.4	RMT
PS69/126-2	02.01.06	00:14	70° 19.70' S	6° 8.54' W	248.8	CTD/RO
PS69/126-3	02.01.06	00:18	70° 19.71' S	6° 8.49' W	245.2	HN
PS69/126-2	02.01.06	00:22	70° 19.71' S	6° 8.45' W	244.0	CTD/RO
PS69/126-3	02.01.06	00:34	70° 19.71' S	6° 8.37' W	241.6	HN
PS69/126-2	02.01.06	00:44	70° 19.73' S	6° 8.25' W	239.6	CTD/RO
PS69/126-4	02.01.06	00:50	70° 19.75' S	6° 8.28' W	238.8	MN
PS69/126-4	02.01.06	00:56	70° 19.77' S	6° 8.21' W	236.8	MN
PS69/126-4	02.01.06	00:57	70° 19.78' S	6° 8.22' W	236.8	MN
PS69/126-4	02.01.06	01:12	70° 19.83' S	6° 8.24' W	234.8	MN
PS69/126-5	02.01.06	01:19	70° 19.83' S	6° 8.15' W	232.8	WP-2 BUCKET
PS69/126-5	02.01.06	01:28	70° 19.80' S	6° 7.99' W	232.4	WP-2 BUCKET
PS69/126-5	02.01.06	01:28	70° 19.80' S	6° 7.99' W	232.4	WP-2 BUCKET
PS69/126-5	02.01.06	01:46	70° 19.76' S	6° 7.65' W	229.2	WP-2 BUCKET
PS69/126-6	02.01.06	02:21	70° 18.71' S	6° 11.99' W	391.2	EF
PS69/126-6	02.01.06	02:31	70° 18.79' S	6° 11.97' W	380.4	EF
PS69/127-1	02.01.06	11:34	69° 27.60' S	8° 57.48' W	2901.2	RMT
PS69/127-1	02.01.06	12:36	69° 27.08' S	9° 2.62' W	2964.0	RMT
PS69/127-1	02.01.06	12:39	69° 27.06' S	9° 2.90' W	2966.4	RMT
PS69/127-1	02.01.06	14:24	69° 24.50' S	9° 12.99' W	3273.2	RMT
PS69/127-2	02.01.06	14:28	69° 24.47' S	9° 13.21' W	3265.6	RMT
PS69/127-2	02.01.06	17:09	69° 21.72' S	9° 24.02' W	3477.6	RMT
PS69/127-2	02.01.06	17:11	69° 21.68' S	9° 24.17' W	3476.4	RMT
PS69/127-2	02.01.06	20:24	69° 17.27' S	9° 41.79' W	0.0	RMT
PS69/128-1	03.01.06	03:00	68° 43.54' S	11° 29.22' W	0.0	RMT
PS69/128-1	03.01.06	03:34	68° 43.98' S	11° 27.30' W	0.0	RMT
PS69/128-1	03.01.06	04:00	68° 44.29' S	11° 25.29' W	0.0	RMT
PS69/128-1	03.01.06	04:50	68° 44.72' S	11° 21.97' W	0.0	RMT
PS69/129-1	03.01.06	14:10	67° 37.68' S	15° 2.11' W	0.0	RMT
PS69/129-1	03.01.06	14:40	67° 38.28' S	15° 1.42' W	0.0	RMT
PS69/129-1	03.01.06	14:51	67° 38.54' S	15° 1.06' W	0.0	RMT
PS69/129-1	03.01.06	14:54	67° 38.60' S	15° 0.94' W	0.0	RMT
PS69/129-1	03.01.06	15:10	67° 38.92' S	15° 0.56' W	0.0	RMT
PS69/129-1	03.01.06	15:53	67° 39.73' S	14° 59.58' W	0.0	RMT
PS69/130-1	03.01.06	18:37	67° 20.56' S	15° 57.67' W	0.0	CTD/RO
PS69/130-1	03.01.06	18:58	67° 20.70' S	15° 57.88' W	4951.6	CTD/RO
PS69/130-1	03.01.06	19:15	67° 20.81' S	15° 58.00' W	0.0	CTD/RO
PS69/131-1	07.01.06	09:33	59° 38,63' S	39° 59,92' W	0,0	CPR
PS69/131-1	09.01.06	02:47	56° 27,02' S	53° 33,41' W	0,0	CPR
PS69/131-1	09.01.06	02:49	56° 26,80' S	53° 38,60' W	0,0	CPR
PS69/131-1	09.01.06	03:02	56° 26,72' S	53° 39,68' W	0,0	CPR
PS69/131-1	09.01.06	11:29	55° 47,78' S	56° 14,02' W	0,0	CPR
PS69/131-1	09.01.06	11:34	55° 47,71' S	56° 14,23' W	0,0	CPR