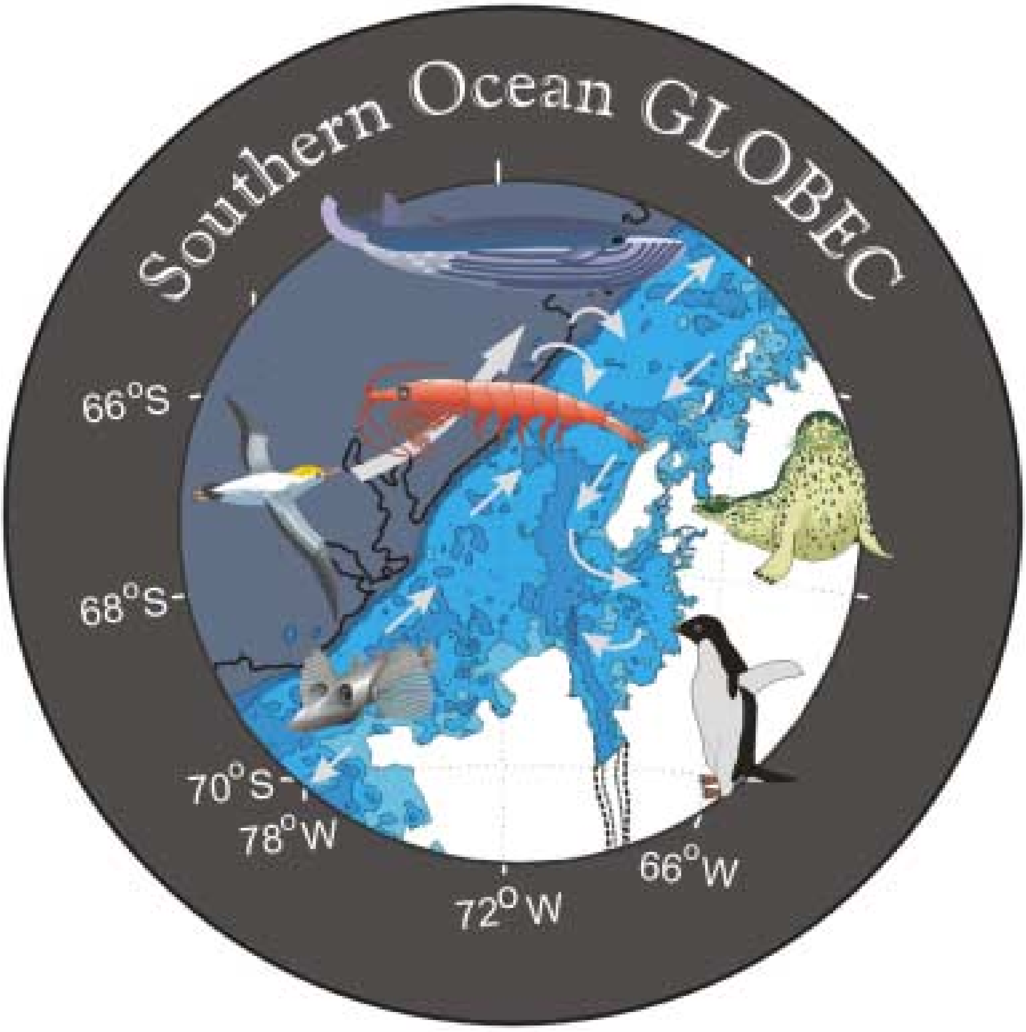
Report of
R/V Laurence M. Gould Cruise LMG02-05
to the
Western Antarctic Peninsula
29 July to 19 September 2002



United States Southern Ocean
Global Ocean Ecosystems Dynamics Program
Report Number 7

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LMG02-05 report prepared by Daniel Costa, with assistance from colleagues in the scientific party and the Raytheon Support Services.

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Acknowledgments

The success we enjoyed on this expedition is due in large part to the very excellent technical assistance we received from the seven members of the Raytheon Marine Technical support group. Led by Karl Newyear (Marine Project Coordinator), they responded to a wide variety of technical challenges as well as the uncertainties produced by the weather and ice. The ship's officers and crew were outstanding as they provided excellent ship handling, in the sea ice and over the water. We are especially grateful to Captain Robert Verret, for his easygoing yet professional manner that was evident throughout the ship. It made this expedition a pleasure to be on.

LMG02-05 Cruise Participants
(see facing page)

Back Row (L-R): Gitte McDonald, Kerry Claffey, Pete Hartsough, Brett Pickering, Heidi Geisz, Jeff Morin, Andy Nunn, Charlie Boch, Karina Johnston, Allan Willis, Langdon Quetin, Eric Hessell, Megan Blees, Bruce Elder, Lindsay Cunningham and Romeo LaRiviere

Front Row (L-R): Daniel (Sparky) Weisblatt, Karl Newyear, Scott Shaffer, Shonna Dovel, Stephanie Oakes, Jenny White, Carey Kuhn, Chris Fritsen, Mo Hodgins, Julie Barnes, Paula Adkins and Dan Costa.

LMG02-05 Cruise Participants

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PURPOSE OF THE CRUISE

The U.S. Southern Ocean Global Ocean Ecosystems Dynamics (U.S. SO GLOBEC) Program is in its second and final field year. The focus of this study is on the biology and physics of a region of the continental shelf to the west of the Antarctic Peninsula that extends from the northern tip of Adelaide Island to the southern portion of Alexander Island and includes Marguerite Bay (Figure 1). The primary goals of this program are:

1) **to elucidate shelf circulation processes and their effect on sea ice formation and Antarctic krill (*Euphausia superba*) distribution; and**
2) **to examine the factors that govern krill survivorship and availability to higher trophic levels, including seals, penguins, and whales.**

The field program consists of five cruises each year. During 2001 there was a mooring cruise in March and April 2001 aboard the *ARSV L.M. Gould,* followed by two joint cruises occurring in April-May and July-August 2001 onboard the *RVIB N.B. Palmer,* which carried out a broad-scale survey, and the *ARSV L.M. Gould*, which conducted process-oriented studies. During 2002 the mooring cruise occurred during February and March 2002 from the *ARSV L.M. Gould.* The mooring cruise recovered and redeployed a series of Woods Hole Oceanographic Institution (WHOI) and Scripps Institution of Oceanography (SIO) moorings across the continental shelf off of Adelaide Island and across the mouth of Marguerite Bay. The WHOI moorings were designed to provide a time series of the physical environment of the region while the SIO moorings recorded marine mammal calls and sounds. In addition, this cruise deployed surface drifters and made observations of marine mammal abundance and collected tissue samples from whales. The mooring cruise was then followed by two joint cruises occurring in April-May and July-September 2002 onboard the *RVIB N.B. Palmer,* which carried out a broad-scale survey, and the *ARSV L.M. Gould*, which conducted process-oriented studies. The goal of the process cruise aboard the *ARSV L.M. Gould* (LMG02-05) is to provide a more detailed examination of the biological and physical processes that are occurring in this region that can be put into the shelf-wide context supplied by the broad scale survey being carried out at the same time on the *RVIB N.B. Palmer.* Our specific objectives were to:

1. **Measure the optical properties of the predominant sea ice types in the Marguerite Bay area, quantify what the sea ice types are and measure their physical characteristics, which have a direct effect on the optical properties, and deploy drifting ice platforms to measure a long-term mass balance history of the sea ice cover over a 1-2 month period;**
2. **Assess the distribution and activity of the sea ice microbial communities in order to determine the stocks and dynamics of the food reserves for krill over wintering in association with sea ice;**
3. **Link the variability in the biological and physical characteristics of the sea ice habitat with the distribution and abundance of larval krill, and the diet and growth of larval and juvenile krill in winter;**
4. **Use ARGOS-based satellite transmitters (Platform Transmitter Terminals, PTTs) to determine the distribution and movements of important krill predators, Adélie penguins and crabeater seals, relative to features such as bathymetry and sea ice; and**

5. **Employ a variety of diet sampling techniques to determine the winter foraging ecology of these predators, and particularly their impacts on krill life history stages and size classes.**

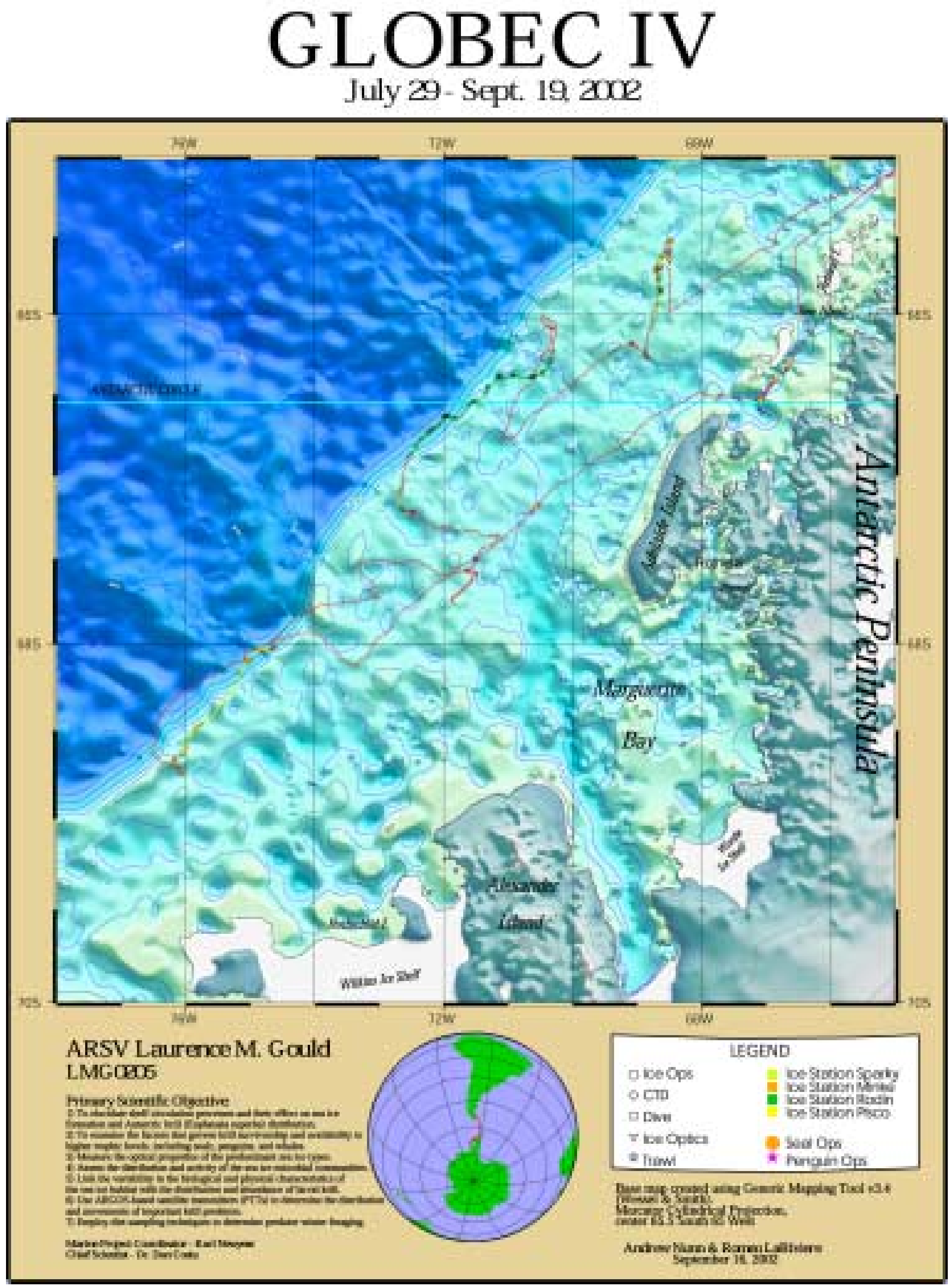


Figure 1. Study region showing cruise track and scientific activities for LMG02-05.

Cruise Planning and Logistics

A significant advantage to this cruise was that we had learned from our experiences during the previous SO GLOBEC winter cruise LMG01-06, which took place July-August 2001 (see U.S. Southern Ocean GLOBEC Report Number 3). During the 2001 winter, the ARSV *L.M. Gould* (LMG) could not operate on its own in most of the ice conditions encountered. During 2001, we could not reach the southern process station and, as a result, only conducted studies on 2 process sites. These experiences lead to a detailed discussion at the December 2001 SO GLOBEC Science Investigator Meeting of how to best coordinate activities of the two ships so that the RVIB *Nathaniel B. Palmer* (NBP) could complete the survey grid and yet be available to assist the LMG. This draft plan turned out to be incredibly useful and allowed us to complete 3 process stations with most if not all of the predator work that was originally proposed. The only major deviation from this plan was that due to the sea ice conditions such that the NBP could not make it into Marguerite Bay. The extra time gained by not going into Marguerite Bay was used by the NBP to complete more of the survey grid and by the LMG to maintain longer process stations. While we had planned for 21 days, we actually spent 24 days of our time at process stations. This provided a significant advantage for the survey cruise because it gave more flexibility for dealing with the difficult sea ice conditions. The original plan was to have three 7-day process stations with 6 dedicated days to search for predators in Crystal Sound (2 days) and Marguerite Bay (4 days). This was important because even though we lost 2 days of process station time when Process Station Minke broke up we were still able to spend 8 days at Process Station Rodin (Figure 2).

Another minor difference from the 2001 cruise was that we held nightly PI meetings. During the 2001 cruise we held frequent PI meetings, but it was felt that a regularly scheduled PI meeting would be useful. This was implemented during this cruise and worked quite well. As one would expect some meetings were quite involved as we were working out details of process stations, while others were quite abbreviated. Nonetheless, these meetings insured that all groups on board the ship were involved in all aspects of the planning and therefore communication between the various projects was excellent.

Finally, we instituted a new program on this year's cruise. We created a "Picture of the Day". Each day participants of the cruise would submit pictures of the day's activities. Each evening a committee would select one image that best represented that day's activities. This was a standing committee made up of representatives of Raytheon Polar Services Compay (RPSC), Edison Chouest Offshore (ECO) and the various science programs. Committee members rotated each week so that anyone who wanted to could participate in the selection. Once a picture was selected, a caption was written, usually by the person who took the picture, the image reduced in size and then transmitted to the SO GLOBEC planning office at Old Dominion University. However, since we were already transmitting the image to the SO GLOBEC office, cruise members were allowed to provide a list of electronic mail (e-mail) addresses that we added to the picture of the day e-mail that was sent to the SO GLOBEC planning office. This was a spectacular success! Not only did we create a wonderful series of images of the cruise, but colleagues, friends, relatives and the support personnel from our home institutions were able to follow the progress of the SO GLOBEC LMG cruise. The response to this program was amazing! We have used a selection of the pictures of the day to illustrate the activities described in this report.

Finally I would like to thank the many individuals who made this cruise possible. Alice Doyle (RPSC) and Karl Newyear (RPSC) provided invaluable assistance before during and after the cruise. They were tremendously helpful throughout this program. The Captain and crew of the *ARSV L.M. Gould* provided outstanding ship support. The RPSC support staff, Jenny White, Mo Hodges and Sparky Weisblatt, was professional and extremely helpful in assisting with deck operations and science support. Andy Nunn and Romeo LaRiviere provided outstanding electronic support and Jeff Morin did an excellent job processing CTD and ice nutrients and other analysis. To all, thank you for a job well done!

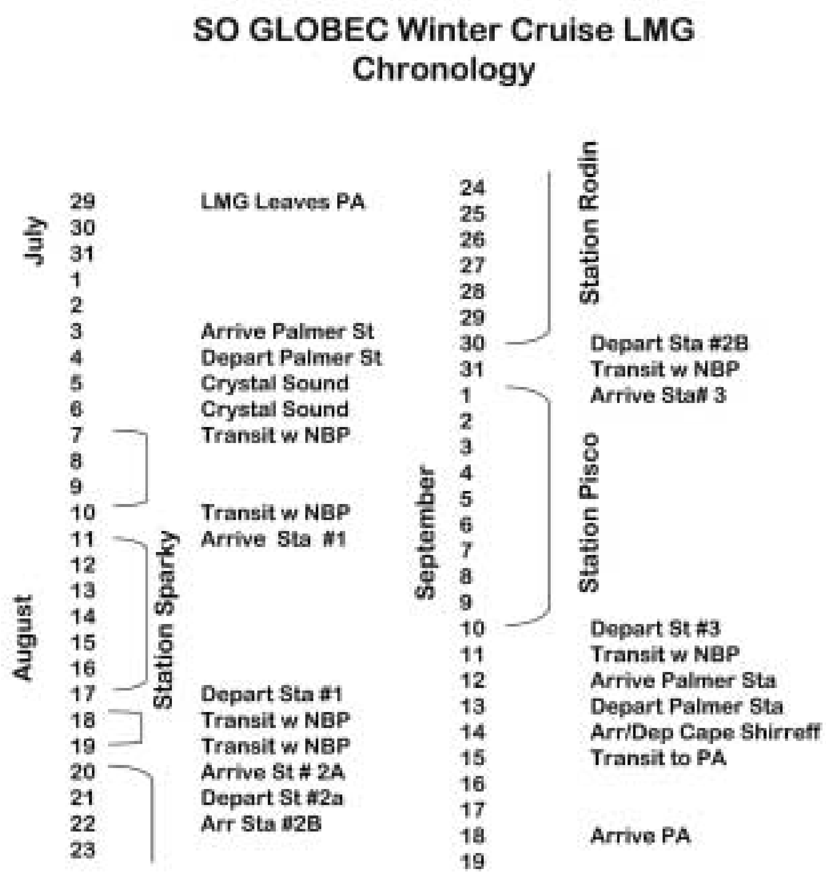


Figure 2. Timeline of activities for SO GLOBEC process cruise LMG02-05. The cruise departed and ended in Punta Arenas, Chile (PA).

CRUISE NARRATIVE

Weekly Synopsis

26 July to 6 August 2002

The ARSV *Laurence M. Gould* departed Punta Arenas, Chile to begin the GLOBEC IV process cruise (LMG02-05) around 1800 on 29 July 2002. We enjoyed a relatively calm but busy crossing of the Drake Passage. Our first iceberg was sighted near 57° 20'S and we encountered pack ice near 60°S, unusually far north even for wintertime. During the crossing we conducted an Expendable Bathythermograph (XBT) transect for OO-260 (Janet Sprintall, PI), collected pCO_2/TCO_2 and salinity samples, and deployed two drifter buoys. We arrived at Palmer Station just after breakfast on 3 August and completed cargo operations that afternoon. We were treated to cross-town pizza by the Palmer Station locals that evening, and left mid-morning the next day towards Crystal Sound. We have spent two full days in the northern Crystal Sound area, which is now known as a biological hot-spot. Both the Seal and Penguin Teams have been very successful and have deployed several of their satellite tracking tags. All RPSC and ECO staff is to be commended for the hard work and efficiency in completing the port call in Punta Arenas, Chile and the operations at Palmer Station. We all seem to have benefited from experience on previous SO GLOBEC cruises and things are shaping up to be quite productive.

6 to 11 August 2002

The LMG began the week by meeting up with the NBP to make an exchange. This included items that did not arrive in Punta Arenas in time for the LMG's departure, various lab items that one ship had but the other one needed, and some empty drums for waste that the LMG picked up at Palmer Station. This operation went quickly, smoothly, and safely and soon the two ships parted ways to do their own tasks. The LMG used its time to conduct the first two SCUBA dives of the cruise and to sample additional seals and penguins. Late in the day on 8 August, the LMG and NBP made another rendezvous at the conclusion of our work in Crystal Sound to begin a convoy to the southern end of the SO GLOBEC grid. Heavy ice prevents the LMG from making progress on our own, so we are dependent on the NBP to open a path for us. Even so, the going has been slow at times and the NBP has needed to back and ram occasionally. We stopped during the day on 9 August to capture more seals and penguins and to conduct further dive operations. On 11 August, we are now approaching the likely site of Process Site 1, near survey station 76. Heavy ice conditions further to the east (closer to the coast) are preventing us from reaching our ideal location in a reasonable amount of time, and numerous icebergs in that direction discourage us from parking the ship there. After several relatively slow work days while the ships are in transit, everyone is eager to begin establishing a camp.

12 to 18 August 2002

We began the week by finishing our convoy to the southern portion of the SO GLOBEC grid with the NBP and selecting a seemingly stable floe as Process Site 1 (informally dubbed Ice Station Sparky). The Ice and Krill Teams conducted initial surveys before deciding this was the place to stay. We planned to conduct morning and evening conductivity-temperature-depth (CTD) casts from the fantail, but rather quickly ran into problems - the ice rapidly closed off the open water we expected to have, and the grease and brash ice clogged the CTD pumps. We tried several things, and finally settled on the solutions of keeping the CTD warm in the Baltic room between casts, turning on the pumps after lowering the package well beneath the ice cover, and using the ship's yokohama boat fender as a “plug” to reduce ice formation between casts.

Eventually even these methods did not work due to relative motion of the ship and the sea ice and we began to use a SeaCat and XBTs through a 10-inch auger hole instead. In the meantime, daily operations included SCUBA diving, ice coring, and seal captures. The Seal Team enjoyed unexpected success and was able to complete the deployment of their 11 satellite tags this week. The Ice Team deployed the first of their three buoy/sensor suites. Wednesday, 14 August brought cold temperatures and high winds, preventing most outdoor activities. However, the scientists remained busy in the labs analyzing samples and processing data. Somewhat surprisingly, our selected floe held together for the most part, though some active ridging consumed most of the original ice thickness transect and the primary dive hole. At week's end we completed operations at this site, met up with the NBP, and began our convoy towards Process Site 2 offshore of the mouth of Marguerite Bay.

19 to 25 August 2002

The week began with the LMG following the NBP toward Process Station 2. Ice conditions and experience led the Captains and Ice Pilot Vladimir Repin of the NBP to reject several likely spots, but we finally found a suitable location a bit further offshore than originally planned. At the same time, air temperatures dropped to around -25°C, with wind chills of -50°C to -60°C not uncommon. A whale was sighted soon after arriving at station, now dubbed “Ice Station Minke”. Unfortunately, after occupying this spot for only 26 hours we were forced to relocate after the floe rapidly broke apart. All personnel and equipment were brought back safely on board. The following morning we found another suitable floe nearby and proceeded to set up camp again. An unusual sea ice formation reminded some people of the famous sculpture, “The Thinker”, so we called this spot “Ice Station Rodin”. The remainder of the week has proceeded relatively uneventfully, with SCUBA diving, establishment of ice/snow thickness transects, CTD casts, and drift net deployments occurring. We have finally caught some krill so things are looking up. The week ended with a sighting of an elephant seal (likely a sub-adult male) in the open water aft of the ship. This is extremely unusual to see, especially in the winter. We are continuing to drift with the pack and are now just north of the Antarctic Circle.

26 August to 1 September 2002

The week began with the LMG at Process Station 2 (Ice Station Rodin). We had several more sightings of the elephant seal, which appeared late last week, including it hauling out just meters from the stern of the ship. A second, larger elephant seal was also seen. Work on the ice station consisted of CTD casts in the morning and evening, SCUBA diving, ice coring and thickness transects, and the deployment of an ice drifter buoy. Although several species of seals were seen in the area of open water aft of the ship during CTD casts, only the elephant seal hauled out. Work at Process Site 2 was finished on 28 August and the LMG began to move in search of penguins to tag while awaiting the NBP's arrival in our area. Unfortunately, no Adélies were seen, much less sampled. On 31 August the two ships met up again and began to head northward toward survey station 4, which we hoped to make into Process Station 3. We conducted a transfer of personnel and equipment between ships and continued on our way. Upon arrival at the northern edge of the grid we discovered that the storm from the previous few days had broken the large floes into smaller pieces ~10 m in size. In addition, we felt a significant swell propagating from the open ocean. After much discussion about where to set up, it was decided that the LMG would move about on our own in this general area and pick floes to work for the day, rather than maintain an extended stay on any single floe. This “free ship” mode of occupying a process station offers advantages as well as disadvantages, and it remains to be seen how productive it will be. Our first day here has yielded success in finding krill.

2 to 9 September 2002

The week began abruptly with a minor incident involving the Dush-5 winch, though no one was injured and only minimal equipment damage was incurred. The problem was quickly traced to a faulty winch control, which was replaced and the CTD system checked over before the evening cast using the Dush-4/fantail CTD configuration. The remainder of the week was rather unremarkable but very productive despite our needing to relocate the LMG several times when our ice floes broke apart or the ship could not hold position with light winds and loose pack ice. All science groups were able to conduct operations including the Seal Team, which had not seen many workable animals in some time. We are beginning to wrap up operations, pack gear, and prepare for our port calls at Palmer Station and Punta Arenas, Chile. Meanwhile, an Antarctic Circle Crossing Ceremony is in the works.

10 to 18 September 2002

As the week began, the ARSV *Laurence M. Gould* was finishing its final process station of the GLOBEC IV cruise and steaming to meet the NBP, which was to the south of us. Upon rendezvous, several people from the LMG took Zodiacs to the NBP for a special session of the SO GLOBEC Executive Committee to discuss logistics for the remainder of the cruise. We then transferred the three scientists back from the NBP that were working there temporarily and began steaming towards Palmer Station. Both ships arrived at Palmer Station on the morning of 12 September and cargo operations began immediately with good weather holding. Palmer Station hosted a dinner party for both ships, and all had a good time. The LMG cargo operations were completed the next day, and we departed from Palmer Station by mid-afternoon bound for Cape Shirreff via the Neumayer Channel. We arrived at Cape Shirreff on the north coast of Livingston Island at mid-day on 14 September in foggy conditions. A party went ashore to census a potential Elephant Seal colony, to collect glacial ice samples, and to see that the huts there were in good condition. Unfortunately, no elephant seals were found, but it was a successful stop nonetheless. The LMG then entered Drake Passage and had a smooth crossing. We are currently scheduled to pick up the pilot at 0200 tonight (18 September) and will dock in Punta Arenas, Chile in the morning.

Daily Activities

29 July 2002

Given that the arrival of a number of key pieces of equipment (SCUBA tanks, baggage, snowshoes) was delayed, the departure of the *L.M. Gould* was delayed until 1800. With Pilot aboard the *L.M. Gould* departed Punta Arenas (53° 10.164′S, 70° 54.999′W) just after 1800 local time (LT) on 29 July 2002 to begin the U.S. SO GLOBEC Process IV cruise. The skies were overcast but winds were light. Shortly after leaving port, we had our first ship orientation and safety meeting with 3rd mate, Alan Arrigoni, and marine project coordinator (MPC), Karl Newyear, at 1930. The goal of this meeting was to insure that all on board were prepared for unexpected emergencies. This included getting into our survival suits, getting into the lifeboats, and a general review of ships safety and procedures.

30 July 2002

The second day we steamed along the eastern coast of Argentina and cleared the Strait of La Maire and the entrance to Drake Passage around 2300. At 1000, Marine Science Technician (MST) Mo Hodgins carried out a chemical safety meeting in the Hydrolab. We had our first fire drill at 1300 today, with an excellent response, with all members of the scientific party having responded within 3 minutes. Once in the lounge, 2nd Mate Jay Bouzigard and MPC Karl Newyear discussed fire safety issues. Later this evening (1930), we had a scientific orientation led by Daniel Costa, where the general goals of the program were discussed including the specific logistics that will be required during the cruise. The weather was overcast and cool and visibility was limited. We exited the sheltered waters of the Straits of Magellan and the east coast of Tierra del Fuego, and encountered significantly more ship motion than previously experienced in the sheltered waters of the Straits or in the lee of Tierra del Fuego. As we entered Drake Passage, the seas picked up slightly and the ship increased its roll. However, the ride was not bad and the seas were better than we had expected. Once we reached the Drake Passage, an XBT survey (Figure 3) was initiated starting at 2235 LT (54° 56.1′S, 64° 57.4′W). This survey is being carried out for Dr. Janet Sprintall of the Scripps Institution of Oceanography (OO-260), who is interested in the dynamics of the Polar Front. XBTs were launched every 10 minutes of latitude during the crossing. Our regular schedule of radio communications was initiated with Palmer Station today at 1300. Our first iceberg was sighted near 57° 20′S. We expect to see pack ice within the next 24 hours or so.

31 July 2002

The *L.M. Gould* continued across Drake Passage towards Palmer Station via the inside passage route. We continued the XBT transect across Drake Passage (Figure 3). The LMG stood by for several hours to adjust ballast. Over the course of the evening 1 Georgian Diving Petrel and 3 Kerguelean Petrels were found to have landed on the bridge. It is common for petrels to be attracted to the ship's lights and crash into the bridge. After identification, we moved these birds to the afterdeck where they could more easily fly. Our first XCTD was released at 0546 LT (56° 1′S, 64° 38.9′W). During the evening, Marine Technicians (MTs) Jenny White and Sparky Weisblatt deployed one of two NOAA Technocean global drifters at 59° 02.3′S, 63° 40.1′W. Unfortunately, while deploying this buoy MT Sparky Weisblatt received a serious laceration on the little finger of his right hand. He received excellent medical attention from veterinarian Julie Barnes and Emergency Medical Technician (EMT) Mo Hodgins. Treatment was coordinated with MAS medical services. We will have to wait until examination by the doctor at Palmer Station to determine whether he has a broken finger. We anticipate arrival at Palmer Station on the morning of 3 August.

Figure 3. Andy Nunn explains how the load the launcher for XBT survey across the Drake Passage.

1 August 2002

The *L.M. Gould* continued across Drake Passage, which treated us reasonably well, though with a fair bit of rolling due to beam seas. Andy Nunn and Shonna Dovel, with Karl Newyear supervising, deployed the second NOAA Technoccean global drifter. MST Mo Hodgins carried out a Radiation Safety briefing with the two programs that will be using radioactive material at 1830. Ice observations were initiated at 0300 and will continue until we leave sea ice. Ice (sugar and grease) was first observed at 0305 and 8/10 pancake and brash ice was observed at 0315 at 59° 49.9′S, 63° 25.2′W.

2 August 2002

The LMG passed between Smith and Snow Islands at the end of the "central" route across the Drake Passage. This crossing took a few hours longer than normal due to unusual amounts of ice as far north at 60°S. Penguins were observed on a flow at 1100. Preparations were made to capture the birds for stomach sampling, but they retreated to the water before we could put a Zodiac in the water. We finished the XBT transect for Janet Sprintall this morning at 0806 local time (1206 GMT) at 62° 42′S. As we passed through the pack ice we have seen many sub-adult and adult male Antarctic fur seals. We saw a large group (10-20 individuals) that porpoised off together at 1510 (64° 34′S, 61° 26.7′W). Later on we saw our first leopard seal of the trip at 63° 43.1′S, 61° 20.26′W. Much of the day has been spent preparing for our stop at Palmer Station. We plan on arriving tomorrow morning around 0800, conducting cargo operations, and spending the night before heading toward Crystal Sound on Sunday morning.

3 August 2002

We arrived at Palmer Station at 0843 LT. Cargo offload began shortly thereafter and continued well into the afternoon (Figure 4). There was very little science preparation to do as the Bio Lab was being renovated. Almost all preparations (sample weighing, etc.) had taken place in Punta Arenas prior to departure. Many individuals enjoyed the walk up the glacier behind Palmer Station. Quetin's group took advantage of open water in the channel next to the ship to carry out a series of practice dives. In the early afternoon the ice opened up so that the seabird group attempted a tour of Palmer Sound to look for penguins and seals. However, they were only able to get as far as Christine Island before the wind changed forcing them to return, as the pack ice was moving back towards Palmer Station. Many of the ship's party enriched the coffers of the Palmer Store, purchasing souvenirs and other items. Palmer Station extended their hospitality with an all-hands pizza feed that started at 1800. The pizza was excellent, as was the party that followed. It was a nice diversion as we prepare for the intense period of science that awaits us.

4 August 2002

The *L.M. Gould* departed Palmer Station at 1000 and began steaming towards the SO GLOBEC study region in Matha Strait and Crystal Sound to initiate the predator studies. We had open water for the first few hours and at 1400 hours we carried out a full CTD cast at 65° 06.045′S, 65° 08.06′W to test the rigging and electronics. This location also coincided with the first appearance of a significant sea ice edge since departing Palmer Station.

Figure 4. The LMG conducts cargo operations at Palmer Station.

5 August 2002

The LMG made good progress to the south, inshore of Lavoisier Island last night. Before breakfast, four workable Adélie penguins were sighted and two were eventually captured and tagged (Figure 5). Less than half an hour after penguin operations were complete, two crabeater seals were located and sampled. Less than half an hour after that operation was complete, another workable seal was sighted (Figure 6). This slowed our southerly progress, but compared to last year, these activities have gotten the predator groups off to an excellent start.

Figure 5. Researchers catching penguins.

6 August 2002

The LMG made some southerly progress towards Matha Strait throughout the night, punctuated by the capture and tagging of several penguins. We have met up with the NBP and are working within visual range of each other (at least when the fog lifts). The Seal Team had a successful morning, as they captured and tagged their third crabeater seal. After lunch, several more penguins were captured and sampled.

Figure 6. Two crabeater seal lying on the sea ice near the LMG. Notice the large scar from a Leopard seal attack on the animal at the top.

7 August 2002

The LMG made a rendezvous with the NBP last night to allow each ship to exchange needed items. Sea ice conditions prevented Zodiac operations so a bow-to-stern exchange using cargo nets was performed (Figure 7). The LMG hove to overnight. Today the predator groups were quite busy. The morning started out with the penguin group catching birds and then moved onto the seal group who caught two crabeater seals and one leopard seal and then finished with the bird group catching additional penguins. The SCUBA divers were able to get into the water and collect krill samples. Once everyone was on board we began our southward journey to establish the first process station at the southern-most region of the survey grid.

Figure 7. The NBP comes up behind the LMG to transfer supplies.

8 August 2002

Today was spent in transit to the southern most part of the survey grid. The day started at midnight when we rendezvoused with the NBP to begin our trek through Matha Strait. This turned out to be tougher than we planned as we spent much of the day stuck, trying to work our way out of the sea ice. Much of the daylight hours were spent backing and ramming by both ships. However, with a combination of Captain Robert's skill and persistence along with considerable assistance from Captain Joe (NBP) and the power of the NBP, we finally got out of Matha Strait and into smooth going.

9 August 2002

The LMG made good progress toward the southwest and Process Station 1 throughout the night following the NBP parallel to the west coast of Adelaide Island. At approximately 0900 this morning a group of ~50 Adélie penguins was sighted. A number were captured and sampled. The Seal Team captured and tagged their sixth crabeater seal, and the Dive Team completed another dive collecting juvenile krill. It has been a successful day for all science groups aboard. We plan to continue to the southwest overnight.

10 August 2002

The LMG followed the NBP towards the southern end of the SO GLOBEC grid. Sea ice conditions varied from heavily rafted rubble fields to relatively uniform floes with diameter 10-20 m. The barometer continued to drop, but the weather remained rather comfortable. Throughout the day many crabeater seals were spotted, but the Seal Team decided to wait until we reached the first Process Station to hopefully deploy their remaining tags.

11 August 2002

The LMG continued to follow the NBP to the vicinity of SO GLOBEC survey station 76. It was determined that the ice types here were acceptable to establish a process site, and further progress to the east was deemed impractical due to thicker and more heavily rafted ice slowing our forward progress. In the afternoon we established our "campsite" and completed another trade of items with the NBP. While the LMG groups were establishing their study areas, the NBP stood off from us and conducted a CTD cast and accomplished other tasks (Figure 8). We anticipate remaining in this location for the next week while conducting sea ice and snow surveys and under-ice dive operations. Predator sampling will occur opportunistically as animals appear within easy reach. We faced the coldest temperatures yet, with the thermometer reaching -18°C or 0°F! Working outside at these temperatures for prolonged periods is very tiring.

12 August 2002

The LMG has firmly established Process Site 1, informally dubbed "Sparky" in honor of our MT whose birthday was yesterday. This morning two minke whales were observed spy hopping and several seals have briefly hauled out in our vicinity. The first SCUBA dive of the day was cut short by a visit from a leopard seal; no injuries were sustained. The Sea Ice Team has been quite successful in completing an initial snow/ice transect and they are planning to extend their lines. We conducted a CTD only (without Rosette bottles) cast both last evening and this morning. We plan to complete two casts per day, 12 hours apart. Only the Penguin Team has been without luck, but they are assisting other groups with their activities.

Figure 8. Picture of the LMG and NBP during the initial stages of setting up Ice Station Sparky.

13 August 2002

The LMG continues to occupy Process Station 1. Daily operations include SCUBA diving, ice coring, seal work, and twice daily CTD casts to 300 meters. The Cold Regions Research Engineering Laboratory (CRREL) personnel deployed one of their three ice drifter buoys in the afternoon, which will remain in place after we leave, and relay information on ice drift, meteorological conditions, and temperature profiles through the sea ice. The Seal Team was very busy with numerous seals both hauled out on the ice and also playfully swimming around. The Dive Team had help on their dives today as the seals were using the same holes in the ice as the divers. Some of the seals would come out on top of the ice to assist the dive tenders.

14 August 2002

The LMG continues to occupy Process Station 1. Yesterday ended successfully with all groups completing activities and collecting data. Our first ice buoy was also deployed. Today all activities have been aboard the ship as the temperature has dropped and the wind speed increased. We are now drifting with the pack ice to the north-northeast at about 1.0 kt but there has been relatively little breakup of the ice. Today was the coldest and windiest day of the cruise so far, with temperatures hovering around -18°C and winds gusting up to 40 kts. The high winds pushed the ship and floe north at a speed of 1.5 kts during most of the day, keeping the divers out of the water and the seals under the ice. One lone, brave Emperor penguin was sited speeding on his belly across the ice floe.

As evening (and darkness) fell the winds died down to 15 kts, and the Ice Team decided to brave the elements to go out onto the ice. With the help of the ship lights they cored a second-year ice floe that was 2.5 m thick with more than 1.3 m of snow and slush on top. All in all it was another successful day for scientists aboard the *L.M. Gould.*

Figure 9. Transect line for ice thickness measurements in the foreground, divers working from a Zodiac in a lead in background.

15 August 2002

The LMG continues to occupy Process Station 1. Our drift has slowed from as much as 1.1 kts yesterday afternoon to 0 kts today, as the winds dropped and the barometer stabilized. All teams, except those looking for penguins, are able to collect samples and data today (Figure 9), and the Seal Team deployed the 10th of their 11 total tags this afternoon. This has been a very productive location.

16 August 2002

The LMG continues to occupy Process Station 1. Our drift speed has decreased to near zero and the weather has held steady, allowing all groups to access the sea ice and collect data, except for the Penguin Team. No birds besides a few snow petrels have been sighted recently. However, the Seal Team deployed their eleventh and final satellite tag this morning (Figure 10). As there were many seals in the area today the Seal Team carried out their first stomach flushing and found nothing in the stomach of a 12th crabeater seal. The Krill Team continues to conduct SCUBA dives, and the Ice Team is getting lots of cores to sample.

17 August 2002

The LMG is completing our final day at Process Station 1 before moving on. Normal operations include SCUBA diving and ice coring. We have been shooting a XBT in the morning and another in the evening in lieu of a regular CTD cast. Ice conditions and our concern about breaking up our working floe have prevented us from keeping a CTD hole open. Although this has been a productive site, very few krill have been found either in the water, under the ice, or in stomach samples collected from predators. This is curious, given the relative abundance of seals we have been seeing.

Figure 10. This is the last seal to be tagged with a satellite telemeter.

18 August 2002

We left Ice Station Sparky late last night and began our transit to our next process station. We found the sea ice conditions favorable for travel over most of the route. One penguin was sighted and an attempt was made to put the Penguin Team on the ice; however, the bird disappeared in the ice fog before we could get the penguin capture team on the ice.

19 August 2002

The LMG followed the NBP last evening towards survey station 41, which was the target spot for Process Station 2. However, sea ice conditions dictated otherwise so we backtracked to a place more likely to have sufficiently stable ice. This, too, proved fruitless so we finished up science operations at this temporary site before moving to the east. The weather has definitely changed and it now feels like Antarctica in the winter. Air temperature dropped to -25°C with winds in the 30-40 kt range. A CTD was done during the early morning hours. The Ice Team sampled a nearby ice floe and the divers went into the water for about an hour in their continuing search for krill. In the late afternoon, the *L.M. Gould* continued looking for a good site for the next long term station being led by the *N.B. Palmer*. We hope to be able to pick out a site early tomorrow.

20 August 2002

The LMG continued its convoy with the NBP throughout yesterday looking for a good location for Process Site 2. No penguins were sighted during our transit, and no one was especially anxious to go outside as the temperatures dropped and the wind chill was in the -50°C to -60°C range. Several possible locations were abandoned due to the presence of icebergs and evidence of their breaking up the ice. This morning we finally found a suitable site that was away from icebergs and provided good access to a stable ice floe. While we were setting up the station, a Minke whale surfaced immediately behind the ship (Figure 11). Many of us ran down and saw it surface at least 3 times before it left. Given our good fortune we named our new home for the next 7-9 days Ice Station Minke.

Figure 11. Minke whale that surfaced in the open water behind the ship.

21 August 2002

Antarctica, generally deemed the harshest of continents, demonstrated this reputation to us today. As daylight broke in a cloudless sky, we initiated science by deploying a CTD beneath 4 inches of ice that formed last night. Despite the temperatures ranging from -20°C to -25°C (with wind chill, -50°C!) and 20-kt winds, excited scientists scattered out on the ice to build Ice Station Minke. The Ice Team set out to collect a series of ice cores to investigate changes in composition of the ice structure, algal biomass and microbial communities. Samples were collected despite the repeated freezing of ice cores to the barrel shaft. Additionally, the ice crew solicited help from the sealers, the penguin folk and the nutrient guy to shovel two quadrants created to monitor how varying light intensities affect algal and microbial productivity. Bundled divers preferred the relative warmth of -2°C seawater to the potentials of freezing air exposure. After setting up transect lines under the ice, divers used suction tubes to collect samples of phytoplankton growing on the undersurface. With a solid day of science complete (Figure 12), folks gathered on the bridge to watch the sunset and as it turns out, to discover a large lead had opened near the Station. The difficulty of studying a dynamic ice system is that it is…dynamic. Consequently, we watched the harshest aspect of our day unfold. The ice crumbled and cracked, dislodged the ship and consequently, Ice Station Minke was destroyed. We collected our gear off the ice and made plans to find a new station at first light tomorrow.

22 August 2002

After the breakup of Ice Station Minke, we hove to for the night and then found a suitable floe in the morning and started over again. We are currently on a piece of ice with large flat areas ~50 cm thick crossed by several small ridges. It was a beautiful clear, though cold, day. Most of the day was spent setting up our new ice station, "Rodin" (Figure 13). The Krill Team made diving holes in the ice and the Ice Team drilled an ice transect. We continue to experience extremely cold but sunny weather; temperatures remained around -20°C to -25°C with wind chill down to -50°C. The cold did not, however, prevent a friendly game of soccer on the ice. In the evening, we were treated to a spectacular sunset with the red sky growing more and more brilliant for several hours after the sun dipped below the horizon (Figure 14).

Figure 12. A montage of representative activities carried out at Ice Station Minke.

Figure 13. The first scientists to step on the ice at Ice Station Rodin.

Figure 14. Sunset at Ice Station Rodin.

23 August 2002

The LMG continues to occupy the new Process Station 2, conducting a full suite of operations including: ice coring, snow/ice thickness transects, SCUBA diving, and CTD casts. We are still without a penguin sighting for the past few days, but seals are occasionally seen. Today it's getting cloudier, and therefore warmer as the downward long-wave radiation increases. After 3 days of sunny, but cold weather, we finally got a break in the activities so we could take a cruise group photo. The ice dynamics team deployed a simple ice buoy and the ice biota team collected ice cores. In the evening the Krill Team deployed nets from the ship's stern to fish for krill.

24 August 2002

We continue to make excellent use of Process Station 2, conducting a full suite of operations including: ice coring, snow/ice thickness transects, SCUBA diving, and CTD casts (Figure 15). Three SCUBA dives were accomplished and the second of three ice buoys were deployed yesterday. We are still seeing rather sparse fauna in this location with no seals, whales, or birds seen and only a few krill. Occasionally a ctenophore will float by during a CTD cast. We are hopeful of maintaining this floe, but the forecast is for winds in the next day or two. The day started with clear sunny skies, but became increasingly overcast as the day continued.

25 August 2002

We continue to occupy Process Station 2 (Rodin). The weather has changed considerably, with 15-20 kt winds coming from the west to northwest. It is warmer, with temperatures around -9°C. We have finally caught some krill using drift nets deployed through the dive holes and left out overnight. The Ice Team is re-measuring their ice/snow thickness transect line and taking optics measurements. Blustery weather has prevented the Seal Team from working on the lone crabeater hauled out in our vicinity. Several other seals have been sighted in the water nearby, though. We have still not seen any penguins lately.

Figure 15. Activities at the ice station included, diving from a Zodiac foreground and two groups conducting ice cores.

26 August 2002

We continued to occupy Process Station 2 (Rodin). It was warmer with temperatures around -9°C. The weather changed considerably with 15-20 kt winds coming from the west to northwest. A crabeater seal was spotted hauled out 400 m to our stern and several were seen in the open water immediately astern of the ship. Given the change in weather coupled with unstable ice conditions no attempt was made to capture the seal. During the afternoon, an elephant seal hauled out just aft of the ship and during the evening CTD (Figure 16) two elephant seals were spotted in the open area immediately to the stern. One could have been the adult female that hauled out; however, the second individual was definitely an adult male southern elephant seal. Ice coring and optics measurements as well as SCUBA diving operations continued. The Dive Team, though collecting data from their underwater transects, still has not been able to find krill in direct association with the over-rafted ice. They placed one-meter ring drift nets in the water overnight to attempt to find krill for growth experiments. They temporarily discontinued their diving operations today when a leopard seal was spotted in the open lead to the stern of the ship.

27 August 2002

The LMG continued to occupy Process Station 2. The weather warmed up considerably with temperatures reaching a balmy -1°C to -5°C. Meanwhile, the Ice Coring Team (Figure 17) and the Krill Team (Figure 18) continue to collect data and samples. We discussed with the NBP when and where to go next as work at this location has begun to wind down after 6 days here. The CTD has been plagued with various arcane problems but we are still attempting to conduct two casts per day. The CTD casts seem to be a time when seals appear behind the stern of the vessel. We have sighted several crabeater seals, a leopard seal, a Weddell seal and at least two elephant seals when we conducted CTD casts. Meanwhile, the Ice Coring Team and the Krill Team continue to collect data and samples.

Figure 16. On left is ET Romeo LaRiviere controlling the CTD and on deck right are MT Jenny White and NUTS tech Jeff Morin deploying the CTD off the stern.

Figure 17. Ice coring Team at work.

28 August 2002

The LMG completed work at Process Station 2 around noon today. We pulled all our gear off the ice, except for the ice drifter buoy and made our way toward a lead of open water/thin ice nearby. The plan was to search for penguins to sample and tag, and to conduct a CTD cast. Activities were coordinated with the NBP, but we were able to move somewhat independently.

Figure 18. Karina Johnson (left) completes measurements of juvenile krill (right) with a microscope.

29 August 2002

Today as the LMG pulled away from Process Station 2, or Ice Station Rodin, the Ice Team frantically scurried about the ice, collecting the last cores and thickness measurements from the piece of ice that we had called home for the last week. Other groups prepared for getting underway in search of penguins and continued analysis of samples already collected. After a final CTD cast we went cruising around the northern end of the SO GLOBEC grid in search of penguins. Although we did not have any success finding birds, we did find that we could move on our own. Nevertheless, as it is unlikely that we could get to the next station on our own, we awaited the arrival of the NBP to assist in moving us to our third and final process station located at or near survey station 4.

30 August 2002

Today started out with the search for penguins, however, by mid-morning the wind had picked up and the visibility dropped such that we could see only a few feet in front of the ship. Since noon time the ship has been parked in the ice. Parked, but still moving, as the ice pack has been drifting at 1.3 kts (nautical miles per hour), blown by 40 to 50 kt winds all afternoon. Our plan was to meet up with the NBP and proceed to our third process station after transferring some gear and personnel between ships but this was delayed due to inclement weather.

31 August 2002

The LMG and NBP met up in the morning and conducted a transfer of personnel and gear, this time with a Zodiac. The weather improved from the blizzard conditions and zero visibility of yesterday. The Penguin Team was finally captured and tagged a bird. Both ships proceeded to convoy to survey station 4 which we hope will serve as Process Site 3.

1 September 2002

After reaching survey station 4, the LMG and NBP carried out a simultaneous CTD cast to allow for intercomparison of the various sensors on board the rosette. The LMG then made it on our own through the loose and recently broken up pack toward the southeast. Just before lunch an acceptable floe was located to work on, and after a quick meal the Ice Team deployed to collect samples. This work was followed by a SCUBA dive, which was quite successful in obtaining krill samples. The ice has been heavily fractured due to the heavy swell associated with the recent storm. It is likely that will we go into a modified process station, where we sample different individual small floes each day.

2 September 2002

The LMG continues to occupy Process Station 3. This site is unlike our previous two locations because we are able to move about on our own. There are no sufficiently large ice floes upon which we can maintain a continued presence. Therefore, we have been picking a "floe of the day" each morning and gathering as much data as possible during the day before moving off to a new floe the following day. Also unlike our previous stations, the SCUBA Dive Team found and collected krill from the underside of the ice.

3 September 2002

The LMG is occupying a relatively small floe (40 m diameter) for a second consecutive day. We were treated to a gorgeous sunrise (Figure 19) (now about 0730 LT) and a visit from a single emperor penguin (Figure 20) in the morning. The SCUBA divers have had good success at this site and the Ice Team deployed their third and final drifter buoy (Figure 20).

Figure 19. Antarctic sunrise.

Figure 20. Emperor penguin on left and simple ice buoy on right.

4 September 2002

Somewhat surprisingly, the LMG has continuously occupied the same relatively small floe for a third consecutive day. We have seen the pack loosen up and begin to re-freeze as the light winds have shifted slightly and the air temperatures have dropped. This area looks completely different than it did just a short while ago when we arrived early this week. The Ice Team and the Krill Team have had very good success here and the Seal Team is pitching in to help wherever possible.

5 September 2002

The LMG moved off the floe we've occupied for the last three days, conducted CTD casts last evening and this morning, and then repositioned alongside a large, thick floe with heavy snow cover to work for the day. Three crabeater seals have hauled out just aft of the ship. Meanwhile, the SCUBA Dive Team and the ice corers have been busy collecting samples. The Seal Team was finally able to work on another crabeater in the evening. Although all their satellite tags were deployed early in the cruise, they are still able to make physiological studies. We are seeing some rather significant relative motion between floes due to a slight swell running through the area.

6 September 2002

The LMG continues to operate in the same general area, though on a different floe from yesterday. The Ice Team recruited help from others on a beautifully clear day and collected many meters of core, and the divers completed two dives. Everyone is pleased with the amount of work we're accomplishing, but we're starting to think about port calls and heading home.

7 September 2002

The LMG found a good ice floe yesterday so we are continuing to occupy it today. The Ice Team is collecting cores and optics measurements (Figure 21), the Dive Team currently made three dives (Figure 22), and the Seal Team was able to complete measurements on another crabeater seal. We are definitely making productive use of the last few science days of GLOBEC IV.

Figure 21. Ice Team completes measurements of the optical properties of the ice.

Figure 22. SCUBA divers work off a Zodiac to collect krill samples and characterize the under-ice habitat of juvenile krill.

8 September 2002

The LMG was not able to maintain position against the floe we worked on the past two days, but we quickly found another location in the immediate vicinity this morning. After lunch the Ice Team went out to make optics measurements and the Dive Team made two dives. We are seeing lots of seals in the area, and one hauled out relatively close to the ship so the Seal Team was able to complete measurements on their fifteenth seal.

9 September 2002

We have completing our final day of on-ice science from the LMG, though analysis of samples in the lab will continue for some time yet. The Dive Team completed three dives and the

Seal Team completed their 16th and "last" seal. We are communicating with both the NBP and Palmer Station to coordinate activities for the next few days, and to think about preparations for the upcoming port call in Punta Arenas.

10 September 2002

This morning, the LMG steamed approximately 12 miles to the south to meet up with the NBP, who had finished work on the SO GLOBEC grid. We retrieved three scientists that had been temporarily working on the NBP for the past ~10 days. We also held a meeting of the SO GLOBEC Steering Committee to discuss operations for the remainder of the cruise. Once we got under way we began looking for Adélie penguins to see what they had been eating. We came upon a group of between 50-100 birds. However, the ice floes were too small and the penguins to fast to be caught. We are currently steaming northeastward toward Palmer Station.

11 September 2002

The morning started with the collection of some final brine samples from the pack ice. The remainder of the day was spent moving in the general direction of Palmer Station looking for penguins. Although a few birds have been sighted, the ice conditions did not allow us to catch them. The ice has been too thin to walk on, but too thick to run a Zodiac in. Given the difficulty of catching birds on the ice, we shifted gears and went to Peterman Island in the hopes of catching birds on their island haulout. While we did find numerous penguins at Peterman Island, they unfortunately were the wrong kind. At this location we found several hundred Gentoo penguins. The remainder of the science parties on the ship is busy packing the gear in anticipation of an arrival at Palmer Station tomorrow.

12 September 2002

The LMG arrived at Palmer Station at approximately 0830 on 12 September and cargo operations began soon thereafter. The NBP arrived in Arthur Harbor just a couple hours behind us. We were able to complete most of the cargo movements by late afternoon, and enjoyed an excellent dinner hosted by Palmer Station. Festivities continued into the evening at the bar.

13 September 2002

Cargo operations were completed during the morning and early afternoon. We departed Palmer Station at 1400 and proceeded through the Neumayer Channel. Later that evening we held a crossing ceremony for our pollywogs. Both the pollywogs and shellbacks put on quite a show!

14 September 2002

The LMG departed from Palmer Station yesterday afternoon. We steamed through the Neumayer Channel during daylight, then headed for Cape Shirreff. Dan Costa and Chris Fritsen's groups went ashore to conduct a survey of the seals, check the condition of the camp and to look for ice bacteria. They returned by 1530 and we started to steam across the Drake Passage on our way home.

15 September 2002

The LMG is continuing across the Drake Passage with relatively good weather and seas. We crossed latitude 60°S this morning at approximately 0830 and anticipate an early return to Punta Arenas.

16 September 2002

The LMG continues across the Drake. Los Islas de los Estados are visible on our starboard side as we approach the Straits of La Maire. We anticipate an arrival in Punta Arenas on 18 September.

17 September 2002

The LMG is currently steaming towards the eastern entrance to the Straits of Magellan. We are scheduled to pick up the pilot tonight at 0200 and will tie up to the pier in Punta Arenas tomorrow morning.

18 September 2002

In Punta Arenas

19 September 2002

In Punta Arenas

INDIVIDUAL PROJECT REPORTS

BG-232 Costa, Burns and Crocker

Field Team: D. Costa, J. Barnes, S. Shaffer, B. McDonald and C. Kuhn

The Antarctic marine environment undergoes considerable inter- and intra-annual variability, resulting in marked variation in the spatial and temporal availability of prey for vertebrate predators. Although we know that oceanographic features are necessary to concentrate or aggregate prey, the specific relationship is poorly understood. Crabeater seals, *Lobodon carcinophagus,* offer a unique opportunity to better understand the foraging strategies utilized by marine predators in the face of meso- and fine-scale environmental variability. Within the seasonal pack ice zone crabeater seals prey almost exclusively on Antarctic krill (*Euphausia superba*). Yet despite their reliance on a locally abundant and spatially heterogeneous prey resource, crabeater seals are the most abundant Antarctic pinniped (ca. 15 million). Our goal is to understand how crabeater seals forage on krill within the seasonal winter pack ice. Data on krill distribution and abundance acquired as part of the SO GLOBEC field program and the biophysical coupling will provide a context in which to place the foraging behavior of crabeater seals. The foraging behavior and ecology of crabeater seals was studied by using satellite-linked time-depth recorders (SLDR, Figure 23), coupled with a suite of physiological measurements that can provide information on animal diet and condition. During the first field season we deployed a total of 16 satellite-linked data loggers and during the second year of the program we were able to deploy a total of 19 satellite tags (8 tags in the fall cruise and 11 tags on this cruise). In addition to the satellite tagged animals we were able to complete physiological measurements on an additional 11 animals (six in the fall and five in the winter). Over the course of the two-year SO GLOBEC program, we were able to capture and study 46 crabeater seals and one leopard seal, *Hydrurga leptonyx* (Table 1). Of these, 35 carried satellite-linked data loggers (Table 2).

An additional component of our deployment of SLDRs on crabeater seals is that the units deployed this year (2002) provided information on water column temperature profiles. We now refer to these data as APBTs (autonmous pinniped bathythermograph), such data have been collected from a variety of marine animals including northern elephant seals. In this study, once each day, the SLDR transmitted the deepest water column temperature profile that was recorded for that day.

During this cruise (LMG02-05), we captured and tagged a total of 15 crabeater seals and one leopard seal. Our field team consisted of Dan Costa, Scott Shaffer and Carey Kuhn (University of California Santa Cruz), Julie Barnes (Taronga Zoo, Sydney, Australia) and Birgitte McDonald (Sonoma State University). Our success this year was in marked contrast to our operations last winter (LMG01-06). During the last winter cruise, we successfully deployed all eight tags, but it required the entire cruise to do it as the last tag went out in the last few days of the cruise, we had significant difficulty finding crabeater seals to study. In contrast, this year we had many opportunities to tag animals and we studied twice as many animals as last year. In fact, we had captured 12 seals by 16 August, only three weeks into the cruise. The difference in availability of seals between years may be due to the relatively milder weather (but more ice) experienced this year compared last year. There appears to be a marked reduction in haul out frequency as the air temperature declines. At some point the water is warmer for the seals than the air.

An unexpected difficulty in our work was the rapid tag loss was experienced by both the fall and winter cruises (Table 2). Each cruise lost a tag within seven days of initial operation and out of 11 tags deployed during the winter cruise, only three are still operating 43 days later (date Table 2 was made). However, one of the tags deployed during the fall cruise is still operating 147 days later. It is suspected that this poor performance is related to the loss of the transmitter aerial. This still occurred even after the manufacturer of the SLDRs increased the strength of the antennae and provided us with three additional tags. However, it appears that the seals and the ice took their toll on the antennae (Figure 23).

Figure 23. Crabeater seal #G42 is shown with a Sea Mammal Research Unit Satellite-linked Dive Recorder attached to its head.

Table 1. Summary of seal captures from the four SO GLOBEC cruises (2001-2002). All animals are crabeater seals except for seal number G037*, which was Leopard Seal. The & denotes the standard length and # denotes the axillary girth of the seal. Tags numbers G031 and G033-G047 were captured and tagged during this cruise (LMG02-05).

Tag No.	Name	Sex	Date	Latitude South	Longitude West	Time Capture	Time Release	Mass (kg)	Length& (cm)	Girth# (cm)
G001	Flo	F	07-May-01	67° 19.8	67° 32.8	12:22	14:30	-	234	
G002	Goober	M	11-May-01	67° 19.5	67° 33.2	10:30	12:30	-	216	172
G003	Layla	F	05-May-02	67° 19.5	67° 33.2	12:57	14:20	-	232	156
G004	Bob	M	22-May-01	69° 14.7	72° 15.1	10:50	12:30	-	240	180
G005	Selena	F	22-May-01	69° 14.9	72° 25.0	16:29	17:56	-	229	169
G006	(Big) Bertha	F	23-May-01	69° 17.6	72° 28.8	13:56	15:45	-	252	195
G007	Oscar	M	23-May-01	69° 17.8	72° 28.8	15:51	17:45	-	216	172
G008	Elvira	F	24-May-01	69° 07.1	72° 26.6	16:52	18:10	-	242	183
G009	KJ	M	02-Aug-01	67° 43.9	69° 18.7	15:30	16:17	179	221	131
G010	Jemma	F	05-Aug-01	68° 04.7	70° 21.4	12:56	14:02	307	243	165
G011	Jimmy	M	29-Jul-01	67° 13.6	69° 25.4	12:35	14:19	232	214	155
G012	Collie	F	06-Aug-01	68° 03.8	70° 10.5	12:10	13:43	288	236	165
G013	Capt. Robert	M	06-Aug-01	68° 04.2	70° 11.6	16:16	17:28	234	216	148
G014	Ryan	M	09-Aug-01	68° 05.2	70° 05.2	16:01	17:20	284	238	174
G015	Shawn	M	15-Aug-01	67° 10.6	70° 13.5	11:23	12:33	234	218	150
G016	Anna	F	21-Aug-01	67° 23.8	70° 51.0	16:39	19:59	273	231	156
G017	Lolita	F	14-Apr-02	66° 21.4	66° 48.5	13:45	16:18	118	177	120
G018	Dexter	M	15-Apr-02	66° 45.2	66° 46.6	10:25	12:46	157	192	134
G019	Patch	F	15-Apr-02	66° 45.2	66° 46.6	12:32	14:39	156	187	131
G020		M	16-Apr-02	66° 36.9	67° 27.4	10:41	12:53	143	180	125
G021	Bubba	M	17-Apr-02	66° 36.9	67° 30.5	14:30	16:46	271	231	160
G022	LaraCroft	F	20-Apr-02	67° 22.4	67° 38.9	11:02	14:12	268	218	158
G023	Ryder	M	23-Apr-02	67° 35.0	68° 10.0	14:37	16:12	174	206	140
G024	Stella	F	27-Apr-02	67° 35.3	68° 60.4	10:40	12:53	256	216	168

G026	Leonie	F	27-Apr-02	67° 35.3	68° 60.4	12:38	15:00	266	228	161
G027		M	12-May-02	66° 38.2	67° 27.3	10:03	12:32	226	210	146
G028		F	05-May-02	68° 31.1	69° 48.1	10:22	12:37	314	236	168
G029		M	02-May-02	68° 43.4	69° 59.6	15:04	17:17	242	222	152
G030		M	12-May-02	66° 38.2	67° 27.3	13:02	15:25	250	219	160
G031		F	05-Aug-02	66° 16.8	66° 35.7	11:12	14:15	385	251	175
G032		F	02-May-02	68° 45.3	69° 52.5	12:17	14:41	230	222	152
G033		F	05-Aug-02	66° 19.6	66° 39.5	16:20	18:20	268	224	148
G034	Mary	F	06-Aug-02	66° 31.9	67° 05.7	9:22	12:15	295	232	165
G035		F	07-Aug-02	66° 24.6	66° 51.5	10:05	11:25	238	229	147
G036		F	07-Aug-02	66° 24.6	66° 51.5	11:30	12:30	207	214	156
G037*	Steve	M	07-Aug-02	66° 24.3	66° 51.6	14:32	16:02	198	227	143
G038	Chewy	M	09-Aug-02	67° 11.2	70° 34.5	13:20	15:25	273	222	162
G039	Tigger	M	12-Aug-02	68° 35.9	75° 59.8	15:35	16:48	247	232	153
G040	Big Boy	M	13-Aug-02	68° 29.3	75° 50.0	10:40	14:30	302	226	168
G041	Scar Boy	M	15-Aug-02	68° 05.8	75° 02.5	11:00	13:30	269	229	165
G042	Matt	M	16-Aug-02	68° 01.8	74° 51.3	10:22	12:25	224	225	151
G043		M	16-Aug-02	68° 01.7	74° 49.8	14:27	16:50	224	216	148
G044		F	05-Sep-02	65° 41.3	68° 39.5	17:40	21:00	280	240	166
G045	Thelma	F	07-Sep-02	65° 37.0	68° 35.9	12:41	16:20	221	224	145
G046		M	08-Sep-02	65° 31.9	68° 28.1	16:55	18:30	237	213	153
G047	Toad	M	09-Sep-02	65° 38.5	68° 30.7	16:08	18:00	257	218	158

Table 2. Summary of satellite tracking effort for crabeater seals on fall and winter 2002 SO GLOBEC cruises.

			Activation			Last Transmission				
Cruise	**Animal**	**PTT No.**	**Activated**	**First Location**	**Time at Location**	**Day**	**Date**	**Time**	**Duration (d)**	**Quiet (d)**
Fall	Bubba	14749	17-Apr-02	17-Apr-02	21:39:46	Wed	11-Sep-02	19:56:47	146.9	6.0
Fall	Dexter	13363	15-Apr-02	15-Apr-02	20:25:01	Sun	04-Aug-02	04:39:51	110.3	44.6
Fall	Hellion	14750	20-Apr-02	20-Apr-02	21:02:14	Mon	16-Sep-02	10:54:28	148.6	1.3
Fall	Leonie	14753	27-Apr-02	27-Apr-02	19:21:59	Tue	17-Sep-02	10:27:20	142.6	0.4
Fall	Lolita	13362	15-Apr-02	15-Apr-02	07:04:23	Thu	23-May-02	20:49:12	38.6	116.9
Fall	Patch	13365	15-Apr-02	15-Apr-02	20:25:19	Tue	23-Apr-02	11:57:34	7.6	147.3
Fall	Ryder	14755	23-Apr-02	23-Apr-02	21:52:08	Fri	19-Jul-02	19:32:06	86.9	60.0
Fall	Stella	14751	27-Apr-02	27-Apr-02	18:08:13	Mon	16-Sep-02	04:23:54	141.4	1.6
Winter	BigBoy	26341	13-Aug-02	13-Aug-02	20:07:26	Sat	07-Sep-02	09:14:10	24.5	10.4
Winter	Chewy	24176	09-Aug-02	10-Aug-02	00:11:59	Wed	11-Sep-02	11:09:23	32.5	6.3
Winter	G031	23102	06-Aug-02	06-Aug-02	00:07:11	Tue	17-Sep-02	10:31:44	42.4	0.4
Winter	G033	13361	06-Aug-02	06-Aug-02	01:01:25	Tue	17-Sep-02	12:16:07	42.5	0.3
Winter	G034	22922	06-Aug-02	06-Aug-02	00:06:28	Tue	17-Sep-02	12:21:42	42.5	0.3
Winter	G035	23103	07-Aug-02	07-Aug-02	22:53:26	Thu	15-Aug-02	04:21:17	7.2	33.6
Winter	G036	13367	07-Aug-02	07-Aug-02	17:53:24	Sat	14-Sep-02	03:31:39	37.4	3.6
Winter	G039	23104	11-Aug-02	12-Aug-02	20:40:14	Sun	15-Sep-02	05:22:43	33.4	2.6
Winter	LeopG037	25966	07-Aug-02	08-Aug-02	03:52:48	Sat	14-Sep-02	03:29:12	37.0	3.6
Winter	Matt	13364	16-Aug-02	17-Aug-02	13:43:57	Tue	17-Sep-02	12:20:55	30.9	0.3
Winter	ScarBoy	24177	15-Aug-02	16-Aug-02	04:10:33	Sat	07-Sep-02	08:39:55	22.2	10.4

The diving behavior observed this year appears quite similar to that observed last year. The animals ranged widely, with many individuals moving away from the area they were originally tagged (Figure 24). One interesting exception to this pattern is the lone leopard seal, which remained in a tightly defined area within Crystal Sound. This behavior is consistent with a predator defending a home range or feeding area. Consistent with our data from last year, crabeater seals tend to spend more time in areas associated with abrupt changes in bathymetry (Figure 25). One crabeater seal followed the edge of the continental shelf, while others moved over the shelf (Figure 24). Further analysis of the diving pattern data will continue when we return to our lab. Figures 26 and 27 provide a graphical example of the kind of diving behavior data we have been able to obtain from these animals. Last year, crabeater seals made dives lasting on average only 7.5 minutes with a range between 12 seconds to 23.5 minutes, and an average depth of only 140 m, with a maximum depth of 545 m. This is rather shallow compared to other southern seals, but well within the range reported for seals in general.

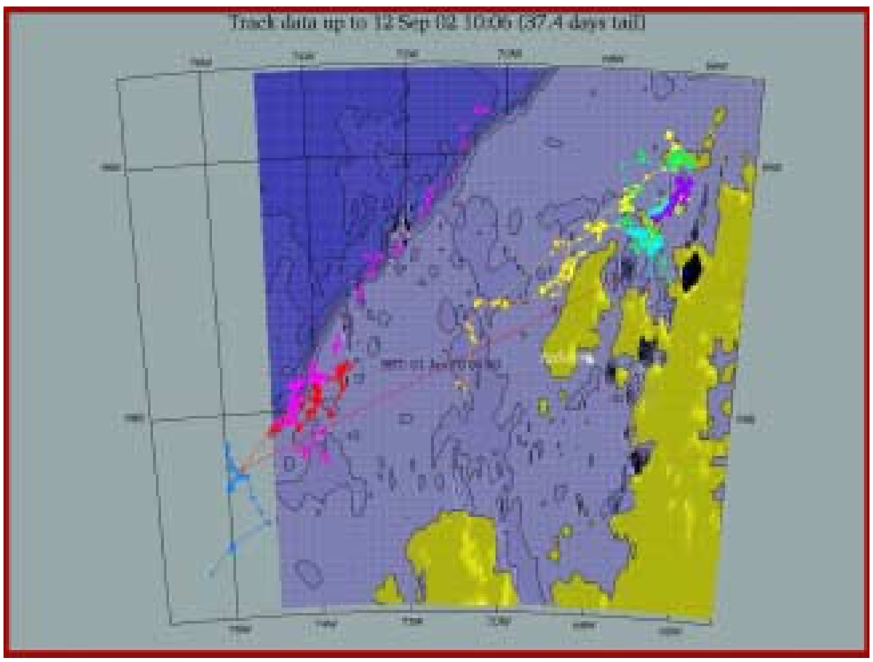


Figure 24. Each color represents a different individual crabeater seal. The blue track in the upper right hand corner (Crystal Sound) is the track of the leopard seal.

One aspect of our study was to measure the physiological capacity of crabeater seals with respect to their diving ability. The major determinant of diving ability is the animal's oxygen stores (its internal SCUBA tank). In seals the primary sites of oxygen storage are the blood and muscle. As this has never been measured in crabeater seals, we determined their blood volume and blood hemoglobin content, as well as collected muscle samples for analysis of myoglobin content. Blood volume was estimated using the Evans blue dye technique. In this method Evans' blue dye is injected intravenously and its dilution into the circulatory space quantified. The dye binds to plasma albumin and thus provides an estimate of plasma volume. Blood volume is then estimated from the animal's hematocrit, which is the ratio of red blood cells to whole blood. We were surprised to find that the blood volume of crabeater seals is only 12.8% of their body mass.

Data from both fall and winter cruises are presented in Figure 28. The blood volume measured for crabeater seals in this study is the lowest value reported for any Phocid seal (Figure 29). However, this low oxygen store appears to be all that is necessary given the large body size (large size alone confers an advantage in diving) and the relatively short shallow dives exhibited by crabeater seals (Figure 30).

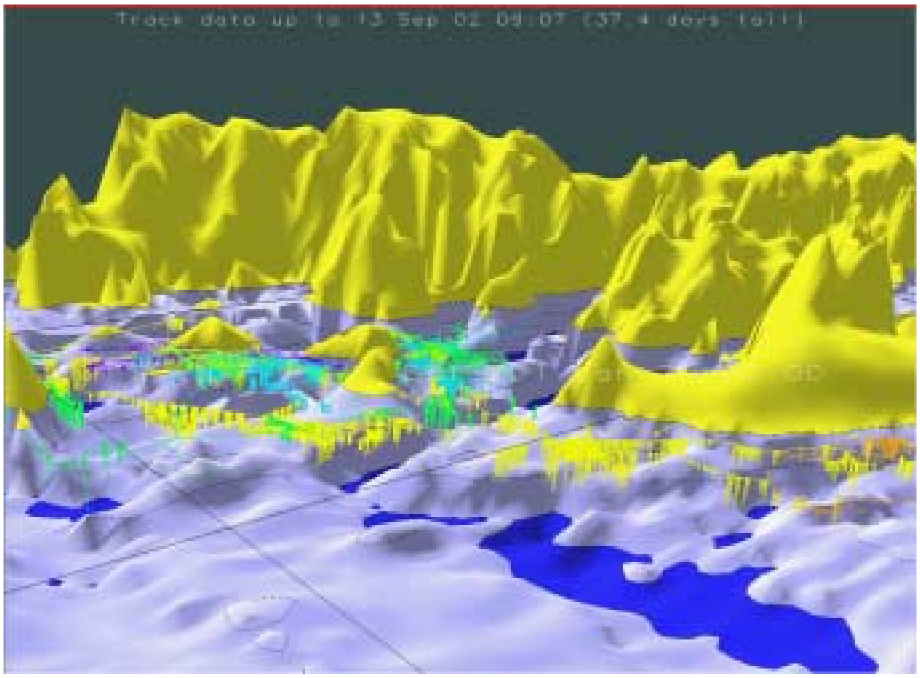


Figure 25. A pseudo 3D visualization of the movements and diving pattern of crabeater seals in the Crystal Sound area. The curtain effect is where the seals are diving, while the regions where there is just a line is where there is significant surface transit. Each seal has a unique color.

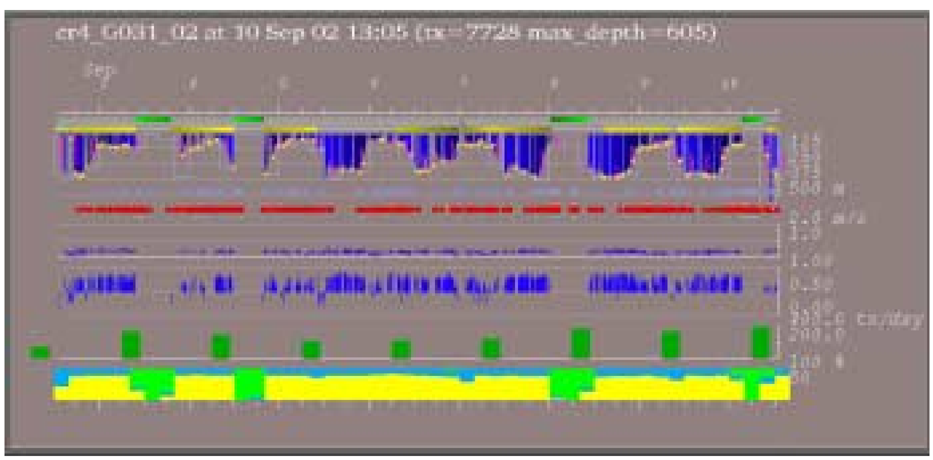


Figure 26. A graphical representation of seal #G31 diving pattern over a single day, 10 September. GMT time in hours is shown across the top. The top graph shows dive depth, the second graph shows the averaged swim speed in m s^{-1}, the bottom yellow, blue and green plot shows the relative amount of time spent hauled out (green), spent diving (yellow) and surface swimming (blue).

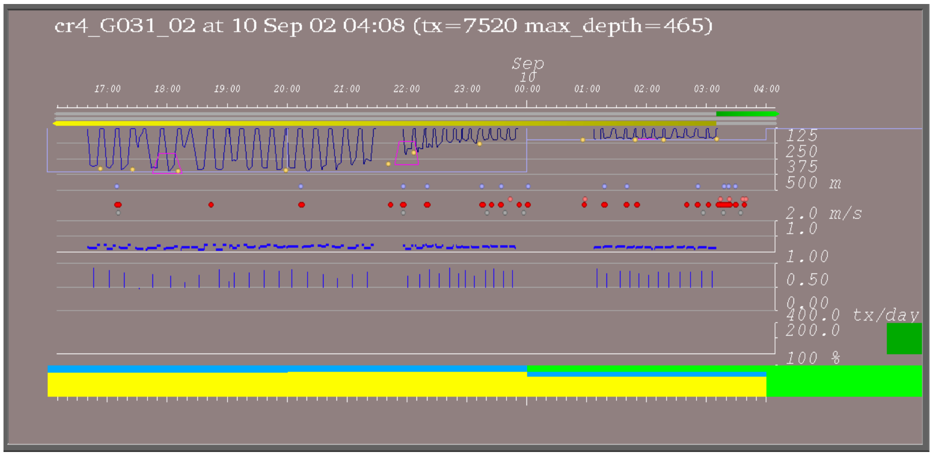


Figure 27. This is the same graphical representation of seal # G31 as in Figure 26. However, in this example, the resolution of the time frame is increased to allow examination of individual dives. The top graph shows dive depth, the second graph shows the averaged swim speed in m s^{-1}, the bottom yellow, blue and green plot shows the relative amount of time spent hauled out (green), spent diving (yellow) and surface swimming (blue).

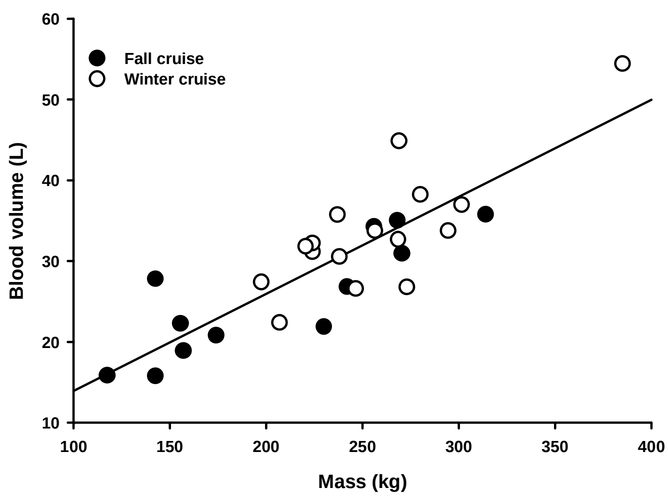


Figure 28. The blood volume in liters is compared to the animal's mass. Data are provided for both fall and winter SO GLOBEC cruises.

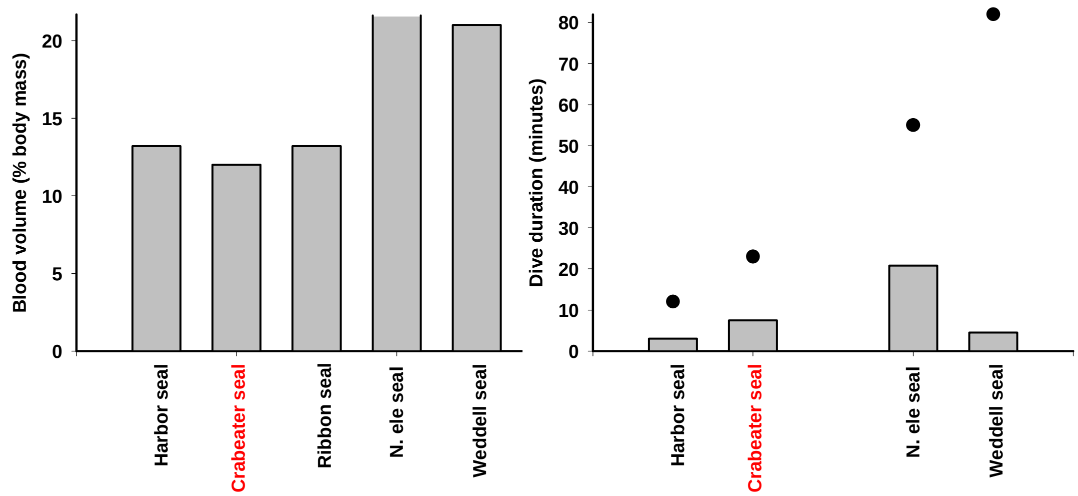


Figure 29. The blood volume and dive duration of crabeater seals measured in this study are compared to other "true" or phocid seals.

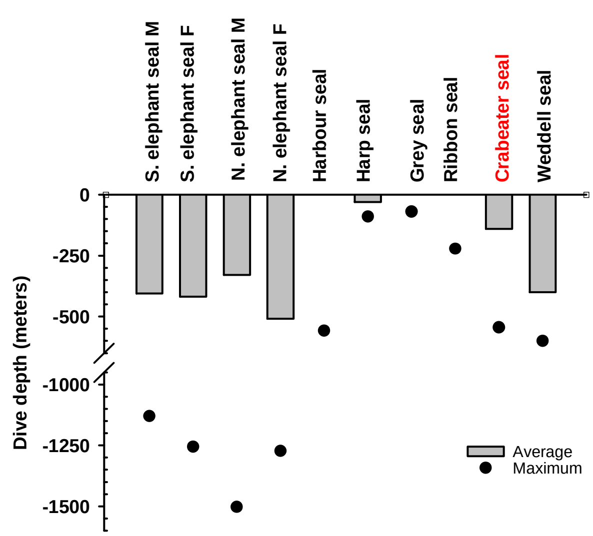


Figure 30. The diving depths observed for crabeater seals in our study are compared to the diving ability of other seals.

An essential component of this project is the safe and predictable handling of the seals. To this end, Dr. Julie Barnes, an experienced marine mammal veterinarian from Taronga Zoo, Sydney, Australia, carried out all anesthetic procedures using the portable gas anesthesia machine (Figure 31) developed and tested during last years cruise by Dr. Nick Gales of the Australian Antarctic Division, Hobart, Tasmania. Prior to netting, the seals were administered an intramuscular dose of midazolam. This was given via a pole syringe and, after a 20-30 minute period, provided a level of sedation that enabled safe physical restraint for anesthetic induction. The animal was then restrained with a capture net and a mask placed over its nose. The gas anesthetic isoflurane was then administered through a winterized gas anesthetic machine. Anesthetic induction and maintenance was achieved with a tight fitting facemask or via intubation. Each anesthetic was monitored closely and a hand-held CO_2 monitor/pulse oximeter was additionally used for this purpose. Anesthetic durations were kept as short as was practical, which is another important component of the safety of the procedure in such extreme environmental conditions. However, two animals were safely anesthetized for three hours using this technique to allow for complete equilibration of tritiated water. The result of the combination of midazolam sedation and isoflurane anesthesia was a safe, repeatable and predicable gas anesthetic protocol suitable for ice-seals. Induction and recovery times were short. All anesthetic equipment (>US$8,000 worth of specifically built or purchased instruments) was provided at no cost to this program by Dr. Gales. The results of this anesthetic procedure are currently in preparation for publication, which we believe is an important development (methodologically and ethically) in pack ice-seal anesthetic protocols.

Figure 31. The field portable gas anesthesia machine in use.

Blood samples were collected from each crabeater seal using standard field procedures. Samples were analyzed on the *L.M. Gould* for hemoglobin content (oxygen carrying capacity of the red blood cell) and a red blood cell count. Blood smears were made on the LMG for later differential blood count, and erythrocyte morphology. In addition, frozen plasma or serum samples are being returned for determination of standard plasma chemistries: sodium, potassium, chloride, calcium, phosphate, cholesterol, glucose, protein, blood urea nitrogen, albumin, creatinine, globulin, bilirubin, lactate dehydrogenase, alanine aminotransferase, aspartate aminotransferase, creatinine phosphokinase, gammaglobulin transferase, and alkaline phosphatase. We also measured the blood volume as previously described. These data, along with dive profiles, are essential in assessing the foraging ecology of the crabeater seal. Blubber and muscle biopsies were taken using standard aseptic techniques. The muscle samples will be used to assess the oxygen carrying capacity of muscle. The blubber sample will be analyzed for it's free fatty acid composition to provide an index of each seals diet. Diet analysis (trophic level) will also be supported with stable isotope analysis of whisker samples that were collected from each seal. Stomach content sampling was attempting in one animal, but the procedure was abandoned, as it was too difficult to complete safely. We were able to collect scat samples from two sites.

A series of morphometric measurements (Figure 32) were collected and used to assess the relative body composition and therefore condition of each seal. Measuring the blubber thickness, using a portable ultrasound scanner, at fifteen sites along the animal's body length, did this. These measurements will be coupled with girth and length measurements at each site to allow a reconstruction of the animal as a series of truncated cones to calculate body composition. The body composition of the seals sampled over the two years ranged from 28.3% to 42.1% blubber. There were no significant difference between the years ($t=1.83$, $DF=25$, $P>0.05$) or the sexes ($t=1.37$, $DF=25$, $P>0.05$) but there was a significant difference in the body composition of juveniles and adults. Of the nine animals sampled in April 2002, four of them where juveniles. These four animals had a significantly lower percentage of blubber (mean = 30.2%) than the adults (mean = 37.0%) ($t = 6.47$, $DF = 7$, $P = 0.0003$) (Figures 33 and 34).

Figure 32. A crabeater seal is being weighed using a tripod with an electronic scale. The seal is held in a stretcher sling. The LMG is in the background.

Overall, we are very excited about the results of our research carried out under the SO GLOBEC program. Until this study, there were no data on the winter foraging ecology of crabeater seals. Also, this is the first use of gas anesthesia on pack ice-seals and proved to be a safe and effective anesthetic method for the seals we processed. Furthermore, there was little if any data on the basic diving physiology of the crabeater seals. This is in marked contrast to the volumes that have been published on the diving behavior and physiology of the Weddell seal.

The difference in our understanding is due primarily to the difficulty of studying a pack ice seal. Weddell seals are readily accessible from shore-based stations, whereas crabeater seals must be studied within the pack ice from a ship. Participation in the SO GLOBEC program made this possible. We are indebted to many individuals who made this work possible. The Captain and crew of the *L.M. Gould* were excellent to work with and extremely helpful, the support provided by Raytheon Polar Services throughout this program was superb!

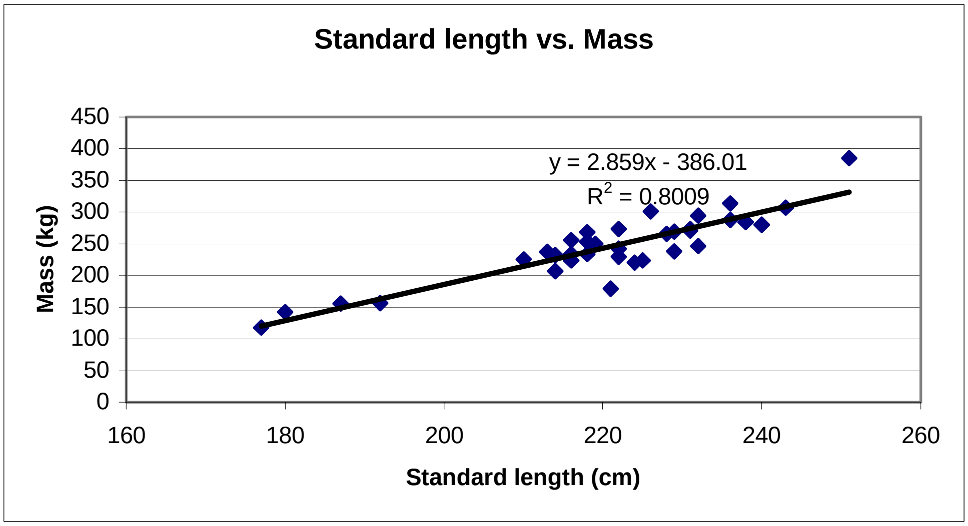


Figure 33. The standard length versus mass of all crabeater seals studied during the SO GLOBEC program.

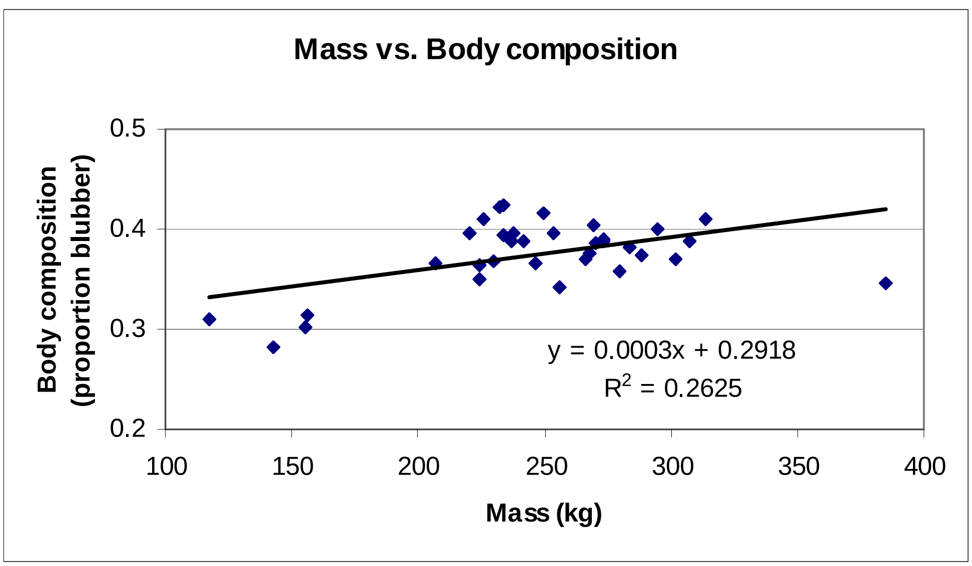


Figure 34. Data on body composition (proportion of body that is blubber) of the crabeater seals studied during all SO GLOBEC cruises is plotted relative to body mass

BG-234 Fraser

Field Team: H. Geisz and B. Pickering

Our research focused on identifying and understanding the processes that sustain the large wintering populations of Adélie penguins in the Marguerite Bay region. Our field program was thus developed with two key objectives in mind. The first was to instrument penguins with ARGOS-based satellite transmitters (PTTs) to determine their winter distribution and movements. The second was to use the PTT-derived data to identify key areas where penguins forage, and to investigate these areas to collect diet samples. This second objective met with limited success, as only five penguins of 21 captured and lavaged during the cruise had significant prey in their stomachs. The early diet samples that were collected consisted of very small masses, few krill and no fish. One sample had nothing other than a squid beak, which was a first for the SO GLOBEC cruise sampling. Given the samples collected during this early portion of the cruise (01-09 August), it may be that Adélies are not feeding on a daily basis in the middle of the winter. Later in September five birds that were sampled had been eating krill. Our limited success with diet samples did not show a clear continuation of sex biases foraging strategies found on last year's cruises.

The goals associated with our first objective were reached on 3 September when we completed the deployment of 17 PTTs. After our early success capturing birds in Crystal Sound and then west of Adelaide Island during our first transit to an ice station, we saw very few Adélies. Due to the fact that we saw no birds during the first two ice stations we accepted an invitation to move aboard the NBP to catch birds during the ship survey time. We were able to deploy our last five tags (Figure 35) and take five diet samples during our time on the NBP. Although all 17 of these instruments are designed to provide data on penguin locations, five of the instruments also provide information on dive depth and other foraging parameters. Sixteen of these instruments are operating flawlessly at this writing (Figure 36), and are providing more information about some previously unknown aspects of Adélie penguin winter foraging ecology. While last year these penguins were noted to track along vast shore leads near Marguerite Bay and along Adelaide Island, this year did not show this pattern. Adélie penguins, in response to the greater extent of sea ice this winter, seemed to move out to the ice edge or to areas of greater stability than shore leads. Movement of the birds were generally to the north and west, with many birds tracking to the ice edge west of Adelaide Island, while others either remained in the Crystal Sound area or moved to north west on the ice edge in a region between Renaud and Anvers Islands. A final and important point to make is that the deployed PTTs are programmed to continue delivering data for up to five months beyond the end of this cruise, a time period that will encompass much of the Adélie penguin breeding cycle. To the extent that instruments continue to function properly, the resulting data will provide a unique perspective on winter-summer foraging movements.

We like to extend thanks to the Raytheon staff and ECO crew of both the LMG and NBP for facilitating our successful cruise.

Figure 35. Digital photograph of a male Adélie penguin that has just been outfitted with PTT #36627 (Photograph by Baris Salihoglu).

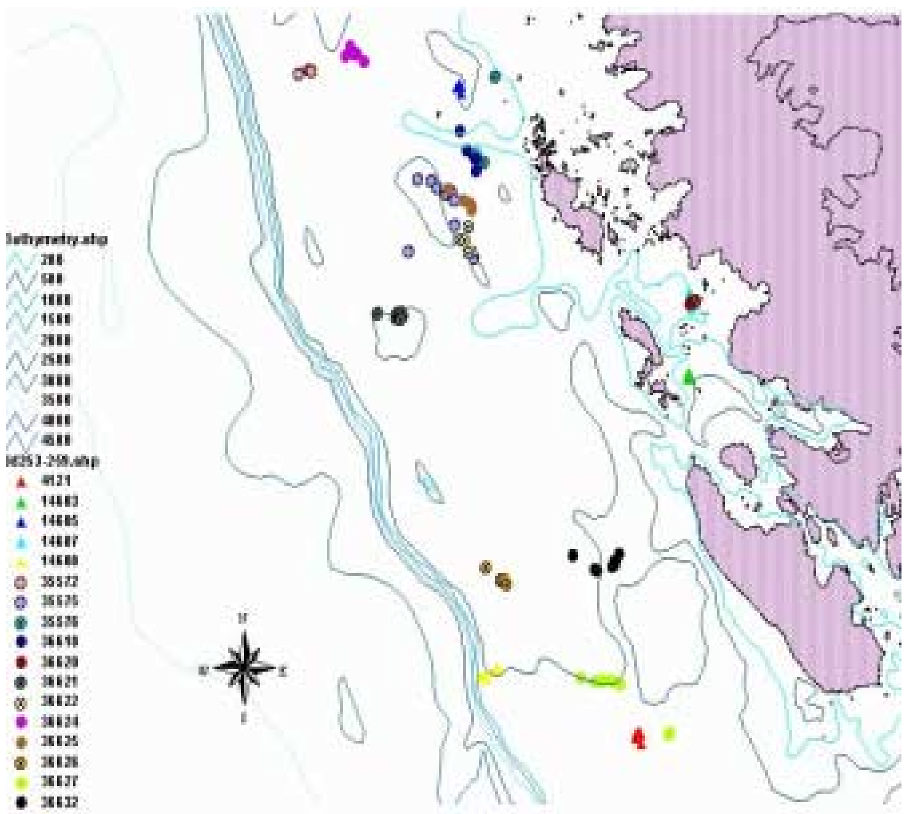


Figure 36. Unedited locations of PTT-instrumented Adélie penguins in the Marguerite Bay region between 10-16 September 2002. With exception of the birds in the Crystal Sound region, the penguins were located in areas where the ice was not as dense as near the shore of Adelaide Island.

BG-235 Fritsen

Field Team: Chris Fritsen, Paula Adkins, Megan Blees, Lindsay Cunningham, Pete Hartsough

Aspects of the BG-235 program were implemented on both the process and survey cruises during July and August of 2002 for determining small-scale and mesoscale distributions and characteristics of microbial biomass and carbon production in sea ice. The objectives of the BG-235 field program were accomplished using an integrated combination of satellite imagery acquisitions, underway observational protocols, small-scale ice, slush and snow sampling and experimental determinations of microalgal and bacterial physiological rate processes. Descriptions and results of several stages of the BG-235 ice ecology program that were accomplished during the LMG01-06 cruise are outlined below.

Ice observations

Routine observations of ice and snow characteristics were routinely collected on an hourly basis while the LMG was actively steaming throughout the cruise. These observations began on 1 August 2002 and continued through 12 September 2002. The observational protocol followed during the cruise was the protocol that is formally endorsed by the SCAR ASPeCt (Antarctic Sea Ice Processes and Climate) program for observing sea ice characteristics. In short, our program (combined with the efforts of OG-241) was able to gather 234 separate observations that will be used to characterize the predominate types of ice in the region according to parameters such as areal coverage, floe size, ice thickness, snow type, snow thickness and deformation. These observations are being analyzed in conjunction with those observations collected by BG-235 personnel (with help from Bob and Sue Beardsley and Francisco Viddi) on the NBP survey cruise to yield regional ice maps.

The summary data from the observations from the LMG are given in Table 3. Note that the LMG spent most of its time at ice stations and these observations were taken during transit between the ice stations and during transit to and from Palmer Station at the beginning and end of the cruise. Hence, these observations are spatially biased towards those areas that the LMG accessed while moving between ice stations. It should be noted that much of this time was spent traveling in conjunction with the NBP and some of this data is repetitive of the sea ice observation data from the NBP and will provide inter-ship comparisons upon further analysis.

Despite these known biases, the preliminary summary statistics show that the ship occupied the ice pack which was roughly 40 cm to 45 cm thick with an average snow cover of 16 cm. However, this statistic represents the level-ice category and is not weighted for the deformed/ridged ice which was estimated at an average of ca. 97.5 cm thick. In contrast to last year's observations from the LMG, the ridged ice was 54 cm thick and the level ice was an average of 38 cm with an average of 15 cm of snow cover. Thus, the preliminary numbers seem to indicate that the earlier onset of ice cover formation during the 2002 appears to have resulted in thicker ice with slightly thicker snow cover. This may seem intuitive, however, ice growth equilibrium may have been reached in both years and the potential biases associated with visiting different areas in the survey grid may have introduced these differences. Further evaluation of the ice observations from the NBP, the meteorological data from the Automatic Weather Stations and Rothera Meteorological Station, as well as the upper water column salinity budget needs to be completed before more definitive conclusions can be drawn regarding the different year's regional ice production.

Table 3. Summary statistics for observations taken during the LMG02-05 cruise.

Total ice concentration (%)	83.08
Open water within pack (%)	16.92
Av level ice thickness (total area) cm:	37.09
Av level ice thickness (ice area) cm:	44.65
Fraction of surface area ridged:	0.13
Av ridged ice thickness (total area) cm:	81.00
Av ridged ice thickness (ice area) cm:	97.50
Av snow thickness (total area) cm:	11.09
Av snow thickness (ice area) cm:	13.35
Av snow thickness (snow covered area) cm:	16.40
Snow covered ice within pack (% total area):	67.65
Snow free ice within pack (% total area):	15.43
Percent ice with snow cover:	81.43
Percent ice with no snow:	18.57
Av albedo (total area):	0.58

Ice Stations

Ice floes were accessed from the LMG throughout the cruise for snow and ice studies that entailed ice and snow thickness transects, snow collections, ice core collections and brine collections. In addition CTD deployments and measures of bacterial and algal production were undertaken while on these long term ice stations. Thickness transects and snow pits were accomplished in conjunction with OG-241.

Ice Cores

The variations in the vertical and horizontal distributions of ice properties and sea ice microbial communities (SIMCO) at scales of centimeters to ~100 m were assessed by sampling ice cores at opportunistic sites as well as the ice stations. Often these cores were collected in a nested sampling regime at horizontal scales of 50 cm up to 100 m at each of the extended process station.

Cores for the determination of the vertical distributions SIMCO biomass were sectioned at 5 cm to 20 cm intervals, melted (using filtered brine or seawater as an osmotic buffer) and routinely subsampled for evaluating the chlorophyll *a* and bacterial abundance. A subset of these sections was sampled for the determination of particulate organic carbon and nitrogen.

Altogether, 146 cores were obtained which were processed for determination of microalgal biomass (as chlorophyll a) and microbial composition studies as well as stable isotope analysis (Table 4). Coring and processing was accomplished in a coordinated manner with BG-244 and OG-241 in order to ensure that ice physical structure and chemistry information can later be linked to biotic composition and microbial consortia structure.

Table 4. Summary statistics of chlorophyll *a* (chla) concentrations and, ice core lengths (H) for cores that were collected and processed for determinations of chlorophyll *a* and during LMG02-05.

Statistic	H (cm)	Chl*a* Concentration (mg m^{-3})
Mean	116.2	13.96
Standard Error	6.8	1.91
Median	83	5.05
Standard Deviation	82.2	42.76
Minimum	10	0.06
Maximum	400	614.84
N	146	502

CTD operations

In addition to the ice station work, BG-235 worked in conjunction with RPSC personnel to obtain depth profiles of conductivity, temperature, nutrients and chlorophyll *a* biomass through CTD and Rosette deployments (outlined in Table 5). These operations were conducted to aid in the description of the upper water column parameters and dynamics as they affect the ice-ocean interactions that, in turn, help determine the ice mass balance, the ice biota dynamics and the coupling of larval krill to ice and ice biota. Nutrient data is being compiled by RPSC subcontractor for nutrient chemistry while the CTD information was compiled and distributed by RPSC personnel through the cruise CD-ROM. Table 5 simply lists those CTD deployment dates, locations bottom depths and depth to which the CTD was deployed.

Chlorophyll a concentrations in the upper 100 m of water column (samples obtained from seven Rosette deployments) averaged 0.04 μg l^{-1} during the LMG-02-05 cruise. Typical profiles showed chla decreasing with depth (as illustrated by Figure 37) from peaks of 0.03 to 0.06 μg l^{-1} in the upper layers to less than 0.01 μg l^{-1} at depths greater than 100 m.

Table 5. CTD deployments during LMG02-05.

Cast	Event #	Year Day	Latitude (ºS)	Longitude (ºW)	Bottom Depth (m)	Cast Depth (m)
000	82	216	65 06.24	65 08.06	168	100
001	87	217	66 20.13	66 41.06	425	421
002	92	218	66 25.60	66 54.21	646	622
003	108	224	68 39.33	76 10.26	430	300
004	109	224	68 05.76	76 10.26	442	300
005	113	225	68 33.57	75 58.41	420	300
006	114	225	68 30.00	75 51.76	424	300
007	120	227	68 05.76	75 03.64	697	300
008	144	232	67 15.12	72 30.55	413	385
009	146	233	67 11.60	72 39.20	431	300
010	147	233	67 06.53	72 40.17	410	300
011	153	235	66 46.75	72 22.20	2188	300
012	154	235	66 43.91	72 14.95	2455	300
013	161	236	66 41.26	72 04.63	2251	300
014	162	236	66 38.46	71 59.68	2425	85
015	164	236	66 38.39	71 59.45	2411	300
016	169	237	66 38.85	71 51.57	1162	300
017	171	237	66 32.85	71 36.50	500	300
018	171	237	67 32.85	72 36.50	500	60
019	176	238	66 27.68	71 18.73	520	400
020	184	238	66 23.84	71 05.81	550	340
021	185	239	66 23.08	70 56.47	550	300
022	188	239	66 23.73	70 40.03	590	185
023	193	239	66 22.94	70 34.99	530	365
024	195	240	66 22.01	70 29.31	598	400
025	198	240	66 18.24	70 21.04	505	400
026	200	240	66 13.73	70 18.34	436	416
027	201	244	66 10.71	69 05.62	353	332
028	204	244	66 13.01	68.51.84	385	355
029	209	245	65 55.92	68 41.77	320	300
030	210	246	66 51.85	68 39.01	328	300
031	215	246	65 51.70	68 40.37	328	300
032	216	247	65 47.07	68 44.56	338	300
033	221	247	65 43.99	68 41.87	354	328
034	222	248	65 42.28	68 39.59	374	340
035	226	248	65 41.30	68 39.54	381	300
036	228	249	65 41.94	68 41.06	371	300
037	232	249	65 40.02	68 40.91	381	300
038	232	250	65 38.36	68 37.34	410	300
039	240	250	65 35.63	68 33.97	461	300
040	241	251	65 32.34	68 32.18	443	300
041	245	252	65 32.19	68 24.92	483	300
042	246	252	65 35.26	68 29.35	498	300
043	251	252	65 39.07	68 30.22	499	470

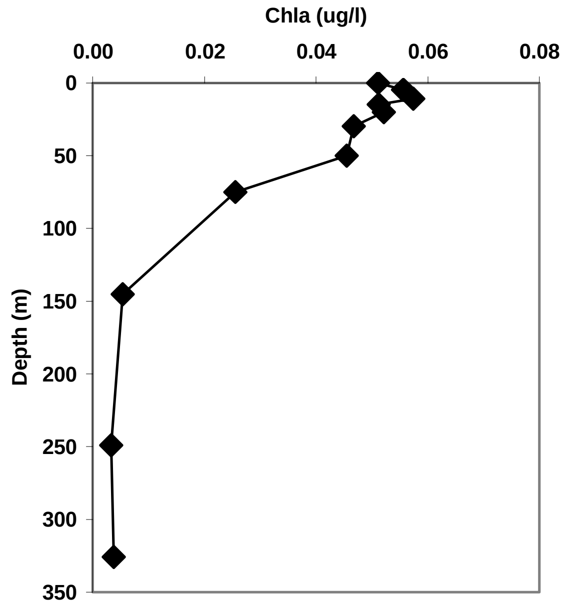


Figure 37. Chlorophyll *a* depth profile determined from CTD Cast 33 (3 September 2002, 65º 43.99′S; 68º 41.87′W).

Chlorophyll *a* concentrations being over 100-fold more concentrated in the sea ice relative to the water column contrasts to last year when the biomass was much lower in the sea ice when compared to this season (average last year was only 1.04 µg l^{-1}). The early formation of the ice along with the increased microalgal biomass in the ice supports one of the overarching hypothesis of the SO GLOBEC program—specifically, that an early forming ice cover provides increased resources for overwintering furcilia juvenile krill coupling to the sea ice. It is interesting to note, however, that increased sea ice algal biomass in the ice (relative to last season) was not accompanied by a general coupling of furcilia and juvenile krill to the ice. Rather, this season was best characterized by a lack of krill (see BG-244's report and reports from the ROV operations in the NBP) and an abundance of ice algae at the stations occupied which is in direct contrast to last year. Further analysis of carbon production and biomass accumulation in the ice when coupled with growth rate indicators for the juvenile krill and documentation of these relationships will be central to testing the SO GLOBEC hypothesis regarding the ecological "values" of early and late-forming ice covers in Marguerite Bay region.

BG-244-O Quetin and Ross

Field Team: Charles Boch, Shonna Dovel, Eric Hessell, Karina Johnston, Stephanie Oakes, Langdon Quetin, Allan Willis

Our general aim was to investigate the physiology and ecology of krill larvae associated with the pack ice and the microbial community on which they feed. Below is a brief accounting of our activities during the cruise.

Logistically this cruise was quite successful, and we were able to follow the draft cruise plan with few alterations. We occupied three time-series stations of approximately 1 week each, and in addition opportunistically sampled at times when other activities had priority. Our primary goal during the cruise was to occupy three ice camps or process stations with the intent of thoroughly studying the under-ice environment by SCUBA in conjunction with other projects working topside. Using SCUBA techniques allowed us to collect larval krill as close as possible to their *in situ* condition. Larval krill were collected for time-based experimentation at the dive hole, for shipboard experiments and preserved for later analysis. In addition samples of the micro-zooplankton community were sampled with suction samplers to gain a better understanding of food available to the larvae relative to their distribution under the ice. In addition, at one of the process stations we were able to deploy drift nets through the dive holes to compare day/night differences in the zooplankton community at depths of 1 m and 10 m below the ice-water interface.

We dove using several methods of entry depending on the ice conditions. Our preferred method was to dive through a hole in an ice floe that was partially covered with a Scott tent (Figure 38). This allowed us to dive in ambient temperatures as low as -35°C (-55°C with wind chill) and conduct experiments in the relative warmth of the Scott tent.

Other diving methods used during the cruise were to dive from a Zodiac tethered to the stern of the ship and also from a Zodiac anchored to an ice floe (Figures 39 and 40). Under-ice operations (Figure 41) included the use of video and still cameras, setting transect lines, collecting krill with aquarium nets, sampling under-ice surfaces with suction samplers (Figure 40) and marking areas with stakes or lag screws. We did some preliminary work with Chris Fritsen inserting ice ablation stakes in floes from the under side and measuring the height over periods of days. We also took some suction samples at the base of some of the ice cores taken by Fritsen's group. We completed a total of 48 dives during the cruise distributed as follows:

- 2 at Palmer Station
- 2 inshore of Lavoisier Island
- 1 west of Adelaide Island during transit
- 9 at Process Station 1 (Ice Station Sparky)
- 3 at Ice Station Minke (short station)
- 13 at Process Station 2 (Ice Station Rodin)
- 18 at Process Station 3 (Ice Station Piscoe)

We observed krill larvae feeding on the ice inshore of Lavoisier Island and at Process Station 3, our northern-most long station and on the shelf seaward of the Biscoe Islands. At the two other Process Stations we did not observe krill larvae feeding directly on the ice. At the southern-most station, Process Station 1, we collected krill larvae from an aggregation we encountered on one dive. Otherwise no larvae were seen at that station. At Process Station 2, no larvae were seen when diving, but we were able to collect larvae using 1-m nets fished through ice holes and using the drift of the floe to move the nets through the water. We suggested this method of fishing to investigators aboard the RVIB *Nathaniel Palmer* who were also having difficulty finding krill larvae, and they, also, had success. This supports a past observation that the ship's hull creates a void of larvae at the stern if the larvae are in the surface waters associated with pack ice. The curious observation is the whereabouts of the larvae when we do not observe them while diving during the day. Hopefully further analysis of the SO GLOBEC data sets will clarify this observation. Floes at Process Station 3 were relatively small and loose and we found it necessary and more efficient to dive from a Zodiac tethered to a floe. Because of the loose nature of the ice pack, Process Station 3 is scattered over several floes but in a radius of approximately 2 miles. This is the only process station where we observed krill larvae feeding directly on the underside of the ice. Highest densities of larvae were found feeding on the edges and bottoms of floes as opposed to the upward facing surfaces as we have observed on past winter cruises (Figures 42-44).

Figure 38. Dive tent with divers and tenders at the end of a dive. The ice hole to the right of the tent is a secondary dive hole and used for drift net deployments when not diving.

Figure 39. Dive tenders keeping watch for divers and ice conditions from the Zodiac tethered to the stern of the *Laurence M. Gould.*

Figure 40. Divers from a Zodiac anchored to an ice floe. The diver is handing the tender on of the suction samplers used to vacuum the microbial community from the underside of the ice.

Figure 41. Crabeater seal checking on a diver.

Figure 42. Side of a floe at Process Station 3 (Ice Station Pisco).

We observed krill larvae feeding on the ice inshore of Lavoisier Island and at Process Station 3, our northern-most long station and on the shelf seaward of the Biscoe Islands. At the two other Process Stations we did not observe krill larvae feeding directly on the ice. At the southern-most station, Process Station 1, we collected krill larvae from an aggregation we encountered on one dive. Otherwise no larvae were seen at that station.

Due to the lack of krill directly associated with the ice at the two southern-most process stations we emphasized sampling the ice-associated microbial community with the suction samplers at those stations. We continued this effort at the northern-most station. Unfortunately, due to the loose nature of the pack ice at the northern station, we were unable do some of the ecological observations along fixed transects and of marked krill aggregations as would have been possible on the larger floes further south, if there had been larvae.

Figure 43. Krill larvae feeding on the upward surface of an ice floe.

Figure 44. Krill larvae feeding on the edge of an ice floe.

During the cruise we collected approximately 50 samples of the microbial sea ice surface community at each of the Process Stations. Some of these collections were random and some purposely collected where krill larvae were feeding. These samples will be analyzed for chlorophyll *a* and particulate inorganic carbon and nitrogen, and for community composition using HPLC and microscopy. Shonna Dovel in our group generated more than 800 slides from ice cores and suction samples for analysis of the microbial community! Despite the lack of larval krill directly associated with the ice during much of the cruise, we collected enough krill for 12 Instantaneous Growth Rate (IGR) experiments, 15 collections for whole body fluorescence, 11 collections for fecal pellet production, and 9 collections for condition factor. Measurements of length and stage frequency of the dive and net krill collections were done routinely. Six combinations of day/night drift net tows were completed at 1 m and 10 m below the ice.

The success of this cruise was due to the efforts by collective group on board. There was much cross project help when needed, and we would like to particularly thank those that helped us lug suction samplers when it was too cold to take them all to the ice hole at once without freezing. Without the help of the "bird" and "seal" people we would not have been as successful. There is no possible way to individually thank everyone who accounted for our success. The Captain and ship's crew were magnificent, the group from Raytheon Polar Services worked long hours and in the spirit of cooperation and innovation. All are responsible for making this cruise both a delight and success.

OG-241-O D. Martinson, R. Smith, D. Perovich

Field Team: Bruce Elder and Kerry Claffey

Over the course of the LMG02-05 cruise we measured the physical properties of the sea ice found in the Marguerite Bay region. To accomplish our study, we set up 12 ice stations working off the *Laurence M. Gould*. These ice stations lasted from a couple of hours to a week in length. Our main focus was on three study areas. At two of these areas we were able to hold station for a week, each, at the same group of ice floes which enabled us to re-measure the same ice over the course of the station. In the last area of study, the ice was not consolidated and a swell was traveling through the ice pack making it difficult for the ship to remain alongside a particular ice floe for more than a couple days. In this mode of operation we would measure the floes immediately adjacent to the ship for a day or two, then move to another floe less than a 0.5 km away. This enabled us to study five different ice floes in the same area over eight days.

We sampled the ice and snow cover and measured its physical properties. Much of the optical properties of sea ice can be modeled once you know something about the physical properties that you are dealing with. From the ice cores we sampled, in conjunction with BG-235, we measured profiles through the ice sheet of temperature, salinity (Figure 45), and $\delta^{18}O$. Cores were also thick sectioned and thin sectioned (Figure 45) in the freezer van in the hold of the ship. From the thick sections we are able to see air bubbles and brine pockets in the ice core. From the thin sections we can determine crystal structure and grain size throughout the ice core. This data will let us determine the history of the ice sheet, whether the ice grew thermodynamically, along the bottom of the ice sheet, or if it grew from flood-freeze cycles on the upper ice surface. Figure 45 is from an ice core collected on the SO GLOBEC cruse in the winter of 2001. We will be making similar plots from all of this year's ice core data once we return home.

At the ice stations we also measured ice thickness transects 20 m to 100 m in length. These transects were often located in an area under which the divers (BG-244) would be working. Along these transect lines we measured snow depth, slush depth (if present), depth of the wicked layer (the layer of snow above the slush layer which has absorbed moisture), ice thickness, freeboard (the distance from sea level to the ice surface), and ice surface temperature. Figure 46 shows the variability in ice thickness and snow depth. The ice surface temperature shows that where the snow is the thinnest, the ice surface is the coldest. The snow insulates the ice from the air temperature.

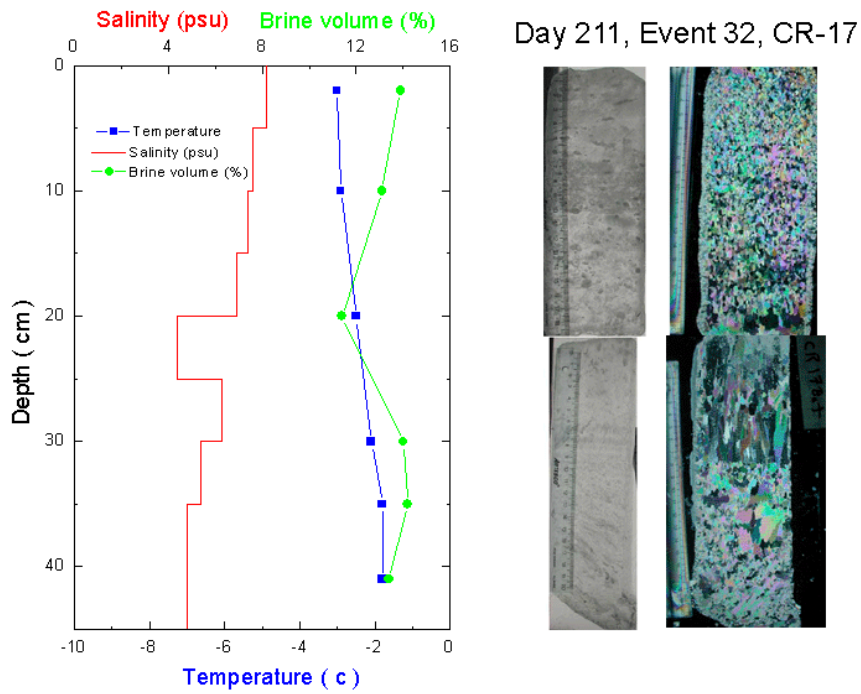


Figure 45. Example temperature and salinity profiles through the ice sheet (left) and ice core sections (right) measured during the 2001 SO GLOBEC winter cruise.

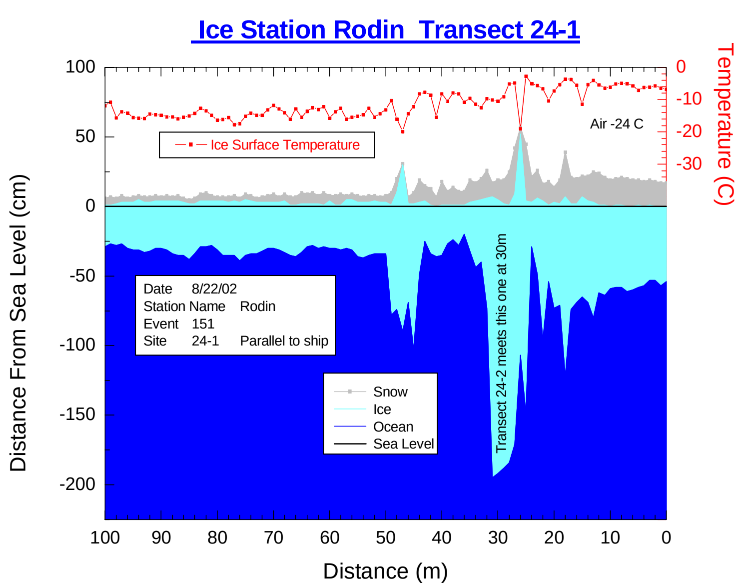
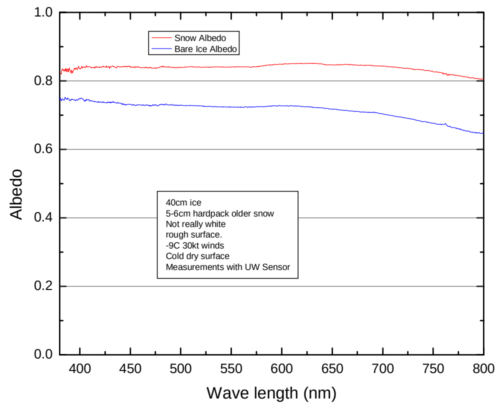


Figure 46. Variability in ice thickness and snow depth measured at Ice Station Rodin.

To further extend our knowledge about the ice in this region, we also deployed three drifting ice stations (Figure 47), one at each of the long-term floes. These stations use Service ARGOS Inc. satellites to transmit the data back to the home institution. Each buoy measures hourly GPS positions that show how the ice has drifted. The buoys also measure barometric pressure, air temperature, snow depth, ice bottom growth/ablation, and ice buoyancy (with a pressure sensor mounted below the ice sheet). Also installed on two of the buoys are a string of 44 thermistors, mounted at 5 cm spacing, extending from 1 m above the snow surface to 0.5 m below the ice bottom. From these measurements we extend out the ice properties of this one location to surrounding floes that we have measured while on station.

Figure 47. Ice station deployed during the SO GLOBEC 2002 winter process study. The *L.M. Gould* is also shown.

We also measured the optics of the sea ice using a scanning spectral radiometer. This instrument measures the light levels in 0.5 nanometer increments from 380 to 800 nanometers (visible light through the near infrared). With this instrument we made optical measurements on seven different ice floes. We performed these measurements through the undisturbed snow and ice, and would then shovel off the area to obtain measurements of just the sea ice with no snow cover. We first measured snow and bare ice albedo, then upwelling irradiance at 1 cm increments as we lowered the sensor down through the snow cover. We then would drill a hole in the ice and measure upwelling irradiance at 2 cm to 5 cm increment down through the ice sheet both before and after removing the snow cover. Additionally, the transmission of light through both snow covered sea ice and bare ice was measured. The upper plot in Figure 48 shows that approximately 85% of the light incident to the snow surface gets reflected back to the atmosphere while only 70% to 75% gets reflected over bare sea ice. The transmitted data shown in the lower plot in Figure 48 shows that for this ice site, only 5% of the incident visible light makes through both the snow and ice sheet while 12% makes it through if you remove the snow cover.



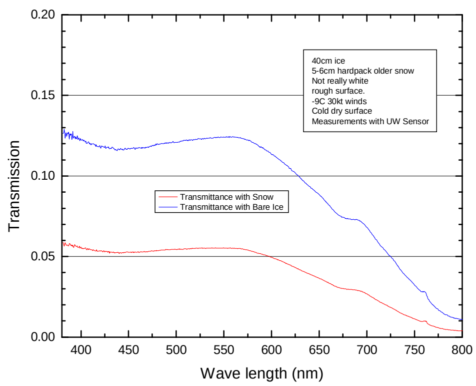


Figure 48. Reflection (upper) and transmission (lower) of incident radiation observed during the SO GLOBEC 2002 winter process cruise.

While the ship was underway in ice-covered seas we, along with BG-235 and BG-244, made hourly ice observations using the ASPeCt protocol. For most of the cruise we also made measurements with a 95 GHz passive microwave sensor (Figure 49) and videotaped the ice beneath the sensor. This work was done for NASA to assist in ground truthing satellite data.

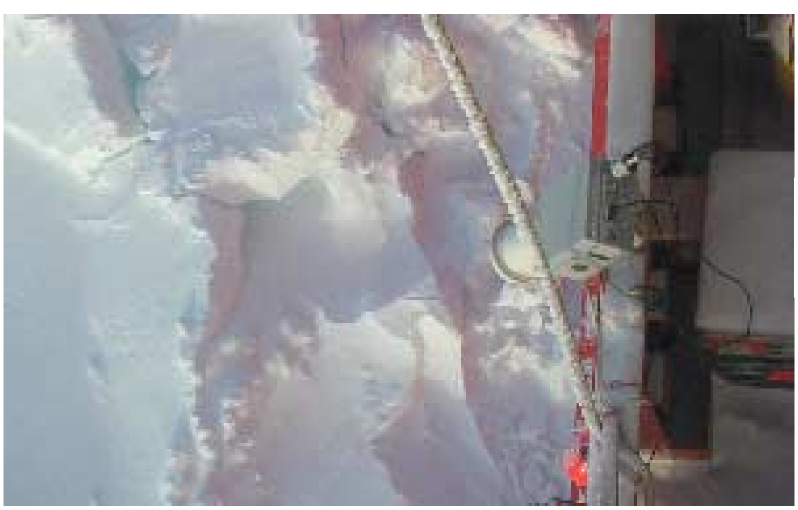


Figure 49. The 95 GHz passive microwave sensor.

In summary, we found that the ice conditions were much different in the Marguerite Bay area from the 2001 season. The ice extent was much greater, the ice thickness greater but the floe size was smaller. This smaller floe size also coincides with more broken up ice floes, which are thicker than the surrounding floes and thus more difficult to maneuver in. The presence of brown/green ice indicated that there is more biology in the ice than last year. This is also seen in our optics measurements.

CRUISE PARTICIPANTS

Science Party (Name, Institution)

BG-232-0 Foraging Ecology of Crabeater Seals	
Costa, Daniel	University of California Santa Cruz
Barnes, Julie	Taronga Zoo, Sydney, Australia
Shaffer, Scott	University of California Santa Cruz
Kuhn, Carey	University of California Santa Cruz
McDonald, Birgette	California State University at Sonoma
BG-234-0 Winter Foraging Ecology of Adélie Penguins	
Pickering, Brett	Polar Oceans Research Group
Geisz, Heidi	Polar Oceans Research Group
BG-235-0 Sea Ice Microbial Communities	
Fritsen, Chris	Desert Research Institute
Adkins, Paula	Desert Research Institute
Cunningham, Lindsay	Desert Research Institute
Blees, Megan	Desert Research Institute
Hartsough, Pete	Desert Research Institute
OG-241-0 Optical Environment of the Western Antarctic Peninsula Region	
Elder, Bruce	Cold Regions Research Engineering Laboratory
Claffey, Kerry	Cold Regions Research Engineering Laboratory
BG-244-0 Winter Ecology of Larval Krill: quantifying their interaction with the pack ice habitat	
Quetin, Langdon	University of California Santa Barbara
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Oakes, Stephanie	University of California Santa Barbara
Willis, Alan	University of California Santa Barbara
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Newyear, Karl	Marine Project Coordinator
Weisblatt, Daniel “Sparky”	Marine Technician
White, Jenny	Marine Technician
Hodgins, Mo	Marine Sciences Technician
Nunn, Andy	Electronics Technician
LaRiviere, Romeo	Electronics Technician

Officers and Crew (Name, Position)

Verret, Robert II	Master
Gann, Jesse	Chief Mate
Bouzigard, Morris. J.	2nd Mate
Arrigoni, Alan	3rd Mate
Waters, Paul	Chief Engineer
Lesser, Russel	1st Engineer
Hanna, George	2nd Engineer
Tamayo, N	Oiler
Dasoy, Donde	Oiler
Lucas, Rodolfo	Steward
Albornoz, Luciano	2nd Steward
Naraga, Fernando	Seaman
Johnston, Eduardo	Seaman
Cardeneas, Juan	Seaman
Cardeneas, Maurico	Gallyhand

Appendix 1. Event Log from the cruise LMG02-05. Local refers to the position given by the latitude and longitude in Month (M) and Day (D) and UCT is Universal Coordinate Time (UCT).

Full Event	Event		Cast	Local				UCT			Latitude		Longitude		Depth	
No.	No.	Instrument	No.	M	D	Time	Event	M	D	Time	(S)		(W)		(m)	Comments
LMG21002.001	1	LMG		7	29	18:20	S	7	29	22:20	053	53.0	066	66.0		Costa
LMG21102.001	2	XBT	1	7	30	22:30	S/E	7	31	02:30	054	48.0			92	Sprintall OO-260
LMG21102.002	3	XBT	2	7	30	23:17	S/E	7	31	03:17	054	56.1	064	57.4	180	Sprintall OO-260
LMG21102.003	4	XBT	3	7	30	23:46	S/E	7	31	03:46	055	1.1	064	57.9	470	Sprintall OO-260
LMG21202.001	5	XBT	4	7	31	00:17	S/E	7	31	04:17	055	6.7	064	56.1	1570	Sprintall OO-260
LMG21202.002	6	XBT	5	7	31	00:52	S/E	7	31	04:52	055	12.6	064	54.0	1966	Sprintall OO-260
LMG21202.003	7	XBT	6	7	31	01:26	S/E	7	31	05:26	055	18.4	064	52.0	2550	Sprintall OO-260
LMG21202.004	8	XBT	7	7	31	02:05	S/E	7	31	06:05	055	24.0	064	50.5	2485	Sprintall OO-260
LMG21202.005	9	XBT	8	7	31	02:37	S/E	7	31	06:37	055	30.2	064	48.6	3016	Sprintall OO-260
LMG21202.006	10	XBT	9	7	31	03:14	S/E	7	31	07:14	055	36.3	064	47.2	3500	Sprintall OO-260
LMG21202.007	11	XBT	10	7	31	03:51	S/E	7	31	07:51	055	42.6	064	44.9	3565	Sprintall OO-260
LMG21202.008	12	XBT	11	7	31	04:29	S/E	7	31	08:29	055	48.7	064	42.5	3808	Sprintall OO-260
LMG21202.009	13	XBT	12	7	31	05:04	S/E	7	31	09:04	055	54.9	064	40.5	3756	Sprintall OO-260
LMG21202.010	14	XBT	13	7	31	05:38	S/E	7	31	09:38	056	0.4	064	39.1	3133	Sprintall OO-260
LMG21202.011	15	XCTD	14	7	31	05:47	S/E	7	31	09:47	056	1.5	064	38.9	3133	Sprintall OO-260
LMG21202.012	16	XBT	15	7	31	06:13	S/E	7	31	10:13	056	6.6	064	37.6	3065	Sprintall OO-260
LMG21202.013	17	XBT	16	7	31	06:48	S/E	7	31	10:48	056	12.7	064	35.7	3448	Sprintall OO-260
LMG21202.014	18	XBT	17	7	31	07:22	S/E	7	31	11:22	056	18.4	064	34.0	3375	Sprintall OO-260
LMG21202.015	19	XBT	18	7	31	07:54	S/E	7	31	11:54	056	24.3	064	32.2	3217	Sprintall OO-260
LMG21202.016	20	XBT	19	7	31	08:26	S/E	7	31	12:26	056	30.1	064	30.1	2475	Sprintall OO-260
LMG21202.017	21	XBT	20	7	31	09:05	S/E	7	31	13:05	056	37.3	064	27.8	3214	Sprintall OO-260
LMG21202.018	22	XBT	21	7	31	09:33	S/E	7	31	13:33	056	42.4	064	26.2	4130	Sprintall OO-260
LMG21202.019	23	XBT	22	7	31	10:07	S/E	7	31	14:07	056	48.4	064	24.4	3921	Sprintall OO-260
LMG21202.020	24	XBT	23	7	31	10:42	S/E	7	31	14:42	056	54.3	064	22.4	3918	Sprintall OO-260
LMG21202.021	25	XBT	24	7	31	11:16	S/E	7	31	15:16	057	0.4	064	20.7	4027	Sprintall OO-260

LMG21202.022	26	XCTD	25	7	31	11:37	S/E	7	31	15:37	057	3.5	064	19.5	3987	Sprintall OO-260
LMG21202.023	27	XBT	26	7	31	11:52	S/E	7	31	15:52	057	6.4	064	18.6	3927	Sprintall OO-260
LMG21202.024	28	XBT	27	7	31	12:27	S/E	7	31	16:27	057	12.5	064	16.8	3813	Sprintall OO-260
LMG21202.025	29	XBT	28	7	31	13:00	S/E	7	31	17:00	057	18.4	064	15.0	4072	Sprintall OO-260
LMG21202.026	30	XBT	29	7	31	13:35	S/E	7	31	17:35	057	24.6	064	12.7	4148	Sprintall OO-260
LMG21202.027	31	XBT	30	7	31	14:10	S/E	7	31	18:10	057	30.3	064	10.9	3310	Sprintall OO-260
LMG21202.028	32	XCTD	31	7	31	14:17	S/E	7	31	18:17	057	31.3	064	10.6	3268	Sprintall OO-260
LMG21202.029	33	XBT	32	7	31	14:46	S/E	7	31	18:46	057	36.5	064	9.1	4035	Sprintall OO-260
LMG21202.030	34	XBT	33	7	31	15:20	S/E	7	31	19:20	057	42.2	064	7.2	4187	Sprintall OO-260
LMG21202.031	35	XBT	34	7	31	15:54	S/E	7	31	19:54	057	48.3	064	5.0	4375	Sprintall OO-260
LMG21202.032	36	XBT	35	7	31	16:28	S/E	7	31	20:28	057	54.5	064	3.0	4226	Sprintall OO-260
LMG21202.033	37	XBT	36	7	31	17:02	S/E	7	31	21:02	058	0.6	064	1.3	3496	Sprintall OO-260
LMG21202.034	38	XCTD	37	7	31	17:08	S/E	7	31	21:08	058	1.4	064	1.1	3448	Sprintall OO-260
LMG21202.035	39	XBT	38	7	31	17:35	S/E	7	31	21:35	058	6.7	063	59.3	3248	Sprintall OO-260
LMG21202.036	40	XBT	39	7	31	18:17	S/E	7	31	22:17	058	12.2	063	56.5	3506	Sprintall OO-260
LMG21202.037	41	XBT	40	7	31	18:43	S/E	7	31	22:43	058	18.7	063	54.8	3807	Sprintall OO-260
LMG21202.038	42	XBT	41	7	31	19:16	S/E	7	31	23:16	058	24.6	063	53.2	4087	Sprintall OO-260
LMG21202.039	43	XBT	42	7	31	19:50	S/E	7	31	23:50	058	30.5	063	51.6	3787	Sprintall OO-260
LMG21202.040	44	XBT	43	7	31	20:24	S/E	8	1	00:24	058	36.3	063	49.2	3912	Sprintall OO-260
LMG21202.041	45	XBT	44	7	31	20:59	S/E	8	1	00:59	058	42.2	063	47.3	3995	Sprintall OO-260
LMG21202.042	46	XBT	45	7	31	21:35	S/E	8	1	01:35	058	48.4	063	45.5	3801	Sprintall OO-260
LMG21202.043	47	XBT	46	7	31	22:08	S/E	8	1	02:08	058	54.4	063	43.4	3513	Sprintall OO-260
LMG21202.044	48	XBT	47	7	31	22:43	S/E	8	1	02:43	059	0.6	063	40.9	3916	Sprintall OO-260
LMG21202.045	49	XCTD	48	7	31	22:57	S/E	8	1	02:57	059	2.3	063	40.3	3908	Sprintall OO-260
LMG21202.046	50	Buoy	49	7	31	22:59	S/E	8	1	02:59	059	2.9	063	40.1	3893	NOAA
LMG21202.047	51	Bird Ops	50	7	31	23:18	S/E	8	1	03:18	059	6.2	063	59.1	3968	Shaffer BG-232
LMG21202.048	52	XBT	51	7	31	23:17	S/E	8	1	03:17	059	6.2	063	58.1	3969	Sprintall OO-260
LMG21202.049	53	XBT	52	7	31	23:51	S/E	8	1	03:51	059	12.3	063	37.1	3921	Sprintall OO-260
LMG21302.001	54	XBT	53	8	1	00:25	S/E	8	1	04:25	059	18.7	063	35.0	3830	Sprintall OO-260
LMG21302.002	55	XBT	54	8	1	01:00	S/E	8	1	05:00	059	24.1	063	23.9	3950	Sprintall OO-260
LMG21302.003	56	XBT	55	8	1	01:38	S/E	8	1	05:38	059	31.0	063	31.0	3941	Sprintall OO-260

LMG21302.004	57	XBT	56	8	1	02:33	S/E	8	1	06:33	059	40.7	063	27.0	3653	Sprintall OO-260
LMG21302.005	58	XBT	57	8	1	03:47	S/E	8	1	07:47	059	50.5	063	24.1	3831	Sprintall OO-260
LMG21302.006	59	XBT	58	8	1	05:23	S/E	8	1	09:23	060	0.4	063	20.9	3921	Sprintall OO-260
LMG21302.007	60	Buoy	59	8	1	05:32	S/E	8	1	09:32	060	1.2	063	20.7	3864	NOAA
LMG21302.008	61	XBT	60	8	1	06:43	S/E	8	1	10:43	060	10.3	063	17.9	3958	Sprintall OO-260
LMG21302.009	62	XBT	61	8	1	08:38	S/E	8	1	12:38	060	20.2	063	14.1	3719	Sprintall OO-260
LMG21302.010	63	XBT	62	8	1	10:19	S/E	8	1	14:19	060	30.0	063	10.5	4002	Sprintall OO-260
LMG21302.011	64	XCTD	63	8	1	10:31	S/E	8	1	14:31	060	31.3	063	9.9	4037	Sprintall OO-260
LMG21302.012	65	XBT	64	8	1	13:25	S/E	8	1	17:25	060	45.3	063	5.0	3749	Sprintall OO-260
LMG21302.013	66	XCTD	65	8	1	13:25	S/E	8	1	17:25	060	45.3	063	5.0	3806	Sprintall OO-260
LMG21302.014	67	XBT	66	8	1	14:54	S/E	8	1	18:54	060	49.5				Sprintall OO-260
LMG21302.015	68	XBT	67	8	1	16:29	S/E	8	1	20:29	061	0.1	062	59.8	3889	Sprintall OO-260
LMG21302.016	69	XBT	68	8	1	18:08	S/E	8	1	22:08	061	10.1	062	55.9	3578	Sprintall OO-260
LMG21302.017	70	XBT	69	8	1	19:39	S/E	8	1	23:39	061	20.3	062	52.0	3452	Sprintall OO-260
LMG21302.018	71	XBT	70	8	1	21:19	S/E	8	2	01:19	061	30.3	062	47.2	3423	Sprintall OO-260
LMG21302.019	72	XBT	71	8	1	22:38	S/E	8	2	02:38	061	40.3	062	44.6	3424	Sprintall OO-260
LMG21402.001	73	XBT	72	8	1	23:57	S/E	8	2	03:57	061	50.1	062	41.3	3901	Sprintall OO-260
LMG21402.002	74	XBT	73	8	2	01:07	S/E	8	2	05:07	061	60.0	062	37.4	4628	Sprintall OO-260
LMG21402.003	75	XBT	74	8	2	01:47	S/E	8	2	05:47	062	5.8	062	34.7	4756	Sprintall OO-260
LMG21402.004	76	XBT	75	8	2	02:46	S/E	8	2	06:46	062	12.2	062	32.6	3309	Sprintall OO-260
LMG21402.005	77	XBT	76	8	2	03:29	S/E	8	2	07:29	062	18.4	062	30.4	2245	Sprintall OO-260
LMG21402.006	78	XBT	77	8	2	04:34	S/E	8	2	08:34	062	25.3	062	28.3	1775	Sprintall OO-260
LMG21402.007	79	XBT	78	8	2	05:47	S/E	8	2	09:47	062	30.0	062	24.4	413	Sprintall OO-260
LMG21402.008	80	XBT	79	8	2	06:56	S/E	8	2	10:56	062	36.1	062	18.2	456	Sprintall OO-260
LMG21402.009	81	XBT	80	8	2	08:06		8	2	12:06	062	42.0	062	12.0	600	Sprintall OO-260
LMG21602.001	82	CTD		8	4	14:00		8	4	18:02	065	6.4	065	5.0	171	
LMG21702.001	83	Penguins		8	5	08:08		8	5	12:08	066	14.2	066	31.5	715	
LMG21702.002	84	Seal G031		8	5	10:46		8	5	14:46	066	16.8	066	35.7		
LMG21702.003	85	Passive Microwave		8	5	16:12		8	5	20:12	066	19.6	066	39.5	453	
LMG21702.004	86	Seal G033		8	5	15:30		8	5	19:30	066	19.6	066	39.5	453	

LMG21702.005	87	CTD		8	5	19:18		8	5	23:18	066	20.1	066	41.0	447	
LMG21702.006	88	Transect, Ice Core, Brine, Snow pit 1-4		8	5	20:50		8	6	00:50	066	20.5	066	40.7	382	
LMG21802.001	89	Penguins		8	6	01:39		8	6	05:39	066	28.2	066	58.3	344	
LMG21802.002	90	Seal G034		8	6	09:00		8	6	13:00	066	31.9	067	5.7	358	
LMG21802.003	91	Penguins		8	6	13:00		8	6	17:00	066	29.4	067	0.0	362	
LMG21802.004	92	CTD		8	6	18:16		8	6	22:16	066	25.6	066	54.2	647	
LMG21802.005	93	Nilas Ice Sampling 5		8	6	21:40		8	7	01:40	066	31.4	067	5.2	479	
LMG21802.006	94	Transect, Ice Core, Brine, Snow pit 6		8	6	22:44		8	7	02:44	066	31.1	067	4.9	417	
LMG21902.001	95	Penguins		8	7	08:13		8	7	12:13	066	24.7	066	51.5	457	
LMG21902.002	96	Seal G035 & G036		8	7	09:53		8	7	13:53	066	24.6	066	51.5	532	Two seals were captured during this event
LMG21902.003	97	Dive 3		8	7	12:00		8	7	16:00	066	24.6	066	51.5	545	
LMG21902.004	98	Seal G037		8	7	14:10		8	7	18:10	066	24.3	066	51.6	384	
LMG21902.005	99	Dive 4		8	7	15:30		8	7	19:30	066	24.3	066	51.6	384	
LMG21902.006	100	Penguins		8	7	17:26		8	7	21:26	066	24.4	066	50.6	253	
LMG22102.001	101	Penguins		8	9	10:12	S/E	8	9	14:12	067	10.5	070	31.3	112	
LMG22102.002	102	Ice Coring & Brine 7		8	9	11:02	S/E	8	9	15:02	067	10.9	070	31.9	112	
LMG22102.003	103	Seal G038		8	9	14:00	S/E	8	9	18:00	067	11.2	070	34.5	506	
LMG22102.004	104	Dive 5		8	9	14:33		8	9	18:33	067	11.2	070	34.5	506	
LMG22102.005	105	Video for Microwave		8	9	15:42		8	9	19:42	067	11.2	070	34.5	521	
LMG22102.006	106	Penguin Ops		8	9	16:31	S/E	8	9	20:31	067	13.2	070	37.5	525	
LMG22302.001	107	Transect, Ice Core, Brine, Snow pit 8-13		8	11	16:41		8	11	20:41	068	39.9	076	10.7	433	
LMG22302.002	108	CTD		8	11	21:00		8	12	01:00	068	39.9	076	10.2	430	
LMG22402.001	109	CTD		8	12	09:29		8	12	13:29	068	38.5	076	4.6	436	
LMG22402.002	110	Dive 6		8	12	11:48		8	12	15:48	068	37.7	076	2.8	441	

LMG22402.003	111	Seal G039		8	12	16:00		8	12	20:00	068	35.9	075	59.8	436	
LMG22402.004	112	Ray Net		8	12	16:26		8	12	20:26	068	35.9	075	59.6	435	
LMG22402.005	113	CTD		8	12	21:21		8	13	01:21	068	33.4	075	58.3	437	
LMG22502.001	114	CTD		8	13	09:05		8	13	13:05	068	29.9	075	51.5	428	
LMG22502.002	115	Seal G040		8	13	10:31		8	13	14:31	068	29.3	075	50.0	435	
LMG22502.003	116	Dive 7		8	13	11:28		8	13	15:28	068	28.9	075	49.1	439	
LMG22502.004	117	Dive 8		8	13	14:30		8	13	18:30	068	27.8	075	45.7	436	
LMG22502.005	118	Ice Buoy 07440		8	13	16:30		8	13	20:30	068	27.8	075	45.7	436	
LMG22602.001	119	Ice Coring, Snow pit 14		8	14	17:07		8	14	21:07	068	9.9	075	11.1	311	
LMG22502.001	120	CTD		8	15	08:57		8	15	12:57	068	5.7	075	3.7	726	
LMG22702.002	121	Dive 9		8	15	11:00		8	15	15:00	068	5.8	075	2.5	630	
LMG22702.003	122	Seal G041		8	15	11:00		8	15	15:00	068	5.8	075	2.5	630	
LMG22702.004	123	Optics, Snow pit, Ice Coring 15		8	15	13:00		8	15	17:00	068	5.6	075	1.0	550	
LMG22702.005	124	Ice Coring 15		8	15	13:00		8	15	17:00	068	5.6	075	1.0	550	
LMG22702.006	125	Dive 10		8	15	14:28		8	15	18:28	068	5.3	075	59.9	533	
LMG22702.007	126			8	15	19:22		8	15	23:22	068	3.4	074	57.8	754	
LMG22702.008	127	XCTD		8	15	20:56		8	16	00:56	068	3.1	074	57.6	756	
LMG22702.009	128	XBT		8	15	20:57		8	16	00:57	068	1.7	074	52.4	648	
LMG22802.001	129	Seal G042		8	16	11:00		8	16	15:00	068	1.8	074	51.9	609	
LMG22802.002	130	Dive 11		8	16	12:22		8	16	16:22	068	1.8	074	51.6	588	
LMG22802.003	131	Optics, Snow pit, Ice Coring 16, 17		8	16	13:26		8	16	17:26	068	1.8	074	51.1	588	
LMG22802.004	132	Dive 12		8	16	15:08		8	16	19:08	068	1.7	074	50.0	479	
LMG22802.005	133	Seal G043		8	16	15:34		8	16	19:34	068	1.7	074	49.8	467	
LMG22802.006	134	XBT		8	16	20:45		8	16	00:45	068	1.3	074	49.0	521	
LMG22902.001	135	XBT		8	17	08:53		8	17	12:53	068	2.3	074	42.4	859	
LMG22902.002	136	Dive 13		8	17	10:25		8	17	14:25	068	2.1	074	41.1	823	
LMG22902.003	137	Transect Re-		8	17	12:41		8	17	16:41	068	1.9	074	39.2	761	

		measure 9-1														
LMG22902.004	138	Dive 14		8	17	13:48		8	17	17:48	068	1.7	074	38.5	808	
LMG22902.005	139	Ice Coring		8	17	15:15		8	17	19:15	068	1.5	074	37.9	831	
LMG22902.006	140	Ice Coring 18, 19		8	17	16:33		8	17	20:33	068	1.3	074	37.4	923	
LMG23102.001	141	CTD		8	19	06:40		8	19	10:40	067	33.9	071	37.4	443	
LMG23102.002	142	Ice Coring 20		8	19	12:10		8	19	16:10	067	30.0	071	30.2		
LMG23102.003	143	Dive 15		8	19	14:20		8	19	18:20	067	30.0	071	30.2		
LMG23202.001	144	Dive 16		8	20	09:32		8	20	13:32	067	13.5	072	28.8	415	
LMG23202.002	145	Transect 21		8	20	16:20		8	20	20:20	067	12.1	072	39.2	406	
LMG23202.003	146	CTD		8	20	21:00		8	21	01:00	067	11.6	072	39.2	410	
LMG23302.001	147	CTD		8	21	09:00		8	21	13:00	067	6.4	072	40.1	416	
LMG23302.002	148	Ice Coring 22, 23		8	21	10:52		8	21	14:52	067	05.3	072	39.5	409	
LMG23302.004	149	Dive 17		8	21	11:37		8	21	15:37	067	4.7	072	39.3	406	
LMG23302.005	150	Dive 18		8	21	15:43		8	21	18:43	067	2.0	072	38.3	409	
LMG23402.001	151	Transect 24		8	22	09:50		8	22	13:50	066	52.1	072	30.5	1164	
LMG23402.002	152	Dive 19		8	22	15:12		8	22	19:12	066	48.9	072	25.5	1735	
LMG23402.003	153	CTD		8	22	20:56		8	23	00:56	066	46.7	072	22.0	2181	
LMG23502.001	154	CTD		8	23	09:03		8	23	13:03	066	43.9	072	14.9	2453	
LMG23502.002	155	Dive 20		8	23	10:00		8	23	14:00	066	43.9	072	14.1	2401	
LMG23502.003	156	Dive 21		8	23	11:57		8	23	15:57	066	43.4	072	12.4	2371	
LMG23502.004	157	Ice Buoy 07413		8	23	14:28		8	23	18:28	066	42.8	072	10.2	2354	
LMG23502.005	158	Dive 22		8	23	14:56		8	23	18:56	066	42.8	072	10.2	2340	
LMG23502.006	159	Integrated Cores 24		8	23	15:00		8	23	19:00	066	42.8	072	10.2	2340	
LMG23502.007	160	Net		8	23	19:14		8	23	23:14	066	41.7	072	6.0	2243	
LMG23502.008	161	CTD		8	23	20:52		8	24	00:52	066	41.3	072	4.6	2251	
LMG23602.001	162	CTD		8	24	08:54		8	24	12:54	066	38.4	071	59.6	2431	
LMG23602.002	163	CTD		8	24	10:15		8	24	14:15	066	38.3	071	59.1	2392	
LMG23602.003	164	Dive 23		8	24	10:55		8	24	14:55	066	38.2	071	58.8	2377	

LMG23602.004	165	Thick Ice Floe 24		8	24	11:20		8	24	15:20	066	38.1	071	58.5	2368	
LMG23602.005	166	Dive 24		8	24	13:29		8	24	17:29	066	37.9	071	57.5	2306	
LMG23602.006	167	Dive 25		8	24	15:35		8	24	19:35	066	37.9	071	56.1	2235	
LMG23602.007	168	Money Core 24		8	24	15:35		8	24	19:35	066	37.9	071	56.1	2235	
LMG23602.008	169	CTD		8	24	20:52		8	25	00:52	066	38.8	071	51.5	1202	
LMG23602.009	170	Trawl 1 & 2		8	24	22:31		8	25	02:31	066	38.8	071	49.1	1056	
LMG23702.001	171	CTD		8	25	08:56		8	25	12:56	066	33.7	071	36.3	503	
LMG23702.002	172	Trawl 3		8	25	11:22		8	25	15:22	066	32.8	071	32.7	492	
LMG23702.003	173	Trawl 4		8	25	11:22		8	25	15:22	066	32.8	071	32.7	492	
LMG23702.004	174	Transect 24-1 Re-measure		8	25	12:24		8	25	16:24	066	32.4	071	31.0	489	
LMG23702.005	175	Optics, Ice Coring, Snow pit 25		8	25	12:34		8	25	16:34	066	32.4	071	31.0	488	
LMG23702.006	176	CTD		8	25	20:53		8	26	00:53	066	27.6	071	18.8	523	
LMG23702.007	177	Trawl 5		8	25	22:15		8	26	02:15	066	27.1	071	19.1	526	
LMG23702.008	178	Trawl 6		8	25	22:15		8	26	02:15	066	27.1	071	19.1	526	
LMG23802.001	179	CTD		8	26	08:56		8	26	12:56	066	24.2	071	10.9	542	
LMG23802.002	180	Dive 26		8	26	11:40		8	26	15:40	066	23.3	071	10.2	1080	
LMG23802.003	181	Optics, Ice Coring, Snow pit 27		8	26	12:53		8	26	16:53	066	23.3	071	9.6	544	
LMG23802.004	182	Dive 27		8	26	14:40		8	26	18:40	066	23.6	071	7.8	543	
LMG23802.005	183	Integrated Cores 26		8	26	14:54		8	26	18:54	066	23.7	071	7.5	543	
LMG23802.006	184	CTD		8	26	15:33		8	26	19:33	066	23.7	071	6.5	542	
LMG23802.007	185	CTD		8	26	20:54		8	27	00:54	066	23.1	070	56.5	549	
LMG23802.008	186	Trawl 8		8	26	22:04		8	27	02:04	066	22.7	070	55.1		
LMG23802.009	187	Trawl 7		8	26	22:04		8	27	02:04	066	22.7	070	55.1		
LMG23902.001	188	CTD		8	27	08:55		8	27	12:55	066	23.7	070	39.9	588	
LMG23902.002	189	Trawl 9		8	27	10:07		8	27	14:07	066	23.5	070	38.4	576	
LMG23902.003	190	Trawl 10		8	27	10:07		8	27	14:07	066	23.5	070	38.4	576	

LMG23902.004	191	Dive 28		8	27	11:22		8	27	15:22	066	23.3	070	37.1	558	
LMG23902.005	192	Money Core 26		8	27	11:29		8	27	15:29	066	23.3	070	37.0	558	
LMG23902.006	193	CTD		8	27	14:51		8	27	18:51	066	22.9	070	34.9	548	
LMG23902.007	194	Dive 29		8	27	14:51		8	27	18:51	066	22.9	070	34.9	548	
LMG23902.008	195	CTD		8	27	20:54		8	28	00:54	066	22.5	070	29.2	583	
LMG23902.009	196	Trawl 11	1	8	27	22:25		8	28	02:25	066	21.5	070	27.6	594	
LMG23902.010	197	Trawl 12	2	8	27	22:25		8	28	02:25	066	21.5	070	27.6	594	
LMG24002.001	198	CTD		8	28	09:03		8	28	13:03	066	18.0	070	20.8	504	
LMG24002.002	199	Transect 24-1 Re-measure & Ice Coring 28		8	28	11:01		8	28	15:01	066	17.2	070	20.1	488	
LMG24002.003	200	CTD		8	28	19:15		8	28	23:15	066	13.6	070	18.2	454	
LMG24402.001	201	CTD		9	1	05:24		9	1	09:24	066	10.7	069	5.6	353	
LMG24402.002	202	Transect, Ice Coring, Snow pit 29		9	1	12:17		9	1	16:17	066	15.7	068	52.5	412	
LMG24402.003	203	Dive 30		9	1	15:00		9	1	19:00	066	15.0	068	53.0	400	
LMG24402.004	204	CTD		9	1	18:31		9	1	22:31	066	13.0	068	52.1	372	
LMG24402.005	205	CTD		9				9			066					This was all that was recorded.
LMG24502.001	206	Transect, Ice Coring 30		9	2	09:45		9	2	13:45	066	1.5	068	44.5	355	
LMG24502.002	207	Dive 31		9	2	14:04		9	2	18:04	065	58.3	068	43.7	336	
LMG24502.003	208	Dive 32		9	2	17:34		9	2	21:34	065	56.3	068	42.3	336	
LMG24502.004	209	CTD		9	2	18:58		9	2	22:58	065	55.6	068	41.4	317	
LMG24602.001	210	CTD		9	3	06:42		9	3	10:42	065	51.8	068	38.9	329	
LMG24602.002	211	Dive 33		9	3	10:15		9	3	14:15	065	51.5	068	37.9	333	
LMG24602.003	212	Dive 34		9	3	13:32		9	3	17:32	065	50.5	068	38.2	330	
LMG24602.004	213	Pancake Ice Sample 30		9	3	14:00		9	3	18:00	065	50.5	068	38.2	330	
LMG24602.005	214	Dive 35		9	3	16:02		9	3	20:02	065	49.9	068	39.5	330	
LMG24602.006	215	CTD		9	3	18:32		9	3	22:32	065	49.6	068	40.4	329	
LMG24702.001	216	CTD		9	4	06:48		9	4	10:48	065	47.0	068	40.5	339	
LMG24702.002	217	Dive 36		9	4	10:14		9	4	14:14	065	46.4	068	40.1	333	

LMG24702.003	218	Integrated Cores 30		9	4	10:34		9	4	14:34	065	46.3	068	40.0	337	
LMG24702.004	219	Optics, Ice Coring, Snow pit 30-3		9	4	13:17		9	4	17:17	065	45.3	068	39.7	341	
LMG24702.005	220	Dive 37		9	4	14:17		9	4	18:17	065	4.8	068	46.0	345	
LMG24702.006	221	CTD		9	4	18:32		9	4	22:32	065	43.9	068	41.9	349	
LMG24802.001	222	CTD		9	5	06:48		9	5	10:48	065	42.3	068	39.5	373	
LMG24802.002	223	Transect, Integrated Cores 31		9	5	13:21		9	5	17:21	065	41.8	068	38.7	378	
LMG24802.003	224	Dive 38		9	5	13:45		9	5	17:45	065	41.8	068	37.7	378	
LMG24802.004	225	Dive 39		9	5	16:17		9	5	20:17	065	41.4	068	38.5	383	
LMG24802.005	226	CTD		9	5	18:52		9	5	22:52	065	41.3	068	39.5	381	
LMG24802.006	227	Seal G044		9	5	17:30		9	5	21:30	065	41.3	068	39.5	381	
LMG24902.001	228	CTD		9	6	06:40		9	6	10:40	065	41.9	068	41.0	373	
LMG24902.002	229	Dive 40		9	6	13:12		9	6	17:12	065	42.6	068	42.9	148	
LMG24902.003	230	Ice Coring 32		9	6	13:12		9	6	17:12	065	42.6	068	42.9	153	
LMG24902.004	231	Dive 41		9	6	16:13		9	6	20:13	065	41.5	068	41.1	375	
LMG24902.005	232	CTD		9	6	18:39		9	6	22:39	065	40.5	068	40.5	383	
LMG25002.001	233	CTD		9	7	06:47		9	7	10:47	065	38.2	068	37.2	410	
LMG25002.002	234	Dive 42		9	7	10:25		9	7	14:25	065	37.6	068	36.7	414	
LMG25002.003	235	Optics, Ice Coring, Snow pit 33		9	7	13:01		9	7	17:01	065	37.2	068	36.2	422	
LMG25002.004	236	Money Coring 32		9	7	13:20		9	7	17:20	065	37.2	068	36.2	422	
LMG25002.005	237	Dive 43		9	7	13:35		9	7	17:35	065	37.1	068	36.0	426	
LMG25002.006	238	Seal G045		9	7	13:56		9	7	17:56	065	37.0	068	35.9	436	
LMG25002.007	239	Dive 44		9	7	16:53		9	7	20:53	065	36.2	068	34.1	467	
LMG25002.008	240	CTD		9	7	18:39		9	7	22:39	065	35.4	068	33.2	457	
LMG25102.001	241	CTD		9	8	06:46		9	8	10:46	065	32.3	068	32.1	444	
LMG25102.002	242	Optics, Ice Coring, Snow		9	8	13:13		9	8	17:13	065	31.4	068	29.1	455	

		pit 34														
LMG25102.003	243	Dive 45		9	8	13:57		9	8	17:57	065	31.4	068	29.1	454	
LMG25102.004	244	Seal G046		9	8	16:40		9	8	20:40	065	31.9	068	28.1	426	
LMG25102.005	245	CTD		9	8	18:55		9	8	22:55	065	32.1	068	27.9	483	
LMG25202.001	246	CTD		9	9	06:38		9	9	10:38	065	35.1	068	29.2	497	
LMG25202.002	247	Dive 46		9	9	10:49		9	9	14:49	065	36.8	068	30.2	530	
LMG25202.003	248	Dive 47		9	9	14:00		9	9	18:00	065	38.0	068	30.8	522	
LMG25202.004	249	Seal G047		9	9	15:55		9	9	19:55	065	38.5	068	30.7	507	
LMG25202.005	250	Dive 48		9	9	16:40		9	9	20:40	065	38.6	068	30.6	501	
LMG25202.006	251	CTD		9	9	18:51		9	9	22:51	065	39.1	068	30.0	496	
LMG25402.001	252	Brine & Slush 35		9	11	07:18		9	11	11:18	065	11.2	065	36.6		
LMG25702.001	253	Seal Ops		9	14	12:30		9	14	16:30	062	27.7	060	44.0		Visit to Cape Shirreff