SC/56/E24

International Whaling Commission – Southern Ocean GLOBEC/CCAMLR collaboration

Cruise report 2003 – 2004

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ABSTRACT

International Whaling Commission /ARP's around the Antarctic (IWC/AAA) initiative field work during the intersessional period has involved collaboration with national programs conducting multidisciplinary ecosystem research in the Antarctic under Southern Ocean Global Ecosystem Dynamics (SO GLOBEC) and other multidisciplinary research programs (ANSLOPE (Cross Slope Exchanges at the Antarctic Slope Front), SOCEP (Southern Ocean Cetacean Ecosystem Program), AAA WARD (AAA Western Antarctic ARP recovery and deployment)). Participation occurred on five research cruises between January 2004 and May 2004, in the Ross Sea, Weddell Sea, East Antarctica and the Western Antarctic Peninsula. The IWC supported observers on two of these cruises, and all other work was supported by other means. Visual survey, sea-ice data collection, individual photo-identification, along-track passive acoustic survey, and acoustic mooring deployments and retrievals were conducted as possible due to cruise and funding conditions. For the first time this season, extensive sea ice information will be recorded and analysis undertaken both on board and after the voyage to determine the patterns between sea ice and whale densities in Antarctic waters. Preliminary results from these cruises are reported here and include: mapped distribution patterns of cetaceans from visual survey sighting data; individual photo identification records; species identification and positions of animals recorded on sonobuoys; and descriptions of environmental conditions observed or recorded as part of the multidisciplinary effort.

BACKGROUND

The International Whaling Commission (IWC) commenced collaborative research with CCAMLR in the Southern Ocean during the 1999/2000 austral summer (Reilly *et al.* 2000; Hedley *et al* 2001). The IWC then developed collaboration with the Southern Ocean Global Ecosystem Dynamics Program (SO GLOBEC) with a series of multi-season and multi-year collaborative research cruises. Participation by IWC and AAA cetacean researchers in National Antarctic research programs has continued to develop since 2001. Initial collaboration opportunities provided by CCAMLR and SO GLOBEC has involved field work (2001 –2004) and analysis, and new partnerships have developed with other research programs. These include, but are not limited to oceanographic (ANSLOPE) and sea ice surveys. This program of IWC collaboration in the Southern Ocean ensures that the IWC is included in multidisciplinary ecosystem studies that will provide the information it requires to determine the impacts of environmental change on cetaceans in the Antarctic and that the IWC remains engaged with international directions in marine research and the efforts of many national programs to investigate the spatial and temporal connections between the biological and physical dynamics of these ecosystems.

Since the 1999/2000 austral summer the International Whaling Commission (IWC) Scientific Committee has been facilitating the inclusion of cetacean research programs aboard the multidisciplinary research cruises of many nations operating in the Antarctic (e.g. CCAMLR 2000 and Southern Ocean GLOBEC 2001-3, UK, Australia, USA, Germany). IWC participation in these cruises is aimed at gathering cetacean data simultaneous with other physical and biological programs, to allow integration of cetacean distribution and ecological data and improve our sparse understanding of the connections between cetacean distribution and the ecology and dynamics of the Southern Ocean ecosystem. This region is an IWC Sanctuary for whales (the IWC Southern Ocean Sanctuary (SOS)) and non-lethal research that will improve our understanding of whale populations at local, regional and circum-Antarctic scales is an important means of contributing to the objectives of the SOS.

NATIONAL SO GLOBEC AND OTHER CRUISES

German SO GLOBEC conducted the first of three multidisciplinary surveys in the Lazarev Sea, Weddell Sea. The IWC participated in this cruise and provided support for one of the two observers.

IWC/AAA participation in two cruises was supported by the United States National Science Foundation Polar Program. One was conducted in the Western Antarctic Peninsula. The purpose of this cruise was to retrieve and redeploy two ARP's from locations near Elephant Island and on the US Long Term Ecological Research (LTER) grid. Two observers conducted visual survey and along-track passive acoustics during the cruise. The IWC did not provide financial support for these observers. The second cruise was conducted in the Ross Sea. This was a comprehensive oceanographic survey in sea ice on and around the eastern and western shelf. The IWC participated in this cruise and provided most of the support for two observers.

Australian SOCEP (Southern Ocean Cetacean Ecosystem Program) participated in two cruises in East Antarctica as part of the AAA initiative and these are reported here. One mooring retrieval cruise sailed to the Mawson Coast in December 2003 – February 2004 (V5) and the second cruise sailed to the Casey ice edge (17 Feb – 12 March 2004) to deploy an ARP and conduct visual survey and sea ice data collection (see SC/54/E23 and 25). The IWC did not provide financial or other support for these cruises.

REPORTS TO IWC

Reports for the 2001 and early 2002 cruises (US and German programs) have been provided to the IWC SC previously (Thiele *et al.* 2001, Thiele *et al* 2002, Thiele *et al.* 2003). Full cruise reports, web diaries and images from all of the cruises can also be found at:
http://www.ccpo.odu.edu:80/Research/globec/iwc_collab/menu.htmlor use the link through the IWC website under Recent Additions.

The current report provides a summary of IWC participation in cruises conducted since the 2003 report to IWC (Thiele *et al* 2003). Five research cruises are reported here. Two cruises with US Polar Programs, one cruise with German SO GLOBEC and two cruises with the Australian Antarctic program. The collaboration program (ARP's around the Antarctic) that we have developed under the IWC collaboration framework has allowed us to incorporate a significant passive acoustic component to most of these cruises (Thiele and Moore 2003, Thiele 2002, Thiele 2003, McKay *et al.* 2004, McKay and Širović 2004). This IWC collaborative project has conducted visual surveys (line transect), tissue biopsy, individual photo identification and passive acoustic projects on these cruises.

INDIVIDUAL CRUISE REPORTS

I. Ross Sea – US Anslope

RV Nathaniel B Palmer NBP0402 - 23 February to 10 April 2004

Visual survey, photo identification, ARP deployment, along-track passive acoustics and sea ice data were collected on this cruise

Visual survey

The NBP 0402 ANSLOPE cruise provided the opportunity for IWC observers to conduct visual survey for wildlife simultaneously with sea ice data collection using a new data logging and photographic system in sea ice over a large sector of the Ross Sea (Cape Adare to eastern side of Iselin Banks). Habitat surveyed included shelf, shelf slope and off slope deep waters through an extensive range of sea ice types (Figure 1.). The data from this, and similar cruises being conducted concurrently in the Weddell Sea, Antarctic Peninsula and East Antarctica will be used to test the relationship between whale distribution/density and sea ice complexity to determine the level of complexity of sea ice that is ecologically important as habitat for these species; and to propose a standard data collection system for simultaneous whale and sea ice records for use in the Antarctic based on an analytical assessment of connections that exist at varying scales of complexity in sea ice habitat.

Visual survey methods
One to two observers conducted visual survey for cetaceans and other wildlife during daylight, subject to weather and sea state conditions, from the bridge of the RV N B Palmer throughout the research cruise from McMurdo Station, Ross Sea to Lyttleton, New Zealand (23 February to 9 March 2004). Bird and mammal

sightings were recorded using a laptop-based version of the logging program (LOGGER[1]) specially adapted for use in the Antarctic (SEA ICE LOGGER). This version of the program allows for entry of individual records for any Antarctic cetacean, seal, penguin or flying bird species, and the full suite of Aspect Sea Ice Data Fields. The program downloads directly into an ACCESS database where data is archived. Photographic records of cetaceans, other wildlife and sea ice were also collected using Nikon D100 Digital/SLR and Nikon Coolpix cameras.

Cetacean survey: Visual survey search area covered 180° ahead along the track, with checks behind the vessel in ice, for any whale sightings at any distance. All sighting records were entered in Sea Ice Logger and a digital image of whale habitat taken, as well as photos of the whales wherever possible (even if distant).

Mammal and seabird diversity survey: Seals were recorded as they passed abeam of the ship and out to a distance of 1nm either side of the vessel track in good visibility. This was reduced to a 1km strip width if busy or visibility was reduced. The distance to each seal sighting was recorded. Birds were recorded in two ways: *Normal mode* - birds were recorded when within 300m except for records of large flocks, which were recorded at any (taking care not to recount birds that were accompanying the ship); *Busy mode* - in this mode we recorded 'bird counts' by doing a count of all species and numbers of each in a 360 degree 100m area around the ship at regular (e.g. 30min) intervals; *NZ transit bird survey protocol* – bird counts were done for the area 360° around vessel on the half hour – counting all birds within 300m of ship and entering each species in the 'other sightings' sheet individually.

Sea ice habitat data: Sea ice records were entered into the sea ice sheets in Sea Ice Logger every 30 mins. Images of the Aspect sea ice area were taken every 5 minutes. An iceberg count has been added to the Aspect sea ice data sheet, with the number of bergs visible with their base within the horizon in a 180° arc ahead of the vessel recorded.

Visual survey preliminary results

Cetacean survey: Cetacean species sighted in the study area (south of 70°S in the Ross Sea) were minke (Balaenoptera bonaerensis sp.), killer (Orcinus orca), fin (Balaenoptera physalus) and beaked whales (Ziphiidae) (Figure 1.). Total sightings of cetacean species are in Table 1. The single Ziphiidae sighting occurred on the transit north from McMurdo Station to Cape Adare, south of the Drygalski Trough. Two fin whales were sighted together on the shelf slope (main mooring area) to the east of Cape Adare. All except one of the killer whale sightings were made on the shelf edge, abutting the slope. The one exception was a group among minke whales on the slope in the eastern Ross Sea, southeast of the Pennell Trough. Humpback whale sightings occurred near the slope, in fairly open water (with streams of brash, nilas and new ice floes) in the first part of the cruise east of Cape Adare. This area had heavy concentrations of ice by the time we returned a few weeks later, and no humpbacks were seen then. Humpbacks were also seen to the northeast of the Iselin Bank where minke whales were numerous. Minke whales had a patchy distribution in the survey area, but were concentrated in a number of areas: the eastern Ross Sea slope; to the northeast of Iselin Bank; and the slope and shelf edge areas to the south and southeast of the Adare Trough in the Western Ross Sea.

Table 1. Cetacean species sighted in study area (south of 70°S in the Ross Sea)

Cetacean species	No sightings	No. individuals
Minke	122	463
Humpback	7	15
Killer	9	61
Fin	1	2
Ziphiidae	1	2
unidentified	20	145
Total	160	688

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

Figure 1. Map of NBP 0402 cetacean sightings – not included here - please see Deb Thiele during the meeting if you would like to see poster size maps for cetaceans, wildlife diversity and seals/birds from this cruise.

Mammal and seabird diversity survey: The main wildlife species encountered, other than whales, were crabeater, Weddell, Ross and leopard seals; and Adelie and emperor penguins. Crabeater seal distribution was fairly scattered, with highest concentrations on the shelf edge and slope, but also in deep waters to the south of the Adare Trough and northeast of the Iselin Bank. A very few Weddell seals were seen on the shelf edge in the eastern Ross Sea, with most found along the coast on the transit between McMurdo and Cape Adare, and on the shelf edge and slope SW of the Adare Trough in the Western Ross Sea. Ross seals were seen on the shelf edge SW of the Adare Trough, and in the Eastern Ross Sea were restricted to the ridge of the Iselin Bank. Leopard seals were concentrated on the shelf slope and to the northeast of the Iselin Bank. In the Eastern Ross Sea, Adelie penguins were concentrated on the ridges and shelf edge of the Iselin Bank, and also abundant in other isolated patches; while in the Western Ross Sea this species was particularly numerous south of the Adare Trough on the shelf edge and slope, and also on the western side of the Iselin Bank. The distribution of emperor penguins differed to that of Adelie's, in being sparser and patchier. Concentrations of this species were also found along the shelf edge; also scattered along the western coast and around the Adare Trough. In the Eastern Ross Sea emperors were much more obviously concentrated along the shelf edge, and to some degree in the deep waters to the east of the southern Iselin Bank. Total seal and penguin sightings and individuals counted appear in Table 2.

Table 2. Seal and penguin records

Species	No. sightings	No. animals
Crabeater seal	209	600
Weddell seal	33	42
Ross seal	6	6
Leopard seal	37	37
Adelie penguin	624	8798
Emperor penguin	133	1399

Wildlife diversity varied considerably between habitat zones (defined by bathymetry) and ice conditions, but was generally greatly enhanced on the shelf slope and shelf edge, with whale, seal, penguin and flying bird species noticeably more abundant here.

Sea ice conditions are described in SC/56/E23

Marine mammal passive acoustic monitoring

Along – track passive acoustic monitoring (using sonobuoys) and ARP deployments made up the acoustic component on this cruise.

Passive acoustic methods

The Acoustic Recording Packages (ARP's) that were deployed during this cruise are bottom-mounted instruments with a hydrophone component floating 10 m above the mooring. Other components of the ARP are: a data logging and acoustic release systems, batteries, and flotation. The ARP's will record continuously at 1000 samples per second for 500 days and the data will be stored on two 18 Gb hard disks. The low frequency calls of blue and fin whales can be recorded from as far as 60 km radius, but somewhat higher frequency minke, humpback, southern right (Eubalaena australis) and possibly sperm whale calls should also be detectable, although over smaller ranges.

During AnSlope II, sonobuoys were deployed opportunistically in order to supplement the information that will be gathered from the seafloor recorders. Sonobuoys are expendable underwater listening devices. The sonobuoy has 4 main components: a float, a radio transmitter, a saltwater battery, and a hydrophone. The hydrophone is an underwater sensor that converts the pressure waves from underwater sounds into electrical voltages that are amplified and sent to the radio transmitter housed in the surface float. This radio signal is picked up by an antenna and a radio receiver on the ship, and it can be reviewed and simultaneously recorded as a WAV file and on a digital audiotape (DAT) at a sample rate of 48 kHz.

Two different types of sonobuoys were used during this cruise: omnidirectional and directional. Omnidirectional sonobuoys (AN/SSQ-57B and AN/SSQ-41B) have hydrophones with a frequency response from 10 to 20,000 Hz. For these types of sonobuoys hydrophone depth can be set to 90 or 400 ft (57B) and 90 or 1000 ft (41B). It is not possible to determine the location of the sound source using these sonobuoys. DIFAR (directional frequency analysis and recording; AN/SSQ-53D) sonobuoys have a hydrophone with directional detection capabilities and frequency response from 5 to 2,400 Hz. Hydrophone depth for 53D sonobuoys can be set to 90, 400, or 1000 ft. The direction of the sound relative to the sonobuoy is obtained from two pairs of direction sensors and a compass located inside the hydrophone. This kind of acoustic data can be correlated to visual observations of marine mammals. All of these sonobuoy types can transmit for a maximum of 8 h before scuttling and sinking.

Three antennae were used during the cruise: a 160 MHz omnidirectional Cushcraft Ringo Ranger ARX-2B, 162 – 174 MHz directional Yagi, and a 138 – 174 MHz dipole Sinclair SRL-210 A-2. The antennae were mounted on the science mast, 33 m above sea surface level. The average reception range of the Ringo Ranger during the cruise was 6 nm and it was 12 nm for the Yagi. It was difficult to determine the range of the Sinclair because it was facing forward, but it was more than 8 nm. This setup of the Sinclair was useful for signal reception during CTD stations. The Yagi was generally used when steaming away from the sonobuoy in a straight line, because of its narrow beam pattern, while Ringo Ranger was preferable when steaming through the ice (which was often difficult to do in a straight line). These ranges were variable depending on weather conditions.

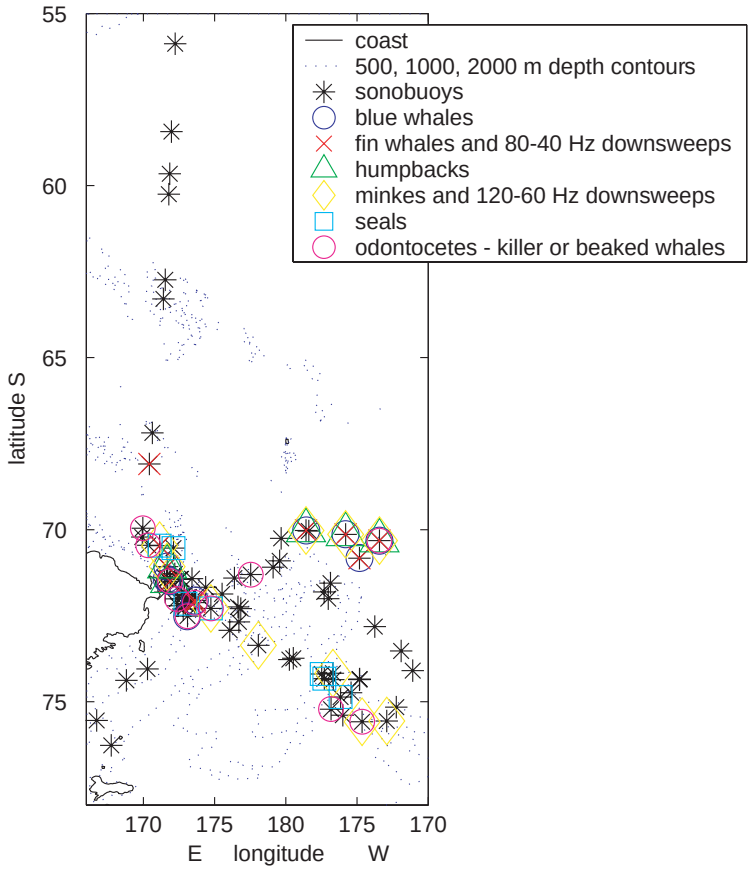

Figure 2. All sonobuoy deployment locations during AnSlope II. Sonobuoys on which marine mammal calls were heard are marked with an appropriate symbol (see legend).

We used software controlled ICOM IC-PCR1000 scanner radio receivers for reception of sonobuoy signal. Data were recorded as 30 minute WAV files using software program *Ishmael*. As a back-up, data were simultaneously recorded on digital audiotapes using Sony PCM-M1 digital audio recorder. Ishmael was also used for real-time review of the sounds. The following items were noted at each deployment: time, latitude, longitude, and depth at deployment, sonobuoy type, channel, time, and depth settings, speed and heading of the ship, ice conditions, and the reason for deployment. Data were generally reviewed in real time and notes of sounds heard were kept. If DIFAR sonobuoys were deployed, bearings to interesting sounds were calculated using Greenridge DIFAR demultiplexing software and they were noted with the description of the sound. Comments on reception and sonobuoy range were also noted. Also, if real-time data were not monitored a note was made so that data can be reviewed in post-process analysis. A spreadsheet with the following information is included on the AnSlopeII data CD: sonobuoy number, date, time and location of deployment, sonobuoy type, indication of species that was heard, reception range, reason for deployment (when applicable), and any additional comments. The noise levels from the Nathaniel B. Palmer were high when breaking through ice, therefore many recordings had high noise. This low frequency noise made it more difficult to determine presence of baleen whale calls.

Passive acoustics preliminary results

The Acoustic Recording Packages were successfully deployed at 62°45.1' S and 171°31.3' E, and 71°24.9' S and 172°40.0' E. The deployment depths were 2847 and 2198 m, respectively. Sonobuoys were deployed when marine mammals were visually detected and randomly throughout the cruise, but attempting to provide maximum reception from a single sonobuoy. A total of 77 sonobuoys were deployed: 50 omnidirectional (32 57B and 18 41B) and 27 DIFAR. Average failure rate was 29%, but it differed between different sonobuoy types. DIFARs were least successful and 14 failed (52%). Omnidirectional sonobuoys had a lower failure rate (6% for 57B and 33% for 41B). This relatively high failure rate is probably due to the age of the sonobuoys, which are only given for research after their shelf life in the Navy has passed. Locations of all the deployments as well as a preliminary summary of the sonobuoys on which calls were heard can be seen in Figures 2 and 3.

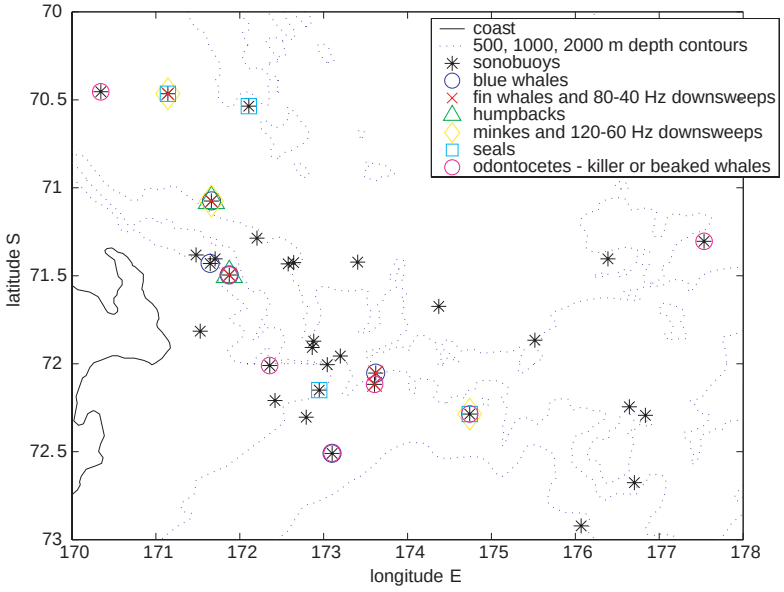

Figure 3. Close-up of sonobuoy deployments and marine mammals heard in the core study area.

Calls from several species were heard: blue whales, fin whales, humpback whales, killer whales (*Orcinus orca*), minkes, Weddell and crabeater seals. Several unidentified call types were heard. They can be classified into three categories: "80-40 Hz downsweeps" of approximately 2 s duration, series of pulses centered around 100 Hz, and "120-60 Hz downsweeps." Even though the source of these calls is not currently known with certainty, they are most likely produced by a marine mammal. The most frequently heard calls were from odontocetes. They were heard on 11 sonobuoys, and while one of those was most likely a beaked whale, the others were probably killer whale calls.

Baleen whale species heard most frequently was minke whale, and they are a likely source of "120-60 Hz downsweeps." These calls were heard most often along the shelf edge, in ice covered areas. Humpback whale song was recorded on several occasions, mostly near the ice edge. Main components of the song were in the 300-500 Hz range and several themes could be distinguished in the song. Crabeater seals were heard once in the eastern part of the survey area, but Weddell seals calls were more common and they were heard seven times, predominately in the southwest of the survey area. Pulses were heard on four sonobuoys. It is possible they were produced by Ross seals, but this needs further confirmation. Fin whale calls were heard on one sonobuoy. It is possible, however, that "80-40 Hz downsweeps" were produced by fin whales as well. These calls were heard near the ice edge. Further analysis of the recordings is needed to double check for calls that were possibly not detected during the preliminary review. Verification of the sources of the unidentified calls is also needed.

II. Weddell Sea – German SO GLOBEC

RV Polarstern ANTXXI/4 - 27 March to 6 May 2004

Visual survey, photo identification and sea ice data were collected on this cruise.

The Polarstern cruise (ANT XXI/4) carried out an SO GLOBEC multidisciplinary cruise focussed on the overwintering of Antarctic krill (*Euphausia superba*) in the Lazarev Sea (Figure 4.). Two observers conducted visual survey for cetaceans and collected comprehensive sea ice data using the Sea Ice LOGGER program (details in SC/56/E23 and 25).

Visual survey methods

Visual survey for cetaceans was conducted aboard Polarstern using standard line transect protocols during daylight hours when weather conditions were appropriate (Beaufort sea state < 6). Survey protocols were the same as those used on NBP 0402 (see cruise report I this paper). Sightings were recorded on a laptop-based program 'Logger', which also allowed recordings of seals, seabirds and sea ice concentrations. GPS position, ship course and speed were logged by the PODAS system, which was downloaded from the ship's database. Survey effort generally commenced after the morning meeting from inside the bridge wings and ceased at dark. While steaming in ice, digital photos were collected every 5 minutes, always from the same point on the bridge for comparison (see NBP 0402 protocols). The sea ice concentrations and types within each photo were then classified out to 1 kilometer from the bow using the protocol outlined on the ASPeCt (Antarctic Sea ice Processes and Climate) CD.

Visual survey preliminary results

On transit between Cape Town and the cruise survey area, only one whale sighting was made, but this was likely due to reduced effort due to weather and low sightability conditions. Sightings made in the survey area were: 16 sightings of 22 whales including humpback and minke whales, a single sperm whale and some unidentified species. Four sightings of 12 individual humpback whales were made on the 25th April in the extended survey leg north of the 4th transect. These whales were all travelling north, an indication of the ice cover extending and the whales starting on their northward migration.

On the 27th April four humpback whales remained with the vessel for four hours. Individual photo identification records were obtained for six humpback whales on this voyage, and four hours of digital video footage of the four humpbacks near the vessel were also obtained. Total cetacean sightings during the voyage was low 26 sightings of 50 individuals (Table 3).The total distance travelled during the voyage until the end of data collection was 5921nm which provided an encounter rate of 0.0084 whales per nm or 1 whale every 118nm. Due to the amount of time spent at stations, time has to be taken into consideration as well as distance travelled. The total time spent on survey (both full effort and casual observations) was 272 hours, providing a figure of 0.184 whales per hour or 1 whale every 5.44 hours. These figures are very general and further analysis is required to examine the effects of effort and the total sightings.

The majority of sea ice encountered was first year ice in the form of cakes and small and medium floes, and brash and frazil. Both singular and cemented pancake ice were also quite common closer to the ice margin. Some multiyear floes in the form of growlers, icebergs and floes were sighted quite frequently but these made up a

small percentage of the overall ice cover. More extensive analysis of the data will be conducted on return from the voyage to start making linkages between the sea ice extent and whale distribution (see SC/56/E23).

Table 3. ANTXXI/4 total cetacean sightings and number of animals.

Total species	Total sightings/animals
Unid. large baleen whale	1:1
Humpback whale	10:29
Undet. minke	1:1
Unid. whale	4:4
Like ordinary minke	1:1
Minke whale (ordinary)	8:13
Sperm whale	1:1
Total	26: 50

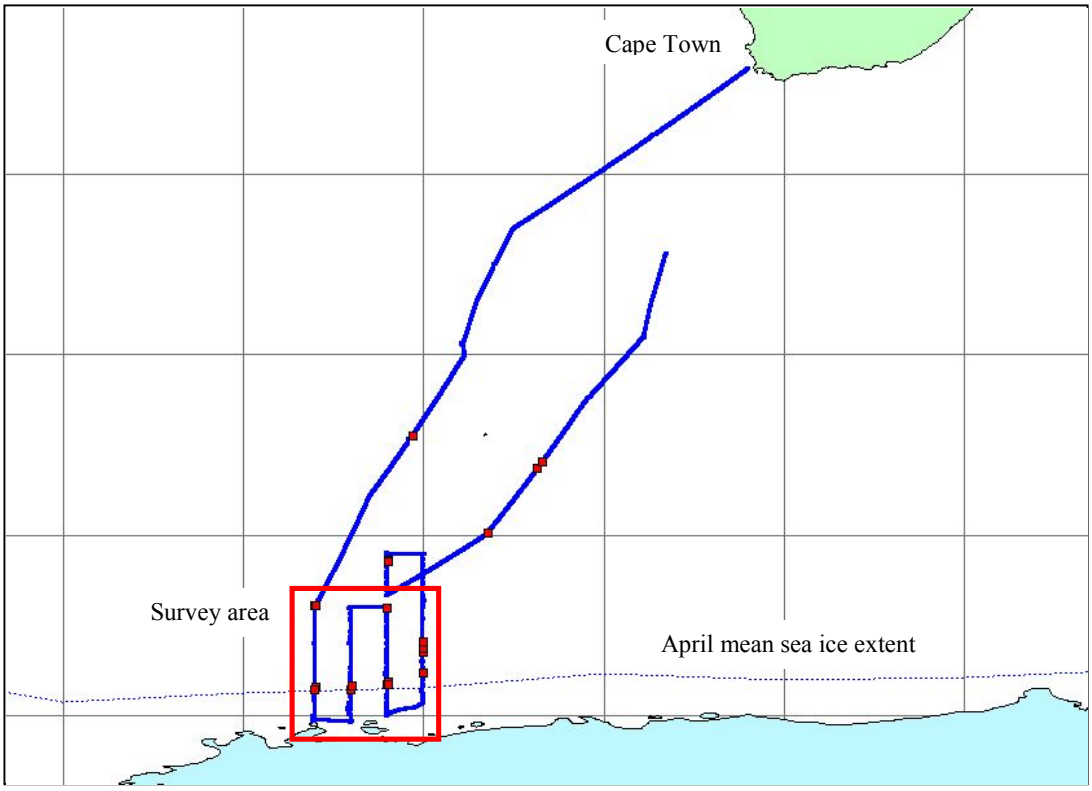

Figure 4. Polarstern ANTXII/5Map of transit and survey area with all cetacean sightings and April mean sea ice extent. Note apparent correlation with sightings and sea ice.

III. Western Antarctic Peninsula – USA mooring recovery and redeployment

RV LAURENCE M GOULD LMG 0403- 29 March – 13 April 2004

Visual survey, photo identification and sea ice data were collected on this cruise.

Methods

Survey protocols were the same as those used on NBP 0402 (see cruise report I this paper).

Visual survey preliminary results

The route from Punta Arenas to the first seafloor recorder Northeast of Elephant Island was mostly foggy and the swells were high making whale observation difficult. On arrival at the seafloor recorder site and waiting most of the night for daylight, the morning broke with clear weather and recovery was straightforward, although the recorder recovered only about the first third of the hoped for full year of continuous data at this site. Leaving the site, back towards Palmer Station, the fog soon closed in again, with one break in the fog revealing a lot of whales, just north of Elephant Island. Within about 10 minutes we had sighted approximately 30 fin whales and one group of Southern Bottlenose whales, before the fog closed in again, along with an estimated 4000 prions. Unfortunately we were late for arrival at Palmer Station and could not stop. Photographs of the Southern Bottlenose whales were obtained. The Gerlache Strait to and from Palmer Station had the usual abundance of humpback whales, though the ratio of animals with calves seemed higher than normal, perhaps because of the lateness of the season. Passage across the Drake Passage was relatively rough weather limited whale observations, though the recovery and replacement of the seafloor recorder at site S1 went smoothly, recovering a full year of continuous data. Cetacean sightings for this voyage have been plotted (Figure 5.) and are presented in Table 4.

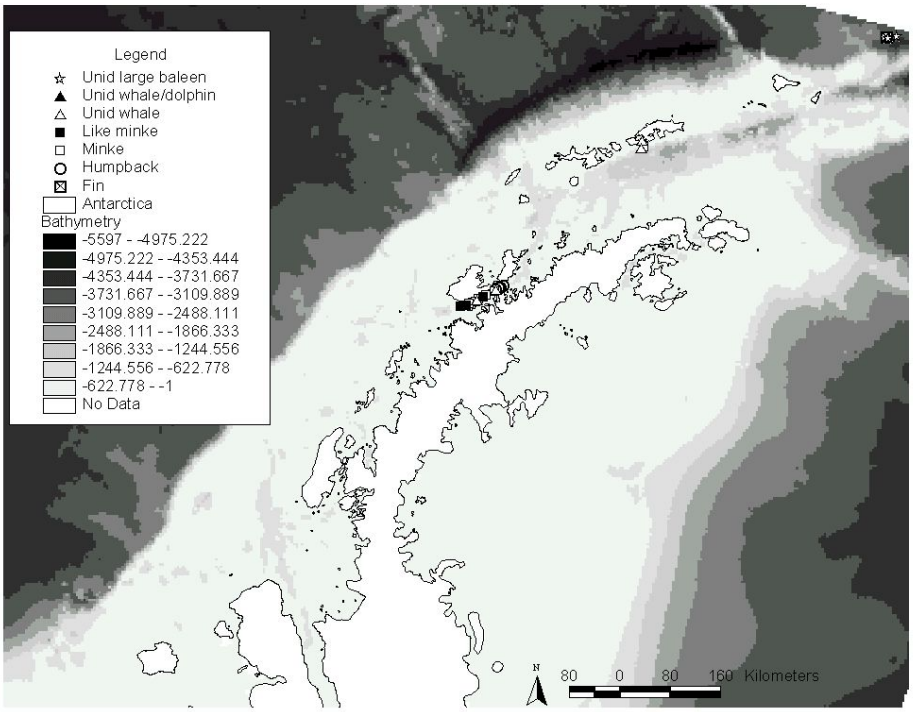

Figure 5. LMG 0403 cetacean sightings

Table 4. LMG 0403 Total cetacean sightings

GPS Latitude S	GPS Longitude W	species common name	Bestno
-60.07983	-52.28783	unidentified large baleen whale	3
-60.13717	-52.51150	unidentified large baleen whale	5
-60.13850	-52.51633	unidentified cetacean (whale/dolphin)	3
-60.14967	-52.55916	fin whale	30
-62.25684	-58.78383	unidentified whale	1
-62.33450	-58.70183	undetermined minke whale	1
-62.37317	-58.76183	unidentified whale	1
-64.52700	-62.47917	humpback whale	4
-64.55183	-62.57250	humpback whale	2
-64.56234	-62.61200	humpback whale	2
-64.58601	-62.70234	unidentified whale	1
-64.58750	-62.70833	humpback whale	2
-64.59766	-62.74733	undetermined minke whale	2
-64.67083	-63.00850	undetermined minke whale	1
-64.70334	-63.09534	undetermined minke whale	3
-64.72617	-63.24567	undetermined minke whale	2
-64.75417	-63.29817	unidentified whale	1
-64.76584	-63.32050	undetermined minke whale	2
-64.79583	-63.52750	undetermined minke whale	1
-64.83183	-63.62317	undetermined minke whale	1
-64.86100	-63.82700	undetermined minke whale	2
-60.14967	-52.55916	Southern bottlenosed whale	

IV. East Antarctica – Casey ice edge and mooring deployment

Aurora Australis Voyage 7 - 17 February to 12 March 2004

Visual survey and sea ice data were collected on this cruise, and one ARP was deployed. This voyage provided the opportunity to deploy one ARP off the coast of Casey base, and to conduct visual survey and along-track passive acoustic monitoring using sonobuoys. Sea ice data was collected using the new Sea Ice LOGGER program as reported in SC/56/E23 and 25.

Visual survey methods

Collectively the time spent on Full Effort by both observers was approximately 55 hours, with a further 88 hours on Casual Observations. On a small number of occasions observers remained Off Effort but maintained a presence on the bridge, to monitor conditions etc. These hours are not included as no active observation was conducted. Two helicopter surveys were conducted opportunistically at Macquarie Island.

Visual survey preliminary results

Observations throughout the voyage were frustrated by poor sightings conditions, with Sea State between 5 and 7 experienced for much of the time. Another unfortunate coincidence was the small amount of ice habitat observed. Although satellite images showed considerable ice concentrations in the waters north of Casey, the

officers managed to locate a relatively thin ice band to the west. Furthermore, our timing was such that the ship's passage through this ice, on both the inward and outward journeys, occurred for the most part during hours of darkness, with only an hour or so of IceData able to be recorded. Icebergs were seen, but at considerable distance, much to the disappointment of the three artists on board as well. Very few cetaceans were observed during the voyage. This is likely to be largely due to the lack of good sighting conditions and the brevity of time spent in ice habitat during daylight. During two opportunistic helicopter surveys (Casey - Thursday 26 February and Macquarie Island - Tuesday 9 March) two pods of two minke whales were observed on the first and no sightings were made on the second. . Cetacean sightings are presented in Table 5 and plotted in Figure 6. A brief period of ice data collection was possible on the morning of Thursday 26 February before the ship arrived at Casey. The ARP was deployed at position 63 49.2S 111 45.2 E on Wednesday 25 February. Distant bergs were sighted the same day, and that night the ship encountered ice.

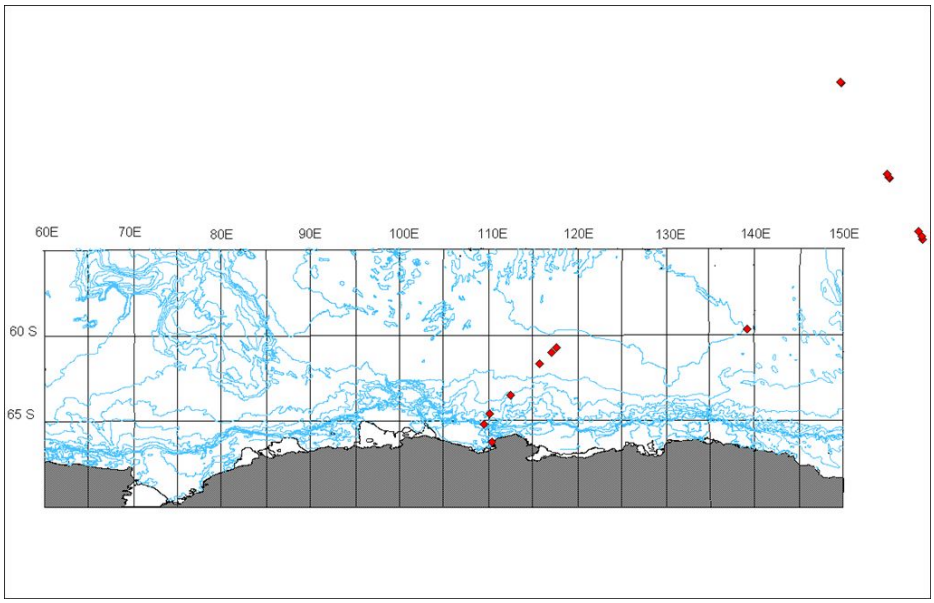

Figure 6. Cetacean sightings SOCEP AA Voyage 7 2003/04

Table 5. All on effort sightings V7 AA 2003/04

Species	**Groups**	**Individuals**
Undetermined minke whale	3	5
Unidentified whale	2	3
Like minke whale	1	1
Like ordinary minke whale	1	1
Like humpback whale	1	1
Killer whale	1	5
Unidentified small whale	1	1
Unidentified large baleen whale	2	3
Sperm whale	2	2
Like fin whale	1	2
Unidentified small cetacean	1	3
Total	**16**	**27**

Passive acoustic methods

Acoustic monitoring for cetaceans was conducted aboard the *RSV Aurora Australis* during the Australian Antarctic Division's Voyage 7, from February 17 to March 12, 2004. Acoustic operations were designed to meet two goals: 1) monitor for the presence of cetaceans during transit between Tasmania and Antarctica, including the waters near Macquarie Island, particularly in association with visual detection and identification of species and 2) deploy an Acoustic Recording Package (ARP) near Casey Station, Antarctica, for long term monitoring of baleen whale acoustic presence in the region. Acoustic detection of visually identified whales and dolphins aids in the assignment of particular call types to various species, and may allow for the determination of vocalization rates in some species. Underway acoustic operations with sonobuoys also provide an alternative means of assessing cetacean presence in the region, as weather, distance, or poor sighting conditions may prevent the detection of whales visually. Long-term acoustic monitoring provides a low cost, and effective means of surveying baleen whale presence, particularly in Antarctic waters, were wintertime operations are infrequent, and visual surveys likely inadequate.

Sonobuoys were deployed periodically each day to monitor for the presence of calling whales, and when the visual observers sighted any cetacean species. Approximately 40 sonobuoys were available for use during this survey. The voyage mission was to retrieve personnel from Casey Station, and to resupply Macquarie Island. Dedicated time for baleen whale monitoring was not allocated, and therefore acoustic detections of whales could not be pursued to determine group size, behaviour, or in species ID in cases when it could not be determined by the acoustic signals alone. The date, GMT and local time, position, buoy life and sensor depths for each deployment are listed in Table 6.

Omni-directional, type 57 sonobuoys used for this survey were obtained from the United States Navy after the shelf life of the buoy had expired. The sonobuoy transmits the acoustic signal at a sample rate of 48kHz on a pre-programmed VHF radio carrier in an analog multiplexed format. Sonobuoy sensor depths can be pre-set to deploy to depths of 90, 300 or 1000 feet. The life of the buoy can be set for various times from 1 to 8 hours, at which time the buoy scuttles itself. The buoys are stripped of all packing materials and unnecessary components before being deployed. Sonobuoys were deployed from the Bridge (A) deck of the Aurora Australis while travelling at speed up to 15kts. The VHF radio signal from the sonobuoys was received using an antenna previously mounted by the AAD on the rail of the upper deck of the *Aurora*.

A single ICOM R100 radio was used to receive the sonobuoy signal. The radio had been previously specially modified and calibrated by Greeneridge Sciences to provide flat frequency response from about 10 Hz to 20 kHz. The signal from the radio was recorded at 48 kHz sampling rate on Sony TCD-D8 digital audio tape recorder and to an externally connected computer hard disk. Tapes were maintained and have been placed in an archive at Scripps Institution of Oceanography (SIO). Each tape was numbered and the sonobuoys recorded to each tape are listed in Table 6. The signal was played through the DAT to an external sound card (Creative Extigy) that was connected to a laptop. The acoustic signals were monitored in real-time on the laptop using the spectrographic display software Ishmael. At full ship speed of approximately 15 kts, each sonobuoy was generally within radio reception range for 30 to 40 minutes.

An acoustic recording package (ARP) was provided by SIO to be deployed near Casey Station, Antarctica to monitor the long-term presence of baleen whales in that region. An ARP consists of two pressure cases which contain batteries and recording hardware, two weights suspended on acoustic release wires, a hydrophone designed to record sound at 500 Hz sample rate, and floatation. The onboard acoustic transponder system allows for querying the instrument prior to release from the seafloor, and allows the ability to track the instrument as it falls to the seafloor. The ARP must be enabled to receive transponder signals, and therefore is generally signalled to disable upon landing on the seafloor to prevent its premature release. Prior to deployment a recording scheme is sent to the ARP from a laptop computer, programming the acquire time, sample rate, number of recording cycles, and emergency shut-off voltage.

Passive acoustic preliminary results

A total of 35 sonobuoys were deployed during the transit between Tasmania and Antarctica and back via Macquarie Island. Because of the short supply of buoys, no sonobuoys were deployed during the first several days of the voyage, as weather conditions prevented the visual observers from watching for whales. We were attempting to retain as many buoys as possible for potential sighting of whales as the weather cleared and we neared the ice edge. A map of all sonobuoy deployment locations and the whale species or sound type recorded from them is shown in Figure 7.

Three species of cetacean were acoustically detected during the survey: sperm whales (*Physeter macrocephalus*), a blue whale (*Balaenoptera musculus*), and killer whales (*Orcinus orca*). In addition, there were several sounds were detected which were of unknown origin. One five occasions during the transit between Casey and

Macquarie Island, downsweep calls lasting nearly two to three seconds duration were heard. The sounds were commonly swept from 27Hz to 60-70Hz, and have been termed "27Hz sounds" for the purposes of this report. Several other unidentified sounds with highly variable frequency, amplitude, and duration characteristics were also occasionally detected, particularly on the transit from Macquarie Island to Hobart, Tasmania. While there were occasional sightings of minke whales (*B. acutorostrata*) during the survey, no minke whale sounds were heard on any sonobuoy deployments. On one occasion, northwest of Macquarie Island, there was joint visual and acoustic detection of sperm whales. All other acoustic detections were independent of visual sightings.

The ARP was deployed on approach to Casey Station, Antarctica at on February 24, 2004 at 2:04am GMT, at 63° 49.220 S, 111° 45.240 E in 3000m of water. The ARP has been set to record for 720 days at 500 Hz sample rate. The ARP was successfully tracked to the seafloor with the acoustic transponder system and disabled.

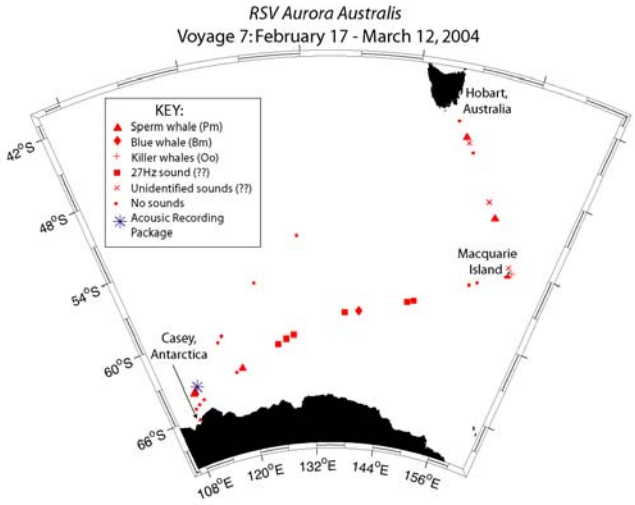

Figure 7. Sonobuoy deployment locations during the Australian Antarctic Division, 7oyage 7 aboard the *RSV Aurora Australis*.

V. EAST ANTARCTICA – MAWSON COAST MOORING RETRIEVAL

MV Vasiliy Golovnin Voyage 5 - 17 February to 12 March 2004

One ARP was retrieved from the Mawson Coast. It had been deployed for one year. Analysis of calls is currently underway.

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Web site address for IWC cetacean summaries by cruise, cruise reports, and technical US SO GLOBEC reports:

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