2007-2008 International Whaling Commission-Southern Ocean Whale and Ecosystem Research (IWC-SOWER) Cruise

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ABSTRACT

We conducted the 30th annual IWC-SOWER (formerly IDCR) Cruise in the eastern part of Antarctic Area IV aboard the Japanese Research Vessel *Shonan Maru No.2*. The cruise departed Fremantle, Australia on 24 December 2007 and returned to Benoa, Bali, Indonesia on 26 February 2008. The cruise had three main objectives: 1) survey waters outside the pack ice for minke whales in collaboration with an aerial survey of waters inside the pack ice conducted by the Australian Antarctic Division; 2) continue research as in previous years on blue whales, and; 3) continue research as in previous years on fin, southern right, and humpback whales. After transiting to the research area, we carried out a whale survey including several method experiments designed to improve and interpret estimates of Antarctic minke whale abundance from previous cruises and to inform the design of future SOWER cruises. From 31 December to 13 January a systematic survey for minke whales was conducted west to east (105°-120°E), in two survey strata. This portion of the survey was intended for collaborative, synchronized coverage with a 15-day Australian aerial survey, however the aerial survey was cancelled. The same research area was re-surveyed, east to west, 13 January to 13 February. During the intended collaborative survey (west to east), a total of 1269.8 n.miles were surveyed in two modes: SS-II Mode (660.5 n.miles) and IO Mode (609.3 n.miles). During the re-survey a total of 1049.5 n.miles was covered (481.6 n.miles in SS-II Mode and 567.9 n.miles in BT-Option II Mode). The total number of minke whales sighted during the entire coverage of the research area was 35 groups, 71 animals. Humpback whales were the most frequently sighted species in the research area, with 283 groups, 483 animals observed. One group of two Antarctic blue whales was sighted adjacent to the ice edge on 10 February at 64°29'S 105°27'E. Identification photos, video, and acoustic recordings were collected. Sightings of other large baleen whales included fin whales (14 groups, 42 animals) and southern right whales (7 groups, 8 animals). An additional, solitary southern right whale was observed during the transit from Fremantle to the research area at 40°29'S 112°41'E. Nine groups (62 animals) of killer whales were sighted in the research area. One group (11 whales) was assessed to be type A and one group (2 animals) was assessed to be Type B. The remaining 7 groups were of undetermined type. Notable sightings during the cruise included 5 groups, 6 animals of spectacled porpoise. During the cruise biopsy samples were collected from 3 fin, 7 humpback, 9 right, and 1 killer whale. Photo-ID images of 2 blue, 3 fin, 56 humpback, 9 right, 28 minke, and 16 killer whales were obtained. Acoustic recordings were conducted at a total of 48 stations using sonobuoys. Sounds attributed to blue whales were recorded during 8 opportunistic stations and 1 station conducted in the vicinity of the sighted blue whales. During SOWER 2007-08 the Estimated Angle and Distance Training Exercise and Experiment was completed as in previous years.

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INTRODUCTION

The 2007-2008 International Whaling Commission - Southern Ocean Whale and Ecosystem Research Program (IWC-SOWER) Cruise was conducted from 24 December 2007 to 26 February 2008. The cruise was the thirtieth in a consecutive series of Antarctic cruises conducted by the IWC. The first eighteen cruises were conducted under the auspices of the International Decade of Cetacean Research (IDCR) and known as the IWC/IDCR Southern Hemisphere Minke Whale Assessment Cruises. The subsequent and twelve most recent cruises were part of the IWC-SOWER Circumpolar program. The first twenty-six cruises focused on obtaining data to estimate the population size and distribution of minke whales south of latitude 60°S and comprised the first, second and third circumpolar series of surveys. A new phase of research was initiated during the 2004-2005 cruise.

The 2007-2008 cruise continued the research begun during the 2004-2005 cruise. The main objectives for the 2007/2008 cruise were to:

1) collaborate with an aerial survey within and outside the pack ice to be undertaken by the Australian Antarctic Division (AAD) with respect to providing information on minke whales in the pack ice; as well as to carry out a series of survey experiments designed to improve and interpret estimates of Antarctic minke whale abundance from previous cruises and to inform the design of future SOWER cruises.

2) continue research on blue whales (including collecting biopsy samples, acoustic data, photographs for identifying individual animals and behavioural data);

3) continue research on fin whales, southern right whales and humpback whales, especially on stock structure (including collecting biopsy samples and individual identification photographs).

Initial planning for the cruise was undertaken at the 2007 Meeting of the IWC Scientific Committee (IWC in Press). Logistical aspects for the cruise and operations of the ships were finalized at a Planning Meeting held in Tokyo on 29 September – 3 October 2007 (Anon. 2007a).

The IWC provided partial funding for the cruise. The Government of Japan provided the research ship, the *Shonan Maru No. 2.* This ship has been used for all of the IWC-IDCR/SOWER cruises since the 1981-82 cruise. Specifications of the ship are given in Appendix A.

The research area for the cruise, 105° - 120°E (in Area IV) was selected to coincide as precisely as possible with the Australian Antarctic Division aerial survey planned to operate from Australian Antarctic Casey Station (66°17'S, 110°32'E) since the collaborative survey was the priority research item for the cruise.

Research in this area had been previously undertaken during the 1978-79, 1984-85, 1988-89 IWC/IDCR cruises and during the 1998-1999 IWC-SOWER cruise.

The cruise was planned to operate from Fremantle, Australia, however during the cruise, the post-cruise home port was changed to Benoa, Bali, Indonesia.

Personnel

Four researchers were selected for the cruise Paul Ensor (cruiseleader, New Zealand), Laura Morse (USA) Paula Olson (USA) and Keiko Sekiguchi (Japan).

Schedule

Listed below is the cruise itinerary.

Date	Event
21-Dec	*Shonan Maru No.2* arrived Fremantle Harbour, Australia
22-Dec	Pre-cruise Meeting
24-Dec	*Shonan Maru No.2* departed Fremantle Harbour
25-Dec	*Shonan Maru No.2* departed the 200 n.mile EEZ of Australia
31-Dec	Minke whale survey, Collaborative (collaborative research with the planned AAD aerial survey) commenced from position 63°55'S 105°01'E
1-Jan	Estimated Angle and Distance Training
13-Jan	Survey, Collaborative completed at position 64°17'S 120°00'E
13-Jan	Re-survey (East to West survey) commenced at position 64°30'S 120°00'E
11Feb	*Shonan Maru No.2* conducted Estimated Angle and Distance Experiment
13-Feb	East to West survey completed at position 61°58'S 106°52'E and transit commenced to Benoa Harbour, Indonesia
24-Feb	Post-cruise Meeting held aboard the ship
25-Feb	*Shonan Maru No.2* entered the 200 n.mile EEZ of Indonesia
26-Feb	*Shonan Maru No.2* arrived Benoa Harbour, Indonesia
29-Feb	*Shonan Maru No.2* departed Benoa Harbour, Indonesia

OBJECTIVES and METHODS

The main objectives for the 2007-2008 IWC-SOWER cruise were to:

1) conduct a shipboard survey collaborative with an aerial survey to be undertaken by the Australian Antarctic Division (AAD) within and outside the pack ice to provide information on minke whale distribution relative to pack ice. This was a priority research item for the SOWER cruise;

2) carry out a series of survey experiments designed to improve and interpret estimates of Antarctic minke whale abundance from previous cruises as well as to inform the design of future SOWER cruises. This includes the survey modes SS-II and BT – Option II. Other experiments conducted were SCANS II video system, minke whale visual dive times, and angle & distance estimation;

3) continue research on blue whales (including collecting biopsy samples, acoustic data, video, photographs for identifying individual animals and behavioural data);

4) continue research on fin whales, southern right and humpback whales, especially for stock structure (including collecting biopsy samples and individual identification photographs).

46 days in the research area were allocated as follows:

- 21 days to the collaborative survey with the aircraft
- 21 days to resurvey of the longitudinal range covered during the collaborative survey
- 3 days for blue whale and southern right whale research
- 0.5 days for angle and distance estimation experiments
- 0.5 days for minke whale visual dive time experiments

Minke Whale Research

During the collaborative research with the aerial survey, the SOWER vessel was to survey the research area (105°E - 120°E) from west to east (referred to as the 'collaborative survey' in this report). After the collaborative research, the SOWER vessel would re-survey from east to west using the same cruisetrack design. This would be the first time that SOWER has been able to monitor changes in spatial distribution on systematically constructed tracklines within the survey season. It was also anticipated that in the intervening period between the collaborative survey and the re-survey, at least in some sections of the research area, the pack ice edge would recede to a position south of the continental slope front. The data obtained during the re-survey may facilitate investigation of the relationship between the density of minke whales and the continental slope front vs the ice edge.

Collaborative research with the aerial survey for whales

Collaboration between the SOWER cruise and the Australian Antarctic Division aerial survey was the highest priority research item for this cruise. The aerial survey would provide important information on minke whales in the pack ice – this is relevant to both interpretation of past cruise data and the design of future SOWER cruises.

The SOWER research was to be synchronized temporally and within the same longitudinal area as the Australian Antarctic Division aerial survey: from 1-15 January, between longitudes 105°E and 120°E. The aircraft would survey from the Antarctic coast covering the pack ice zone and ice-free water approximately 60 n.miles north of the ice edge. The SOWER vessel was to survey an area extending from the ice edge to approximately 180 n.miles north, thus providing approximately 60 n.miles overlap with the aerial survey.

The SOWER research area was to be covered in two contiguous strata (southern and northern). The southern stratum was to extend 60 n.miles north from the ice edge and a standard SOWER cruisetrack design and coverage intensity was planned. There was not sufficient time available for the SOWER vessel to cover the entire area between the ice edge and the standard SOWER northern boundary at 60°S; the SOWER survey would be restricted approximately 180 n.miles north of the ice edge (i.e. approximately 120 n.miles north of the Interstratum boundary). In addition there was insufficient time available to complete a normal SOWER zigzag cruisetrack in the northern stratum. The northern stratum cruisetrack was to be constructed as either bisectors of the southern stratum trackline or north-south lines and would be surveyed on both directions.

The SOWER collaborative survey was to be synchronized as much as possible with the aerial survey, however, the vessel would require a longer duration (approximately 1-21 January) to achieve normal SOWER survey intensity in both strata.

If sufficient sample size were obtained then in principle this would allow calibration of the aerial and vessel surveys and thus comparison of densities among the northern, southern strata and within-ice strata.

A contingency plan in the event that the aerial component could not be undertaken for logistical reasons was for the vessel component to be undertaken as planned. This would provide valuable information for an area which may be a future target of aerial surveys and the comparison allowed by re-surveying the same area later in the cruise would still be informative.

Survey Modes

Investigation of minke whale school size estimation was to be continued during this cruise and SS-II mode (abeam closure from Passing mode (NSP)) was to be used instead of normal closing mode (NSC) for the entire survey. During the collaborative survey SS-II mode was alternated with IO mode. To further evaluate BT mode (Buckland and Turnock, 1992) survey methodology as a protocol for future SOWER minke whale surveys, BT-Option II was to be used instead of IO mode during the re-survey of the research area.

When SS-II or Passing mode (NSP) were the only activities of the day, research was conducted for 12 hours between 06:00-18:00 hrs. During days when survey was conducted in Passing mode with independent observer (IO mode) research was scheduled for 12 hrs a day between 06:00-19:00 hrs to allow for two 30-minute meal breaks. Research was scheduled for 12 hrs a day during the transits to and from the research area.

SS-II

A school size estimation experiment was incorporated into normal survey by substituting SS-II mode in place of NSC mode on this cruise. The aim was to continue the investigation into the difference between confirmed school sizes of minke whales (mainly obtained during NSC mode) and unconfirmed school sizes (mainly obtained during Passing mode).

School size estimation experiments had been previously undertaken during the 1984-85 and 2006-07 cruises. On the 2006-07 cruise school size experiments were mainly undertaken in IO mode (SS-III experiment) so as to most closely relate to previous SOWER normal survey methods; however some additional trials were also conducted in NSP mode (SS-II). The results for SS-II during 2006-07, were not significantly different from SS-III, therefore as SS-II is logistically easier to incorporate into the cruise, this year emphasis was placed on SS-II trials. Abeam closure was attempted on all minke whale and 'like minke whale' sightings with the proviso that only sightings for which the initial estimates of perpendicular distance from the trackline was less than or equal to 1.5 n.miles were considered for closure. The methods to be used for the SS-II mode trials are provided in Anon (2007b).

BT – Option II mode

Analyses of IO (Passing with independent observer) mode data on ICDR/SOWER cruises suggest that estimates of g(0) are positively biased and thus yield negatively biased abundance estimates. It has been suggested that a reason for this is that observers on the two platforms used for these analyses (the Top Barrel and the IOP) search in the same area of the sea. BT mode is a possible alternative method of searching because it intends to separate the areas searched by the two platforms (Tracker and Primary), with the Tracking platform searching an area ahead of the area searched by the Primary platform. This separation of search areas may yield estimates of abundance with reduced bias. Sightings made by the Tracker thus serve to set up binary trials for observations made by the Primary platform ('Seen' or 'Not Seen').

BT mode trials (using BT-Option II as trialled on the 2006-07 cruise) constituted a substantial part of the research planned for this cruise in accordance with the recommendation of the Scientific Committee to further investigate the method as a potential future survey protocol for minke whales. For BT-Option II the location of the Tracker Platform was the Top Barrel (with the two observers searching 60° either side of the trackline using 7x50 binoculars) and the Primary Platform was the IOP (with two observers; one topman and one researcher searching 90° either side of the trackline with naked eye). Both the Tracker and the Primary Platforms tracked minke whale sightings until they were estimated abeam with all re-sightings recorded. Full details of the methods used for BT-Option II mode trials are described in Anon (2007b).

Video distance and angle measurement (SCANS II)

With respect to the continuing concerns related to SOWER distance and angle estimates, the IWC Scientific Committee recommended that more data related to distance and angle measurements should be obtained on the 2007-08 cruise using at least some components of the SCANS II video recording system. The SCANS II system had been used on the 2006-07 cruise, however few minke whale blows were detected on video during the 2006-07. The main reason for the paucity of blows recorded appeared to be related to poor image quality and the characteristics of minke whale blows. For the 2007-08 cruise, video recordings of minke whale cues detected by

one observer in the Top barrel were to be attempted using improved equipment. A high definition video camera (Canon HV20) was to be attached to the 7x50 binoculars of one of the two observers in the Top barrel. Bearing measurements were to be made using a still camera.

Minke whale visual dive time experiment

The purpose of this activity was to collect data on the surfacing rate of minke whales for use in estimation of $g(0)$. The visual dive time recordings are useful since they provide data on cue availability in different weather conditions and for different school sizes, as well as on school synchrony and dive behaviour. The visual dive time experiment was an important part of the minke whale research conducted on the 2004-2005 cruise. Although additional trials of the experiment were planned for the last two year's cruises there were no opportunities.

The trials were to be continued during the 2007-08 cruise and one half day of research time was allocated to the dive time experiment. Previous dive time data collected on the 2004-2005 cruise were restricted to observations in good conditions only (mainly Beaufort sea states 0, 1 and 2) and few trials were completed on solitary animals. During this cruise emphasis was to be placed on conducting additional trials on solitary animals in a range of sea states trials as well as on a range of group sizes in poorer conditions (Beaufort sea states 3 and 4), but within the standardized range of acceptable searching conditions. For a description of the protocol refer to Anon (2007b).

Angle and distance experiments

An Estimated Angle and Distance Training Exercise and Estimated Angle and Distance Experiment were planned using the same protocol as on recent cruises (Anon. 2007b).

Blue whale research

Blue whale research was to be conducted during a maximum of three days allocated to biopsy and photo-identification of the priority species during the cruise. The blue whale research included a continuation of research focused on trying to discriminate between the 'Antarctic' and 'pygmy' subspecies of blue whale, including the collection of skin samples for genetic analysis, photographs for identification of individuals, acoustics recordings, and behavioural observations including collection of video recordings. During the Blue Whale Research Component we used the same research protocol as on recent IWC-SOWER cruises. Methods and equipment used for biopsy, photo-identification, and acoustic recordings are given below.

Blue whales were to be approached to within 1 n.mile and for at least a 30-minute duration, dive times were recorded if feasible. The whales were then approached for biopsy, photo-identification, and videotaping. The surfacing behaviour of blue whales was recorded from the Top Barrel on high-resolution digital video (Panasonic digital video camera NV-GS200K. Acoustic recording using sonobuoys was to be conducted.

Fin, southern right and humpback whale biopsy sampling and photo-identification

For the 2007-08 cruise the priority species for biopsy and photo id (blue, fin, southern right, and humpback whales) remained unchanged from recent cruises. Three days of research time was allocated to biopsy and photo-id studies. Opportunities were to be taken for collection of biopsy samples from sperm and killer whales as well as other 'incidental' species during the normal process of confirming species identification and numbers, or if animals approach the vessel while off-effort.

Although not part of the planned research on the most recent cruise (2006-07), minke whales were photographed opportunistically during normal closing mode procedures. On the 2007-08 cruise, photo id of minke whales was also to be undertaken opportunistically, provided it would not use any additional research time and would not interfere in any way with the priority items of research.

Two types of biopsy equipment were available on board: Larsen guns and compound crossbows. The IWC-owned Paxarms guns, which are normally available on these cruises, were not on board as they had inadvertently been omitted from a freight consignment from South Africa.

Biopsy tissue samples were split, with one half for Japan and the other half for IWC. All samples were frozen. When samples had a "significant" amount of blubber attached, the blubber was removed from the skin, and frozen.

Photographs for identifying individual whales were obtained using digital cameras (Canon EOS 20D) each equipped with a 100-400 mm image-stabilized zoom lens. Additionally, researchers used their personal digital cameras and contributed images.

Acoustics Research

As for recent SOWER cruises acoustic recording this year focused on obtaining, blue whale recordings, with the aims of potentially distinguishing 'Antarctic' from pygmy blue whales and comparison with other regions worldwide. Acoustic recordings were made using sonobuoys (Ultra Electronics 53D DiFAR, manufactured 2003 and Hermes Electronics 53D DiFAR, manufactured 1990). The majority of the sonobuoys were programmed for 30 m depth (with a few set to 120m) and all were set for 8 hours. Channels 80-90 were primarily used as these most closely matched the frequency response of the *Shonan Maru No. 2* antenna. Sonobuoy signals were received by an Icom IC-R100 communications receiver, with output to a computer for recording to hard disc. Signals were monitored in real time on multiple computers (Dell Inspiron 6000, Apple Powerbook G4, Acer Extensa 4620z using the programs Ishmael (D. Mellinger) and Raven (Cornell Lab. of Ornithology). Signals were also monitored in real time using the program Ishmael on the ship's NEC computer. The receiving equipment had been tested and evaluated since the last cruise (see Appendix B for a summary of the tests).

Ice Edge Information

Ice edge information was critical for construction of the cruisetrack for the SOWER vessel and ice information was received from two sources:

1) daily Advanced Microwave Scanning Radiometer (AMSR-E) passive microwave images (available at http://iup.physik.uni-bremen.de:8084/amsr/amsre.html); were sent to the SOWER vessel from the Australian Antarctic Division (after transformation at AAD). See Appendix B for details.

2) via the Internet from the US National Ice Center (NIC) during the cruise. (Available at http://www.natice.noaa.gov: SSM/I satellite image data provided on a daily basis.) As with recent cruises the SSM/I data were transformed aboard the vessels (by programs developed at ICR), from polar stereographic to Mercator projection.

Oceanography

No oceanographic sampling was planned, as on the last two year's cruises. Two ARGOS floats were provided under the ARGOS oceanographic programme to be deployed at latitudes 55°S and 56°S during the transit from Fremantle to the Antarctic.

Coordination with JARPAII

Normally the areas of operation of the SOWER minke whale sighting survey and the JARPA programme are in different Antarctic Areas. This was the second time for which the areas of operation of the SOWER minke whale sighting survey and JARPA programmes coincided. The previous occasion the SOWER and JARPA vessels operated in the same general area was in 2002/03 in Area V when, as a priority, the SOWER cruise was to complete the third circumpolar coverage. This year, the SOWER research area was selected so that the priority research item for the cruise, synchronized collaborative research with the Australian Antarctic Division aerial survey, could be accomplished. During this cruise the primary rule was that the SOWER vessel always preceded JARPAII. JARPAII kindly coordinated their activities with ours.

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NARRATIVE, RESULTS AND DISCUSSION

The following section is a descriptive account of the major aspects of the cruise. Details of the survey area, and cruisetracks are presented in Figures 1a-e.

PRE-CRUISE MEETING AND TRANSIT TO THE ANTARCTIC RESEARCH AREA

The *Shonan Maru No. 2* arrived in Fremantle Harbour on 21 December 2007, and a Pre-cruise Meeting was held on 22 December at the Maritime Museum, Fremantle. The ship departed Fremantle at 15:00hrs on 24 December.

Given the time constraints in reaching the research area from Fremantle, only Passing mode survey was conducted during the transit, including within the Australian Exclusive Economic Zone (EEZ). No permit for research in the EEZ was required as only passing mode would be undertaken there. Research in NSP mode was conducted within the EEZ of Australia for a total of 12.00 hours (137.3 n.miles) and good sighting conditions were experienced. The vessel departed the EEZ on 25 December at position 37°35.0'S 113°24.0'E at 22:40hrs.

Between the boundary of the Australian EEZ and the intercept with latitude 60°00'S weather conditions were mainly poor; a total of 19.19 hours (228.5 n.miles) of searching in NSP mode was conducted. The vessel intersected 60°00'S (at longitude 106°39'E) at 19:20hrs on 30 December. During the transit the acoustics equipment was tested. Two Argo buoys were successfully deployed on 29 December at positions 55°00'S 108° 28'E and 56°00'S 108°07'E.

The ship arrived at the starting point for the minke whale research on the afternoon of 31 December.

COLLABORATIVE MINKE WHALE SURVEY, (WEST TO EAST)

Collaboration with the Australian Antarctic Division Aerial Survey

The priority research item, synchronized collaborative research with the AAD aerial survey, did not eventuate as the full-scale, 15-day aerial survey was cancelled. The aerial survey was restricted to three test flights carried out on 14, 16 and 23 January. The test flights were conducted over pack ice in Vincennes Bay and Petersen Bank, west of Casey Station. At the time of the test flights, the SOWER vessel had completed coverage of the research area west to east (originally intended to be synchronized with the full-scale aerial coverage) and had commenced re-survey (east to west) of the research area.

Collaborative Survey

The collaborative survey of the research area commenced from the western border of the research area (105°00'E) at an ice edge waypoint at position 63°55'S 105°01'E on 31 December (15:10hrs) and was completed at 120°E on 13 January (09:17hrs).

During the collaborative survey, from the SOWER vessel a total of **112.73** hours of searching was conducted and **1269.8** n.miles were covered on primary effort: SS-II mode - **660.5** n.miles (**58.72** hours) and IO mode - **609.3** n.miles (**54.01** hours).

A summary of research effort by mode during the collaborative survey is presented in Table 1. Sections of the trackline covered on primary effort during the collaborative survey are shown in Figure 1d.

For almost all of the survey period very good weather, calm seas and excellent sighting conditions were experienced. Of the 150.11 hours available for research only 16.52 hours (11.0%) were lost to poor weather. The stable, very good weather conditions resulted in completion of coverage for the collaborative survey 7 days ahead of the scheduled date.

As planned, the research area was divided into two contiguous strata (southern and northern). The southern stratum was approximately 60 n.miles in width and the northern stratum extended 120 n.miles north of the southern stratum. Survey in both strata was conducted in alternating SS-II and IO modes. Each survey leg was divided in half by survey mode. The cruisetrack was constructed in relation to an estimated ice edge based on satellite information.

The cruisetrack during the collaborative survey totalled 1378.9 n.miles (including a bisector 10.9 n.miles in length) and a total of 1269.8 n.miles (92.1%) were covered on effort.

The trackline in the southern stratum comprised 7 survey legs totalling 658.9 n.miles in length (including a bisector 10.9 n.miles in length). The southern stratum trackline was based on a locus interstratum boundary approximately 60 n.miles from the estimated ice edge. Waypoints on the interstratum boundary were initially established at 150 n.mile intervals. In the eastern half of the research area, coverage intensity was increased and the inter-waypoint distance on the boundary was reduced to 120 n.miles, due to very good progress with the survey as a result of the remarkably good weather conditions experienced. Northward adjustments of the

interstratum boundary were made at two waypoints in response to northward movement of the pack ice edge. The aim of the adjustments, perpendicular to the ice edge, was to maintain the width of the southern stratum as close as possible to 60 n.miles and to avoid tracklines running parallel the ice edge. The second of these adjustments resulted in a very small overlap of coverage between the strata.

During the collaborative survey, three north-south tracklines in the northern stratum were constructed totaling 360 n.miles (each 120 n.miles in length). The northern stratum tracklines were originally planned to be bisectors of the Southern Stratum tracklines, however the design was changed and north-south lines were constructed due to the complex configuration of the ice edge (to avoid bisectors potentially crossing over). Another reason for changing the design was that if it were necessary to adjust the interstratum boundary, subsequent to the construction of the northern stratum tracklines, then such lines would no longer represent bisectors of the southern stratum tracklines. The northern stratum tracklines were to be covered in both directions, however two of the tracklines were not completely re-surveyed due to selection of the shortest transits between survey legs when the interstratum boundary was adjusted. This resulted in a total of 30.0 n.miles (4.2%) of the northern stratum trackline not re-surveyed.

A total of 31.9 n.miles was steamed off effort through snow showers and fog patches, mainly in the southern stratum.

Ice obstructed a total of 35.6 n.miles of the constructed trackline. The estimated ice edge approximated the true ice edge. At all ice edge waypoints the pack ice was of relatively high concentration ranging from 06/10 to 8/10 concentration.

During the collaborative survey, research on fin whales, humpback and killer whales was conducted (see Table 2 and Biopsy and Photo-id Sections below). Images of minke whales (potentially of use for photo-id) were obtained opportunistically during SS-II closures with no allocation of research time (see Photo-id Section below).

Estimated Angle and Distance Training Exercise

The Estimated Angle and Distance Training Exercise was conducted on the first survey leg on the afternoon of 1 January during 3.96 hours. During the exercise the observers familiarized themselves with naked eye estimates from the IOP in preparation for BT–Option II mode.

RE-SURVEY OF THE RESEARCH AREA, (EAST TO WEST SURVEY)

Re-survey of the research area was commenced on 13 January (10:18hrs) at the eastern border of the research area and continued until 13 February (17:13hrs).

During the re-survey, the same principles were used for cruisetrack construction and for division of the research area into strata. As well as providing an opportunity to investigate the potential influence of ice recession on minke whale density, the re-survey was also used as a trial for BT-Option II mode as a future survey method for minke whales. For the re-survey, IO mode was replaced with BT-Option II mode, thus the research was conducted in alternating SS-II and BT-Option II modes.

During the re-survey the SOWER vessel conducted a total of **92.76** hours of searching and **1049.5** n.miles were covered on primary effort: SS-II mode – **481.6** n.miles (**43.31** hours) and BT-Option II mode – **567.9** n.miles (**49.45** hours). In addition, searching in BB mode, off the constructed trackline, was conducted during **4.90** hours of research time and a total of **54.2** n.miles was covered.

A summary of research effort by mode during the re-survey is presented in Table 1. Sections of the trackline covered on primary effort during the re-survey are shown in Figure 1e.

Very poor weather conditions were experienced during the re-survey. Of the 380.38 hours available for research 287.96 hours (75.7%) were lost to poor weather. The poor weather conditions delayed survey progress with the result that coverage of the constructed trackline for the re-survey was not completed.

The cruisetrack for the re-survey totalled 1428.9 n.miles (including two bisectors totalling 13.0 n.miles in length) and a total of 1049.5 n.miles (73.4%) were covered on effort. A total of 351.8 n.miles was steamed off effort during poor weather, mainly in the northern stratum.

During the re-survey, three north-south tracklines in the northern stratum were constructed totaling 720 n.miles (each 120 n.miles in length).

The southern stratum trackline comprised eight survey legs totalling 708.9 n.miles in length (including the two bisectors totalling 13.0 n.miles in length). Waypoints on the interstratum boundary were established at 150 n.mile intervals for the first two zigzags. In the western half of the research area the intensity was increased; the

inter-waypoint distance on the boundary was reduced to 130 n.miles for the third zigzag and to 100 n.miles for the final zigzag. In the west of the southern stratum the cruisetrack modified by inverting the final zigzag. Instead of continuing on the original constructed trackline to survey a planned north-south leg in the northern stratum (and also to avoid very poor weather forecast for the north), the vessel transited from the interstratum boundary to the ice edge in the vicinity of 108°E.

Manipulation of coverage probability by modifying the trackline is not standard SOWER trackline construction procedure. However, the modifications were considered appropriate for this cruise for two reasons: 1) it would facilitate construction of an ice edge waypoint adjacent to a location that, according to satellite images, a large coastal polynya was potentially confluent with ice-free water to the north; 2) The continental shelf had become exposed by southward ice recession during the intervening time since the collaborative survey.

On 1 February, from the vicinity of an ice edge waypoint at position 65°15'S 112°02'E, an unsuccessful attempt was made to enter the polynya. The pack ice concentration in this locality was not particularly high, however it comprised bands of brash ice and well developed first year floes that prevented navigation.

Ice obstructed a total of 27.63 n.miles of the constructed trackline during the re-survey.

During the re-survey, research on blue whales, southern right, humpback and killer whales was conducted (see Table 2 and Blue Whale Research Component and Biopsy and Photo-id Sections below). Images of minke whales (potentially of use for photo-id) were also obtained opportunistically during SS-II closures with no allocation of research time (see Photo-id Section below).

Estimated Angle and Distance Experiment

The Estimated Angle and Distance Experiment was conducted on 11 February during 4.15 hours. In addition to the normal trials, observers made naked-eye estimates from the IOP (as for BT–Option II mode). Also, trials were conducted with the SCANS video system for potential use in calibration of that system.

BT-Option II

This was the first SOWER cruise to incorporate BT-Option II as part of standard survey protocol. During re-survey of the research area, BT-Option II mode survey was used on alternate trackline mode segments instead of IO mode. BT-Option II was conducted in both strata, in a range of sighting conditions and initial cue types for minke whales. Sighting rates for minke whales were low and group sizes were small on almost all of the segments of trackline covered during BT-Option II. Although complete coverage of the constructed trackline was not achieved, BT-Option II was conducted during 15 days and on 12 trackline segments; a total of 567.9 n.miles was covered during 49.45 hours of research time.

Sightings during BT-Option II mode, from all platforms combined, included a total of 10 groups of minke whales (comprising 39 animals). The Tracker platform detected a total of 8 groups of Antarctic minke whales. The Primary platform subsequently detected 2 of those minke whale groups. (In addition the Primary platform detected 2 other minke whale groups that were not seen by the Tracker Platform).

The Tracker platform detected 2 groups classified as ‘like minke whale’. These groups were not detected by the Primary platform. The Primary platform detected one group classified as ‘like minke whale’ that was not detected by the Tracker platform. Two additional sightings classified as ‘like minke whale’ were sighted only by the Upper Bridge.

As with the trials conducted last cruise the Tracker and Primary platforms tracked only those sightings believed to be minke whales. Tracking of all sightings, re-sightings and data recording, was accomplished. Voice recordings of all sightings and all minke whale re-sightings detected by the Tracker and Primary platforms were made using the Miyashita voice recording system. The voice recordings were used as a backup as during normal survey the minke whale re-sightings could be recorded in real time.

The distance covered during BT-Option II mode this year was more than twice the distance covered during last years’ trials, however the sighting rate for minke whales was much lower this year. (Last year a total of 276.2 n.miles were covered and 116 groups of minke whales and 30 groups classified as ‘like minke whale were detected). The trials last year were only in the southern stratum of Area III and in an area selected for a high minke whale sighting rate. Implementation of the mode on this cruise during re-survey of the research area provides the basis for a more realistic assessment of the utility of the mode under normal survey conditions in both strata and in more usual minke whale sighting rates compared with the trials conducted last year.

Furthermore, during BT-Option II mode survey this year the species diversity was higher. Humpback whales were the most frequently encountered species and sightings during survey in BT-Option II mode included a total of 36 groups of humpback whales comprising 58 animals (from all platforms combined). A total of 33 sightings

of humpback whales were detected by the Tracker platform and 16 of these sightings were subsequently detected by the Primary platform. One humpback whale sighting was seen by the Primary platform and not detected by the Tracker platform.

The Primary observers, searching with the naked eye, did not have the usual aids (a pointer attached to the binocular stick and reticle binoculars) to assist with angle and distance estimation. To assist the Primary observers with estimation of angles, pointers for the IOP angle boards were manufactured on board. No aids were available to assist the Primary observers with distance estimation. During survey in BT-Option II research was usually not interrupted for the 30-minute meal breaks. (Although BT-Option II survey requires the same number of crew and same rotation schedule as IO mode, this year there were seven Topmen available).

BT-Option II mode was easily implemented on this cruise as one of the main survey methods and as with the experimental trials conducted last cruise, no major problems were encountered.

SS-II

In the research area on this cruise, SS-II mode survey was used as a standard survey mode instead of normal closing mode. SS-II mode survey was conducted in both strata during the collaborative survey and the re-survey and a total of 1142.1 n.miles were covered during 102.03 hours of research.

Sightings during SS-II mode included a total of 17 groups of minke whales and 1 group classified as 'like minke whale'. Abeam closures were attempted for a total of 16 groups. Abeam identification of the groups selected for closure totaled 8 groups of minke whales and 8 groups classified as 'like minke whale'. Successful closure was completed for 13 groups including 7 of the groups classified from abeam as 'like minke whale'. One of the groups classified from abeam as a solitary 'like minke whale' was subsequently identified as a solitary humpback whale.

The abeam estimates of group size for groups for which closure was successfully completed and numbers confirmed, ranged 1 - 2 (mean 1.1).

The confirmed group sizes after closure ranged 1 - 4 (mean 1.5).

Two groups of minke whales and one group classified as a 'like minke whale' could not be relocated during the closure attempt and the group sizes could not be confirmed. The unconfirmed group size for each of these was a solitary animal.

The sighting rate for minke whales was low during this cruise, however SS-II mode was conducted in a range of sighting conditions and initial cue types. Also since only one minke whale group was detected prior to each closure attempt, return to trackline procedures were easily carried out. There were no secondary sightings of minke whales during the closure attempts. SS-II mode was easily implemented on this cruise as one of the main survey methods.

VIDEO DISTANCE MEASUREMENT (SCANS-II)

The SCANS-II system was operated on 15 days with a high definition video camera attached to one set of 7X50 binoculars in the Top Barrel during SS-II Mode. 65 initial detections of whale sightings were recorded, 3 of minke whales and 62 of other species (mainly humpback whales). A summary of results is presented in Table 14.

Operation of the recording system for the SCANS video camera required a researcher to be stationed with the Topmen in the Top Barrel. The video camera was operated during SS-II mode, when conditions permitted (periods with lower swell height and stable weather free from snow showers). To maximize the likelihood of recording minke whale blow cues the video camera was used on full zoom (10x). The camera field of view, on full zoom, was smaller than that of the 7X50 binoculars, thus alignment of the camera view and binocular fields of view was critical. A geared tripod head had been provided with the equipment to provide precise adjustable alignment, however it was too heavy to mount on the binoculars without affecting their normal use. As a solution, the Chief Engineer on board the ship made a lightweight adjustable mount for the video camera. Adjustment of the mounting was necessary, between users, to ensure the horizon was visible in the recorded images.

A small digital still camera to obtain images for measurement of detection angles was to be mounted on the binoculars in addition to the video camera, however as the weight of the video camera alone was already excessive, no satisfactory method of mounting the camera could be devised. No images of angles were obtained.

During the Estimated Angle and Distance Experiment the SCANS video camera was operated during an additional approach to the buoy and selected target distances were measured by radar. Potentially the radar

measurements could be used to investigate any error in the distances measured from the SCANS video recordings.

MINKE WHALE DIVE TIME EXPERIMENT

No trials of the Minke Whale Visual Dive Time Experiment were conducted during the cruise. Suitable opportunities for the experiment did not occur.

BLUE WHALE RESEARCH

One group of blue whales (comprising two animals) was detected during the cruise. They were identified as Antarctic blue whales. The blue whales were sighted on 10 February at position 64°30'S 105°27'E (Figure 2f). The whales were in the vicinity of the pack ice and were moving towards the ice when initially detected. We were concerned that the whales would move into the pack ice and thus be inaccessible for photo-ID and biopsy sampling, so no dive time experiment or pre-approach acoustic recording could be conducted. The whales were approached for photo-id and biopsy and acoustic recording was conducted during and after approach (see Acoustics Research Section below). Good photo-id images of both animals were obtained (Table 13) however as the whales moved into dense pack ice there was no opportunity for biopsy sampling during the 1.05-hour attempt. Video of the animals was recorded for 4 min. 43sec.

FIN, SOUTHERN RIGHT AND HUMPBACK WHALE RESEARCH

All of the biopsy attempts were made using the Larsen system (although compound crossbows were also available). Limited supplies of ammunition were available for the Larsen guns due to difficulty arranging airfreight of replacement ammunition in a timely manner. (Only 150 rounds of ammunition were available, however, it eventuated that only 41 rounds were used). Allocation of research time to biopsy attempts was initially intentionally restricted with the aim of maximizing the chances of achieving synchronous coverage with the AAD aerial survey. Later in the cruise when it became evident the aerial survey had been cancelled very poor weather restricted survey progress and little time was allocated to biopsy attempts

A total of 26 biopsy samples were collected from 20 individuals of fin, southern right, humpback and killer whales during the cruise.

Fin whale
During the cruise a total of 3 fin whales were biopsied during 1.78 hours of research time. Photo-id images of the three whales were obtained. Acoustic recordings were also obtained (see Acoustics Research Section below).

Southern right whale
A total of 9 southern right whales were approached for biopsy and photo-id during 6.13 hours of research time. Biopsy samples and photo-id images were obtained of all 9 animals (Tables 12 and 13). Acoustic recordings were made in the vicinity of 4 sightings (see Acoustics Research Section below).

Humpback whale
A total of 7 humpback whales were biopsied during the cruise during 4.45 hours of research. 52 individuals were photographed including all of the biopsied animals (Tables 12 and 13). A total of 0.17 hours of research time was allocated to approaches to humpback whales for photo-id without biopsy being attempted. Most of the photo-id images were obtained opportunistically during passing mode survey with no allocation of research time.

OTHER SPECIES

Killer whale
Three groups of killer whales were approached for biopsy and or photo-ID during the cruise. One biopsy sample was collected and individuals of a group comprising 11 whales (classified as type A) that were also photographed during 0.59 hours of research. One group, comprising two whales, (classified as type B) was photographed during 0.3 hours. An attempt was made to approach a solitary killer whale for photo-id during 0.5 hours. A fourth group was photographed opportunistically during SS-II mode with no allocation of research time.

Minke whale
Opportunistic photo-identification was attempted on all minke whale groups approached during closing procedures to confirm school size and on whales that approached the ship or were observed near the ship during passing mode. All minke whale photo-id was opportunistic with no research time allocated. Images were obtained of 28 whales.

ACOUSTICS RESEARCH

In addition to conducting acoustic stations in the presence of blue whales, opportunistic stations were conducted evenings in the research area while the vessel was drifiting.

A total of 71 sonobuoys were deployed during 48 acoustic stations conducted 26 December 2007 through 13 February 2008. 45 stations were in the research area (Figures 3a-b) and 3 during the transit south to the research area from Fremantle. Over 240 hours of acoustic monitoring (most in real-time) was performed during the stations (Table 15). Bio-sounds were heard during 41 stations (91%). Directed acoustic effort on blue whales (1 station), southern right whales (4 stations), and fin whales (1 station) resulted in good recordings of these species. The remaining buoys were deployed during opportunistic night stations (34) or day stations while drifting due to poor weather (5).

No bio-sounds were detected during the three stations during the transit south from Fremantle to the research area.

Of the 71 sonobouys, 10 were non-functional resulting in a 14% failure rate with nine of these buoys of 1990 and one of 2003 manufacture date.

Effort was made this year to ensure that DiFAR signals were recorded correctly. Both the output volume on the ICOM receiver and the input volume into the computer were set very low, and no preamplifier was used following the suggestions provided by Greenridge Sciences, Inc. (see Appendix B). Unfortunately, the DiFAR program with an Ishmael-Matlab interface was not available for use on the ship so magnetic bearings from a sonobuoy to a sound source could not be determined during the cruise. To verify that DiFAR signals were recorded correctly, samples of recordings were emailed during the cruise to Jason Gedamke (AAD) for review; his initial assessment indicates that the DiFAR signals were successfully recorded and these data will be useable.

An alternate method to potentially enhance the recording of the relative position of whales and the positions of the ship and sonobuoy was tested on the SOWER vessel this year. The software program Whaletrak 2, (created by Glen Gailey at Texas A&M University) was used on a laptop computer (Acer Extensa 4620z) interfaced with a handheld GPS (Garmin GPSmap76) to log ship, sonobuoy deployment position (and whale's positions, if visually detected) in realtime for all acoustic stations. The system was portable and could be used on the upper bridge so data on the position of whales relative to the ship and sonobuoy(s) deployment position could be input during biopsy attempts. These data would potentially aid in relating whale vocalizations to the observed position individual whales, particularly if analysed in conjunction with DiFAR bearings.

Blue whale acoustic research

Blue whale calls were recorded during 8 stations on 9 days in the research area. Three-part tonal calls indicative of Antarctic blue whales and downsweeps were recorded. No sounds attributed to pygmy blue whales were detected. The station summaries where blue whale sounds were recorded are as follows:

2 Jan: (Night station) Occasional faint to moderate blue whale downsweeps

5 Jan: (Night station) A few faint downsweeps

23 Jan: (Night station) Frequent moderate to strong downsweeps and 28hz tonals in the last few hours of station

24 Jan: (Night station) A few faint to moderate downsweeps

6 Feb: (Day station on southern right whales) A faint partial 28hz tonal noted late in station

9 Feb: (Night station) Frequent moderate to strong downsweeps and 28hz tonals, 3 part tonal calls

10 Feb: (Blue whale biopsy attempt) Frequent strong downsweeps and very strong 3 part tonal calls

10 Feb: (Night station) Infrequent faint to moderate downsweeps and 28hz tonals

11 Feb: (Day station) A few faint 28hz tonals, but very short station

In the presence of a pair of Antarctic blue whales on 10 February, three sonobuoys were deployed. There was no opportunity for the standard practice of commencing acoustic recording of the whales prior to the approach of the ship for biopsy and photo-id since when first detected the whales were moving toward the pack ice. The software program Whaletrak2 was tested during the approach and successful real-time tracking of the whales relative to the buoy was obtained. During this station strong 3-part tonal calls were recorded.

Acoustic recordings of other species

Other species recorded opportunistically included fin whales, humpback whales, southern right whales, sperm whales, pilot whales and seals.

On 6 January, a station conducted in the presence of fin whales during a biopsy attempt resulted in good recordings of short duration low frequency downsweeps (90 to 40hz). Very few "classic" fin whale 40 to 10hz downsweeps were recorded. Although there were other sightings of fin whales in the research area, fin whales calls were not detected during any other stations during the cruise.

Humpback whale sounds were the most commonly recorded sound in the research area, being detected at 23 stations (51%). Humpback calls as described by Stafford (IWC SOWER cruise 2005-06) were frequent throughout January. However, in February, despite the continued presence of humpbacks, the known call types were notably absent.

Four stations were conducted in the immediate vicinity of four solitary southern right whales between Feb 4th and 6th. Excellent recordings of grunt like calls were obtained.

During one of the stations conducted in the presence of a solitary southern right whale, pilot whales were in the same vicinity as the whale and excellent recordings were obtained of this species (though limited by the 2khz roll-off of the DiFAR buoys).

Probable killer whale sounds were recorded four times, however, given the overlap in distribution of killer whales and pilot whales observed this cruise, species identification could not be confirmed.

On 6 February, patterned sequences of 3-clicks (possibly sperm whale) were noted.

The most notable non-biological sound recorded was an unidentified pulsed sound produced every 20sec for extended periods and is thought possibly to be seismic-airgun in origin. This sound was heard at 10 stations for a total of 46 hours (19% of the acoustic effort in the research area).

SIGHTINGS

A list of all the sightings recorded in the minke whale research area, by species and by effort mode, is presented in Table 5. Tables 3 and 4 summarize the sightings recorded during the collaborative survey and the re-survey, respectively. Figures 2a-h illustrate the location of the sightings.

Table 6 shows the duplicate status of sightings observed during survey in IO mode. Tables 7-9 list the sightings observed during transits to and from the research area (including those south of latitude 60°S) and in the EEZ of Australia. An additional summary of observations of cetaceans during transit within the 200 n.mile EEZ of Australia is presented in Appendix C.

Table 11 summarizes all the sightings observed during the entire cruise.

Minke Whale Research Area

A total of 35 groups, 71 minke whales were observed in the minke whale research area; 15 groups (22 animals) during the collaborative survey and 20 groups (49 animals) during the re-survey. Additionally, 9 groups (15 animals) classified as 'like minke whale' were recorded. Mean group size of minke whales during the collaborative survey was 1.47 and during the re-survey was 2.45. Proportionally more minke whales were observed in the northern stratum during the collaborative survey: 8 groups/12 animals were sighted in the northern stratum (53.3%) and 7 groups/10 animals (46.7%) in the southern stratum. During the re-survey, proportionally more minke whales were sighted in the southern stratum: 15 groups/44 animals (75%) in the southern stratum and 5 groups/5 animals (25%) in the northern stratum. During the re-survey a cluster of minke whale and 'like minke whale' sightings occurred along 24 n.miles of trackline on 24 January between the longitudes 116°05'E and 115°14'E.

Humpback whales were the most frequently encountered species (283 groups, 483 animals). This species was sighted throughout the research area but was more frequently sighted during the collaborative survey. Mean group size was 1.7.

One group of 2 Antarctic blue whales was sighted during the re-survey, adjacent to the ice edge on 10 February at 64°29'S 105°27'E. These were the only blue whales sighted during the cruise.

Fin whales (14 groups, 42 animals) were observed in both strata. Except for 1 group, all sightings occurred during the collaborative survey.

All 7 groups (8 animals) of southern right whales observed in the research area occurred in the western half of the area, in the southern stratum, and during the re-survey only. Additionally, a solitary right whale was observed during the transit from Fremantle to the research area at 40°29'S 112°41'E.

Sperm whale sightings (24 groups, 24 animals) occurred primarily in the eastern half of the study area, in the southern stratum.

Southern bottlenose whales (44 groups, 91 animals) were observed regularly within the research area in both strata.

Nine groups (62 animals) of killer whales were sighted in the research area. One group (11 whales) was assessed to be Type A and one group (2 animals) was assessed to be Type B. The remaining 7 groups were of undetermined type. Only poor views were available of these groups due to distance from the ship (during passing mode) or the evasive behavior of the whales.

Systematic re-survey of the research area was accomplished during this cruise as planned for the first time during this series of cruises aimed at minke whale abundance estimation. Therefore, this was the first time that SOWER has been able to monitor changes in spatial distribution on systematically constructed tracklines within the survey season.

Although poor coverage in the west of the research area during the re-survey somewhat confounds attempts to compare the distribution of sightings, there were some obvious differences. Minke whales were more frequently sighted during the re-survey and particularly in the Southern Stratum. The sighting rate for humpback, fin, sperm and southern bottlenose whales during the collaborative survey was roughly twice the rate observed during the re-survey. Southern right whales and blue whales were only seen during the re-survey.

Notable sightings

With calm weather and excellent sighting conditions experienced during the collaborative survey, 5 groups (6 animals) of spectacled porpoise were detected. All 5 groups were approached for closer observation but the solitary male sighted on 11 January could not be relocated after the ship turned to close.

07 January, 61°25'S 113°05'E, solitary adult male
07 January, 61°58'S 113°05'E, solitary adult male
11 January, 61°19'S 117°29'E, solitary adult male
11 January, 61°33'S 117°30'E, mother/calf pair
11 January, 62°19'S 117°29'E, solitary adult female

Spectacled porpoise were only seen during the collaborative survey, however their detection is dependent on exceptionally good sighting conditions and these were experienced only during the collaborative survey and not the re-survey, when more-normal, rougher sea conditions were experienced

Also during the exceptional viewing conditions of the collaborative survey, 37 groups (60 animals) of beaked whales (Ziphiidae) were observed and 2 groups (2 animals) of *Mesoplodon* sp. The higher-than-usual proportion of ziphiids unidentified to species was attributed to the distant views of the whales owing to the greater-than-normal detection distances during very calm seas and very good sighting conditions.

Two of the 3 groups of pilot whales sighted during the cruise occurred south of 60°S: One group (20 animals) at 62°19S 113°05E and 1 group (20 whales) at 64°31S 107°13E.

ICE EDGE

The pack ice extent in the research area was greater this year than in average years. Usually in this area at this time of the year, across much of the longitudinal range of the research area, the pack ice edge recedes to a position south of the continental slope front (defined by the 1000m isobath).

During the collaborative survey (31 December – 13 January) the ice edge was north of the 1000m isobath. In the intervening period between the collaborative survey and the re-survey, the ice edge receded south of the 1000m isobath only in a small part of the research area between approximately 107°E and 109°E (see Figures 1b and c).

Two extensive coastal polynyas south of the main ice edge the research area were indicated on satellite predictions for the entire research period. The two polynyas are inter-annual features of the pack ice in this region (in some years they become contiguous with ice-free water to the north of the main ice edge when the pack ice edge recedes). Their locations, in Vincennes Bay and off Cape Poinsett are shown in Appendix C (Appendix C Figures A-F). Their size varied with dynamics of the pack ice; rough estimates of their combined area ranged 1500 - 6000 n.miles^2 during the research period. During calm, stable weather in the first two weeks in January their combined area increased from roughly 1500 to 3400 n.miles^2; decreased 17 - 22 January to

roughly 1800 n.miles^2 (when strong winds from a northerly quarter were experienced); increased 22 – 28 January to roughly 4000 n.miles^2 during calmer weather; decreased 28 January – 3 February to roughly 1500 n.miles^2 when strong northerly winds were experienced and increased 3 - 9 February to roughly 6000 n.miles^2 during more moderate weather.

The *Shonan Maru No.2* made an unsuccessful attempt (prevented by too much pack ice) to enter the easternmost of the two polynyas on 1 February during the re-survey.

The polynyas, represent extensive areas of predicted ice-free water south of the main ice edge; were inaccessible to the SOWER vessel and were unsurveyed.

The satellite predicted ice edge approximated the observed ice edge for the entire research period. The ships officers, usually by a combination of visual and radar observations, recorded the location of the ice edge routinely during the cruise. A best estimate of the position of the ice edge (as normally produced on SOWER cruises aimed at abundance estimation) was made for the each of the two surveys (the collaborative survey and the re-survey). The spacing of the ice edge waypoints and the precision of the best estimate of the ice edge was approximately the same as for recent SOWER cruises.

KRILL – VISUAL OBSERVATIONS

While there was not a dedicated search effort to detect surface krill patches (and lack of sightings does not indicate lack of presence), opportunistically a total of 7 visual observations of krill patches were recorded during the cruise. All were circular in shape and ranged between 20 and 100 metres in size. Four of the patches were recorded in the west of the research area during the first three days of survey. Three were recorded at position 64°02'S 106°55'E on 6 February.

MARINE DEBRIS

Observations of marine debris encountered during the cruise, south of latitude 60°S are shown in Table 16.

OCEANOGRAPHY

No oceanographic sampling was undertaken, as on last year's cruise. Two ARGOS floats were deployed under the ARGOS oceanographic programme. The deployments were made at latitudes 55°S and 56°S during the transit from Fremantle to the Antarctic.

TRANSIT TO BENOA AND POST-CRUISE MEETING

The cruise was planned to return to Fremantle, Australia, however during the cruise, the post-cruise homeport was changed to Benoa, Bali, Indonesia.

The *Shonan Maru No.2* commenced transit to Benoa, Bali, Indonesia from position 61°58'S 106°52'E on the evening of 13 February. This was one day earlier than scheduled however weather conditions were already poor and based on the forecast much worse weather was expected the following day.

During transit south of 60°00'S due to the poor experienced no research was conducted. During the transit 10-day transit between latitude 60°00'S and the intercept with the 200 n.mile EEZ of Indonesia, mainly very poor conditions were experienced and a total of 208.7 n.miles was covered during 18.60 hours of research in NSP mode.

The report of the cruise was finalized during a Post-cruise Meeting held aboard the vessel on the morning of 24 February.

The Indonesian EEZ was intersected adjacent to the coast of Bali. The vessel entered the EEZ on 25 February at 12°05'S 113°54'E at 06:27 hours. No research was conducted in the EEZ of Indonesia.

The ship entered Benoa Harbour, Bali at 09:00 hours on 26 February. The vessel departed Benoa Harbour on 29 February at 14:00 hours.

SUMMARY OF MODIFICATIONS TO THE PROCEDURES, VESSELS AND EQUIPMENT

This was the first SOWER cruise to implement BT mode (BT-Option II) as a standard survey protocol. BT-Option II was used instead of IO mode during the Re-survey of the research area (13 January – 13 February).

As BT-Option II involved Primary observers using naked eye in the IOP, the normal pointers installed on the binocular sticks were replaced with pointers attached to the angle boards on this platform as an aid for estimation of bearings to sightings.

This was the first SOWER cruise to implement SS-II as a standard survey protocol. SS-II was used instead of NSC for the entire period in the research area (31 December – 13 February).

Effort, weather and sightings data records were entered into computer files using the Moon Joyce DataForm00 program. The sightings data entry section of this program has no facility to record newly implemented survey modes such as SS-II and BT-Option II. Sightings recorded during SS-II, BT-Option II and BB mode were entered into the computer files as NSC, NSP and IO modes respectively. (Note the only reason for choice of these modes for the data entry process was to facilitate data summary using the program).

The IWC purchased new equipment prior to this cruise including a new high definition video camera (to use with the SCANS system for video distance measurement) and a digital still camera for bearing measurement.

The IWC supplied 2 additional external hard drives for the storage of photo-id images and SCANS video, additional flash cards (2x2Gb), and 2 high speed card readers and 1 replacement battery for the Canon digital cameras.

Replacement darts (50 alloy darts) and propelling plugs (1000) were purchased for the Larsen system. Replacement alloy darts for the Larsen system were received for this cruise. Although good supplies of fibre-alloy darts remained from last cruise, the replacement alloy darts had been ordered as they matched the stronger type of ammunition available for this cruise.

The IWC provided a Dell Inspiron 6000 computer for acoustics recording. As a modification to the acoustics procedure the program Whaletrak 2 was used to log ship, sonobuoy deployment position (and whale's positions, if visually detected) in realtime for acoustic stations. This would potentially facilitate relating whale vocalizations to the observed position individual whales.

RECOMMENDATIONS

The researchers and captain make the following recommendations based on their experience of this cruise (note that recommendations do not appear in any order of priority).

Acoustics:

1. It is strongly recommended to purchase the necessary software for the SOWER cruises, specifically Greenridge Inc DiFAR demultiplexing software, and MATLAB to be used with Ishmael. It is recommended that Greenridge be asked to load the software directly for correct setup.
2. The Dell Inspiron computer used this cruise for acoustic recording is installed with a Sigma Tel C – Major Audio sound card. This sound card may not be adequate to control sound input and it is recommended that use of an alternate sound card be investigated and possibly in combination with a 'Mackie mixer'. This may increase input volume control resulting in improved DiFAR signal acquisition.
3. Currently, simultaneous recording of two sonobuoys had to be done on separate computers. The proper cords necessary for interfacing two receivers into one computer were not available and are recommended for future cruises.
4. During a cruise with more acoustic effort, a larger external hard drive dedicated to acoustics would be necessary for data storage.
5. The Acoustic Record forms need to be revised. (Suggested revisions: It is recommended "*Station #*" be changed to "*Sonobuoy #*", or "*Sonobuoy #*" be added to the form "*Tape #*" is no longer relevant as recordings are now made to hard disc, and the "*If not seen during normal sighting*" section is not relevant. At least the intention of this section is unclear as no sightings are made by acoustics with group size estimates and behavior recorded).

Biopsy/photo-Identification

1. Opportunistic minke whale photo-identification was undertaken on this cruise. We reiterate the recommendation agreed at the Planning Meeting for this cruise: 'that a review of the usefulness of photo-identification work on Antarctic minke whales be undertaken during the year and presented at the 2008 Annual Meeting. Such a review should incorporate the information obtained from the 2006/07 cruise as well as previous cruises. Where appropriate (e.g. for abundance estimation) the review should address the question of suitable sample sizes and the effort required to obtain them.' We suggest that the information obtained during the 2007-08 cruise would also be potentially useful for this review.

General

2. A monopod for holding a video camera during whale dive times is suggested.
3. Researchers reiterate their support for a direct data entry system.

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IWC In press. Report of the Scientific Committee, Annex G, Appendix 1: Report of the *ad-hoc* Working Group to plan logistic aspects of the proposed 2007-2008 IWC-SOWER Cruise. *J. Cet. Res. and Manage*.

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Table 1. Summary of search effort (time and distance) conducted during the cruise in each effort mode.

Area	**Start** Date Time	**End** Date Time	**NSP** Time-Distance (hours-n.miles)		**SS-II Abeam closure from NSP** Time-Distance (hours-n.miles)		**IO** Time-Distance (hours-n.miles)		**BT-Option II** Time-Distance (hours-n.miles)		**BB** (hours-n.miles)	
Fremantle to boundary of Australian EEZ	24 Dec 15:00	25 Dec 22:40	12.00	137.3	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Transit from Australian EEZ to intercept of Latitude 60°S	25 Dec 22:40	30 Dec 19:20	19.19	228.5	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Transit from intercept of 60°S to start of Minke Whale survey	30 Dec 19:20	31 Dec 15:10	02.35	27.3	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Collaborative survey (105°E to 120°E)	31 Dec 15:10	13 Jan 09:17	0.00	0.0	58.72*	660.5*	54.01	609.3	0.00	0.0	0.00	0.0
Re-survey (120°E to 105°E)	13 Jan 10:18	13 Feb 17:13	0.00	0.0	43.31**	481.6**	0.00	0.0	49.45	567.9	4.90	54.2

* includes 1.42hrs, 13.4 n.miles with ice navigation

** includes 1.79hrs, 9.1 n.miles with ice navigation

Table 1 continued. Summary of search effort (time and distance) conducted during the cruise in each effort mode.

Area	Start Date Time	End Date Time	NSP Time-Distance (hours-n.miles)		SS-II Abeam closure from NSP Time-Distance (hours-n.miles)		IO Time-Distance (hours-n.miles)		BT-Option II Time-Distance (hours-n.miles)		BB (hours-n.miles)	
Transit from Minke Whale survey to intercept of latitude 60°S	13 Feb 17:13	14 Feb 03:04	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Transit from latitude 60°S to intercept of Indonesian EEZ	14 Feb 03:04	25 Feb 06:27	18.60	208.7	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Transit from intercept with Indonesian EEZ to Benoa	25 Feb 06:27	26 Feb 09:00	0.00	0.00	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Total	-	-	52.14	601.8	102.03*	1142.1*	54.01	609.3	49.45	567.9	4.90	54.2

* includes 3.21hrs, 22.5 n.miles with ice navigation

Table 2. Summary of experimental time (hours) during 2007-08.

Area	**Start** Date Time	**End** Date Time	**Photo-ID, Biopsy** Time (hours)	**Minke whale visual dive time** Time (hours)	**Estimated angle and distance training** Time (hours)	**Estimated angle and distance experiment** Time (hours)
Fremantle to boundary of Australian EEZ	24 Dec 15:00	25 Dec 22:40	0.00	0.00	0.00	0.00
Transit from Australian EEZ to intercept of Latitude 60°S	25 Dec 22:40	30 Dec 19:20	0.31	0.00	0.00	0.00
Transit from intercept of 60°S to start of Minke Whale survey	30 Dec 19:20	31 Dec 15:10	0.00	0.00	0.00	0.00
Collaborative survey (105°E to 120°E)	31 Dec 15:10	13 Jan 09:17	4.71	0.00	3.96	0.00
East to West survey (120°E to 105°E)	13 Jan 10:18	13 Feb 17:13	11.03	0.00	0.00	4.15
Transit from Minke Whale survey to intercept of latitude 60°S	13 Feb 17:13	14 Feb 03:04	0.00	0.00	0.00	0.00
Transit from latitude 60°S to intercept of Indonesian EEZ	14 Feb 03:04	25 Feb 06:27	0.00	0.00	0.00	0.00
Transit from intercept with Indonesian EEZ to Benoa	25 Feb 06:27	26 Feb 09:00	0.00	0.00	0.00	0.00
Total	-	-	15.74	0.00	3.96	4.15

Table 3. Number of sightings for all species (Groups/Animals) observed during the collaborative survey of the Minke Whale Research Area in each effort mode. (Excludes sightings observed south of 60°S during transit from Fremantle to start of minke whale research).

Species	SS-II (Abeam closure from NSP)		IO		OE		Total	
	G	A	G	A	G	A	G	A
Minke (Antarctic)	8	14	4	5	0	0	12	19
Minke (undetermined)	1	1	2	2	0	0	3	3
Like minke	0	0	3	3	0	0	3	3
Fin	7	26	6	13	0	0	13	39
Like fin	0	0	1	4	0	0	1	4
Humpback	104	188	86	134	2	4	192	326
Like humpback	6	11	1	1	0	0	7	12
Sperm	11	11	5	5	0	0	16	16
Like sperm	1	2	0	0	0	0	1	2
Killer (type undetermined)	2	5	2	25	1	3	5	33
Southern bottlenose whale	8	15	12	33	3	9	23	57
Like so. bottlenose whale	1	2	2	4	0	0	3	6
Pilot whale	0	0	1	20	0	0	1	20
Spectacled porpoise	3	4	2	2	0	0	5	6
Ziphiid	19	36	10	14	0	0	29	50
Mesoplodon sp.	2	2	0	0	0	0	2	2
Unid. large baleen	46	78	38	66	0	0	84	144
Unid. large whale	1	2	0	0	0	0	1	2
Unid. small whale	3	6	6	10	0	0	9	16
Unid. whale	3	4	1	2	0	0	4	6

Table 4. Number of sightings for all species (Groups/Animals) observed during the Re-survey of the Minke Whale Research Area in each effort mode.

Species	BT-Option II		SS-II (Abeam closure from NSP)		BB		OE		Total	
	G	A	G	A	G	A	G	A	G	A
Minke (Antarctic)	9	38	6	6	0	0	2	2	17	46
Minke (undetermined)	1	1	2	2	0	0	0	0	3	3
Like minke	5	11	1	1	0	0	0	0	6	12
Blue (Antarctic)	0	0	1	2	0	0	0	0	1	2
Fin	1	3	0	0	0	0	0	0	1	3
Humpback	36	58	41	66	6	12	8	21	91	157
Like humpback	2	2	1	2	0	0	0	0	3	4
Southern right whale	3	4	2	2	2	2	0	0	7	8
Sperm	4	4	4	4	0	0	0	0	8	8
Killer (type A)	0	0	1	11	0	0	0	0	1	11
Killer (type B)	0	0	0	0	1	2	0	0	1	2
Killer (type undetermined)	1	15	1	1	0	0	0	0	2	16
Southern bottlenose whale	10	18	5	6	1	2	5	8	21	34
Like so. bottlenose whale	2	2	0	0	0	0	0	0	2	2
Pilot whale	0	0	1	30	0	0	0	0	1	30
Hourglass dolphin	0	0	0	0	0	0	1	3	1	3
Ziphiid	5	5	2	4	1	1	0	0	8	10
Unid. large baleen	10	12	10	15	2	2	0	0	22	29
Unid. large whale	0	0	1	1	0	0	0	0	1	1
Unid. small whale	4	7	2	7	0	0	0	0	6	14
Unid. whale	0	0	1	1	0	0	0	0	1	1

Table 5. Number of sightings for all species (Groups/Animals) observed within the entire Minke Whale Research Area (collaborative survey and re-survey combined) in each effort mode. (Excludes sightings observed south of 60°S during transit from Fremantle to start of minke whale research).

Species	IO		BT-Option II		SS-II (Abeam closure from NSP)		BB		OE		Total	
	G	A	G	A	G	A	G	A	G	A	G	A
Minke (Antarctic)	4	5	9	38	14	20	0	0	2	2	29	65
Minke (undetermined)	2	2	1	1	3	3	0	0	0	0	6	6
Like minke	3	3	5	11	1	1	0	0	0	0	9	15
Blue (Antarctic)	0	0	0	0	1	2	0	0	0	0	1	2
Fin	6	13	1	3	7	26	0	0	0	0	14	42
Like fin	1	4	0	0	0	0	0	0	0	0	1	4
Humpback	86	134	36	58	145	254	6	12	10	25	283	483
Like humpback	1	1	2	2	7	13	0	0	0	0	10	16
Southern right whale	0	0	3	4	2	2	2	2	0	0	7	8
Sperm	5	5	4	4	15	15	0	0	0	0	24	24
Like sperm	0	0	0	0	1	2	0	0	0	0	1	2
Killer whale (type A)	0	0	0	0	1	11	0	0	0	0	1	11
Killer whale (type B)	0	0	0	0	0	0	1	2	0	0	1	2
Killer (type undetermined)	2	25	1	15	3	6	0	0	1	3	7	49
Southern bottlenose whale	12	33	10	18	13	21	1	2	8	17	44	91
Like so. bottlenose whale	2	4	2	2	1	2	0	0	0	0	5	8
Pilot whale	1	20	0	0	1	30	0	0	0	0	2	50
Hourglass dolphin	0	0	0	0	0	0	0	0	1	3	1	3
Spectacled porpoise	2	2	0	0	3	4	0	0	0	0	5	6
Ziphiid	10	14	5	5	21	40	1	1	0	0	37	60
Mesoplodon sp.	0	0	0	0	2	2	0	0	0	0	2	2
Unid. large baleen whale	38	66	10	12	56	93	2	2	0	0	106	173
Unid. large whale	0	0	0	0	2	3	0	0	0	0	2	3
Unid. small whale	6	10	4	7	5	13	0	0	0	0	15	30
Unid. whale	1	2	0	0	4	5	0	0	0	0	5	7

Table 6. Identification of duplicate sightings observed during survey in Independent Observer (IO) mode. Duplicate status was based on the number of sightings made by the Independent Observer Platform (IOP) that were observed also by the Topmen in the Standard Barrel. Status codes: **D** - Definite duplicate, **P** - Possible duplicate, **R** - Remote duplicate, **N** - Not duplicate.

Species	Number of sightings made by IOP	Duplicate Status			
		D	P	R	N
Minke (undetermined)	1	-	-	-	1
Fin	2	2	-	-	-
Like fin	1	-	-	-	1
Humpback	42	27	2	-	13
Sperm	3	2	-	-	1
Killer	2	2	-	-	-
Southern bottlenose whale	6	4	-	-	2
Like so. bottlenose whale	2	1	-	-	1
Ziphiid	5	-	-	-	5
Unid. large baleen whale	12	4	1	-	7
Unid. small whale	1	-	-	-	1

Table 7. Number of sightings for all species (Groups/Animals) observed during the transit from Fremantle to the start of Minke Whale Research, in each effort mode. (Includes sightings observed south of 60°S during transit).

Species	NSP		OE		Total	
	G	A	G	A	G	A
Sei	5	10	0	0	5	10
Humpback	8	14	10	17	18	31
Southern right	1	1	0	0	1	1
Southern bottlenose whale	0	0	1	1	1	1
Short finned pilot whale	1	25	0	0	1	25
Striped dolphin	1	60	0	0	1	60
Ziphiid	1	4	1	2	2	6
Unidentified large baleen whale	6	8	1	1	7	9
Unidentified small whale	3	3	1	1	4	4
Unidentified dolphin	1	40	0	0	1	40

Table 8. Number of sightings for all species (Groups/Animals) observed during the transit from the Minke Whale Research Area to the intercept of the EEZ of Indonesia, in each effort mode.

Species	NSP		OE		Total	
	G	A	G	A	G	A
Sperm whale	1	2	0	0	1	2
Hourglass dolphin	0	0	1	3	1	3
Striped dolphin	2	80	0	0	2	80
Spotted dolphin	1	20	0	0	1	20
Unidentified dolphin	1	20	0	0	1	20
Unidentified cetacean	1	4	0	0	1	4

Table 9. Number of sightings for all species (Groups/Animals) observed in the EEZ of Australia during the transit between Fremantle and the Minke Whale research Area, in each effort mode.

Species	NSP	
	G	A
Striped dolphin	1	60
Unidentified dolphin	1	40

Table 11. Summary of all sightings (Groups/Animals) observed during the entire cruise.

Species	Total	
	G	A
Minke (Antarctic)	29	65
Minke (undetermined)	6	6
Like minke	9	15
Blue (Antarctic)	1	2
Fin	14	42
Like fin	1	4
Sei	5	10
Humpback	301	514
Like humpback	10	16
Southern right whale	8	9
Sperm	25	26
Like sperm	1	2
Killer (type A)	1	11
Killer (type B)	1	2
Killer (type undetermined)	7	49
Southern bottlenose whale	45	92
Like so. bottlenose whale	5	8
Short-finned pilot whale	1	25
Pilot whale	2	50
Hourglass dolphin	2	6
Striped dolphin	3	140
Spotted dolphin	1	20
Spectacled porpoise	5	6
Mesoplodon sp.	2	2
Ziphiid	39	66
Unid. large baleen	113	182
Unid. large whale	2	3
Unid. small whale	19	34
Unid. dolphin	2	60
Unid. whale	5	7
Unid cetacean	1	4

Table 12. Results of biopsy sampling during SOWER 2007-08. All samples were collected with the Larsen system.

Species & Date	Sight No.	School Size	Individual whale number	Sample Number	Blubber	Comments
Fin						
11 January	006	3	1	08021005	Yes	
11 January	006	3	2	08021006	No	
11 January	006	3	3	08021007	Yes	
Humpback						
04 January	034	1	1	08071002	Yes	double hit; 2 blubber samples
07 January	020	5	1	08071003	Yes	
07 January	020	5	2	08071004	No	
10 February	004	2	1	08071015	Yes	double hit; 2 vials of skin samples; 2 blubber samples
10 February	004	2	2	08071016	Yes	double hit; 2 vials of skin samples; 2 blubber samples
10 February	007	2	1	08071018	No	
10 February	010	2	1	08071019	No	
So. right						
26 December	011	1	1	08081001	No	
02 February	011	2	1	08081009	Yes	
02 February	011	2	2	08081010	No	
04 February	001	1	1	08081011	No	double hit; 2 vials of skin samples
04 February	005	1	1	08081012	No	
05 February	001	1	1	08081013	No	double hit; 2 vials of skin samples
06 February	002	1	1	08081014	No	double hit; 2 vials of skin samples
10 February	006	1	1	08081017	No	
11 February	004	1	1	08081020	Yes	double hit; 2 vials of skin samples
Killer whale						
14 January	002	11	1	08101008	Yes	Type A

Table 13. Summary of the photo-ID images collected in 2007-08.

Species & Date	Sighting no.	No. of whales photo'd	Biopsy sample no.'s	Comments
Blue				
10 February	001	2	-	
Fin				
11 January	006	3	08021005, 08021006, 08021007	
Humpback				
31 December	017	1	-	
31 December	018	1	-	
31 December	019	1	-	
31 December	024	1	-	
31 December	035	2	-	
02 January	001	3	-	1 whale w/ substantial deformity
02 January	023	2	-	
04 January	018	2	-	
04 January	034	1	08071002	
05 January	027	2	-	
05 January	030	1	-	
05 January	054	2	-	
05 January	055	1	-	
06 January	012	1	-	
07 January	017	3	-	
07 January	020	2	08071003, 08071004	
10 January	003	2	-	
12 January	019	1	-	
12 January	024	1	-	
14 January	004	1	-	
18 January	002	2	-	
18 January	004	2	-	
23 January	006	1	-	
29 January	019	1	-	
30 January	002	2	-	
01 February	001	2	-	
02 February	002	2	-	
09 February	002	1	-	
10 February	004	2	08071015,08071016	
10 February	007	2	08071018	
10 February	010	2	08071019	
11 February	003	2	-	
13 February	003	2	-	
13 February	004	2	-	
Total		**56**		

Table 13 continued. Summary of the photo-ID images collected in 2007-08.

Right				
26 December	011	1	08081001	
02 February	011	2	08081009,08081010	
04 February	001	1	08081011	
04 February	005	1	08081012	
05 February	001	1	08081013	
06 February	002	1	08081014	
10 February	006	1	080710017	
11 February	004	1	08081020	
Total		**9**		
Minke				
06 January	022	1	-	
06 January	031	2	-	
06 January	032	2	-	
08 January	027	1	-	
08 January	039	4	-	1 whale w/unusual pigmentation
11 January	008	2	-	
15 January	003	1	-	
23 January	009	1	-	
24 January	015	5	-	
24 January	016	6	-	
01 February	014	1	-	
02 February	034	1	-	
06 February	005	1	-	
Total		**28**		
Killer whale				
05 January	062	3	-	distant shots, Type A or B
13 January	004	1	-	distant shots, Type A or B
14 January	002	11	08101008	Type A
11 February	001	1	-	Type B
Total		**16**		

Table 14. Sightings recorded by video camera attached to 7X binoculars for SCANS II video distance measurement analysis.

File No.	Date	Sighting No.	Species	Group Size	Cue	Radial Distance (n.miles)	Comments
071838	04 Jan	11	Unid. large baleen	2	Blow	4.2	Lens zoomed fully out
154321	04 Jan	36	Humpback	2	Blow	3.5	
155147	04 Jan	39	Humpback	2	Blow	3.3	
155351	04 Jan	40	Unid. large baleen	1	Blow	3.6	
170419	04 Jan	51	Unid. large baleen	2	Blow	4.4	
170714	04 Jan	52	Fin	5	Blow	4.3	
171407	04 Jan	49*	Fin	3*	Blow	2.6	*Subgroup of #49; initial detection of this subgroup by observer with camera
171829	04 Jan	55	Fin	3	Blow	2.8	
172513	04 Jan	58	Humpback	2	Blow	4.0	
173514	04 Jan	61	Humpback	3	Blow	3.3	
174305	04 Jan	63	Fin	3	Blow	3.5	
175131	04 Jan	65	Humpback	2	Blow	2.5	
180500	04 Jan	67	Unid. large baleen	1	Blow	3.5	
182204	04 Jan	71	Unid. large baleen	2	Blow	4.4	
123613	05 Jan	61	So. bottlenose	1	Blow	1.3	
133000	05 Jan	66	Ziphiid	1	Body	3.0	
140044	05 Jan	68	Ziphiid	3	Body	2.3	
094710	06 Jan	06	Humpback	2	Body	3.7	
115317	06 Jan	19	Humpback	2	Blow	3.0	
120020	06 Jan	21	Ziphiid	1	Body	0.8	
132114	06 Jan	27	Like humpback	2	Body	3.8	
134730	06 Jan	31	Minke	2	Body	2.0	
143131	06 Jan	32	Minke	2	Body	0.5	
122656	07 Jan	03	Ziphiid	1	Body	1.8	
124122	07 Jan	05	Ziphiid	3	Body	3.5	
130134	07 Jan	07	Unid. small whale	1	Body	3.1	
131714	07 Jan	08	*Mesoplodon* sp.	1	Body	0.7	Good views of (probable) Gray's beaked whale
085443	08 Jan	25	Ziphiid	1	Body	2.6	
094827	08 Jan	29	So. bottlenose	2	Body	2.0	
115236	08 Jan	38	Humpback	1	Blow/body	2.8	
122146	09 Jan	13	Sperm	1	Blow	1.8	
124551	09 Jan	15	Humpback	1	Blow	3.3	
172052	09 Jan	21	Unid. large baleen	1	Blow	3.8	Cue is blow and not body as said on video
174919	09 Jan	22	Unid. large baleen	1	Blow	4.2	Japanese observer says 4.5 in English on video. Either observer made an error in English or data recorder made a transcription error.
175342	09 Jan	24	Humpback	2	Blow	3.8	
175443	09 Jan	25	Unid. large baleen	2	Blow	4.2	

Table 14 continued. Sightings recorded by video camera attached to 7X binoculars for SCANS II video distance measurement analysis.

File No.	Date	Sighting No.	Species	Group Size	Cue	Radial Distance (n.miles)	Comments
061353	12 Jan	05	Humpback	1	Body	3.5	
061958	12 Jan	08	Unid. large baleen	1	Blow	4.2	
073658	12 Jan	20	Humpback	2	Blow	1.3	Not 1.5 miles as heard on video
074545	12 Jan	21	Humpback	2	Blow	3.1	
074824	12 Jan	22	Humpback	1	Body	2.2	Not 1.2 miles as heard on video
075757	12 Jan	23	Sperm	1	Blow/body	3.2	
084513	12 Jan	29	Sperm	1	Body	2.9	
085823	12 Jan	31	Humpback	2	Body	2.8	
090157	12 Jan	32	Sperm	1	Body	1.8	
121303	13 Jan	10	Sperm	1	Blow	2.8	
072555	14 Jan	02	Killer whale	11	Blow	3.5	
084337	14 Jan	03	Unid. small whale	6	Blow	3.1	Probable killer whales
092535	14 Jan	04	Humpback	1	Ring	0.2	
113421	23 Jan	04	Unid.whale	1	Blow	1.3	
124542	26 Jan	04	Humpback	1	Blow	3.5	
130553	26 Jan	05	Unid. large baleen	1	Blow	3.4	
115602	01 Feb	04	Unid. large baleen	2	Blow	3.1	Many floating ice bits on 01 Feb
121000	01 Feb	06	Humpback	1	Blow	3.0	"
124204	01 Feb	09	Humpback	2	Blow	2.3	"
131105	01 Feb	11	Humpback	1	Blow	1.5	"
132540	01 Feb	12	Unid. large baleen	1	Blow	4.3	"
132832	01 Feb	13	Sperm	1	Blow	2.2	"
135309	01 Feb	15	Ziphiid	2	Body	1.9	"
114348	02 Feb	26	Humpback	1	Blow	2.8	
114740	02 Feb	27	Humpback	2	Blow	2.8	
120758	02 Feb	30	Humpback	1	Blow	1.3	
122704	02 Feb	32	Humpback	2	Blow	1.8	
125737	02 Feb	34	Minke	1	Ring	0.3	Horizon not visible
063115	06 Feb	02	So. right whale	1	Blow	2.5	

Table 15. Summary of acoustic recording during 2007-08.
(Unk1= unidentified explosive sound; Unk2=550hz call; Unk3=pulsed sound every 20sec)

Date	Station	Sonobuoy #	Position		Time recorded (hour)	Bio-Sounds Heard
			Latitude	Longitude		
26-Dec	1	1	39°58.34'S	112°50.92'E	1.3	None
26-Dec	2	2	41°40.87'S	112°22.60'E	0.5	None
27-Dec	3	3	45°04.36'S	111°28.32'E	0.4	None
31-Dec	4	4	63°40.30'S	106°00.79'E	5.7	Humpback, sperm, seals?
1-Jan	5	5	63°08.78'S	107°26.80'E	6.5	Humpback, seals?
2-Jan	6	6	61°35.28'S	107°30.67'E	0.85	Humpback
2-Jan	6	7	61°34.23'S	107°31.34'E	3.2	Blue, humpback
3-Jan	7	8	61°56.30'S	107°30.96'E	5	Humpback, Unk1
4-Jan	8	9	63°43.49'S	109°14.64'E	4.6	Humpback
5-Jan	9	10	63°25.86'S	112°19.50'E	4	Blue, humpback, seals?
5-Jan	9	11	63°25.52'S	112°20.09'E	3.7	Blue, humpback, seals?
6-Jan	10	12	61°23.72'S	113°05.42'E	4.5	Humpback, seals?, Unk2
7-Jan	11	13	62°18.75'S	113°01.97'E	5.7	Humpback, seals
8-Jan	12	14	63°48.40'S	115°17.79'E	6.8	Humpback, sperm, seals
9-Jan	13	15	62°28.32'S	117°30.33'E	1.6	Humpback
9-Jan	13	16	62°28.28'S	117°31.92'E	2.9	Humpback
9-Jan	13	17	62°28.26'S	117°33.45'E	4.6	Humpback
9-Jan	13	18	62°28.19'S	117°34.40'E	0	n/a
10-Jan	14	19	61°05.83'S	117°29.66'E	2.4	Humpback, Unk2, Unk3
10-Jan	14	20	61°06.86'S	117°30.76'E	7	Humpback, Unk3
11-Jan	15	21	61°43.28'S	117°29.28'E	3.9	Fin, humpback, Unk3
11-Jan	16	22	62°46.96'S	117°29.67'E	8	Humpback, sperm, Unk1&3, killer, seals?
12-Jan	17	23	64°12.54'S	117°31.25'E	1.8	Humpback, sperm, seals
12-Jan	18	24	64°15.92'S	118°35.22'E	4.75	Humpback, sperm, seals
13-Jan	19	25	63°50.78'S	118°43.36'E	3.5	Humpback, sperm, Unk3

Table 15. continued. Summary of acoustic recording during 2007-08.

Date	Station	Sonobuoy #	Position		Time recorded (hour)	Bio-Sounds Heard
			Latitude	Longitude		
14-Jan	20	26	61°39.13'S	118°20.15'E	8	Humpback, Unk2, Unk3
15-Jan	21	27	61°59.55'S	118°21.75'E	4	Humpback, Unk1, Unk3
18-Jan	22	28	62°07.33'S	118°17.32'E	6.5	Blue?, humpback, Unk1, unk3?
1-Jan	23	29	62°52.90'S	118°11.47'E	3.9	Humpback, Unk3
21-Jan	23	30	62°56.11'S	118°16.70'E	1.2	Humpback
23-Jan	24	31	64°18.89'S	116°17.40'E	7.9	Blue, humpback, seals
24-Jan	25	32	63°51.50'S	114°25.52'E	1.6	Sperm
24-Jan	25	33	63°50.77'S	114°23.08'E	6.1	Blue, sperm, unid baleen
25-Jan	26	34	63°48.99'S	114°28.58'E	5.4	Humpback, sperm
26-Jan	27	35	62°46.60'S	112°59.45'E	2.2	Killer?
26-Jan	27	36	62°46.27'S	112°59.05'E	6.9	Unk3
27-Jan	28	37	61°33.49'S	112°51.36'E	6.1	Unk3, killer?
28-Jan	29	38	62°52.38'S	112°47.55'E	4.5	None
29-Jan	30	39	64°10.83'S	112°26.04'E	0.6	Sperm
29-Jan	30	40	64°10.38'S	112°20.25'E	1.4	Sperm
30-Jan	31	41	64°23.51'S	112°29.18'E	4.4	Humpback?
1-Feb	33	43	65°03.85'S	112°02.40'E	2.7	None
2-Feb	34	44	65°06.73'S	108°37.50'E	7.6	Unid baleen - so. right?
3-Feb	35	45	65°20.85'S	107°52.99'E	7.2	None
4-Feb	36	46	65°25.65'S	107°53.62'E	1.7	So. right
4-Feb	37	47	64°56.26'S	107°32.01'E	3.1	So. right
5-Feb	38	48	64°30.14'S	107°12.50'E	1.9	So. right, pilot
5-Feb	39	49	64°10.63'S	106°39.04'E	7.4	So. right, sperm?, unk Odontocete
6-Feb	40	50	63°56.21'S	106°54.68'E	7.1	Blue, so. right, sperm?,
8-Feb	41	51	64°02.83'S	106°39.70'E	6.4	So. right?, 2nd ship

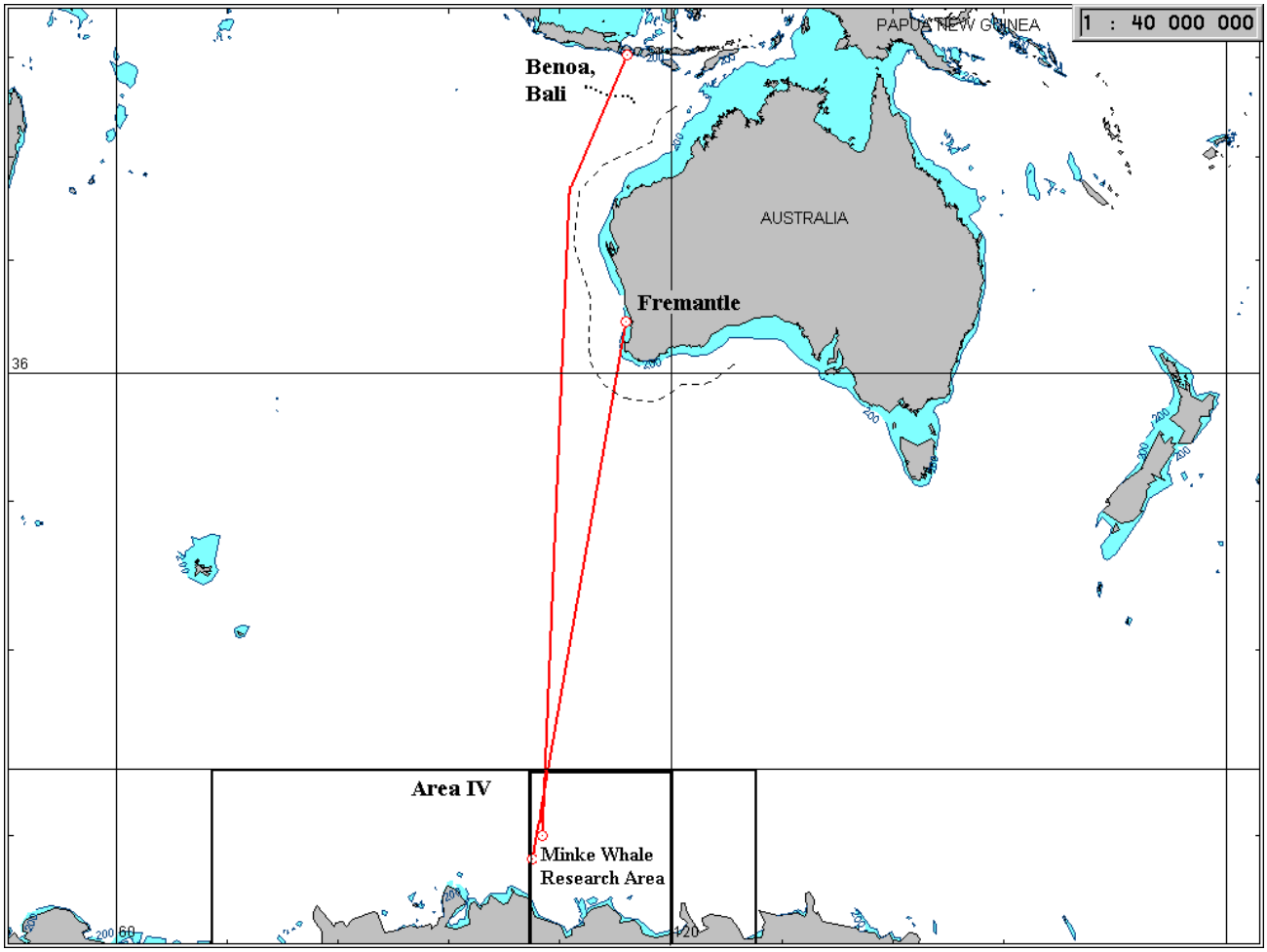
Table 15. continued. Summary of acoustic recording during 2007-08.

Date	Station	Sonobuoy #	Position		Time recorded (hour)	Bio-Sounds Heard
			Latitude	Longitude		
9-Feb	42	52	64°03.15'S	106°43.38'E	7.1	Blue, so. right?, humpback?
9-Feb	42	53	64°05.77'S	106°45.35'E	7.6	Blue, so. right?, humpback?
10-Feb	43	54	64°31.67'S	105°18.93'E	1.6	Blue
10-Feb	43	55	64°31.68'S	105°18.64'E	2.4	Blue
10-Feb	43	56	64°34.47'S	105°21.05'E	1.4	Blue
10-Feb	44	57	64°38.82'S	106°28.73'E	6.1	Blue, unid whale
11-Feb	45	58	64°31.46'S	105°03.31'E	0.4	Blue
11-Feb	46	59	64°16.27'S	105°35.17'E	8.1	Unid whale
12-Feb	47	60	63°22.00'S	106°20.48'E	7.5	Unid whale
13-Feb	48	61	61°58.49'S	106°51.78'E	1.4	Unid whale?

Table 16. Observations of marine debris south of the 60°S during 2007-08.

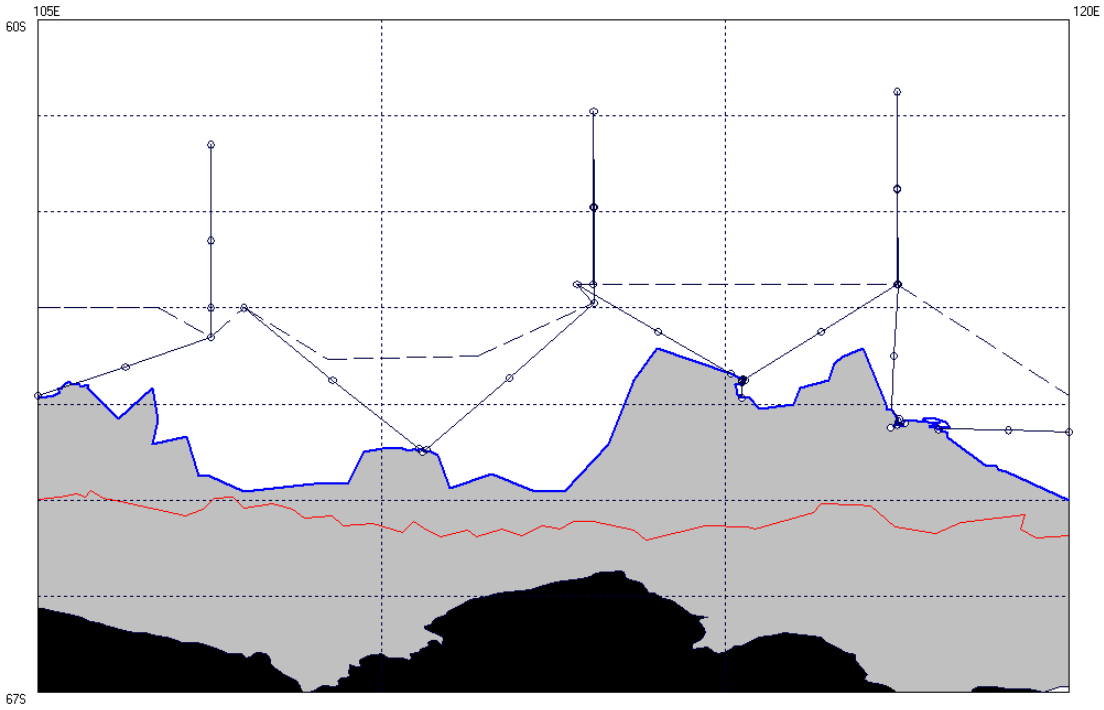
Object	Date	Position	Size
Styrofoam cone	02 January	62°28'S 107°31'E	60cm
Polystyrene “ball”	06 January	62°40'S 113°05'E	Size of 10 gallon bucket
Flat plastic square	07 January	61°51'S 113°05'E	1 square m
Synthetic mesh fabric	08 January	63°14'S 114°01'E	1 square m
Polystyrene “object”	11 January	61°48'S 117°30'E	2.5m x 1m
Plastic bottle	11 January	62°14'S 117°29'E	1.5 liter
Fishing float	14 January	62°47'S 118°20'E	0.8 – 1 m diameter
Plastic bottle	27 January	62°04'S 112°58'E	2 liter
Plastic bottle	28 January	61°34'S 112°59E	1.5 liter
Styrofoam “object”	28 January	61°53'S 112°58E	large
Fishing float	29 January	63°06'S 112°58'E	0.75m

Figures 1a-e. Details of the cruisetracks.

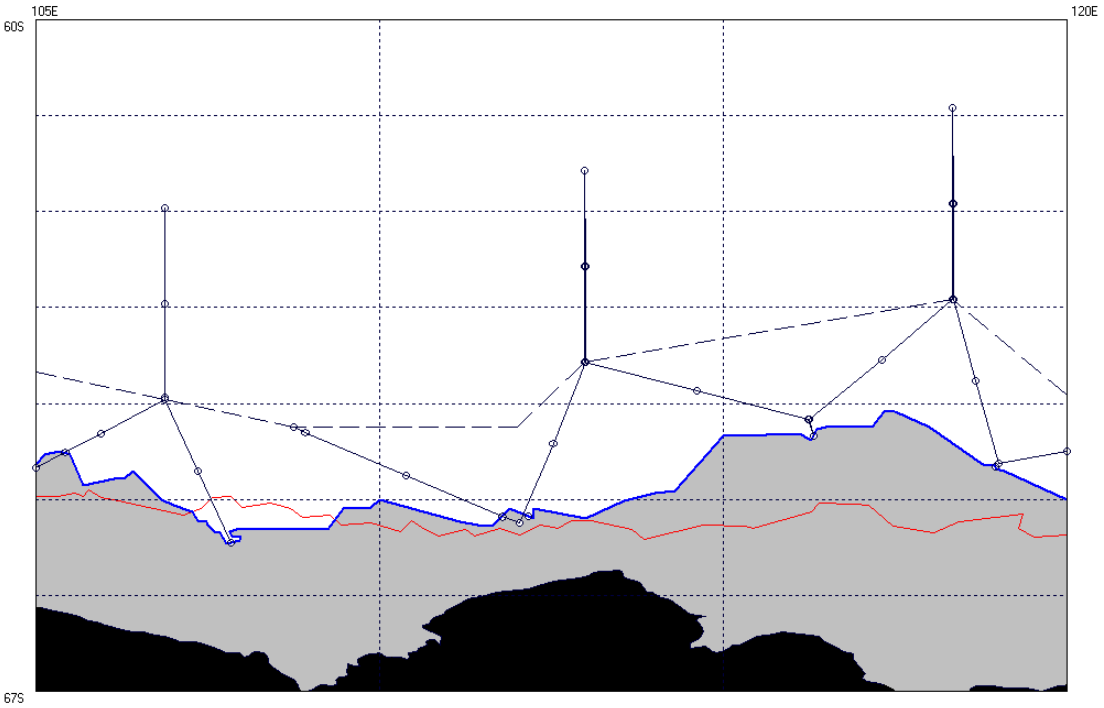


1a. The entire survey, including the transits to and from the Minke Whale Research Area.
The Australian 200 n.mile EEZ is indicated by the dashed line. The Indonesian 200 n.mile EEZ is indicated by the dotted line.

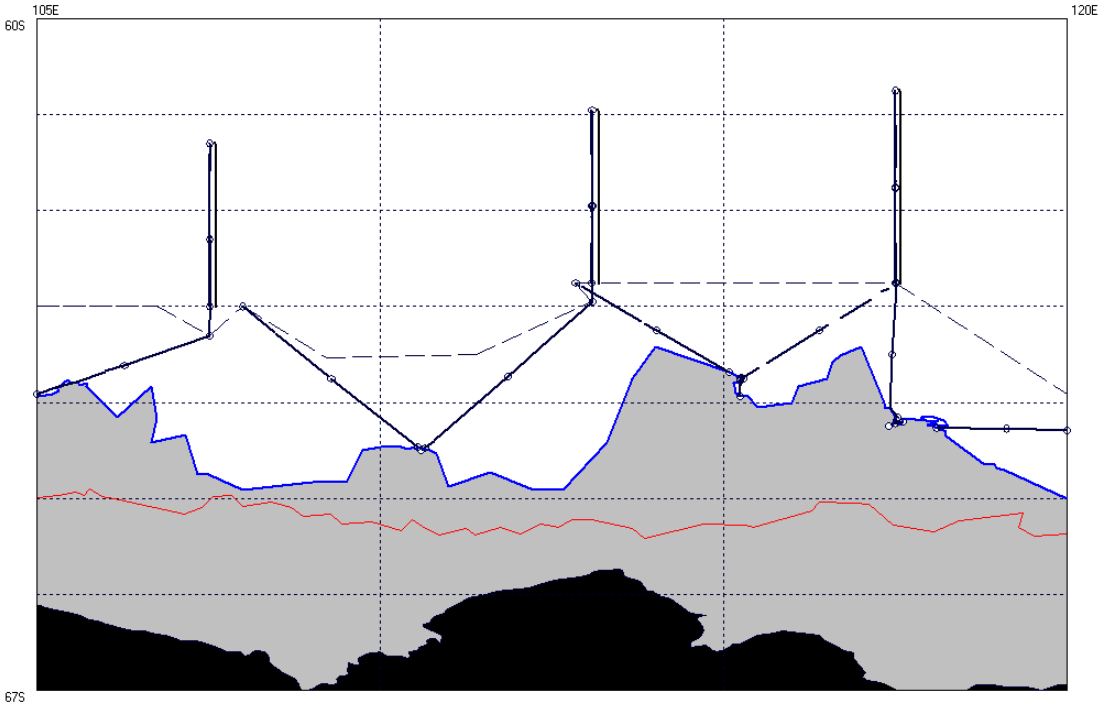
In Figures **1b-e**, **2a-h** and **3a-b** the black area represents land, the gray shaded area represents the extent of the pack ice and the red line represents the 1000m isobath.



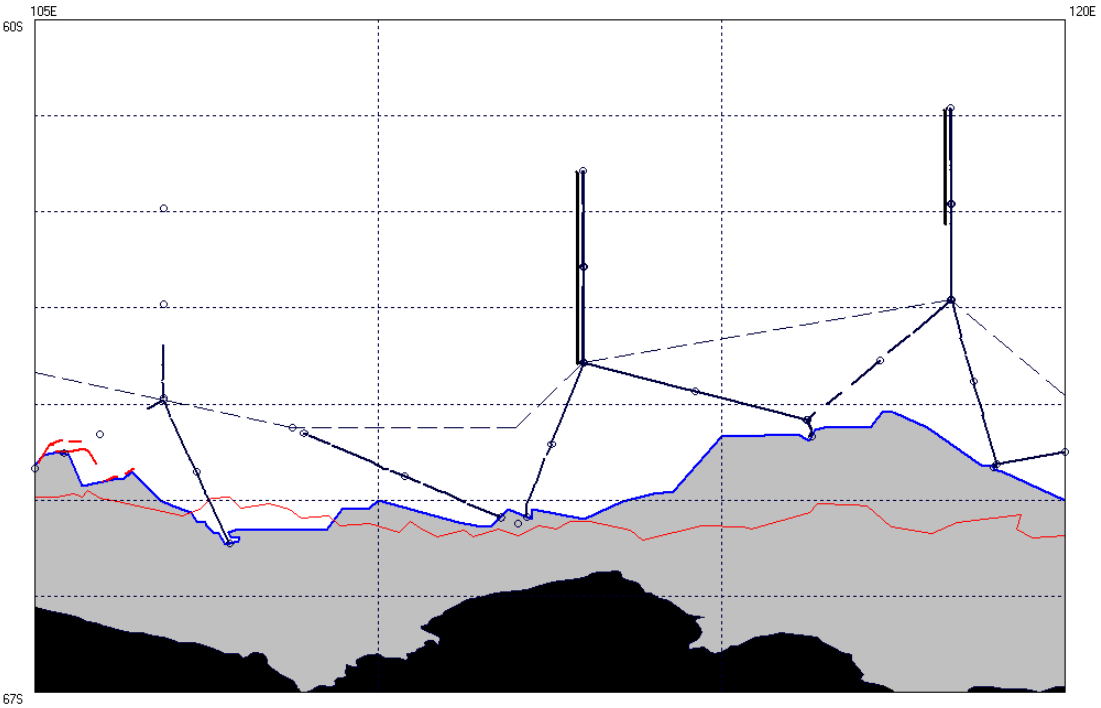
1b. The trackline design for the collaborative survey of the Research Area.



1c. The trackline design for the re-survey of the Research Area.

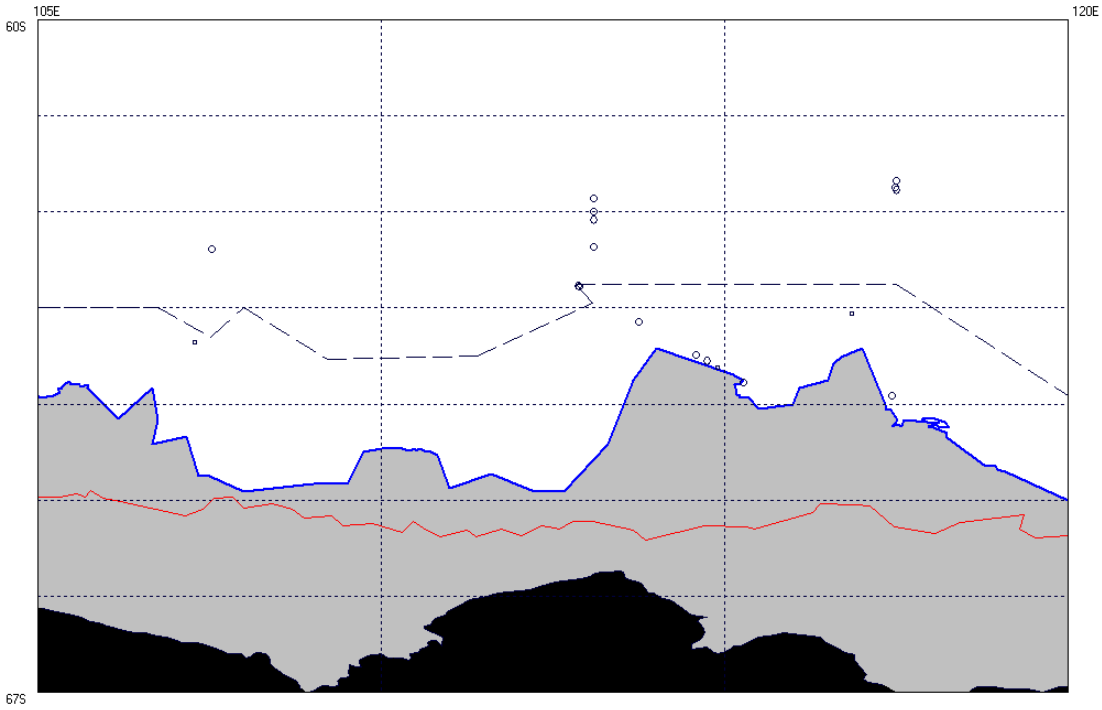


1d. Sections of the cruisetrack during the collaborative survey of the Research Area covered on search effort.

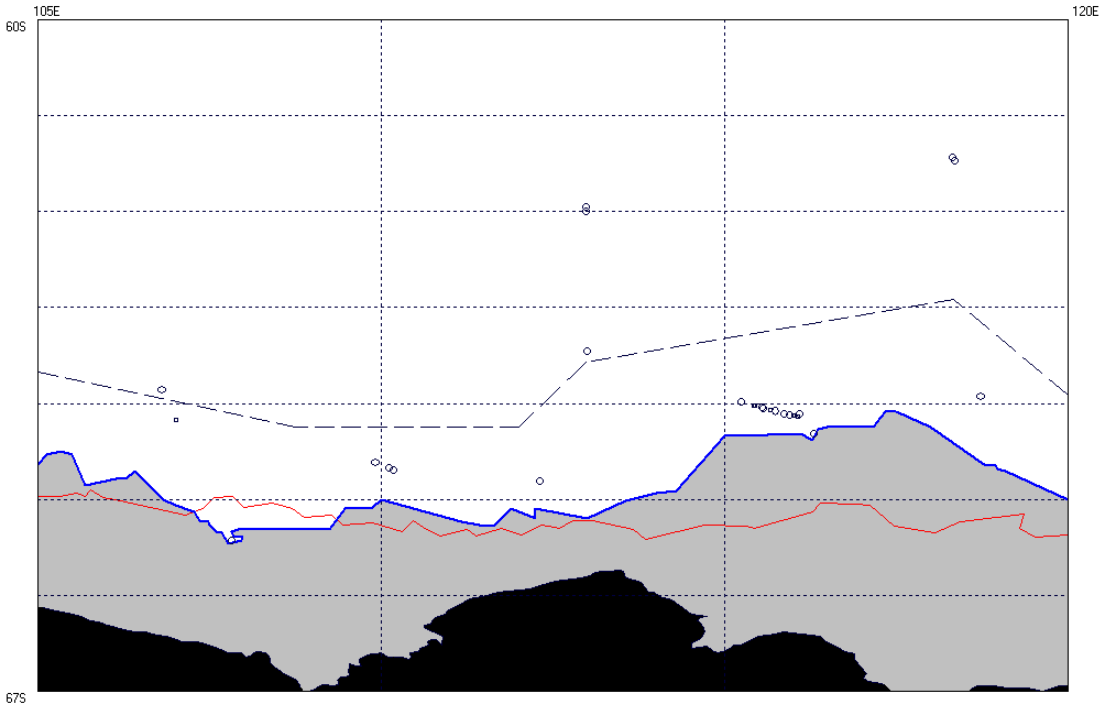


1e. Sections of the cruisetrack during the re-survey of the Research Area covered on search effort. The thick red line represents coverage on search effort in BB mode.

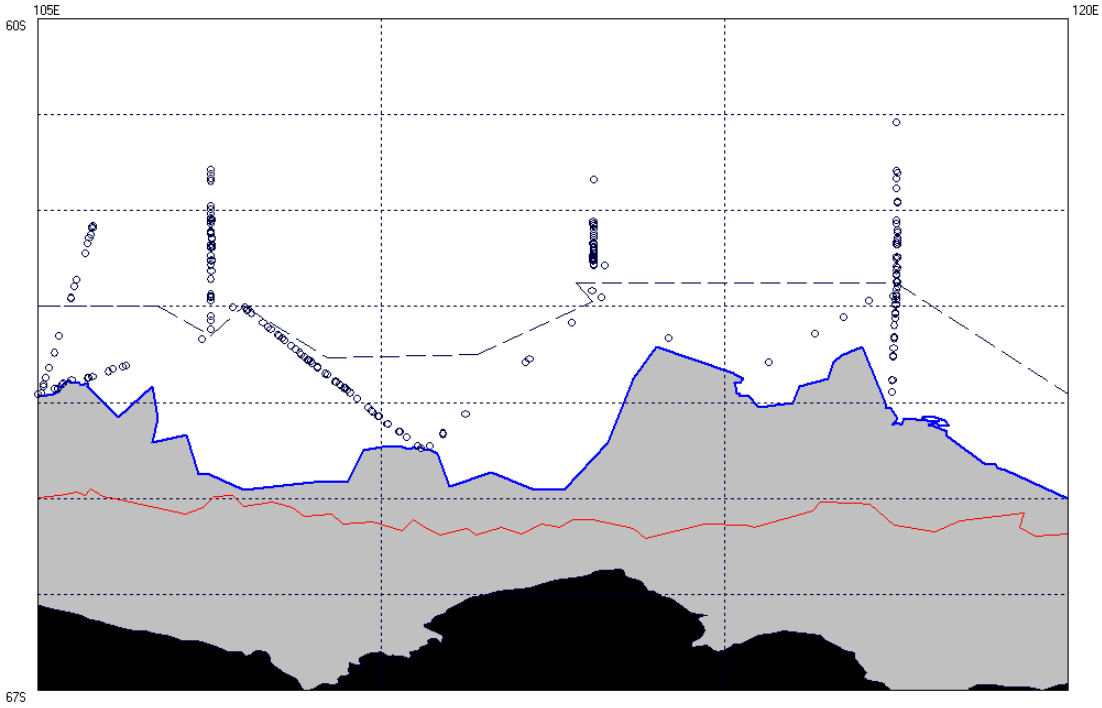
Figures 2a-h. Positions of whale sightings in the Minke Whale Research Area.



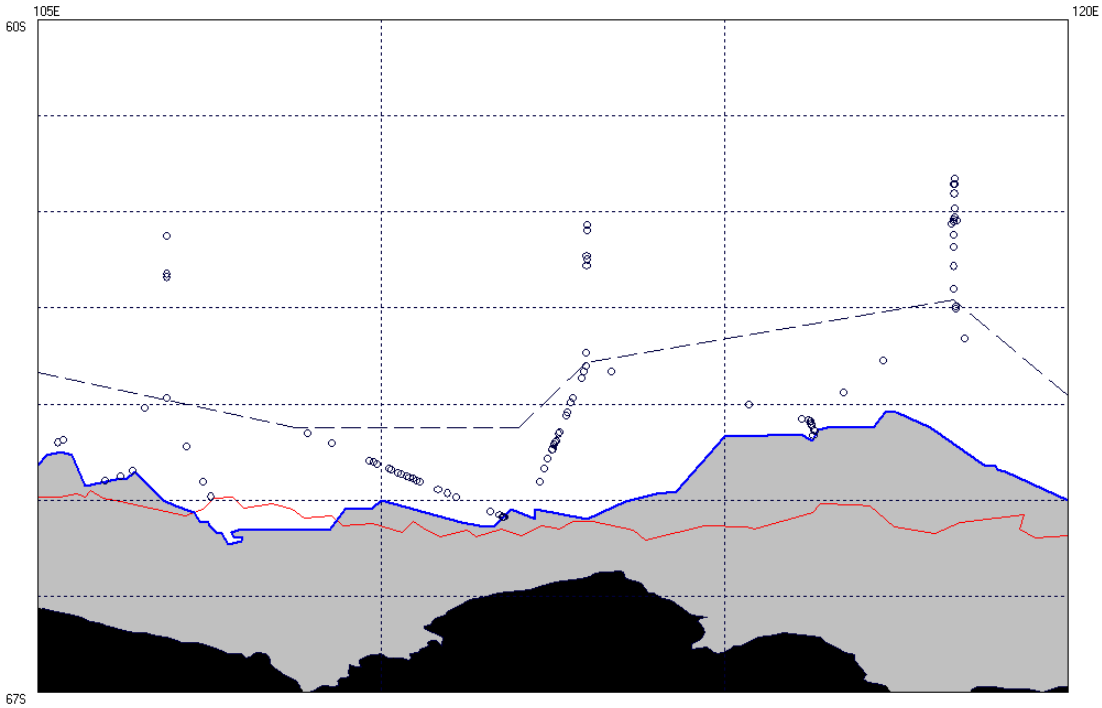
2a. Positions of minke whale (O) and 'like minke whale' (□) observed during the collaborative survey of the Research Area.



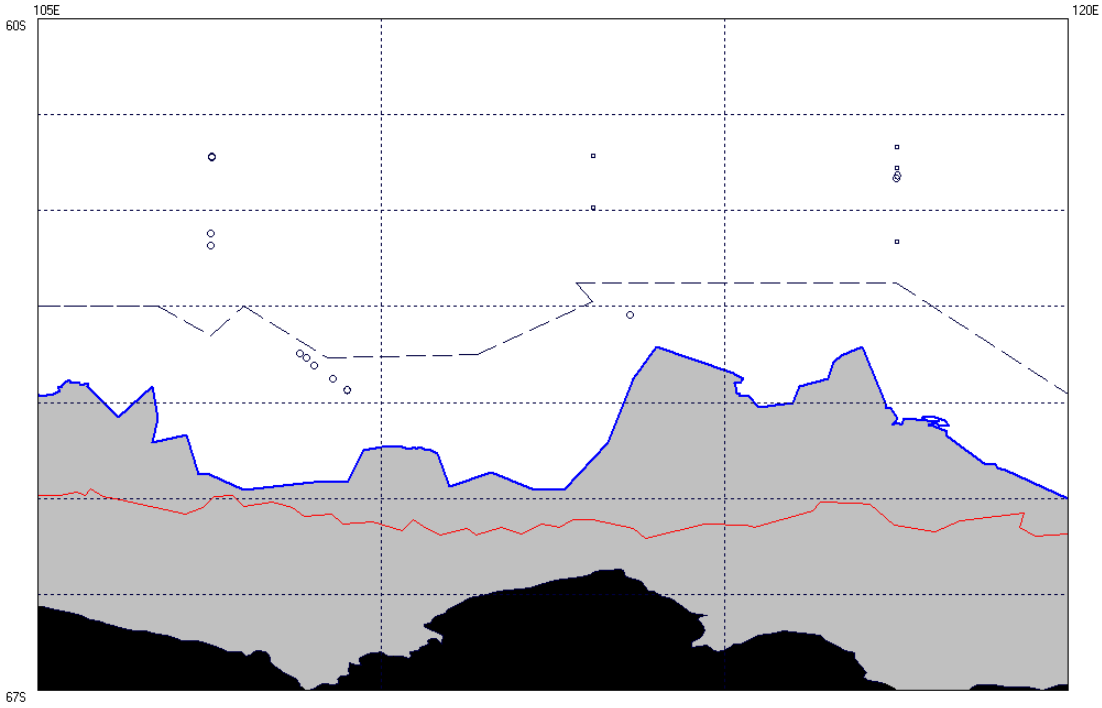
2b. Positions of minke whale (O) and 'like minke whale' (□) observed during the re-survey of the Research Area.



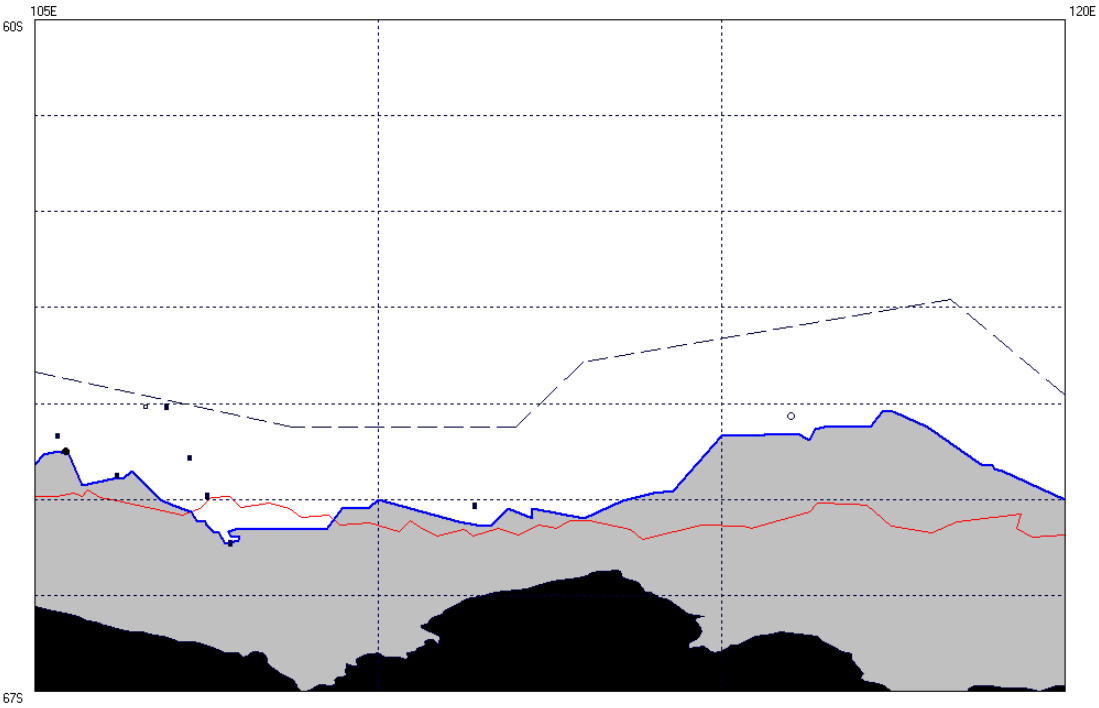
2c. Positions of humpback whale (O) observed during the collaborative survey of the Research Area (includes sightings made during transit in the Research Area).



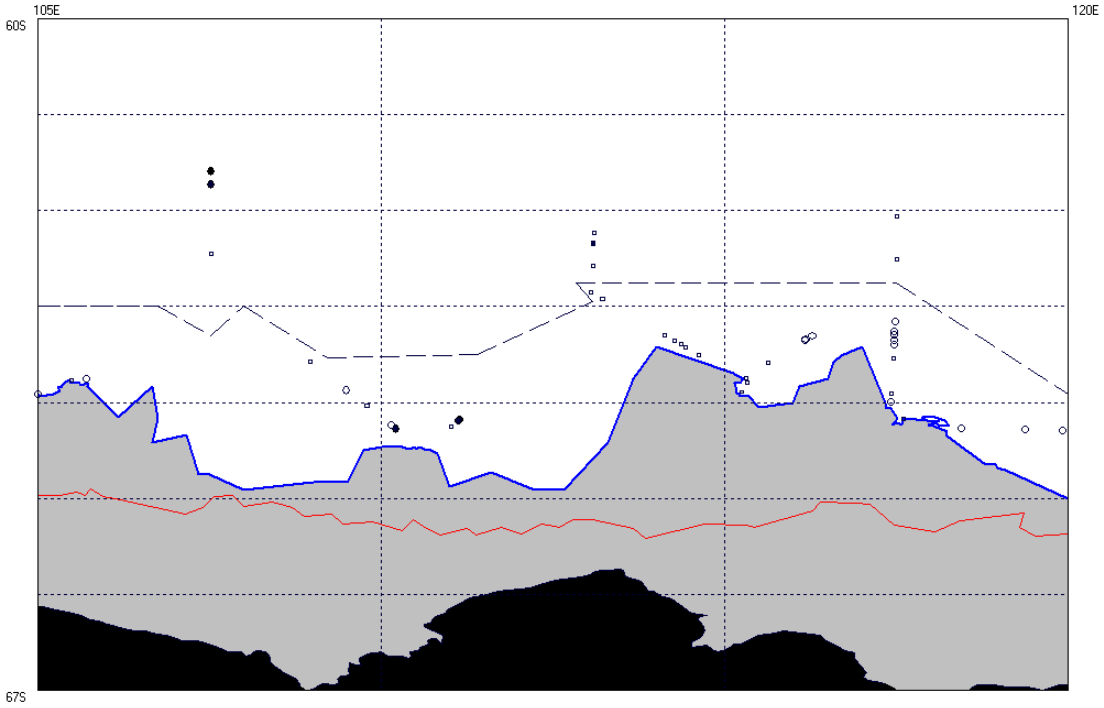
2d. Positions of humpback whale (O) observed during the re-survey of the Research Area.



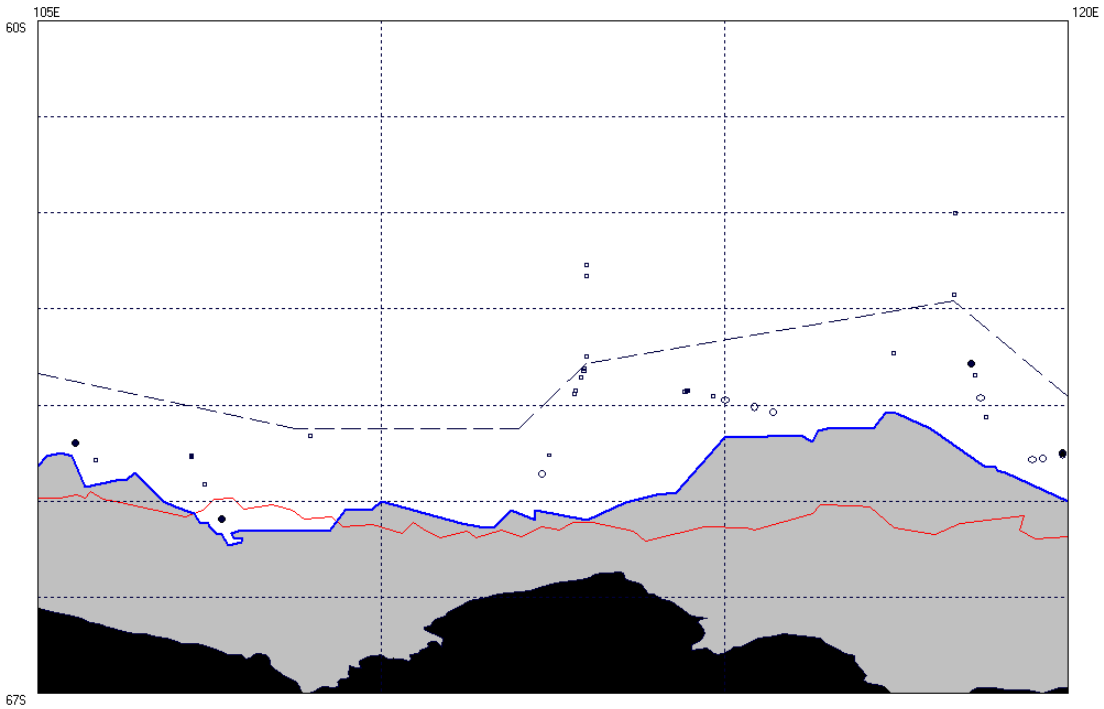
2e. Positions of fin whale (O) and spectacled porpoise (□) observed during the collaborative survey of the Research Area.



2f. Positions of blue whale (Antarctic) (●), fin whale (O), southern right whale (■), and hourglass dolphin (□) observed during the re-survey of the Research Area.



2g. Positions of killer whale (●), sperm whale (O), southern bottlenose whale (□) and pilot whale (■) observed during the collaborative survey of the Research Area.



2h. Positions of killer whale (●), sperm whale (O), southern bottlenose whale (□) and pilot whale (■) observed during the re-survey of the Research Area.

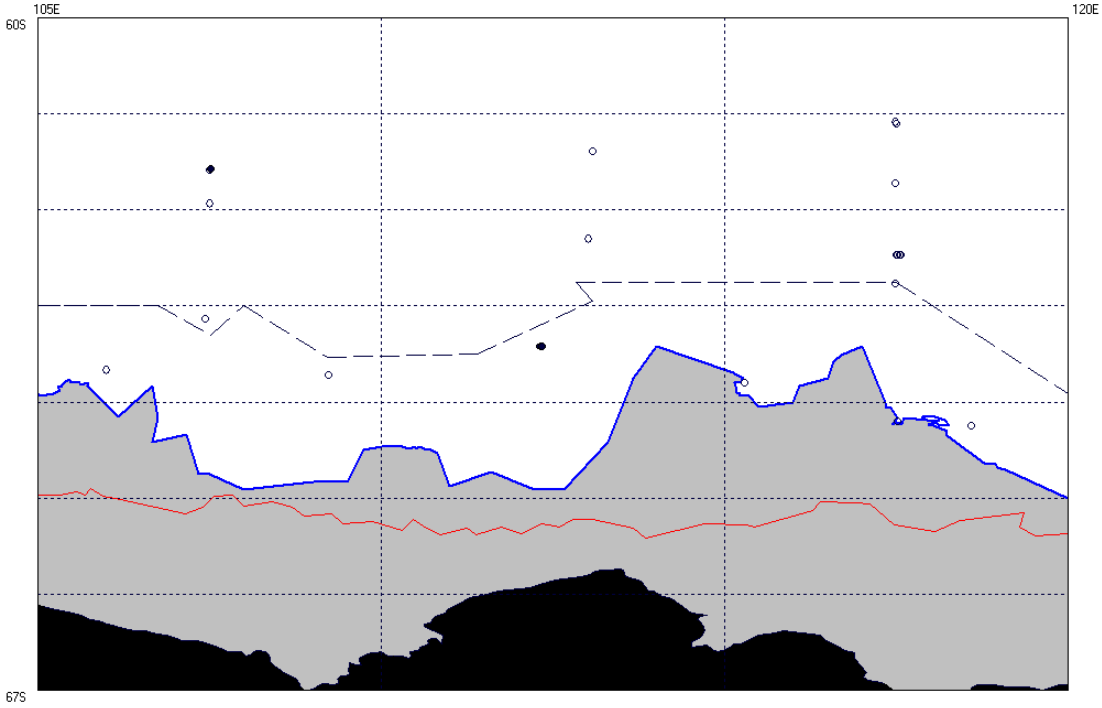


Figure 3a. Locations of all acoustic recording stations during the collaborative survey of the Research Area. Stations with blue whale acoustic detections (●) and stations with no blue whale acoustic detections (O).

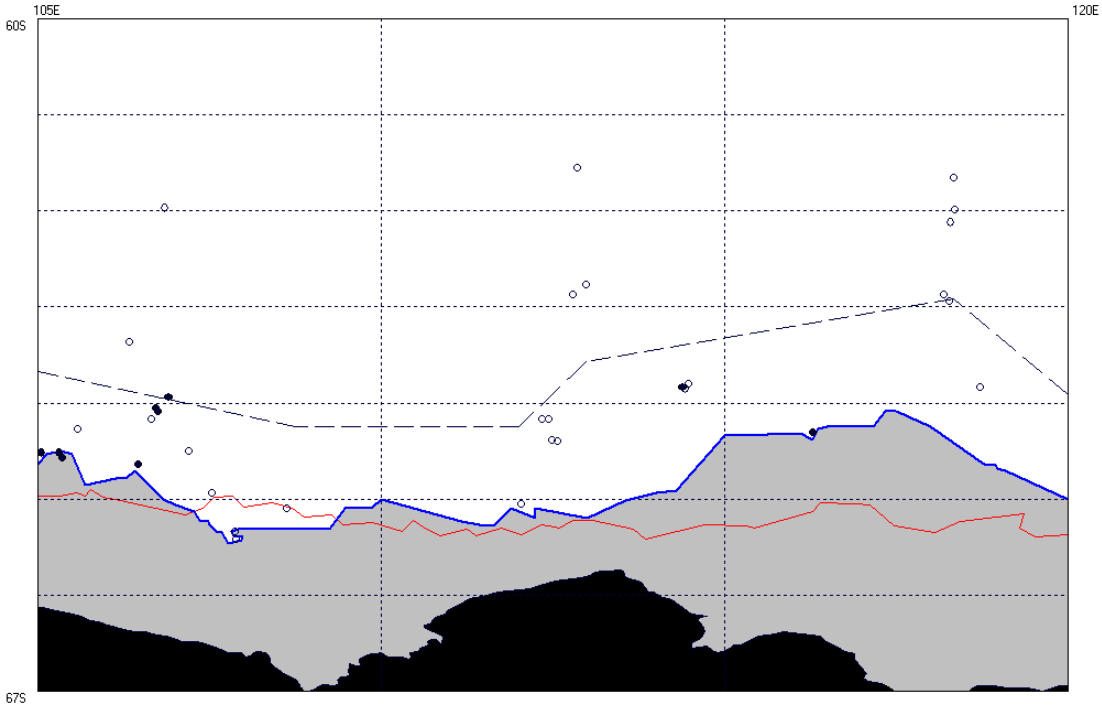


Figure 3b. Locations of all acoustic recording stations during the re-survey of the Research Area. Stations with blue whale acoustic detections (●) and stations with no blue whale acoustic detections (O).

Appendix A: Ship specifications and crew list

Ship specifications:

	Shonan Maru No.2
Call sign	JFCF
Length	64.8 m
Breadth	10.2 m
International Gross tonnage	1015 t
Japan Gross tonnage	712 t
Barrel height	20.0 m
IOP height	14.0 m
Upper Bridge height	11.0 m
Bow height	6.5 m
Engine power (main)	5500 HP
Crew	19

Crew list:

	Shonan Maru No.2
Captain	K. Minami
Chief Officer	H. Kasai
Second Officer	M. Nagamine
Chief Engineer	H. Tanno
First Engineer	H. Yasunaga
Second Engineer	K. Kawamoto
Third Engineer	F. Shimoda
Chief Operator	Y. Tsuda
Boatswain	T. Ohmura
Quartermaster	K. Hasebe
Quartermaster	K. Kawamoto
Sailor	C. Ohmukai
Sailor	T. Satoh
Sailor	Y. Fujieda
Sailor	T. Okita
No. 1 Oiler	H. Yanagiuchi
Wiper	K. Abe
Chief Steward	H. Hodokuma
Steward	K. Mae

Appendix B. Summary of Test results of the Sonobuoy Receivers and Preamplifiers by Greeneridge Sciences.

The Planning Meeting had endorsed recommendations in the 2005-06 and 2006-07 IWC SOWER cruise reports, to send the sonobuoy radio receivers and pre-amplifiers to Greeneridge Sciences Inc. (1411 Firestone Road Goleta, CA 93117 U.S.A.) for testing and assessment. This was to investigate the cause of the partial or non-recording of DiFAR signals from the sonobuoys that had been a problem on recent cruises.

The results of tests carried out in November 2007 indicated that both receivers (modified ICOM IC-R100 radios, serial numbers 06111 and 06221) were functioning normally in the parameters - frequency response, THD, and RF sensitivity.

The frequency response on both of the preamplifiers (Shure FP11) was also evaluated using the 'HI LEVEL INPUT' (3.5 mm phone jack) connector. This input, rather than the XLR (microphone) input, is more appropriate for use with the modified IC-R100 radios because of the fact that the XLR input overloads on input signals larger than 0.14 Vpk (0.28 Vpp), which the radio would produce routinely when receiving a signal from a DiFAR-53x sonobuoy.

The frequency response tests indicate the Shure FP11 preamps should work acceptably well for sonobuoy use. The frequency response and distortion rises significantly below 20 Hz. However, poor fidelity below 20 Hz should not be an issue for DIFAR-53x use.

Greeneridge also noted the following on the Shure preamplifier:

1) The gain between the 'IN' and 'OUT' XLR connectors is actually about 4.5 dB higher than indicated on the rotary switch.

2) The max input signal level, when using the 'IN' XLR input, is about 150 mVpk or 300 mVpp. If the input signal exceeds this amplitude, the output will be clipped ‘independent’ of the rotary switch setting. The XLR input on this device is obviously intended for low-level signals, e.g. microphones.

Greeneridge concluded that the inability to process the acoustic data recorded on recent SOWER cruises with the DIFAR demux software was due to the fact that the signal was severely clipped.

The probable cause of the clipped signal was that the input level to the preamplifier often exceeded the 150 mVpk limit. Furthermore, if the input signal level is less than the 150 mVpk, it is also possible, to get a clipped output signal if the gain is set too high for the input signal. The 7.5 frequency pilot in the DIFAR signal has a deviation of 7.5 kHz. 7.5/10 * 10^(-23/20) = 0.053 Vrms, or 75 mVpk. The 15 kHz pilot has the same deviation. The sum of these two signals, alone, can be expected to add up to 150 mVpk. Any acoustic signal will likely push it 'over the edge'.

It was stressed that the use of the Shure FP11 preamplifier is only necessary if the recording or data acquisition system needs a higher input level than the modified radio produces directly (an ADC with a full-scale range of approximately +/-2 Vpk should be sufficient). The preamplifier can be potentially used to increase the low-level output from the modified R100 radio to a level suitable for the recording equipment however the user should research and test to demonstrate this need.

Appendix C. AMSR-E satellite ice.

The Advanced Microwave Scanning Radiometer (AMSR-E) is a high-resolution passive microwave Instrument on NASA's AQUA satellite. The AMSR-E sea ice data are made available from the University of Bremen (http://iup.physik.uni-bremen.de:8084/amsr/amsre.html) in near real-time (i.e., the next day). See Spreen *et al*. (2005) and Spreen *et al*. (2007) for further details of the AMSR-E satellite and associated analysis algorithms. AMSR-E provides a clear view of sea ice dynamics in greater detail than previous remote sensing technologies and data is provided on a 6.25 km grid resolution—which is the highest resolution of freely available vectorised sea ice data.

Sea ice data were downloaded daily at Australian Antarctic Division from the above website and the research area isolated using custom written software. The region specific data were then imported into ArcMap, where the sea ice grid data are converted into an interpolated raster image. This raster image was constructed using sea ice concentration categories (0-3%, 3-20%, 20-30%, 30-90% and 90-100%) as requested by the SOWER vessel. A sea ice map was then produced from the raster image. See Figures A-F below for examples of AMSR-E satellite ice predictions at various times of the cruise and when critical logistic decisions were made.

Supplying the SOWER vessel with this sea ice data is not without faults. Often times, the sea ice data are not uploaded to the University of Bremen sea ice website for many days. Further, the sea ice data for some days are not made available at all. Finally, the sea ice map produced in ArcMap must also be produced a fairly low resolution to produce a file small enough to be received, via satellite, by the SOWER vessel

References

Spreen, G., Kaleschke, L. and Heygster, G. (2005). Operational sea ice remote sensing with AMSR-E 89 GHz channels. Proceedings 2005 IEEE International 25-29 July, 2005, vol 6, 4033-4036.

Spreen, G., Kaleschke, L. and Heygster, G. (2007). Sea ice remote sensing using AMSR-E 89 GHz channels, *Journal of Geophysical Research*, 113.

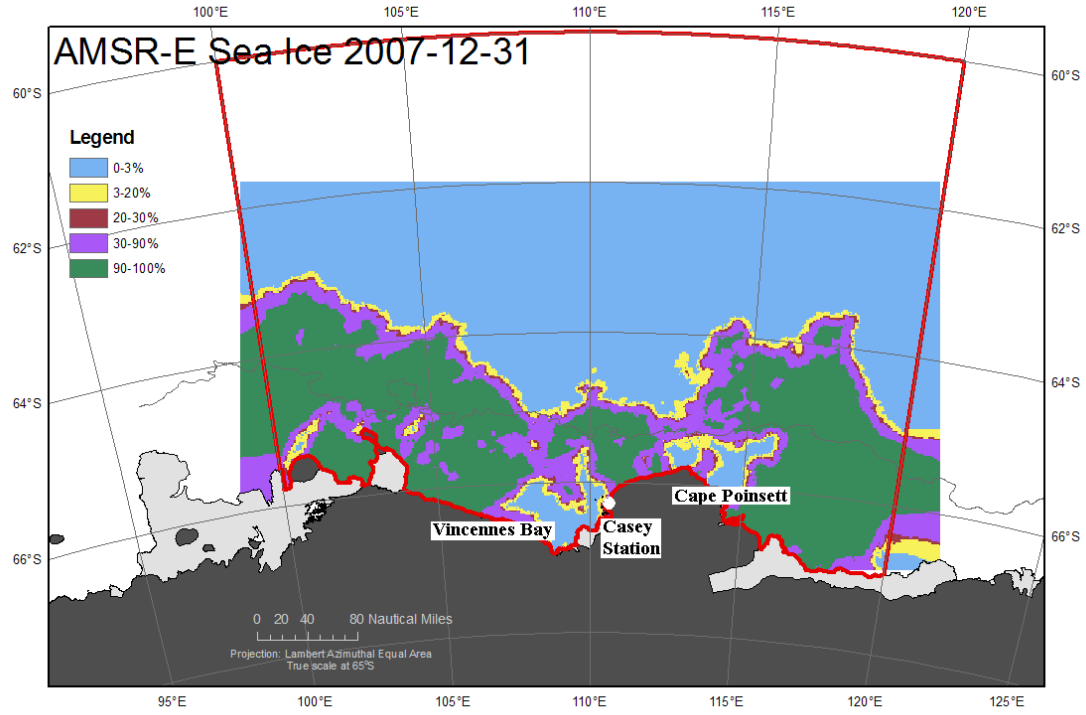


Figure A. Collaborative survey of the Research Area commenced at longitude 105°E on 31 December.

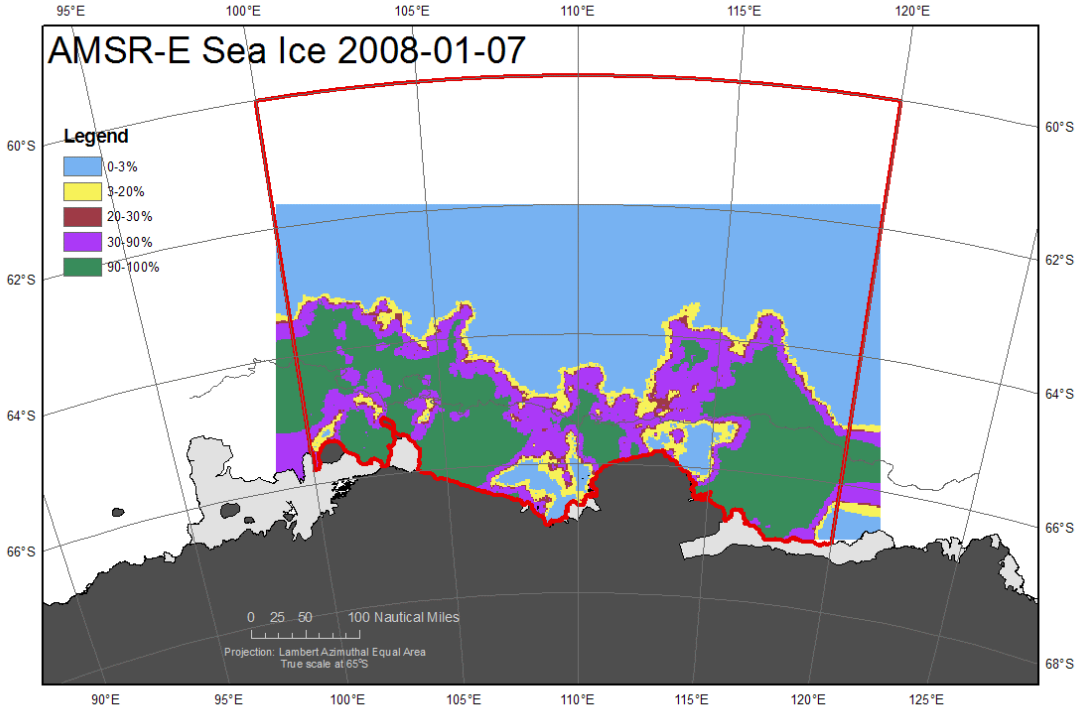


Figure B. Mid-way through the collaborative survey of the Research Area on 7 January.

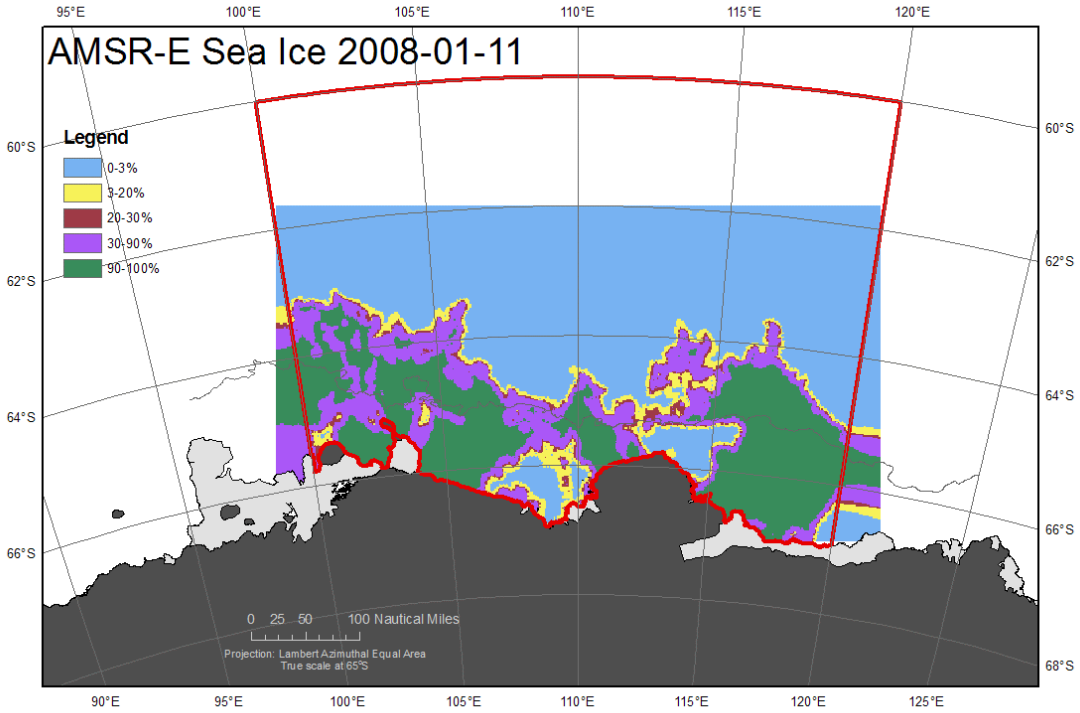


Figure C. This is the image closest in time to completion of the collaborative survey of Research Area and the re-survey commenced. (The image for the actual date; 13 January, was not available).

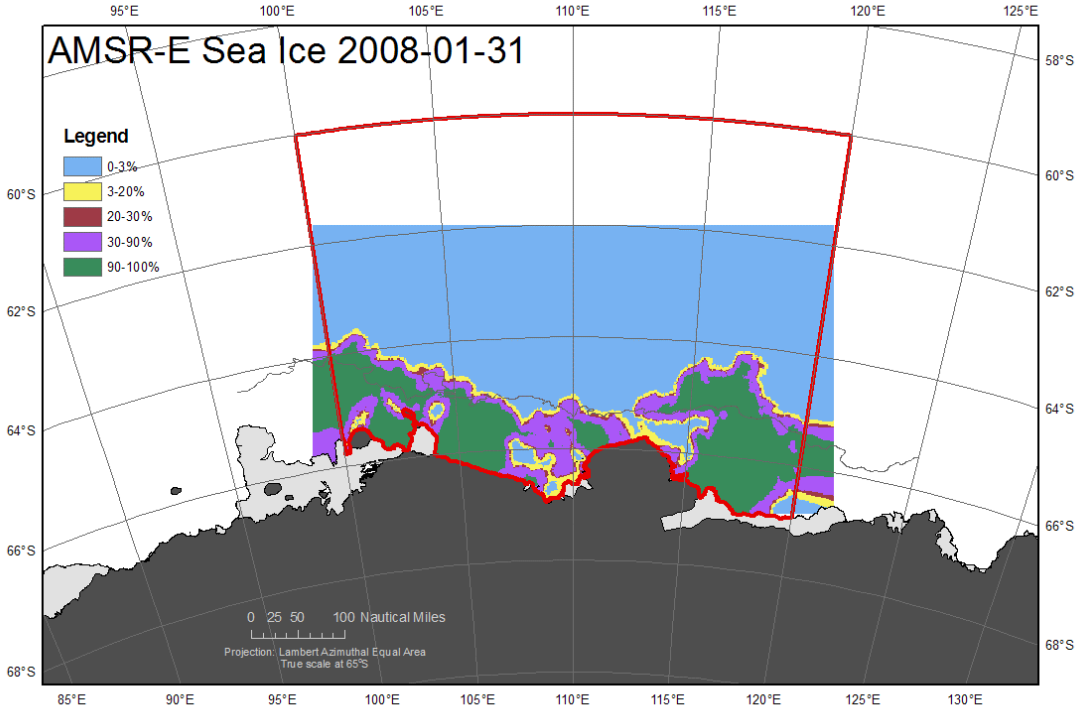


Figure D. An attempt was made to enter the polynya east of Cape Poinsett from vicinity of position 65°15'S 112°02'E on 1 February.

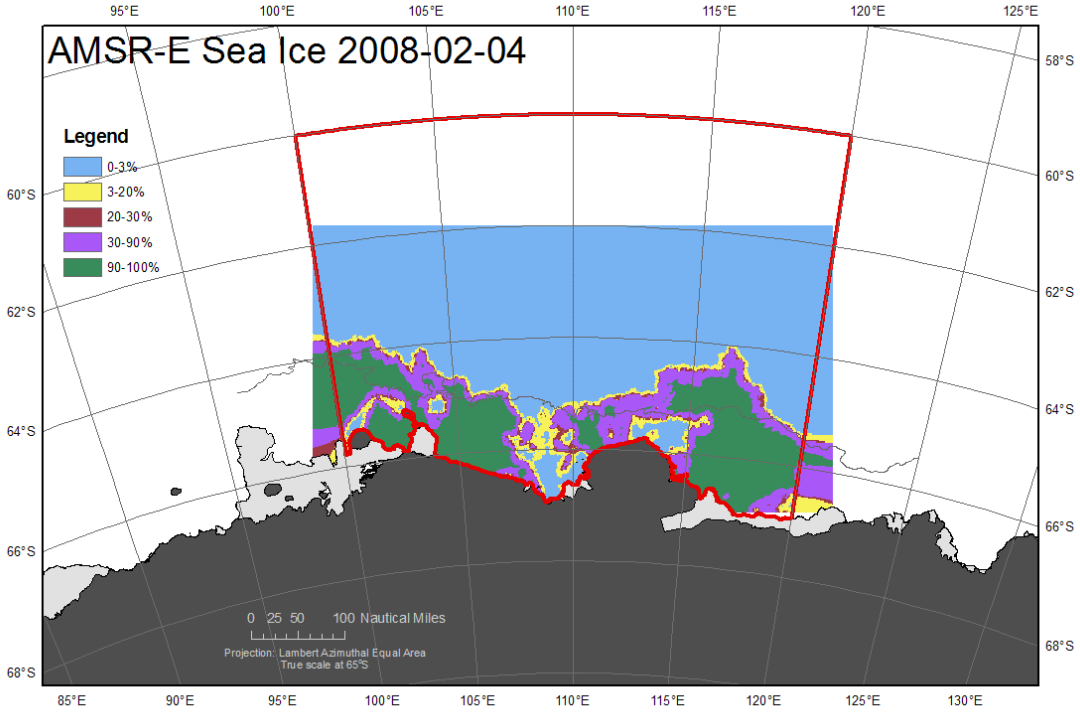


Figure E. Survey was conducted near the ice edge south of the 1000m isobath in the vicinity of longitude 108°E.

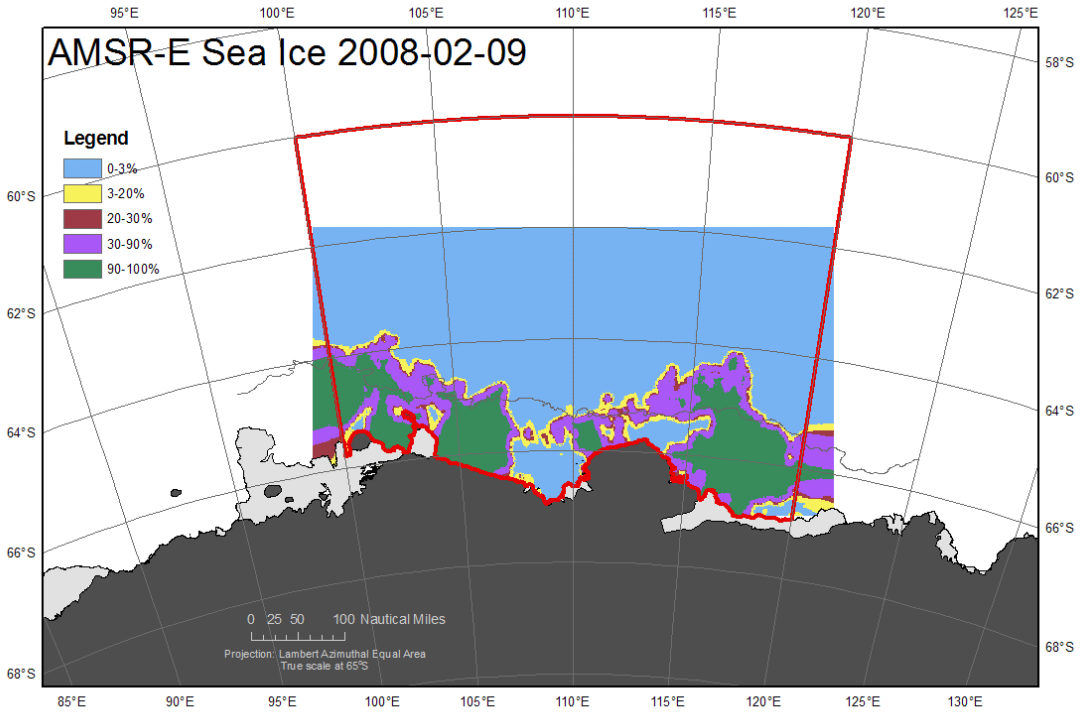


Figure F. Re-survey in the vicinity of the ice edge at 105°E was completed on 10 February.

Appendix D. Observations of cetaceans while in the 200 n.mile Exclusive Economic Zone of Australia.

Introduction

The 2007-2008 International Whaling Commission - Southern Ocean Whale and Ecosystem Research Program (IWC-SOWER) Cruise surveyed in IWC Antarctic Area IV in December 2007, and January - February 2008. The main objectives of the 2007-2008 cruise were to:

1. carry out a series of survey experiments designed to improve and interpret estimates of Antarctic minke whale abundance from previous cruises as well as to inform the design of future SOWER cruises. A priority research item for the SOWER cruise, with respect to providing information on minke whales in the pack ice, was to be collaboration with an aerial survey within and outside the pack ice to be undertaken by the Australian Antarctic Division;
2. continue research on blue whales (including collecting biopsy samples, acoustic data, photographs for identifying individual animals and behavioural data);
3. continue research on humpback whales and fin whales, especially on stock structure (including collecting biopsy samples and individual identification photographs).

The research area was between longitudes 105° and 120°E (Anon 2007a). Details of the entire cruise are reported in Ensor *et al*. (2008).

The vessel from which the research was conducted (the *Shonan Maru No.2*) was to use Fremantle as the homeports pre-cruise and post-cruise. The vessel passed through the 200 n.mile Exclusive Economic Zone (EEZ) of Australia on the transit to the Research Area. Given the time constraints in reaching the research area from Fremantle there was no possibility of conducting research other than Passing mode operations in the EEZ of Australia and permission from the Australian Government was not required for that activity.

During the cruise, the post-cruise homeport was changed from Fremantle, Australia to Benoa, Bali.

Methods

The ship departed Fremantle on 24 December 2007. En route to the Antarctic research area the vessel intersected the Australian EEZ and while in the zone research was to be conducted in Passing mode (NSP). A description of the research procedures and data recording methodology is given in Anon (2007b).

Results

The ship departed Fremantle at 15:00 hours on 24 December 2007. Within the zone good sighting conditions were experienced. A total of 12.00 hours of research in NSP mode (137.3 n.miles) was conducted. The vessel departed the EEZ on 25 December at position 37°35.0'S 113°24.0'E at 22:40 hours. Two sightings were made within the Australian EEZ (Table A).

On return from the Antarctic the *Shonan Maru No.2* did not intersect the Australian EEZ.

References

Anon 2007a. Report of the Planning Meeting for the 2007-2008 IWC-SOWER Cruise. Available from the IWC Secretariat, Cambridge, United Kingdom.

Anon 2007b. 2007-2008 IWC-SOWER Cruise. Information for Researchers. Available from the IWC Secretariat, Cambridge, United Kingdom.

Ensor P., Minami K., Morse L., Olson P. and Sekiguchi K. 2008. 2007-2008 IWC-Southern Ocean Whale and Ecosystem Research (IWC-SOWER) Cruise. Available from the IWC Secretariat, Cambridge, United Kingdom.

Table A. Number of sightings for all species observed during transit in the Australian 200 n.mile EEZ in each effort mode.

Species	NSP	
	G	A
Striped dolphin	1	60
Unidentified dolphin	1	40