2004-2005 International Whaling Commission-Southern Ocean Whale and Ecosystem Research (IWC-SOWER) Cruise, Area III

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ABSTRACT

We conducted the 27th annual IWC-SOWER (formerly IDCR) Cruise in Area III (000°-070°E) aboard the Japanese Research Vessels *Shonan Maru* and *Shonan Maru No.2*. The 65-day cruise departed Cape Town, South Africa on 4 January 2005 and returned to Fremantle, Australia on 9 March 2005. After transiting to the study area, we carried out a minke whale survey and several research experiments from 12 January to 25 February. A systematic minke whale survey was conducted in Area IIIW (000°-035°E) from 12 January until 8 February. The survey design was intentionally similar to that used during the IWC/IDCR second circumpolar series of cruises (CPII) to provide information towards addressing the effect of changing cruise track design on Antarctic minke whale abundance estimates. 000°-020°E was surveyed in two contiguous strata (Northern and Southern), from 64°30'S to the ice edge. Poor weather limited the coverage 020°E-035°E to the Southern Stratum only. A total of 1788.2 nmiles was surveyed (000°-035°E) including 935.5 nmiles in closing mode and 930.3 nmiles in independent observer mode, and a total of 466 minke whales were sighted. Minke whale visual dive time experiments were conducted during the minke whale survey. 35 trials were completed, recording surfacing cues for a total of 45.81 hours. From 10-22 February the ships conducted collaborative studies with the Japanese icebreaker, *Shirase* to investigate the relationship between minke whale abundance and the sea ice. During this study the SOWER vessels surveyed for minke whales in the near-ice area from 035°-050°E. 575.3 nmiles were covered and a total of 22 minke whales were detected. The *Shirase* surveyed in the pack ice zone 040°-050°E from 12-15 February. Two methods-testing experiments were carried out during the cruise: Adaptive Line Transect Sampling and 'BT Mode.' Adaptive Line Transect Sampling was tested during survey in Area IIIW. BT Mode trials were conducted 22-25 February in the area between 050° and 065°E. A direct electronic data acquisition program was evaluated during the cruise on both ships. Sightings for the entire cruise included: minke whales (237 groups/515 animals); blue whales (13 groups/46 individuals) of which 6 groups (28 individuals) were identified as true blue whales and 3 groups (3 individuals) were identified as pygmy blue whales; fin whales (14/132); humpback whales (251/646); sperm whales (35/49); killer whales (23/217); southern bottlenose whales (32/60); Gray's beaked whales (1/7); Layard's beaked whales (2/3); pilot whales (4/265); hourglass dolphins (4/17); striped dolphins (3/435) and common bottlenose dolphins (1/20). Opportunistic research during the cruise included blue whale research on 8 groups/29 animals resulting in 5 biopsies and images of 23 individuals for photo-identification studies. Biopsy samples and photo-ID images were also obtained opportunistically from other species. Biopsies were collected from 6 humpback whales and 1 southern right whale. Photo-ID images were collected from 45 humpback whales, 1 southern right whale and 8 groups of killer whales. Estimated Angle and Distance Training Exercise and Experiment were each completed on both vessels.

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

The 2004-2005 International Whaling Commission - Southern Ocean Whale and Ecosystem Research Program (IWC-SOWER) Cruise was conducted from 4 January 2005 to 9 March 2005. The cruise was the twenty-seventh 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 eight most recent cruises were part of the IWC-SOWER Circumpolar program. The twenty-six cruises focussed on obtaining data to estimate the population size and distribution of minke whales south of latitude 60°S have comprised the first, second and third circumpolar series of surveys. The 2004-2005 cruise represented the start of a new phase of research following completion of the third circumpolar series of surveys, last year on the 2003-2004 cruise.

Initial planning for the cruise was undertaken at the 2004 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 29-30 September 2004 (Anon. 2004a).

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

The research area for the cruise was defined as Area III (000°E - 070°E), south of latitude 64°30'S. This area had been previously surveyed during the 1979-80, 1987-88, 1992-93 and 1994-95 IWC-IDCR cruises. The objectives for the 2004-2005 cruise were to: (1) investigate the relationship between minke whale abundance and the sea ice (including collaborative studies with an icebreaker); (2) carry out a series of experiments addressing (a) problems encountered with the analysis of previous cruises and (b) the possibility of using different sampling strategies on future cruises; and (3) providing information towards addressing the effect of changing cruise track design on Antarctic minke whale abundance estimates.

The 2004-2005 cruise was scheduled later in the season so the Area IIIW component would be most comparable with the 1987-88 cruise. This also meant that the timing was comparable to the timing of the cruises between 1994-95 and 2000-2001.

The minke whale research component of the previous three cruises (the 2001-2002, 2002-2003 and 2003-2004 cruises), had started approximately three weeks earlier than the six preceding cruises. The six earlier cruises had been scheduled later in the season to facilitate cruisetrack construction. The intent was to allow time for ice to recede prior to the survey period and to form a compact edge at a position more readily determined. (The three most recent cruises were scheduled to start earlier and were longer in duration to allow sufficient time to achieve comparable coverage over the very large research area in the eastern part of Area V).

Personnel

Eight researchers were selected for the cruise and assigned to the vessels as follows:

Shonan Maru	*Shonan Maru No. 2*
P. Ensor [1]	K. Findlay [2]
P. Olson	G. Friedrichsen
L. Morse	K. Van Waerebeek
K. Sekiguchi	I. Yoshimura

[1] /: Cruiseleader
[2] /: Senior Scientist

This year, as with recent SOWER cruises, there were four researchers on each vessel. Normally one of the researchers is dedicated to acoustics research. However, on this cruise, as there was no blue whale acoustics research, and considering the need to standardize search effort from the Upper Bridge, the fourth researcher was rostered to other duties.

Schedule

Listed below is the cruise itinerary.

Date	Event
1-Jan	Ships arrived Cape Town
2-Jan	Pre-cruise Meeting
4-Jan	Ships departed Cape Town
5-Jan	Ships departed 200 nmile EEZ of South Africa
10-Jan	Ships intercepted latitude 60°S and traversed the 000°E-010°E Sector
11-Jan	Ships entered the research area at latitude 64°30'S and traversed the 000°E-010°E Sector.
11-Jan	Estimated Angle and Distance Training and biopsy training conducted from *Shonan Maru No.2*
12-Jan	Ships arrived at their respective starting positions for the systematic minke whale survey on the constructed trackline in the Research Area
20-Jan	Estimated Angle and Distance Training conducted from *Shonan Maru*
22-Jan	*Shonan Maru No.2* completed survey of the Northern Stratum of the 000°E-010°E Sector
23-Jan	*Shonan Maru* completed survey of the Southern Stratum of the 000°E-010°E Sector
28-Jan	*Shonan Maru No.2* completed survey of the Northern Stratum of the 010°E-020°E Sector and moved to the Southern Stratum to focus on experiments
5-Feb	*Shonan Maru* completed survey of the Southern Stratum of the 010°E-020°E Sector
5-Feb	*Shonan Maru* conducted Estimated Angle and Distance Experiment
6-Feb	Survey of the Northern Stratum 020°E-030°E was relinquished
8-Feb	Survey of the Southern Stratum 020°E-030°E Sector was relinquished
10-Feb	Ships commenced survey of the near-ice area at 035°E as an extension of the collaborative research with the icebreaker (*Shirase)*
12-Feb	Ships commenced collaborative research with the *Shirase* at 040°E
22-Feb	Ships completed collaborative research with the *Shirase* at 050°E
23-Feb	Ships commenced experiments east of 050°E. *Shonan Maru No.2* commenced Estimated Angle and Distance Experiment (interrupted by a sudden change in weather)
24-Feb	*Shonan Maru No.2* completed remaining trials of Estimated Angle and Distance Experiment
26-Feb	Ships commenced transit to Fremantle, traversed the 060°E-070°E Sector
26- Feb	Ships departed the research area at latitude 64°30'S and traversed the 060°E-070°E Sector.
27-Feb	Ships traversed the 070°E-080°E Sector and *Shonan Maru No.2* intercepted latitude 60°S
28-Feb	*Shonan Maru* intercepted latitude 60°S
7-Mar	Ships entered 200 nmile EEZ of Australia
9-Mar	Ships arrived Fremantle
10-11-Mar	Post-cruise Meeting
12-Mar	Ships departed Fremantle

OBJECTIVES

Sighting Survey

A sighting survey was conducted on this cruise to provide information aimed towards addressing the effect of changing cruise track design on Antarctic minke whale abundance estimates. The research area for the survey was defined as Area IIIW (000°E - 035°E) with the survey conducted on a cruisetrack design comparable with that used during the second circumpolar series (CPII). As with the CPII survey of Area III, the northern boundary of the research area was on the line of latitude 64°30'S and the research area for the survey was divided into two strata (Northern and Southern). The width of the Southern Stratum was planned to be approximately 60 nmiles. Sighting survey protocol for the minke whale survey was the same as in recent cruises (Anon. 2004b). Survey was conducted in alternating Closing mode (NSC) and Passing mode with independent observers (IO). As in recent cruises, minimum survey coverage was set at 80% in the Southern Stratum and 45% in the Northern Stratum. To facilitate the distribution of research effort, up to 30 nmiles could be steamed at night.

The *Shonan Maru* was to cover the Southern Stratum and the *Shonan Maru No.2* to cover the Northern Stratum between 000°E and 035°E. Additional details of the ships' movements and survey coverage are given below in the narrative section.

Ice information was received 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 was transformed aboard the vessels (by programs developed at ICR), from polar stereographic to Mercator projection. A selection of these sea ice images indicative of the ice conditions when key logistic decisions were made during the cruise are presented in Appendix D.

When NSC mode was the only activity of the day, research was conducted for 12 hrs between 0600-1800 hrs. During days when survey was conducted in IO mode, research was scheduled for 12 hrs a day between 0600-1900 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.

An Estimated Angle and Distance Training Exercise and Estimated Angle and Distance Experiment were conducted using the same protocol as on recent cruises (Anon. 2004b).

Minke whale visual dive time experiment

The minke whale visual dive time experiment was one of the main experiments undertaken on this cruise. The purpose of the visual dive time experiment was to collect data on the surfacing rate of minke whales for use in estimation of $g(0)$. Visual recordings are useful since they provide data on cue availability in different weather conditions for different school sizes, and on school synchrony and dive behaviour. For a description of the protocol refer to Anon. (2004b). The time allocated to this experiment was not fixed and up to a maximum of 9 days of the research time could be allocated.

The equipment used for this experiment was identical on both ships: voice recording system, video (Panasonic Digital Video NVDJ1) tape recorder and stopwatches. All equipment was time-synchronized. The equipment was used in a slightly different manner on each ship.

On the *Shonan Maru* cue start times (accurate to the nearest second) were obtained from the voice recorder time stamps and the type of cue from the subsequent voice recordings. The start of each verbal announcement was delayed until three seconds after the microphone switch was depressed to account for the inevitable time-lag before recording started. Where necessary a stopwatch was used during playback to obtain the cue start times from the longer duration recordings that contained information on more than one cue. Video recording was routinely carried out for as much of the experiment as possible. In addition, two researchers used stopwatches to measure the duration of a sample of cues. The durations were usually as seen through 7x50 binoculars and occasionally with the naked eye. Cue durations were measured to the nearest 1/100 of a second.

On the *Shonan Maru No. 2* the voice recording system was used to time stamp the start of each cue with the microphone switch. Cues were called immediately so that the cues were often not picked up by the voice recorder system (due to the time lag) but were recorded on the video sound track and tape recorder. Thus the time event was recorded on the voice recorder system while the verbal description of cue information was recorded on the video sound track and tape. The voice recorder operator typically observed with naked eye. As an aid for transcription and as a backup, times of spoken cues and where possible end of cues, were timed by stopwatch time (to the nearest

second) and recorded to paper on the upper bridge. It should be noted that the voice record system does not record a new time stamp within a short period (possibly three seconds) of a previous time stamp. Consequently the cue durations observed from the *Shonan Maru No. 2* are recorded as real - time spoken voice on the audio track of the video tape recordings.

VHF telemetry

VHF telemetry providing information on the biological surfacing rate data for individual minke whales was planned for this cruise. However as appropriate equipment was not available prior to the cruise within the available budget, this experiment could not be carried out.

Adaptive line transect sampling

Adaptive line transect sampling trials were conducted to provide information on the practical aspects of implementing the method on the SOWER cruises. The trials, using normal IO mode protocol, were allocated a maximum of two days time, to be conducted either on independently designed tracklines, or during resurvey of the systematic minke whale survey tracklines. The tracklines for the adaptive sampling trials were subdivided into 3.0 nmile segments. The procedure used on this cruise was that if either the TOP or the IOP detected no groups of minke whales within a perpendicular distance of 3.0 nmiles, the vessel continued on the straight track line as in normal IO mode. However, if both the TOP and the IOP detected at least one group of minke whales within a perpendicular distance of 3.0 nmiles in a given 3.0 nmile segment, then the vessel commenced adaptive sampling effort at the end-point of that 3.0 nmile segment. During adaptive sampling effort, the vessel started a cyclic zigzag track of four legs. The zigzag courses had an inner angle of 60 degrees with the original course and each leg was 3.0 nmiles in length. The direction (port or starboard) of this initial course change was randomly determined. If at least one group of minke whales was detected by both platforms during the final leg of a cycle, adaptive sampling effort was continued and another zigzag cycle implemented. If either of the platforms had no detections on the final leg of a cycle, then the vessel returned the predetermined straight track line.

Collaborative research with the Japanese ice breaker Shirase

Collaborative research between the SOWER vessels and the Japanese icebreaker *Shirase* (operating as part of the Japanese Antarctic Research Expedition) was undertaken to investigate the relationship between minke whale abundance and the pack ice. This research was scheduled for the area between 040°E and 050°E, and planned to include simultaneous surveys inside the pack ice zone (from *Shirase*) and outside the pack ice (SOWER vessels).

BT mode

Analyses of IO 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 barrel and the IOP) essentially search in the same area of the sea. BT mode (Buckland and Turnock, 1992) is a possible alternative method of searching that, because it intends to separate the areas searched by the two platforms (Tracker and Primary), should reduce the bias and thus may yield estimates of abundance with smaller bias. The practical objective of BT survey mode is for observers from two platforms (Tracker and Primary) to search a separate area of sea, with the Tracking platform searching an area *ahead* of the area searched by the Primary platform. Sightings made by the Tracker thus serve to set up binary trials for observations made by the Primary platform ('Seen' or 'Not Seen'). Unlike normal IO mode there were two observers in the Iop for these trials (a researcher and a crew member).

A full description of the methods to be used for BT mode trials, (including options) are described in Anon. (2004b). For these trials, one pair of 20x60 binoculars was available on each vessel, in addition to angle boards and the standard 7x50 binoculars.

Trials for the use of BT mode were conducted on this cruise since its feasibility for use on future cruises needs to be determined. The aim of the trials, allocated a maximum of two days research time was primarily to provide information on the practical aspects of implementing the method.

Direct data acquisition

The feasibility of direct electronic data acquisition on the upper bridge was tested. This was done in conjunction with the usual SOWER paper and pencil data recording.

Weatherized laptop computers were provided for both ships. The *Shonan Maru* and the *Shonan Maru No. 2* supplied power and connecting cables from the ship's GPS to the computers. Portable GPS units were tested with the computers as well as the ships' GPS. Two sighting data acquisition programs already in use by other research organizations, Logger and Wincruz, were loaded on to the laptops prior to the ships' departure.

Logger proved to be non-functional without supporting software that was not known to be necessary until after departure. Our testing efforts, therefore, were focused on Wincruz. On the *Shonan Maru* the laptop, and fourth researcher acting as direct data recorder, were set-up in an auxiliary seat behind the researcher entering sighting data into the paper data forms. On the *Shonan Maru No. 2,* the auxillary seat was found to be too small to operate the computer system and the direct data researcher stood behind this seat, with the computer encased within a wooden shade box on the seat. Wincruz was used to record data during both NSC and IO modes, and data from different modes was placed in separate daily NSC or IO files.

Blue whale studies and other opportunistic research

Unlike on the previous six IWC-SOWER cruises, there was no specific time allocated to a blue whale research component for this cruise. Blue whale research was to be conducted on an opportunistic basis during the cruise. The blue whale research includes a continuation of research focused on trying to discriminate between the 'true' and 'pygmy' subspecies of blue whale, and includes the collection of skin samples for genetic analysis and photographs for identification of individuals. During the blue whale research component the research protocol was simplified compared to recent IWC-SOWER blue whale cruises, as this year no acoustics recording was attempted.

Photographs identifying individual whales were obtained using auto-focus SLR cameras and 400ASA black & white film (routinely exposed with ASA pushed to 800) as well as digital cameras on *Shonan Maru No.2*. On *Shonan Maru* images were only taken using digital cameras. Two types of biopsy equipment were available on both vessels: Larsen guns and compound crossbows. Biopsy samples were split with one half of the sample frozen (for Japan) and the other half preserved in DMSO/salt solution (for IWC). When samples had a "significant" amount of blubber attached, the blubber was removed from the skin, wrapped in aluminium foil, and frozen.

Biopsy samples and photo-identification photos of humpback and southern right whales were also to be obtained on an opportunistic basis during the cruise. As a lesser priority biopsy sampling of killer whales and other species could also to be conducted opportunistically.

NARRATIVE OF THE CRUISE

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

Pre-cruise Meeting and Transit to the Research Area

The ships arrived in Cape Town on 1 January 2005, and a Pre-cruise Meeting was held on 2 January at the Iziko/South African Museum.

The ships departed Cape Town as planned on 4 January (*Shonan Maru No.2* at 15:20 hrs and *Shonan Maru* at 15:40 hrs). The vessels transited to the research area on parallel courses approximately 20 nmiles apart.

Research within the 200 nmile Exclusive Economic Zone (EEZ) of South Africa was undertaken in NSC mode, however windy conditions restricted research. A total of 8.17 hrs of research (105.9 nmiles) was conducted: 4.14 hrs (48.8 nmiles) from the *Shonan Maru*, and 4.03 hrs (57.1 nmiles) from the *Shonan Maru No.2*. The vessels departed the EEZ on 5 January: the *Shonan Maru* departed at 37°33'S, 017°23'E at 10:28 hrs, and the *Shonan Maru No. 2* at 37°26'S, 017°00'E at 11:07 hrs.

Between the boundary of the EEZ surrounding South Africa and latitude 60°00'S, a total of 28.54 hrs (325.7 nmiles) of searching in NSC mode was conducted. The *Shonan Maru* carried out 14.21 hrs (162.6 nmiles) and the *Shonan Maru No.2*, 14.33 hrs (163.1 nmiles) of research.

During the transit three Argo buoys were deployed from the *Shonan Maru No.2* on behalf of the Japan Agency for Marine Earth Science and Technology. The buoys were deployed at latitudes 50°S, 53°S and 56°S.

South of latitude 60°00'S both vessels traversed the 000°-010°E Sector. Between latitude 60°00'S and latitude 64°30'S (the Northern Boundary of the research area) the vessels experienced poor conditions, and a total of 4.94 hrs (55.9 nmiles) of searching in NSC mode was conducted. The *Shonan Maru* and *Shonan Maru No.2*, respectively, carried out 2.44 hrs (27.3 nmiles) and 2.50 hrs (28.6 nmiles) of research.

Transit in the 000°-010°E Sector continued south of latitude 64°30'S as the ships approached their starting waypoints of the systematic minke whale research (see details under Additional Survey in the 000°-010°E Sector).

Estimated Angle and Distance Training Exercise

Both ships conducted the Estimated Angle and Distance Training Exercise. On the *Shonan Maru No. 2* the training exercise was conducted on 11 January, prior to reaching the starting point for the minke whale research. The training exercise on the *Shonan Maru* was delayed until after commencing research due to the presence of scattered ice and sea conditions unsuitable for radar imaging of the buoy. The exercise was completed on 20 January after 51.6 nmiles of research had been completed on the constructed trackline.

Biopsy test firing was also carried out on the *Shonan Maru No. 2* immediately after the Estimated Angle and Distance Training Exercise.

Minke Whale Sighting Survey (000°-035°E) and Experiments

The systematic minke whale survey was conducted in Area IIIW from 12 January until 8 February. Both ships began survey at the western border of the Research Area (longitude 000°).

The Northern Boundary of the research area was on latitude 64°30'S. The cruisetrack in the Southern Stratum was constructed in relation to a locus Interstratum Boundary and was not constrained within the ten-degree longitude sectors. Waypoints were evenly spaced along the interstratum boundary thus, at the longitudinal boundaries of the sectors, transects did not necessarily intersect either the locus or the estimated ice edge. For the following sector summaries transects were divided where they intersect the longitudinal boundaries of the 10-degree sectors.

Minke whale visual dive time trials and Adaptive line transect sampling trials were conducted from both ships during the minke whale sightings survey between 000°E and 035°E (for details see Results and Discussion Section).

000°-010°E Sector

Survey commenced at 000°00'E and proceeded eastward. The Interstratum Boundary for the sector was constructed as a locus and was defined by the line joining positions 68°30'S 000°00', 68°50'S 002°20'E, 68°40'S 007°21'E, and 68°10'S 010°00'E. The NIC-predicted ice edge approximated the true ice edge.

Northern Stratum

The *Shonan Maru No. 2* surveyed the Northern Stratum from 12-22 January. The proportion of time lost to poor weather conditions in this stratum was high: of the 121.26 hrs available for research, 78.15 hrs (64%) were lost. Very poor weather conditions were experienced in this stratum from 12-17 January due to continuous easterly gales and high seas and research could only be initiated on 18 January.

The cruisetrack in this stratum comprised two survey transects totaling 519.8 nmiles in length. The first survey leg was covered under fair conditions between 18 January and 20 January. While there was some off-effort steaming conducted in the far north of the stratum on both legs, most of the second leg was covered during excellent conditions. 445.8 nmiles (85.8%) were covered on effort; a total of 233.0 nmiles was surveyed in IO mode (during 20.18 hours of research) and 212.8 nmiles in NSC mode (during 18.43 hours of research).

Southern Stratum

The *Shonan Maru* surveyed the Southern Stratum from 12-23 January.

The proportion of time lost to poor weather conditions in this stratum was also high: of the 127.03 hrs available for research, 85.03 hrs (66.9%) were lost due to poor weather. As with the Northern Stratum continuous easterly gales and high seas were experienced from 12-17 January. From 19-22 January the weather moderated and sighting conditions were generally good for the remainder of the sector.

The cruisetrack comprised four transects totalling 298.2 nmiles in length (including one bisector of 6.0 nmiles) with each leg divided into two mode segments. The first survey leg was covered 18-20 January in poor, but acceptable, conditions. The remainder of the trackline in the Southern Stratum was covered in generally very good conditions. A total 261.8 nmiles (87.8%) was covered on effort; 140.7 nmiles was surveyed in IO mode (during 11.95 hours) and 121.1 nmiles in NSC mode (during 10.95 hours).

The width of the Southern Stratum for this sector was approximately 60 nmiles.

Additional survey in the 000°-010°E Sector

While in transit from Cape Town to the start of the systematic survey, a total of 14.82 hrs (176.1 nmiles) of survey was conducted south of latitude 64°30'S in the 000°-010°E Sector. The *Shonan Maru* carried out 9.35 hrs (111.6 nmiles) and the *Shonan Maru No. 2,* 5.47 hrs (64.5 nmiles) of research in closing mode.

010°E-020°E Sector

The Interstratum Boundary for the sector was constructed as a locus and was defined by the line joining positions 68°10'S 010°00', 67°50'S 011°44'E, 67°40'S 014°06'E, 67°40'S 016°30'E, and 68°00'S 020°00'E. The cruisetrack in the Southern Stratum was constructed using the same inter-waypoint distance on the locus as in the 000°-010°E Sector (110 nmiles). As with the 000°-010°E Sector, the track was not constrained within the ten-degree longitude sector, thus, for this summary transects in the Southern Stratum were divided where they intersect the longitudinal boundaries of the sector.

Northern Stratum

The *Shonan Maru No 2* surveyed the Northern Stratum from 22 to 28 January. Survey conditions in this sector were generally good, and although 35.6 % of survey time was lost to poor weather conditions, the survey effort that was carried out was in excellent conditions.

The trackline in the Northern Stratum was 493.7 nmiles length and comprised two legs. A total of 364.8 miles of the track-line (70.2 %) was covered. Of this, 129.42 miles were covered in NSC mode (during 11.75 hours), while 217.4 miles were covered in IO mode (during 18.75 hours).

Southern Stratum

The *Shonan Maru* surveyed the Southern Stratum from 23 January to 5 February.

The proportion of time lost to poor weather conditions in this stratum was high: of the 156.52 hrs available for research, 85.92 hrs (55%) were lost due to poor weather. As with the Northern Stratum the survey coverage that was carried out was in very good sighting conditions.

The constructed cruisetrack comprised five transects totalling 401.2 nmiles in length, including two bisectors (0.85 nmiles and 15.37 nmiles respectively) with each complete leg divided into two mode segments. A total of 293.7 nmiles (73.2%) was covered on effort; 185.0 nmiles was surveyed in IO mode (during 16.45 hours), (including 8.7 nmiles in NSP during ice navigation) and 108.7 nmiles in NSC mode (during 10.95 hours), (including 8.0 nmiles in NSC during ice navigation). Pack ice obstructed 13.2 nmiles (3.3%) of the constructed trackline.

The ice was farther north than anticipated at the estimated ice edge waypoint at longitude 018°15'E and the true ice edge was encountered 4.5 nmiles before the estimated ice edge. The constructed trackline was rejoined 8.7 nmiles from the estimated ice edge waypoint on the next survey leg.

As in the 000°-010°E Sector, the position of the NIC-predicted ice edge approximated the true ice edge.

The Southern Stratum in this sector ranged in width from 55 nmiles to 70 nmiles.

Additional research in the Southern Stratum of the 010°E-020°E Sector

On completion of coverage of the Northern Stratum of the 010°E-020°E Sector the *Shonan Maru No 2* moved into the Southern Stratum of the 010°E-020°E Sector to focus on conducting additional experiments. The aim was to complete as many dive time experiments as was feasible and to carry out trials of the Adaptive Sampling procedure, before proceeding with the survey eastward in the Northern Stratum, where the sighting rate was expected to be lower. The opportunity for the *Shonan Maru No.2* to carry out these experiments in the Northern Stratum 000°E-020°E had also been restricted by a lower sighting rate; as a result it was impossible to achieve the required effort for these experiments.

In the Southern Stratum, the *Shonan Maru No.2* transited westward in poor weather, to an area where a reasonable sighting rate of minke whales had been observed by the *Shonan Maru* during survey in the Southern Stratum. Poor weather on 2 – 3 February prevented research. Seven dive time experiments were then carried out on 4 and 5 February during 10.32 hours.

In the Southern Stratum of the 010°E-020°E Sector the *Shonan Maru No.2* covered a total of 135.5 nmiles in NSC mode (during 12.68 hours) and 9.0 nmiles in IO mode (during 0.63 hours). This effort was mainly on additional constructed tracklines that were designed in relation to the lines already constructed for the *Shonan Maru* during the systematic survey of this stratum. (The midpoints between the locus waypoints for the *Shonan Maru* were used as the locus waypoints for the *Shonan Maru No.2* and the estimated ice edge waypoint was on the perpendicular bisector of the *Shonan Maru* waypoints on the locus). It should be noted that this survey effort was designed to optimize encounters with minke whales and should not be considered systematic in area coverage.

The *Shonan Maru No.2* returned to the vicinity of the sector boundary at longitude 020°E on 6 February.

020°E-030°E Sector and the remainder of Area IIIW (to 035°E)

The Interstratum Boundary for the 020°E-030°E Sector was constructed as a locus defined by the line joining positions 68°00'S 020°00'E, 68°07'S 021°12'E, 68°00'S 026°04'E, 67°30'S 030°42'E. The cruisetrack in the Southern Stratum of the 020°E-030°E Sector was constructed using the same inter-waypoint distance on the locus (110 nmiles) as in the previous two sectors.

Northern Stratum

There was no survey in the Northern Stratum east of longitude 020°E. On 6 February, we decided to forgo the survey of the Northern Stratum east of 020°E. This decision was due mainly to the poor schedule of the cruise and the considerable distance still to be covered in the Northern Stratum, combined with the necessity to transit to 040°E for the collaborative research with the icebreaker. The timing coincided with the presence of a slow moving low-pressure system in the area and therefore there was a low likelihood of experiencing acceptable conditions for survey. Furthermore, it had been impossible for the *Shonan Maru No.2* to achieve the required effort for the dive time experiments due to the continued poor conditions and lack of suitable subjects for dive time experiments in the Northern Stratum.

Southern Stratum

Coverage of the Southern Stratum of the 020°E-030°E Sector was not completed (see below).

Both vessels conducted research in the Southern Stratum. The *Shonan Maru* commenced the Southern Stratum of the 020°E-030°E Sector on 5 February and completed the Estimated Angle and Distance Experiment the same day. The tracklines in the Southern Stratum of the 020°E-030°E Sector were constructed using the same inter-waypoint distance on the locus (110 nmiles) as in the previous two sectors. The locus was constructed as the line joining positions 68°00'S 020°00'E, 68°07'S 021°12'E, 68°00'S 026°04'E, 67°30'S 030°42'E.

The cruisetrack for the *Shonan Maru* comprised five transects totalling 395.0 nmiles in length, including one bisector (25.0 nmiles in length) with each complete leg divided into two mode segments.

The *Shonan Maru No.2* moved eastward into the 020°E-030°E Sector on 7 February to continue to focus on dive time and adaptive sampling experiments (since survey of the Northern Stratum had been discontinued). As in the 010°E-020°E Sector, the trackline for the *Shonan Maru No.2* was constructed in relation to the line already constructed for the *Shonan Maru*. Poor weather on 7 February hampered research, although an adaptive sampling trial was attempted in marginal conditions. Although minke whales were sighted off effort near the ice edge a combination of large swell and high winds precluded dive time experiments on that day.

Both vessels experienced poor weather and rough seas on the morning of 8 February. Due to the slow progress, increasingly tight schedule and the windy conditions with rough seas from the east meant there was little chance of conditions moderating quickly.

Therefore on 8 February we unfortunately had to decide to forgo systematic coverage of the remainder of the Southern Stratum in Area IIIW (the remainder of the 020°E-030°E Sector as well as the Southern Stratum between 030°E and 035°E).

Prior to forgoing the survey on 8 February the *Shonan Maru* had covered more than half of the constructed trackline in the stratum (survey coverage was completed between longitudes 020°00'E and 025°36'E). On the 395.0 nmile trackline a total of 230.3 nmiles (58%) was covered on effort; 123.2 nmiles was surveyed in IO mode (during 10.63 hours) and 107.1 nmiles in NSC mode (during 9.58 hours)..

The *Shonan Maru No.2* covered a total of 62.8 nmiles on parts of two constructed survey legs. 33.0 nmiles were covered in NSC mode (during 3.13 hours) and 29.8 nmiles were covered in IO mode as an Adaptive Sampling trial (during 2.67 hours).

The true ice edge was farther south than the *Shonan Maru* estimated ice edge at longitude 023°50'E and the Southern Stratum ranged in width from approximately 70 nmiles to 90 nmiles. The ice edge appeared to be in close proximity to the estimated ice edge waypoint at longitude 029°17'E. However, the precise location of the ice edge was not confirmed as there was no survey on the constructed trackline in this vicinity since the *Shonan Maru* had traversed this area after the systematic survey had been interrupted.

Thus the vessels moved eastward on 8 February towards the pack ice with the hope of finding conditions appropriate for experiments in the lee of the northeasterly oriented pack ice. Sea conditions were substantially better near the ice edge and conditions were acceptable for research. The *Shonan Maru No.2* covered 16.6 nmiles in NSC mode (during 1.60 hours) as well as a trial of the Adaptive line transect sampling procedure during which 18.8 nmiles were covered (during 1.65 hours). On reaching the ice edge, the *Shonan Maru No. 2* surveyed a non-systematic track along and within the brash ice (logged as BA mode) to maximize minke whale encounters for dive time trials. The *Shonan Maru No. 2* also carried out a dive time experiment at the ice edge. The *Shonan Maru* conducted research in NSC mode near the ice edge and 34.4 nmiles were covered during 3.15 hours. (Two solitary minke whales were encountered but neither was appropriate for dive time experiments.

The strategy for the remaining period before the start of the collaborative research with the icebreaker (scheduled to commence on 12 February at 040°E) was for the vessels to continue transit eastward in the vicinity of the ice edge to 035°E on 9 February and to recommence systematic survey in the Southern Stratum at 035°E on 10 February. In doing so, the near-ice coverage for the collaborative research would potentially be extended westward by five degrees of longitude with coverage achieved prior to the start of the collaborative research.

The *Shonan Maru* transited approximately 150 nmiles on 9 February and covered a total of 43.2 nmiles on effort. 20.4 nmiles were covered in NSC mode and later in the day, due to ice navigation delays, survey was changed to

Passing mode and a further 22.8 nmiles were covered. The *Shonan Maru No. 2,* further west, transited for about 180 nmiles at a distance of about 15-20 nmiles off the ice edge where slightly better conditions were experienced. A total of 85.1 nmiles were covered on effort: 24.4 nmiles in NSC mode and during an Adaptive Sampling trial 60.7 nmiles were covered during 5.40 hours.

Collaborative Research with the Icebreaker Shirase

Collaborative research between the Japanese icebreaker *Shirase* and the SOWER vessels was planned to commence at 040°E on 12 February and extend eastward to 050°E. The aim of the collaborative research was for the SOWER vessels to survey the near-ice area simultaneously with a survey in the pack ice zone from the *Shirase*. The *Shirase* surveyed on a fixed schedule starting on 12 February at longitude 040°E and surveyed eastward in the pack ice to end the survey in the vicinity of Amundsen Bay (at longitude 050°E) completing the research on 15 February.

The SOWER component was set to begin at 035°E on 10 February, two-days earlier than planned. In doing so, the near-ice survey would potentially be extended westward by five degrees of longitude with coverage achieved prior to the start of the collaborative research with the icebreaker.

035°E - 040°E

The northern boundary of the near-ice area between 035°E and 040°E was set on line of latitude at 67°00'S. Systematic overlapping zigzag tracklines (in alternating NSC and IO modes) were constructed for each vessel. The tracklines comprised two legs for each vessel and totalled 325.5 nmiles (both ships combined). The tracklines for the *Shonan Maru* and *Shonan Maru No.2* were 166.1 nmiles and 159.4 nmiles in length, respectively. The inter-waypoint distance on the northern boundary for each trackline was 117 nmiles and the overlapping tracklines resulted in waypoints being spaced at 58.5 nmile intervals on the northern boundary. Thus, potential coverage was approximately twice that achieved in the Southern Stratum between 000° and 020°E (and twice the normal Southern Stratum coverage achieved on recent SOWER cruises).

The ships were in position to start survey at 035°E on the morning of 10 February, however conditions were poor for almost the entire two-day period allocated for research between 035°E and 040°E. The only survey carried out was 17.2 nmiles in IO mode from the *Shonan Maru* (during 1.45 hours of research on the morning of 10 February). This coverage was in the north of the area, furthest away from the ice edge. For the remainder of the 10 and 11 February, the ships either drifted or proceeded off effort along their tracklines in an attempt to find conditions acceptable for research. At a waypoint on an intercept of the tracklines, the ships met on 10 February during poor weather. Ship supplies were transferred to the *Shonan Maru No.2* and a backup IWC computer was transferred to *Shonan Maru* (as both of the IWC-owned computers on the *Shonan Maru* had failed).

040°E - 050°E

On 12 February, the collaborative research was commenced at 040°E. The *Shirase* surveyed in the pack ice 12-15 February and the SOWER near-ice component surveyed 12–22 February. During communications between the *Shonan Maru* and Shimada on the *Shirase* logistic details were exchanged and useful ice edge information was provided for the SOWER vessels.

The SOWER component covered the area between the ice edge and a northern boundary planned to run parallel to the ice edge at a distance of 60 nmiles. The northern boundary of the SOWER component was defined by the line joining positions 67°00'S 039°00', 66°25'S 041°00'E, 66°16'S 043°30'E, 65°54'S 045°42'E, 65°32'S 047°52'E and 65°10'S 050°00'E.

For most of the survey the northern boundary was between 55 nmiles and 75 nmiles from the ice edge, however, at its narrowest, the width of the survey area was approximately 35 nmiles. The reduction in width of the research area resulted from a decision not to modify the position of the northern boundary later in the survey (after changes in the estimated ice edge). This strategy was used because of an increasingly difficult schedule (resulting from persistent poor weather) and the need to distribute coverage over the entire longitudinal range of the near-ice area between 040°E and 050°E.

Between 040°E and 050°E five survey transects were constructed for each SOWER vessel using almost exactly the same inter-waypoint distance on the northern boundary (118 nmiles instead of 117 nmiles). Thus, as between 035°E and 040°E potential coverage was approximately double that achieved in the Southern Stratum on recent SOWER cruises.

The locus northern boundary and the tracklines were not constrained within the longitudinal boundaries of the collaborative research area (040°E-050°E) potentially providing a more nearly even coverage probability. Thus at the western side of the research area the northern boundary was constructed from west of longitude 040°E where its start point was established on a line perpendicular to the general trend of the ice edge in this vicinity. (The modification to the northern boundary west of 040°E was made because it potentially improved coverage, in the vicinity of 040°E, and because there had been no coverage in the east of the near-ice area 035°E-040°E). Similarly, at the eastern side of the research area (at 050°E), the constructed trackline extended east of longitude 050°E to a final ice edge waypoint on a line perpendicular to the northern boundary at 050°E.

The constructed trackline (for both vessels combined) in the near-ice research area was 810.4 nmiles in length and a total of 558.1 nmiles (68.9%) was covered on effort. The SOWER vessels experienced persistent very poor weather conditions in the near-ice stratum and the proportion of time lost to poor weather conditions was high. Of the 152.34 hrs available for research from the *Shonan Maru*, 121.18 hrs (79.6%) were lost and for the *Shonan Maru No. 2* of the 148.69 hrs available for research 119.60 hrs (80.4%) were lost.

The trackline for the *Shonan Maru* was 406.3 nmiles in length (including a bisector 5.5 nmiles in length) and comprised five legs. A total of 291.4 miles of the track-line (71.7%) was covered during 26.56 hours. Of this, 140.1 miles were covered in NSC mode during 12.88 hours, while 151.3 miles were covered in IO mode during 13.68 hours.

The trackline for the *Shonan Maru No.2* was 404.1 nmiles in length and also comprised five legs. A total of 266.7 miles of the track-line (66.0%) was covered during 24.23 hours. Of this, 128.6 miles were covered in NSC mode during 12.08 hours and 138.1 miles were covered in IO mode during 12.15 hours.

Pack ice obstructed a total of 22.0 nmiles (7.2%) of the constructed tracklines (both vessels combined). The position of the true ice edge was not confirmed in the vicinity of the final ice edge waypoint east of 050°E. This area was only investigated during poor visibility when belts of pack ice and grounded icebergs were encountered.

The position of the NIC-predicted ice edge in the near-ice area, 035°E - 050°E, approximated the true ice edge.

Although both surveys commenced at longitude 040°E on 12 February, longitudinal progress of the two components was different due to dissimilar schedules. The schedule for the *Shirase* was predetermined, while the more flexible schedule of the SOWER component had emphasized achieving a good distribution of coverage conducted under the normal standardised conditions. As a result the total duration of each of the components was different. The *Shirase* completed the pack ice zone transects in four days. The SOWER component (040°E-050°E) was conducted during 10-days; the longer duration in comparison to the *Shirase* component was due to delays caused by the poor weather experienced.

BT Mode

BT mode trials were completed from both vessels during the last three days in the Research Area. During the trials, a total of 387.5 nmiles were covered in BT mode (Option 1) during 34.10 hours and 54.8 nmiles were covered in BT mode (Option 2) during 4.45 hours.

The *Shonan Maru* conducted 229.9 nmiles of research in BT mode (Option 1) during 20.44 hours and 54.8 nmiles of BT mode (Option 2) during 4.45 hours.

The *Shonan Maru No.2* covered 157.6 nmiles while in BT mode (Option 1) during 13.66 hours.

On completion of coverage to 050°E, additional transects were constructed for both vessels east of 050°E. This was to potentially extend the near-ice coverage as well as to provide the potential for BT mode trials and additional minke whale dive time trials were planned.

On the 23 February, poor weather was experienced by the *Shonan Maru;* the additional near-ice constructed transects were relinquished and the vessel moved eastward in the vicinity of the ice edge in the hope of finding conditions acceptable for the trials. Conditions improved and the *Shonan Maru* conducted BT mode trials (Options 1 and 2) while moving eastward in the vicinity of the ice edge from the afternoon of 23 February to 25 February. During most of this period the *Shonan Maru* was between 8 nmiles and 25 nmiles from the ice edge (as determined by radar). Prior to the BT mode trials, research in NSC mode was conducted for 2.62 hours and 28.2 nmiles were covered.

On completion of the collaborative research on 22 February, the *Shonan Maru No.2* attempted the Estimated Angle and Distance Experiment. Despite suitable conditions at the start of the trial, a sudden decrease in visibility forced the postponement of about half of the trials.

At the start of research on 23 February, in the north, the *Shonan Maru No.2* experienced light too poor to continue the previous day's aborted Distance and Angle experiment, and survey was conducted in NSC mode on the additional constructed transect (with the aim of continuing the Distance and Angle experiment as soon as conditions were acceptable). Due to a high sighting rate of fin whales the survey mode was changed to NSP mode on this section of trackline. Both the increasing headwind and sea conditions and the densities of fin whales were unsuitable for initial BT mode trials. Poor survey conditions and a large iceberg obstructing much of the southern part of this transect (confirmed by the *Shonan Maru*), resulted in the *Shonan Maru No.2* moving eastward to survey between 055°E and 065°E on a constructed zigzag cruisetrack which ranged from approximately 25 to 90 nmiles from the ice edge. BT mode trials (Option 1) were conducted on this transect on 24 - 25 February. NSC mode survey was also carried out to allow observers some rest during this period. The *Shonan Maru No.2* also completed Estimated Angle and Distance Experiment on 24 February in good conditions.

Transit to Fremantle and Post-cruise Meeting

Due to poor survey conditions encountered (and the presence of an advancing low pressure system) the vessels commenced the transit toward Fremantle on the morning of 26 February, the final day of the scheduled research. The *Shonan Maru* commenced transit from position 65°57'S, 064°52'E and the transit course of the *Shonan Maru No.2* was started from position 65°09'S, 064°00'E.

Both vessels traversed the 060°E-070°E and 070°E-080°E sectors during the transit to Fremantle. South of 60°00'S, poor weather prevented research.

Between latitude 60°S and the boundary of the Australian EEZ mainly poor weather was experienced, however, weather conditions improved further north. A total of 594.9 nmiles of research in closing mode was conducted during 50.17 hrs (both vessels combined). The *Shonan Maru* carried out 26.17 hrs (311.3 nmiles) and the *Shonan Maru No. 2,* 24.00 hrs (283.6 nmiles) of research in closing mode.

The vessels transit courses were outside the Australian EEZ surrounding Heard and MacDonald Islands. The Australian EEZ was intersected adjacent to the coast of Western Australia. Research within the 200 nmile Exclusive Economic Zone (EEZ) of Australia was undertaken in NSC mode. Permission from the Australian Government was not required under Australian legislation (the Environment Protection and Biodiversity Conservation Act 1999) to undertake this research providing the vessels approached to whales no closer than 100 metres.

The ships entered the Australian EEZ on 7 March: the *Shonan Maru* at position 35°12'S, 111°07'E at 02:54 hrs, and the *Shonan Maru No. 2* entered at position 35°23'S, 111°11'E at 05:17 hrs. In the Australian EEZ, research in NSC was conducted for a total of 23.75 hrs (279.9 nmiles). The *Shonan Maru* and *Shonan Maru No. 2*, respectively, carried out 10.9 hrs (126.8 nmiles) and 12.85 hrs (153.1 nmiles) of searching in closing mode within the Zone.

Both ships entered Fremantle Harbour on the morning of 9 March. A Post-cruise Meeting was held at the Western Australian Maritime Museum, Fremantle on 10 - 11 March. The vessels departed Fremantle on 12 March.

RESULTS AND DISCUSSION

All results presented here are preliminary as the data have not been through a final validation screening.

The cruisetracks for both vessels are presented in Figures 1a-g. Figure 1a shows the entire cruisetrack for both ships including transits to and from the Research Area. The cruisetracks in the minke whale research area are shown in Figures 1b-g. The sections of the cruisetrack covered while searching on effort are shown in Figures 1c, 1e and 1g.

During the entire cruise, standard survey was conducted for 404.25 hours and a total of 4713.6 nmiles covered. 2839.9 nmiles were covered in NSC mode, 1376.8 nmiles in IO mode (including 162.7 nmiles in IO mode during Adaptive Line Transect Sampling trials) and 54.7 nmiles in NSP mode.

In the Research Area (south of latitude 64°30'S), a total of 288.68 hours of searching was conducted and 3351.3 nmiles were covered: IO mode – 1376.8 nmiles (120.33 hours), including a total of 162.7 nmiles (14.45 hours) covered in IO mode during Adaptive Line Transect Sampling trials; NSC mode – 1477.5 nmiles (124.83 hours); NSP mode – 54.7 nmiles (4.97 hours) and during trials in BT mode survey – 442.3 nmiles (38.55 hours).

On the transits to and from the Research Area (between the intercepts of the South African and Australian EEZ's and north of latitude 64°30'S), 976.5 nmiles of survey was conducted in NSC mode during 83.65 hours of research. Between the boundary of the EEZ surrounding South Africa and latitude 64°30'S, a total of 33.48 hrs (381.6 nmiles) of research was conducted in NSC mode. Between latitude 64°30'S and the boundary of the EEZ surrounding Australia, a total of 50.17 hrs (594.9 nmiles) of research was conducted in NSC mode.

In the EEZ of South Africa a total of 105.9 nmiles was covered in 8.17 hours of research in closing mode. In the EEZ of Australia a total of 279.9 nmiles was covered in NSC mode during 23.75 hours of research.

Minke Whale Sightings Survey

Effort Summary

Research was completed in the 000°-010°E and 010°-020°E sectors in two strata (the Northern and Southern Strata) (Figure 2b). In addition there was some survey in the Southern Stratum of the 020°-030°E Sector.

In the minke whale survey research area (000°-035°E), the combined search effort for both ships comprised a total of 196.35 hours over a distance of 2204.6 nmiles. (This total includes IO mode during Adaptive Line Transect Sampling Trials; 162.7 nmiles covered during 14.45 hours and research during transit in the research area).

Table 1a-b. gives the starting and ending dates, search effort, and the length of constructed cruisetrack surveyed for each stratum, for each vessel.

The amount of time spent surveying each stratum was not equal due to the different sizes of the strata and weather variation in each stratum.

Survey Coverage in the completed sectors of the Northern Stratum

In the Northern Stratum, an overall coverage of 85.8% in the 000°-010°E Sector, and 70.2% in the 010°E-020°E Sector respectively, was much higher than the target minimum coverage for the stratum (45%). In addition, a good distribution of coverage by latitude, longitude and by research mode was achieved.

Furthermore, the coverage intensity achieved in the Northern Stratum on this cruise was higher compared to the third circumpolar series of cruises. This was due to the reduced latitudinal range of the northern stratum on this cruise (northern boundary on line of latitude 64°30'S) compared to CPIII cruises where the northern boundary has been set on line of latitude 60°00'S.

Additional coverage in the Northern Stratum

Additional coverage in the Northern Stratum of the 000°-010°E Sector on the transit course from Cape Town totalled 176.1 nmiles (south of latitude 64°30'S). Although the additional coverage was achieved on independent tracklines, this distance is equivalent to 33.9% of the constructed trackline during the systematic survey of the Northern Stratum of this sector (12 - 22 January).

Survey Coverage in the Southern Stratum

The coverage achieved of 87.8% on the constructed cruisetrack in the Southern Stratum of the 000°-010°E Sector was higher than the standard target minimum coverage (80%). This was due to the good weather experienced, the relatively lower sighting rate encountered in NSC mode (consequently the distance covered during confirming activities in closing mode was reduced) and because ice did not obstruct the trackline. The lower proportion of coverage in the 010°-020°E Sector (73.2%) was due to a higher sighting rate in closing mode and additionally because ice obstructed 3.3% of the trackline. In each sector, a good distribution of effort within the stratum and by mode was achieved.

Coverage effort in the Southern Stratum in the completed sectors was slightly higher compared to the Southern Stratum in other Areas on recent IWC-SOWER circumpolar cruises. Although the number of survey legs in each sector was the about the same as on recent SOWER cruises, the stratum was narrower in width. Its width approximated the planned 60 nmiles in both of the completed sectors. In comparison, on recent SOWER cruises the Southern Stratum has usually been wider (extending between 75 and 90 nmiles from the ice edge). The narrower Southern Stratum on this cruise was partly due to construction of the cruisetrack in relation to an Interstratum Boundary as the locus of points equidistant from the ice edge (instead of the standard boundary on a line of latitude). Additionally, in the completed sectors (the 000°-010°E and 010°E-020°E sectors), the position of the ice edge approximated the NIC predictions; ice edge estimation was therefore not problematic and the Interstratum Boundary could be reliably constructed near the planned 60 nmile distance from the ice.

Ice Edge

Shipboard observations of the ice edge and positions from the NIC-predictions and SSM/I data were combined to produce a best estimate of the ice edge for the entire Research Area (Figures 1b-d).

During the current cruise, SSM/I data (transformed on the vessels) were used to estimate the ice edge. In most cases, the SSM/I data approximated the true ice edge and therefore ice edge estimation *per sec* for the majority of the research area was generally not problematic.

Comparison with the 1987-88 CPII survey

The systematic minke whale survey in Area IIIW on this cruise was designed to facilitate a comparison with the 1987-88 CPII series cruise.

The northern boundary of the research area during the 1987-88 and 2004-2005 surveys was the same: on the line of latitude 64°30'S.

The longitudinal coverage between the surveys was different. The 1987-88 cruise covered all of Area III (000°-070°E), while the planned systematic survey coverage for 2004-2005 was only in Area IIIW (000°-035°E).

The longitudinal direction of survey was different between the surveys; the 1987-88 cruise surveyed from east to west, while in 2004-2005, survey was from west to east. However, although the direction of survey was different, the 2004-2005 survey in Area IIIW was scheduled to start on approximately the same date as the Area IIIW component of the 1987-88 cruise.

There was a large difference in the coverage achieved on the 1987-88 and 2004-2005 cruises. During the 2004-2005 cruise, the width of the Southern Stratum in the completed sectors (the 000°-010°E and 010°E-020°E sectors), approximated the planned width of 60 nmiles. In 1987-88 however, the width of the Southern Stratum in these two sectors was about 90 nmiles. Coverage intensity in these sectors was also much better during the 2004-2005 cruise compared with the 1987-88 cruise. The 1987-88 survey achieved poor coverage in the Southern Stratum of the 000°-010°E Sector and there was almost no coverage in the Northern Stratum in that sector.

The location of the ice edge was approximately the same during the 1987-88 and 2004-2005 cruises. Our estimate of the ice edge location had about the same precision as the estimate during the 1987-88 cruise because the number of ice edge waypoints was approximately the same.

Estimated Angle and Distance Experiment

Both ships conducted the Estimated Angle and Distance Experiment. On the *Shonan Maru* the experiment was conducted on 5 February. On *Shonan Maru No. 2* the experiment was commenced on 22 February, however trials

were interrupted due to a sudden change in the weather. The remaining trials were completed from *Shonan Maru No. 2* on 24 February.

Sightings

A list of all the sightings recorded during the minke whale research, by species, by area and by effort mode, is presented in Tables 3-8. Figures 2a-j show the location of sightings. Tables 9 – 12 list the sightings observed during transits to and from the research area, including those in the EEZ's of South Africa and Australia. Table 13 summarizes all sightings observed during the entire cruise.

Observations of cetaceans during transit within the 200 nmile EEZ's of South Africa and Australia are presented in Tables 9 and 12. Details of the South African EEZ survey are in Appendix B and details of the Australian EEZ survey are in Appendix C.

Sightings recorded between the EEZ of South Africa and 60°00'S and also between 60°00'S and the northern boundary (latitude 64°30'S) of the current Research Area are presented in Table 10. Sightings recorded between 60°00'S and the Australian EEZ are presented in Table 11.

Minke whales (232 groups, 502 animals) were observed throughout the Research Area 000°-065°E and were the second most frequently observed species. Mean group size was 2.16. In addition, 36 groups of 52 animals of 'like minke' whales were observed. The highest sighting rate for minke whales was in the Southern Stratum 000°-020°E and particularly in the 010°E-020°E Sector. Most of the sightings were recorded within 40 nmiles of the pack ice.

Humpback whales were the most frequently encountered species in the Research Area (233 groups, 533 animals), and were sighted almost throughout the entire Area. Mean group size in the Research Area was 2.29; this is larger than the mean group size reported from SOWER cruises in the 1990's. Humpback whales were sighted most frequently in the Southern Stratum east of longitude 030°E. There was a high sighting rate of humpback whales in the vicinity of ice edge waypoints 035°-065°E with concentrations mainly within 15 nmiles of the pack ice. During the transits, to and from the Research Area, humpback whales were recorded in the region of Bouvet Island and on the Kerguelen Ridge. The status of humpback whales as a low priority species for research on these cruises is surprising, given their increase in the area, the lack of photo-identification and genetic data forthcoming from Antarctic areas (apart from those collected by the SOWER cruises in the past), and the importance of assigning the Area III feeding grounds to the C substocks in the Western Indian ocean.

Blue whales (6 groups, 37 animals) were infrequently recorded in the Research Area. During the systematic survey 000°-020°E blue whales were only recorded in the Southern Stratum with a wide distribution from near the pack ice to about 40 nmiles from the ice. Included in this area was an unusual observation of an aggregation of 26 blue whales recorded at position 68°32'S 019°16'E. There was one observation of a blue whale in the eastern part of Area III (near the pack ice at position 65°55'S 058°04'E). In addition, 5 groups of 10 animals of 'like blue' whales were observed in the Southern Stratum of the Research Area. On the transit to Fremantle, a total of 8 groups (9 animals) of blue whales were detected: in the vicinity of the Kerguelen Ridge and within the Australian EEZ. For more details about blue whale sightings, see Section below: Blue whale Studies and Other Opportunistic Research, and also Appendix G.

Fin whales (8 groups, 119 animals) were observed mainly in one large aggregation on 23 February in the vicinity of position 65°10'S 050°00'E. This aggregation comprised four distinct sub-aggregations, each of which was recorded as a separate sighting. All sub-aggregations were comprised of a number of sub-groups of individuals. An interesting observation was a totally white-pigmented individual (estimated in length at 20m.), observed with 2 other normally pigmented individuals. Apart from the aggregation of fin whales near 050°00'E, this species was infrequently sighted during the systematic survey 000°-020°E and only in the Southern Stratum.

A solitary southern right whale observed on 25 February at position 66°34'S 063°52'E. The whale was either a calf of the year or a yearling (based on the head shape) with an estimated body length of 10-11m and appeared to be in poor condition. The whale was detected amongst scattered brash ice.

Sperm whales (28 groups, 29 animals) were widely distributed in both strata of area covered during the minke whale survey 000°-020°E, and were infrequently recorded in the Southern Stratum eastward to 035°E.

Southern bottlenose whales (28 groups, 55 animals) were also widely distributed throughout the Research Area.

Killer whales (16 groups, 173 individuals) were only recorded in the Northern Stratum during the systematic survey 000°-020°E, however east of 020°E this species was widely distributed in the remainder of the area covered. Of the killer whales identified to type, Types A and B were observed. Two killer whale sightings observed from the *Shonan Maru* comprised individuals that could be matched between the sightings. Examination of digital images show that one individual with a completely severed dorsal fin observed on 9 February at position 68°20'S 031°27'E was observed again one week later on 16 February, 261 nmiles away (in a direct line) at position 67°10'S 042°32'E. In addition, the images of at least three and probably four additional individuals can be matched between the sightings. The group composition was apparently similar: the sighting on 9 February comprised a best estimate of 12 individuals (including two calves) and the sighting on 16 February the best estimate was 14 individuals (including at least two calves). On both occasions the sightings were in the vicinity of the pack ice. On 9 February the group was amongst scattered ice at the edge of the pack ice and on 16 February the sighting position was about 20 nmiles from the pack ice. Both groups were classified as Type A at the time of the sighting, (no cape pattern was observed through binoculars and from the proportions of the eye patches) however during subsequent examination of digital images, a cape pattern was clearly discernable on one individual.

Two sightings of Layard's beaked whales were recorded on 8 January from the *Shonan Maru* on the transit from Cape Town to the Research Area: a group of 2 (at position 51°49'S, 011°38'E) and a solitary animal (at position 52°06'S, 011°30'E).

On the return transit to Fremantle on 7 March in the EEZ of Australia, the *Shonan Maru* sighted a group of Gray's beaked whales (comprising 7 individuals including 2 calves) at position 34°04'S, 112°31'E.

An interesting sighting of a single ziphiid was observed from the *Shonan Maru No. 2* on 23 January at position 67°12.51'S, 011°25.48'E. The pigmentation pattern was unlike any previously described phenotype.

Resighting During IO Mode

Resighting data were recorded for a total of 121 sightings during IO Mode (101 sightings from the *Shonan Maru* and 25 from the *Shonan Maru No. 2)*. Table 14 shows the identification of duplicate sightings observed during survey in IO Mode.

Minke whale visual dive time experiment

The minke whale visual dive time trials were carried out in the first half of the cruise in Area IIIW. Thirty-five trials of the dive time experiment were conducted from the two ships for a total of 45.81 hours (Tables 16 and 17).

Videotaping was undertaken during all the visual dive time trials. Video sequences of diving behaviour of minke whales were not obtained during the systematic sighting survey, as had been suggested during planning, because of the few chances available; in IO mode, minke whales were too difficult to track with the video camera; in NSC mode, we generally elected to conduct dive time trials on suitable groups anyway.

Of the 35 trials, the results from 32 were considered to be of acceptable quality. The group sizes of the (acceptable) targeted groups were as follows: 4 groups of 1 whale, 26 groups of 2-5 whales, and 2 groups of 6 whales. All group sizes were confirmed, either during or after the trials. We took the opportunity for trials with every group available and did not intentionally select for group size. However, after initial poor success with solitary animals we concentrated on the more-workable larger groups.

Except at the very start of the survey, both ships had only very good sighting conditions during the on-effort survey periods, therefore all but one of the visual dive time trials were conducted in Beaufort conditions between 1 and 3.

The trials were conducted in a range of locations in relation to the ice edge. From the Shonan Maru, one trial commenced inside the pack ice and the ship followed the group out of the ice; another at the ice edge was lost when the whales entered the ice. Seven other trials were conducted within 15 nmiles of the ice. The remaining trials in the Southern Stratum carried out by the *Shonan Maru* ranged from 15 to 60 nmiles from the pack ice. From the *Shonan Maru No. 2,* one visual dive time trial was carried out by the in the vicinity of the ice edge and during the trial the animals entered brash ice. Three of the *Shonan Maru No. 2* trials were conducted within 15 nmiles of the ice edge, while a further four were conducted between 15 and 60 nmiles from the ice edge. The remainder of the trials carried out by the *Shonan Maru No. 2* were located over 60 nmiles from the ice edge.

In both Southern and Northern Strata a proportion of the sighted minke whale groups were considered unacceptable for dive time trials due to vessel avoidance or altered behaviour patterns. Groups swimming fast when first sighted, or those considered to have reacted to the vessels, were not selected.

The distance from the vessels to the whales was usually maintained between 0.3 and 0.7 nmiles (typically 0.4-0.5 nmiles on the *Shonan Maru* or 0.3-0.6 nmiles on the *Shonan Maru No. 2*) by moving the vessel with engine starts and stops and periods of drifting and slow vessel movement (at speeds of 3 - 4 kts). On the *Shonan Maru*, the whales only rarely approached the vessel and did not approach the vessels closer than about 0.2 nmiles. In four trials on the *Shonan Maru No. 2*, whales approached the vessel closer than 0.2 nmiles. No marked reactions were noted after these close approaches, although a brief reaction was noted in the fifth trial after the whales had crossed the bow of the vessel within 0.2 nmiles. Slight avoidance was apparent in the seventeenth trial when the whales approached to within 0.1 nmiles, within the brash ice, although it is uncertain if this was a function of the ship, the ice, or the noise of the vessel hull passing through the ice.

We attempted to record separately the surfacings of individual whales within a group (i.e. animals with distinctive dorsal fins) but this was unsuccessful. Most whales appeared indistinguishable at 0.4-0.5 nmiles for the brief time they were at the surface and they would frequently exchange relative position within the group.

A range of behaviours was observed; in most cases unidirectional travel with small course and speed changes. We also observed very slow milling and on two trials a short period of very fast 'charging' (up to 15 knots). We did not attempt to 'chase' animals when they demonstrated this behaviour and they very soon slowed down, milled, and resumed their previous slow swimming behaviour. We don't know if this was ship reaction, however on first inspection it does not appear to be related to the timing of our engine starts or stops. (This behaviour is not uncommon and is quite frequently the initial sighting cue during these surveys). During one trial carried out by the *Shonan Maru No. 2*, one group of two large minke whales had markedly longer intervals between detections (sometimes over ten minutes) and greater inter-surfacing distances (of up to one mile) than other groups.

Swimming speeds were calculated from trial start and end positions for groups that exhibited predominantly unidirectional travel. A mean swimming speed of 4.86 kts (range 1.9 – 6.9 kts) was calculated for 19 groups (*Shonan Maru* trial nos. 3, 4, and 6 through18; and *Shonan Maru No.2* trial nos. 4, 9, 11, 13 and 15).

Only during two trials (one from each ship) were groups observed to split or otherwise become confused with cues from other groups in the vicinity. For all other trials there was no change in group numbers. School compactness occasionally varied from the norm of all animals within about five body lengths; some groups spread out to more than 12 body lengths between some individuals and then merged together again.

While the presence or absence of secondary sightings was noted during the dive time trials, Sighting Data Records for these sightings were not usually completed on the *Shonan Maru*, due to the need to concentrate on the trial. Off-effort Sighting Data Records were completed for secondary sightings made during dive time trials on the *Shonan Maru No. 2*, although it must be noted that no effort was placed by researchers on these sightings, due to their concentration on dive time trials.

Although identical equipment was available an each ship, a different experimental procedure was adopted on each ship as noted in the Objectives Section. The researchers on both ships consider that the experiment was successfully conducted. Due to the difference in methods, the results from the two ships might be slightly different, but should be complementary in scope. Detailed inspection of the results may provide an insight into how the experimental procedures might be improved in the future.

A brief log of the trials is attached as Appendix E. A summary of the video sequences taped on both ships is attached as Appendix F.

Adaptive line transect sampling

Adaptive line transect sampling trials were conducted for a total of 14.46 hrs and 162.8 nmiles were covered (both ships combined). One trial was conducted from the *Shonan Maru* and 53.5 nmiles were covered during 4.74 hours of research. From the *Shonan Maru No. 2*, three trials were conducted over 109.2 miles during a total of 9.71 hours.

From the *Shonan Maru* a trial was carried out on 27 January in the Southern Stratum of the 010°E -020°E Sector. The trial resurveyed a segment of the constructed trackline previously covered in IO mode during the systematic

survey.[9] The segment was selected for the adaptive sampling trial because in IO mode minke whale sightings had been relatively clustered during the middle of the segment. Three cycles of the adaptive sampling protocol were triggered. The first cycle was triggered during survey of the third-3.0 nmile segment; the second cycle was triggered during the first cycle and the third cycle was triggered in the second-3.0 nmile segment after returning to the original course from the second cycle.

Sighting conditions were similar on this segment of the trackline during survey in each of the modes and there was no glare. However there appeared to be a difference in the initial sighting cue between the modes with the blow component of cues more prominent during the adaptive sampling trial. The distance covered in IO mode on this segment was 33.2 nmiles (during 2.93 hours of research) and the distance covered during the adaptive sampling trial was 53.5 nmiles (during 4.74 hours of research).

Adaptive line transect sampling was carried out from the *Shonan Maru No. 2* on 7 February (2.66 hours; 29.7 nmiles), 8 February (1.65 hours; 18.8 nmiles) and 9 February (5.40 hours; 60.7 nmiles). The 7 February sampling was conducted in marginal conditions (high seas and greater than 15kts wind) and no sightings of any species were seen. The 8 February sampling was carried out in good conditions, but only one 'like minke' whale sighting was made by the IO platform and no cycles were triggered. The 9 February sampling was carried out in passing snow fog conditions and was interrupted by off effort steaming on occasion. One cycle was triggered on 9 February by a duplicate 'like minke' whale sighting, and one duplicate sighting of a minke whale was made during this cycle as well as another minke whale detected by only the Top.

Unfortunately, due to the poor schedule of the cruise, arising from the high proportion of unacceptable survey conditions, the total amount of time allocated to the adaptive sampling trials by both ships (14.45 hours) was much less than the suggested maximum of 48 hours. However, we were able to conduct the procedure on both independently designed tracklines and during a re-survey of one IO mode segment of the systematic minke whale survey trackline.

Although relatively few sightings were detected, no particular problems were encountered with the practical aspects of implementing the adaptive sampling protocol.

Our concern with the protocol after these trials is the potential for confusion when tracking of sightings during course changes in areas with a higher sighting rate. However, in this regard the prescribed 60-degree course changes and the 3.0 nmiles lengths of the adaptive sampling segments seem to be appropriate for areas of lower sighting rate. During the trial on the *Shonan Maru,* on 3 of the 10 adaptive sampling course changes, sightings were forward of the beam. In the first instance a non-duplicated sighting moved abaft the beam as the vessel turned. In the second instance, a sighting was tracked from port to starboard during a course change (it was subsequently detected by the other platform), and during the third instance a sighting was estimated to come forward of abeam again (however it was not detected again). On the *Shonan Maru No.2*, a similar problem with tracking a sighting during a course change was noted. This sighting was initially made from the Top close to the vessel almost at the end of a turn (the vessel heading was noted as variable) and seen 28 seconds later by the IO platform. This sighting was not seen by the Upper Bridge.

It was noted that tracking of sightings during course changes would be facilitated by use of a mapping function such as is available in Wincruz. During normal IO mode survey, course changes do not normally occur (unless the glare protocol is implemented). It was also noted that glare might be a problem during adaptive sampling.

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[9] Survey of the 37.6 nmile IO mode segment was commenced at 06:00hrs on the morning of 27 January from a mode change waypoint, at position 68°13'S 017°22'E, towards an estimated ice edge waypoint, and completed at 08:56hrs at a true ice edge waypoint at position 68°41'S 018°09'E, 4.5 nmiles from the estimated ice edge waypoint.

The adaptive sampling trial was conducted on the same trackline in the opposite direction (i.e. from the true ice edge northward towards the mode change waypoint) during the afternoon of the same day. The trial was commenced at 12:22hrs from a waypoint at position 68°38'S 018°04'E, just north of the true ice edge (8.3 nmiles from the estimated ice edge waypoint) and ended at 17:50hrs at position 68°09'S 017°17'E, 3.0 nmiles from the mode change waypoint from where IO mode survey had commenced in the morning.

Collaborative research with the icebreaker Shirase

Collaborative research between the SOWER vessels and the icebreaker *Shirase* was undertaken between 040°E and 050°E as planned, although the poor survey conditions experienced by the SOWER vessels meant that longitudinal progress by the *Shirase* and SOWER vessels was not synchronous.

The results of the *Shirase's* survey in the pack ice zone are not included in this summary.

Prior to the scheduled start of the collaborative research the SOWER vessels had attempted to extend the near-ice coverage westward by five degrees of longitude (commencing from 035°E instead of 040°E). However, between 035°E and 040°E, persistent poor weather restricted research and only 17.2 nmiles (5.3%) of coverage was achieved on the constructed tracklines (totaling 325.5 nmiles).

Despite persistent poor weather also experienced by the SOWER component between 040°E and 050°E, the SOWER component achieved good coverage (68.9%) on the constructed tracklines. Due to the overlapping tracklines the coverage intensity was approximately double the coverage achieved in the Southern Stratum on recent cruises).

From the SOWER vessels, 24 groups of minke whales (comprising 29 animals) were encountered in the Research Area during the collaborative study, including 7 groups (9 animals) observed while off effort. Mean group size was 1.2. In addition, a solitary 'like minke' whale was observed. The minke whales were most frequently observed within approximately 25 nmiles from the ice edge. Minke whales were seen in the vicinity of the ice edge or within scattered pack ice at all the ice edge waypoints. The largest group comprised 3 animals and was recorded from the *Shonan Maru* while off effort in poor weather during ice edge investigation at the final ice edge waypoint (at 050°50'E). Humpback whales were the most frequently sighted species and a total of 156 groups comprising 364 individuals. The mean group size was 2.33. There was a high sighting rate of humpback whales in the vicinity of all ice edge waypoints with concentrations mainly within 15 nmiles of the pack ice.

A major objective of the collaborative research was to achieve simultaneous coverage by the SOWER vessels and the *Shirase*. Both components were commenced on schedule on 12 February at longitude 040°E, however due to the dissimilar schedules of the components, synchronized survey was not achieved. The schedule for the *Shirase* was predetermined, while the more flexible schedule of the SOWER component had emphasized achieving a good distribution of coverage conducted under the normal standardised conditions. The *Shirase* completed the pack ice zone transects in four days. The SOWER duration of the SOWER component (040°E-050°E) was 10-days; the longer duration in comparison to the *Shirase* component was due to delays caused by the poor weather experienced.

Our estimates of the position of the ice edge approximated the position of the true ice edge. In the vicinity of almost all the ice edge waypoints the pack ice was of relatively high concentration. Observations of pack ice were to be recorded systematically during the collaborative study using the ASPECT recording system, however this was not undertaken. The reasons were: either the pack ice was of high concentration and the ships did not approach the ice (closer than the standard waypoint distance of 2.5 nmiles from the ice edge) which precluded detailed observations, or, emphasis was placed on recording and tracking whale sightings (as there was a high sighting rate of humpback whales in the vicinity of all the ice edge waypoints).

Research with ice navigation in either IO or NSC mode was only conducted from the *Shonan Maru*. A total of 16.2 nmiles (1.62 hours) was covered during research in the vicinity of the final two ice edge waypoints. Most ice edge navigation was in the vicinity of the final ice edge waypoint near 050°E where the position of the true ice edge was not confirmed. This area was only investigated during poor visibility when belts of pack ice and grounded icebergs were encountered.

BT mode

BT mode trials were completed from both vessels during the last three days in the Research Area (23, 24. 25 February). During the trials, a total of 387.5 nmiles were covered in BT mode (Option 1) during 34.10 hours and 54.8 nmiles were covered in BT mode (Option 2) during 4.45 hours (Table 2a).

The *Shonan Maru* conducted 229.9 nmiles of research in BT mode (Option 1) during 20.44 hours and 54.8 nmiles of BT mode (Option 2) during 4.45 hours.

The *Shonan Maru No.2* covered a total of 157.6 nmiles while in BT mode (Option 1) during 13.66 hours. Three trials were conducted (28.3 nmiles, 59.3 nmiles and 70.0 nmiles during 2.58 hrs, 5.05 hrs and 6.03 hrs, respectively).

Table 15 summarizes the sightings made during BT mode by the *Shonan Maru* and the *Shonan Maru No.2*.

A total of 5 minke whales were detected during the BT mode trials: 4 solitary minke whales were detected from the *Shonan Maru No.2* during Option 1 and 1 minke whale was detected by the *Shonan Maru* during Option 2.

Shonan Maru No.2 BT Mode Option 1:

23 February, sighting #022 – Undetermined minke whale first detected by the Tracker Platform at 2.10 nmiles using 7x50 binoculars. Tracking was attempted for 15 minutes until the whale was estimated to be abeam; however it was not detected again by the Tracker Platform. The whale was sighted abeam from the bridge at a closest distance of 0.6 nmiles. The sighting was not detected by the Primary Platform.

24 February, sighting #014 – Antarctic minke whale first detected by the Tracker Platform at 3.2 nmiles using 7x50 binoculars. It was tracked for 21 minutes. Closest distance was 0.60 nmiles. The sighting was not detected by the Primary Platform.

25 February, sighting #002 – Antarctic minke whale first detected by the Tracker Platform at 1.40 nmiles using 20x60 binoculars. It was tracked for 12 minutes. Closest distance was 0.40 nmiles. The sighting was not detected by the Primary Platform.

25 February, sighting #003 – Antarctic minke whale first detected by the Tracker Platform at 0.30 nmiles using 7x50 binoculars. It was tracked for 5 minutes. Closest distance was 0.30 nmiles. The sighting was not detected by the Primary Platform.

Shonan Maru BT Mode Option 2:

25 February, sighting #003 – Antarctic minke whale first detected by the tracker platform at 1.7nmi using 7x50 binoculars. It was tracked by the observers in the top barrel (and the upper bridge) and was observed 3? times during 7 minutes before the whale passed abeam. Closest distance was 1.0 nmile. The sighting was not detected by the Primary Platform.

Observations from the Shonan Maru

The first sighting tracked by the Tracker Platform (Option 1, 23 February, sighting #031) during BT mode was classified as 'like blue whale' based on the appearance of the blows. The sighting was detected at an estimated distance of 10.0 nmiles and tracked for 66 minutes until last seen at a distance of 8.0 nmiles. The Primary Platform did not detect this sighting. Because of the long duration spent tracking this sighting, and because humpback whales and unidentified large baleen whales were the most frequently species sighted in the area, it was decided that the Tracker Platform should forgo tracking any species other than minke whales so as to maximize searching time for more minke sightings.

Interestingly, the majority of the sightings detected by each platform were not detected by the other. In some cases the Primary Platform sightings were made beyond 60° and therefore out of the searching range of the tracker.

However, a possible reason for missed sightings by the Tracker Platform was fatigue. The observers reported eye strain from searching with the high powered 20X binoculars for long stretches without whale sightings. For this reason, at the start of the day on 24 February the *Shonan Maru* decided to try Option 2. After a minke whale was sighted at 08:06 (see above), it was hoped that the ship had moved into a higher relative density of minke whales and the decision was made to return to Option 1. On *Shonan Maru*, we exceeded the normal limit of 100 nmiles of continuous survey in this mode (which in terms of crew rotation and scheduled rest periods is equivalent to normal IO mode). We did this with agreement from the Captain and crew in order to maximize the duration of the BT mode trials and although sighting conditions were good (if cold) this may have contributed to the fatigue.

Glare was more of a problem for naked eye primary observers in Option 2. Normally while searching with binoculars the field of view is restricted and glare can be more easily avoided.

During the two days of the experiment there was, unfortunately, a paucity of minke whale sightings, so the minimum sample sizes needed to assess the mode (10 sightings from each platform) or to analyse for $g(0)$ (20 duplicate sightings) were not met. Although the minimum number of minke whale sightings desired to assess the mode was not obtained during this trial, based on the samples and experiences available Option 2 seemed preferable to Option 1. The use of the high powered binoculars was difficult in low density areas because of fatigue. The greater distances that large baleen whales could be detected was distracting and the good sighting conditions

confounded assessment of duplicate status of large baleen whales. This was due to the very large radial distances of detections and substantial whale movement during the long periods the whales were ahead of the beam.

Observations from the Shonan Maru No. 2

Summaries of sightings made by the Tracker Platform during BT mode are presented in Tables 15. Whilst many of the sightings of humpback whales and both of the killer whale groups sighted by the Tracker Platform were seen by the Primary Platform, it should be noted that none of the four minke whale sightings (nor the groups of unidentified small whales or ziphiidae) made from the Tracker Platform were seen by the Primary Platform. However, it should be noted further that two of the Antarctic minke whale sightings made by the Tracker Platform were close to the ship, while the one undetermined minke whale sighting made at 2.1 nmiles was not seen again by the Tracker or Upper Bridge Platforms. The sighting was seen abeam at 0.60 nmiles from the Bridge.

Generally no problems were encountered with BT mode from the *Shonan Maru No. 2*, apart from the use of the 20x60 power binoculars in the Tracker (Top) Platform. Three of the four minke whales sightings from the Tracker Platform were made with the 7x50 binoculars.

Comments from the observers on both vessels regarding the 20x60 binoculars[10]

a) there was difficulty of adapting to the narrow field of view,

b) although vibration was not a significant problem, the pitching and movement of the ship caused difficulties in maintaining a stable view,

c) without reticles estimating distance was problematic,

d) it was difficult to find a comfortable position for viewing because the binoculars did not match the standard sunglasses used and the adjustment of width of the eyepieces is not easy. On the *Shonan Maru No. 2*, sunglasses were not used with the instrument, leading to eye fatigue,

e) tracking was difficult due to the narrow field of view and potentially it could be problematic tracking minke whales with long dive times or individuals that moved substantially between surfacings. Tracking with 20x60 binoculars was easier when icebergs or pack ice was present to use as a reference,

f) during viewing conditions when the horizon was slightly misty or foggy, the 20x60 binoculars were more difficult to use than the standard 7x50's,

g) the focal plane of the instrument was too narrow to search the area in a panning motion,

h) the weight of the instrument was heavy,

i) on *Shonan Maru No. 2*, the image stabilizer did not function adequately and the clamp was consequently removed to lighten the instrument. Also the inability to change the angle of the hand pole to search closer to the vessel.

Direct data acquisition

Wincruz was used to record data on the *Shonan Maru* and on the *Shonan Maru No.2*. A sample of the data out-put is given in Appendix H along with a key to the respective data fields.

The version of Wincruz tested was one that was developed for the 1999-2000 IWC/CCAMLR Synoptic Survey. Therefore most of the sighting entry fields were comparable to the paper forms normally used on the SOWER cruises. The system proved as fast as the paper forms for data entry on the upper bridge, with the benefit of collecting position data directly from the GPS and also the ability to record immediately changes in sighting conditions.

The program also collects weather, viewing conditions, and effort data. The obvious benefit of such a system is the time it saves the bridge personnel from entering these data into paper forms and researchers from entering these same data later (usually in the evening) into a computer file (currently the Moon-Joyce DataForm program).

[10] These comments are based on a limited time for trials. More experience with these binoculars would be desired for observers to further assess the ease/difficulty of use from the top barrel.

There were some problems in getting Wincruz to read the position data correctly from either of the GPS's (the ships' or the portable GPS). While this technicality was finally resolved for the sighting data file, it was never resolved successfully for the mapping function of the program. Wincruz has a real-time mapping function that displays sighting positions relative to the ship. It was hoped to test this during IO mode as a real-time map would be a very useful aid to the tracking of sightings and would facilitate the assessment of duplicate status. This function would be particularly useful during the tracking of sightings detected at large distances from the ship, such as humpback and other large baleen whales.

During these trials experienced and first-time users assessed the utility of Wincruz. Although the program did not operate perfectly during this trial, and the monitors of the computers were difficult to view, it worked well enough to prove viable as a method of direct data acquisition on the Upper Bridge.

Currently, the main obstacle to any type of data recording on the Upper Bridge (paper or direct computer entry) is the potential high demands on the researcher responsible for translations when there is a lot of information to be recorded or when the information is potentially confusing. In the current system, the translating researcher writes sighting data as it called out on to a dry erase board to assist with the entry into the IWC paper forms. It is imperative that the use the dry erase board be continued with an electronic data recording system. Based on our experience with Wincruz during the cruise we conclude that it would be feasible and desirable to use such a direct data acquisition program on these vessels during this type of research. With the dedicated attention of a programmer, adapting Wincruz to be completely functional or designing a program specifically for SOWER is entirely possible.

Blue whale studies and other opportunistic research

Blue whale biopsy and photo-identification summary

There were 13 sightings of blue whales (comprising 46 animals) during the cruise. 29 individuals of 6 groups were identified as true blue whales. Three solitary animals were identified as pygmy blue whales. 13 individuals were not approached closely and were classified as blue whale – undetermined (a sub-group comprising 6 individuals, a group of 3, a group of 2 and three solitary individuals). A synopsis of blue whale sightings is presented in Appendix G.

In the Research Area seven groups were approached for biopsy and photo-id research, which was conducted for a total of 3.25 hours. (Of this total, 1.12 hours was when the vessels would have been otherwise off-effort in conditions unacceptable for minke whale research).

On the return transit to Fremantle, north of 60°S in the vicinity of the Kerguelen Ridge, two groups were observed (a solitary individual and a group of two). Both groups were approached; all individuals were identified as true blue whales. Biopsy sampling and photo-identification was conducted during a total of 1.88 hours (while off effort in poor conditions).

In the EEZ of Australia 5 groups of blue whales (a group of two and 4 solitary animals) were detected. Three solitary animals were approached and identified as pygmy blue whales.

During the entire cruise, blue whale research was conducted for a total of 5.13 hours. 3.00 hours of this research time was during conditions when the vessels would have been otherwise off-effort in conditions unacceptable for minke whale research.

5 biopsy samples were collected from 5 true blue whales during the cruise. Results of biopsy sampling are given in Table 18. Total time spent on blue whale biopsy effort for the whole cruise was 5.13 hrs. This equates to 1hr 2min/sample obtained. The collection of individual identification photographs of blue whales occurred simultaneously with biopsy sampling. 23 individual blue whales were adequately photographed: 22 from the *Shonan Maru* and 1 from the *Shonan Maru No. 2*. All the biopsied whales were also photographed.

No video was recorded and no dive time studies were conducted for any of the blue whale sightings.

Southern right whale, humpback and killer whale: opportunistic biopsy sampling and photo-identification studies

Numbers of biopsy samples and identification photographs collected are given in Tables 18-20.

A solitary southern right whale was photographed for photo-identification studies from the *Shonan Maru*. Digital images for photo-id were obtained and two biopsy samples were obtained when two darts struck the whale.

From both vessels, humpback whales were photographed from the upper bridge and bow in NSC and IO modes when the whales were in range close enough for good opportunity. A total of 45 humpback whales were photographed. Biopsy sampling of groups of humpback whales was attempted four times (twice from each vessel) while the vessels were otherwise off effort in conditions unacceptable for survey. A total of 6 biopsy samples were collected from 6 whales. Three of the biopsy attempts were made on groups that approached the vessels while drifting off effort in poor conditions.

Killer whales were photographed from both vessels, from the upper bridge and bow in NSC and IO modes when the whales were in range close enough for good opportunity. 8 groups of killer whales were photographed during the cruise. Images were obtained of 6 groups from the *Shonan Maru* and 2 groups from the *Shonan Maru No.2*.

Two unusual fin whales were observed during the cruise. A totally white-pigmented fin whale (estimated in length at 20m.) was observed with two other normally pigmented individuals, seen from the *Shonan Maru No.2* on 23 February. A fin whale with an abnormal dorsal fin was observed on 23 January at position 65°10'S 050°00'E (in a group comprising 3 whales).

Images were obtained of an unusual single ziphiid from the *Shonan Maru No. 2* on 23 January at position 67°12.51'S, 011°25.48'E.

Marine debris

Observations of marine debris encountered south of 60°S latitude are given in Table 21.

Modifications to the Procedures, Vessels and Equipment

Modifications to the vessels

On both vessels an AC power supply and a cable outlet from the GPS had been installed to the Upper Bridge. The power supply was essential for using a computer on the Upper Bridge during the trials of the Wincruz direct data acquisition program. The GPS cable outlet facilitated the trials of Wincruz.

The voice recording system (on loan from The Institute of Far Seas Fisheries, Shimizu) had been specifically modified prior to this cruise. The modification provided the option of using a microphone on the Upper Bridge (for dive time experiments) and in the wheelhouse (for VHF telemetry). The microphone on the Upper Bridge was used extensively for the dive time experiment. As VHF telemetry was not conducted on this cruise the microphone in the wheelhouse was not used.

A recommendation from the 2003-2004 cruise was that a laser boresight be available on each vessel to facilitate sighting-in of the scopes used on the Larsen guns. A boresight of the correct calibre was sourced prior to the cruise, however it was designed for a rimless casing and its dimensions were not suited to the chamber of the Larsen gun, which accepts only rimmed cartridges. The devise was not purchased and we sighted in the scopes by eye, as on previous cruises.

Data recording and computer data entry

Effort, weather and sightings data records were entered into computer files using the Moon Joyce DataForm programmme. The Sightings Record has no Survey Mode box to record sighting experiments such as Adaptive Sampling. On both ships sightings recorded during Adaptive Sampling trials and BT mode were coded as IO mode with appropriate annotation and entered into the computer files as IO mode.

RECOMMENDATIONS

Most of the research procedures have been standardized during the last several cruises and we encountered no major problems.

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

Recommendations Pertaining To Specific Experiments

Minke Whale Visual Dive Time

1) The dive time data sheets were found to be cumbersome and repetitive for real time use. Furthermore, transcription of dive time data at the end of the day was difficult and time consuming with the use of the current system. It is recommended that the use of a direct data entry sampling system be investigated for dive time experiments if these are to be continued. Palm - pilot type systems or a laptop with dedicated behaviour function keys linked to GPS and time code are available, and would minimize both transcription time and errors and subsequent data re-entry. A DAT recording system would work well as a back-up to a palm – pilot system.

2) The current video recorders available on the vessels (Panasonic Digital Video NVDJ1) are outdated. On *Shonan Maru* the video recorder occasionally malfunctioned. We recommend that these cameras be replaced with an up-to-date high definition camera outfitted with maximum available optical zoom (digital zoom not appropriate), and high quality lens with polarizing filter. Such a system would enhance the quality of the video recording of minke whale surfacing sequences during any future visual dive time experiments and potentially also allow additional data to be collected during passing mode. Additionally the possibility of mounting the camera on a spotting scope may potentially improve the results. We recommend filming from the top barrel as it would provide a better view of the cues and be easier to track the whales than from the upper bridge platform. If this was used it would be necessary to tape an audio record on the upper bridge as well. Time synched DAT recorders could be used for the upper bridge audio recording. The primary recording system should not have a time lag.

Adaptive Line Transect Sampling:

1) Researchers were unsure how to handle poor survey conditions during adaptive sampling. More detailed information outlining protocol for situations such as glare on the trackline or reduced visibility that would potentially interrupt cycles would be very useful.

Direct Data Acquisition

1) We reiterate the need for a direct data acquisition system. A decision on direct data entry on SOWER cruises was deferred until after the completion of the third circumpolar series. This cruise was the first cruise following completion of the third series and we recommend that planning for future cruises consider the recommendations arising from previous cruises (such as the 1997-98 cruise) with regard to data management and the development of such a an electronic data entry system. If a complete data system cannot be provided by the next cruise, at least a real-time mapping program should be provided for use during IO mode. It is imperative that the direct data acquisition system be viewed as a replacement rather than a duplication of the paper entry system.

2) The following recommendations related to direct data acquisition arise from the test carried out on the two vessels during this cruise:

    a) The electronic data recorder should sit next to the Japanese interpreter/researcher.

    b) One of the major benefits of using the WinCruz program is the extremely helpful mapping component that has provided support in high density areas on other research cruises. Although problems were encountered using this function during these tests, it believed this function will greatly alleviate confusion when several sightings are made within close proximity to one another or during IO mode. This would also be very beneficial when tracking sightings during turns in Adaptive Sampling.

c) The entry of effort, weather and visibility data directly into a data acquisition program on the upper bridge as the data change is essential and would relieve the bridge officers of the data recording tasks they are currently asked to perform. Furthermore, the installation of a ship's computer system (SCS) on the vessels would allow for automated recording of environmental parameters and positions. Linking a data acquisition system to a SCS could relieve the bridge officers of the data recording tasks they are asked to perform at this time.

d) Use of reticle binoculars by all observers (including all 6 upper bridge observers) would greatly enhance distance accuracy and help prevent clumping of sightings at rounded distance estimates. The Wincruz® program readily accepts reticle information and, once programmed with height of eye to sea level from each observer location, converts reticle information to distance in nautical miles. This is also a further justification for obtaining reticled binoculars for all observer positions.

e) Communication between researchers is hampered by the noise level of the Upper Bridge and the relaying of sighting information is difficult. A central data recording system linked to a series of networked monitors or Palm Pilot systems visible by all (6) observer locations on the Upper Bridge would allow rapid information transfer.

BT Mode

The 20x60 binoculars used during the BT mode trials raised a number of comments from Top observers (see Results and Discussion). These generally related to binocular design and it is recommended that 20x60 power binoculars that are similar in design to the 7x50 binoculars be investigated. Further more distance estimation was problematic and it is essential that reticles be provided.

Our initial impression of the 20X60 binoculars is that they would not be appropriate for use in high Beaufort states and we suggest their use through Beau 0-3 only. With use in low Beaufort states it may be feasible to mount high power binoculars (but hey MUST be image stabilized) which would increase their ease of use and more accurate reticle readings.

Unfortunately only limited time was available for BT mode trials at the end of this cruise. Based on the experience gained during the trials it is strongly recommended that trials continue in future cruises.

General Recommendations

1. It is recommended that prevailing weather conditions be considered when planning future cruises. Winds within this cruise have been predominantly from the east, while low frontal pressure systems move from west to east. On a number of occasions both vessels could not survey in marginal conditions as the wind was directly on the bow. Having the wind from the stern or stern - quarter may increase sighting probabilities both through observer comfort and reduced binocular vibration. Furthermore, moving towards rather than with low pressure frontal systems allows considerable more flexibility in short term planning as the vessels to pass through systems rather than moving in synchrony with them.
2. Currently a distance limitation of 1.5 miles is suggested for the identification of minke whales to species level. It is recommended that a distance limitation be instituted for the identification of beaked whales to species level and a distance of 0.8 miles is suggested. Such a limitation should be instituted as a guide only.
3. It is recommended that a protocol be instituted that allows certain groups to be closed with when abeam in IO mode to confirm both species identification and group size. Such closure should be at the Senior Scientists' discretion.
4. Communication on the Upper Bridge of the *Shonan Maru No. 2* was at times problematic. If no computer network system is available, it is strongly recommended that a white board that is visible to all researchers be mandatory at all times. Furthermore the use of the buzzer (or light) to report sightings during NSC mode immediately alerts researchers to a sighting (as opposed to other information being verbally relayed from the Top). Buzzer access should be provided to Upper Bridge observers to report sightings. Furthermore as buzzers could cue IOP observers in IO mode, it is recommended that a system of lights be investigated to alert Upper Bridge personnel to sightings in IO mode.
5. On this cruise, as with other cruises, there were a number of opportunities for collecting biopsy samples from vessel-attracted humpback whales while the vessels were off-effort and drifting. We recommend that tethered-dart or pole biopsy systems be available for biopsy sampling of vessel - attracted humpback whales. We suggest that the two

IWC Paxarms guns currently in storage in New Zealand be made available with a supply of tethered darts. Additionally, a simple crossbow system with tethered darts would also be a valuable aid.

6. The IWC cameras currently available for photo-identification during the cruises, although well maintained and operating well, are now outdated. (For example, the auto-focus response times are slow which results in potentially missed opportunities). Replacement with up to date digital cameras with image-stabilized lenses is essential and would enhance the results of the photo-identification efforts. One of the major advantages of the digital systems is the immediate and end of day review of the data collected. Associated with the upgrade of cameras, the IWC needs to develop protocols for storing and cataloguing digital images during the cruises.

7. The IWC computers currently available during the cruises are outdated. The primary machine this year on the *Shonan Maru* (Notebook computer Toshiba Satellite 4030CDT IWC No. 00679 Serial no. 39014198) failed during the cruise. Also the disk drive on the back-up Compaq Presario failed. We recommend that up-to-date computers (and backups) are available on both vessels operating with Windows 2000 or XP. These additions should include items such as CD burners, USB sticks and external hard drives (with reference to recommendation 6).

8. We recommend that cues (such as large baleen whale blows) should not be recorded during standardized searching until they are detectable 6.0nmiles or closer to the ship, when an accurate estimate of distance can be obtained. Due to the large sighting distances during good survey conditions, reliable tracking and assessment of duplicate status is problematic. This is exacerbated in areas with increasing rates of large baleen whale sightings such as the densities of humpback whales encountered on this cruise.

9. It is recommended that secondary sightings not be recorded during experiments if they interfere with the primary objective of the experiment. The decision to record secondary sightings during experiments should be at the discretion of the senior scientist.

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Table 1a. Summary of search effort conducted in each stratum in the research area (Area IIIW). IO mode time and distance does not include adaptive line transect sampling.

Area	Start Research	End Research	Total Time Available	NSC Mode Survey		IO Mode Survey		Total Distance Surveyed
	Date - time	Date - time	(hours)	Time (hours)	Distance (nmiles)	Time (hours)	Distance (nmiles)	(nmiles)
000°E-010°E								
Northern Stratum								
Shonan Maru No. 2	12-Jan 12:10:00	22-Jan 13:07:32	120.79	18.43	212.8	20.18	233.0	445.8
Southern Stratum								
Shonan Maru	12-Jan 13:03:00	23-Jan 07:32:22	127.03	10.84	121.1	11.95	140.7	261.8
010°E-020°E								
Northern Stratum								
Shonan Maru No. 2	22-Jan 13:07:32	28-Jan 18:04:30	77.51	11.75	129.4	18.75	217.4	346.8
Southern Stratum								
Shonan Maru	23-Jan 07:32:22	5-Feb 08:00:42	156.52	10.95	108.7	16.45	185.0	293.7
Shonan Maru No. 2	29-Jan 06:00:00	7-Feb 07:32:00	109.17	12.67	123.9	0.59	8.2	132.1
020°E-035°E								
Southern Stratum								

Shonan Maru	5-Feb 08:00:42	9-Feb 18:00:00	58.57	14.69	161.9	10.63 (plus NSP 1.98)	123.2 (plus NSP 22.8)	230.3
Shonan Maru No. 2	7-Feb 07:32:00	9-Feb 18:00:00	35.42	7.17	77.7	0.05	0.0	77.7
Total			685.01	86.5	935.5	80.58	930.3	1788.2

Table 1b. Summary of experiment effort conducted in each area in the research area (Area IIIE). IO mode time and distance does not include adaptive line transect sampling.

Area	**Start Research** Date - time	**End Research** Date - time	**Total Time Available** (hours)	**NSC Mode Survey** Time (hours)	Distance (nmiles)	**IO Mode Survey** Time (hours)	Distance (nmiles)	**Total Distance Surveyed** (nmiles)
035°E-050°E								
Collaborative research with Icebreaker								
Shonan Maru	10-Feb 06:00:00	22-Feb 13:20:13	152.34	12.88	140.1	15.13	168.5	308.6
Shonan Maru No. 2	10-Feb 06:00:00	22-Feb 10:38:00	148.72	12.07	128.6	12.15	138.1	266.7

050°E-065°E **Shonan Maru** *Shonan Maru No. 2*	22-Feb 13:20:13 22-Feb 10:38:00	25-Feb 18:45:00 26-Feb 12:28:00	42.67 55.36	2.62 5.94	28.2 69.0	0.00 2.99 (NSP)	0.0 31.9 (NSP)	28.2 100.9
Total			399.09	33.51	365.9	30.27	338.5	704.4
Grand total **(Table 1a and 1b)**			1084.1	120.01	1301.4	110.85	1268.8	2492.6

Table 2a. Summary of experiment effort conducted in each stratum in the research area (Area IIIW).

Area	Start research	End research	Total Time Available	Adaptive Sampling		BT Mode Survey		Minke Dive Time	Angle & Distance	Biopsy (and Photo-ID)
	Date - time	Date - time		Time (hours)	Distance (nmiles)	Time (hours)	Distance (nmiles)	Time (hours)	Time (hours)	Time (hours)
000°E-010°E										
Northern Stratum										
Shonan Maru No. 2	12-Jan 12:10:00	22-Jan 13:07:32	120.79	-	-	-	-	0.90	-	-
Southern Stratum										
Shonan Maru	12-Jan 13:03:00	23-Jan 07:32:22	127.03	4.74	53.5	-	-	4.45	3.96	0.79
010°E-020°E										
Northern Stratum										
Shonan Maru No. 2	22-Jan 13:07:32	28-Jan 18:04:30	77.51	-	-	-	-	10.30	-	-
Southern Stratum										
Shonan Maru	23-Jan 07:32:22	5-Feb 08:00:42	156.52	-	-	-	-	18.66	-	2.46 (+0.36 Photo-id only)
Shonan Maru No. 2	29-Jan 06:00:00	7-Feb 07:32:00	109.17	-	-	-	-	10.32	-	-
020°E-035°E										
Southern Stratum										
Shonan Maru	5-Feb 08:00:42	9-Feb 18:00:00	58.57	-	-	-	-	1.39	3.10	-
Shonan Maru No. 2	7-Feb 07:32:00	9-Feb 18:08:00	35.42	9.71	109.2	-	-	0.90	-	-
Totals			685.01	14.45	162.7			46.92	7.06	3.25 (+0.36 Photo-id only)

Table 2b. Summary of experiment effort conducted in each stratum in the research area (Area IIIE).

Area	Start research	End research	Total Time Available	Adaptive Sampling		BT Mode Survey		Minke Dive Time	Angle & Distance	Biopsy (and Photo-ID)
	Date - time	Date - time		Time (hours)	Distance (nmiles)	Time (hours)	Distance (nmiles)	Time (hours)	Time (hours)	Time (hours)
035°E-050°E										
Near-ice survey										
Shonan Maru	10-Feb 06:00:00	22-Feb 13:20:13	152.34	-	-	-	-	-	-	1.55*
Shonan Maru No. 2	10-Feb 06:00:00	22-Feb 10:38:00	148.72	-	-	-	-	-	-	1.61*
050°E-065°E										
Shonan Maru	22-Feb 13:20:13	25-Feb 18:45:00	42.67	-	-	24.89	284.7	-	-	0.29
Shonan Maru No. 2	22-Feb 10:38:00	26-Feb 12:28:00	55.36	-	-	13.66	157.6	-	3.92	-
Total			399.09	0.00	0	38.55	442.3	0.00	3.92	3.45
Grand Total (Table 2a & 2b)			1084.1							6.7 (+0.36 Photo-id only)

* Off effort

Table 3. Number of sightings by both vessels for all species (Groups/Animals) observed within the research area 000°-065°E in each effort mode.

Species	NSC		IO		NSP		Adaptive Sampling		BT		OE		Total	
	G	A	G	A	G	A	G	A	G	A	G	A	G	A
Minke (Antarctic)	81	208	41	79	1	1	12	18	4	5	36	66	175	377
Minke (like Antarctic)	1	2	1	1	0	0	0	0	0	0	1	3	3	6
Minke (undetermined)	17	57	20	40	0	0	9	12	2	2	6	8	54	119
Like minke	8	10	20	30	0	0	4	7	0	0	4	5	36	52
Blue (true)	3	5	0	0	0	0	0	0	0	0	1	20	4	25
Blue (undetermined)	0	0	1	3	0	0	0	0	0	0	1	6	2	12
Like blue	0	0	2	3	0	0	0	0	2	4	1	3	5	10
Fin	5	113	0	0	1	3	0	0	0	0	2	3	8	119
Humpback	79	176	75	178	8	18	1	2	28	63	42	96	233	533
Like humpback	6	11	6	13	0	0	1	2	5	8	0	0	18	34
Sperm	9	9	17	18	0	0	0	0	0	0	2	2	28	29
Killer	1	14	7	70	0	0	1	3	3	32	4	54	16	173
Southern bottlenose	10	18	11	22	0	0	0	0	1	2	6	13	28	55
Like so. bottlenose	2	2	4	8	0	0	0	0	1	1	0	0	7	11
Mesoplodon sp.	1	3	1	2	0	0	0	0	0	0	0	0	2	5
Ziphiid	7	11	14	32	0	0	2	4	2	3	4	5	29	55
Unid. large baleen	13	16	16	33	6	20	6	9	19	36	6	10	66	124
Unid. small whale	11	22	10	12	0	0	1	10	3	5	1	1	26	50
Unid. large whale	2	2	3	4	0	0	0	0	0	0	0	0	5	6
Unid. whale	3	4	2	2	0	0	0	0	3	3	0	0	8	9

Table 4. Number of sightings for all species (Groups/Animals) observed in the 000°-010°E Sector in each effort mode.

Species	NSC		IO		OE		Total	
	G	A	G	A	G	A	G	A
Northern Stratum								
Shonan Maru No. 2								
Minke (Antarctic)	7	14	1	1	1	1	9	16
Minke (undetermined)	2	4	0	0	1	1	3	5
Humpback	2	2	1	1	0	0	3	3
Sperm	0	0	8	8	1	1	9	9
So. bottlenose	1	1	1	1	0	0	2	2
Killer	0	0	0	0	1	6	1	6
Ziphiid	0	0	1	2	0	0	1	2
Unid. small whale	1	1	3	4	0	0	4	5
Southern Stratum								
Shonan Maru								
Minke (Antarctic)	17	49	5	9	5	10	27	68
Minke (like Antarctic)	1	2	0	0	0	0	1	2
Minke (undetermined)	2	3	7	15	0	0	9	18
Like minke	5	5	7	11	0	0	12	16
Blue (true)	1	2	0	0	0	0	1	2
Like blue	0	0	0	0	1	3	1	3
Sperm	3	3	4	5	0	0	7	8
So. bottlenose	1	2	0	0	0	0	1	2
Unid. large baleen whale	3	3	0	0	1	1	4	4
Unidentified large whale	0	0	2	2	0	0	2	2

Table 5. Number of sightings for all species (Groups/Animals) observed in the 010°-020°E Sector in each effort mode.

Species	NSC		IO		Adaptive Sampling		OE		Total	
	G	A	G	A	G	A	G	A	G	A
Northern Stratum										
Shonan Maru No. 2										
Minke (Antarctic)	7	11	8	8	-	-	6	18	21	37
Minke (undetermined)	1	2	0	0	-	-	0	0	1	2
Like minke	0	0	1	1	-	-	0	0	1	1
Humpback	0	0	2	4	-	-	0	0	2	4
Sperm	2	2	2	2	-	-	1	1	5	5
So. bottlenose	3	5	4	7	-	-	0	0	7	12
Like so. Bottlenose	0	0	1	3	-	-	0	0	1	3
Killer	0	0	3	27	-	-	0	0	3	27
Mesoplodon sp.	1	3	0	0	-	-	0	0	1	3
Ziphiid	4	4	5	6	-	-	1	1	10	11
Unid. large whale	1	1	0	0	-	-	0	0	1	1
Unid. small whale	0	0	4	5	-	-	0	0	4	5
Unid. whale	2	3	1	1	-	-	0	0	3	4
Southern Stratum										
Shonan Maru										
Minke (Antarctic)	34	102	20	52	6	12	4	9	64	175
Minke (undetermined)	7	43	8	18	9	12	2	2	26	75
Like minke	2	4	7	12	2	2	0	0	11	18
Blue (true)	2	3	0	0	0	0	1	20	3	23
Blue (undetermined)	0	0	1	3	0	0	1	6	2	9
Like blue	0	0	2	3	0	0	0	0	2	3
Fin	1	3	0	0	0	0	0	0	1	3
Humpback	2	4	1	2	0	0	0	0	3	6
Like humpback	0	0	1	1	0	0	0	0	1	1
Sperm	0	0	2	2	0	0	0	0	2	2
So. bottlenose	2	4	1	4	0	0	0	0	3	8
Like so. bottlenose	0	0	3	5	0	0	0	0	3	5
Mesoplodon sp.	0	0	1	2	0	0	0	0	1	2
Ziphiid	0	0	4	9	1	3	0	0	5	12
Unid. large baleen	5	5	1	2	0	0	0	0	6	7
Unid. large whale	0	0	1	2	0	0	0	0	1	2
Shonan Maru No. 2										
Minke (Antarctic)	7	18	0	0	-	-	8	12	15	30
Minke (undetermined)	0	0	0	0	-	-	1	3	1	3
Like minke	0	0	0	0	-	-	1	1	1	1
Fin	0	0	0	0	-	-	1	2	1	2
Humpback	3	6	0	0	-	-	1	2	4	8
So. bottlenose	2	4	0	0	-	-	2	5	4	9
Unid. small whale	5	14	0	0	-	-	0	0	5	14
Unid. large baleen	1	2	0	0	-	-	0	0	1	2

Table 6. Number of sightings for all species (Groups/Animals) observed in the Southern Stratum, 020°E-035°E in each effort mode.

Species	NSC		IO		Adaptive Sampling		NSP		OE		Total	
	G	A	G	A	G	A	G	A	G	A	G	A
Shonan Maru												
Minke (Antarctic)	4	6	1	1	-	-	0	0	0	0	5	7
Minke (undetermined)	1	1	2	4	-	-	0	0	1	1	4	6
Like minke	1	1	4	5	-	-	0	0	3	4	8	10
Humpback	1	1	1	1	-	-	4	8	0	0	6	10
Like humpback	0	0	1	2			0	0	0	0	1	2
Sperm	4	4	0	0	-	-	0	0	0	0	4	4
Killer	0	0	2	16			0	0	1	12	3	28
Unid. whale	0	0	1	1	-	-	0	0	0	0	1	1
Shonan Maru No. 2												
Minke (Antarctic)	1	2	0	0	6	6	-	-	6	10	15	22
Like minke	0	0	0	0	2	5	-	-	0	0	2	5
Humpback	3	5	0	0	1	2	-	-	2	3	6	10
Like humpback	0	0	0	0	1	2	-	-	0	0	1	2
Killer	0	0	0	0	1	3	-	-	0	0	1	3
Ziphiid	0	0	0	0	1	1	-	-	0	0	1	1
Unid. large baleen	0	0	0	0	6	9	-	-	1	1	7	10
Unid. small whale	1	1	0	0	1	10	-	-	0	0	2	11

Table 7. Number of sightings for all species (Groups/Animals) observed in the near-ice area during the collaborative research with the ice-breaker, 035°E-050°E in each effort mode.

Species	NSC		IO		OE		Total	
	G	A	G	G	G	A	G	A
Shonan Maru								
Minke (Antarctic)	2	2	5	7	5	5	12	14
Minke (like Antarctic)	0	0	1	1	1	3	2	4
Minke (undetermined)	2	2	2	2	0	0	4	4
Like minke	0	0	1	1	0	0	1	1
Humpback	31	64	47	125	13	29	91	218
Like humpback	4	8	4	10	0	0	8	18
Sperm	0	0	1	1	0	0	1	1
So. bottlenose	0	0	2	5	3	6	5	11
Like so. bottlenose	2	2	0	0	0	0	2	2
Killer	1	14	2	27	1	8	4	49
Ziphiid	2	4	1	1	3	4	6	9
Unid large baleen whale	0	0	12	25	0	0	12	25
Unid. whale	1	1	0	0	0	0	1	1
Shonan Maru No. 2								
Minke (Antarctic)	1	2	1	1	0	0	2	3
Minke (undetermined)	2	2	1	1	1	1	4	4
Humpback	21	53	23	45	20	47	64	145
So. bottlenose	1	2	3	5	1	2	4	7
Ziphiid	0	0	3	4	0	0	3	4
Unid. large baleen whale	2	4	3	6	4	8	9	18
Unid. large whale	1	1	0	0	0	0	1	1
Unid. small whale	3	5	3	3	1	1	7	9

Table 8. Number of sightings for all species (Groups/Animals) observed in the area 050°E-065°E in each effort mode.

Species	NSC		NSP		BT		OE		Total	
	G	A	G	A	G	A	G	A	G	A
Shonan Maru										
Minke (Antarctic)	0	0	-	-	0	0	1	1	1	1
Minke (undetermined)	0	0	-	-	1	1	0	0	1	1
Blue (undetermined)	0	0	-	-	1	1	0	0	1	1
Like blue	0	0	-	-	2	4	0	0	2	4
Humpback	14	37	-	-	21	42	5	12	40	91
Like humpback	2	3	-	-	5	8	0	0	7	11
So. right	0	0	-	-	1	1	0	0	1	1
Killer	0	0	-	-	1	10	1	28	2	38
Like so. bottlenose	0	0			1	1	0	0	1	1
Unid. large baleen	2	2	-	-	18	34	0	0	20	36
Unid. whale	0	0	-	-	2	2	0	0	2	2
Shonan Maru No. 2										
Minke (Antarctic)	1	2	1	1	4	5	0	0	6	8
Minke (undetermined)	0	0	0	0	1	1	0	0	1	1
Fin	4	110	1	3	0	0	1	1	6	114
Humpback	2	4	4	10	7	21	1	3	14	38
Killer	0	0	0	0	2	22	0	0	2	22
So. bottlenose	0	0	0	0	1	2	0	0	1	2
Ziphiid	1	3	0	0	2	3	0	0	3	6
Unid. large baleen whale	0	0	6	20	1	2	0	0	7	22
Unid. small whale	1	1	0	0	3	5	0	0	4	6
Unid. whale	0	0	0	0	1	1	0	0	1	1

Table 9. Number of sightings for all species (Groups/Animals) observed during transit in the South African 200 nmile EEZ in each effort mode.

Species	NSC		OE		Total	
	G	A	G	A	G	A
Shonan Maru						
Sperm	2	3	0	0	2	3
Heavisides dolphin	0	0	2	15	2	15
Mesoplodon sp.	1	2	0	0	1	2
Unidentified small whale	1	1	0	0	1	1
Shonan Maru No. 2						
Like sei whale	1	1	0	0	1	1

Table 10. Number of sightings for all species (Groups/Animals) observed during transit between South African EEZ and the Research Area in each effort mode.

Species	NSC		OE		Total	
	G	A	G	A	G	A
Between South African EEZ and 60°S						
Shonan Maru						
Fin	3	7	1	1	4	8
Humpback	0	0	7	10	7	10
Sperm	2	2	0	0	2	2
Killer	2	12	0	0	2	12
Layard's beaked whale	0	0	2	3	2	3
Ziphiid	1	2	1	1	2	3
Like sperm whale	1	1	0	0	1	1
Unidentified large baleen whale	1	1	1	2	2	3
Shonan Maru No. 2						
Minke (Undetermined)	1	2	0	0	1	2
Fin	1	2	1	3	2	5
Humpback	1	2	7	15	8	17
Sperm	2	14	0	0	2	14
Killer	2	4	1	15	3	19
Southern bottlenose whale	3	4	0	0	3	4
Unidentified large baleen whale	2	2	0	0	2	2
Unidentified large whale	2	2	0	0	2	2
Latitude 60°00'S to Latitude 64°30'S						
Shonan Maru						
Minke (Antarctic)	0	0	2	6	2	6
Southern bottlenose whale	1	1	0	0	1	1
Like southern bottlenose whale	2	2	0	0	2	2
Shonan Maru No. 2						
Minke (Antarctic)	1	2	1	3	2	5
Killer	1	8	0	0	1	8
Mesoplodon sp.	1	2	0	0	1	2

Table 11. Number of sightings observed for all species (Groups/Animals) during transit between the Research Area and the Australian EEZ in each effort mode.

Species	NSC		OE		Total	
	G	A	G	A	G	A
Latitude 64°30'S to Latitude 60°00'S						
Shonan Maru						
No sightings						
Shonan Maru No. 2						
Houglass dolphin	1	3	0	0	1	3
Between 60°S and Australian EEZ						
Shonan Maru						
Humpback	o	o	1	1	1	1
Long-finned pilot whale	2	85	0	0	2	85
Hourglass dolphin	0	0	1	5	1	5
So. right whale dolphin	1	120	0	0	1	120
Ziphiid	2	4	0	0	2	4
Unid. large baleen whale	0	0	1	1	1	1
Shonan Maru No. 2						
Blue (true)	0	0	2	3	2	3
Like blue	0	0	1	1	1	1
Hourglass dolphin	0	0	2	9	2	9
Ziphiid	1	2	1	1	2	3
Unidentified large baleen whale	1	1	1	1	2	2
Unidentified small whale	1	1	0	0	1	1

Table 12. Number of sightings for all species (Groups/Animals) observed during transit in the Australian 200 nmile EEZ in each effort mode.

Species	NSC		Total	
	G	A	G	A
Shonan Maru				
Blue whale (undetermined)	2	3	2	3
Pygmy blue whale	1	1	1	1
Killer whale	1	5	1	5
Pilot whale	1	150	1	150
Gray's beaked whale	1	7	1	7
Common bottlenose dolphin	1	20	1	20
Striped dolphin	2	185	2	185
Mesoplodon sp.	2	6	2	6
Ziphiid	2	4	2	4
Shonan Maru No. 2				
Pygmy blue whale	2	2	2	2
Sperm whale	1	1	1	1
Ziphiid	2	8	2	8
Short-fin pilot whale	1	30	1	30
Striped dolphin	1	250	1	250
Unidentified small whale	2	2	2	2
Unidentified dolphin	1	40	1	40

Table 13. Summary of all sightings observed during the entire cruise.

Species	Groups	Animals
Minke (Antarctic)	179	388
Minke (like Antarctic)	3	6
Minke (undetermined)	55	121
Like minke	36	52
Blue (true)	6	28
Blue (pygmy)	3	3
Blue (undetermined)	4	15
Like blue	6	11
Fin	14	132
Like sei	1	1
Humpback	251	646
Like humpback	18	34
So. right	1	1
Sperm	35	49
Like sperm	1	1
Killer	23	217
Southern bottlenose	32	60
Like southern bottlenose	9	13
Gray's beaked whale	1	7
Layard's beaked whale	2	3
Long-finned pilot whale	2	85
Short-finned pilot whale	1	30
Pilot whale	1	150
Hourglass dolphin	4	17
Striped dolphin	3	435
So. right whale dolphin	1	120
Bottlenose dolphin	1	20
Heaviside's dolphin	2	6
Mesoplodon sp.	6	15
Ziphiid	38	70
Unidentified large baleen	73	132
Unidentified small whale	30	54
Unidentified large whale	7	8
Unidentified whale	8	9
Unidentified dolphin	1	40

Table 14. Identification of duplicate sightings observed during survey in Independent Observer (IO) mode. Duplicate sightings made during Adaptive Sampling and BT Mode are not included. 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
Shonan Maru					
Minke (Antarctic)	15	13	0	0	2
Minke (undetermined)	7	1	1	0	5
Like minke	3	0	0	0	3
Like blue	1	0	0	0	1
Humpback	32	20	0	1	11
Like humpback	1	0	0	0	1
Sperm	4	3	0	0	1
Killer	1	0	0	0	1
So. bottlenose	3	3	0	0	0
Like so. bottlenose	2	1	0	0	1
Mesoplodon sp.	1	0	0	0	1
Unid. large baleen whale	2	0	0	0	2
Shonan Maru No. 2					
Minke (Antarctic)	2	0	0	0	2
Humpback	13	11	0	0	2
Sperm	6	3	0	1	2
So. Bottlenose	3	3	0	0	0
Killer	1	1	0	0	0
Like so. bottlenose	1	1	0	0	0
Ziphiid	5	3	0	0	2
Unid. large baleen whale	3	3	0	0	3
Unid. Small whale	2	1	0	0	1

Table 15. Summary of sightings in BT Mode from the *Shonan Maru* and *Shonan Maru No. 2*.

OPTION 1				
First Detectected by Tracker **Species**	**Group Size**	**Sighting Position** **Angle**	**Dist.**	**Detected by Primary**
Shonan Maru				
Humpback	2	P015	4.00	Yes
Humpback	3	S001	2.50	Yes
Humpback	2	P008	2.90	Yes
Humpback	1	S037	2.20	No
Killer whale	10	P022	3.80	No
Like blue	1	S018	10.0	No
Like blue	3	S011	9.00	No
Like humpback	2	S032	5.00	No
Like so. bottlenose	1	S003	2.30	No
Unid. large baleen whale	1	S018	7.00	No
Unid. large baleen whale	4	S008	6.50	No
Unid. large baleen whale	1	P015	8.00	No
Unid. large baleen whale	2	P003	8.00	No
Unid. large baleen whale	1	S019	4.80	No
Unid. large baleen whale	1	S045	8.00	No
Shonan Maru No. 2				
Minke (Antarctic)	1	P022	3.20	No
Minke (Antarctic)	1	P015	0.30	No
Minke (Antarctic)	1	P005	1.40	No
Minke (undetermined)	1	S002	2.10	No
Humpback	3	S016	3.80	Yes
Humpback	5	P053	5.20	Yes
Humpback	7	S007	4.30	Yes
Humpback	2	S017	4.10	Yes
Humpback	2	S063	0.70	No
Humpback	1	P008	4.50	No
Humpback	1	-	-	No
Killer whale	10	P034	4.60	Yes
Killer whale	12	S037	1.30	Yes
Ziphiidae	2	P023	2.30	No
Ziphiidae	1	S012	1.50	No
Unidentified small whale	1	P025	4.50	No
OPTION 2				
Shonan Maru				
Minke (undetermined)	1	S055	1.70	No
Humpback	1	S024	4.60	No
Humpback	2	A000	3.00	No
Unid. large baleen whale	2	S017	8.00	No

Table 16. Summary of minke whale visual dive time experiments conducted from the *Shonan Maru*. For minke visibility and sightability codes see Anon. 2004b.

Trial No.	Date	Position		Sight. No.	Group size	Beau.	Minke Visibility	Sightability	Duration (hrs)	Data Quality
		Lat	Lon							
1	21 January	69°31'S	05°35'E	15	1	1	3.0	4	0.28	Unacceptable
2	21 January	69°24'S	05°49'E	27	2	1	888	3	0.25	Unacceptable
3	21 January	69°38'S	05°48'E	28	4	1	3.0	4	2.00	Good
4	22 January	68°45'S	07°54'E	10	2	2	3.0	4	0.78	Good
5	22 January	68°52'S	08°46'E	12	3	2	3.0	4	1.15	Good
6	23 January	69°00'S	10°57'E	31	5	2	3.0	4	1.45	Good
7	24 January	68°08'S	12°44'E	8	2	3	3.0	3	1.21	Good
8	25 January	68°36'S	14°19'E	8	2	1-2	3.0	4	0.98	Good
9	25 January	68°46'S	14°22'E	10	3	2	3.0	4	0.30	Good
10	25 January	68°47'S	14°22'E	21	1	2-1	3.0	4	1.00	Good
11	25 January	68°28'S	14°35'E	32	6	2-3	3.0	3	1.55	Good
12	26 January	68°16'S	15°06'E	2	3	1	3.0	4	1.25	Good
13	26 January	68°13'S	15°15'E	12	5	2-3	1.5	2	1.70	Good
14	27 January	67°41'S	16°32'E	25	4	1	3.0	4	2.37	Good
15	28 January	68°41'S	18°09'E	1	2	1-2	2.5	4	2.03	Good
16	28 January	68°37'S	18°19'E	2	4	1	3.0	4	2.30	Fair
17	28 January	68°36'S	18°56'E	3	2	1-2	3.0	4	2.00	Good
18	06 February	68°33'S	19°11'E	5	2	3	3.0	4	1.39	Good
Total									23.99	

Table 17. Summary of minke whale visual dive time experiments conducted from the *Shonan Maru No. 2*. For minke visibility and sightability codes see Anon. 2004b.

Trial No.	Date	Position		Sight. No.	Group size	Beau.	Minke Visibility	Sightability	Duration (hrs)	Data Quality
		Lat	Lon							
1	19 January	65°36'S	03°43'E	005	2	4	2.0	3	0.25	Usable data
2	22 January	68°06'S	10°07'E	008	1	3	3.0	3	0.66	Fair
3	23 January	67°17'S	11°17'E	001	2	2	2.0	3	1.63	Good
4	25 January	64°29'S	14°53'E	001	2	2	2.0	3	2.00	Good
5	26 January	66°15'S	17°26'E	001	5	1	2.5	3	2.00	Good
6	26 January	66°25'S	17°38'E	014	2	2	3.0	3	0.82	Good
7	28 January	67°42'S	19°30'E	005	1	2	2.0	3	1.00	Fair
8	28 January	67°44'S	19°38'E	007	1	2	2.5	3	0.25	Unacceptable
9	28 January	67°42'S	19°40'E	009	6	2	2.5	3	1.82	Good
10	4 February	68°52'S	15°58'E	003	1	3	2.0	2	1.00	Good
11	4 February	68°49'S	16°03'E	004	2	3	2.0	2	1.48	Good
12	4 February	68°40'S	15°54'E	006	3	3	2.0	2	0.93	Good
13	4 February	68°37'S	15°36'E	007	4	2	2.0	3	1.30	Good
14	5 February	68°36'S	16°41'E	002	2	2	2.0	3	2.00	Good
15	5 February	68°36'S	16°57'E	007	2	2	2.5	3	1.78	Good
16	5 February	68°33'S	17°12'E	009	4	2	2.5	3	2.00	Good
17	8 February	69°18'S	27°21'E	010	2	2	3.0	3	0.90	Fair
Total									21.82	

Table 18. Results of the biopsy sampling from the *Shonan Maru* and *Shonan Maru No.2* in 2004/2005.
System: L=Larsen gun.

Species & Date	Sight No.	School Size	Whale No.	System	Sample No.	Comments
Shonan Maru						
Blue (true)						
23 January	027	2	1	L	0501001	Skin
04 February	001	20	1	L	0501002	Skin & blubber
04 February	001	20	2	L	0501003	Skin & blubber
04 February	001	20	3	L	0501004	Skin
Humpback						
11 February	004	4	1	L	0507005	Skin & blubber
19 February	001	3	1	L	0507006	Skin & blubber
So. right						
25 February	015	1	1	L	0508007	Skin & blubber
Shonan Maru No. 2						
Blue (true)						
28 February	001	1	1	L	0501105	Skin & blubber
Humpback						
12 February	002	2	1	L	0507101	Skin
12 February	002	2	2	L	0507102	No blubber
17 February	001	8	1	L	0507103	Skin & blubber
17 February	001	8	2	L	0507104	Skin

Table 19. Summary of the individual identification and other photographs collected from the *Shonan Maru*. For codes of body surface photographed and opportunity see Anon. 2004b.

Species & Date	Sighting no.	Group size	Number photographed	Opportunity	Body surface photographed	Comment
Blue (true)						
21 January	023	2	2	E	HD,LD,RD,OT	
23 January	021	1	1	G	HD,LD,RD	
23 January	027	2	2	P	HD,RD,OT	Biopsy
04 February	001	20	16	G	HD,LD,RD,OT	Biopsies
Blue (undet.)						
28 January	006	2	1	P	LD	
Fin						
23 January	033	3	3	G	HD,LD,RD	Distinctive marks
Humpback						
09 February	008	2	2	P	FL, LD	
11 February	004	4	4	G	HD,LD,RD	Biopsy
15 February	002	3	1	P	RD	
15 February	003	3	3	P	LD,RD	
19 February	001	3	3	G	FL,LD,RD	Biopsy
21 February	019	2	1	P	RD	
21 February	029	3	1	G	RD	
21 February	034	2	1	P	RD	
21 February	041	2	2	P	LD	
22 February	003	2	2	G	RD	
22 February	031	4	3	P	RD	
23 February	002	4	2	G	LD	Partial fluke
23 February	005	2	1	P	LD	
23 February	010	2	1	P	RD	
25 February	012	3	2	G	RD	
So. Right						
25 February	015	1	1	E	HD,OT	Biopsy
Killer*						
07 January	004	5	2	P	HD,LD, OT	Type B
07 January	006	7	4	P	DM,LD,RD	Type A
09 February	002	12	8	P	HD,LD,RD	Type A;severed fin
16 February	003	14	8	P	LD,RD	Same gr. as 9 Feb
25 February	001	28	4	P	LL,RL	Type B; distant
07 March	005	5	5	G	LD,RD	Type B

*Includes additional personal photos that were made available by Y. Yamauchi.

Table 20. Summary of the individual identification and other photographs collected from the *Shonan Maru No. 2*. For codes of body surface photographed and opportunity see Anon. 2004b.

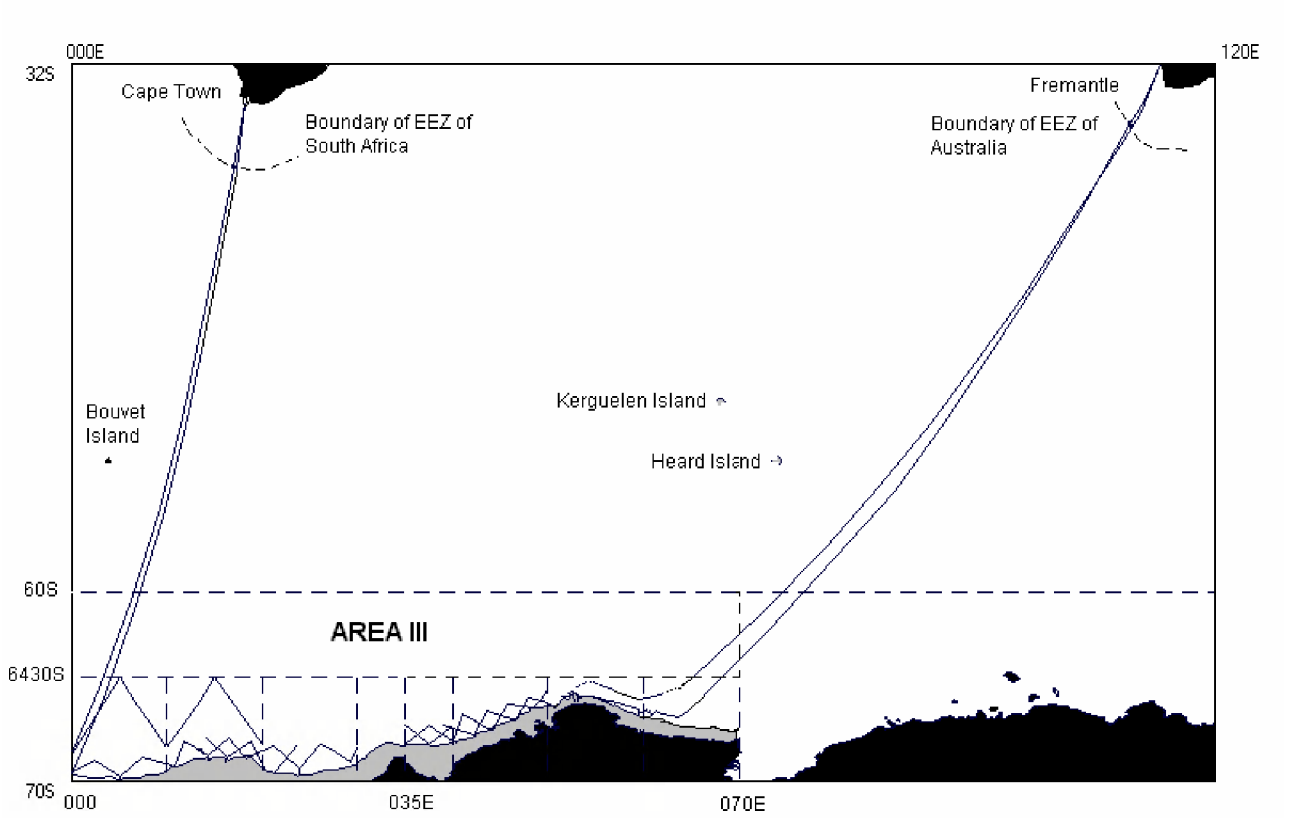
Species & Date	Sighting no.	Group size	Number photographed	Opportunity	Body surface photographed	Comment
Blue (true)*						
28 February	001	1	1	P	LD	Biopsy
28 February	002	2	1	P	HD	
Blue (pygmy)						
8 March	005	1	1	E	HD	
8 March	006	1	1	G	HD,RD	
Fin*						
23 February	009	3	1	E	DM	Albinistic
Humpback*						
6 February	002	2	2	E	LD,RD	
12 February	002	2	2	P	LD,RD	Biopsies
16 February	023	2	1	P	LD	
17 February	001	8	6	E	LD,RD,FL	Biopsies
21 February	002	3	2	P	LD	Distant
21 February	032	4	3	G	LD;RD	
21 February	033	2	2	E	LD,RD,FL	
Killer*						
11 January	004	8	2	P	RD	Type A
19 January	011	6	4	G	LD,RD	Type A
Ziphiid*						
23 January	005	1	1	E	DM	
8 March	003	5	4	P	OT	

*Includes additional personal photos that were made available by J. Utashiro.

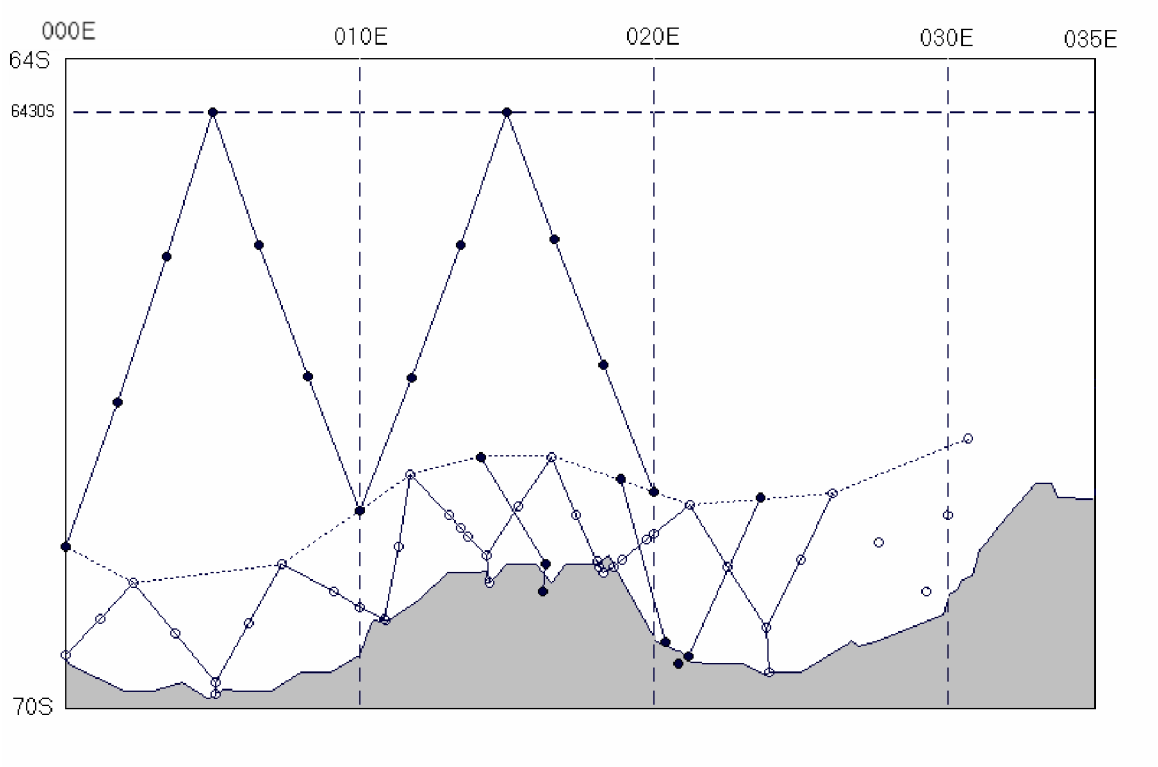
Table 21: Observations of Marine Debris south of latitude 60°S.

Object	Date	Position	Size
Shonan Maru			
Unknown black object	11 January	64°33'S 004°64'E	Uneven shape, roughly 2.5m x 2m
Red buoy	11 January	66°01'S 003°04'E	1meter diameter
Oil drum, rusty	16 January	69°32'S 000°09'W	200 litre capacity
Oil drum, rusty	16 January	69°32'S 000°01'E	200 litre capacity
Oil drum, rusty	17 January	69°32'S 000°00'E	200 litre capacity
4 Oil drums, rusty	17 January	69°28'S 000°08'E	200 litre capacity; in pack ice
2 Oil drums, rusty	17 January	69°28'S 000°05'E	200 litre capacity; in pack ice
Oil drum, rusty	17 January	69°29'S 000°05'E	200 litre capacity
Oil drum, rusty	17 January	69°30'S 000°59'E	200 litre capacity; in pack ice
Oil drum, rusty	17 January	69°30'S 000°03'E	200 litre capacity; in pack ice
Red buoy	09 February	67°50'S 032°57'E	1meter diameter
Shonan Maru No.2			
Fishing float	10 January	61°45'S 005°18'E	0.75m diameter

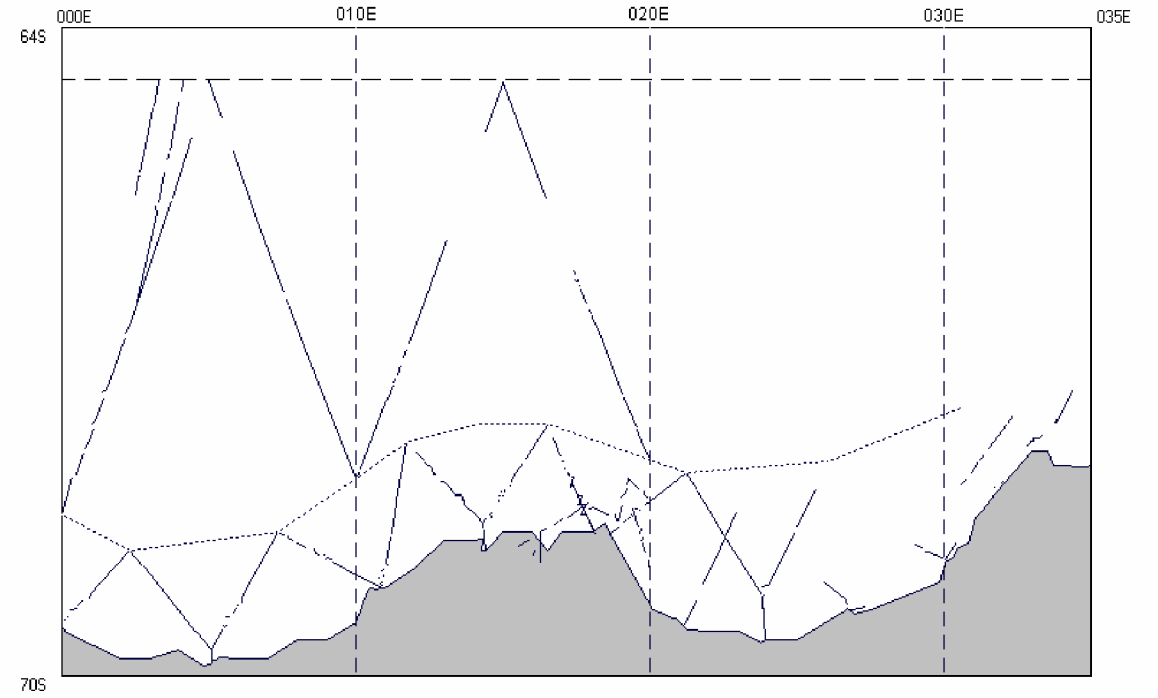
Figures 1a-g. Details of the constructed cruisetracks. The grey area represents the best estimate of the extent of ice. The black area represents land.



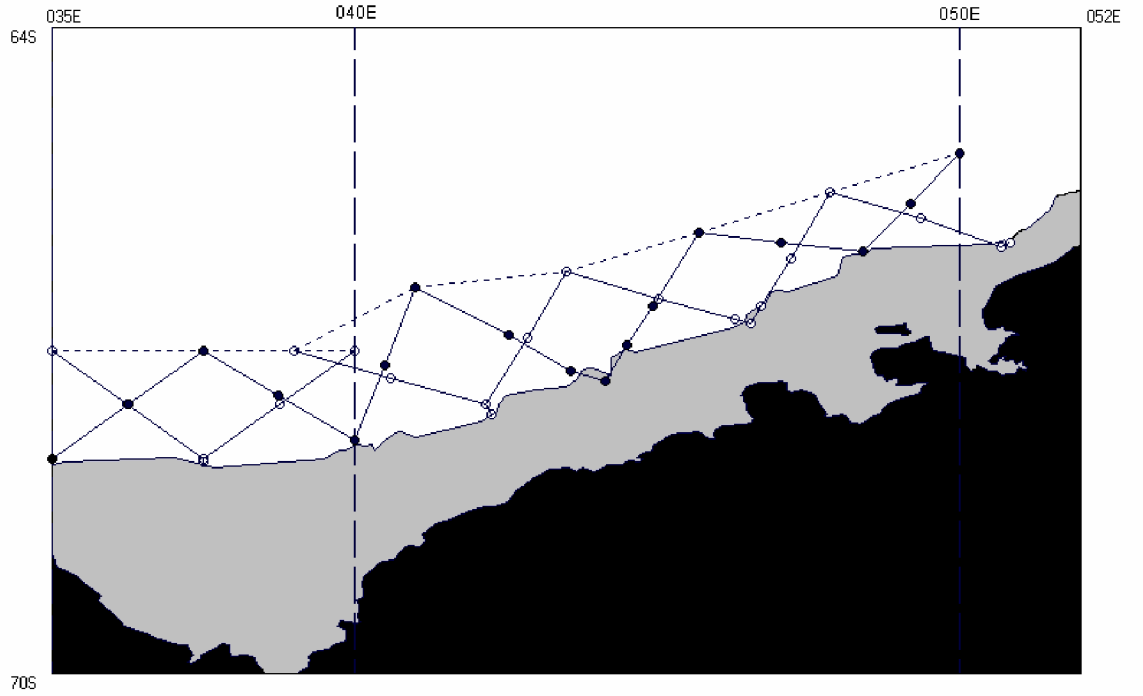
1a. The entire survey, including the transits to and from the Research Area.



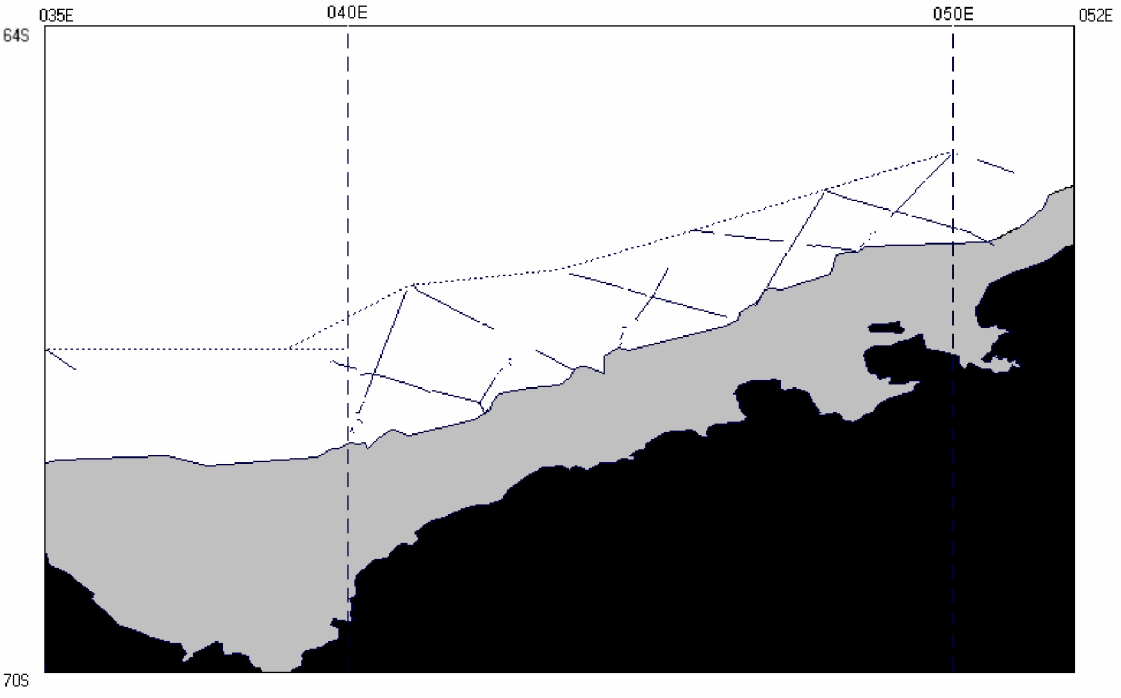
1b. The systematic survey of the area 000°-035°E. The waypoints for the *Shonan Maru* are shown as circles, and the *Shonan Maru No.2* as filled circles.



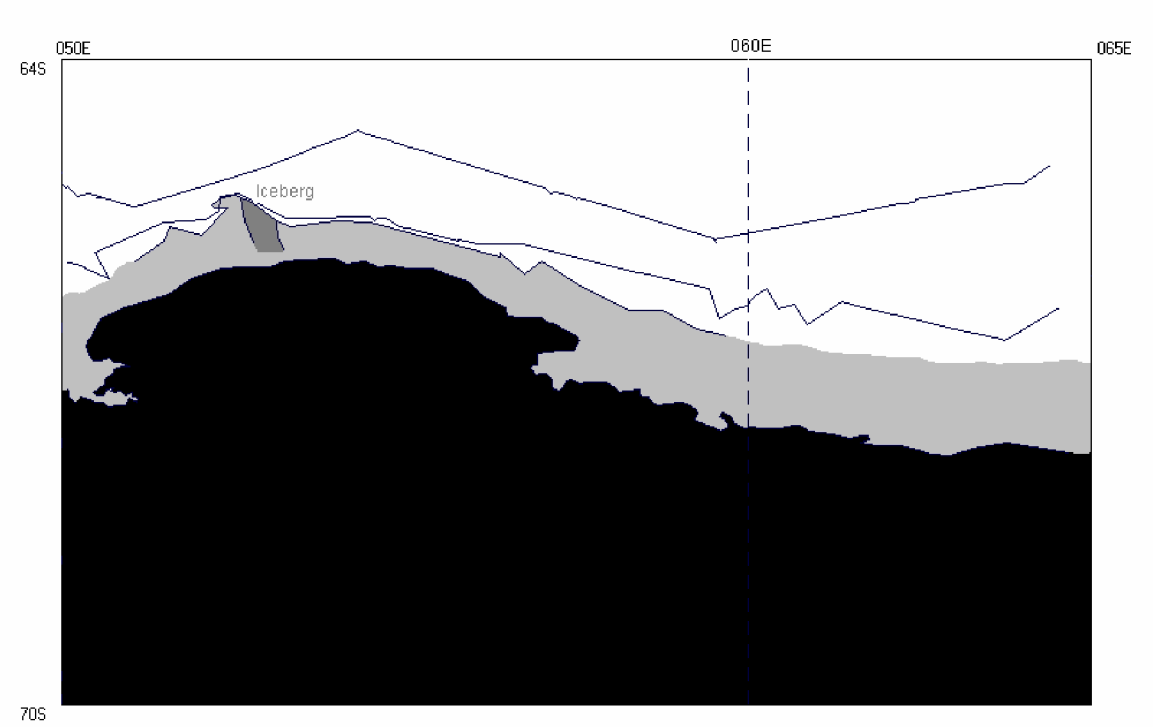
1c. Sections of the cruisetrack in the area 000°-035°E covered on search effort. (Note: coverage that appears in the pack ice was achieved after the main systematic survey when the ice edge had moved further south). The dotted line represents the Interstratum Boundary



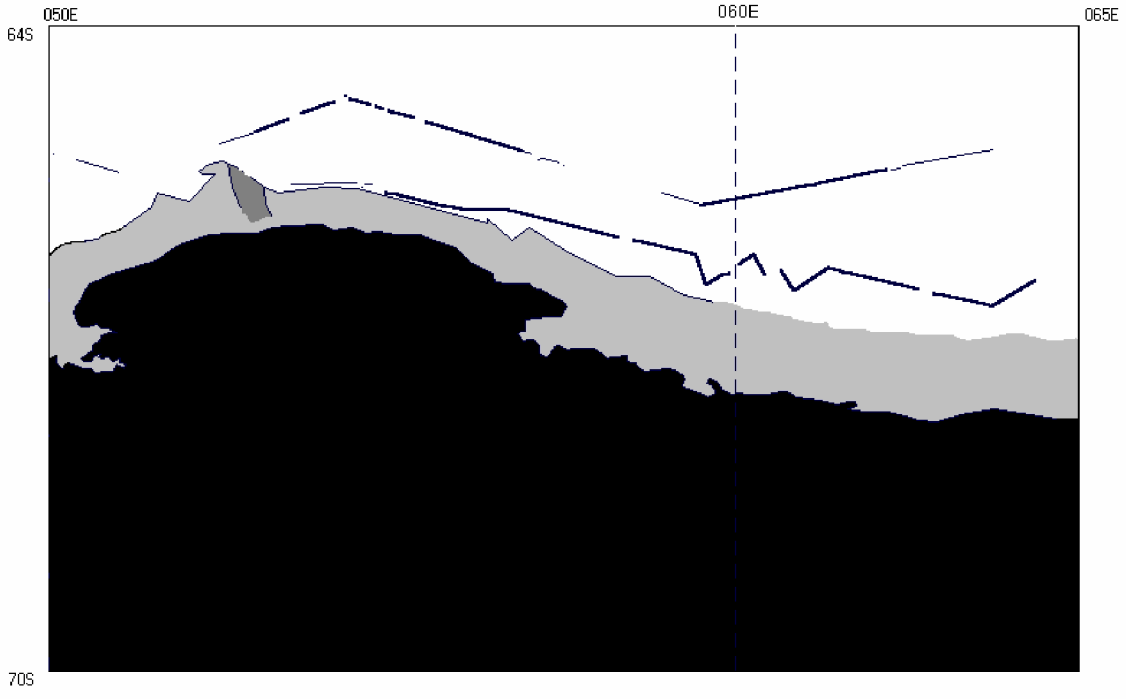
1d. The survey of the area 035°-050°E during the collaborative research with the icebreaker *Shirase*. The waypoints for the *Shonan Maru* are shown as circles, and the *Shonan Maru No.2* as filled circles. The dotted line represents the Northern Boundary of the collaborative research area.



1e. Sections of the cruisetrack covered on search effort in the area 035°-050°E during the collaborative research with the icebreaker *Shirase*.

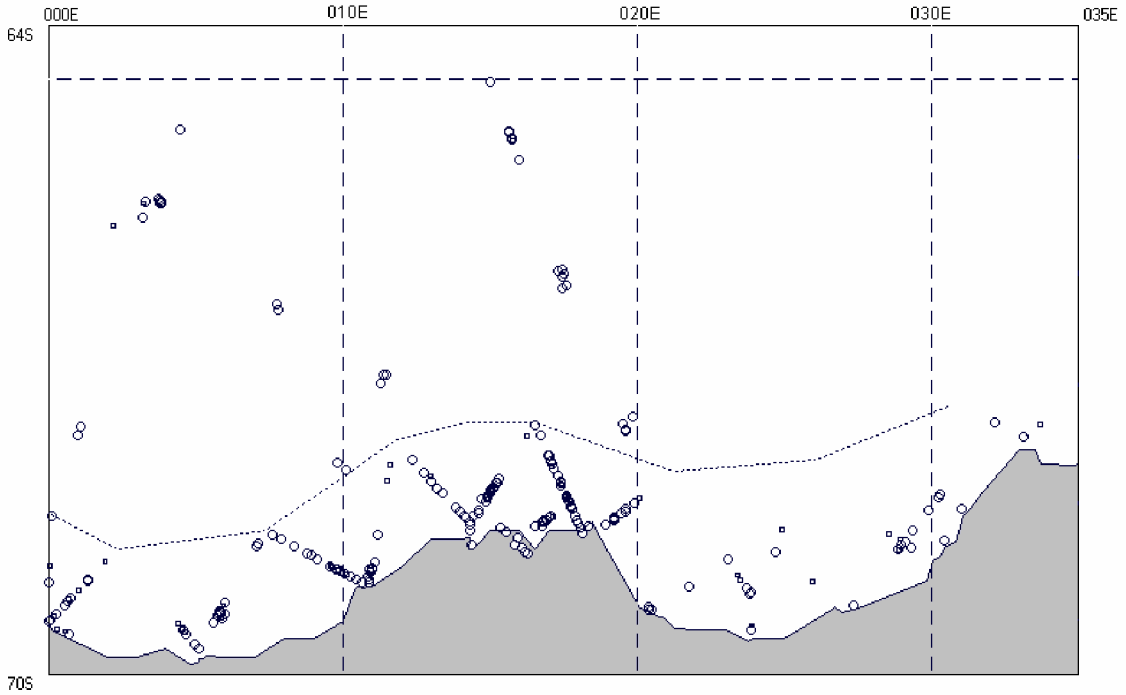


1f. The cruisetracks in the area 050°-065°E.

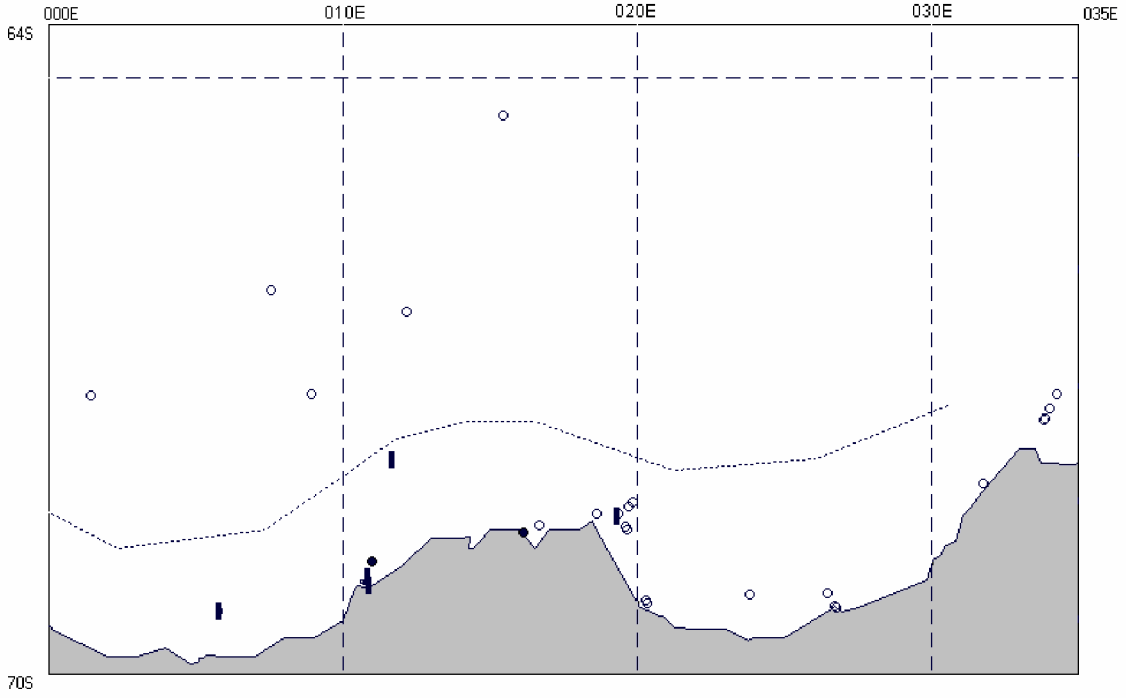


1g. Sections of the cruisetrack in the area 050°-065°E covered on search effort. The bold lines represent coverage during BT mode trials and the narrow lines either NSC or NSP modes.

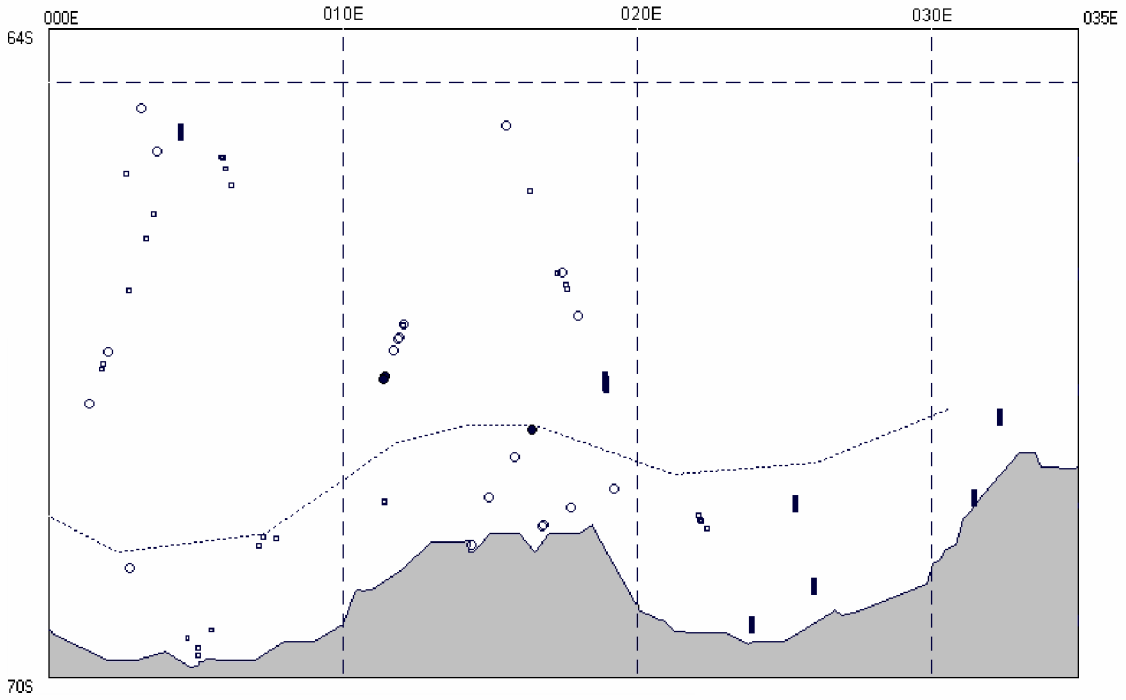
Figures 2a-k. Positions of whale sightings in the area 000°-035°E, including sightings on the survey cruisetracks and during transits. The dotted line represents the Interstratum Boundary.



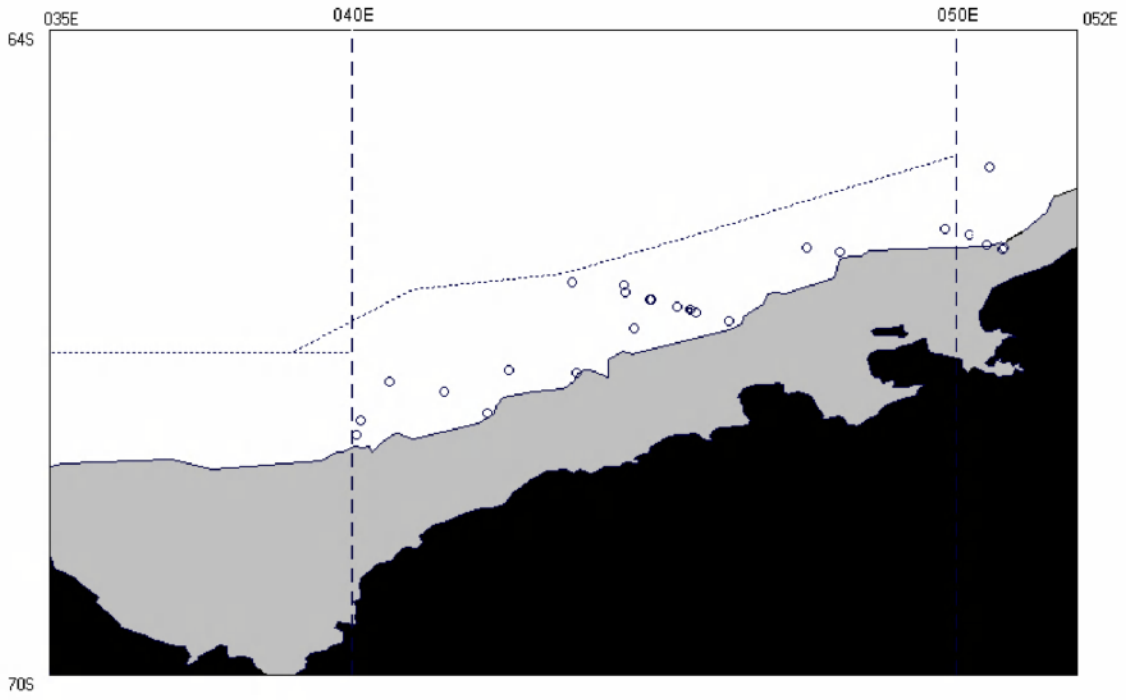
2a. Positions of minke whale (O) and 'like minke' whale (□) sightings in the area 000°-035°E. (Note: sightings that appear in the pack ice were observed at those locations after the main systematic survey when the ice edge had moved further south).



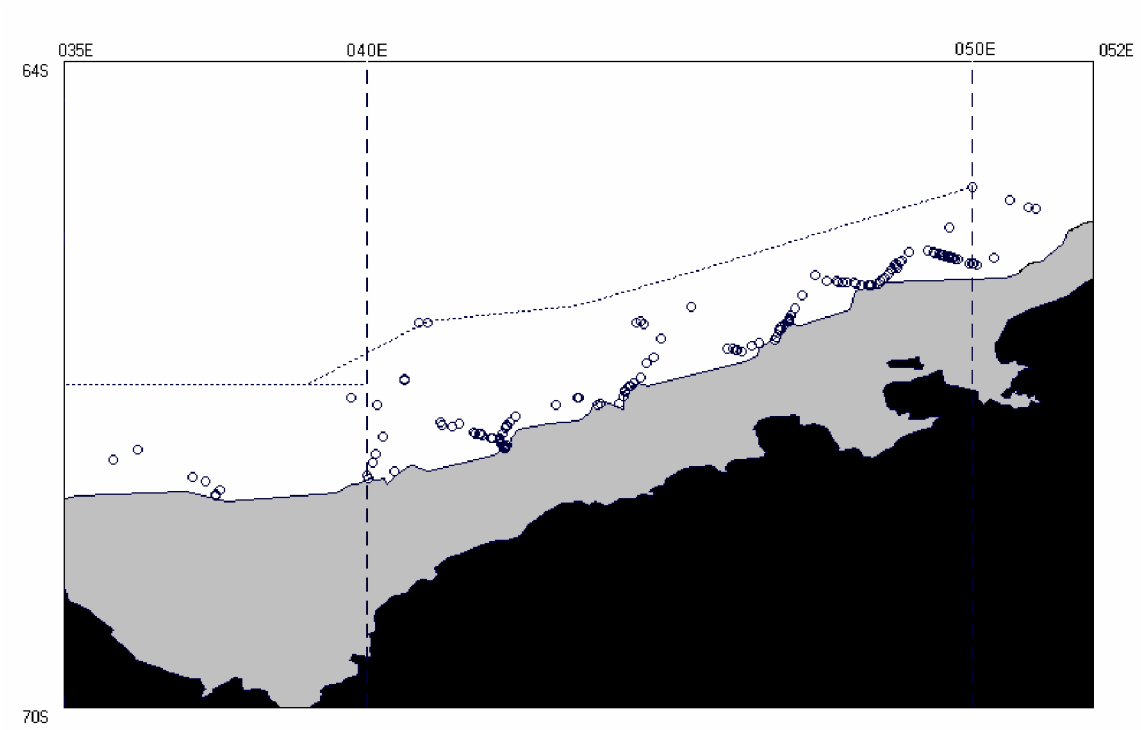
2b. Positions of blue whale (blue - true and undetermined ■), fin whale (●), humpback whale (O) and like blue whale (□) observed in the area 000°-035°E.



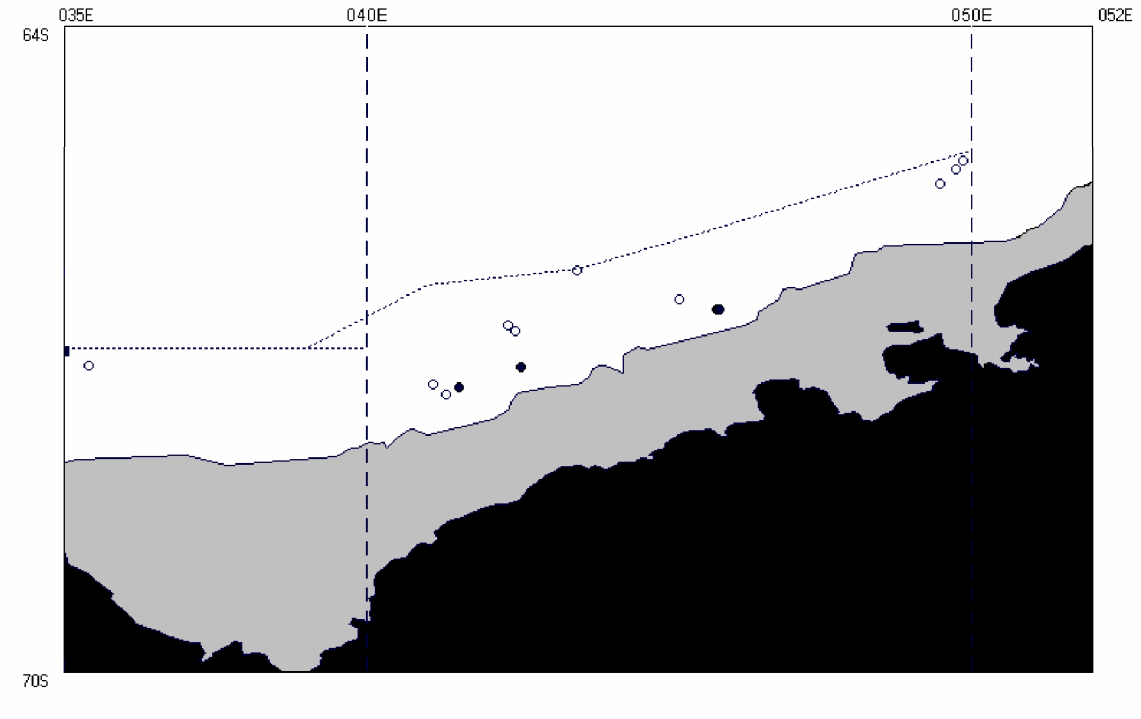
2c. Positions of killer whale (■), *Mesoplodon sp.* (●), southern bottlenose whale (O) and sperm whale (□) observed in the area 000°-035°E.



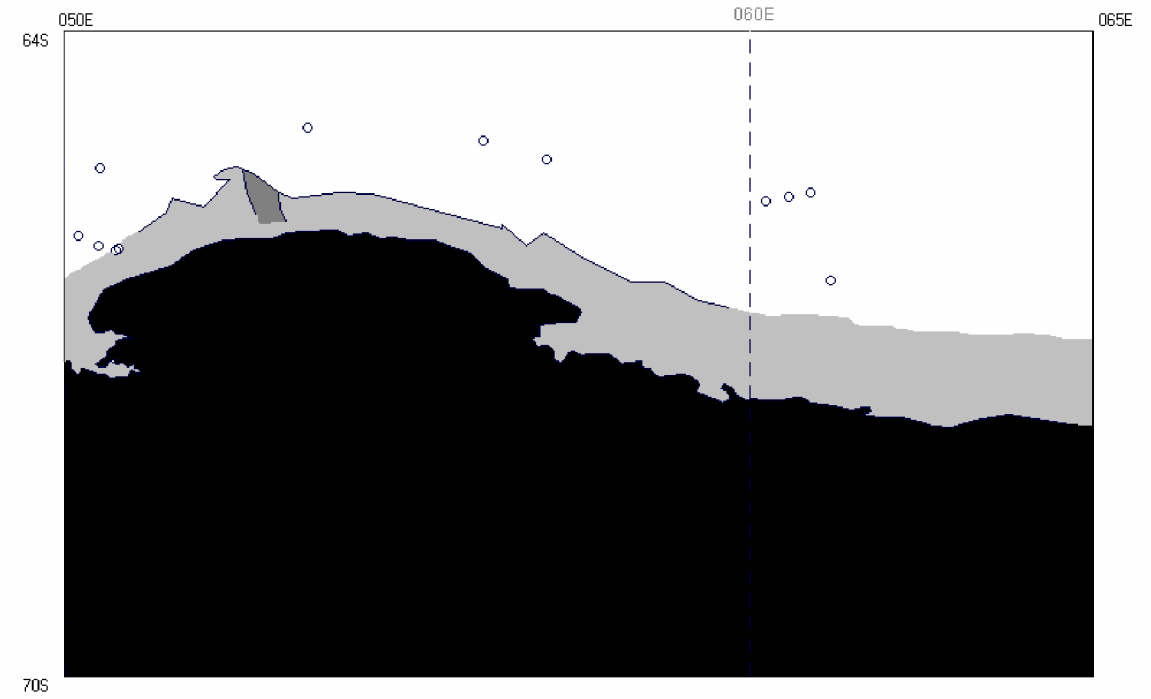
2d. Positions of minke whale (O) and 'like minke' whale (□) sightings observed in the area 035°E-050°E during the collaborative research with the icebreaker *Shirase*. The dotted line represents the Northern Boundary of the collaborative research area.



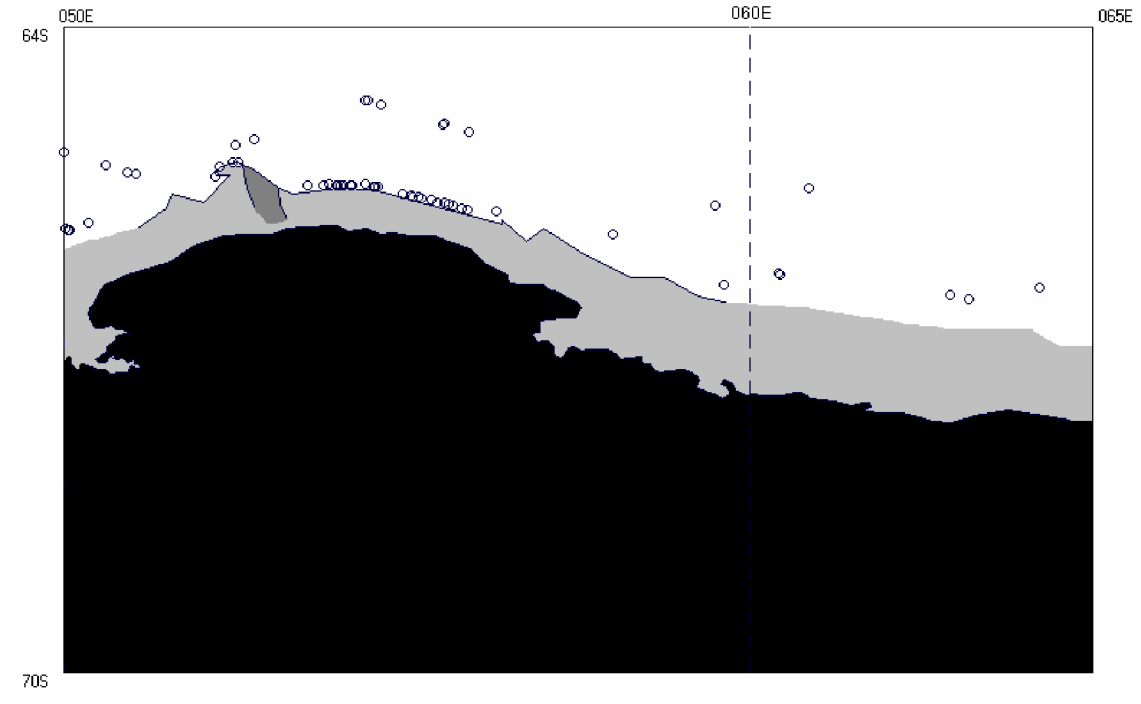
2e. Positions of humpback whale (O) sightings observed in the area 035°E-050°E during the collaborative research with the icebreaker *Shirase*.



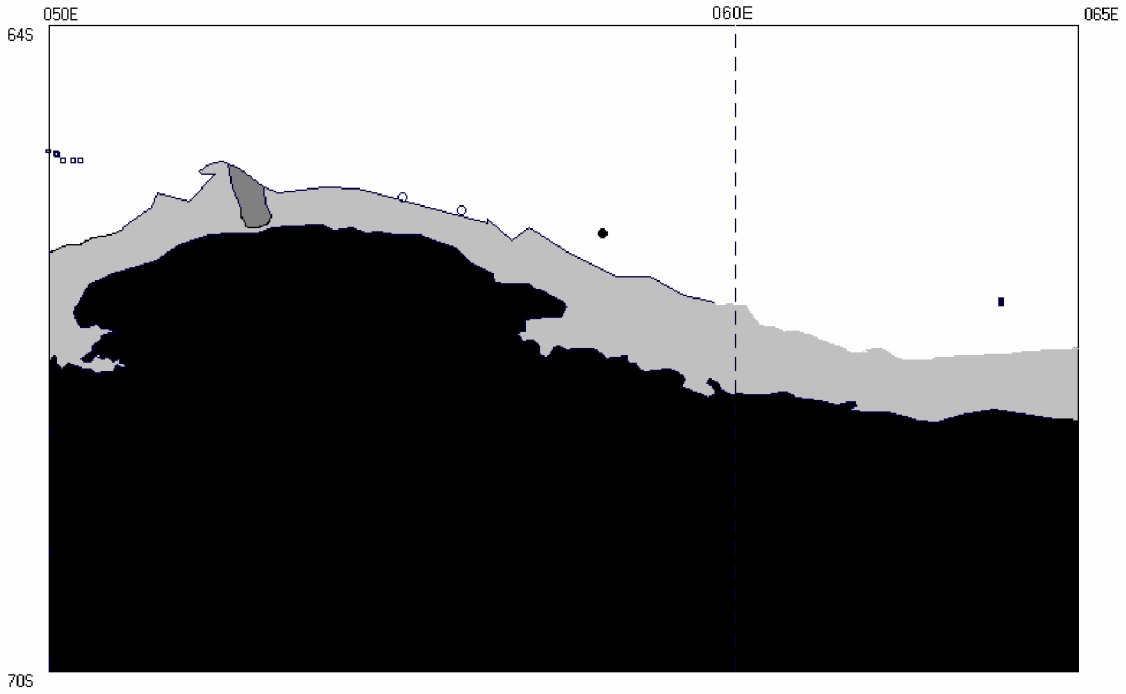
2f. Positions of killer whale (●), southern bottlenose whale (O) and sperm whale (■) sightings observed in the area 035°E-050°E during the collaborative research with the icebreaker *Shirase*.



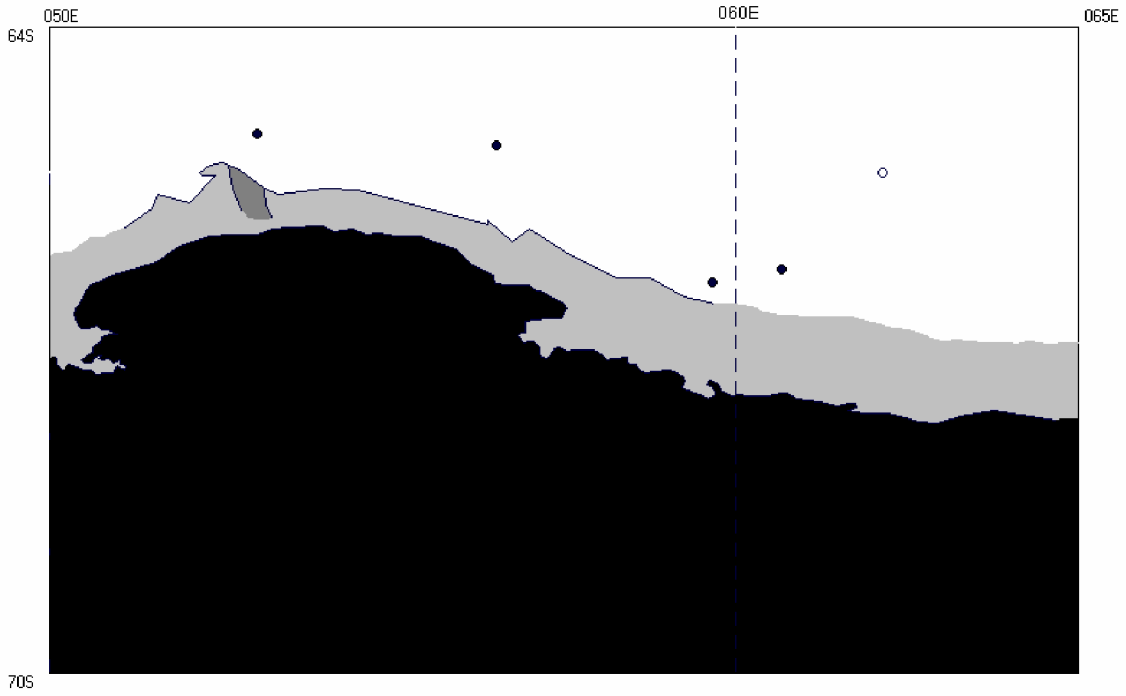
2g. Positions of minke whale (O) sightings observed in the area 050°E-065°E.



2h. Positions of humpback whale (O) sightings observed in the area 050°E-065°E.

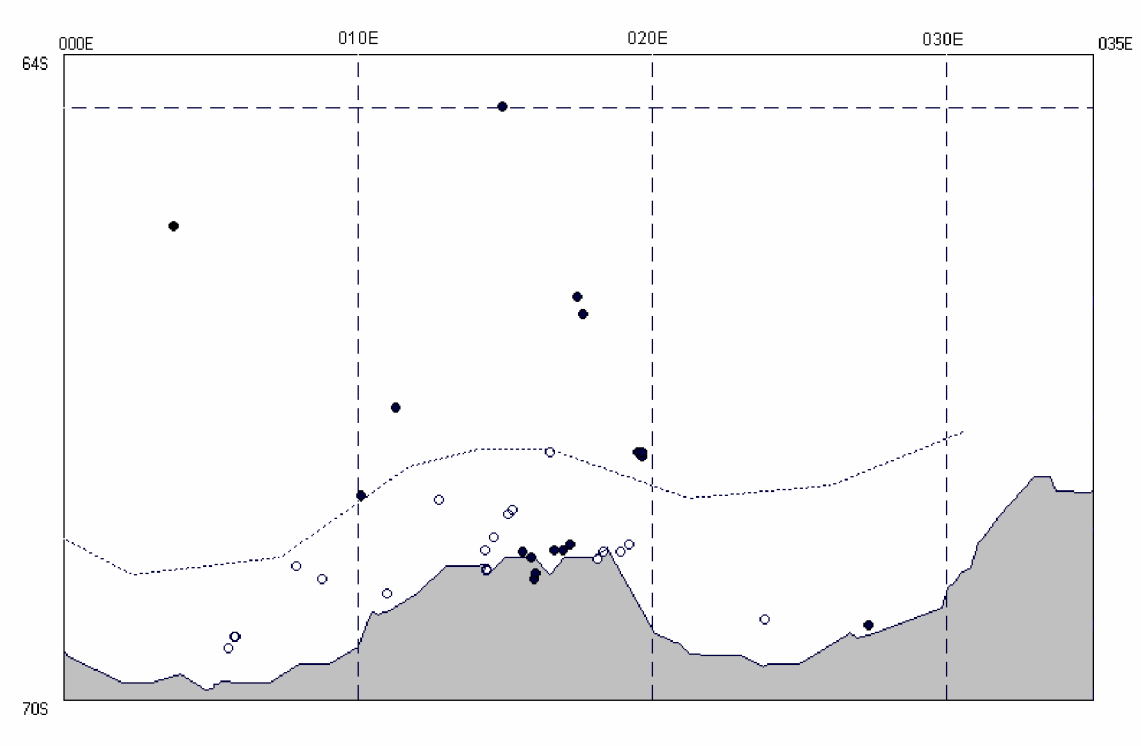


2i. Positions of blue whale (blue whale – undetermined) (●), 'like blue' whale (O), fin whale (□) and southern right whale (■) sightings observed in the area 050°E-065°E.



2j. Positions of killer whale (●) and southern bottlenose whale (O) sightings observed in the area 050°E-065°E.

Figure 3. Locations of the minke whale visual dive time trials conducted in the Research Area from the *Shonan Maru* (O) and *Shonan Maru No.2* (●). The grey area represents the best estimate of the extent of the pack ice related to the main systematic sighting survey. The dotted line represents the Interstratum Boundary.
Note: Trials that appear in the pack ice were conducted at those locations after the systematic survey had been completed and when the ice edge had moved further south.



Appendix A: Ship specifications and crew list

Ship specifications:

	Shonan Maru	*Shonan Maru No.2*
Call sign	JFBW	JFCF
Length	64.8 m	64.8 m
Breadth	10.2 m	10.2 m
International Gross tonnage	1015 t	1015 t
Japan Gross tonnage	712 t	712 t
Barrel height	20.0 m	20.0 m
IOP height	14.0 m	14.0 m
Upper Bridge height	11.0 m	11.0 m
Bow height	6.5 m	6.5 m
Engine power (main)	5500 HP	5500 HP
Crew	18	19

Crew list:

	Shonan Maru	***Shonan Maru No.2***
Captain	K. Hirose	H. Komiya
Chief Officer	Y. Yamauchi	S. Sato
Second Officer	T. Oshima	T. Takamatsu
Chief Engineer	S. Nakamura	M. Matsushita
First Engineer	Y. Mori	H. Yasunaga
Second Engineer	K. Kikuchi	I. Narazaki
Third Engineer	M. Ishida	N. Fujita
Chief Operator	Y. Tsuda	T. Iida
Boatswain	T. Shibata	N. Kasai
Quartermaster	N. Nakamura	K. Wakazuki
Quartermaster	K. Sugiyama	J. Utashiro
Sailor	S. Sakimukai	Y. Sekine
Sailor	F. Yamaguchi	H. Kaji
Sailor	S. Enomoto	T. Imai
No. 1 Oiler	M. Shiraishi	S. Andou
Fireman	H. Fujimoto	K. Aman
Fireman	*	D. Kinoshita
Chief Steward	K. Kawasaki	K. Yamashita
Steward	S. Seizawa	T. Sugisawa

* No allocation

Appendix B. Observations of cetaceans while in the 200 nmile Exclusive Economic Zone of South Africa.

Introduction

The 2004-2005 International Whaling Commission-Southern Ocean Whale and Ecosystem Research (IWC-SOWER) Cruise surveyed in IWC Antarctic Area III in January and February 2004. The objectives for the 2004-2005 cruise were to: (1) investigate the relationship between minke whale abundance and the sea ice (including collaborative studies with an icebreaker); (2) carry out a series of experiments addressing (a) problems encountered with the analysis of previous cruises and (b) the possibility of using different sampling strategies on future cruises; and (3) providing information towards addressing the effect of changing cruise track design on Antarctic minke whale abundance estimates. The research area was the area between longitudes 000° and 070°E, south of latitude 64°30'S (Anon. 2004a). Details of the entire cruise are reported in Ensor *et al.* (2005).

The vessels from which the research was conducted (the *Shonan Maru* and *Shonan Maru No.2*) used Cape Town as the port of departure from South Africa. The vessels passed through the 200 nmile Exclusive Economic Zone (EEZ) of South Africa on the transits to the Research Area. Permission was granted by the Department of Foreign Affairs of the Republic of South Africa for research in the Zone to be conducted in Closing Mode.

Methods

The ships departed Cape Town on 4 January and returned to Fremantle, Australia on 9 March 2005.

En route to the Antarctic research area the vessels intersected the South African EEZ and while in the zone research from both vessels was to be conducted in Closing mode (NSC).

A description of the research procedures and data recording methodology is given in Anon. (2004b).

Results

The ships departed Cape Town as planned on 4 January (*Shonan Maru No.2* at 15:20 hrs and *Shonan Maru* at 15:40 hrs). The vessels transited to the research area on parallel courses 20 nmiles apart.

Research within the 200 nmile Exclusive Economic Zone (EEZ) of South Africa was undertaken in NSC mode, however windy conditions restricted research. A total of 8.17 hrs of research (105.9 nmiles) was conducted: 4.14 hrs (48.8 nmiles) from the *Shonan Maru*, and 4.03 hrs (57.1 nmiles) from the *Shonan Maru No.2*. The vessels departed the EEZ on 5 January: the *Shonan Maru* departed at 37°33'S, 017°23'E at 10:28 hrs, and the *Shonan Maru No. 2* at 37°26'S, 017°00'E at 11:07 hrs.

Seven sightings were made within the South African EEZ (Table A). Details of each cetacean sighting are given in Table B.

References

Anon. 2004a. Report of the Planning Meeting for the 2004-2005 IWC-SOWER Cruise. Available from the IWC Secretariat, Cambridge, United Kingdom.

Anon. 2004b. 2003-2004 IWC-SOWER Cruise. Information for Researchers. Available from the IWC Secretariat, Cambridge, United Kingdom.

Ensor P., Findlay K., Friedrichsen G., Hirose K., Komiya H., Morse L., Olson P., Sekiguchi K., Van Waerebeek K. and Yoshimura I. 2005. 2004-2005 IWC-Southern Ocean Whale and Ecosystem Research (IWC-SOWER) Cruise, Area III. Available from the IWC Secretariat, Cambridge, United Kingdom.

Table A. Number of sightings for all species observed during transit in the South African 200 nmile EEZ in each effort mode.

Species	NSC		OE		Total	
	G	A	G	A	G	A
Shonan Maru						
Sperm	2	3	0	0	2	3
Heavisides dolphin	0	0	2	15	2	15
Mesoplodon sp.	1	2	0	0	1	2
Unidentified small whale	1	1	0	0	1	1
Shonan Maru No. 2						
Like sei whale	1	1	0	0	1	1

Table B. Cetacean sightings made while in the 200 nmile EEZ of South Africa.

Date	Time	Mode	Species	Number	Position	
					Latitude	Longitude
Shonan Maru						
04 January 2005	17:40	OE	Heaviside's	1	34°04.42'S	18°11.68'E
04 January 2005	18:08	OE	Heaviside's	5	34°10.19'S	18°10.54'E
05 January 2005	08:10	NSC	Unid. small whale	1	37°08.14'S	17°29.31'E
05 January 2005	09:00	NSC	Sperm whale	2	37°15.77'S	17°27.48'E
05 January 2005	09:13	NSC	Sperm whale	1	37°18.15'S	17°26.49'E
05 January 2005	10:15	NSC	*Mesoplodon sp.*	2	37°30.10'S	17°24.00'E
Shonan Maru No.2						
05 January 2005	06:45	NSC	Like Sei whale	1	36°41.19'S	17°15.67'E

Appendix C. Observations of cetaceans while in the 200 nmile Exclusive Economic Zone of Australia.

Introduction

The 2004-2005 International Whaling Commission-Southern Ocean Whale and Ecosystem Research (IWC-SOWER) Cruise surveyed in IWC Antarctic Area III in January and February 2004. The objectives for the 2004-2005 cruise were to: (1) investigate the relationship between minke whale abundance and the sea ice (including collaborative studies with an icebreaker); (2) carry out a series of experiments addressing (a) problems encountered with the analysis of previous cruises and (b) the possibility of using different sampling strategies on future cruises; and (3) providing information towards addressing the effect of changing cruise track design on Antarctic minke whale abundance estimates. The research area was the area between longitudes 000° and 070°E, south of latitude 64°30'S (Anon. 2004a). Details of the entire cruise are reported in Ensor *et al.* (2005).

The vessels from which the research was conducted (the *Shonan Maru* and *Shonan Maru No.2*) used Fremantle as the port of arrival in Australia. The vessels passed through the 200 nmile Exclusive Economic Zone (EEZ) of Australia on the transit from the Research Area and conducted research in the Zone.

Permission was not required from the Australian Government, in accord with the relevant Australian legislation (the Environment Protection and Biodiversity Conservation Act 1999) since the main aim of the research to be undertaken in the Australian EEZ (determination of species identification and school size) did not necessitate approach whales closer than from 100-300 metres).

Methods

The ships departed Cape Town on 4 January and returned to Fremantle, Australia on 9 March 2005.

En route from the Antarctic research area to Fremantle the vessels intersected the Australian EEZ and while in the zone research from both vessels was conducted in Closing mode (NSC).

A description of the research procedures and data recording methodology is given in Anon. (2004b).

Results

The ships entered the Australian EEZ on 7 March: the *Shonan Maru* at position 35°12'S, 111°07'E at 02:54 hrs, and the *Shonan Maru No. 2* entered at position 35°23'S, 111°11'E at 05:17 hrs. In the Australian EEZ, research in NSC was conducted for a total of 23.75 hrs (279.9 nmiles). The *Shonan Maru* and *Shonan Maru No. 2*, respectively, carried out 10.9 hrs (126.8 nmiles) and 12.85 hrs (153.1 nmiles) of searching in closing mode within the Zone.

The *Shonan Maru* and *Shonan Maru No. 2* made 13 and 10 sightings, respectively, within the Australian EEZ.

Three sightings of three individual pygmy blue whales were sighted from the two vessels. All of these were in or offshore of the Perth Canyon region. Two individuals were photographed from distances of over 100 m from the *Shonan Maru No.* 2, and one individual was photographed from the *Shonan Maru.* A further 2 groups of 3 blue whales (undetermined) were sighted by the *Shonan Maru*. No other large baleen whales were encountered.

The *Shonan Maru No. 2* sighted one individual sperm whale during the transit through the Australian EEZ.

A number of beaked whale sightings were made by both vessels during the transit through the Australian EEZ. One of these was a group of 7 Gray's beaked whales, while two sightings were identified as Mesoplodon species. A further four groups of (unidentified) Ziphiid's were sighted. Both vessels encountered groups of pilot whales and the *Shonan Maru* sighted one group of 5 killer whales.

Two groups (totaling 420) striped dolphins were sighted by both vessels during the transit and the *Shonan Maru* sighted 20 bottlenose dolphins.

References

Anon. 2004a. Report of the Planning Meeting for the 2004-2005 IWC-SOWER Cruise. Available from the IWC Secretariat, Cambridge, United Kingdom.

Anon. 2004b. 2004-2005 IWC-SOWER Cruise. Information for Researchers. Available from the IWC Secretariat, Cambridge, United Kingdom.

Ensor P., Findlay K., Friedrichsen G., Hirose K., Komiya H., Morse L., Olson P., Sekiguchi K., Van Waerebeek K. and Yoshimura I. 2005. 2004-2005 IWC-Southern Ocean Whale and Ecosystem Research (IWC-SOWER) Cruise, Area III. Available from the IWC Secretariat, Cambridge, United Kingdom.

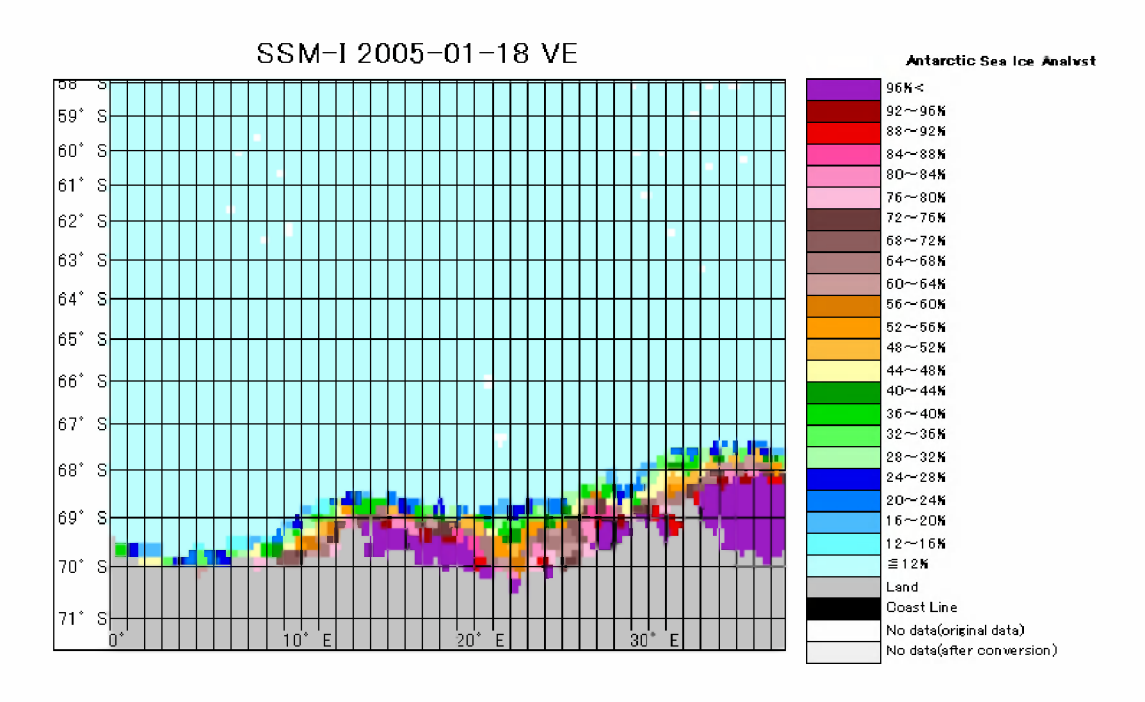
Table A. Number of sightings for all species observed during transit in the Australian 200 nmile EEZ in each effort mode.

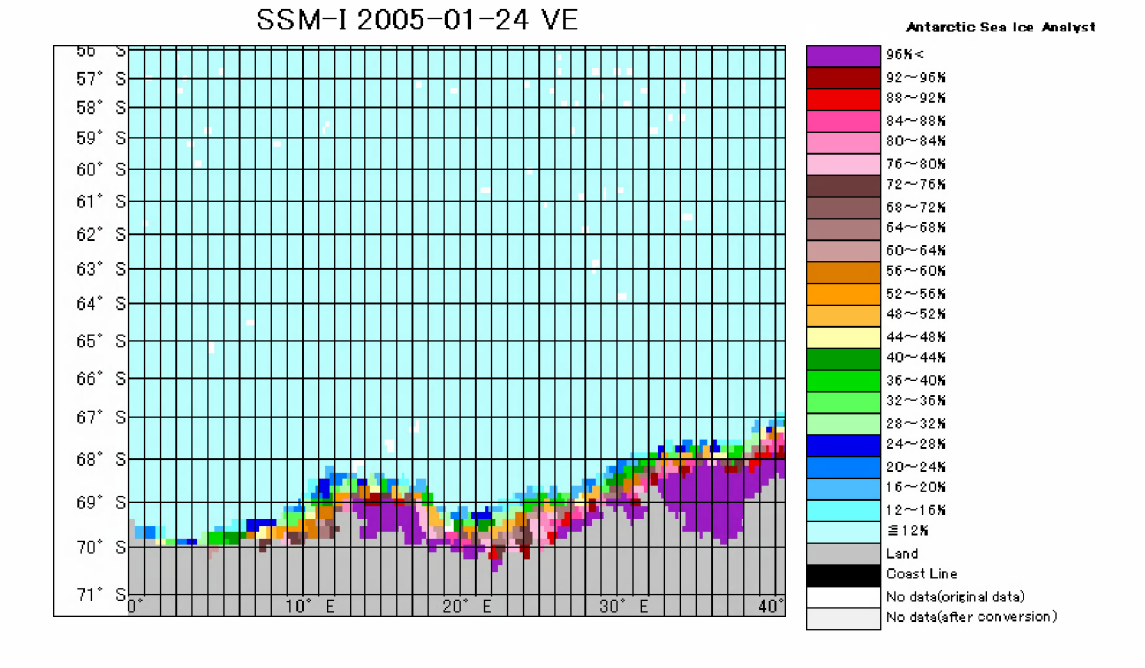
Species	NSC		Total	
	G	A	G	A
Shonan Maru				
Blue whale (undetermined)	2	3	2	3
Pygmy blue whale	1	1	1	1
Killer whale	1	5	1	5
Pilot whale	1	150	1	150
Gray's beaked whale	1	7	1	7
Common bottlenose dolphin	1	20	1	20
Striped dolphin	2	185	2	185
Mesoplodon sp.	2	6	2	6
Ziphiid	2	4	2	4
Shonan Maru No. 2				
Pygmy blue whale	2	2	2	2
Sperm whale	1	1	1	1
Ziphiid	2	8	2	8
Short-fin pilot whale	1	30	1	30
Striped dolphin	1	250	1	250
Unidentified small whale	2	2	2	2
Unidentified dolphin	1	40	1	40

Table B. Cetacean sightings made while in the 200 nmile EEZ of Australia.

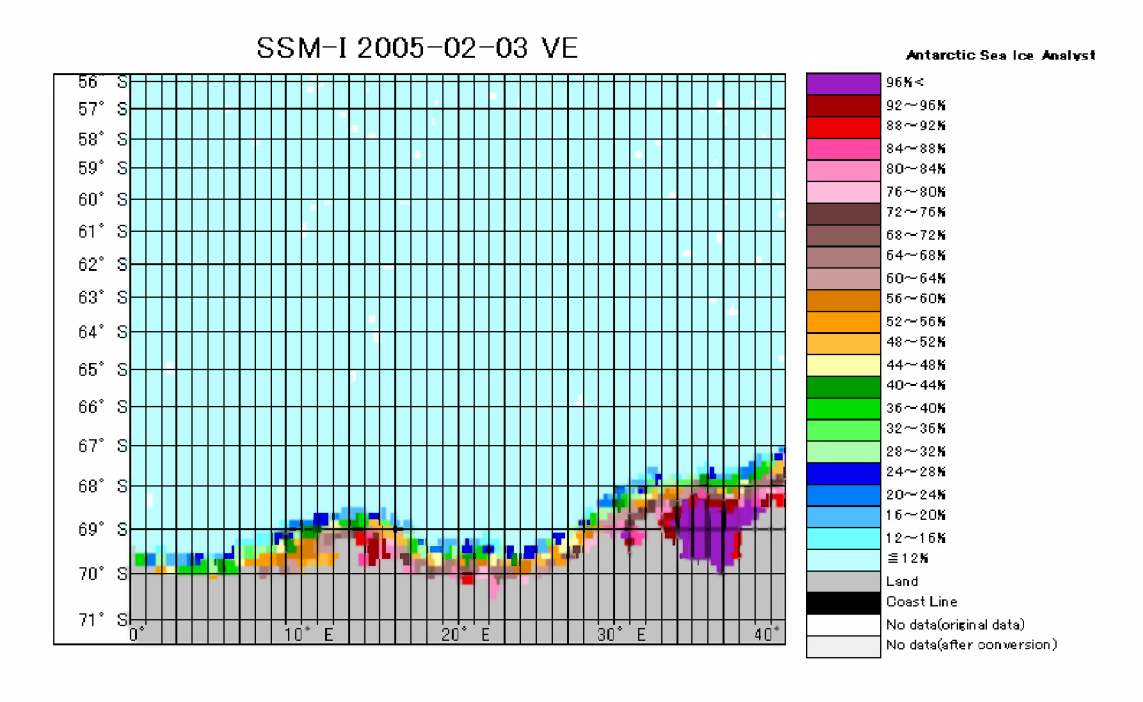
Date	Time	Mode	Species	Number	Position	
					Latitude	Longitude
Shonan Maru						
07 March 2005	10:36	NSC	Striped dolphin	15	34°08.04'S	112°28.61'E
07 March 2005	11:14	NSC	Gray's beaked whale	7	34°04.13'S	112°31.41'E
07 March 2005	11:46	NSC	*Mesoplodon sp.*	3	34°00.27'S	112°35.59'E
07 March 2005	12:13	NSC	Ziphiid	1	33°57.05'S	112°40.40'E
07 March 2005	13:59	NSC	Killer whale	5	33°43.91'S	112°59.45'E
07 March 2005	15:45	NSC	*Mesoplodon sp.*	3	33°32.13'S	113°14.64'E
08 March 2005	09:18	NSC	Ziphiid	3	32°14.28'S	114°50.67'E
08 March 2005	10:06	NSC	Pilot whale	150	32°09.66'S	114°57.12'E
08 March 2005	10:06	NSC	Bottlenose dolphin	20	32°09.66'S	114°57.12'E
08 March 2005	10:23	NSC	Striped dolphin	170	32°07.35'S	114°59.34'E
08 March 2005	10:25	NSC	Blue (undetermined)	2	32°07.24'S	114°59.83'E
08 March 2005	10:28	NSC	Pygmy blue whale	1	32°07.39'S	115°00.56'E
08 March 2005	10:41	NSC	Blue (undetermined)	1	32°07.54'S	115°04.43'E
Shonan Maru No.2						
07 March 2005	09:21	NSC	Sperm whale	1	34°48.13'S	111°52.63'E
07 March 2005	10:51	NSC	Ziphiid	3	34°40.44'S	112°01.62'E
07 March 2005	14:48	NSC	Unid. small whale	1	34°07.44'S	112°40.89'E
07 March 2005	14:50	NSC	Unid. small whale	1	34°07.10'S	112°41.02'E
08 March 2005	12:17	NSC	Ziphiid	5	32°12.39'S	114°48.34'E
08 March 2005	13:21	NSC	Short-fin pilot whale	30	32°08.11'S	114°52.75'E
08 March 2005	13:59	NSC	Pygmy blue whale	1	32°04.26'S	114°56.66'E
08 March 2005	13:59	NSC	Pygmy blue whale	1	32°02.32'S	114°59.68'E
08 March 2005	08:29	NSC	Unidentified dolphin	40	32°46.76'S	114°16.62'E
08 March 2005	08:05	NSC	Striped dolphin	250	32°49.25'S	114°10.94'E

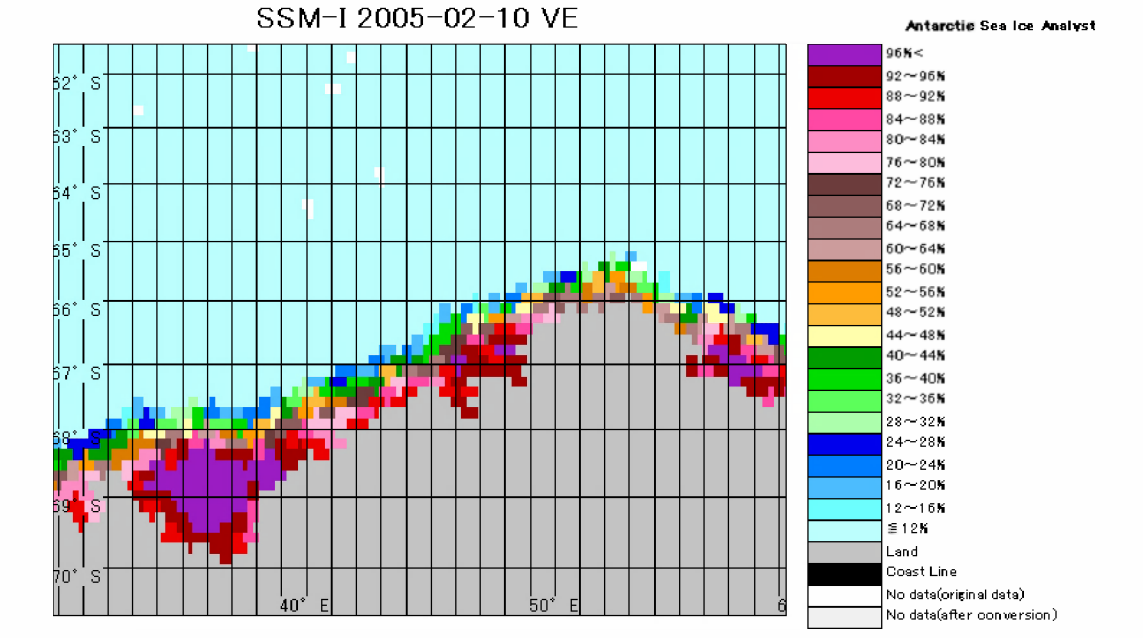
Appendix D: Selected Ice Images



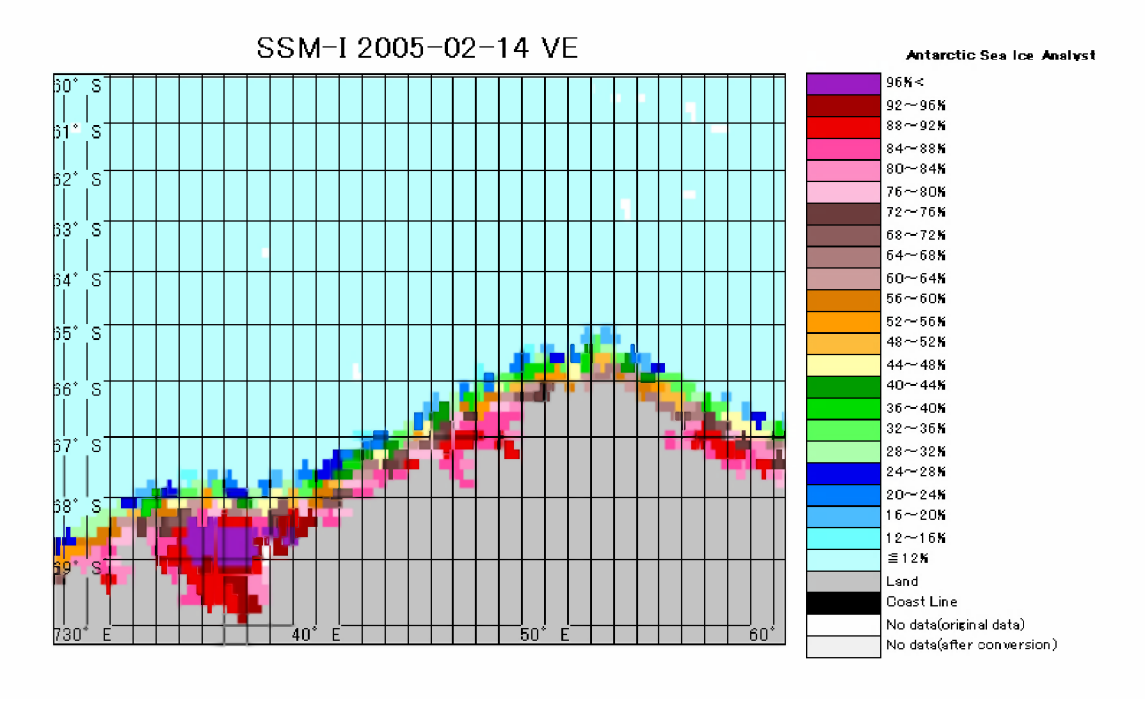


Appendix D: Selected Ice Images continued.





Appendix D: Selected Ice Images continued.



Appendix E. Minke Whale Visual Dive Time Experiment Logs

I. *Shonan Maru*

Trial 1

Initial sighting of this solitary minke on **21 January** was a body cue at 3.2 nmiles at 10:20.55. The ship turned and spent 25 minutes attempting confirmation but the whale was not detected again. When turning to return to the trackline, the whale was spotted about 1 nmile away. Then closure was completed to 0.25 nmile with three surfacings and underwater body were clearly observed and the group size was confirmed as 1. The whale was swimming slowly and no blow was visible. At this point it was decided to commence the dive time experiment. However, by 11:03.55 the whale had not been resighted so the dive time experiment was stopped for this sighting.

Trial 2

On **21 January** the ship had been drifting for 20 minutes waiting for a snow squall to pass that was obscuring the trackline. Observers were searching for a secondary sighting that would be appropriate for a dive time experiment. A ring cue appeared close to the ship at 14:45 and it was decided to conduct the experiment on this (secondary) minke sighting. The experiment started at 14:50 on the group of two whales, but sighting conditions were poor due to fog patches and it was difficult to track the whales. In the meantime we found a better candidate, sighting #28 (trial 3) which was located away from the fog. So, the experiment on sighting #27 was terminated as a subject for the dive time experiment at 15:04.

Trial 3

This experiment period for this trial continued on from trial 2 on **21 January** The sighting was detected at 15:03.24, initially thought to be a group of two, but numbers were confirmed as four whales. Whales surfaced regularly and almost continuously during the observation period. Generally the whales were heading S, but alternating their direction of travel from SE to SW. At first the group was cohesive and surfacing slowly. Twenty minutes or so into the observation period the whales became quite active at the surface, splashing, swimming fast and charging and throwing up white water. The whales spread out at this time, further than several body lengths from one another and especially with one whale separated from the other three. Eventually the whales came back together and began swimming slowly again, and surfacing synchronously, in close proximity to one another. Blows were readily visible during this sighting. After the dive time experiment was completed the ship approached the group to confirm numbers.

Trial 4

The fourth trial was conducted on **22 January**. The group consisted of two whales, slow rolling within 5 body lengths of one another. They often surfaced synchronously and were heading generally S-SE. The experiment was stopped when whales had not been seen for 14 minutes and it could not be determined if the next whales observed surfacing (at 1.0 nmile) were the group selected for the trial (sighting #10) or a secondary sighting. So final closure on sighting #10 was not completed, however, we assessed the group numbers as confirmed because we observed the whales many times during the 45 minutes of the experiment and at a closest observation distance of 0.3nmi. Blows were not easily visible during this sighting. There were two secondary sightings observed but not recorded on the sighting data records during the experiment: one sighting was a solitary minke (1.5nmi) and one sighting was a group of two minkes (1.0nmi).

Trial 5

During this trial on **22 January** the three minke whales surfaced synchronously in sequences separated by several minutes. Almost all sequences consisted of several slow rolls at the surface. Slow rolling sequences varied in direction, but travel tended to be uni-directional within a sequence. Direction of travel during most sequences(s) was away from the ship. There was a behavior change in the middle of the observation period with the whales charging with frequent changes in direction and throwing up white water. Blows were readily visible during this sighting. Group size was confirmed during the 64 minutes of dive time

experiment with the closest distance of 0.3 nmiles when body pigment could be seen underwater. No secondary sightings were observed during this experiment. Observation recording ceased at 16:24.54. Unrecorded surfacings occurred before the experiment ended at 16:30.

Trial 6

On **23 January**, trial six was conducted on this group of 5 minke whales. The whales were blowing and surfacing slowly at surface almost continuously when initially sighted, continuing as the ship started to close and during the first part of the dive time observations. Then surfacing pattern evolved into a pattern of several surfacings followed by a break for a longer time when the whales were submerged. These periods of down time increased in duration over the course of the observation period. The whales were blowing and slow rolling, often milling, sometimes slow traveling, alternating heading directions of SE and SW. For a short time during the middle of the observation time the whales were swimming fast and charging. The group was fairly compact, whales always within 5 body lengths of another group member. The dive time observations ended when a secondary sighting of two minke whales approached the ship (to 0.15nmi). It seemed best to avoid potential confusion in discriminating between sightings. Closure for determination of group size was then completed for the experimental subject.

Trial 7

Two whales were moving slowly and steadily southward towards a belt of pack ice during this trial on **24 January**. The whales changed direction slightly between surfacings and we interpreted this behaviour as possible reaction to the ship as it was following the whales, at a distant, but directly from behind. For subsequent trials we adopted the practice of following the whales off to one side and this behaviour was then rarely observed. Body cues were harder to see than during the previous experiments due to poor contrast. Blow visibility varied greatly. The group was approached and numbers were confirmed at the end of the trial.

Trial 8

During this trial on **25 January**, two minke whales were traveling slowly SSW towards the ice, with some milling. Initially only 1 whale seen, then later two whales and the numbers were confirmed when the ship approached to within 0.3nmi. The experiment ended when the whales swam headed into the ice further than the ship could follow.

Trial 9

25 January When first observed the three whales swimming along the margin of the pack ice which composed of relatively compact brash and first year floes. Conditions were very calm, while body cues were clearly observed, blows were difficult to detect. The experiment ended when whales headed into ice and were difficult to detect.

Trial 10

This solitary minke whale was sighted on **25 January** at an intial distance of 4.3 nmiles. Blows were clearly visible initially in Beaufort 2 conditions, but later became somewhat difficult to detect when Beaufort conditions changed to 1. Whale exhibited regular surfacing sequences. The experiment terminated because of suspected missed cues and the presence of a secondary sighting at 13:38 (2 – 3 minkes seen 1.8nmi to starboard).

Trial 11

This trial was conducted on **25 January** on a secondary sighting of 6 minkes. It consisted of a group of six minkes, most frequently traveling as a compact group within 5 body lengths of one another. The general direction of travel was SW. During the observation period the group spread out to about 10 body lengths apart. Traveling speed was approximately 4 knots and slightly faster than the group of five in Trial 6. Blow visibility ranged from clearly visible to diaphanous.

Trial 12

During this trial on **26 January** on a group of 3 minkes conditions were initially Beaufort 0, a slight snow shower during part of observation period and after that a slight breeze change to Beaufort 1. Sightability for body cues was very good. Body cues and rings were clearly visible, blows were invisible for almost all the

experiment and only barely discernable sometimes. These whales were swimming slowly and consistently on a southerly heading, traveling at 3-4 knots. Sometimes the group was very tight, with whales surfacing right next to one another and all within 5 body lengths; sometimes whales would spread out, but keeping within 7 body lengths of one another.

Trial 13

This trial on **26 January** was conducted on a group of 5 whales. Although wind speed and Beaufort increased from 2 to 3 about mid-way through the experiment and body sightability decreased, conditions remained such that we considered that all surfacings were detected. Very clear water made body colouration clearly visible underwater at distances up to 0.5 nmiles and the whales were therefore very easy to track. The whales were moving overall in a south easterly direction, often at a moderate pace, 4-5kts. Pace was brisker during the first half of the observation time. Later the whales slowed, with changes in swimming direction during different surfacing sequences. Through most of the observation period the whales formed a compact group, but over time they spread out, with 5-10 body lengths between them. There were no secondary sightings.

Trial 14

Observations on this group on **27 January** started in brash ice and four whales were tracked through scattered brash ice for 45 minutes and then into open water. The starting location of the experiment was about 3-4 nmiles from was we would define as an 'ice edge'. The first mile was through scattered ice, a band of brash and floes and then through brash ice gradually increasing ice concentration towards a clearly defined ice edge. The whales generally moved in a northeasterly direction. A secondary sighting of two minke whales at a distance of 0.5 nmiles inside the packice was detected just as the target group left the ice. Outside the ice the sightability was excellent, conditions were initially Beaufort 1 and later changing to 2. Other secondary sightings were detected: a blow at a distance of 4.0 nmiles to the NE and another blow 0.5 nmiles to starboard. There was some confusion briefly with the sighting at 0.5nmi (1 minke) but no confusion with the secondary sighting at 4.0nmi. That sighting was identified as minke (3 whales) with a closest distance of 2.0 nmiles. Outside packice the whales were swimming 3-4 knots sometimes spread out to 12 body lengths between individuals but mainly within 5 lengths. Swimming speed was constant except on a very few brisker surfacings. Swimming direction not as variable as some other groups that have switched R and L. Perhaps that was because we had changed the ship's following procedure to maintain the target on one side or other. We considered that no cues went undetected, although in the pack ice the different sightability between platforms was evident. The Top saw more surfacings in the ice than were observed from the Upper Bridge. No cues missed in open water in conditions almost as good as it gets. Whales were easy to follow because of a substantial number of rings. The experiment ended about 5 nmiles from the edge of the pack ice (and about 8 nmiles from the harder pack boundary).

Trial #15

This trial was conducted on a group of two whales on **28 January**. Beaufort conditions were 1-2. The whales were traveling steadily N: for the first part of the observation NE, then turned to the N, then headed NW. Whales were always within 5 body lengths of one another and surfaced sequentially within a few seconds of one another. Their behaviour was generally to surface 1-3 times each, before diving for several minutes at a time.

Trial #16

28 January. The trial was conducted on a group of 4 minkes in Beaufort 1 conditions. The group of 4 whales sighted first. A secondary sighting of 1 whale about 1 nmile from primary group was also sighted. The group of 4 headed slowly SE, dispersing, as after a while the group only contained 3 whales. Then, 1 whale separated further and further from the remaining two, which did stay in close formation. Single whale was separated by .25 nmiles at 11:42. All 3 would surface within several seconds of each other. Eventually the pair surfaced S60 at .05nmi, having moved west, while the single whale surfaced P40 at 0.4 nmi, having moved east (11:52). The ship followed the single whale for several dive sequences. After a long break between surfacings, 2 whales were spotted behind the ship to the NE at 0.7 nmi (12:04). We were not sure if the single whale or other members of the original group were part of this surfacing. This group was slowly heading S. After another long break between surfacings, whales were spotted behind the ship (again) to the NE at 0.8 nmiles.(12:14). We were not sure if this was the same group most recently

sighted or if it contained any members of the original group. After a long break between surfacings a group of 3-4 whales was sighted to the NE, close to the ship at 0.2nmi (12:20). This group was followed until the end of the dive time observation period and contained 4 whales. This subgroup may or may not have been the original group.

Trial #17

28 January. Two whales traveling steadily 210° from about 7.0 nmiles off ice edge then into scattered loose ice and gradually into more concentrated ice (end of expt in about 3/10 brash). Conditions were very good (Beaufort 1-2). The whales were swimming at speeds of 4-5 knots. Whales only breathed 1–4 times per surfacing sequence, then would dive for a longer duration of several minutes. Throughout the entire experiment rings were clearly visible on each surfacing and the constant speed and swimming direction meant the whales were exceptionally easy to follow. Probably no cues were missed. Only on one surfacing was there a significant change of direction and that was amongst scattered brash ice near the end of the experiment. There were no secondary sightings.

Trial #18

Trial 18 was conducted on **6 February** in Beaufort 3 conditions. Initially, the sighting consisted of two whales separated by several hundred meters, blowing asynchronously. Then began blowing more synchronously, but still separated. Finally joined together, blowing synchronously. The whales travelled steadily NE. Surfacing pattern was a blow or two only, followed by minutes of down time. The cues were difficult to detect: blows were faint and wave chop and poor contrast often obscured much of the body. Some cues probably were almost certainly missed. There were two secondary sightings: 2 minkes, W at 1.3 nmiles and 2-3 minkes, NE at 1.5 nmiles. There were krill patches and flocks of snow petrels, some feeding, in the area about 30 miles from ice edge.

II. *Shonan Maru No. 2*

Trial #1

On **19 January**, two minke whales were approached as subjects for the initial dive time experiment. These two whales generally oriented away from the vessel during the experiment, and although conditions were poor, the blows from these two subject animals were clearly visible. At least two other groups of minke whales were sighted in the area during the experiment. Cues from these secondary groups were reported from the top, and although these cues are not recorded on the experimental form they will be within the video audio track. Experiment terminated early after 15 minutes due to confusion with cues from these secondary groups. It should be noted that further time was spent attempting to sort out this confusion so that 53 minutes was spent in experimental mode of which 15 minutes of experiment was carried out. Only 15 minutes are included in the total time above.

Trial #2

On **22 January**, a single minke whale was approached for a dive time experiment. This whale was seen blowing clearly on surface prior to start of experiment, and appeared good experiment candidate. On starting the experiment however, the behaviour appeared to change and the animal was observed only once during the 40 minutes of experiment. Experiment terminated after 40 minutes as it was believed that the animal was lost.

Trial #3

On **23 January**, a group of two minke whales was approached for a dive time experiment. These whales were generally moving slowly in milling manner with little or no response to vessel. The blows were fairly indistinct and few "end blow" cues could be recorded. This experiment was terminated due to advancing snow fog and deteriorating visibility after 1 hour and 38 minutes.

Trial #4

On **25 January**, two minke whales were approached as dive time experiment subjects. These animals were generally travelling slowly in unidirectional manner. Large patches of krill were visible within the area of the experiment. The whales appeared to have a marked dive pattern of 6.5 – 7 minutes, with 4 – 5

respirations per animal on each surfacing. Experiment terminated after maximum time of two hours. Confident that all, or most of, the cues were detected in the good conditions experienced in this experiment.

Trial #5

On **26 January**, five animals were seen alongside the vessel moving in slow manner during drifting. The animals generally moved west during dive time experiment and appeared to be aware of, but tolerant of vessel. At one stage the whales crossed the bow of the vessel closer than 0.1 miles and briefly reacted to vessel by strong swimming away. However, the whales settled down to slow travel shortly thereafter. The blows were very indistinct in this experiment and generally of shorter duration than body cues (sometimes blows were apparent with polarised glasses from the Upper Bridge when Top does not report them). Experiment terminated after maximum time of two hours.

Trial #6

Later in the afternoon of **26 January**, two minke whales were approached for dive time experiments. The whales were moving slowly westward close together and were kept on port side of the ship as there was strong late afternoon glare on starboard. This experiment was terminated after 49 minutes when a single animal (possibly one of the subject group) surfaced within 0.05 miles of the bow and cues were reported by top. Not recorded on voice system or paper, but is on the video audio track. At least one of the subject group was observed thereafter at expected position some distance from vessel on the port side.

Trial #7

A single minke whale originally detected from ring was approached for a dive time experiment on **28 January**. Initially this animal had long dive sequences with rings apparent on surface between surfacing bouts. These appeared to become longer slicks rather than rings as experiment continued. It was believed that the animal was reacting to position of the vessel, albeit in a slow travel manner. By end of experiment the whale was slowly orientating away from vessel, forming zig-zag track on each surfacing. The experiment was terminated after 1 hour due to this apparent reaction.

Trial #8

Later on **28 January**, one minke whale was sighted close to the vessel (0.1 nmile) where it was repeatedly sighted while preparing for experiment. This whale was lost immediately as the experiment started, and was not seen for a further 15 minutes. This experiment was consequently terminated. Immediately thereafter a group of minke whales visible in the distance as a secondary sighting was approached for dive time experiment 9 (below).

Trial #9

The secondary sighting of minke whales made during the previous dive time experiment on **28 January** was approached as an experimental candidate group after experiment 8 had been aborted. This was a reasonably compact group of six animals moving in a general NE direction. At one stage the group split into two subgroups before joining again on the next surfacing. Animals appeared aware but tolerant of the vessel. Sharp turns away from the vessel were recorded on two surfacings, but these could not definitely be ascribed as vessel effect as animals settled down immediately thereafter. Experiment terminated after 1 hour 49 minutes due to consistent behaviour and end of video tape.

Trial #10

On **4 February**, one minke whale was encountered approximately 10 miles north of the estimated ice edge. A dive time experiment was carried out for one hour during which the whale moved slowly but steadily westward. This animal on occasion turned sharply away from the vessel, but settled down immediately to general slow travel. Some surfacings were very close to the vessel. Easily followed by track of footprints. This experiment was terminated after one hour due to the whale's consistent behaviour.

Trial #11

Later on **4 February** two minke whales were approached for a dive time experiment. As with the previous whale these two animals moved westward downswell in generally unidirectional travel with no clear dive behaviour (whales moving on surface rather than showing clear dive patterns). Experiment terminated after 1 hour 54 minutes due to consistent behaviour.

Trial #12

The third dive time experiment carried out at 15:14 on **4 February** was on a group of 3 minke whales moving generally westward. These whales moved slowly at first, but appeared to be running from the vessel by end of experiment. Possibly one animal broke off from the group between 15:37 and 15:47 but had rejoined the loosely aggregated group by 15:47. This experiment was terminated due to subject's running behaviour after 56 minutes.

Trial #13

A fourth dive time experiment was initiated at 16:32 on **4 February** on four minke whales. The group appeared to start with three minke whales, which then split into two subgroups (one on port and one on starboard) of indeterminate size. These then joined together as possible four animals. A fourth whale was confirmed at 16:55. Generally slowly moving in westerly direction for the duration of the experiment. This experiment was terminated to allow confirmation of group size before end of research at 18:00, and confirmed as four whales.

Trial #14

Dive time experiment 14 was carried out from 07:11 on **5 February** on two large minke whales (estimated at 9 & 10 m) with long diving durations (some over 10 mins). The whale generally moved in a large circle during experiment and often surfaced some distance from the vessel (up to 1 mile). All cues were believed to have been sampled (even at long distances) during this experiment.

Trial #15

A second dive time experiment was carried out on **5 February** on two minke whales generally slow moving in a south-westerly direction. No marked directional or behavioural responses to the vessel were noted. The experiment was terminated after 1 hour 47 minutes.

Trial #16

The third dive time experiment carried out from 13:37 on **5 February** was on four minke whales generally moving slowly in a south westerly direction. Although initially travelling at about 0.3 miles on the port side of the vessel a marked change in direction towards the west by some or all animals was noted at 14:18. The whales settled back down to slow unidirectional travel by 14:28. General south west movement during this dive time experiment (as with the previous experiment). The experiment was terminated after a maximum time of two hours.

Trial #17

Two minke whales in the vicinity of the ice edge were approached at 17:36 on **8 February** for a dive time experiment. These whales entered the brash ice during the experiment. Animals at times appeared to be skittish of the vessel, although at other times moving slowly within 0.05 miles of the bow. It is possible that whales were moving from open patch to open patch within the brash ice. Experiment terminated after 54 minutes due to the end of the day.

Appendix F. Evaluation of Video recordings during the Minke Whale Visual Dive Time Experiment

I. *Shonan Maru*

Video recordings were obtained from the Upper Bridge on both ships during all minke whale visual dive experiments. Video recording was not conducted for the entire duration of each experiment as equipment problems sometimes caused delays and interruptions. Video recording was most successful for large groups that were easy to locate and follow with the camera. Small groups with fewer detected surfacings were the most difficult to video and resulted in the lowest proportion of surfacings captured. Although almost all the experiments on this cruise were conducted in very good sighting conditions, it was extremely difficult to obtain adequate video recordings of surfacings occurring at distances greater than 0.5 nmiles from the ship. Zooming in on these sightings rendered blurry, poor quality recordings. However for most surfacings, including those closer than 0.5 nmiles, some degree of zooming was desirable. If not zoomed in partially, surfacings often were not visible on the tape even though the event was "captured".

An initial review of all the tapes recorded on the *Shonan Maru* was made during the cruise. During most video sessions, the voice recorder and the topmen were clearly heard on the audio track of the video and this was useful in verifying the transcribed data from the voice recorder system. This was valuable because in a very small number of cases the transcription from the voice recorder required editing as some time stamps had been missed, cue type wrongly ascribed or sometimes surfacings of multiple animals had been announced as synchronous, when in fact there had been a small time difference between individual surfacings. The potential value of the video taped surfacing sequences for any subsequent analysis of these experiments should therefore be noted.

During review of the video recordings from *Shonan Maru* the number of visible complete surfacings captured on the video was determined as well as counts of the total number of surfacings reported per experiment (compiled from the voice recorder as well as the video track). The quality of the video was assessed based on how clear the surfacings appear on tape and, if in the researchers assessment, an accurate measure of length of surfacing could potentially be obtained. Finally, on the *Shonan Maru,* the duration of surfacing sequences and the number of detected individual surfacings per sequence were briefly examined in relation to group size; the results will be presented in a separate report to be presented to the analysts.

In addition, the clarity of blows as recorded on tape was found to be extremely variable, and in general did not accurately reflect what was being seen through the binoculars or naked eye. As a result the video is probably not useful for examining blow properties and durations. Body durations can be measured, but should be considered an underestimate of the true duration as seen through binoculars or naked eye as the resolution or definition of the cameras currently available on the ships are not adequate to capture more distant cues.

Table A. Summary of minke whale dive time experiments videotaped from the *Shonan Maru* during IWC-SOWER 2004-2005. Video quality assessed as Poor, Fair , Good or Excellent to reflect the clarity of the whale surfacing on tape and ability to measure its total duration. Cue durations were measured by stopwatch from the upper bridge (not from the video).

Trial No.	***Date***	**Sight. No.**	**Group size**	**Experiment Duration (hrs)**	**Video Duration (hrs)**	**No. of Cue Durations Measured by Stopwatch**	**No. of Audio Cues on Voice Recorder**	**No. of Visual Cues on Video Tape**	**Video Quality**
1	21 January	15	1	0.28	-	-	-	-	-
2	21 January	27	2	0.25	-	-	-	-	-
3	21 January	28	4	2.00	1.05	-	232	94	Poor to Good
4	22 January	10	2	0.78	0.75	-	17	1	Poor
5	22 January	12	3	1.15	0.54	49	123	20	Fair to Good
6	23 January	31	5	1.45	1.34	111	239	139	Good
7	24 January	8	2	1.21	1.0	19	35	4	Fair to Good
8	25 January	8	2	0.98	0.77	28	53	21	Good
9	25 January	10	3	0.30	0.26	9	23	10	Good
10	25 January	21	1	1.00	0.9	4	13	3	Fair
11	25 January	32	6	1.55	0.9	72	305	142	Poor to Fair
12	26 January	2	3	1.25	1.0	37	121	65	Good
13	26 January	12	5	1.70	1.62	186	313	203	Fair to Good
14	27 January	25	4	2.37	2.32	112	299	152	Fair to Good
15	28 January	1	2	2.03	1.95	37	83	19	Poor to Fair
16	28 January	2	4	2.30	2.22	41	222	135	Good
17	28 January	3	2	2.00	1.86	29	128	53	Good
18	06 February	5	2	1.39	1.09	-	41	5	Fair
Total				23.99	19.57	753	2,496	1,066	

II. *Shonan Maru No. 2*

Video was recorded for the total durations of dive time experiments carried out by the *Shonan Maru No. 2*, apart from brief tape changes. All video recorded during dive time experiments carried out by the *Shonan Maru No. 2* was reviewed during the cruise (particularly to transcribe and compare voice cue times from the audio track to the paper data forms completed on the Upper Bridge). Quality of video recordings varied considerably with a considerable improvement as dive time experiments progressed, but were very dependent on the environmental and light conditions of the day. No detailed qualitative assessment of each video tape or the detectability of cues within tapes were made on the *Shonan Maru No 2*.

The video tapes recorded from the *Shonan Maru No. 2* (and particularly the audio tracks thereof) are an extremely important data component of the dive time experiments as they contain a real time stamped voice record of all the cues from the animals. The value of the video material per se is probably far lower. It is uncertain if the poor quality (general softness of the image) noted in reviewing the tapes during the cruise, arises from the use of composite cables between the camera and monitor (as opposed to digital firewire cables), the quality of the monitor or the image quality. It is doubtful if review of the video material will provide further information on blow duration (these are however recorded on the audio track of the video tapes) as blows were often very blurred and indistinct in the video image. Also the duration of body cues could not be adequately reviewed from the video image due to image quality. However it is suggested that tapes be viewed on high resolution screens in digital format before any further evaluations of video image material be made.

Table B. Summary of minke whale dive time experiments videotaped from the *Shonan Maru No. 2* during IWC-SOWER 2004-2005. Video quality was not qualitatively assessed on the *Shonan Maru No. 2*.

Trial No.	*Date*	Sight. No.	Group size	Experiment Duration (hrs)	Video Duration (hrs)	No. of Cues Voice Recorder	No. of Cues Audio track of Video Tape	No. of Cues Paper form	Video Quality (Note 2)
1	19 January	005	2	0.25	0.25	Not counted	Not counted	15	Not Assessed
2	22 January	008	1	0.66	0.66	1	1	1	Not Assessed
3	23 January	001	2	1.63	1.63	Not counted	Not counted	124	Not Assessed
4	25 January	001	2	2.00	2.00	Not counted	Not counted	83	Not Assessed
5	26 January	001	5	2.00	2.00	165	282	283	Not Assessed
6	26 January	014	2	0.82	0.82	44	42	45	Not Assessed
7	28 January	005	1	1.00	1.00	20	21	19	Not Assessed
8	28 January	007	1	0.25	0.25	0	0	0	Not Assessed
9	28 January	009	6	1.82	1.82	219	330	336	Not Assessed
10	4 February	003	1	1.00	1.00	41	43	44	Not Assessed
11	4 February	004	2	1.48	1.48	76	98	105	Not Assessed
12	4 February	006	3	0.93	0.93	69	99	99	Not Assessed
13	4 February	007	4	1.30	1.30	129	156	159	Not Assessed
14	5 February	002	2	2.00	2.00	80	103	103	Not Assessed
15	5 February	007	2	1.78	1.78	87	102	103	Not Assessed
16	5 February	009	4	2.00	2.00	104	156	157	Not Assessed
17	8 February	010	2	0.90	0.90	53	60	61	Not Assessed
Total				21.82	21.82	1088	1493	1737	

Note 1: Number of cues represent all cues produced by one animal at one surfacing (for example, blow, body and splash produced by one individual on surfacing is for the purposes of this Table counted as one cue).
Note 2: No qualitative assessment of video carried out on *Shonan Maru No. 2*, as believed this should be carried out on digital systems.

Appendix G. Synopsis of blue whale sightings.

21 January

A group of true blue whales (comprising two animals) was observed by the *Shonan Maru* about 15 nmiles from the ice edge at position 69°25'S 005°47'E on 21 Jan. Biopsy and photo-ID were attempted during 0.79 hours. Digital images of both individuals were obtained for Photo-ID including a good image of the blow-hole of one individual. No video attempted. No biopsy samples; two shots missed the whales.

One group 'like blue whale' (three animals) seen during by the *Shonan Maru* a minke whale dive time experiment about 10 nmiles further north. Closure was not attempted.

23 January

Two groups of true blue whales, a solitary animal and a group of 2, were observed by the Shonan Maru on 23 January in NSC mode (at positions 69°09'S 010°51'E and 69°05'S 010°48'E) about 10 nmiles from the ice edge. Biopsy and photo-ID was attempted for both groups during a total of 0.84 hours. The solitary animal was evasive and there was no chance for biopsy. A biopsy sample was collected from one individual of the pair. (Two shots were fired with verdicts of 2 hits and 1 dart stuck). Digital images for photo-ID were obtained of all three individuals.

Two groups 'like blue whale' (three animals) were observed during IO mode, in the same vicinity, shortly before these two sightings were recorded and they were probably the same individuals.

24 January

On 24 January, at position 68°01'S 011°37'E (about 45 nmiles from the ice edge) a group comprising three blue whales (classified as blue whale-undetermined) was observed by the *Shonan Maru*. (As with the sighting on 23 January, this sighting was also initially recorded in IO mode and later approached during NSC mode). During a biopsy attempt they were very evasive and the closest distance we could approach during 0.50 hours was 0.6 nmiles.

4 February

On 4 February an aggregation comprising twenty-six blue whales (in five subgroups) was sighted at position 68°32'S 019°16'E (approximately 35 nmiles from the estimated ice edge) by the *Shonan Maru*. The vessel was drifting off effort in poor weather at the time of the encounter. When first sighted at a distance of 1.5 nmiles, and throughout the encounter the whales were generally swimming fast (more than 10 knots) and were quite surface active. The five sub-groups comprised 2, 8, 10, 3, and 3 individuals and were separated by approximate distances of 0.3, 0.3, 0.8 and 0.3 nmiles, respectively. Individuals of each sub-group initially appeared to be within about 5 body lengths. The *Shonan Maru* approached two subgroups for biopsy and photo-id. Individuals in these two subgroups (8 and 10 animals respectively) and another subgroup (comprising 2 individuals which was approached to within 0.2 nmiles) were identified as true blue whales. Biopsy samples were obtained from 3 true blue whales. Five shots were fired with verdicts of 3 hits and 2 misses during 1.12 hours. There was a reasonably good opportunity for photographs although the rough sea conditions and splashes from fast swimming during many surfacings frequently obscured many lateral views. Images of lateral body surfaces and dorsal fin profiles were obtained of 16-18 true blue whales, including the biopsied whales. Very good images of open blowhole were obtained of at least 4 individuals, including 2 individuals which were extensively photographed of which 1 was biopsied. Several of the whales had a markedly brownish-yellow colouration apparently due to diatoms. The remaining individuals in two subgroups (each comprising 3 individuals) were approached to a closest distance of approximately 0.8 nmiles and they were classified as blue whale-undetermined. The aggregation was eventually lost due to poor visibility.

23 February

A single 'like blue whale' based on the appearance of the blows was observed late in the day. No attempt was made to approach the sighting.

24 February

On 24 February a solitary blue whale was detected at position 65°55'S 058°04'E during BT mode by the *Shonan Maru*. The sighting was not approached and the sighting was classified as blue whale-undetermined.

One group of 3 whales classified as 'like blue whale' based on the appearance of their blows were observed 25 miles away. No attempt was made to approach the sightings.

28 February

The *Shonan Maru No.2* sighted two groups of true blue whales on 28 February while steaming off effort in poor conditions on the Kerguelen Ridge during the transit to Fremantle. A solitary individual was recorded at position 57°34'S 079°06'E and a group of two at position 57°35'S 079°10'E. Biopsy and natural marking and identification experiments were carried out on both groups during a total of 1.88 hours in poor conditions. The opportunity for photographs was poor and images were obtained of one individual, and two biopsy samples were taken in two strikes on one animal.

8 March

Three groups of blue whales were recorded from the *Shonan Maru* on 8 March within the EEZ of Australia in the vicinity of the Perth Canyon about 20 nmiles off Rottnest Island. Solitary individuals were observed at positions ?°?'S 0?°?'E and ?°?'S 0?°?'E, respectively and a group of two at ?°?'S 0?°?'E A solitary individual was approached and identified as a pygmy blue whale. The animal was long diving and there was no chance for photo-identification images.

8 March

Two solitary blue whales were detected from the *Shonan Maru No.2* in the same vicinity (at positions ?°?'S 0?°?'E and ?°?'S 0?°?'E) on 8 March. Both individuals were approached and identified as pygmy blue whales. Images for photo-identification studies were obtained of both whales?.

Appendix H. Sample Data Out-put from Wincruz

I. *Shonan Maru* (see data field key next page)

```
001C 132814 021505 S67:22.79 E041:23.28 Will be starting IO Mode in a few minutes
002C 132840 021505 S67:22.80 E041:23.48 Running Ant Wincruz 5.91
003B.133017 021505 S67:22.88 E041:24.27 0405  sm1    P
004R.133017 021505 S67:22.88 E041:24.27
005P.133017 021505 S67:22.88 E041:24.27
006Q.133017 021505 S67:22.88 E041:24.27
007V.133017 021505 S67:22.88 E041:24.27    3    4    3    0
008N.133017 021505 S67:22.88 E041:24.27  106 11.5
009W.133017 021505 S67:22.88 E041:24.27   04 04.0
010S.133033 021505 S67:22.91 E041:24.49  002  037    1    2  000     0.70  888
011A.133033 021505 S67:22.91 E041:24.49  002  007                  1    1
0121.                                    037  003  003  003  100
013M.133035 021505 S67:22.93 E041:24.65  003  011    1      353     1.00  888  002
014A.133035 021505 S67:22.93 E041:24.65  003  007           002D   1    1
0151.                                    011  003  003  003  100
017C.133408 021505 S67:23.12 E041:26.08 resights are blowing now
018M.133457 021505 S67:23.18 E041:26.46  004  023    1    2 337     0.80  888  002
019A.133457 021505 S67:23.18 E041:26.46  004  007           002D   1    1
0201.                                    023  003  003  003  100
021*.133802 021505 S67:23.42 E041:27.88
022*.134802 021505 S67:24.14 E041:32.52
024*.135802 021505 S67:24.85 E041:37.14
025P.140045 021505 S67:25.04 E041:38.38  016  012
026Q.140045 021505 S67:25.04 E041:38.38  024
027V.140045 021505 S67:25.04 E041:38.38    3    4    3    0
028N.140045 021505 S67:25.04 E041:38.38  112 11.4
029W.140045 021505 S67:25.04 E041:38.38   04 04.0
030W.140241 021505 S67:25.18 E041:39.26   04 04.0000.0
031*.140942 021505 S67:25.69 E041:42.41
032S.141508 021505 S67:26.11 E041:44.79  005  037    1    2 326     6.00  999
033A.141508 021505 S67:26.11 E041:44.79  005  007                  9    9
0341.                                    037  003  003  003  100
035s.141632 021505 S67:26.21 E041:45.39  004  325       6.0  113
037S.141839 021505 S67:26.38 E041:46.32  006  037    1      323     3.00
038A.141839 021505 S67:26.38 E041:46.32  006  007
0391.                                    037  001  001  001  100
```

Table B. Antarctic Wincruz Data Field Key

All columns with sample data line:

Line#&Event	Time	MMDDYY	Latitude	Longitude	Column 6	7	8	9	10	11	12	13	14
013 M. 133035	021505	S67:22.93	E041:24.65	003	011	1	2	353	1.00	888		002	

Key for Columns 6 – 14:

Event	Column 6	7	8	9	10	11	12	13	14
B	Cruise#	Vessel Code	Closing/Passing	GMT Off-set					
R	Start or Resume on-effort								
E	End on-effort								
P	LObsID	RObsID							
Q	Tracker	Recorder	Duplicate Indentifier						
V	Swell	Beau	Sightability	Glare strength	L Edge Glare	R Edge Glare			
N	Course	Speed							
W	Weather Code	Visibility	Ice Cover						
s (resight)	Sight#	Bearing	Reticle	DistNMI	Ship's Course				
* (time stamp)									
S	Sight#	ObsID	Cue	Method	Bearing	Reticle	DistNMI	Swim Dir	Dupe#
A	Sight#	Sp Code			Duplicate#	Reaction	Dynamics		
1	ObsID	Best Est	High Est	Low Est	%Spp1	%Spp2	%Spp3		
M (duplicate)	Sight#	ObsID	Cue	Method	Bearing	Reticle	DistNMI		Dupe#

C Comments are continuous lines across all the data fields and may wrap around to subsequent comment lines.

II. *Shonan Maru No. 2 2 (*See end appendix for event codes*).*

001B. 055306 012105 S65:08.64 E005:49.43 0005 SM2 P 0
002R. 055306 012105 S65:08.64 E005:49.43
003P. 055306 012105 S65:08.64 E005:49.43 101 307
004V. 055306 012105 S65:08.64 E005:49.43 4 3 3 0
005N. 055306 012105 S65:08.64 E005:49.43 151 11.0
006W. 055306 012105 S65:08.64 E005:49.43 04 04.0 0.0
007*. 055954 012105 S65:09.06 E005:50.00
008S. 060639 012105 S65:10.05 E005:51.48 001 101 1 2 329 2.00
009A. 060639 012105 S65:10.05 E005:51.48 001 063
0101. 101 100
011#. 060639 012105 S65:10.05 E005:51.48
012#. 060639 012105 S65:10.05 E005:51.48
013#. 060639 012105 S65:10.05 E005:51.48
014*. 060954 012105 S65:10.57 E005:52.26
015S. 061236 012105 S65:11.01 E005:52.92 002 101 1 2 347 3.50
016A. 061236 012105 S65:11.01 E005:52.92 002 005
0171. 101 100
018S. 061659 012105 S65:11.71 E005:53.96 003 307 5 2 348 1.50
019A. 061659 012105 S65:11.71 E005:53.96 003 005
020#. 061659 012105 S65:11.71 E005:53.96

034C. 062449 012105 S65:12.97 E005:55.73 sighting 2 and 3 are same duplicate
035V. 062655 012105 S65:13.32 E005:56.19 4 3 3 2 -45 -30
036N. 062747 012105 S65:13.46 E005:56.37 151 11.0
037V. 062747 012105 S65:13.46 E005:56.37 4 3 3 2
038N. 062808 012105 S65:13.52 E005:56.44 151 11.0
039V. 062808 012105 S65:13.52 E005:56.44 4 3 3 2
040W. 062816 012105 S65:13.54 E005:56.47 03 04.0 0.0
041*. 062954 012105 S65:13.80 E005:56.83
042V. 063445 012105 S65:14.60 E005:57.86 4 3 3 2
043V. 063445 012105 S65:14.60 E005:57.86 4 3 3 2
044W. 063507 012105 S65:14.66 E005:57.94 02 04.0 0.0
045*. 063956 012105 S65:15.47 E005:58.97
046*. 064956 012105 S65:17.14 E006:01.00
047S. 065154 012105 S65:17.47 E006:01.41 004 101 1 2 358 2.60
048A. 065154 012105 S65:17.47 E006:01.41 004 005
0491. 101 001 001 001 100
050M. 065233 012105 S65:17.58 E006:01.53 005 307 1 2 352 2.50 002

051A. 065233 012105 S65:17.58 E006:01.53 005 005 002D
0521. 307 001 001 001 100
053C. 065705 012105 S65:18.35 E006:02.44 sightings 4 and 5 duplicate
054*. 065956 012105 S65:18.83 E006:03.02

058V. 073040 012105 S65:23.98 E006:09.51 4 3 3 3 55 35
059*. 073956 012105 S65:25.49 E006:11.57
060S. 074639 012105 S65:26.59 E006:13.06 006 101 1 2 013 3.70
061A. 074639 012105 S65:26.59 E006:13.06 006 005
0621. 101 001 001 001 100
063*. 074956 012105 S65:27.13 E006:13.80

076C 092743 012105 S65:43.48 E006:35.16 end of iop

Table A.
Column 1 – 5
Record No.and Event Time HHMMSS MMDDYY SLatitude ELongitude

WinCruz® Event Codes
B – Begin effort marker; R – Resume effort marker; E – End effort; P – Observer positions; Q – Tracking crew positions; V – Viewing conditions; N – Navigation information; W – Weather information; M – Match in sighting; m – Possible match in sighting; X – Incomplete record – needs more information; C – Comments string; S – Cetacean sighting; s – Resighting information; A – Auxiliary sighting information; t – Pinniped sighting; F – Boat sighting; * - 10 minute marker; # - Deleted entry

Columns 6 onwards are Event dependent.

	Column								
Event	6	7	8	9	10	11	12	13	14
B	Cruise #	Mode	GMT Offset						
P	Port Observer	Recording Observer	Starboard Observer	Independent Observer					
V	Beaufort	Swell height	Swell Direction	Wind Speed					
N	Course	Speed							
W	Weather	Glare	Glare						
M; m or S	Sight #	Observer	Cue	Eye / Binoc.	Bearing	Reticule	Distance (nmiles)	Initial ID	
A	Sight #	Photo ?	Birds ?	Species 1	Species 2	Species 3			
1,2,3,4,5 or 6	Observer	Best Group Size	High Group Size	Low Group Size	Percentage of Species 1	Percentage of Species 2	Percentage of Species 3		
C	Comment across all fields								