2005-2006 International Whaling Commission-Southern Ocean Whale and Ecosystem Research (IWC-SOWER) Cruise

Paul Ensor[1], Hiroyuki Komiya [2], Paula Olson [3], Keiko Sekiguchi [4], Kate Stafford[5].

ABSTRACT

We conducted the 28th annual IWC-SOWER (formerly IDCR) Cruise in the western part of Antarctic Area III (000°-020°E) aboard the Japanese Research Vessel *Shonan Maru No.2*. The cruise departed Cape Town, South Africa on 22 December 2005 and returned to Cape Town on 22 February 2006. The cruise had two primary research components: a feasibility study for fin whale research in latitudes north of 60°S; and survey experiments designed to improve and interpret estimates of minke whale abundance from previous cruises. After departing Cape Town, the ship first transited south to the study area for fin whales, located between latitudes 55°S and 61°S. From 27 December to 16 January a visual survey for fin whales was conducted using Adaptive Line Transect Sampling (ALTS) as the primary method.. A total of 863.9 nmiles of trackline were covered in primary searching effort including 729.9 nmiles of ALTS. Ten ALTS cycles were triggered during the survey. Biopsy sampling was conducted on four groups of fin whales resulting in 30 samples collected from 26 whales. 25 of the 26 biopsied whales were photographed. Acoustic monitoring for fin whales was also undertaken using sonobuoys. 75 sonobuoys were deployed but fin whale calls were only recorded on eight of these. Fin whales and humpback whales were the most frequently sighted species in the fin whale research area, totaling 31 groups/274 individual fin whales and 149groups/377 individual humpback whales. Minke whale research was carried out from 18 January to 13 February in the vicinity of the ice edge. The focus of this research component was to evaluate BT mode (Buckland and Turnock, 1992) survey methodology using 25X mounted binoculars. 1,730 nmiles of trackline were surveyed during the minke whale research, including 1,305 in BT mode. 38 sightings of minke whales out of a total of 309 sightings were first detected and tracked by the 25X binoculars; of these 23 were subsequently detected by the primary platform. The number of re-sightings during tracking before detection or the whale(s) passed the ship's beam ranged from 0 to 101. Minke whales were the most frequently sighted species in this research area, totaling 361 groups/940 animals. During the cruise, additional research was conducted on blue whales and humpback whales. 33 groups of 63 blue whales were sighted (61 individuals were identified as true blue whales). Of these, biopsies were collected from 36 whales and photo-id images collected from 52 whales. Sounds attributed to blue whales were recorded in the vicinity of 29 sightings. During the cruise, biopsies were collected from 71 humpback whales and photo-id images from 115. Other notable sightings during the cruise included two sightings of southern right whales (1 group/1 individual, 1group/2 individuals). All three whales were photographed and the group of two were biopsied. Ten groups/75 individual killer whales were sighted including two groups determined to be Type A, two groups Type B, and one group Type C. Biopsy samples and photographs were collected from all three types. The Estimated Angle and Distance Training Exercise and Experiment was completed as in previous years.

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[1]/: Governors Bay, Lyttelton RD1, New Zealand; paulensor@xtra.co.nz

[2]/: Kyodo Senpaku Kaisha, Ltd., Toyomi Shinko Bldg, 4-5 Toyomi-cho, Chuo-ku, Tokyo 104-0055, Japan

[3]/: Southwest Fisheries Science Center, NMFS/NOAA, 8604 La Jolla Shores Dr., La Jolla, CA 92037, USA; paula.olson@noaa.gov

[4]/: Pacific Aquaculture and Coastal Resources Center, University of Hawaii at Hilo, 200 W Kawili St. Hilo HI 96720 USA; ksekiguc@hawaii.edu

The Institute of Cetacean Research, Toyomi Shinko Bldg., 4-5 Toyomi-cho, Chuo-ku, Tokyo 104-0055, Japan;

[5]/: Seattle WA 98115 USA; kate.stafford@noaa.gov

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INTRODUCTION

The 2005-2006 International Whaling Commission - Southern Ocean Whale and Ecosystem Research Program (IWC-SOWER) Cruise was conducted from 22 December 2005 to 22 February 2006. The cruise was the twenty-eighth 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 first twenty-six cruises focussed on obtaining data to estimate the population size and distribution of minke whales south of latitude 60°S and comprised the first, second and third circumpolar series of surveys.

The 2005-2006 cruise continued a new phase of research, initiated during the 2004-2005 cruise. The main objectives of the 2005-2006 cruise were to: (1) carry out a series of survey experiments designed to improve and interpret estimates of minke whale abundance from previous cruises; (2) undertake a feasibility study for fin whale research in waters north of 60°S, involving a sighting survey, acoustic sampling and biopsy sampling of the skin for genetic analyses; (3) continue previous research on blue whales (including collecting biopsy samples, acoustic data, photographs for identifying individual animals and behavioural data); and (4) continue research on humpback whales.

Initial planning for the cruise was undertaken at the 2005 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 22-24 September 2005 (Anon. 2005a).

The IWC provided partial funding for the cruise. The Government of Japan provided the research ship, the *Shonan Maru No. 2*. This ship has been used for all of the IWC-IDCR/SOWER cruises since the 1981-82 cruise. Specifications of the ship are given in Appendix A. This was the first cruise in the series to be conducted with only one ship; on all previous cruises in this series there have been at least two ships.

The research area for the cruise was selected as the western part of Area III (000° - 020°E). The feasibility study for fin whale research (and most of the humpback whale research) was to be conducted in the area bounded by latitudes 55°00'S and 61°00'S. Research on minke and blue whales was to be conducted in the vicinity of the ice edge; research in this area had been previously undertaken during the 1979-80, 1987-88 and 1992-93 IWC-IDCR cruises and during the 2004-2005 IWC-SOWER cruise.

Personnel

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

Schedule

Listed below is the cruise itinerary.

Date	Event
17-Dec	*Shonan Maru No.2* arrived Table Bay Harbour, Cape Town
18-Dec	Pre-cruise Meeting
20-Dec	Scheduled departure of the *Shonan Maru No.2* from Table Bay Harbour. Departure delayed to await freight consignment of biopsy equipment and refueling
22 Dec	*Shonan Maru No.2* departed Table Bay Harbour
23-Dec	*Shonan Maru No.2* departed the 200 nmile EEZ of South Africa
27-Dec	Estimated Angle and Distance Training and biopsy training conducted
27-Dec	Feasibility study for fin whale research commenced at position 55°00'S 020°00'E
16-Jan	Feasibility study for fin whale research completed at position 61°00'S 005°00'E and transit commenced to the minke whale research area.
18-Jan	Minke whale research commenced from position 68°30'S 000°00'
12-Feb	*Shonan Maru No.2* conducted Estimated Angle and Distance Experiment
13-Feb	Minke whale research completed at position 68°44'S 012°40'E and transit commenced to Cape Town
15-Feb	*Shonan Maru No.2* intercepted the southern boundary of the fin whale research area at position 61°00'S, 014°20'E
16-Feb	*Shonan Maru No.2* departed the fin whale research area at position 55°00'S, 015°19'E
20-Feb	*Shonan Maru No.2* entered the 200 nmile EEZ of South Africa
22-Feb	*Shonan Maru No.2* arrived Table Bay Harbour, Cape Town. Post-cruise Meeting aboard vessel
25-Feb	*Shonan Maru No.2* departed Table Bay Harbour, Cape Town

OBJECTIVES and METHODS

The main objectives for the 2005-2006 cruise were to:

(1) carry out a series of survey experiments designed to improve and interpret estimates of Antarctic minke whale abundance from previous cruises;

(2) undertake a feasibility study for fin whale research in waters north of 60°S, involving a sighting survey, acoustic sampling and biopsy sampling of the skin for genetic analyses;

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

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

Minke whale research

The goals of the minke whale research component were to evaluate BT mode (Buckland and Turnock, 1992) survey methodology, conduct the associated distance and angle experiments and to carry out visual dive time experiments.

The research area selected for the minke whale research was 000°-020°E, close to the ice edge, based on the relatively high density of minke whales observed in this area during the 2004-05 cruise. A total of 23 days were allocated for minke whale research. (In addition, up to 4 days were allocated for blue whale research in the minke whale research area (see Blue Whale Research section below)).

BT mode

Analyses of IO (Passing with independent observer) mode data on ICDR/SOWER cruises suggest that estimates of g(0) are positively biased and thus yield negatively biased abundance estimates. It has been suggested that a reason for this is that observers on the two platforms used for these analyses (the barrel and the IOP) essentially search in the same area of the sea. BT mode 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’).

BT mode trials constituted the major part of the research planned for the minke whale research component of this cruise. The trials have potentially two different possible uses:

1. The potential to affect interpretation of abundance estimates from previous cruises (by providing independent evidence on g(0) robust to data and to difficulties such as responsive movement)
2. In designing future survey methods

BT mode trials scheduled for this cruise primarily focused on point (1) above, using a pair of 25x binoculars (Leviathan, Monk Optics, UK) mounted on the Upper Bridge. The Upper Bridge was the Tracker Platform in this option of BT mode (big eye BT).

Additional trials to assess point (2) above were also to be attempted using last year’s BT mode options (Options 1, 2 or 3) in accordance with the recommendation of the Scientific Committee. The exact timing of these trials and the extent of the trials for Options 1, 2 or 3 were to be dependent on the effectiveness of the big eye BT option. For Options 1, 2 and 3, 20x60 binoculars were available to be used in the Tracker Platform. (Note that in these options the location of the Tracker Platform is either the Top barrel or the IOP depending on which Option is selected).

A distinct advantage of the big eye method over last year’s Options 1, 2 or 3, is that if used in conjunction with IO mode (big eye BT/IO mode), the TOP and IOP platforms would be Primary platforms and both would operate as normal with the observers searching using 7x50 binoculars. Thus if the trials were successful and estimates of g(0) could be obtained they would be relevant to the standard IDCR/SOWER survey protocol.

The big eye binoculars were mounted in the observer box on the starboard side of the helmsman’s seat. The observer box had been enlarged to accommodate the binocular stand and arranged so the observer using the big eyes could either stand, or sit. These modifications were completed during the vessels annual dock repair work in Setoda, Japan. A one-day sea trial on 28 October provided an opportunity to evaluate the effectiveness of the mounting and further evaluation by the crew was made during the transit from Japan to Cape Town. The big eyes were to be operated and evaluated by two of the researchers on a rotational basis. After approximately the mid point of the minke whale research period, two of the Top men were also included in the roster to search with the big eyes up to 1 hour per day.

During the planning phase of the cruise it was proposed that big eye BT/IO mode (with observers stationed as in normal IO mode) was to be the major focus of the research during the minke whale component. BT mode was to be interspersed with NSC (normal searching closing) mode, minke whale dive time experiments, humpback whale biopsy sampling, BB mode searching and blue whale research. A full description of the methods to be used for BT mode trials, (including options) are described in Anon. (2005b).

The work schedules for the TOP and IOP observers during big eye BT/IO mode are the same as normal IO mode. Therefore, normal IO mode guidelines were to apply to the amount of time for continuous survey in this mode (i.e. no more than 100 nmiles surveyed continuously) to ensure observers take their scheduled rest periods.

During the cruise, however, a modified protocol 'big eye BT/NSP mode' (using the big eyes in combination with NSP mode) was employed extensively as a strategy to allow continuous operation. Unlike IO mode, NSP mode does not have restrictions imposed by the crews work schedule on the amount of continuous survey. This alternative protocol, big eye BT/NSP mode, therefore permitted a greater proportion of survey time to be allocated to the BT trials than if big eye BT/IO mode was used. In addition, the complexities of data recording, tracking of sightings and assessment of their duplicate status during big eye BT/NSP were comparable to normal IO mode.

The preferred choice of cruise track design during the minke whale research component would be to use standard SOWER cruisetrack design procedures (with systematic coverage) so data could be used to estimate abundance in addition to acquiring the data for the estimation of g(0). However, it was recognised that a flexible cruise track design in the vicinity of the ice edge, where the sighting rate for minke whales was expected to be higher, would probably maximise the number of potential binary trials during BT mode. In addition, re-surveying areas with higher sighting rates was another acceptable approach to achieve this.

Although ice edge information was not as critical for this cruise as for the standard SOWER surveys, ice information was still 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 were transformed aboard the vessels (by programs developed at ICR), from polar stereographic to Mercator projection. These images assisted with logistic decisions.

When NSC or NSP modes were the only activities 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. 2005b).

Minke whale visual dive time experiment

The visual dive time experiment was an important part of the minke whale research conducted on the 2004-2005 cruise and the trials were to be continued during the 2005-2006 cruise. The purpose of this activity is to collect data on the surfacing rate of minke whales for use in estimation of $g(0)$. The visual dive time recordings are useful since they provide data on cue availability in different weather conditions and for different school sizes, as well as on school synchrony and dive behaviour.

The time allocated to the dive time experiment was not fixed and was to be conducted on an opportunistic basis during the minke whale research component. Previous dive time data collected on the 2004-2005 cruise were restricted to observations in good conditions only (mainly sea states 0, 1 and 2 (Beaufort scale). Therefore emphasis during this cruise was to be on conducting trials on a range of group sizes in poorer conditions (sea states 3 and 4), but within the standardized range of acceptable searching conditions. For a description of the protocol refer to Anon. (2005b).

Feasibility Study for Fin Whale Research

The aim of the feasibility study for fin whale research was to investigate methods for estimating the abundance of fin whales in waters north of 60°S, and especially to try out Adaptive Line Transect Sampling (ALTS) techniques to maximise the efficiency of sighting effort. Acoustic research was undertaken, and the feasibility of obtaining fin whale biopsy samples under Antarctic conditions was also investigated.

To obtain the necessary sample size, the Adaptive Line transect Sampling method needed to be tried in areas of highest density as the sighting rate for fin whales was expected to be relatively low. The research area was selected as 55°-61°S, 000°-020°E. Indirect sources (catch records) suggest that historically the highest densities of fin whales in Area III during January were in this geographic area.

Twenty days were allocated for the feasibility study for fin whale research (17 days for survey and 3 days for biopsy sampling). An estimated distance and angle training exercise was to be given priority near the start of the research.

Also in the fin whale research area, up to 3 days were allocated for humpback whale biopsy sampling and photo-identification studies (see Humpback whale research section below).

Adaptive line transect sampling

Adaptive line transect sampling (ALTS) is integral to the design of the survey for the fin whale research component. The protocol to be used on this cruise was developed from adaptive sampling trials conducted during the 2004-2005 IWC-SOWER cruise when practical aspects of implementing the method for minke whales was investigated. Adaptive line transect survey using normal NSP mode protocol (ALTS/NSP mode), was to be the main survey method although segments of the trackline were also to be conducted in IO and NSC modes.

The cruisetrack design for the fin whale survey comprised four legs (each approximately 400 nmiles in length), joining positions 55°S 020°E, 61°S 015°E, 55°S 010°E, 61°S 005°E and 55°S 000° (Fig. 1b). However there was the option to modify this during the cruise based on the observed sightings distribution. This cruisetrack is too long to be covered completely in the time allocated (17 days); assuming approximately the same proportion of poor weather as experienced during the IDCR/SOWER Antarctic cruises. Although ideally coverage should be distributed as evenly as possible over the four legs, one option was to cover only three of the legs.

The survey was to be conducted in three research modes: (1) ALTS/NSP mode, (2) IO mode and (3) NSC. Sighting rates are not anticipated to be high and thus to provide the best test of the adaptive sampling strategy, most of the trackline was to be covered in mode (1). This mode was to be used for 3/5 of the total length of each leg, while the other modes were each to make up 1/5. Each alternate segment was to be covered in mode (1), whilst the intermediary segments were to alternate between modes (2) and (3).

Detailed protocols for search modes and the adaptive sampling, including diagrams, are given in Anon (2005b). An outline of the protocols is provided here.

The tracklines for the adaptive sampling trials were divided into pre-designated 3.0 nmile segments. The procedure used was that if either the TOP or the Upper Bridge detected no groups of fin whales within a perpendicular distance of 3.0 nmiles, the vessel continued on the straight track line as in normal NSP mode. However, if either the TOP or the Upper Bridge detected at least one group of fin whales, or whales classified as 'like fin whale' within a perpendicular distance of 3.0 nmiles of a given predesignated 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 short legs (ALTS cycle). The zigzag courses had an inner angle of 60 degrees with the original course and each leg was 6.0 nmiles in length. The direction (port or starboard) of this initial course change was randomly determined. If at least one group of fin whales or whales classified as 'like fin whale' was detected by either platform within a perpendicular distance of 3.0 nmiles 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 to the predetermined straight track line. The options existed to change the number of fin whale detections to trigger an ALTS cycle (from 1 to 2) and/or to reduce the leg lengths within an ALTS cycle (from 6.0 nmiles to 4.5 nmiles) if the sighting rate were higher than expected and implementation of the above protocol was problematic.

Acceptable conditions for fin whale survey were assessed subjectively and were usually when the wind speed was <25 knots and sea state <Beaufort 6. During the NSC segments, closure was only completed to whales believed to

be fin whales. 25x binoculars (on board for BT mode evaluation) were available to facilitate species identification and school size estimation for sightings of non-fin whale species.

Acoustics

The main focus of the acoustics research during the fin whale research component was designed to investigate the utility of the method to assist in the location of vocalizing fin whales in the context of obtaining fin whale abundance estimates. Sonobuoys were used for the acoustics research, which included attempts to detect and triangulate on fin whale sounds. Sonobuoys were deployed roughly every 20 nmiles along the track line during fin whale research with the aim of acoustically covering the entire track line. Due to the vagaries of weather, when the ship was stationary for several days at a time, at least one sonobuoy was deployed per day and monitored for whale sounds even if the ship had not moved along the trackline. Sonobuoys were deployed independently of whale sightings in order to provide presence/absence information for vocalizing whales in the area that may have been outside of visual detection range. For details, see Acoustics Research section below.

Acoustic recordings were made using sonobuoys (Ultra Electronics 53D DiFAR). Sonobuoy signals were received by an Icom IC-R100 communications receiver with output to a computer for recording and real-time monitoring for fin whale sounds. Signals were monitored in real time on a Sony Vaio computer, and recorded to hard disc. A DiFAR program with an Ishmael-Matlab interface was available to provide magnetic bearings from a sonobuoy to a sound source (fin whale call). However this feature was not used, as fin whales only seldom vocalized in the study area and the available receivers were not modified for DiFAR signals.

Fin whale biopsy sampling

The feasibility of obtaining fin whale biopsy samples was to be investigated during a maximum of three research days. Three types of biopsy equipment were available on board: Larsen guns, Paxarms 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.

Blue whale research

Time was allocated to a blue whale research component during this cruise similar to recent IWC-SOWER cruises (apart from the 2004-2005 cruise). Blue whale research was to be conducted during a maximum of four days during the cruise and was scheduled for during the minke whale research component as blue whales were expected to be more common in this area. The blue whale research included a continuation of research focused on trying to discriminate between the ‘true’ and ‘pygmy’ subspecies of blue whale, and included the collection of skin samples for genetic analysis, photographs for identification of individuals, acoustics recordings, and behavioural observations. During the blue whale research component we used essentially the same research protocol as on recent IWC-SOWER blue whale cruises.

Acoustic recording in the vicinity of blue whale sightings was undertaken. (For details see Acoustics Research section below). Blue whales were to be approached to within 1 nmile and for at least a 30-minute duration dive times were to be recorded if feasible. The whales were then approached for photo-identification, videotaping and biopsy.

The collection and processing of biopsy samples for blue whales was conducted in the same manner as for fin whales (described above). When the DMSO supply was exhausted after the fin whale component, skin samples for the IWC were frozen. Also, the numbering system for samples was changed upon reaching sample number 100. Since the current numbering system only allows for sample numbers 01 to 99, we put a ‘2’ in the ‘Boat’ column to indicate samples 100 and higher (e.g. sample 101 for the cruise was labeled xxxx201).

The surfacing behaviour of blue whales was recorded from the Top barrel on high-resolution digital video (Panasonic digital video camera NV-GS200K). Photographs for identifying individual whales were obtained using digital cameras (Canon EOS 20D) equipped with a 100-400 mm image-stabilized lens. Additionally, researchers used their personal digital cameras and contributed images.

Humpback whale research

The importance of collecting humpback whale biopsy samples was stressed by the Scientific Committee in connection with its work on the comprehensive assessment of this species (IWC 2005). The major aim of this component was to collect biopsy samples and photo-identification images to help in clarifying the uncertainty concerning these stocks and the pattern of their migration. Three days of research time were allocated to this research component. The goal was to obtain biopsy samples from animals distributed as widely as possible spatially and temporally, but particular emphasis was to be placed on sampling whales from west of the longitude of South Africa. Effort was made to link the biopsy sample with the photographed animal when in groups.

Biopsy sampling was conducted as for the fin whale and blue whale research components. However, later in the cruise all skin samples were frozen as our supplies of DMSO/salt solution and sterile containers were all used.

Opportunistic biopsy sampling and Photo-identification studies

Priority species for biopsy and photo-identification studies are blue whale, humpback and right whales, in that order of priority. Opportunities should be taken for collection of biopsy samples from sperm and killer whales and other ‘incidental’ species during the normal process of confirming species identification and numbers, or if animals approach the vessel while off-effort.

Direct Data Acquisition

A direct data acquisition system was set-up on the Upper Bridge for recording sighting data. This was to be the primary data recording system for the cruise. A weatherized laptop computer was connected to power and the ship’s GPS by cables provided by the *Shonan Maru No. 2.* Existing data recording software, Wincruz, was modified by Southwest Fisheries Science Center, La Jolla, CA, USA specifically for SOWER. The researcher acting as direct data recorder sat in the seat traditionally used by the paper data recorder. Data were continued to be entered into paper forms as a back-up. Electronic data were edited in the evening after checking for errors and comparison to the paper forms.

Oceanographic survey

No oceanographic sampling was to be undertaken, as on last year’s cruise. Deployment of three floats under the *Argo* oceanographic programme, outside the Norwegian EEZ surrounding Bouvet Island, at 60°S, 59°S and 58°S. Deployment at the target latitudes would be made during the transit to (or from) the Antarctic.

NARRATIVE RESULTS AND DISCUSSION

The following section is a descriptive account of the major aspects of the cruise. Details of the survey area, and cruisetracks are presented in Figure 1a, b, c and d.

Pre-cruise Meeting and Transit to the Fin Whale Research Area

The *Shonan Maru No. 2* arrived in Table Bay Harbour, Cape Town on 17 December 2005, and a Pre-cruise Meeting was held on 18 December at the Breakwater Lodge Hotel.

The vessel was scheduled to depart Cape Town on 20 December, however on agreement of the Government of Japan departure from Cape Town was delayed by two days due to the late arrival of a freight consignment from Australia containing IWC biopsy equipment (Larsen guns and crossbows and related equipment). The ship departed Cape Town at 17:30 hrs on 22 December. Refueling of the vessel was also late and was delayed until the afternoon of 21 December (one day after the scheduled departure time) due to a shortage of fuel in Cape Town. As there was a chance the IWC biopsy equipment from Australia would not arrive before the end of 22 December, alternate sources of equipment were investigated. Options included: dispatching the IWC Larsen gun from Greenland, borrowing equipment from South African colleagues and purchasing two Paxarms guns from New Zealand. A delay associated with the granting of permission to import the IWC gun from Greenland ruled out this option. As a contingency plan, two new Paxarms guns and associated equipment were purchased from New Zealand (hand delivered by the makers) and equipment was borrowed from Peter Best (a Paxarms system) and Mike Meyer (crossbow). However on the afternoon of 22 December, not long before the deadline for departure of the ship, the freight consignment arrived from Australia. Thus the equipment on loan from Best and Meyer was not required and was returned to the owners.

Permission for research in NSC mode within the 200 nmile Exclusive Economic Zone (EEZ) of South Africa was granted by the South African Government, however within the zone windy conditions restricted research. A total of 4.35 hrs of research (48.9 nmiles) was conducted. The vessel departed the EEZ on 23 December at position 37°56'S, 018°15'E at 16:24 hrs.

Between the boundary of the EEZ surrounding South Africa and the starting location for fin whale research (55°00'S, 020°00'E) a total of 15.99 hrs (184.5 nmiles) of searching in NSC mode was conducted.

The acoustics equipment was tested during the transit from Cape Town (outside the South African EEZ) in preparation for the fin whale research component. A total of 4 sonobuoys were deployed. Two of these operated successfully and were received for up to 2 hours (over 20 nmiles) until out of range of reception at normal searching speed.

The ship arrived in the vicinity of the starting point for fin whale research (position 55°00'S 020°00'E) early on the morning of 27 December.

Estimated Angle and Distance Training Exercise and biopsy test firing

The Estimated Angle and Distance Training Exercise was conducted on the morning of 27 December during 2.84 hours. During the exercise the researchers familiarized themselves with the use of the reticles, and confirmed the reticle-distance conversion calculated for the *Shonan Maru No.2* Upper Bridge platform. Biopsy ‘test firing’ was also carried out on a group of humpback whales near the same location.

The onset of snow fog then prevented the start of fin whale research until later in the day.

FEASIBILITY STUDY FOR FIN WHALE RESEARCH

The feasibility study for fin whale research area was commenced on 27 December from position 55°00'S 020°00'E (16:37 hrs) and completed at position 61°00'S 005°00'E on 16 January (15:51 hrs). Research was conducted using the cruisetrack design of four transects as defined in the Report of the Planning Meeting (Anon. 2005a) and as shown in Figure 1b. Additional transects were also constructed in attempt to investigate geographic extent of an aggregation of fin whales.

Acoustics research was conducted at 75 stations during the fin whale research (see Acoustics Section below for details).

As expected, poor weather conditions were experienced in the fin whale research area. The proportion of time lost to poor weather conditions in the fin whale research area was relatively high: of the 239.82 hrs available for research, 135.23 hrs (56%) were lost. The largest block of the time lost to poor weather was at the start of the research period when a strong storm was experienced. Although visibility was patchy, wind and sea conditions were usually reasonably moderate for much of the remainder of the research period.

Although the proportion of time lost to poor weather was thus approximately the same as during recent IWC-SOWER minke whale surveys south of latitude 60°00'S, guidelines to define acceptable conditions for survey were vastly different compared to the standard minke whale survey. Acceptable conditions for survey during the fin whale research were similar to those for BB mode. An important consideration when defining acceptable sighting conditions for survey in ALTS/NSP mode was if the whales' body could be seen. Species identification of large baleen whales was usually problematic when sea conditions were higher and only blows were visible. In comparison to the definition of acceptable conditions used for BB mode survey used on recent cruises, conditions for survey in ALTS/NSP mode required generally more moderate sea conditions. (In BB mode survey, species identification is usually not problematic as there is the option to approach sightings). The 25x binoculars facilitated species identification when the wind speed was low and sea conditions very moderate.

In the fin whale research area, coverage was achieved on the first three transects (spanning the area between longitudes 020°E and 005°E). No attempt was made to cover the fourth transect (005°E - 000°).

On primary effort a total of 863.9 nmiles of trackline was covered (including adaptive line transect sampling cycles and two additional transects) during 76.06 hours of research. 729.9 nmiles was surveyed in ALTS/NSP mode (during 63.53 hours of research), 74.0 nmiles in NSC mode (7.23 hours) and 60.0 nmiles in IO mode (5.29 hours).

A summary of research effort by mode in the fin whale research area is presented in Table 1. Sections of the trackline covered on primary effort are shown in Figure 1c

The first transect (020°E - 015°E) was surveyed 27 December to 3 January. A total of 258.8 nmiles (64.7% coverage) of survey was completed during 22.71 hours of research. 198.8 nmiles were covered in ALTS/NSP mode and 60.0 nmiles in IO mode.

Survey on the second transect (015°E - 010°E) was conducted 4 to 8 January; 213.0 nmiles (53.3% coverage) of survey was conducted during 19.20 hours of research. 173.5 nmiles were covered in ALTS/NSP mode and 39.5 nmiles in NSC mode.

The third transect (010°E - 005°E), as well as two additional transects (constructed to provide additional coverage in the vicinity of where an aggregation of fin whales was detected), were surveyed 8 to 16 January; 392.1 nmiles (80.0% coverage) of survey was completed during 34.15 hours of research. 357.6 nmiles were covered in ALTS/NSP mode and 34.5 nmiles in NSC mode.

During the fin whale research the *Shonan Maru No.2* entered the Norwegian 200 EEZ surrounding Bouvet Island. The ship entered the zone at 17:11hrs on 11 January at position 55°49.6'S 008°53.7'E and departed at 18:05hrs the same day at position 55°44.9'S 008°56.7'E during survey on an ALTS cycle on the first of the additional transects mentioned above.

Intensity of survey coverage was lower on the first and second transects than on the third transect. The main reason was because no coverage was attempted south of latitude 59°20'S on the first two transects (approximately the southern quarter of these transects). Sightings of large baleen whales was relatively sparse on the south of the central part of the first transect so we made a short cut to the west to rejoin the trackline on the second transect about 110 nmiles from the southern waypoint.

The southern waypoint (position 61°00'S 005°00'E) at the end of the third transect was reached on 16 January; we decided to interrupt the fin whale study without covering the fourth transect and head south to the minke whale research area. This was three days ahead of scheduled end date (19 January) of the fin whale research component. The strategy was adopted as sightings of large baleen whales had been relatively sparse on the southern part of the third transect, and assuming a similar low density on the south of the fourth transect, the three days remaining meant there was insufficient time remaining to proceed significantly far north on the fourth transect.

Pattern of alternation of research modes

The pattern of research mode alternation, as described in Anon 2005a, was implemented on the first survey transect.

On the second and third transects we conducted additional survey in ALTS/NSP mode instead of using IO mode. The change was made with the aim of increasing the sample size of ALTS cycles (as on the first two transects a total of only three cycles was completed).

On the second transect we commenced survey northward from position 59°20.81'S 013°55.65'E. This transect was subdivided into three segments: a 120 nmile long ALTS/NSP segment, an 80 nmile segment of NSC mode and an 84 nmile ALTS/NSP segment. The third transect was subdivided into an ALTS/NSP segment (120 nmiles), an NSC segment (83 nmiles) and a segment in ALTS/NSP (191 nmiles).

Adaptive line transect sampling

Ten ALTS cycles were triggered during 729.9 nmiles of survey in ALTS/NSP mode during the feasibility study for fin whale research. Six of the ALTS cycles were completed. Two of the cycles were triggered during a previous ALTS cycle.

Four of the ten ALTS cycles were either not started or were not completed. One cycle (Cycle 1) was interrupted by poor weather and abandoned. Cycle 3 was not commenced, as there was insufficient time for its completion before the end of the research day. Cycle 6 was abandoned because delays caused by poor weather left insufficient time for completion before the end of the research day. Cycle 9 was not started because of a sudden decrease in visibility.

On two of the completed cycles, research was interrupted by patchy poor visibility (fog or snow fog), however, as we anticipated the fog patches to be of relatively small size, instead of following the protocol and abandoning these cycles, we stopped survey to await acceptable conditions.

Although relatively few fin whale sightings were detected on this cruise, no particular problems were encountered with the practical aspects of implementing the adaptive sampling protocol. The default options for Adaptive Sampling survey (one fin whale (or like fin whale) detection to trigger an ALTS cycle, the 60° angle of course changes and the 6.0 nmile leg lengths within a cycle) appeared appropriate for the sighting rates of fin whales encountered on this cruise.

Interestingly, sightings during the two ALTS cycles (Cycles 7 and 8) on 10 January included 15 groups of fin whales comprising 70 animals (excluding duplicate sightings). An aggregation of fin whales had been observed while the vessel was off-effort in this vicinity the previous day and during biopsy sampling attempts we established that the whales were dispersed over at least an area measuring approximately 12 x 12 nmiles. Based on our observations on 9 January, during the biopsy sampling attempts, we estimated of the number of fin whales in this vicinity to be 100 individuals (with a range of 75-135), similar to the number observed on the systematic survey on the next day.

Synopsis of ALTS cycles:

Cycle 1

There were two sightings each of fin whales and ‘like fin whales’ on 02 January during survey in ALTS/NSP mode. Both groups of fin whales were in the same three-mile segment and close to the trackline. An ALTS cycle was commenced at 07:32:16 hrs at position 55°49.42'S 019°21.67'E. Unfortunately the ALTS cycle was interrupted by poor visibility on the first segment and the cycle was abandoned at 07:47:54 hrs at position 55°51.87'S 019°24.42'E.

Cycle 2

Later the same day, a sighting classified as ‘like fin whale’ triggered a further ALTS cycle. The sighting was not passed abeam until after a mode change waypoint (to IO mode), however we extended survey in ALTS/NSP beyond the mode change waypoint so we could initiate the ALTS cycle. The cycle was started at 14:03:00 on 2 January at position 56°55.37'S 018°29.04'E. On the first 6.0 nmile segment of the ALTS cycle there was another sighting classified as ‘like fin whale’. Poor visibility interrupted survey on this ALTS cycle shortly after the second sighting. Rather than abandon the cycle, we stopped survey until visibility improved. After an interval of 50 minutes we were able to continue survey on the ALTS cycle. The cycle was completed at 17:01:00 at position 57°06.50'S 018°20.33'E.

Cycle 3

A fin whale sighting was a valid trigger for an ALTS cycle on 4 January, (17:05:55 hrs) however the cycle was not implemented due to insufficient time to complete a cycle before end of scheduled research day. Biopsy sampling was undertaken instead.

Cycles 4 and 5

On 5 January a sighting of solitary fin whale triggered an ALTS cycle. The cycle was started at 06:31:04 hrs at position 58°46.47'S 013°02.85'E. Poor visibility (fog and snow patches) interrupted research however rather than completely abandon the cycle (as per instructions) we drifted until visibility improved. Thus on 3 occasions, for a total of 2.5 hours we stopped and drifted until we had acceptable visibility. Another detection of a solitary fin whale triggered a second cycle following on from the first. Snow showers also interrupted survey on the second cycle on two occasions and the survey was stopped for a total of 0.56 hrs. The end of the second cycle was completed at 15:08:00 hrs at position 58°19.01'S 012°39.80'E.

Cycle 6

On 8 January, a sighting of a solitary animal classified as 'like fin whale' triggered ALTS cycle. The cycle was commenced at 16:20:00 hrs at position 55°24.69'S 009°40.93'E however the cycle was abandoned at 16:53:00 hrs at position 55°25.70'S 009°30.73'E due to poor visibility and also the delays due to poor weather left insufficient time to complete a cycle before the end of the research day.

Cycles 7 and 8

On 10 January, two ALTS cycles were completed in an area with a high sighting rate of fin whales. The first cycle was started at 13:31:00 hrs at position 56°00.36'S 009°13.14'E and the second cycle was completed at 17:40:34 at position 56°22.32'S 008°55.65'E.

Additional transects were surveyed in ALTS/NSP mode in this vicinity during the following two days, however apart from one off effort detection of a fin whale group, trigger sightings for ALTS Cycles 9 and 10 (below) were only fin whales or 'like fin whale' recorded.

Cycle 9

On the 11 January a fin whale sighting at position 56°08'S 008°40'E was a trigger for an ALTS cycle however the cycle was not started due to a sudden reduction in visibility.

Cycle 10

A detection of a like fin whale sighting at position 56°03.27'S 008°43.66'E was a trigger for an ALTS cycle later on 11 January when we were able to again resume survey. The cycle was commenced at 16:07:00 hrs at position 55°55.70'S 008°49.97'E. The cycle was completed at 18:10:00 at position 55°44.53'S 008°58.39'E without further sightings of fin (or like fin) whales.

Fin whale biopsy sampling

Biopsy sampling was attempted for 4 sightings comprising 145 animals. Group sizes were: 2, 3, 40 and 100 (the latter two groups were aggregations each spread over an area of several square nmiles). A total of 30 biopsy samples were collected from 26 fin whales during 12.08 hours of research (Table 1). The average time to collect a sample was 24 minutes.

All the biopsied animals were photographed as well as many others (the exact number is yet to be determined).

The groups comprising 2 and 3 animals were reasonably difficult to approach due to their long dive times and evasive behaviour. Also, both the smaller groups were detected where water clarity was poorer. The watercolour was green (probably due to a plankton bloom) and this made it difficult to track the animals underwater.

On both occasions when the fin whales were encountered in aggregations, approaching the whales for biopsy sampling was much more easily accomplished. The whales' behaviour varied widely and included slow swimming, feeding behaviour and occasional boisterous fast swimming. However the whales were generally quite easy to approach even though conditions were very difficult for the crew: windy with rough sea conditions, and poor visibility due to mist and passing dense snow showers. In the vicinity of both the aggregations of fin whales, water clarity was good and this facilitated tracking the animals underwater during chasing.

Both of the aggregations of fin whales we encountered comprised discreet subgroups ranging in size from solitary individuals up to about seven animals. The distance between subgroups in the aggregation varied widely but was usually 1.0 –2.5 nmiles. Merging and splitting of subgroups was observed during the biopsy attempts. However, we believe the likelihood of double sampling was very low. Many of the whales had prominent colouration patterns and/or distinctive dorsal fin profiles and many individuals were easily recognizable.

Due to the rough seas, strong wind and difficult shooting conditions requiring moderate to long firing ranges (30-60 metres), all biopsy attempts were made using the Larsen system. The sampling rate was 100%: with every hit verdict, a sample was obtained. None of the biopsy darts stuck in the whales and no darts were damaged during the sampling of fin whales.

Acoustic recording during the feasibility study for fin whale research

Seventy-five sonobuoys were deployed during the fin whale research period. Fin whales were recorded on only eight of these (Figure 4b). When they were recorded, there were only about 6-10 calls recorded per hour. A rare group of five calls together is shown in Figure 5. Fin whales were never heard before they were seen and even when large groups of them were encountered, few calls were recorded. For this reason, the use of acoustics to direct the ship to fin whales in this region and season does not seem like a feasible methodology for the future. Even if the DiFAR processing had worked (which it did not, likely due to the radios not being modified for DiFAR, but DiFAR processing is notoriously fickle at any rate), the very few numbers of calls received would have made it difficult to direct the ship, particularly if the calls were from different animals in different locations. Normally, a series of calls close in time and similar in frequency are used to get a group of bearings towards which the ship can then be directed. The paucity of fin calls implies that this would not be very practical under the circumstances in which we were working.

The predominant sounds recorded during the fin whale portion of research were the sounds of humpback whales (Fig. 5). These were recorded on almost every sonobuoy deployed and consisted of a repertoire of roughly 5 call types that did not appear to occur in any particular order but that were recorded consistently in all locations (Fig. 6). This suggests that an acoustic survey for humpback whales in this area and season might be quite successful should this ever be of interest.

Transit to the Minke Whale Research Area

Transit to the Minke whale research area was conducted from 16 January (on completion of the fin whale research at 15:57 hrs) to 18 January (until 06:54 hrs when the starting position for the minke whale research was reached. The transit spanned the northern part of the 000°-010°E Sector and 134.3 nmiles were covered on effort in NSP mode (during 11.38 hours of research). The transit was used as a trial session to evaluate the use of the big eyes in Antarctic conditions in preparation for the minke whale research.

MINKE WHALE RESEARCH

Research in the minke whale research area was conducted from 18 January until 13 February. The main focus of the research was big eye BT mode trials using 25x binoculars mounted on the Upper Bridge. The minke whale research was commenced from the western border of the research area (000°00') at latitude 68°30'S approximately 60 nmiles from the estimated position of the ice edge. Research generally proceeded eastward, however re-survey of several sections of the research area was undertaken.

During the minke whale research component, research on blue whales was conducted (see blue whale research section below) and research on humpback whales was continued (see humpback whale research section below).

BT Mode

During the minke whale research component priority was given to the big eye BT mode trials using 25x binoculars mounted on the Upper Bridge. Although trials of last years Options 1, 2 and 3 were scheduled, no trials were conducted as priority was given to the big eye BT mode trials in an attempt to achieve the target sample size of 50 binary trials.

The big eye BT mode trials were commenced with the intention of using a standard SOWER constructed trackline within the normal southern stratum width (60 nmiles). However, as north of the ice edge (apart from on the first transect) the sighting rate for minke whales was low, the option of a flexible cruisetrack in the vicinity of the ice edge was adopted with the aim of increasing the likelihood of encountering minke whales. Also, a revised research protocol for big eye BT mode was used in an effort to achieve the desired sample size of binary trials: BT mode was conducted during NSP mode instead of IO mode. NSP mode does not have the same limitations on the duration of periods of continuous survey as IO mode (see Objectives and Methods section). In addition, during the first two days of research in big eye BT mode included trials of big eye BT/IO mode. Difficulties were experienced due to complexities of data recording, tracking of sightings and assessment of their duplicate status (as big eye BT/IO mode is effectively the same as including an additional platform to normal IO mode; the complexities of data acquisition during big eye BT/NSP was comparable to normal IO mode).

A summary of research effort by mode in the minke whale research area is presented in Table 1. Sections of the trackline covered on primary effort are shown in Figure 1d.

Almost the entire ice edge margin between 000°00' and 020°00'E was covered during research in BT mode. Some sections of the research area were re-surveyed several times. The following is a brief account of our activities during the minke whale research component.

Research during the first four days (18-22 January) of the 27-day minke whale research component were spent mainly conducting survey in big eye BT/NSP mode and mostly in the vicinity of the pack ice between longitudes 000°00' and 010°28'E. Few minke whales were detected apart from on the first day near the western boundary of the research area (between longitudes 000°00' 002°30'E). On 23 January, we returned from 010°30' E to the western border of the research area. The intent was to allow time for ice in the east of the research area (between longitudes 016°00'E and 020°00'E) to recede and potentially form a more compact edge (as based on satellite ice information for this region, a large area of pack ice extending south of the ice edge was of low concentration and progressively decreasing in concentration). Potentially, recession to form a compact ice edge in this area would increase the likelihood of encountering minke whales outside the pack ice for the big eye BT mode trials.

The aim in returning to the western border of the research area was also to re-survey the area north of the ice edge near longitude 000°00' (as the sighting rate for minke whales in that region had been reasonably good on 18 January). Our return course to western border of the research area provided coverage in the ice-free northern part of a large bay in the ice edge between 005°00'E and 010°00'E. More thorough coverage of the western ice edge of this bay was another goal. The additional coverage of the ice edge of the area between 000°00' - 010°28'E was achieved between 24 and 27 January however, as during the initial coverage few minke whales were detected.

BT mode survey was continued in the vicinity of the ice edge between 011°00'E and 017°30'E from 28 to 31 January. In this region the pack ice was of low concentration and although very good sighting conditions were experienced the sighting rate for minke whales was generally low. On 31 January there was a reasonably good sighting rate for minke whales on a 25-nmile segment of trackline in the vicinity of position 68°30'E, 017°30'E near pack ice of higher concentration. Resurvey of this area was commenced, however, research was interrupted by poor weather. The BT mode trials were recommenced on 4 February, however although sightability was good, few minke whales were detected in that area. In the intervening period strong easterly winds had moved the pack ice westward approximately 30 nmiles and reduced its concentration. For the next four days research was conducted further south in a large lead, between the pack ice and an extensive iceberg (in the vicinity of position 69°15'S 017°00'E. Survey in BT mode was conducted on three separate days in the lead (on 4, 5 and 7 February) as there was a relatively high sighting rate of minke whales. Although quite windy weather was experienced, the sheltered location surrounded by pack ice provided workable conditions. The sighting rate was relatively high on 4 February, however during the subsequent coverage on 5 and 7 February the sighting rate was lower. On 7 and 8 February, BT mode survey was conducted near the ice edge eastward to the vicinity of 020°00'E, however, the pack ice edge was of low concentration and the sighting rate for minke whales was low. In the vicinity of 68°45'S 020°00'E on 10 February on a short section of the trackline near the pack ice a steady sighting rate of minkes was recorded and resurvey of this area was conducted the same day and again on 11 February when sighting rates were lower. Between 11 February and until the end of the schedule minke whale research on 13 February, resurvey of the area near the pack ice was conducted in a westerly direction between longitudes 020°00'E and 012°40'E. On the evening of 13 February, transit to Cape Town was commenced from position 68°44'S 012°40'E.

Very good weather conditions were experienced in the minke whale research area compared to recent SOWER Antarctic cruises. Of the 328.42 hrs available for research, 103.83 hrs (32%) were lost. Generally, during the on-effort survey periods, only very good sighting conditions were experienced.

In the minke whale research, a total of 148.61hours of searching was conducted and 1730.0 nmiles were covered. During survey in big eye BT mode a total of 1305.5 nmiles were covered during 111.06 hours of research (including big eye BT/NSP mode – 1105.2 nmiles (93.93 hours); big eye BT/IO mode – 127.8 nmiles (10.88 hours); big eye BT/NSP with ice navigation – 72.5 nmiles (6.25 hours). Research was also conducted in NSC mode – 164.8 nmiles (14.78 hours); NSC mode with ice navigation – 51.4 nmiles (4.56 hours); NSP mode – 25.9 nmiles (2.31 hours); NSP mode with ice navigation – 78.9 nmiles (7.05 hours) and BB mode – 103.5 nmiles (8.83 hours).

A total of 62 sightings (including all species) was first detected by the big eyes during the 1305.5 nmiles of survey in big eye BT mode. A total of 434 sightings were detected from all platforms combined.

Sightings by the big eyes during BT mode included 38 groups of minke whales. In addition 4 groups were classified as 'like minke' whale (based on the appearance of their blows). During the same period in BT mode a total of 309 groups of minke whales were sighted by all platforms combined and 283 groups of minkes were detected by the TOP platform.

Of the 38 groups of minke whales initially sighted by the big eyes, 23 groups were subsequently detected by the TOP platform (Table 8). The number of re-sightings of the big eye sightings during tracking before they were either seen by the TOP or estimated to be past the beam, ranged from 0-101. The number of re-sightings was similar to the number of re-sightings recorded during standard IO mode.

The group size for the minke whales sighted by the big eyes during BT mode ranged from solitary individuals to 6 animals (mean group size was 2.39). The mean group size for minke sightings detected by the TOP during BT mode was 2.8. (Numbers for most sightings were unconfirmed during this passing mode survey).

For most of the on-effort periods in the minke whale research area, weather conditions were better-than-average and sea conditions very calm compared to those normally experienced during recent IDCR/SOWER minke whale surveys. However, searching in big eye BT mode was attempted in a range of weather and sighting conditions which included reasonably long durations when the initial cue detected was mainly one of the following: body; body or ring; blow; or blow/body. For the big eye sightings, the numbers of each type of initial cues were: blow – 19; body – 15; and blow/body – 4.

For minke whales, it appeared that the initial sighting distances by the big eyes were slightly greater than from the TOP platform. The mean sighting distance for big eye sightings was 2.70 and for TOP sightings was 2.02. This probably means there was only a partial separation of search areas. One reason for this lack of clear separation was perhaps the difference in platform heights. The big eyes were mounted on the Upper Bridge, 10.5 metres above sea level (eye height = 12.03 metres) while height of the TOP platform is 19 metres (eye height = 20.5 metres). Visible horizon from the Upper Bridge is calculated as 7.06 nmiles and from the TOP as 9.32 nmiles.

Also, the big eye users felt that the narrow field of the big eyes constituted one of the greatest difficulties for detecting minke cues and tracking sightings compared to use of the usual 7x binoculars.

As any form of glasses did not match the oculars of the big eyes, observers used naked eye, while all other observers routinely use polarized glasses to enhance blow contrast; this may have affected the detection rate of blow cues with the big eyes.

Searching with the big eyes could only be conducted in relatively good conditions. Although a range of wind speeds was experienced, searching was most often conducted downwind and/or in the shelter of the pack ice as a strategy to increase the likelihood of detections by the big eyes.

Misty or hazy conditions impeded searching with the big eyes as their higher magnification resulted in an obscured horizon far more than with the usual 7x binoculars. Problems with wind vibration were experienced when the vessel's course was against the wind and searching against the wind with the big eyes was not feasible when the wind speed was greater than approximately 10 knots due to wind vibration of the binoculars. The mounting stand provided good isolation from the engine vibration which was relatively frequent but could be reduced by adjusting the engine RPM. The problem of wind vibration was thought to be mainly due to the relatively lightweight construction of this particular model of big eyes and because of their size the protruded above the wind dam of the Upper Bridge.

Vessel rolling and pitching, potentially a problem for use of the big eyes, was rarely a problem on this cruise due to the calm sea conditions experienced.

As most of the research was conducted in the vicinity of the pack ice, avoiding scattered ice floes sometimes required minor course changes (5°-10°) and this made it difficult for the big eye users. Another disadvantage of conducting research near the pack ice, was that minke whale body cues were sometimes obscured by ice floes; the view from the Upper Bridge being more obscured compared with the TOP.

Data recording and assessment of duplicate status of sightings during big eye BT/NSP mode was similar to during IO mode. Assessment of duplicate status was problematic for a few sightings when a moderate-high sighting rate for minke whales was encountered for a short duration 4 February. Data recording during the short periods of big eye BT/IO mode completed on 18 and 19 January was difficult.

Estimated Angle and Distance Experiment

The Estimated Angle and Distance Experiment was conducted on 12 February during 3.13 hours. During the experiment the two researchers who used mainly the 25x binoculars during BT mode survey, made their estimates using these binoculars.

Minke Whale Dive Time Experiment

No minke whale visual whale dive time experiments were conducted on this cruise.

During this cruise, to complement the data collected last year, emphasis was to be on conducting the dive time trials in poorer conditions (sea states 3 and 4), within the standardized range of acceptable searching conditions. However, as with last year'ss cruise, usually only good sighting conditions were experienced during the on-effort survey periods when conditions were acceptable for research. (Additionally, priority was given to big eye BT mode trials in an attempt to achieve the target sample size of 50 binary trials).

ACOUSTICS RESEARCH

Over 270 hours of acoustic monitoring (most in real-time) was performed during the entire cruise. A total of 127 sonobuoys were deployed from 23 December 2005 through 13 February 2006 (Fig. 4a). Of these 19 performed poorly either from the time of deployment (4) or within the first hour (15) for a 15% failure rate. This is considerably less than usual and is due to the buoys' recent manufacture date (January 2003). The sonobuoys were programmed for 30 m depth and usually 4 or 8 hours, depending upon the ship's activities. If the ship was steaming, buoys were set for 4 hours as we would generally be out of range within 2 hours. If the ship was stationary, the duration was set at 8 hours for maximal acoustic coverage. Depth setting was 30 m and channels 80-90 were used as these most closely matched the frequency response of the antenna. Animal sounds were detected on 5 of the poor buoys before they failed. Of the 108 "good" buoys, animal sounds were heard on 98 (90.6%). In the fin whale research area, humpback whale sounds were the most commonly recorded sound while in the minke whale research area, blue whale and seal sounds were the most commonly heard with sperm whales also frequently detected. Other species recorded included killer whales (four times) and fin whales (eight times).

BLUE WHALE RESEARCH

There were 33 sightings of blue whales (comprising 63 animals) during the cruise. 61 individuals of 32 groups were identified as true blue whales. 2 individuals were not approached closely and were classified as blue whale – undetermined.

Group sizes of blue whales were: 15 solitary animals; 10 groups of 2; 4 groups of 3; and 4 groups of 4. One calf was observed.

Most blue whales were seen in close proximity to the ice edge and they were widely distributed longitudinally in the research area.

Based on examination of digital images, three individual blue whales were re-sighted during re-survey of the area between 000° and 011°E after an interval of approximately a week had elapsed.

During the entire cruise, 32 groups (comprising 61 individuals) were approached for biopsy and photo-id research, which was conducted for a total of 39.06 hours. Biopsy samples were collected from 36 true blue whales. Results of biopsy sampling are given in Table 9. The collection of individual identification photographs of blue whales occurred simultaneously with biopsy sampling. 52 individual blue whales were adequately photographed (Table 10) including all the biopsied whales.

Video was recorded for 31 sightings (53 animals) during 4 hours 21 min. 33 sec (Table 13).

Acoustic recording was conducted in the vicinity of 29 of the 33 sightings of blue whales (see Acoustic Section below).

As usual, some groups were very easy to approach while others have been long diving and evasive (three groups could not be closely approached before they entered the pack ice). Two of the groups were feeding at the surface and easy to approach, the others were long diving and more difficult.

Also during the minke whale research there were 5 sightings (8 animals) of large baleen whales that were not approached and were classified as like blue whale based on the appearance of their blows.

Due to the unpredictable but usually long firing ranges required (35-60 metres) during biopsy attempts on blue whales only the Larsen system was used.

Acoustic recording during the blue whale research component

Forty-one sonobuoys were deployed either upon sighting blue or like blue whales or at night when blue whales had been seen that day or in locations where they had been seen on previous days. Blue whale sounds, including downsweeps and 28 Hz calls were recorded on 37 of these (Figure 9). No sounds attributed to pygmy blue whales were recorded. Although the sounds were frequently faint (especially the 28 Hz sounds), there were occasions where they were quite loud (Figs 9 and 10). Downsweeps were the most frequently recorded blue whale sound. This is similar to the pattern found by Rankin *et al*. (2005). There did not seem to be any association between 28 Hz calls and downswept calls. On six occasions, two buoys were deployed at least 2 nmiles apart and transmitted on different channels in order to try to track the sounds in post-processing either by DiFAR processing, if this proves feasible, or via time delay between the two to get rough locations of vocalizing animals. This may provide a comparison of the number of animals seen versus recorded. In many cases, blue whales were biopsied during periods in which sounds were recorded. In particular, on 13 February 2006, a sonobuoy was deployed before approaching a solitary animal, at least 10 nmiles from any other blue whale sightings. Very loud 28 Hz calls, including some with harmonics were recorded and were almost certainly produced by this animal. Sex information from the biopsy of this animal (and all the blue whales in whose presence recordings were made may be very useful information in assessing the role of sound production in blue whales.

HUMPBACK WHALE BIOPSY SAMPLING AND PHOTO-IDENTIFICATION STUDIES

Biopsy samples were collected from 71 humpback whales during the cruise during 27.82 hours of research. 115 individuals were photographed including all the biopsied animals (Tables 9 and 10). Collection of biopsy samples and photo-identification images of humpback whales was conducted throughout the entire cruise, however as humpback whales were frequently encountered in the fin whale research area most sampling was carried out in this area. Additional samples and photographs were obtained during the minke whale research component. Most of the biopsy attempts on humpback whales were made using the Larsen system at ranges of approximately 20-35 metres.

Occasional attempts were made with the Paxarms system using a tethered dart, particularly when humpback whales approached the ship when drifting off-effort in poor conditions.

Fin whale research area.

During the fin whale research, biopsy samples were collected from 48 humpback whales, during 15.57 hours of research. 79 individuals were photographed including all the biopsied animals. Almost all humpback whale biopsy sampling attempts in the fin whale study area were made during the NSC mode segments or during poor weather when the vessel would have otherwise been off effort. During the NSC mode segments, normally closure was only to be completed to whales believed to be fin whales, however we used closing mode as an opportunity to conduct humpback biopsy sampling and photo-ID. Most of the humpback whale samples were collected during survey of the third transect (spanning longitudes 010°E-005°E); the remainder were collected from between longitudes 010°E and 020°E.

In the fin whale research area humpback whales were generally very easy to approach, their larger group sizes and more surface-active behaviour with frequent exposure of flukes compared to most other Antarctic regions enhanced the results of the photo-identification studies.

Minke whale research area.

In the minke whale research area biopsy samples were collected from 15 humpback whales and 18 individuals were photographed including all the biopsied whales during 10.62 hours of research.

The samples were all collected in the vicinity of the ice edge and from two locations: in the west of the research area (near 000°00'E), and between longitudes 015°00'E and 020°00'E.

Transit between research areas

On 15 February, Samples were collected from 8 humpback whales and all were photographed during the transit north from the minke whale research area to Cape Town. The samples were collected from two groups at positions 61°07'S, 014°18'E and 61°01'S, 014°18'E (very close to the southern boundary of the fin whale research area).

OTHER SPECIES: BIOPSY SAMPLING AND PHOTO-IDENTIFICATION STUDIES

Southern right whale

In the fin whale research area on 6 January a pair of southern right whales was observed at position 57°05'S 011°39'E. They were extensively photographed and biopsy samples were collected from both animals using the Larsen system. A total of four samples were collected during 1.25 hours. Three samples were collected from one individual and one of these was treated separately as requested by Peter Best. Acoustics recording was conducted in the vicinity of the southern right whale sighting but no right whale sounds were heard (see Acoustics section below).

Killer whale

Two groups of killer whales were approached during the minke whale research component; biopsy attempts were made and the animals were photographed.

On 8 February at position 68°45'S 019°50'E a group of killer whales (Type A) comprising 13 individuals was approached. Two biopsy samples were collected during 3.02 hours of research.

Near the same vicinity, on 10 February (at position 68°48'S 020°03'E) a group of killer whales (Type B) comprising 12 individuals was approached amongst scattered ice floes. Three biopsy samples were collected during 1.46 hours of research.

A total of 13 animals were photographed including the biopsied individuals during these approaches.

During the transit north from the minke whale research area to Cape Town, a group of killer whales (Type C) comprising 25 animals was detected on 15 February at position 61°03'S, 014°19'E. The group was approached; biopsy samples were obtained from two individuals during 1.85 hours of research. 10 individuals were photographed including the biopsied animals.

Acoustics recording of other species

Other species recorded opportunistically included sperm whales in both research areas, and seals that were only recorded in the western portion of the minke whale research area. Killer whale sounds were recorded four times. Once in the presence of a lone type-A young male, twice in the same evening (10 January 2006) with no visual confirmation of type and once more in the presence of type C killer whales (15 February 2006). No sounds were recorded from a group of type-B killer whales encountered on 10 February 2006.

SIGHTINGS

A list of all the sightings recorded during the fin whale research, by species, and by effort mode, is presented in Table 2. Sightings recorded during the minke whale research, by species, and by effort mode, is presented in Table 3. Figures 2a-e show the location of sightings.

Tables 4-6 list the sightings observed during transits to and from the research area, including those in the EEZ's of South Africa. Table 7 summarizes all sightings observed during the entire cruise.

Observations of cetaceans during transit within the 200 nmile EEZ of South Africa are presented in Appendix B.

Fin whale research area

Fin whales (31 groups, 274 animals) were observed mainly in two large aggregations in the fin whale research area. On 7 January an aggregation of 40 animals was observed in the vicinity of position 56°34'S 011°09'E. On 9 January an aggregation of 100 (including a calf) was observed in the vicinity of position 55°57'S 009°16'E and fin whale sightings were numerous in this vicinity the following day. Apart from the two aggregations of fin whales, this species was infrequently sighted in the part of the research area covered.

Humpback whales were the most frequently encountered species in the fin whale research area (149 groups, 377 animals), and were sighted almost throughout the section of the area where coverage was achieved. Mean group size for humpback whales in the fin whale research area was 2.5; this is larger than the mean group size reported from recent SOWER cruises in the Antarctic. During the survey, two aggregations of humpbacks were observed on 5 January: an aggregation of 15 whales in the vicinity of position 58°26'S 012°42'E and a dispersed aggregation of 30 humpback whales (spread over an area approximately 1.5 x 4.0 nmiles) was recorded in the vicinity of position 58°01'S 012°30'E. The water in this area was greenish brown apparently due to plankton. On 15 February during the transit from the minke whale research area to Cape Town additional sightings of humpback whales in the fin whale research area included an aggregation of 30 animals recorded at position 59°55'S 014°31'E.

A high proportion of the humpback whales in the fin whale research area appeared to be infested with barnacles and other ectoparasites compared to other Antarctic regions.

There were 6 sightings of solitary minke whales in the fin whale research area, including one dwarf minke.

A group (two animals) of southern right whales was observed on 6 February at position 57°05'S 011°39'E.

Killer whales (3 groups 7 animals) were seen only in the north of the research area. Two of the groups were classified as Type A.

Southern bottlenose whales (8 groups 12 animals) although widespread were uncommon.

Gray's beaked whales (2 groups 3 animals) were observed during two consecutive days (31 December and 1 January) at position 55°30'S 019°33'E.

Minke whale research area

Minke whales (361 groups, 940 animals) were observed throughout the entire length of the ice edge in the minke whale research 000°-020°E and were the second most frequently observed species. As the focus of the minke whale research was sightings experiments and not on obtaining an abundance estimate, areas of higher sighting rate were re-surveyed, thus double counting will have occurred. Mean group size was 2.6. In addition, 19 groups of 25 animals of 'like minke' whales were observed. A moderate-high sighting rate for minke whales was observed on 4 February in a lead in the ice at the east of the research area in the vicinity of 69°11'S 016°28'E where the largest group size was also observed (50 animals). The minke whale sighting rate for much of the remainder of the ice edge was patchy and between longitudes 005°00'E and 015°00'E the sighting rate was low. An interesting observation was the marked difference in the sighting rates of minke whales recorded during re-survey of the same area within a short temporal scale (over several days). We selected three areas of higher sighting rate for re-survey during the BT mode trials; in all cases the sighting rate decreased markedly during the subsequent surveys despite comparable sighting conditions.

Humpback whales (39 groups 81 animals) were the second most commonly encountered species and were most commonly sighted east of longitude 010°E.

Blue whales (33 groups, 63 animals) were widespread along pack ice edge in the entire research area, however most sightings were in large bays in the ice edge in the far west and in the far east of the research area (as on previous cruises to this area). Group sizes ranged from solitary individuals to four animals. One calf was observed.

Sperm whales (33 groups, 33 animals) had a patchy distribution with most sightings in two main locations in the research area (in the vicinity of longitude 005°E and between longitudes 010°E and 015°E).

Southern bottlenose whales (5 groups, 10 animals) with the exception of one sighting were only seen between longitudes 015°E and 020°E.

Killer whales (8 groups, 69 individuals) were infrequently sighted and widely distributed along the ice edge in the minke whale research area. Of the killer whales identified to type, Types A and B were observed. (see Other species biopsy and photo-ID Studies Section)

DIRECT DATA ACQUISITION

The SOWER-modified version of Wincruz worked well during closing mode, but was problematic during passing modes. The recorder and the current version could not keep up with the rapid-fire recording necessary during multiple and duplicate sighting events. Furthermore, the subsequent data editing required in the evening after a day of passing mode exceeded the amount of time that would have been used to enter the same data into the Moon-Joyce program as in previous years. After consideration, direct data entry into Wincruz was stopped on 8 January and the paper form continued to be the primary data record for the remainder of the cruise.

However, the mapping function of Wincruz was very useful during passing mode as an aid for assessment of duplicate status. After 8 January, through the remainder of research in the fin whale area, the mapping function was used following entry of an abbreviated record for each sighting.

Despite the lack of success this year incorporating direct data acquisition, we feel positive that it would work with further revision to Wincruz and an acquisition system. See Appendix D for specific recommendations.

KRILL – VISUAL OBSERVATIONS

We recorded a total of 756 visual observations of krill patches during the cruise. Many were seen only by the Top barrel and later reported to the researchers. Most were circular in shape and usually between 20 and 60 metres in size.

The highest density of krill swarm detected visually was on a 45.0 nmile segment of trackline between positions 68°00'S 005°00'E and 68°39'S 005°57'E on 19 January, when approximately 500 patches (each 10-20 metres in diameter) were observed in ice-free water to the northwest of a large bay in the pack ice. In addition, on 23 January there were many visual observations of krill patches southeast of this location amongst scattered remnants of pack ice on a segment of trackline between positions 68°48'S 006°42'E and 68°51'S 005°30'E.

ICE EDGE

Most of the research was conducted in the immediate vicinity of the northern margin of pack ice and the ship navigated along almost the entire ice edge between was 000°00'E and 021°00'E. The ships officers, usually by a combination of visual and radar observations, recorded the location of the ice edge routinely during the cruise. Re-survey of several areas was undertaken and, as expected, substantial changes in the location of the pack ice occurred during the intervening periods. Because of this complexity and because the aim of the cruise was not to produce an abundance estimate, a best estimate of the position of the ice edge for the entire research area as normally produced on this series of cruises was not made.

It was noted that the location of the ice edge was approximately the same during the 2005-2006 as during the 1987-88, 2004-2005 cruises to this area.

MARINE DEBRIS

Observations of marine debris encountered during the cruise, south of the northern boundary of the fin whale research area (latitude 55°S) are given in Table 12.

Transit to Cape Town and post-cruise Meeting

The *Shonan Maru No.2* commenced transit to Cape Town from position 68°44'S, 012°40'E on the evening of 13 February.

The 010°E-020°E sector was traversed on 14 February during the transit to Cape Town. South of 61°00'S (the southern boundary of the fin whale research area) 110.4 nmiles were covered in NSC mode during 9.48 hours of research and mainly in very good sighting conditions.

During the transit between the minke whale research area and Cape Town the fin whale research area was intersected however mainly very poor conditions were experienced which prevented all but a little additional coverage in this area. The vessel entered the fin whale research area at 09:35 hours on 15 February at position 61°00'S, 014°20'E and departed the area at 14:50 hours on 16 February at position 55°00'S, 015°19'E. During the transit in the fin whale research area a total of 18.6 nmiles were covered during 1.61 hours of research: NSC mode – 5.4 nmiles (0.51 hours) and BB mode – 13.2 nmiles (1.10 hours).

On 15 February, three Argo buoys were successfully deployed from the *Shonan Maru No.2* on behalf of the Japan Agency for Marine Earth Science and Technology at latitudes 60°S, 59°S and 58°S.

Between latitude 55°00'S and the boundary of the South African EEZ poor weather was experienced and no research was conducted.

The South African EEZ was intersected adjacent to the coast of South Africa. The vessel entered the EEZ on 20 February at 37°40'S, 017°35'E at 08:42 hrs Permission for research in NSC mode within the 200 nmile Exclusive Economic Zone (EEZ) of South Africa was granted by the South African Government, however within the zone windy conditions restricted research; a total of 55.2 nmiles were covered during 4.76 hours of research in NSC mode.

The ship entered Table Bay Harbour on the morning of 22 February. The report of the cruise was finalized during a Post-cruise Meeting held aboard the vessel on the afternoon of 22 February. The vessel departed Table Bay Harbour, Cape Town on 25 February.

MODIFICATIONS TO THE PROCEDURES, VESSELS AND EQUIPMENT

Modifications to the vessel

The Upper Bridge was modified prior to this cruise specifically for the minke whale BT mode experiment. The observer seat immediately on the starboard side of the helmsman had been enlarged to accommodate the stand and big eye binoculars, and included a purpose built adaptable seating arrangement to provide reasonable comfort for the big eye user.

For the blue whale research a late model high resolution digital video recorder was provided by The National Research Institute of Far Seas Fisheries (Shimizu); this camera was smaller an easier to use than that previously available and enhanced the results of video recording made during the blue whale research. The recorder was also to be used during the minke whale dive time experiment but no trials were conducted.

The IWC purchased considerable new equipment prior to this cruise including a digital camera, biopsy equipment and a computer:

- The camera (Canon 20D equipped with an image stabilized 100-400 mm lens) enhanced the results of the photo-identification efforts. One of the major advantages of the digital system was the immediate and end-of-day review of the data collected.
- The IWC purchased two complete Paxarms biopsy systems prior to the cruise. These items were purchased at very short notice due to the uncertainty of arrival for the cruise of a freight consignment containing IWC-owned Larsen guns and crossbows. However as the Larsen equipment eventually arrived, the Paxarms system was not used extensively during the cruise. The Larsen system continued to be used as the primary biopsy system on this cruise due to its greater effective range compared to the Paxarms system. In addition, the Larsen darts tend to be much easier to relocate than Paxarms darts when floating on the water. The Paxarms system with a tethered dart was successfully used on several occasions for sampling humpback whales that approached the ship while drifting.
- The IWC purchased a weatherised computer (Panasonic Toughbook Model CF-18) to be used on the Upper Bridge for direct data acquisition. The data acquisition program was not fully developed for this cruise and we decided to abandon these efforts part way through the cruise, however the computer performed very well in this difficult environment and will be very useful in the future. As this was the only IWC-owned computer on board it was also put to extensive use for storing digital photo-identification images and was employed for recording data from a second concurrent sonobuoy.

RECOMMENDATIONS

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).

Acoustics:

1. Send VHF radios back to Greeneridge for DiFAR modification and to have the output signal levels checked. These are analog radios that are preferable to the digital ICOM PCR-1000s because they do not require a computer to run the radio programming.
2. Purchase a dedicated acoustics computer, headphones, external hard drive and all necessary software for the SOWER cruises. The computer should have a stereo sound card (or an external sound card) so that 2 buoys can be recorded at once onto different channels during the same recording. On the present cruise, a separate computer was used for each channel when two buoys were deployed simultaneously.
3. As the gender of calling baleen whales has been a question of great interest to the acoustics community, expediting biopsy sample processing/transfer to the IWC is highly recommended.

Biopsy photo-Identification

1. There are no darts remaining for the Larsen system. A stock of new darts, propelling plugs and ammunition will be needed for biopsy sampling on future cruises.
2. Collection of increased numbers of biopsy samples and whale identification photos such as on this cruise results in a large amount of data recording and cross-referencing; it would be desirable if the IWC developed electronic protocols for recording biopsy data, the cataloguing and storing of digital images, and cross-referencing between sample numbers and ID photos. The Natural Marking Record should be modified to reflect the use of digital images.
3. In relation to recommendation 2, another computer with external storage/back up is required for storing digital images and for general cruise duties. Currently the only IWC-owned computer available on board is the new weatherized computer intended for the direct data acquisition system.

Direct Data Acquisition

1. We reiterate the need for a direct data acquisition system. Reducing the collection of redundant data in multiple places by implementing a single direct data acquisition system would reduce the recording burden placed on the bridge officers and researchers. Implementation of a direct data acquisition and mapping system would facilitate data entry and tracking of individual sightings during normal IO mode and trials such as big eye BT mode. For more detailed recommendations, see Appendix C.

BT Mode

1. If big eye BT mode survey is to be repeated in the future, it is strongly recommended that a protocol be established whereby only the TOP and big eye observers call sightings with other observers on the upper bridge limited to assisting with tracking of sightings. Upper observers may keep track of animals not sighted by either platform but should only report them after the animal has passed the beam of the ship. This both increases the opportunities for the Tracker platform to detect and track animals and decreases the confusion experienced by the recorders in determining whether sightings are new or are resights.
2. While we were not aware of any change in searching behaviour of the Top platform in response to the use of the big eyes on this cruise, if such trials are conducted in the future, to avoid any potential change in searching behaviour, a randomized schedule of big eye use might be put in place where the Top is unaware of whether or not the big eyes are being used. This would likely only be feasible in an area of high minke whale density so that the necessary number of samples is still obtained.
3. Recognizing the 25x binoculars were generously loaned to the IWC for the BT mode trials on this cruise, the particular Model was of relatively lightweight construction. If further big eye BT trials are to be carried out, acquiring a larger/heavier instrument with matching mounting system may increase the effectiveness searching and particularly allow searching in a wider range of wind speeds and sightability conditions. With the current Model searching was difficult, when wind speeds were greater than 10 knots except downwind. Also, the choice of reticle design should be considered as some users found those installed in

the current model hindered their searching. In addition, as sunglasses did not match the eyepieces of the current big eyes, users considered the inability to wear polarized glasses when searching on the big eyes decreased their ability to sight distant blow cues as well as causing increased eye fatigue.

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

Area	**Start**	**End**	**ALTS/ NSP**		**NSC (includes BA)**		**IO**		**NSP (includes BI)**		**BT/IO**		**BT/NSP**		**BB**	
	Date Time	Date Time	Time-Distance (hours-nmiles)		Time-Distance (hours-nmiles)		Time-Distance (hours-nmiles)		Time-Distance (hours-nmiles)		Time-Distance (hours-nmiles)		Time-Distance (hours-nmiles)		Time-Distance (hours-nmiles)	
Transit Cape Town to Fin Whale Research Area	22 Dec 17:30	27 Dec 16:37	20.34	233.4	-	-	-	-	-	-	-	-	-	-	-	-
Fin Whale Research Area	27 Dec 16:37	16 Jan 15:57	63.3	729.9	7.23	74.0	5.29	60.0	-	-	-	-	-	-	-	-
Transit FWR to Minke Whale Research Area	16 Jan 15:57	18 Jan 06:54	-	-	-	-	-	-	11.38	134.3	-	-	-	-	-	-
Minke Whale Research Area	18 Jan 06:54	13 Feb 18:00	-	-	19.34	216.3	-	-	9.36	104.8	10.88	127.8	100.8	1177.7	8.83	103.5
Transit MWR to Cape Town	13 Feb 18:00	22 Feb 08:30	-	-	14.75	179.4	-	-	-	-	-	-	-	-	1.10	13.2

Table 2. Number of sightings for all species (Groups/Animals) observed in the Fin Whale Research Area in each effort mode.

Species	ALTS		IO		NSC		OE		Total	
	G	A	G	A	G	A	G	A	G	A
Fin	27	223	-	-	1	3	3	48	31	274
Like fin	11	46	-	-	-	-	-	-	11	46
Minke (Antarctic)	-	-	-	-	-	-	4	4	4	4
Minke (dwarf)	-	-	-	-	-	-	1	1	1	1
Minke (undetermined)	1	1	-	-	-	-	-	-	1	1
Like minke	1	1	-	-	-	-	2	2	3	3
Humpback	90	240	13	23	37	94	9	20	149	377
Like humpback	18	27	3	3	-	-	-	-	21	30
So. right whale	-	-	-	-	1	2	-	-	1	2
Killer whale	2	6	-	-	-	-	1	1	3	7
So. bottlenose whale	6	9	-	-	1	1	1	2	8	12
Gray's beaked whale	-	-	-	-	-	-	2	3	2	3
Mesoplodon sp.	1	1	-	-	-	-	-	-	1	1
Ziphiid	2	3	-	-	1	3	-	-	3	6
Unid. large baleen	18	35	14	25	-	-	1	3	33	63
Unidentified whale	2	2	-	-	1	1	-	-	3	3

Table 3. Number of sightings for all species (Groups/Animals) observed within the Minke Whale Research Area in each effort mode.

Species	BT-NSP		BT-IO		NSP		NSC		BB		OE		Total	
	G	A	G	A	G	A	G	A	G	A	G	A	G	A
Minke (Antarctic)	271	727	18	51	1	2	12	22	23	62	13	35	338	899
Minke (like Antarctic)	1	10	-	-	-	-	-	-	-	-	-	-	1	10
Minke (undetermined)	12	19	7	9	-	-	2	2	-	-	1	1	22	31
Like minke	16	21	-	-	-	-	-	-	2	3	1	1	19	25
Blue (true)	21	44	-	-	1	1	2	2	3	5	4	8	31	60
Blue (undetermined)	-	-	-	-	1	1	-	-	-	-	1	2	2	3
Like blue	4	6	-	-	-	-	-	-	-	-	1	2	5	8
Humpback	30	60	-	-	2	4	5	13	1	3	1	1	39	81
Sperm	26	26	3	3	-	-	4	4	-	-	-	-	33	33
Killer	7	56	-	-	-	-	1	13	-	-	-	-	8	69
Southern bottlenose	2	4	-	-	1	1	1	2	-	-	1	3	5	10
Like so. bottlenose	2	4	-	-	-	-	-	-	-	-	-	-	2	4
Ziphiid	1	3	-	-	-	-	-	-	-	-	-	-	1	3
Unid. large baleen	9	16	3	3	-	-	-	-	-	-	1	1	13	20
Unid. whale	-	-	1	1	-	-	-	-	-	-	-	-	1	1

Table 4. Number of sightings for all species (Groups/Animals) observed during transit between Cape Town and the Fin Whale Research Area in each effort mode.

Species	NSC		OE		Total	
	G	A	G	A	G	A
Fin	5	21	-	-	5	21
Humpback	3	6	3	11	6	17
So. right	-	-	1	1	1	1
Sperm	1	1	1	2	2	3
Hourglass dolphin	3	10	-	-	3	10
Ziphiid	3	6	-	-	3	6
Unidentified large baleen whale	-	-	1	1	1	1
Unidentified whale	1	1	-	-	1	1

Table 5. Number of sightings for all species (Groups/Animals) observed during transit from the Fin Whale Research Area to the Minke Whale Research Area. Effort was conducted in NSC mode.

Species	NSP		Total	
	G	A	G	A
Minke (Antarctic)	8	30	8	30
Humpback	3	7	3	7
Like humpback	1	1	1	1
Sperm	2	2	2	2
So. bottlenose	2	2	2	2
Ziphiid	2	4	2	4
Unidentified large baleen	3	5	3	5

Table 6. Number of sightings for all species (Groups/Animals) observed during the transit from the Minke Whale Research Area to Cape Town, in each effort mode.

Species	NSC		BB		OE		Total	
	G	A	G	G	G	A	G	A
Minke (Antarctic)	4	6	-	-	-	-	4	6
Humpback	4	11	2	2	4	37	10	50
Sperm	4	6	-	-	-	-	4	6
Killer	1	25	-	-	-	-	1	25
So. bottlenose whale	3	9	-	-	-	-	3	9
Pilot whale	-	-	-	-	1	10	1	10
Hourglass dolphin	-	-	-	-	1	2	1	2
Ziphiid	1	1	-	-	-	-	1	1

Table 7. Summary of all sightings (Groups/Animals) observed during the entire cruise in each effort mode.

Species	ALTS		NSC		IO		NSP		BT-IO		BT-NSP		BB		OE		Total	
	G	A	G	A	G	A	G	A	G	A	G	A	G	A	G	A	G	A
Minke (Ant)	-	-	12	22	-	-	9	32	12	44	276	732	23	62	17	39	349	931
Minke (like Ant)	-	-	-	-	-	-	-	-	-	-	1	10	-	-	-	-	1	10
Minke (dwarf)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1
Minke (undet.)	1	1	2	2	-	-	-	-	5	7	14	21	-	-	1	1	20	29
Like minke	1	1	-	-	-	-	-	-	-	-	16	21	2	3	3	3	21	27
Blue (true)	-	-	2	2	-	-	2	2	-	-	20	43	3	5	4	8	31	60
Blue (undet.)	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1	2	2	3
Like blue	-	-	-	-	-	-	-	-	-	-	4	6	-	-	1	2	5	8
Fin	27	223	6	24	-	-	-	-	-	-	-	-	-	-	3	48	36	295
Like fin	11	46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	46
Humpback	90	240	49	124	13	23	5	11	-	-	30	60	3	5	17	69	202	532
Like humpback	18	27	-	-	3	3	1	1	-	-	-	-	-	-	-	-	22	31
So. right	-	-	1	2	-	-	-	-	-	-	-	-	-	-	1	1	2	3
Sperm	-	-	8	10	-	-	2	2	-	-	29	29	-	-	1	2	40	43
Killer	2	6	1	13	-	-	-	-	-	-	7	56	-	-	-	-	10	75
Pilot whale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	10	1	10
Hourglass		-	3	10	-	-	-	-	-	-	-	-	-	-	1	2	4	12
So. bottlenose	6	9	2	3	-	-	3	3	-	-	2	4	-	-	2	5	15	24
Like so. bottlenose	-	-	-	-	-	-	-	-	-	-	2	4	-	-	-	-	2	4
Gray's beaked	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	3	2	3
Mesoplodon sp.	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Ziphiid	2	3	5	10	-	-	2	4	-	-	1	3	-	-	-	-	10	20
Unid. large baleen	18	35	-	-	14	25	3	5	2	2	10	17	-	-	3	5	50	89
Unid. whale	2	2	2	2	-	-	-	-	-	-	1	1	-	-	-	-	5	5

Table 8. Minke and 'like minke' whale sightings detected by the big eye (25X) binoculars during BT mode.

Date	Sighting No.	Cue	Species	Group Size	No. of Resightings	Detected by Top (Y/N)
Jan 18	004	Blow	Minke (Antarctic)	4	1	Y
Jan 18	022	Blow/body	Minke (Antarctic)	3	5	Y
Jan 18	026	Body	Minke (Antarctic)	1	0	Y
Jan 18	043	Body	Minke (Antarctic)	4	4	Y
Jan 22	001	Body	Minke (Antarctic)	5	6	Y
Jan 25	006	Blow	Like minke	1	0	Y
Jan 29	004	Blow/body	Like minke	1	2	N
Jan 29	015	Blow	Minke (Antarctic)	1	3	N
Feb 04	002	Body	Minke (Antarctic)	3	10	Y
Feb 04	008	Body	Minke (Antarctic)	1	6	N
Feb 04	014	Body	Minke (Antarctic)	3	2 (+ cues detected but not recorded)	Y
Feb 04	017	Body	Minke (Antarctic)	2	0	Y
Feb 04	025	Blow	Minke (Antarctic)	3	16	N
Feb 04	026	Blow/body	Minke (Antarctic)	2	1	N
Feb 04	049	Body	Minke (Antarctic)	5	11	Y
Feb 04	052	Blow	Minke (Antarctic)	2	12	Y
Feb 04	078	Blow	Minke (Antarctic)	2	11	N
Feb 04	080	Blow	Minke (Antarctic)	4	13	Y
Feb 04	087	Blow	Like minke	2	5	N
Feb 04	093	Body	Like minke	1	1	Possibly
Feb 05	007	Blow	Minke (Antarctic)	3	13	N
Feb 05	009	Blow	Minke (Antarctic)	4	3	Y
Feb 05	017	Blow	Minke (Antarctic)	3	3	Y
Feb 07	005	Blow	Minke (undetermined)	1	6	N
Feb 07	008	Blow	Minke (Antarctic)	3	10	Y
Feb 07	014	Blow	Minke (Antarctic)	3	16	Y
Feb 07	017	Blow/body	Minke (Antarctic)	1	12	N
Feb 07	020	Blow	Minke (Antarctic)	6	2 cues detected but not recorded	Y
Feb 07	026	Blow	Minke (Antarctic)	1	1	Y
Feb 10	007	Blow	Minke (Antarctic)	1	0	Y
Feb 10	012	Blow	Minke (Antarctic)	1	7 (+ 3 cues detected but not recorded)	Y
Feb 10	026	Body	Minke (Antarctic)	1	0	Y
Feb 10	036	Blow	Minke (undetermined)	1	0	N
Feb 10	038	Body	Minke (Antarctic)	2	2	Y
Feb 10	049	Body	Minke (undetermined)	1	1	N
Feb 11	006	Body	Minke (undetermined)	1	1	N
Feb 12	007	Body	Minke (undetermined)	1	6	N
Feb 12	013	Body	Minke (undetermined)	1	0	N
Feb 13	008	Body	Minke (undetermined)	2	8	N
Feb 13	024	Blow	Minke (Antarctic)	1	3	Y
Feb 13	028	Blow	Minke (Antarctic)	3	4	Y
Feb 13	032	Blow/body	Minke (undetermined)	5	101	N

Table 9. Results of the biopsy sampling in 2005/2006. System: L=Larsen gun P=Paxarms gun. All whales were photographed.

Species & Date	Sight No.	School Size	No. of Whales Sampled	System	Sample Numbers	Comments
Blue (true)						
19 January	001	3	1	L	0601182	
20 January	014	2	-	L	-	2 misses
20 January	016	3	2	L	0601183, 0601184	
24 January	002	3	1	L	0601185	1 hit-no sample, 1 miss
24 January	011	2	2	L	060187, 0601188	
25 January	004	2	1	L	0601189	2 misses
25 January	011	1	1	L	0601190	
26 January	003	2	2	L	0601191, 0601192	1 miss
26 January	009	1	1	L	0601193	
26 January	013	1	1	L	0601194	1 miss
28 January	004	1	1	L	0601199	
29 January	001	2	2	L	0601200, 0601201	
29 January	027	4	3	L	0601202, 0601203, 0601204	2 misses
30 January	007	2	1	L	0601205	1 miss
30 January	028	4	2	L	0601206, 0601207	1 miss
09 February	001	3	3	L	0601217, 0601218, 0601219	
09 February	002	3	2	L	0601220, 0601221	4 misses
09 February	004		1	L	0601222	
09 February	006	1	1	L	0601223	1 miss
09 February	007	2	2	L	0601224, 0601225	
09 February	008	1	1	L	0601226	
09 February	011	1	1	L	0601227	2 misses
12 February	033	1	1	L	0601235	
13 February	017	2	2	L	0601236, 0601237	1 hit-no sample
13 February	035	1	1	L	0601238	1 miss
Total			**36**			
Fin						
04 January	009	2	1	L	0602111	1 hit-no sample
06 January	021	3	1	L	0601120	
07 January	002	40	8	L	0602121, 0602122, 0602123, 0602124, 0602125, 0602126, 0602127, 0602128	1 hit-no sample, 8misses
09 January	002	100	16	L	0602130, 0602131, 0602132, 0602133, 0602134, 0602135, 0602136, 0602137, 0602138, 0602139, 0602140, 0602141, 0602142, 0602143, 0602144, 0602145	9 misses
Total			**26**			
Humpback						
27 December	002	3	2	L	0607101, 0607102/0607103	Samples 02 & 03 are from the same whale
27 December	003	1	-	L, P	-	2 misses

Table 9 continued. Results of the biopsy sampling in 2005/2006.

Humpback (continued)						
28 December	001	2	1	L, P	0607104	1 dart stuck-no sample, 1 miss
29 December	001	3	3	P	0607105, 0607106, 0607107	4 misses
02 January	001	2	2	L	0607108, 0607109	
04 January	002	3	1	L, P	0607110	(Double sample)
06 January	006	4	1	L	0607112	1 miss
06 January	008	2	1	L	0607113	1 miss
06 January	018	2	2	L	0607118, 0607119	
08 January	002	2	1	L	0607129	
13 January	001	2	2	L	0607148, 1607149	1 dart hit & stuck
13 January	002	5	3	L	0607150, 0607151, 0607152	1 miss
13 January	003	2	2	L	0607153, 0607154	M/C pair; 1 miss
13 January	004	2	2	L	0607155, 0607156	
13 January	005	2	2	L	0607157, 0607158	
13 January	007	5	2	L, P	0607159, 0607160	2 hits-no samples, 1 dart hit & stuck, 1 miss
13 January	008	15	4	L, P	0607161-0607162, 0607163, 0607164, 0607165	Samples 61 & 62 are from same whale; 1 dart hit & stuck-no sample, 6 misses
14 January	002	2	2	L	0607166, 0607167	
15 January	001	1	1	L	0607168	1 miss
15 January	002	2	2	L	0607169, 0607170	1 miss
15 January	003	4	3	L	0607171, 0607172, 0607173	1 miss
15 January	005	3	2	L	0607174, 0607175	1 hit-no sample, 1 miss
15 January	006	3	3	L	0607176, 0607177, 0607178	
15 January	007	7	3	L	0607179, 0607180, 0607181	1 dart stuck & fell out later-sample recovered, 1 miss
24 January	007	1	1	L	0607186	
27 January	010	2	3	L	0607195, 0607196, 0607197	Photos show samples 95 & 96 are the same whale
27 January	014	2	1	P, L	0607198	2 hits-no samples, 7 misses
03 February	001	3	3	L, P	0607208, 0607209, 0607210	2 misses
07 February	016	2	2	L	0607211, 0607212	2 misses
08 February	002	2	2	L	0607213, 0607214	1 hit-no sample, 2 misses
12 February	004	2	2	L	0607231, 0607232	1 miss
12 February	006	2	2	L	0607233, 0607234	2 hits-no samples, 4 misses
15 February	001	3	3	L	0607239, 0607240, 0607241	2 misses
15 February	003	5	5	L, P	0607244, 0607245, 0607246, 0607247, 0607248	2 misses
Total			**71**			
So. right						
06 January	011	2	**2**	L	0608114, 0608115, 0608116, 0608117	Photos show samples 15, 16, & 17 are the same whale

Table 9 continued. Results of the biopsy sampling in 2005/2006.

Killer						
08 February	004	13	2	L	0610215, 0610216	Type A; 3 hits-no samples, 3 misses
09 February	070	12	3	L	0610228, 0610229, 0610230	Type B, 2 misses
15 February	002	25	2	L	0610242, 0610243	Type C, 4 misses
Total			**7**			

Table 10. Summary of the photo-ID images collected in 2005/2006. For codes of body surface photographed and opportunity see Anon. 2005b.

Species & Date	Sighting no.	Group size	Number Photo'd	Opportunity	Body surface photographed	Comments
Blue (true)						
19 January	001	3	3	G	LD, RD	1 biopsy
20 January	014	2	2	G	LD, RD	
20 January	016	3	3	P	LD, RL	2 biopsy
24 January	002	3	3	G	LD, RD, HD	1 biopsy
24 January	011	2	2	P	LD, RD, HD	2 biopsy
25 January	002	1	1	E	LD	
25 January	004	2	2	E	LD, RD, HD	1 biopsy
25 January	011	1	1	P	LD, RD, HD	Biopsy
26 January	003	2	2	G	LD, RD	2 biopsy
26 January	009	1	1	G	LD, RD, HD	Biopsy
26 January	013	1	1	P	LL	Biopsy
27 January	005	1	1	P	LD, RD	
28 January	004	1	1	P	LD, RD, HD	Biopsy
29 January	001	2	2	G	LD, RD	2 biopsy
29 January	009	1	1	G	LD, RD, HD	
29 January	027	4	4	G	LD, RD	1 M/C pair; 3 biopsy
30 January	007	2	2	P	LD, RD	1 biopsy
30 January	012	1	1	G	RD	
30 January	028	4	3	G	LD, RD, HD	2 biopsy
09 February	001	3	3	G	LD, RD, HD	3 biopsy
09 February	002	3	3	G	LL, RL, HD	2 biopsy
09 February	004	1	1	E	LD, RD	Biopsy
09 February	006	1	1	G	LD, RD, HD	Biopsy
09 February	007	2	2	E	LD, RD	2 biopsy
09 February	008	1	1	G	LD, HD	Biopsy
09 February	011	2	2	P	LD, RD, HD	1 biopsy
13 February	017	2	2	G	LD, RD	2 biopsy
13 February	035	1	1	G	LD, RD	Biopsy
Total			**52**			
Fin						
26 December	002	2	1	G	RL	
26 December	003	1	1	G	RL	
26 December	005	2	1	G	RL	
04 January	009	2	2	P	LD, RD	1 biopsy
06 January	021	3	3	G	LD, RD	
07 January	002	40	3	G	RL	2 biopsy
09 January	002	100	16	G	LL, RL	12 biopsy
Total			**27**			
Minke						
27 January	001	1	**1**	G	LL	Distinctive dorsal fin
Humpback						
22 December	001	2	2	G	FL, LD	
22 December	003	7	5	G	FL, LD, RD	

Table 10 continued. Summary of the photo-ID images collected in 2005/2006.

Humpback (continued)						
23 December	001	2	2	G	LD, RD	
27 December	001	1	1	P	RD	
27 December	002	3	3	E	LD, RD	2 biopsy
27 December	003	1	1	E	LD	
28 December	001	2	2	G	FL, LD, RD	1 biopsy
29 December	001	3	3	E	FL, LD, RD	3 biopsy
02 January	001	2	2	G	LD, RD	2 biopsy
02 January	005	3	2	P	RD	
02 January	006	3	3	G	RD	
02 January	022	1	1	G	RD	
04 January	002	1	1	G	LD, RD	Biopsy
05January	020	2	1	P	LD	
06 January	006	4	4	E	LD, RD	1 biopsy; distinctive mark
06 January	008	2	2	G	RD	1 biopsy
06 January	014	2	1	P	FL, LD	
06 January	018	2	2	P	RD	2 biopsy
08 January	002	2	2	G	LD	1 biopsy
08 January	003	1	1	G	FL, RD	
11 January	010	1	1	P	RD	
13 January	001	2	2	G	FL, LD, RD	2 biopsy
13 January	002	5	5	G	FL, LD, RD	3 biopsy
13 January	003	2	2	E	LD, RD	M/C pair; 2 biopsy
13 January	004	2	2	G	FL, LD, RD	2 biopsy
13 January	005	2	2	G	RD	2 biopsy
13 January	006	2	2	P	FL	
13 January	007	5	5	E	FL, LD, RD	2 biopsy
13 January	008	15	9	E	FL, LD, RD	5 biopsy
14 January	002	2	2	G	FL, LD, RD	2 biopsy
14 January	003	2	1	P	RD	
15 January	001	1	1	E	FL	Biopsy
15 January	002	2	2	G	LD	2 biopsy
15 January	003	4	3	G	FL, RD	1 biopsy
15 January	005	3	2	G	LD, RD	1 biopsy
15 January	006	3	3	G	FL, LD, RD	3 biopsy
15 January	007	7	4	G	FL, LD, RD	2 biopsy
24 January	007	1	1	E	FL	Biopsy
27 January	010	2	2	G	FL, LD, RD	2 biopsy
27 January	012	2	1	P	FL	
27 January	014	2	2	G	FL, LD, RD	1 biopsy
28 January	007	5	1	E	FL, LD, RD	
03 February	001	3	3	G	FL, LD, RD	3 biopsy
07 February	016	2	2	G	LD, RD	2 biopsy
08 February	002	2	2	G	LD, RD	2 biopsy
12 February	004	2	2	G	LD	2 biopsy
12 February	006	2	2	G	FL, LD, RD	2 biopsy
15 February	001	3	3	G	FL, LD, RD	3 biopsy
15 February	003	5	5	E	FL, LD, RD	5 biopsy
Total			**115**			

Table 10 continued. Summary of the photo-ID images collected in 2005/2006.

So. right						
22 December	003	1	1	P	HD	
06 January	011	2	2	G	HD	2 biopsy
Total			**3**			
Sperm	007	1	**1**	P	FL	
Killer						
10 January	001	1	1	P	LD	Type A
21 January	002	7	1	P	LL	Type B
08 February	004	13	13	G	LD, RD	Type A; 2 biopsy
10 February	070	12	7	G	LL, RL	Type B; 3 biopsy
15 February	002	25	12	G	LD, RD	Type C; 2 biopsy
Total			**34**			

Table 11. Summary of acoustic monitoring during 2005/2006.

Date YYMMDD	Station	Position Latitude (S)	Longitude (E)	Time monitored (HH:MM:SS)	Bio-Sounds Heard
05/12/23	1	-38.25	18.29	1:54:00	No, hydrophone dropped off?
05/12/25	2	-46.54	19.07	0:15:00	No, failed
05/12/25	3	-46.59	19.07	1:46:00	None, hydrophone dropped off?
05/12/26	4	-52.29	19.85	1:09:00	Sperm, Humpback
05/12/27	5	-54.97	19.97	4:06:00	Humpback
05/12/27	6	-55.15	19.89	3:47:00	Sperm
05/12/28	7	-55.17	19.86	0:32:00	No
05/12/29	8	-55.12	19.84	3:46:00	Humpback
05/12/31	9	-55.30	19.77	0:08:00	Humpback
05/12/31	10	-55.34	19.77	0:47:00	Humpback
05/12/31	11	-55.52	19.59	0:11:00	No
05/12/31	12	-55.54	19.64	0:21:00	No
06/01/01	13	-55.57	19.67	1:00:00	Humpback
06/01/01	14	-55.64	19.41	0:15:00	No
06/01/01	15	-55.66	19.47	1:38:00	Humpback
06/01/02	16	-55.92	19.28	1:28:00	Sperm, Humpback
06/01/02	17	-56.50	18.83	1:26:00	Humpback
06/01/02	18	-57.00	18.58	0:18:00	Humpback
06/01/02	19	-57.10	18.33	2:03:00	Humpback
06/01/03	20	-57.29	18.18	1:38:00	Humpback
06/01/03	21	-57.79	17.77	1:21:00	Humpback
06/01/03	22	-58.33	17.32	1:27:00	Humpback
06/01/03	23	-58.86	16.26	1:22:00	Sperm, Humpback
06/01/03	24	-59.37	16.43	1:12:00	Humpback
06/01/03	25	-59.36	14.82	4:05:00	Humpback, Sperm
06/01/04	26	-59.29	13.49	1:21:00	Humpback
06/01/04	27	-59.00	13.28	0:33:00	Humpback
06/01/04	28	-58.76	13.02	2:02:00	Humpback, Sperm
06/01/05	29	-58.68	12.86	0:40:00	Humpback
06/01/05	30	-58.43	12.24	1:54:00	Humpback
06/01/05	31	-57.94	12.33		No, failed
06/01/05	32	-57.92	12.33	2:03:00	Humpback
06/01/06	33	-57.54	12.02	1:45:00	Humpback
06/01/06	34	-57.10	11.66	1:55:00	Humpback
06/01/06	35	-56.56	11.14	2:03:00	Humpback, Fin
06/01/06	36	-56.57	11.22	0:55:00	Humpback, Fin
06/01/06	37	-56.56	11.29	0:07:45	Humpback, Fin
06/01/07	38	-56.55	11.19	3:10:00	Humpback, Fin
06/01/07	39	-56.45	11.18	0:43:00	Humpback, Fin
06/01/08	40	-56.55	11.21	2:03:00	Humpback
06/01/08	41	-56.05	11.82	1:34:00	Humpback
06/01/08	42	-55.56	10.43	1:29:00	Humpback

Table 11 continued. Summary of acoustic monitoring during 2005/2006.

Date YYMMDD	Station	Position Latitude (S)	Longitude (E)	Time monitored (HH:MM:SS)	Bio-Sounds Heard
06/01/08	43	-55.33	9.74	1:29:00	Humpback
06/01/08	44	-55.46	9.68	0:50:00	Faint Humpback
06/01/09	45	-55.55	9.57	1:15:00	Humpback
06/01/09	46	-56.00	9.27	2:03:00	Humpback
06/01/09	47	-56.06	9.22	4:03:00	Humpback, Fin, Trill
06/01/09	48	-55.95	9.26	8:00:00	Humpback, Fin
06/01/09	49	-55.92	9.22	2:03:00	Humpback, Sperm, Fin, Orca
06/01/10	50	-56.19	9.08	2:02:00	Humpback, Sperm, Fin, Orca
06/01/10	51	-56.42	8.90	1:13:00	Humpback, Sperm, Orca
06/01/10	52	-56.44	8.30	8:00:00	Humpback , Sperm
06/01/11	53	-56.11	8.68	0:53:00	Humpback,
06/01/11	54	-56.92	8.73	1:07:00	Humpback, Sperm; (few)
06/01/11	55	-55.75	8.91	1:20:00	Humpback, Sperm; (few)
06/01/12	56	-55.71	8.98	0:20:00	No, failed
06/01/12	57	-55.74	9.00	0:53:00	Humpback (few)
06/01/12	58	-56.14	9.18	1:17:00	Humpback (few)
06/01/12	59	-56.68	8.68	2:03:00	Humpback, Sperm
06/01/12	60	-56.78	8.60	1:45:00	Humpback (few), Sperm
06/01/13	61	-56.96	8.46	1:30:00	Failed, faint Humpback
06/01/13	62	-57.35	8.08	1:26:00	No, failed early
06/01/13	63	-57.36	8.06	1:28:00	Humpback (few), Sperm
06/01/13	64	-57.55	7.96	2:03:00	Faint Humpback
06/01/14	65	-57.53	7.98	0:31:00	No, failed
06/01/14	66	-57.62	7.92	2:03:00	Humpback
06/01/14	67	-57.76	7.70	0:18:00	No, failed
06/01/14	68	-57.78	7.79	2:54:00	Humpback
06/01/15	69	-57.87	7.70	1:45:00	Humpback (few)

Table 11 continued. Summary of acoustic monitoring during 2005/2006.

Date YYMMDD	Station	Position Latitude (S)	Longitude (E)	Time monitored (HH:MM:SS)	Bio-Sounds Heard
06/01/15	70	-58.38	7.28	0:16:00	No, failed
06/01/15	71	-58.44	7.24	1:23:00	Sperm, Humpback (few)
06/01/15	72	-58.98	6.77	0:10:00	No, failed
06/01/15	73	-59.04	6.73	0:34:00	No, failed
06/01/15	74	-59.23	6.51	1:59:00	No
06/01/16	75	-59.36	6.45	1:16:00	No
06/01/16	76	-59.86	6.01	1:00:00	Sperm
06/01/16	77	-60.33	5.61	0:22:00	Sperm, failed
06/01/16	78	-60.72	5.25	1:00:00	Sperm
06/01/17	79	-65.18	2.72	1:40:00	No
06/01/17	80	-66.33	1.89	1:00:00	none
06/01/18	81	-68.44	4.49	8:01:00	Blue, seals
06/01/19	82	-68.51	4.79	3:27:00	Blue, Sperm, seals, Humpback?
06/01/19	83	-68.43	4.62	5:51:00	Blue (faint), Sperm, seals, unknown
06/01/20	84	-69.16	4.20	0:14:00	No, failed
06/01/20	85	-69.16	4.20	3:08:00	Blue, Sperm, seals, unknown*
06/01/20	86	-69.16	4.20	2:35:00	Blue, Sperm, seals, unknown*
06/01/20	87	-69.36	4.35	6:30:00	Blue, Sperm, seals, unknown^
06/01/20	88	-69.33	4.34	8:06:00	Blue, Sperm, seals, unknown^
06/01/24	89	-68.98	0.32	3:04:00	Blue (faint), Humpback (faint), seals, unknown”
06/01/24	90	-68.99	0.48	1:06:00	Blue (faint), Humpback (faint), seals, unknown”
06/01/24	91	-68.94	0.77	1:32:00	Humpback (faint), seals
06/01/24	92	-68.85	2.46	3:06:00	Blue (faint), seals
06/01/25	93	-69.00	2.87	1:16:00	seals
06/01/25	94	-69.38	3.27	3:40:00	Blue, seals
06/01/25	95	-69.51	3.77	3:59:00	Blue, seals”

Table 11 continued. Summary of acoustic monitoring during 2005/2006.

Date YYMMDD	Station	Position Latitude (S)	Longitude (E)	Time monitored (HH:MM:SS)	Bio-Sounds Heard
06/01/25	96	-69.55	3.75	4:06:00	Blue, seals"
06/01/25	97	-69.49	3.95	1:27:00	Blue, seals'
06/01/25	98	-69.49	4.10	3:06:00	Blue, seals'
06/01/26	99	-69.63	4.48	2:19:00	Blue, seals^
06/01/26	100	-69.66	4.54	0:49:00	Blue, seals^
06/01/26	101	-69.63	6.11	1:48:00	Blue, Sperm, seals
06/01/27	102	-68.35	10.98	2:24:00	Blue, Sperm, seals
06/01/29	103	-67.96	12.19	4:02:00	Blue, Sperm, seals*
06/01/29	104	-68.35	12.28	3:13:00	Blue, Sperm, seals*
06/01/29	105	-67.52	12.56	4:06:00	Blue, Sperm, seals
06/01/30	106	-67.55	13.30	3:46:00	Blue, Sperm, Humpback, seals
06/01/30	107	-67.66	13.79	2:05:00	Blue, Sperm, seals
06/01/30	108	-68.17	16.08	4:25:00	Blue, Sperm, seals
06/02/04	109	-69.25	15.63	2:15:00	Blue
06/02/05	110	-69.22	16.93	3:55:00	Blue
06/02/06	111	-69.17	17.52	2:43:00	Blue (few, faint)
06/02/08	112	-68.76	19.21	1:55:00	Blue, Sperm
06/02/08	113	-68.73	19.42	4:06:00	Blue, Sperm
06/02/09	114	-68.73	19.42	6:35:00	Blue, Sperm
06/02/09	115	-68.73	19.42	6:00:00	Blue, Sperm
06/02/09	116	-68.73	19.42	2:09:00	Blue, Sperm
06/02/10	117	-68.73	19.42	1:10:00	None
06/02/10	118	-68.73	19.42	1:38:00	None
06/02/12	119	-68.64	16.10	1:07:00	Sperm, crummy buoy
06/02/13	120	-68.75	14.15	3:46:00	Blue, Sperm*
06/02/13	121	-68.73	14.02	2:17:00	Blue (v. loud), Sperm*
06/02/13	122	-68.75	12.47	2:02:00	Blue (v. loud), Sperm
06/02/15	123	-61.05	14.33	2:02:00	Orca, type C
Total	127			271:55:00	

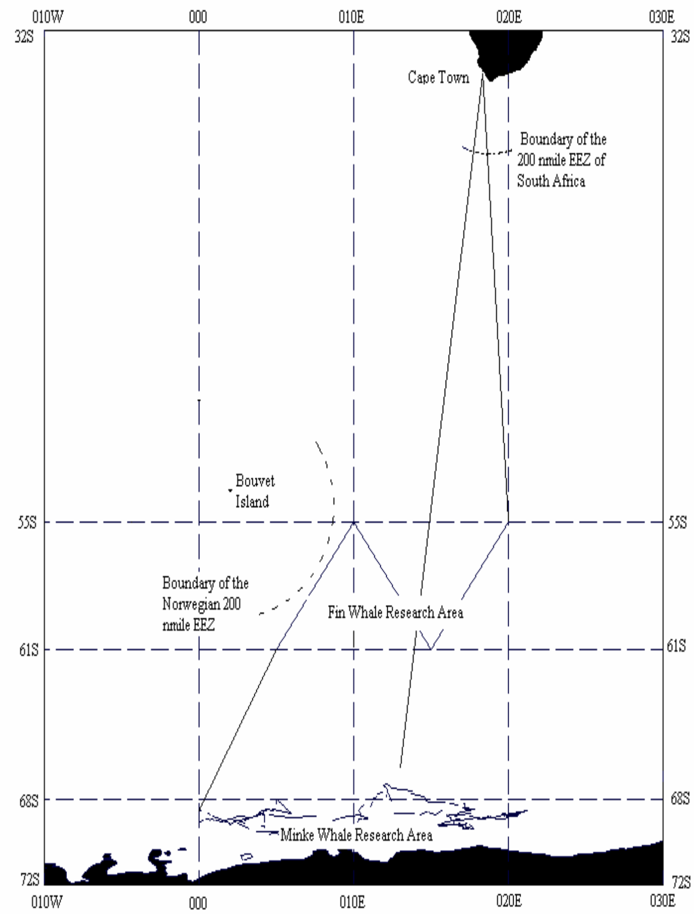
Table 12. Observations of marine debris south of latitude 55°S during 2005/2006.

Object	Date	Position	Size
Large orange buoy	29 December	55°07'S 019°49'E	-
Pink-orange fishing float	16 January	59°56'S 005°56'E	1 meter diameter
Small yellow float, faded	14 February	66°03'S 013°17'E	0.3 meter length
Large pink buoy	15 February	60°40'S 014°22'E	1.5 meter diameter

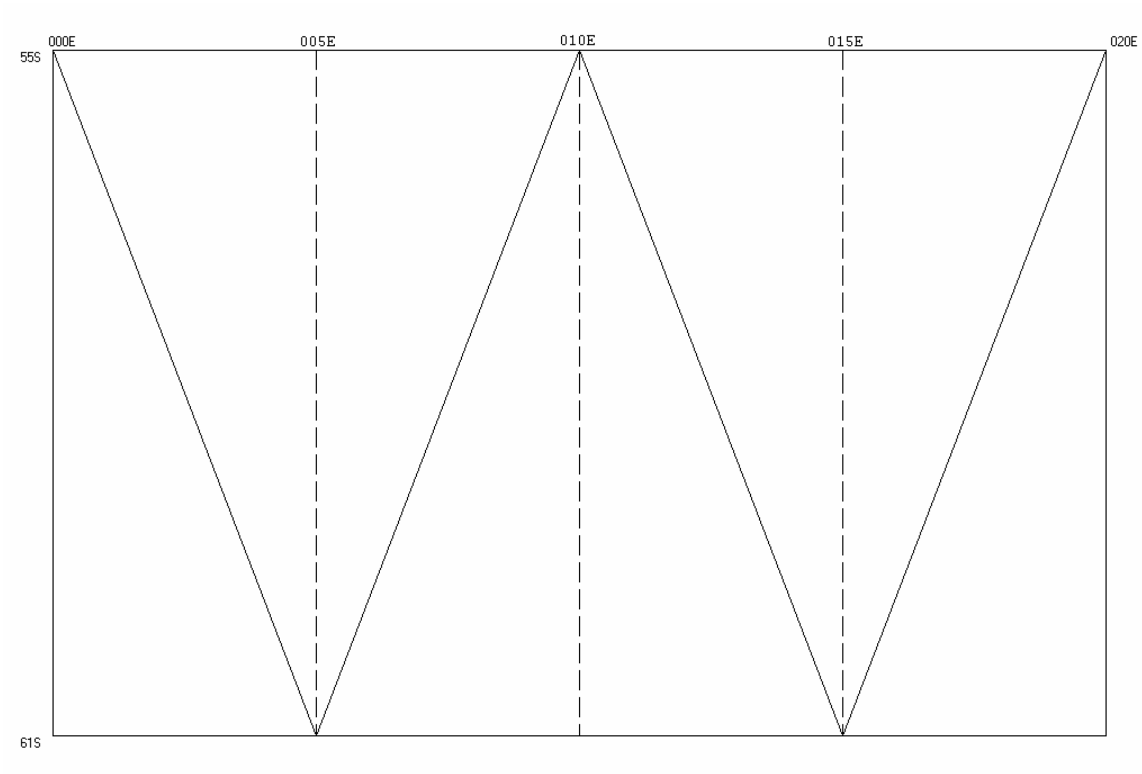
Table 13. Summary of video recording of blue whale sightings during 2005/2006.

Date	Sighting number	Group size	Numbers of animals recorded	Taped time (min:sec)	Tape number
19-Jan-06	001	4	3	0:12:04	1
20-Jan-06	014	2	2	0:00:43	1
20-Jan-06	016	3	3	0:12:20	1
24-Jan-06	002	3	1	0:03:33	1
24-Jan-06	003	4	2	0:03:24	1
24-Jan-06	011	2	2	0:09:05	1
25-Jan-06	002	1	1	0:04:10	1
25-Jan-06	004	2	2	0:22:32	1, 2
25-Jan-06	011	1	1	0:06:53	2
26-Jan-06	003	2	2	0:06:07	2
26-Jan-06	009	1	1	0:04:41	2
26-Jan-06	013	1	1	0:08:37	2
27-Jan-06	005	1	1	0:00:55	2
28-Jan-06	004	1	1	0:03:04	2
29-Jan-06	009	1	1	0:15:04	2, 3
29-Jan-06	001	2	2	0:07:56	3
29-Jan-06	027	4	4	0:12:35	3
30-Jan-06	007	2	2	0:16:07	3
30-Jan-06	012	1	1	0:04:07	3
30-Jan-06	028	4	3	0:09:33	3
9-Feb-06	001	3	3	0:04:30	3
9-Feb-06	002	3	3	0:21:47	4
9-Feb-06	004	1	1	0:02:13	4
9-Feb-06	006	1	1	0:05:20	4
9-Feb-06	007	2	2	0:12:29	4
9-Feb-06	008	1	1	0:08:33	4
9-Feb-06	011	2	1	0:04:53	4
12-Feb-06	033	1	1	0:06:55	4
13-Feb-06	014	1	1	0:08:53	5
13-Feb-06	017	2	2	0:12:03	5
13-Feb-06	035	1	1	0:10:27	5
			Total time	4:21:33	

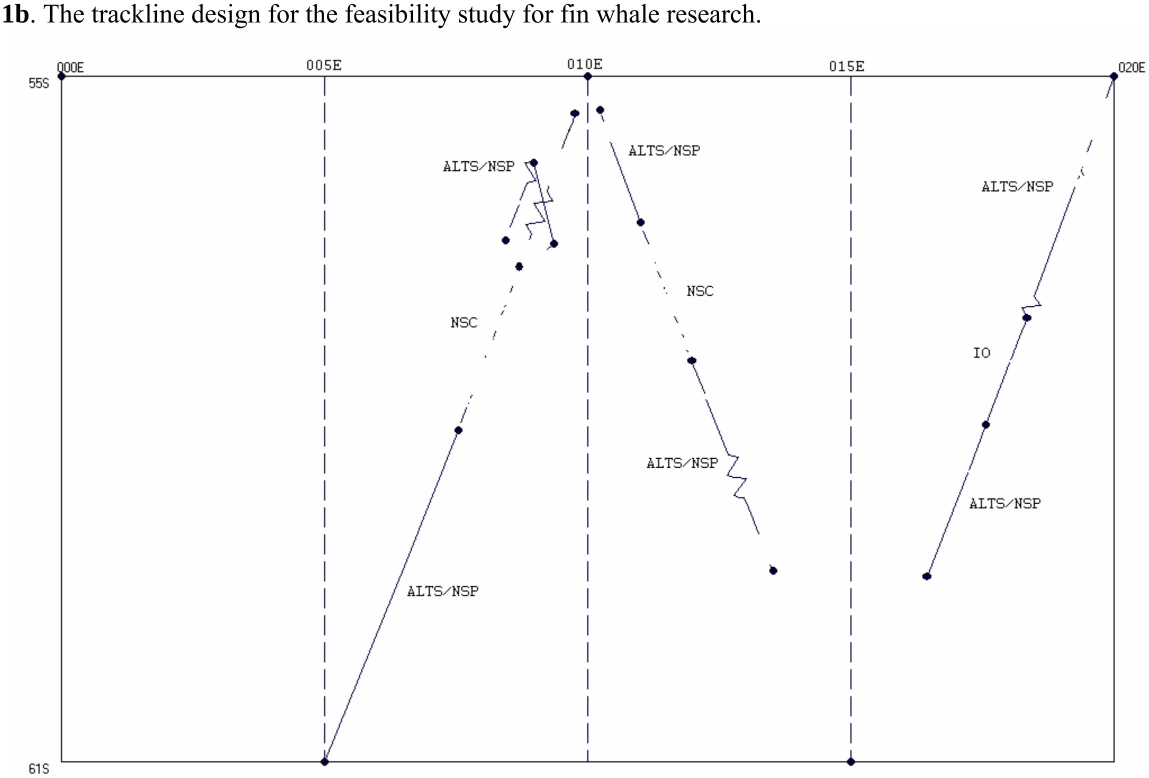
Figures 1a-d. Details of the cruisetracks. The black area represents land.



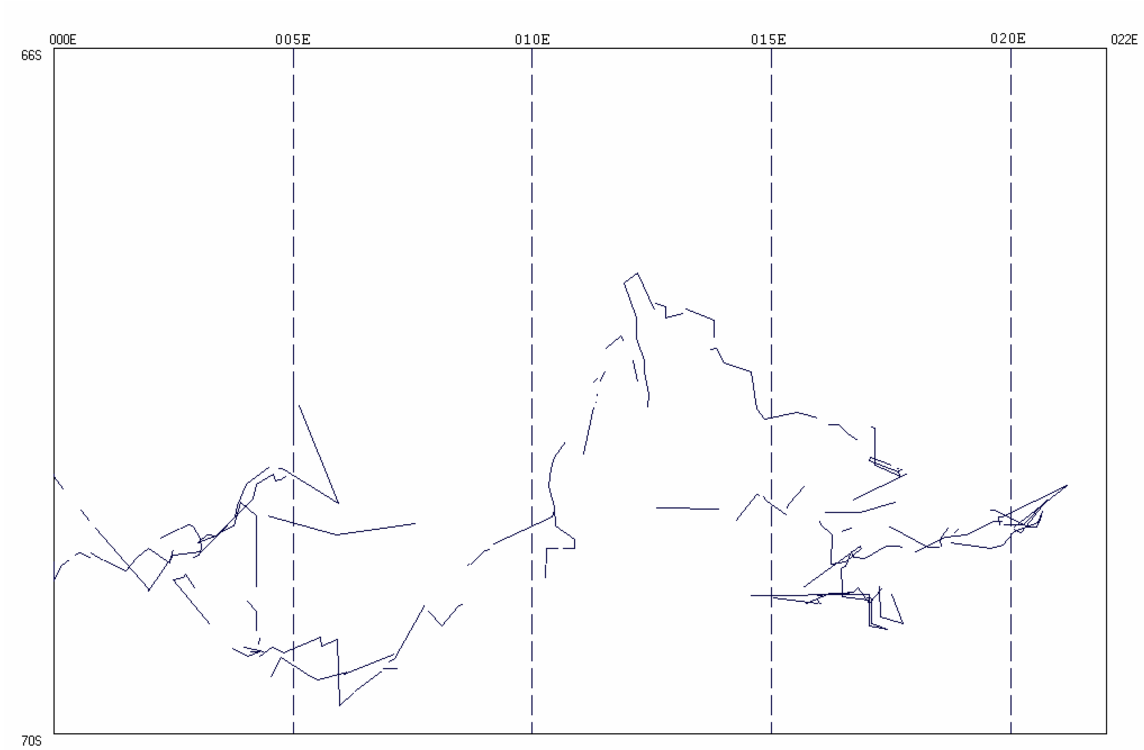
1a. The entire survey, including the transits to and from the Research Areas.



1b. The trackline design for the feasibility study for fin whale research.

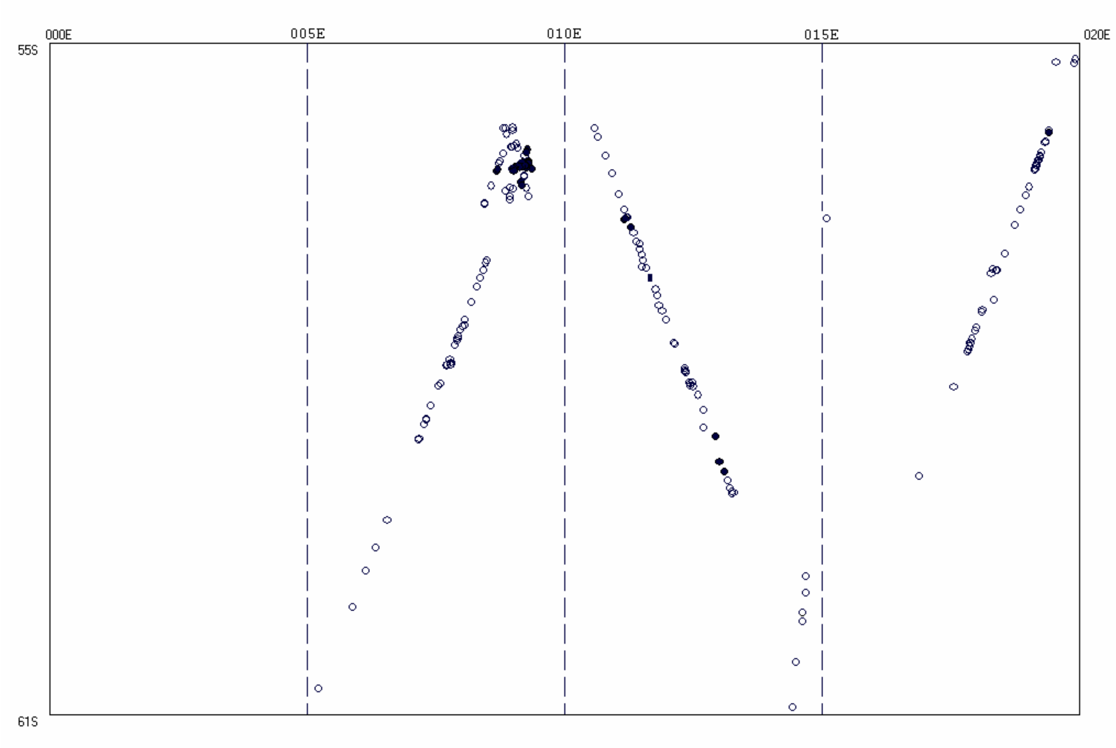


1c. Sections of the cruisetrack during the feasibility study for fin whale research covered on search effort. The filled circles indicate waypoints. Research modes are indicated as follows: ALTS/NSP (Adaptive line transect sampling in Passing mode); IO (Passing mode with independent observer); NSC (Closing mode).

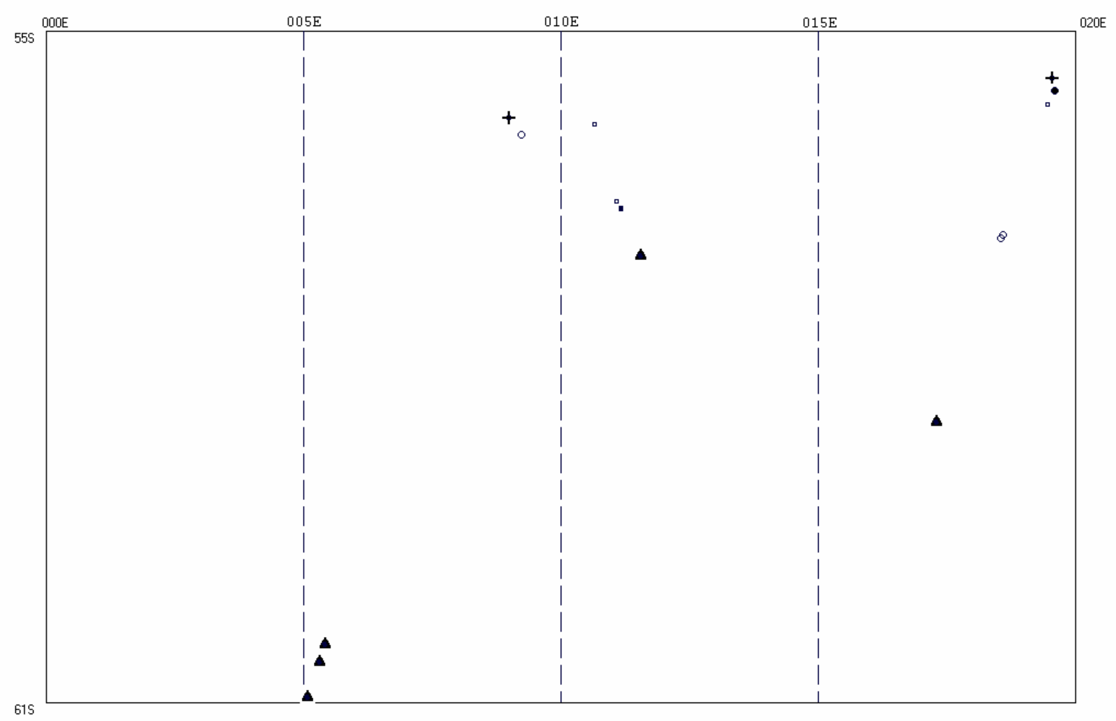


1d. Sections of the cruisetrack during the minke whale research component covered on search effort. The extent of the pack ice is not shown as re-survey of some areas was conducted and the position of the ice edge changed substantially between surveys. The research was mainly conducted in the vicinity of the ice edge, thus the position of the ice edge at the time of survey is indicated approximately by the tracklines.

Figures 2a-b. Positions of whale sightings in the fin whale research, including sightings on the survey cruisetracks and during transits.

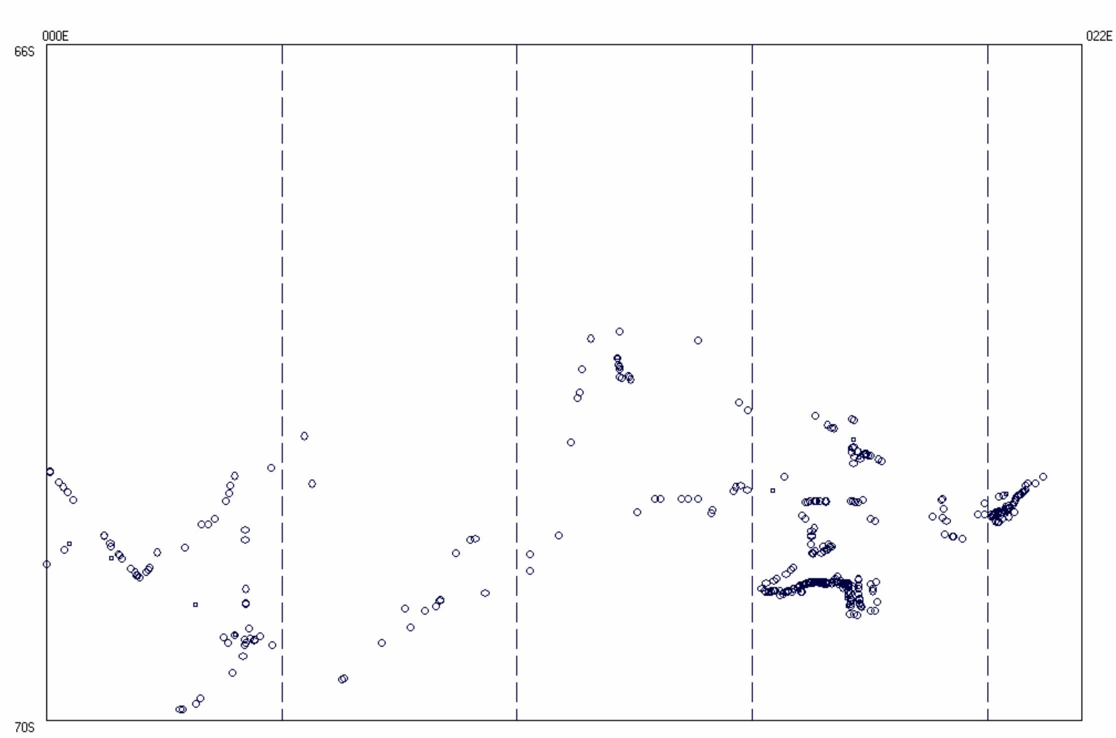


2 a. Positions of fin whale (●) and humpback whale (O) observed in the fin whale research area.

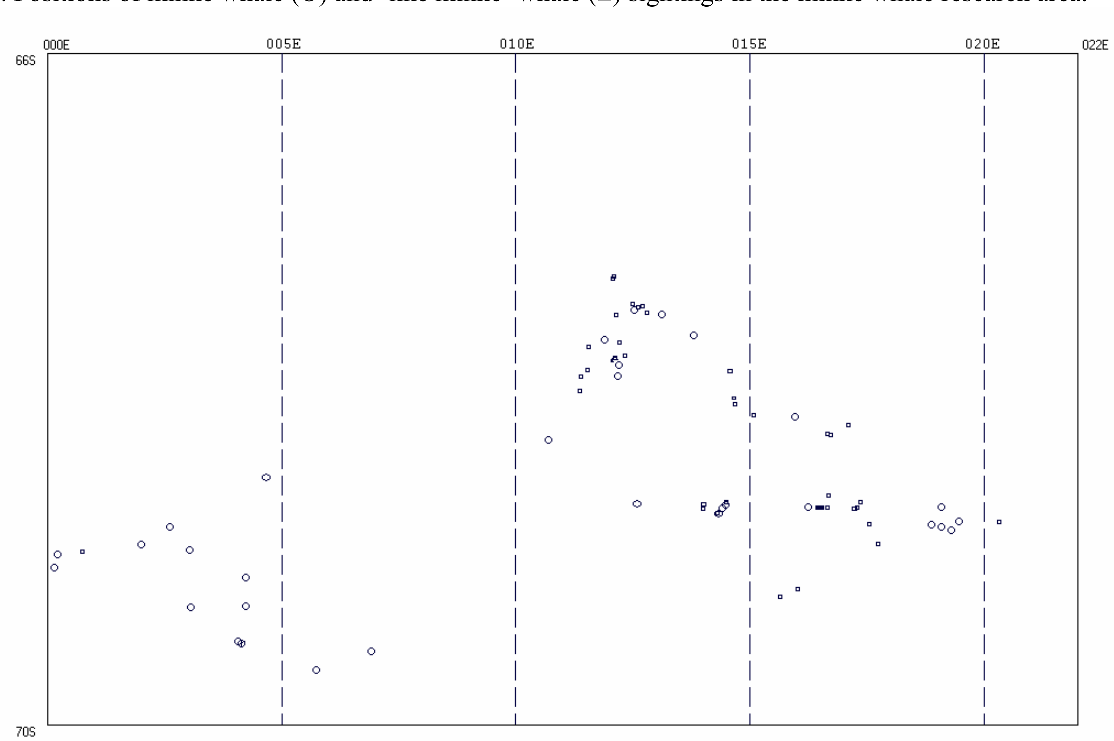


2 b. Positions of killer whale (O), Gray's beaked whale (●), *Mesoplodon sp.* (+), southern bottlenose whale (▲), minke whale-Antarctic and undetermined (□) and dwarf minke whale (■) observed in the fin whale research area.

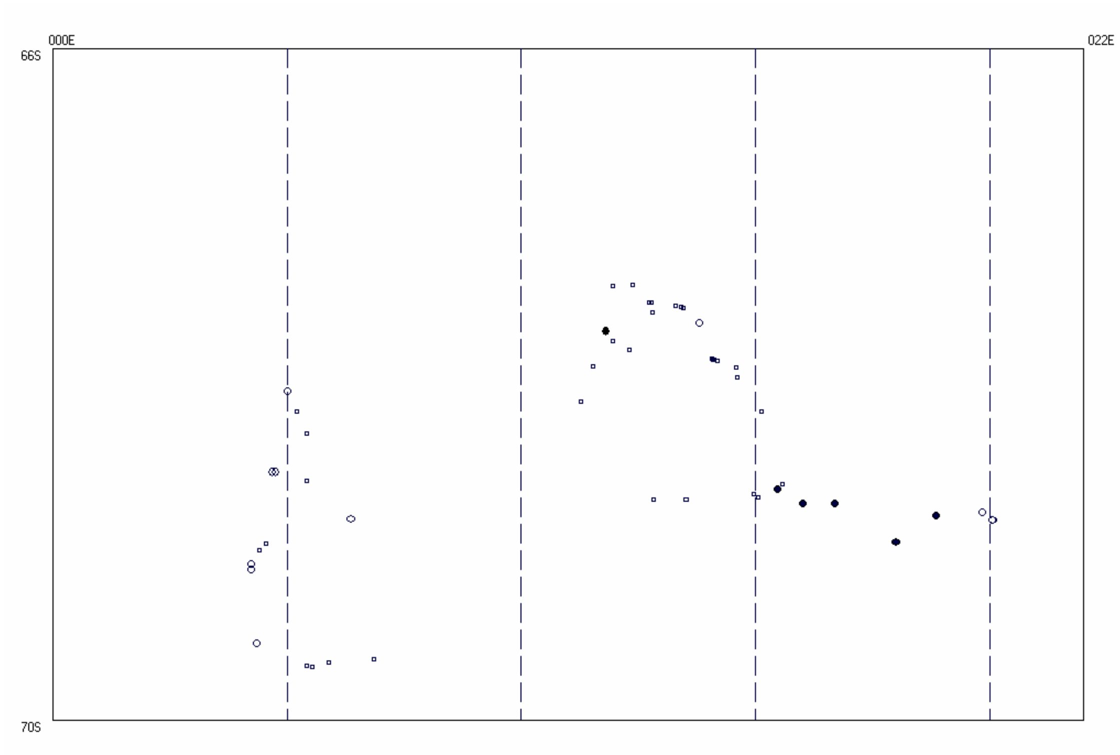
Figures 2c-e. Positions of whale sightings in the minke whale research.



2c. Positions of minke whale (O) and 'like minke' whale (□) sightings in the minke whale research area.



2d. Positions of blue whale (blue - true and undetermined) (O) and humpback whale (□) observed in the minke whale research area.



2e. Positions of sperm whale (□), killer whale (O) and southern bottlenose whale (●) observed in the minke whale research area.

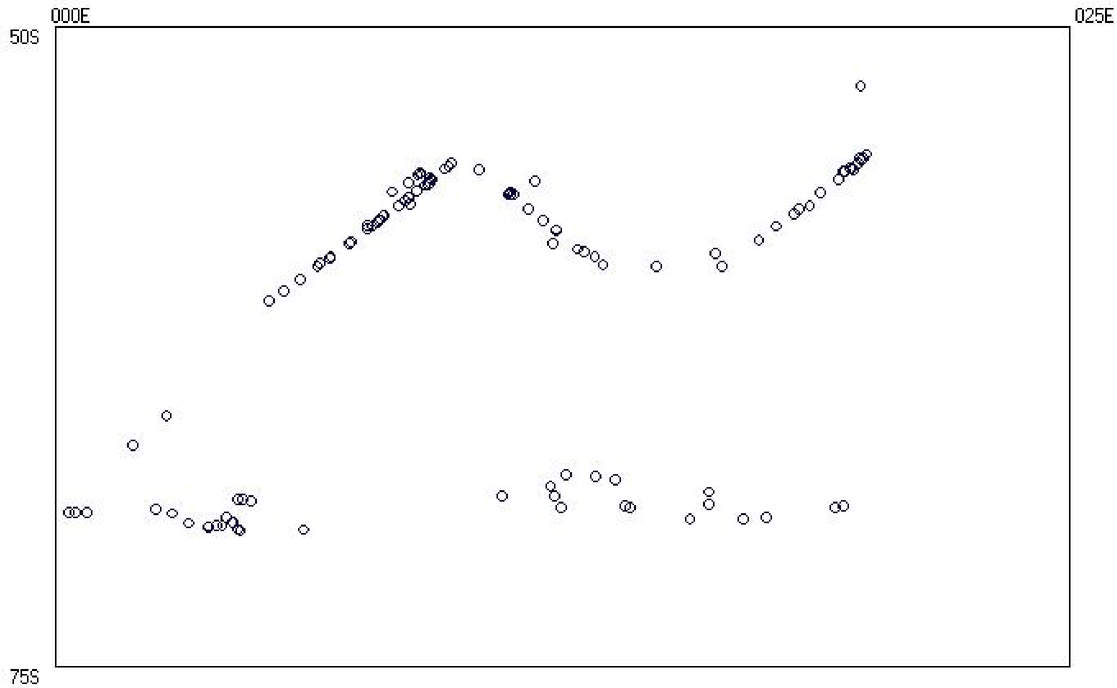


Figure 3a. Locations of all sonobuoys deployed during the cruise.

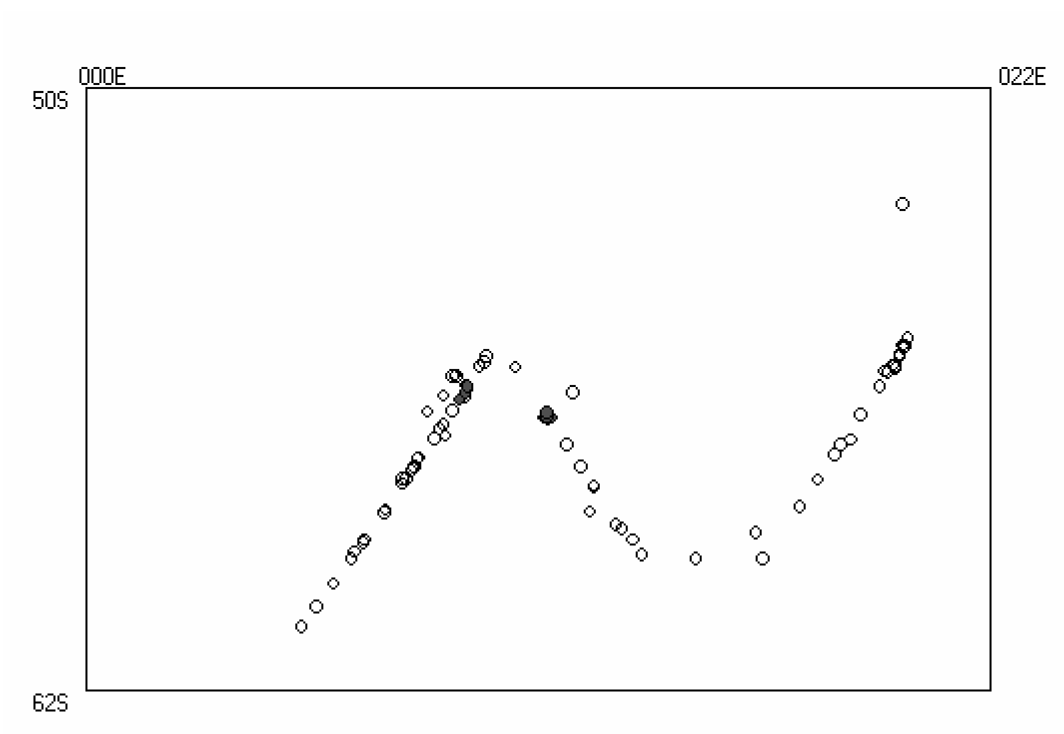


Figure 3b. Locations of sonobuoy deployments in the fin whale research area. Fin whale acoustic detections are shown as filled circles, deployments where no sounds were heard are shown as open circles.

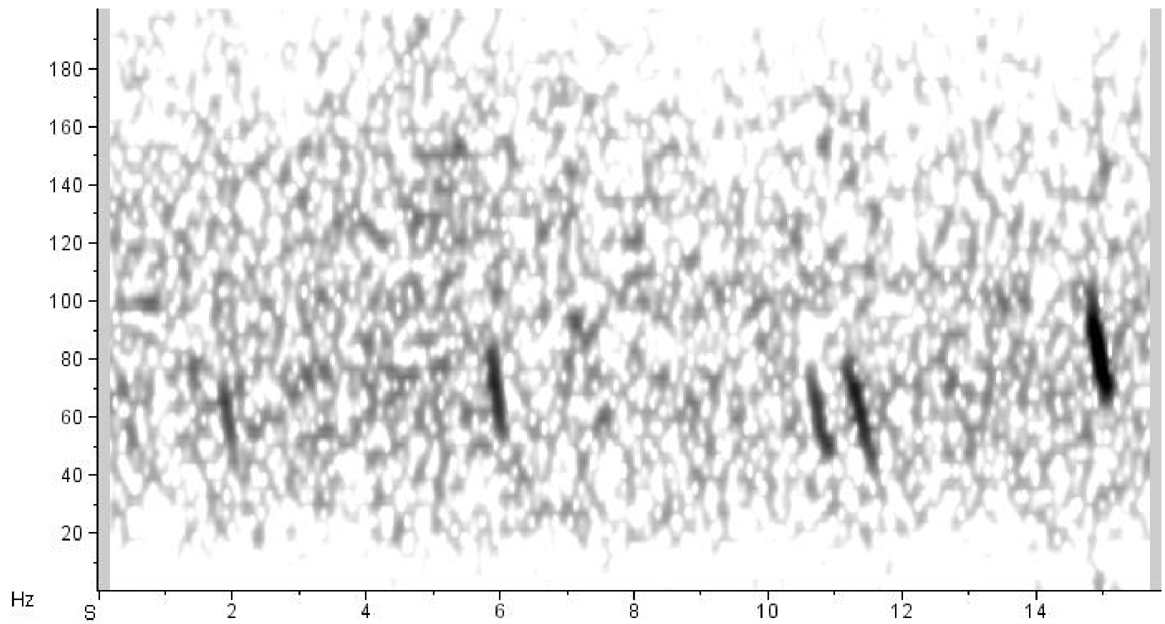


Figure 4. Spectrogram of five fin whale pulses recorded in the fin whale research area. This number of calls were seldom recorded in such a short time span (FFT 16394, 87.5% overlap, Hanning window).

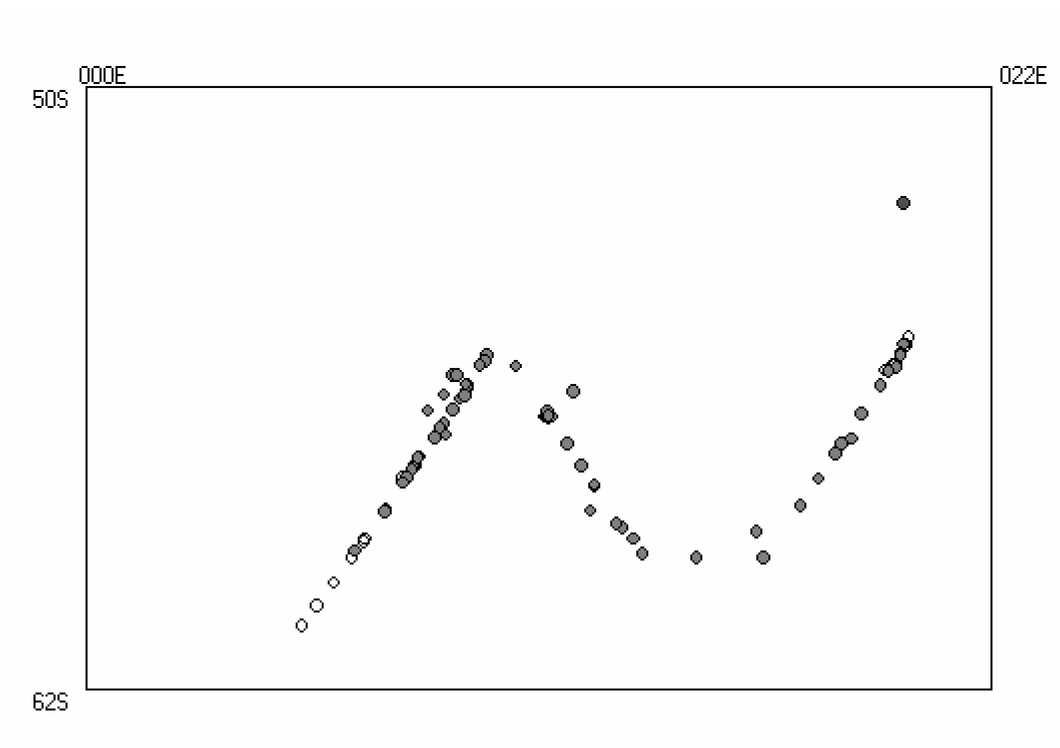


Figure 5. Acoustic detections of humpback whales on sonobuoys in the fin whale research area. Humpback acoustic detections are shown as filled circles.

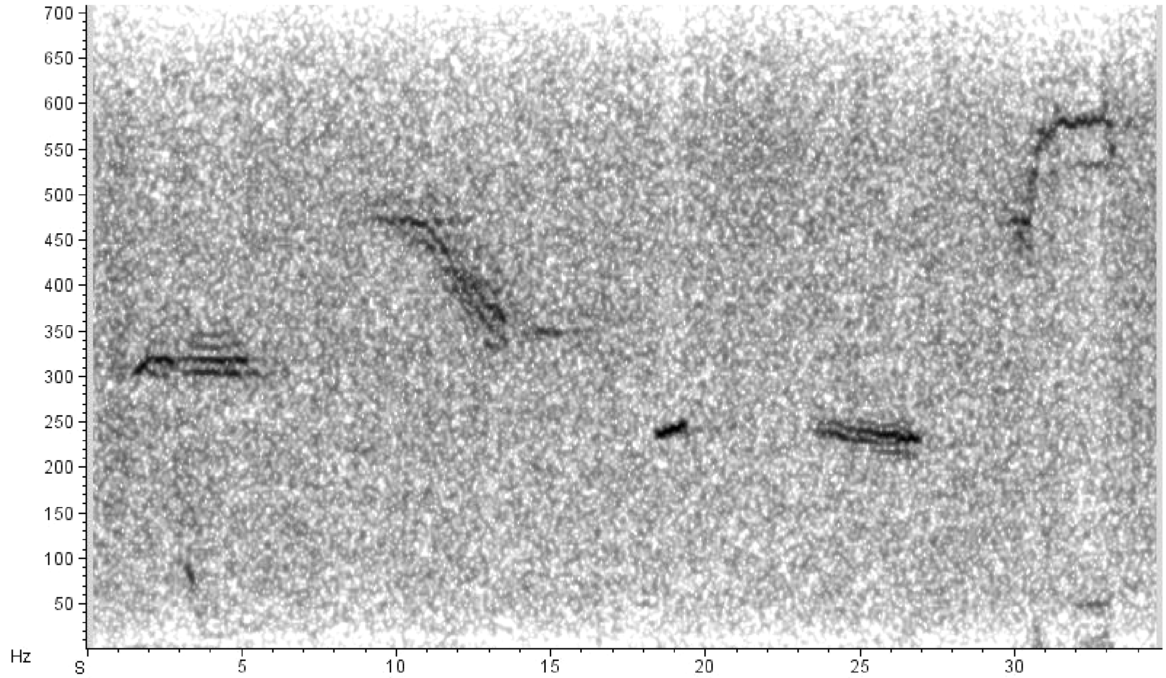


Figure 6. Examples of the five main humpback whale sounds recorded in the fin whale research area. The sounds in this example have been cut and pasted together as an illustration; these calls did not normally occur in this order (FFT 16384, 87.5% overlap, Hanning window).

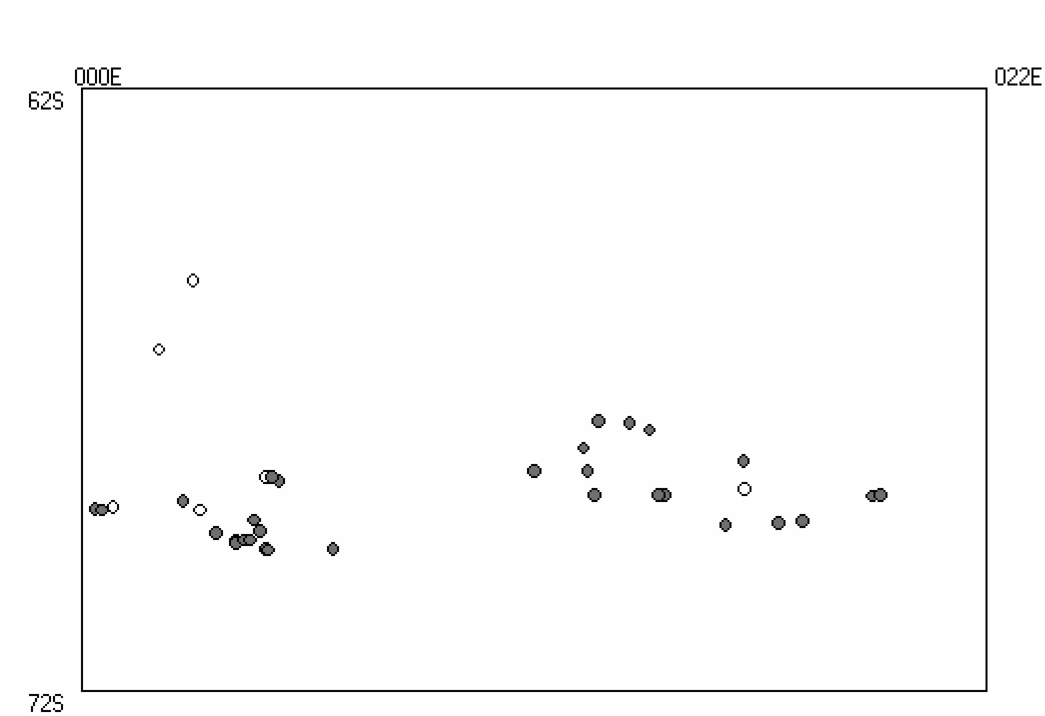


Figure 7. Acoustic detections of blue whales on sonobuoys in the minke whale research area. Blue whale acoustic detections are shown as filled circles.

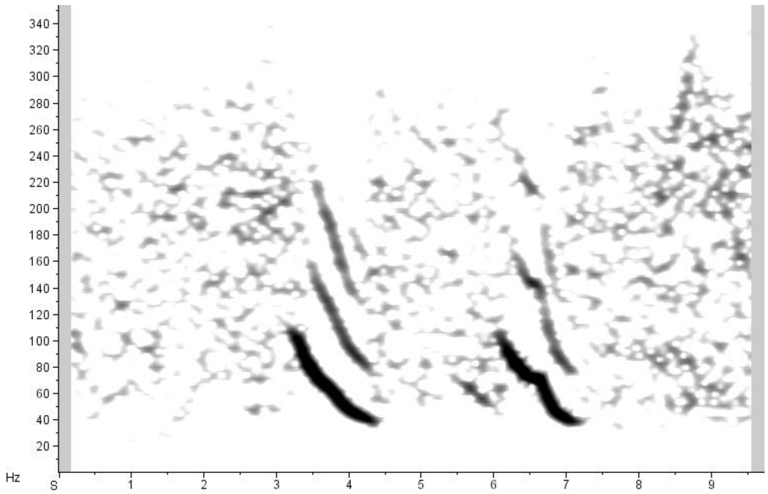


Figure 8. Spectrogram of two very loud downsweeps calls from Antarctic blue whales (FFT 32768 pts, 87.5% overlap, Hanning window).

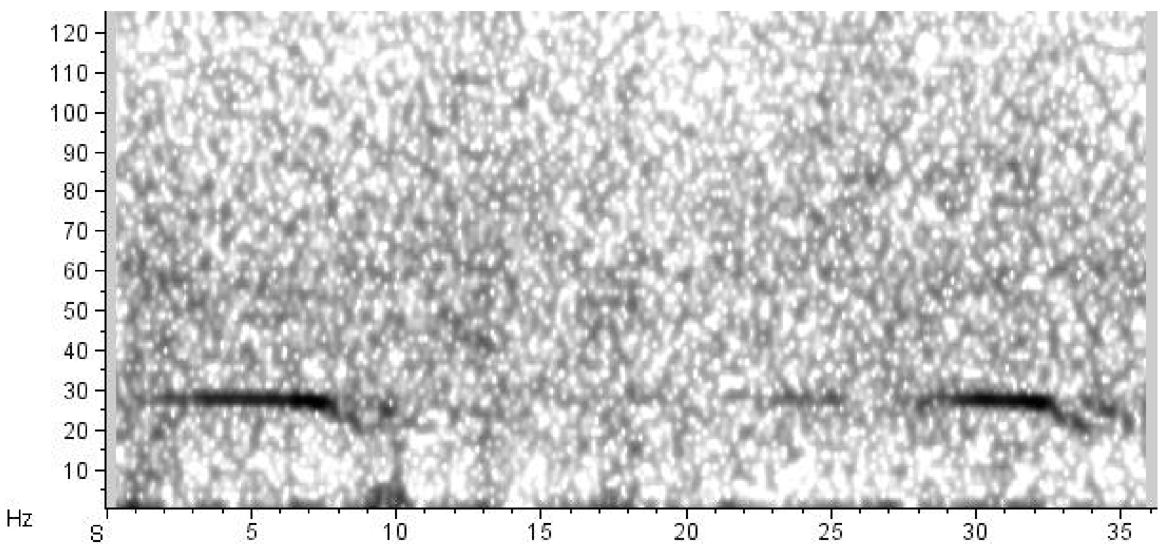


Figure 9. Two 28 Hz calls from Antarctic blue whales (spectrogram parameters same as Fig. 7).

Appendix A: Ship specifications and crew list

Ship specifications:

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

Crew list:

	Shonan Maru No.2
Captain	H. Komiya
Chief Officer	H. Eguchi
Second Officer	T. Koyanagi
Chief Engineer	S. Nakamura
First Engineer	T. Miura
Second Engineer	Y. Koga
Third Engineer	K. Takamatsu
Jr. Third Engineer	F. Shimoda
Chief Operator	Y. Tsuda
Boatswain	K. Wakatzuki
Quartermaster	K. Hasebe
Quartermaster	K. Tsuda
Sailor	H. Terashima
Sailor	F. Yamaguchi
Sailor	H. Seko
Sailor	K. Umetsu
No. 1 Oiler	S. Ando
Chief Steward	T. Emoto
Steward	S. Seizawa

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

Introduction

The 2005-2006 International Whaling Commission - Southern Ocean Whale and Ecosystem Research Program (IWC-SOWER) Cruise surveyed in IWC Antarctic Area III in December 2005, and January - February 2006. The main objectives of the 2005-2006 cruise were to: (1) carry out a series of survey experiments designed to improve and interpret estimates of Antarctic minke whale abundance from previous cruises; (2) undertake a feasibility study for fin whale research in waters north of 60°S, involving a sighting survey, acoustic sampling and biopsy sampling of the skin for genetic analyses; (3) continue the research on blue whales (including collecting biopsy samples, acoustic data, photographs for identifying individual animals and behavioural data); and (4) continue research on humpback whales. The research area for the fin whale study was the area bounded by latitudes 55°S and 61°S and longitudes 000° and 020°E. The minke whale research area was in the vicinity of the pack ice edge longitudes 000° and 020°E. (Anon. 2005a). Details of the entire cruise are reported in Ensor *et al*. (2006)

The vessel from which the research was conducted (the *Shonan Maru No.2*) used Cape Town as the homeport for the cruise. The vessel passed through the 200 nmile Exclusive Economic Zone (EEZ) of South Africa on the transits to and from 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 ship departed Cape Town on 22 December 2005 and returned on 22 February 2006.

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

A description of the research procedures and data recording methodology is given in Anon. (2005b).

Results

The ship departed Cape Town at 17:30 hrs on 22 December 2005, two days behind schedule after waiting for a delayed freight consignment of equipment to arrive. Within the zone windy conditions restricted research; 4.35 hrs of research in NSC mode (48.9 nmiles) was conducted. The vessel departed the EEZ on 23 December at position 37°56'S, 018°15'E at 16:24 hrs.

On return from the Antarctic the *Shonan Maru No.2* intersected the EEZ at 08:42 hrs on 20 February at position 37°40'S, 017°35'E. Windy conditions were again experienced; 4.76 hrs of research was conducted and 55.2 nmiles were covered in NSC mode. The *Shonan Maru No.2* and arrived Cape Town at 08:30 hrs on 22 February 2006.

In the EEZ`of South Africa, during both transits, a total of 9.11 hours of research was conducted and 104.1 nmiles were covered in NSC mode. Eleven sightings were made within the South African EEZ (Table A). Details of each cetacean sighting are given in Table B.

References

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

Anon. 2005b. 2003-2004 IWC-SOWER Cruise. Information for Researchers. Available from the IWC Secretariat, Cambridge, United Kingdom.

Ensor P., Komiya H., Olson P., Sekiguchi K., Stafford K. 2006. 2005-2006 IWC-Southern Ocean Whale and Ecosystem Research (IWC-SOWER) Cruise. Available from the IWC Secretariat, Cambridge, United Kingdom.

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

Species	NSC		OE		Total	
	G	A	G	A	G	A
Humpback whale	1	2	3	11	4	13
Southern right whale	-	-	1	1	1	1
Sperm whale	4	6	-	-	4	6
Unidentified Ziphiid	1	1	-	-	1	1
Unidentified large whale	-	-	1	1	1	1

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

Date	Time	Mode	Species	Number	Position	
					Latitude	Longitude
22 December 2005	18:19	OE	Humpback whale	2	33°51.98'S	018°20.42'E
22 December 2005	18:23	OE	Humpback whale	2	33°51.68'S	018°19.67'E
22 December 2005	18:46	OE	Humpback whale	7	33°51.51'S	018°17.68'E
22 December 2005	18:46	OE	Southern right whale	1	33°51.51'S	018°17.68'E
23 December 2005	08:18	NSC	Humpback whale	2	36°31.13'S	018°13.27'E
23 December 2005	09:50	OE	Unidentified large baleen whale	1	36°44.98'S	018°09.34'E
21 February 2006	10:37	NSC	Unidentified Ziphiid	1	34°46.54'S	017°55.82'E
21 February 2006	10:47	NSC	Sperm whale	1	34°45.06'S	017°55.83'E
21 February 2006	11:16	NSC	Sperm whale	2	34°39.65'S	017°56.90'E
21 February 2006	11:20	NSC	Sperm whale	1	34°38.76'S	017°56.33'E
21 February 2006	11:21	NSC	Sperm whale	2	34°38.62'S	017°56.23'E

Appendix C: Recommendations for direct data acquisition

To earnestly make electronic data acquisition the primary recording system during SOWER may mean more changes to the current system than were originally envisioned. For example, currently when a sighting is detected the upper bridge records the time (on paper form) and presses a buzzer to alert the bridge officer who writes down the ship's position. A significant attribute of Wincruz is that the exact time and (ship) position of a sighting are recorded in a single keystroke. A system of networked computers between the upper bridge and bridge would allow each platform to see what is happening. A computer on the bridge would allow the officer to enter effort data directly. Weather data could also be entered directly hourly by the officer and when changes are observed by the researchers. However, the crucial change in adopting a direct acquisition system is that the electronic data become the primary data and are not edited to reflect what is recorded on paper.

Since Wincruz has been used successfully for so many other cruises (including 1999-2000 IWC/CCAMLR Synoptic Survey) it seems reasonable to continue working to further customize Wincruz for SOWER. However, the challenge of changing the way data are collected during SOWER may warrant a thorough overall with new methods and proposed software developed during a meeting of steering committee representatives, analysts, and field personnel (IWC and Japanese).

Wincruz needs further modifications to work effectively. These include:

1) Each sighting record visible in one window (not four)

2) The ability to switch between sighting records by entering the sighting number

3) Abbreviated data to be recorded during passing mode (boxes that are usually filled with '999' during passing mode could be left off the record)

4) Modifications to allow for faster recording of re-sights during IO and BT modes

5) Specialized summary programs compatible with SOWER-modified Wincruz to tabulate data (the current versions of summary programs from Southwest Fisheries did not work accurately).

Appendix D. Acoustics equipment

Per an email from Charles Greene (Greeneridge Sciences), neither of the IWC radios were modified for DiFAR reception, rather they were both modified in 1998 to have a flat response from 10 Hz to 20 kHz. The signal from the modified output of both of these radios seemed saturated whether sent through the amplifier boxes or not. Various combinations of recording level and radio/amplifier pairings were tried but to no avail. Since the low frequencies were very important to this project, the modified output was nevertheless used. Recordings were monitored visually on a spectrogram and audibly via headphones. Playback of signals indicated that they were acceptable for time and frequency measurements although noisy.

Under good sea conditions, reception range from the ship with one buoy in the water was about 20 nmiles (15 nmiles for very good signal reception). With two buoys in, it was closer to 12 nmiles.

The amplifier boxes require 9 V batteries; the acoustician needs to buy some before the cruise.

Appendix E. Biopsy skin and blubber samples from IWC-SOWER cruise 2005/2006. X = 1 sample. Totals: 147 skin samples for IWC (74 in DMSO, 73 frozen) and 146 skin samples for Japan (146 frozen). 94 blubber samples for Japan (frozen) and 7 blubber samples for IWC (frozen).

Sample #	SKIN				BLUBBER		NOTES
	IWC			JAPAN	IWC	JAPAN	
	DMSO-LG	DMSO-SM	FROZEN	FROZEN			
101	X			X		no	
102	X			no		X	
103	no			X		X	
104	X			X		no	
105	2 samples			2 samples		2 samples	
106	X			no		no	
107	X			X		no	
108	X			X		X	
109	X			X		no	
110	X			X		X	
111	X			X		no	
112	X			X		X	
113	X			X		no	
114	X		X*	X		no	* 1/3 skin refrigerated for Peter Best
115	X			X		X	
116	X			X		X	
117	no		*	no		no	* This entire sample for P. Best. 1/2 frozen, 1/2 refrigerated.
118	X			X		no	
119	X			X		X	
120	X			X		X	
121	X			X		X	
122	X			X		no	
123	X			X		no	
124	X			X		X	
125	2 samples			2 samples		2 samples	
126	X			X		X	
127	X			X		X	
128	X			X		no	
129	X			X		no	
130	X			X		no	
131	X			X		X	
132	X			X		X	
133	X			X		X	
134	X			X		X	
135	X			X		no	
136	X			X		no	

137	X			X		X	

Continued. Biopsy skin and blubber samples from IWC-SOWER cruise 2005/2006.

Sample #	SKIN				BLUBBER		NOTES
	DMSO-LG	IWC DMSO-SM	FROZEN	JAPAN FROZEN	IWC	JAPAN	
138	X			X		no	
139	X			X		X	
140	X			X		X	
141	X			X		no	
142	X			X		X	
143	X			X		no	
144	X			X		X	
145	X			X		X	
146	VOID - NO SAMPLE WITH THIS NUMBER						
147	VOID - NO SAMPLE WITH THIS NUMBER						
148		X		X		X	
149		X		X		no	
150		X		X		X	
151		X		X		no	
152		X		X		X	
153		X		X		X	
154		X		X		X	
155		X		X		X	
156		X		X		no	
157		X		X		X	
158		X		X		X	
159		X		X		X	
160		X		X		X	
161		X		X		no	
162		X		X		X	
163		X		X		X	
164		X		X		no	
165		X		X		X	
166		X		X		no	
167		X		X		X	
168		X		X		X	
169		X		X		no	
170		X		X		X	
171		X		X		X	
172		X		X		X	
173		X		X		no	
174		X		X		no	
175		X		X		X	
176		X		X		X	
177			X	X		X	
178			X	X		X	
179			X	X		X	
180			X	X		no	

181			X	X		2 samples	

Continued. Biopsy skin and blubber samples from IWC-SOWER cruise 2005/2006.

Sample #	SKIN				BLUBBER		NOTES
	DMSO-LG	IWC DMSO-SM	FROZEN	JAPAN FROZEN	IWC	JAPAN	
182			X	X		no	
183			X	X		no	
184			X	X		X	
185			X	X		no	
186			X	X		X	
187			X	X		X	
188			X	X		X	
189			X	X		X	
190			X	X		X	
191			X	X		no	
192			X	X		no	
193			X	X		X	
194			X	X		no	
195			X	X		no	
196			X	X		X	
197			X	X		X	
198			X	X		X	
199			X	X		X	
200			X	X		no	
201			X	X		X	
202			X	X		X	
203			X	X		no	
204			X	X		X	
205			X	X		X	
206			X	X		X	
207			X	X		no	
208			X	X		X	
209			X	X		X	
210			X	X		X	
211			X	X		X	
212			X	X		X	
213			X	X		X	
214			X	X		no	
215			X	X	X	X	
216			X	X	X	X	
217			X	X		no	
218			X	X		no	
219			X	X		X	
220			X	X		no	
221			X	X		X	
222			X	X		no	
223			X	X		X	
224			X	X		X	

225			X	X		X	

Continued. Biopsy skin and blubber samples from IWC-SOWER cruise 2005/2006.

Sample #	**SKIN**				**BLUBBER**		NOTES
		IWC		JAPAN	IWC	JAPAN	
	DMSO-LG	DMSO-SM	FROZEN	FROZEN			
226			X	X		X	
227			X	X		no	
228			X	X	X	X	
229			X	X	X	X	
230			X	X	X	X	
231			2 samples	2 samples		X	
232			X	X		no	
233			X	X		no	
234			X	X		X	
235			X	X		no	
236			X	X		X	
237			X	X		no	
238			X	X		no	
239			X	X		no	
240			X	X		no	
241			X	X		X	
242			X	X	X	X	
243			X	X	X	X	
244			X	X		X	
245			X	X		X	
246			X	X		no	
247			X	X		X	
248			X	X		no	