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Research plan for the NEWREP-A dedicated sighting survey in the Antarctic in 2016/17

Takahashi Hakamada, Koji Matsuoka and Luis A Pastene

INTERNATIONAL WHALING COMMISSION

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TAKASHI HAKAMADA, KOJI MATSUOKA AND LUIS A PASTENE

Institute of Cetacean Research, Toyomi 4-5, Chuo-ku Tokyo, 104-0055, JAPAN

Contact e-mail: hakamada@cetacean.jp

ABSTRACT

A systematic vessel-based sighting survey is planned in the Antarctic for the 2016/17 austral summer season by Japan as a part of the NEWREP-A. The main objective of this cruise is to examine the distribution and estimate the abundance of large whales for the management and conservation purposes. Krill and oceanographic surveys will be also conducted along the track-lines of the sighting survey. The feasibility studies of biopsy sampling and telemetry of Antarctic minke whale started in 2015/2016, will continue during this survey. The survey will be conducted using two research vessels, *Yushin-Maru No. 3* (*YS3*) and an undetermined vessel with similar platforms, and will involve Area V (130°E-170°W). Whales sighting will be conducted under passing and IO modes. Routine biopsy sampling and photo-id of large whales will be also conducted. The report of the sighting survey will be submitted to the 2017 IWC SC meeting.

KEY WORD: ANTARCTIC MINKE WHALE, SURVEY-VESSEL, ANTARCTIC

INTRODUCTION

The NEWREP-A includes a dedicated whale sighting component aimed to produce abundance estimates of Antarctic minke whale and other large whales species, and to develop spatial distribution models (SDM). Abundance information will contribute to the ecosystem models as well as providing direct input for the SCAA and the RMP for Antarctic minke whales.

There are two NEWREP-A objectives related to abundance estimates. One is Objective I (i): Abundance estimates for Antarctic minke whales taking into account of g(0) and additional variance and another is Objective II (ii): Abundance estimate of some cetacean species as input data for ecosystem modelling (Government of Japan, 2015a). Abundance estimates require sighting data collected in a systematic manner under the guidelines agreed by the International Whaling Commission Scientific Committee (IWC SC) (IWC, 2012).

The NEWREP-A review workshop made the following recommendations regarding the sighing survey (IWC, 2015b):

a) Every effort be made to estimate g(0) for the other whale species, at least to determine rather than assume whether it is significantly different from one.
b) The survey design and analysis methods be carefully considered to enable the survey results to have multiple uses.
c) Carefully consider a number of options for survey design and methods taking into account: (i) the experience gained from the several years of data analysis before the Scientific Committee adopted abundance estimates from the previous IWC IDCR/SOWER cruises; (ii) the developments in spatial modelling approaches; (iii) the experience of previous multi-disciplinary survey efforts; (iv) the recommendations from the JARPAII review; (v) the possibility of incorporating more focused surveys to address specific issues in some years; (vi) consideration of whales within the ice; (vii) updated power analyses of the effects of survey interval and

estimation of trend to determine necessary levels of effort and survey design in the future (including consideration of the regions outside the core study area (additional longitudinal range in Areas III, VI, and coverage north of 60°S).

d) Work closely with the IWC Scientific Committee before finalising their survey approaches.

e) Ensure that future survey plans submitted to the Scientific Committee follow fully the guidelines for such survey plans, including incorporating proposed track lines - since the dedicated sighting survey/echo sounder platform will be separated from the sighting/sampling vessels, sabotage should not be an issue.

Same as in the case of the 2015/16 dedicated sighting survey in Area IV, the 2016/17 survey will respond the recommendations above as much as possible, and obviously the design and implementation will follow the 'Requirements and Guidelines for Conducting Surveys and Analyzing Data within the Revised Management Scheme (RMS)' (IWC, 2012), as recommended by the NEWREP-A review workshop. A summary of how these protocols are followed was provided in Government of Japan (2015b).

While the main aim of the survey is to obtain sighting data for abundance estimates of large whales, the same platform will be used for carrying out krill and oceanographic surveys in a similar manner as in the previous season. The feasibility studies of biopsy sampling and telemetry of Antarctic minke whale started in 2015/2016, will continue during this survey.

The main body of this document contains a draft research plan for the 2016/17 dedicated sighting survey in Antarctic Area V, prepared for consideration of the IWC SC. The plan for other research activities are presented in the appendices to this report.

RESEARCH PLAN FOR DEDICATED SIGHTING SURVEY

This section describes the survey procedure and design for dedicated sighting survey of whales under this multi-purpose survey. Some of the Review Panel's recommendations are taken into consideration in this survey while others will be considered in future surveys or during the analyses.

Research area

Antarctic Area V (130°E-170°W) included the Ross Sea will be covered by the 2016/17 survey.

Research period and schedule

The duration of the survey including transit is planned to be 130 days. The number of days dedicated to research in Antarctic waters is planned to be 80 days. The schedule of the survey is as follow:

Date	Activity
Mid November	Vessels leave Japan
Mid December	Start survey in the research area
Early March	Complete survey in the research area
Early April	Vessels return to Japan

Research vessels

Two specialized vessels will be available for this survey, the *Yushin-Maru No. 3* (*YS3*) and an undetermined vessel similar to *YS3* (Figure 1 and Table 1). Both vessels are equipped with top barrel (TOP), independent observer platform (IOP) and upper bridge platform (UBP). The *YS3* is also equipped with instruments required for the krill and oceanographic surveys (see Appendix 1 for details).

Researchers on board

For the sighting activities including experiments in IO mode, two researchers are required on board each vessel. An additional researcher to conduct the krill and oceanographic surveys is required on board the *YS3*. Koji Matsuoka (Institute of Cetacean Research) is the responsible person for these surveys. He will be the oversight person on behalf of the IWC SC.

Guidelines for sighting survey
The plan outlined here follow the 'Requirements and guidelines for conducting surveys and analyzing data within the Revised Management Scheme (RMS)' (IWC, 2012), as recommended by the NEWREP-A Review Panel. Summary was provided in Government of Japan (2015b) on the proposed sighting procedure and design in the context of the IWC requirements and guidelines.

Stratification of the research area
The research area is divided into a western and eastern sector at 165°E. Each sector is further divided into a southern and northern strata. At the western sector the boundary between southern and northern strata is defined by a line 45 n.miles from the ice-edge. At the eastern sector the boundary is defined at 69°S (Figure 2).

Track line design
The survey track line for each vessel will consist of two legs in the northern stratum at 5° longitudinal degree intervals and four legs in the southern stratum at 2°30' longitudinal degree intervals in a 10 degrees longitudinal band following Nishiwaki *et al*. (2014). The two vessels alternately survey the northern and southern strata each crossing the track line at the way-point between two strata (Figure 3). Track lines are decided based on the original longitude line, which was selected at random. The interval of legs and number of legs in each stratum could be changed in consideration of delay caused by bad weather conditions and other factors. The proposed track lines in sectors given the assumed ice edge and strata of Area V are shown in Figure 4. Note that these tracks are based on 'guess estimated' ice conditions in an unpredictable area, especially the Ross Sea. Considerable flexibility may be needed by the Cruise Leader in determining the final cruise tracks.

In principle, the South East stratum in Area V (Ross Sea) is defined as an area south of 69°S and between 165°E and 170°W surrounded by ice edge. The stratum is divided into western and eastern part by 180° longitudinal line. A longitudinal zig-zag line was allocated in the western and eastern sector, respectively (Figure 4). Track lines are decided based on the original longitude line, which was selected at random in the western and eastern part of the stratum, respectively. The interval of legs and number of legs in each stratum could be changed in consideration of delay caused by bad weather conditions and other factors.

Research hours, acceptable weather conditions and number of observers on effort
Research hours will be consistent with those in previous IWC/SOWER surveys. Research will start 60 minutes after sunrise and will end 60 minutes before sunset, with a maximum 12-hour research day (approximately 06:00-18:00). Time-zone changes will be recorded in 30-minute intervals, effective from 01:00h. Schedules will adhere to local 'ship' time ranging between +9.0 and +12.0 GMT. Data collected throughout the survey and all associated reporting will be in accord with the local 'ship' time. The searching activity was conducted when the weather conditions were suitable for observations: visibility (minke whale visibility) better than 1.5 n. miles and the wind speed less than 20 knots in northern strata and 25 knots in southern strata.

The vessel speed during the sighting survey will be 11.5 knots with slight adjustment to avoid vibration of the vessels.

Survey modes
Sighting activities onboard the vessels will be classified into two principal types: 'On-effort' and 'Off-effort'. On-effort means sightings activities executed under weather and sea state conditions considered acceptable. Off-effort means all activities that are not On-effort. All sightings to be recorded On-effort will be classified as 'Primary sightings'. All other sightings will be classified as 'Secondary sightings'. Sighting effort will be conducted by the boatswain and topmen from the top barrel (there will be always two primary observers on the top barrel) and the upper bridge where the helmsman, captain or officer-on-watch, researchers, and the chief engineer (or second engineer) will be also present (always two primary observers and four secondary observers). The sighting survey will be conducted using (1) Passing with abeam Closing mode (NSP) and (2) Passing with Independent Observer (IO) mode in order to estimate whale abundance considering estimated $g(0)$. Both survey modes follow the protocol endorsed for the IWC/SOWER surveys (e.g. Matsuoka *et al.*, 2003, IWC, 2008).

Under NSP mode, there will be two primary observers on the top barrel (TOP). These observers will search for cetaceans by using angle board and binoculars (7x), which include the distance estimate scales. Members of two observer teams on TOP will be fixed and will operate in one or two hours-shifts. There will be open communication between the upper bridge and the TOP. These observers report sighting-information to researchers and other observers on the upper bridge for data recording.

Under IO mode, there will be two primary observers on the TOP and one primary observer on the independent observer platform (IOP). These observers on TOP and IOP platforms will conduct searching for cetaceans by using angle board and binoculars (7x). Members of the two observer teams on TOP will be fixed and will operate in one or two hours-shifts. There will be no open communication between the IOP and the TOP. The observers on the upper bridge will communicate to the TOP (or IOP) independently, with the topmen required only to clarify information without distracting them from their normal search procedure. These observers report sighting-information to researchers and other observers on the upper bridge for data recording. For encounters of very rare species (e. g. blue and southern right whales), it will be decided that the vessels approach the whales immediately to avoid losing them due to the delay of closing (IWC, 2008).

Following a recommendation from the NEWREP-A Review Panel, IO experiments will be conducted on both Antarctic minke and other large whale species.

Identification of species
Guidelines for species identification were based on the IWC-SOWER methods for classification of identification (IWC, 2008):

'Positive identification of species was based on multiple cues and usually required clear observation of the whale's body. Occasionally, repeated observations of the shape of the blow, surfacing and other behavioural patterns were sufficient; this judgement was made only by the senior researcher. Identification of species was recorded as 'probable' based on multiple cues, which were nevertheless insufficient to be absolutely confident of identification. This usually occurred when blows and surfacing patterns could be confirmed, but the whale's body could not be clearly seen. Details of recording procedures during sightings can be found in 'Information for Researchers'.

Effort was made to classify killer whales into three ecotypes following to that the Panel recommends the collection of data on the ecotype of killer whales to try to allow estimates of abundance to be developed for each (IWC, 2015a).

Determination of group size
The following guidelines were used in determining group size (IWC, 2008):

'Schools where the number of animals, or an accurate estimated range of the number of animals was determined, were classified as confirmed schools. Data from the confirmed schools can be used to determine a mean school size. Therefore, it is critical that the confirmed schools accurately represent the size of schools in the survey area. Normally, schools believed to be confirmed for school size are approached to within 1 n. mile for large whales and to within 0.3n.miles for minke whales. Allowing for context-specific differences (i.e. environmental conditions and animal behavior), every effort was made to be consistent with regard to the maximum time spent on identification of species and confirmation of numbers. Normally, if the sighting was thought to be minke whales, no more than 20 minutes (after closure has been completed) should be spent on confirmation, this reduces the potential for confusion estimates of school sizes in the research area, except when indicated otherwise'.

Distance and angle experiment
Sighting distance and angle experiment will be conducted in order to evaluate the accuracy of sighting distance and angle provided by primary observers. Observers on each vessel will be required to assess eight sets of angles and distance from two platforms (TOP and IO) and upper bridge. All trials will be conducted under the weather and sighting conditions defined above.

Data entry system
Researchers will input the data collected during the survey (weather, effort, sighting and experiments data) into the computer onboard the vessel using the 'onboard data collecting system' (ICR, 2013). Survey modes and effort codes definitions for this survey correspond to those used in the IWC/SOWER surveys. The data will be validated and stored at the Institute of Cetacean Research (ICR), and all sighting data for abundance estimates will be submitted to the IWC based on the IWC SC Guidelines (IWC, 2008; 2012).

Data availability
After validation by ICR, the sighting and associated data will be submitted to the IWC secretariat. Other data and samples obtained during the survey will be available to IWC SC members through data access Procedure B.

Cruise report
A cruise report will be prepared just after completed the survey and will include a list of the samples and data collected during the survey. The cruise report will be presented to the 2017 IWC SC meeting.

Oversight report
An oversight report will be presented as an appendix to the cruise report of the survey.

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Table 1. Specifications of the vessels to be engaged in the 2016/17 season dedicated sighting survey under the NEWREP-A.

	Yushin-Maru No.3	*Undetermined*
Call sign	7JCH	-
Length overall [m]	69.61	-
Gross tonnage (GT)	742	-
Top barrel height [m]	19.5	-
IO platform height [m]	13.5	-
Upper bridge height [m]	11.5	-
Bow height [m]	6.5	-
Engine power [PS / kW]	5,280 / 3,900	-

Figure 1. Research vessel to be used in the dedicated sighting survey: *Yushin Maru No. 3*.

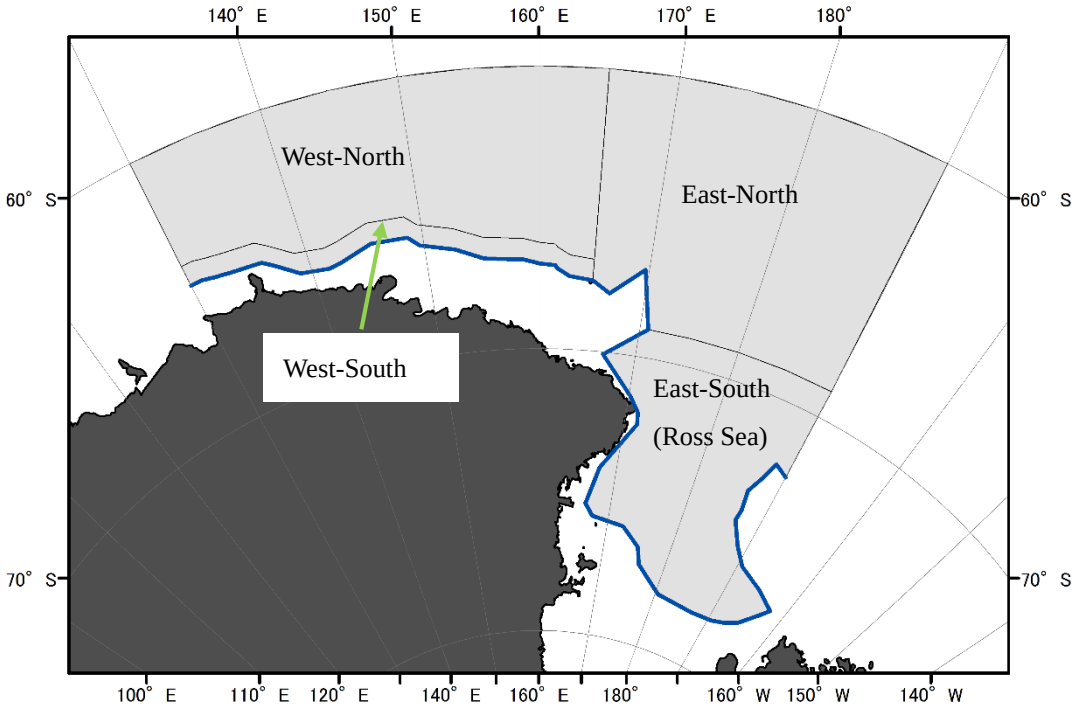

Figure 2. Sectors and strata to be covered by the dedicated sighting survey in Area V. Blue line indicates assumed ice edge line.

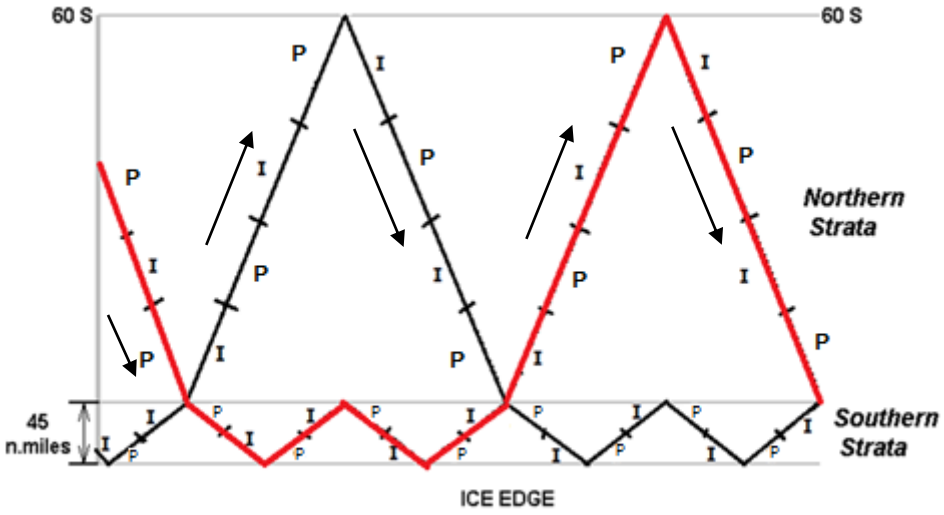

Figure 3. Basic design for pre-determined cruise track lines. Red and black bold line indicates track line for each vessel, respectively. 'I' indicates that the survey will be conducted under IO mode and 'P' indicates that the survey will conducted in NSP mode (passing mode with abeam closing mode).

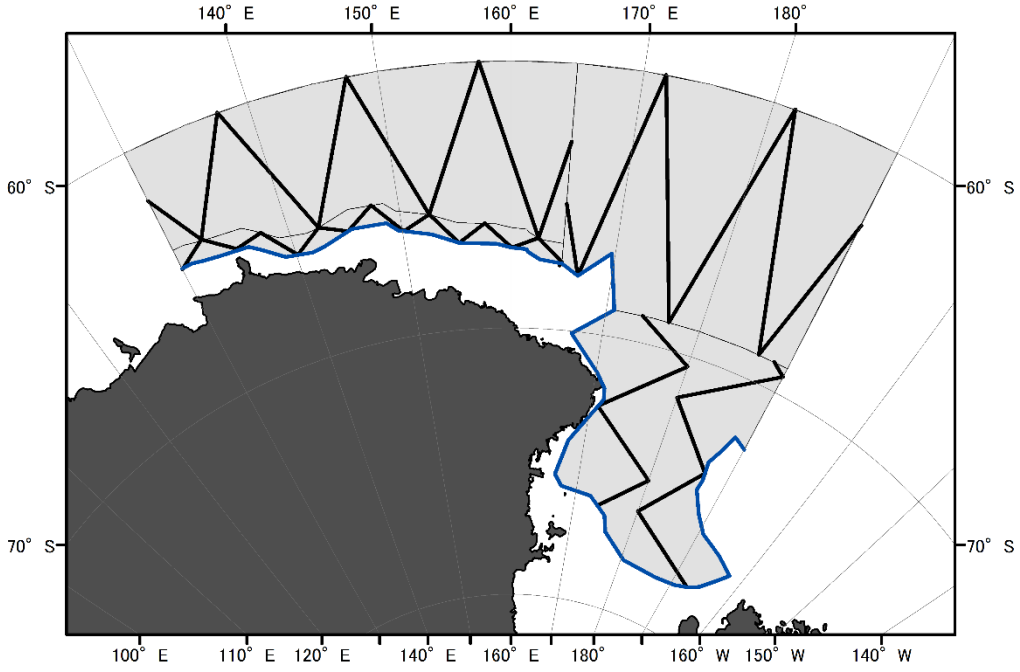

Figure 4. Proposed track lines given assumed ice edge lines (blue line). Considerable flexibility may be needed by the Cruise Leader in determining the final cruise tracks.

Appendix 1
Krill and Oceanographic survey

Krill and oceanographic surveys will be conducted in a similar manner as conducted during the 2015/16 season. The krill survey will consist of scientific echo-sounder survey and net sampling.

Echo-sounder
The *YS3* will be equipped with a Quantitative Echo-sounder (EK80; Simrad, Norway). EK80 operates with frequencies at 38kHz, 120kHz and 200kHz. The transducers will be hull-mounted at a depth of 4.3m below the sea surface. Maximum data recording depth will be at 500m. Acoustic data would be recorded continuously while *YS3* steamed on the predetermined track-lines at a speed of 11.5 knots. Calibration of the EK80 was made in Japan and in the research area to determine the likely effective acoustic sampling range and potential for detecting krill for multiple frequencies over the required survey depth.

Net sampling
The *YS3* will be also equipped with a small ring net designed by Nihon-Kaiyo Co., Ltd. Japan. The net is 1m in mouth diameter and 3m length. To investigate the efficiency of sampling, two mesh sizes will be used 1.5mm or 4.5mm. During the sampling, the vessel will stop the engine so that the net could be towed vertically.

Decision on net sampling will be based on the echo-signs. In principle net sampling is planned to be conducted once a day. The main purpose of the net sampling will not be the collection of quantitative information (e.g. number of individuals and length frequency distribution) but the collection of qualitative information (e.g. species occurring in the echo-signs). This is because the net used in this survey is suitable for the collection of representative sample of krill.

Net sampling will be conducted with Light Emitting Diode (LED) with the expectation of attracting krill so that the number of sampled individuals increases as demonstrated by previous studies (Wiebe *et al*., 2004). A maximum 3,000 lumen LED (FIX NEO 3000 DX, Fisheye Co., Ltd. Japan), digital compact camera (TG-4 Tough, Olympus Co., LTD. Japan) and housing system (Nauticam TG3, Fisheye Co., LTD. Japan) will be mounted in the mouth of net. In this survey, no specific experiment will be conducted to test the effect of light on sampling as the main aim will be to test whether krill could be sampled by using the small ring net.

The target depth of net sampling will be based on depth of echo sign but maximum depth will be 200m. If the net is attached with LED and digital compact camera, the maximum depth will be switched to 100m (considering pressure capacity). The depth of the mouth will be estimated from angle of wire by visual with protractor. Towing speed of the net was 1.0 m/s.

Preliminary standard measurements (AT) of krill sampled, will be carried out on board the *YS3*. AT is from the front of the eye to the tip of the telson, the thin, tapered triangular plate at the end of the abdomen (CCAMLR, 2011). Samples will be kept in 100mL or 500 mL bottle with 10 percent formalin for further analysis in the laboratory.

Oceanographic
Hydraulic pressure, temperature, salinity, chlorophyll and oxygen concentrations will be recorded from sea surface to 500m depth using a CTD (SBE 19 plus V2 SeaCAT, Sea-Bird Electronics, USA). In principle, CTD casting will be conducted once a day.

Seawater sampling will be carried out for calibration of sensors. The data of CTD will be uploaded to conversion by a manual (Sea-Bird Electronics, Inc., 2013). Niskin water sampling bottle (Model-1010 1.2L, General Oceanics, Inc., USA) will be dropped to take seawater in depths from 0 to 200m by every 20m.

The water will be kept in 2 bottles. A 250mL clarity seawater bottle (WOCE type 5419-C, Rigosha, Japan) for salinity calibration of CTD, which will be stored at about 4°C. The second will be a 100mL bottle for chlorophyll calibration of CTD. The water in this bottle will be filtrated using paper filter

233303 GF/F 2.5cm, Whatman, UK. The filter paper will be kept into 8mL centrifugal tubes (60.452, Sarstedt, Germany) filled with dimethyl-formamide. The tubes will be stored in freezer at about -20°C (Saito, 2007). The calibration will be carried out in the laboratory.

It should be noted that this is a draft plan, which could change based on the discussions and suggestions at the CCAMLR SAM-WG in June/July 2016. It could be also changed based on the equipments available in the second, undetermined vessel that will participate in this survey.

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Appendix 2
Feasibility study on biopsy sampling and telemetry in Antarctic minke whale

As mentioned earlier this feasibility study started during the 2015/16 survey and will continue during the 2016/17 survey. Final conclusion of these non-lethal approaches on Antarctic minke whale will be reached after the third survey in 2017/18.

Biopsy sampling
The NEWREP-A review workshop made the following recommendations, which are taking into consideration during the design of the study. a) the experiment to examine the effort required to obtain biopsy samples from Antarctic minke whales be given high priority at the start of any long-term programme; b) involve people with expertise in successfully biopsy sampling common minke whales in the North Atlantic; c) mimic the sampling strategy developed for lethal sampling (e.g. when dealing with schools >2); d) record information on time taken, sea state, swell, etc. to enable a plausible measure of effort required to be developed; and e) consider the amount of tissue and nature of tissue required (for each analysis and in total).

At the 2015/16 survey the main purpose was the training of the research personnel with the Larsen biopsy gun. During that survey, trials were made at different sea state as measured by the Beaufort scale. Trials under different sea conditions will continue during the 2016/17 survey.

Study design
The study will be based on Larsen gun, and two Larsen gun systems will be available on board the YS3.

In the offshore stratum of the research area, single animals will be targeted under the normal wind speed acceptable for sighting surveys, e.g. 1-20knots. Tentatively a total of 10 biopsy trials will be attempted for each of the following wind speed ranges: 0-5; 6-10; 11-15; 16-20 (40 trials in total). For each trial other information such as behaviour of the animal should be recorded.

If a biopsy is obtained, the weight of the sample should be obtained to respond one of the recommendations from the NEWRE-A review workshop.

In the southern strata the study design will try to respond recommendation c) above from the NEWREP-A review workshop. Schools of two or more animals will be targeted and the target animal for biopsy sampling will be decided randomly using the same method used in the lethal sampling of Antarctic minke whale.

Tentatively a total of three trials will be attempted for each of the following wind speed range: 0-5; 6-10; 11-15; 16-20; 21-25 (15 trials in total) in the southern stratum. For each trial other information such as behaviour of the animal should be recorded. If a biopsy is obtained, the weight of the sample should be obtained to respond one of the recommendations from the NEWRE-A review workshop.

Telemetry
The feasibility study on telemetry in the Antarctic minke whale was also started during the 2015/16 survey. The NEWREP-A review workshop made the following recommendations: a) This experiment should be accorded high priority but notes the difficulties in the attachment and functioning of long-term satellite tags on minke whales in both hemispheres; b) Undertake this work in collaboration with research groups with experience in such work rather than try to develop techniques on their own. The NEWREP-A Review Panel noted 'the difficulties in the attachment and functioning of long-term satellite tags on minke whales in both hemispheres' and recommended that 'the proponents undertake this work in collaboration with research groups with experience in such techniques rather than try on their own'.

Consequently, in planning this feasibility study, effort will be spent in developing an attachment system in consultation with the National Research Institute of Far Seas Fisheries (NRIFSF, Yokohama, Japan) and Lars Kleivane, Norway, all of them experienced in telemetry studies, and considering the experience acquired in the previous survey.

Study design

As in the past survey, the study will be based on a pneumatic tool (the whale tag launcher: ARTS Aerial Rocket Tag System, Lars Kleivane and Restech Norway A/S, Norway) and satellite tag (SPOT6, Wildlife computers, WA, USA). Satellite and dummy tags will be shot by the pneumatic tool from the bow deck and carried a blubber penetration-type mount system for whales. The harpoon heads function to anchor under the skin.

Tentatively a total of six trials will be attempted for each of the following wind speed range: 0-5; 6-10 in both offshore and southern strata (24 trials in total). School size and behaviour will be recorded in each trial.