SC/67A/ASI/07

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INTERNATIONAL WHALING COMMISSION

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ABSTRACT

The results of the 2016/17 NEWREP-A dedicated whale sighting survey in Antarctic Area V (south of 60°S) are reported. Two dedicated sighting vessels (SVs) were engaged and successfully conducted the survey for 33 days, from 13 December 2016 to 14 January 2017 in the western sector of Areas V (130°E - 165°E), under two survey modes (Normal Passing mode NSP and Independent Observer mode IO), and based on IWC/IDCR-SOWER survey procedures.
The total searching distance in the research area was 2,937.1n.miles (5439.5km), including 1,542.0n.miles covered in NSP and 1,395.1n.miles in IO mode. The survey coverage was 77% in the northern stratum and 91% in the southern stratum. Five baleen whale species, i.e. blue (11 schools/13 individuals), fin (21/67), Antarctic minke (115/223), southern right (1/1) humpback (253/516) and at least three toothed whale species (sperm (30/30), southern bottlenose (4/8), killer (4/26)), were sighted in the research area. Antarctic minke whales were mainly encountered in the northern and southern stratum of the western part of the research area. Humpback whales were the most frequently sighted large whale species, and were widely distributed longitudinally throughout the research area. Blue whales were found mainly in the western part of the research area. Estimated Angle and Distance Experiments were completed as in previous years. Routine photo-ID and biopsy sampling on large whales were also conducted, and a total of 20 photos (9 blue, 1 southern right and 10 humpback whales), were obtained. A total of 10 biopsy (skin and blubber) samples were also collected from 2 blue, 1 southern right and 7 humpback whales using the Larsen system. A total of eight marine debris were observed. The sighting data were validated and already submitted to the IWC secretariat. During this survey, feasibility studies on telemetry and biopsy sampling of Antarctic minke whales were continued, and the results are presented in this paper. Krill and oceanographic surveys were also conducted along the tracklines designed for sighting, and results are reported by Wada *et al*. (2017).

KEYWORDS: ANTARCTIC; FEEDING GROUNDS; ANTARCTIC MINKE WHALES; BLUE WHALES; FIN WHALES; HUMPBACK WHALES; SOUTHERN RIGHT WHALES; LINE-TRANSECT; SURVEY VESSEL

INTRODUCTION

The Main Objective I of NEWREP-A is 'Improvement in the precision of biological and ecological information for the application of the Revised Management Procedure (RMP) to the Antarctic minke whales'. In order to attain Objective I, four sub-objectives were set: Objective I (i): Abundance estimates for Antarctic minke whales taking into account of g(0) and additional variance, Objective I (ii): Improvement of precision of biological and ecological parameters, Objective I (iii): Refinement of stock structure hypotheses of Antarctic minke whale in Areas III-VI for the implementation of the RMP, Objective I (iv): Specification of RMP *Implementation Simulation Trials* (ISTs) for the Antarctic minke whales (Government of Japan, 2015a).

The Main Objective II of NEWREP-A is 'Investigation of the structure and dynamics of the Antarctic marine ecosystem through building ecosystem models'. Four objectives were identified with this main objective: Objective II (i): Ecological Research (krill abundance estimation and oceanographic observation), Objective II (ii): Abundance estimate of some cetacean species as input data for ecosystem modelling, Objective II (iii): Estimation of prey consumption by the Antarctic minke whale and its nutritional condition, Objective II (iv): Ecosystem modelling (Spatial interaction among baleen whales and consideration of predators-prey system and allometric reasoning) (Government of Japan, 2015a).

Objectives I (i), II (ii) and II (iv) require whale abundance information obtained through systematic sighting surveys. After the completion of the IDCR/SOWER surveys, the dedicated sighting surveys under NEWREP-A are the only source of sighting data for abundance estimate.

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

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 tracklines - since the dedicated sighting survey/echo sounder platform will be separated from the sighting/sampling vessels, sabotage should not be an issue.

The research plan for the 2016/17 NEWREP-A dedicated sighting survey (Hakamada *et al*., 2016) was submitted to the International Whaling Commission Scientific Committee (IWC SC) in 2016 in line with recommendations d) and e) above. The plan took in consideration some of the elements in a)-c) above (Government of Japan, 2015b). The original plan of this dedicated sighting survey was to cover all sectors of Antarctic Area V (130°E-170°W) including the Ross Sea. However due to interferences from external NGO groups, the survey was restricted only to the western part of Area V.

The main research objectives of this survey were i) to collect systematic sighting data for the abundance estimates of Antarctic minke whales and other baleen whale species in Area V, including the collection of data for estimates of g(0), ii) to conduct krill and oceanographic surveys, and iii) to continue with the feasibility studies on biopsy sampling and telemetry in the Antarctic minke whale. Results of the sighting survey is presented in the main text of this document while the results of the feasibility studies on biopsy sampling and telemetry are presented in Appendices 1 and 2, respectively. The results of the krill and oceanographic surveys are presented by Wada *et al*. (2017).

SURVEY DESIGN

Research area

The research area covered by the survey was the western sector of Area V (130°E-165°E), south of 60°S (Figure 1a). The area was divided into northern and southern strata based on the ice edge information (Figure 1b).

Research vessel

Two dedicated sighting vessels (SVs), the R/V *Yushin-Maru No.3* (YS3) (742GT) and *Kaiyo-Maru No.7* (KY7) (649GT) were engaged in the survey. They were equipped with a top barrel platform (TOP), Independent Observer Platform (IOP) and an upper bridge platform. Vessels specifications and photos are provided in Appendix 3.

Trackline

In the northern and southern strata, the survey tracklines consisted of a zigzag course changing direction at 5°00' and 2°30' longitudinal degree intervals, respectively (Figures 1c-e). The boundary between southern and northern strata was defined by a line 45n.miles from the ice-edge. A randomised start point for survey tracks was used, as for all previous IWC-SOWER surveys, based on the IWC/SC survey guidelines (IWC, 2012).

Research hours, acceptable weather conditions and number of observers on effort

Research hours was consistent with previous SOWER survey procedure. Research effort began 60 minutes after sunrise and ended 60 minutes before sunset, with a maximum of 12-hour research per day (approximately 06:00-18:00). Time-zone changes was recorded at 30-minute intervals, effective from 01:00h. Schedules were adhered to local 'ship' time ranging between +9.0 and +12.0 GMT. Data collected throughout the survey and all associated reporting was 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 21 knots in northern stratum or 26 knots in southern stratum.

The vessel speed during the sighting survey was 11.5 knots with slight adjustment to avoid vibration from the vessels.

Whale sighting was conducted by the boatswain and topmen from the TOP (there will be always two primary observers in the TOP) and the upper bridge where the helmsman, captain or officer-on-watch, researchers, and the chief engineer (or second engineer) were also present (always two primary observers and four secondary observers were present).

Survey modes

The survey modes followed previous SOWER survey procedures. Sighting activities were classified into two principal types: 'On-effort' and 'Off-effort'. In the sightings survey portion of the research, On-effort activities were times when full search effort was being executed and conditions (such as weather and sea state) were within acceptable parameters to conduct research. Off-effort activities were all activities that were not On-effort. All sightings recorded while the vessel was On-effort were classified as 'Primary sightings'. All other sightings were considered to be 'Secondary sightings'. Sighting effort was conducted by the boatswain and topmen from the TOP and by observers at the upper bridge. The sighting survey was conducted using (1) Normal Passing mode (NSP) and (2) Passing with Independent Observer (IO) mode. Both survey modes followed the protocol endorsed for the IWC/SOWER surveys (e.g. Matsuoka *et al*., 2003; IWC, 2008).

For NSP mode, there were two primary observers on the TOP. These observers conducted searching for cetaceans by using angle board and binoculars (7x), which include the distance estimate scales. Members of the two observer teams on TOP were fixed and operated in one or two hours shifts. There was open communication between the upper bridge and the TOP. These observers reported sighting-information to researchers and other observers on the upper bridge for data recording (IWC, 2008).

For IO mode, there were two primary observers on the TOP and one primary observer on the IOP. These observers on TOP and IOP platforms also conducted searching for cetaceans by using angle board and binoculars (7x). Members of the two observer teams on TOP were fixed and operated in one or two hours shifts. There was no open communication between the IOP and the TOP. The observers on the upper bridge communicated to the TOP (or IOP) independently, with the topmen only to clarify information and did not distract the topmen 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 was decided that the vessel would approach whales immediately to avoid losing them due to the delay of closing (IWC, 2008).

Identification of species

Guidelines for species identification were the same as those used during the IWC-SOWER surveys:

'Positive identification of species is based on multiple clues and usually requires the clear observation of the whale's body. Occasionally, repeated observations of the shape of the blow, surfacing and other behavioural patterns may also be sufficient; this judgement should be made only by the Senior Scientist or other designated researcher.' (IWC, 2008).

'Probable identification of species is based on multiple clues, which are nevertheless insufficient to be absolutely confident in identification. This usually occurs when blows are seen, the surfacing pattern is correct, but the whale's body cannot be seen or clearly seen' (IWC, 2008).

Effort will be made to classify killer whales into three ecotypes to respond a NEWREP-A review Panel recommendation to collect data on the ecotype of killer whales to try to allow estimates of abundance to be developed for each (IWC, 2015b).

Determination of group size

The following guidelines were used in determining group size:

'Schools where the number of animals, or an accurate estimated range of the number of animals, is determined are classified as confirmed schools. The data from the confirmed schools are used in the analysis to determine a mean school size. Therefore it is critical that the schools that are confirmed are representative in size of the schools that are in the survey area. Normally, schools believed to be confirmed for school size are approached to within 1n.mile for large whales and to within 0.3 n.miles for minke whales. Obviously, there are differences in the environmental conditions and behaviour of the animals for every sighting, however, (with particular reference to minke whale sightings) every effort should be made to be as consistent as possible in regard to the maximum time spent on identification of species and confirmation of numbers. Normally, if the sighting is thought to be minke whales, no more than 20 minutes (after closure has been completed) should be spent trying

to complete these tasks (Otherwise there is the potential for confusion with other sightings in the vicinity).' (IWC, 2008).

Attending scientists and responsibilities

The original research plan welcomed the participation of international researchers. No official application for participation was received from international researchers. Six experienced Japanese researchers were selected for this survey. These researchers had enough experience conducting line transect surveys, biopsy sampling and photo-identification (photo-ID) experiments in the Antarctic through the JARPA/JARPAII and NEWREP-A programs or other research programs. Koji Matsuoka (Institute of Cetacean Research) was the responsible person for this survey, and same as in recent seasons, acted as the oversight person on behalf of the IWC SC.

Yushin-Maru No.3 (YS3)
Futoshi YAMAGUCHI - sighting, photo-ID and biopsy
Ryuichiro MORIYAMA - sighting, photo-ID and biopsy
Atsushi WADA - krill and oceanographic survey
Kaiyo-Maru No.7 (KY7)
Kenji KONISHI - sighting, photo-ID, biopsy and satellite tagging
Shinya KAWABE - sighting data, photo-ID and biopsy
Shunjiro BANJO - krill and oceanographic survey

Other research activities

The sighting distance and angle experiment was conducted in order to evaluate the accuracy of sighting distance and angle provided by primary observers. Observers on each vessel were required to assess eight sets of angles and distance from two platforms (TOP and IOP) and upper bridge. All trials were conducted under acceptable sighting condition.

Research time was allocated for routine biopsy sampling of blue, fin, sei, southern right, humpback, sperm and killer whales, with higher priority given to the blue and southern right whales. The Larsen system was used to collect samples. Priority species for photo-ID were blue, southern right and humpback whales, although photos of all other species, including killer whales would be obtained opportunistically (e.g. Matsuoka and Pastene, 2014; Kanda *et al*., 2014).

During the research time, marine debris on the sea surface was recorded. For each debris, the following information was obtained: date of the observation, geographical position (longitude and latitude) of the observation and type of debris.

Data entry system and analysis

Researchers input the data collected on weather, effort, sighting and experiments into the computer at the field 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 should be validated and stored at the Institute of Cetacean Research (ICR), and all sighting data for abundance estimates should be submitted to the IWC based on the IWC SC Guidelines (IWC, 2008; 2012).

RESULTS AND DISCUSSION

Brief narrative of the survey

The *YS3* departed Shiogama, Miyagi, Japan on 17 November 2016 and started the transit survey on 2 December 2016, which was completed on 11 December 2016. It started dedicated sighting survey in the western sector of the Area V on 13 December 2016, which was completed on 14 January 2017. Due to external interferences the vessel engaged in different research activities until 10 March 2017. The vessel arrived at Shimonoseki on 31 March 2017 (Table 1a).

The *KY7* departed Hachinohe, Aomori, Japan on 16 November 2016 and started the transit survey on 2 December 2016, which was completed on 11 December 2016. It started dedicated sighting survey in the western sector of the Area V on 13 December 2016, which ended on 8 January 2017. The vessel started the transit survey on 9 January 2017 arriving at Ogasawara on 3 February 2017 (Table 1a).

Summary of sightings

Antarctic research area

The two dedicated sighting vessels were engaged in the research for 33 days, from 13 December, 2016 to 14 January, 2017 in the western sector of the Area V (130°E - 165°E, Figure1b).

Figures 1c-e shows the trackline design and location of the searching effort.

Tabulations of all trackline Waypoint (WP) are shown in Tables 1b and 1c, the searching effort and time spent on experiments in Table 1d. The pack ice shape at 65°S, 155°E was swell up to north (Figure 2), therefore the survey tracklines at this site was complicated.

The sightings in the research area and those obtained in transit to and from the research area, are summarized by species and by stratum in Table 2a, 2b, 2c and 2d, respectively.

The total searching distance in the research area was 2,937.1n.miles (5439.5km), including 1,542.0n.miles in NSP and 1,395.1n.miles in the IO mode. The searching effort coverage was 77% in the northern stratum and 91% in the southern stratum.

Five baleen whale species and at least three toothed whale species were sighted in the research area. The most dominant whale species in the research area was humpback whale (253 schools/516 individuals) followed by Antarctic minke whale (115/223). Sightings of other species are as follows; blue whale (11 schools/13 individuals), fin (21/67), southern right whale (1/1), sperm whale (30/30), southern bottlenose whale (4/8) and killer whale (4/26) (Table 2a, 2b). Figures 3a to 3h show the geographical distribution of the primary sightings in the research area for the main whales sighted.

Antarctic minke whales were frequently sighted and they were encountered mainly in the northern and southern stratum of western part in the research area (Figure 3c). This distributional pattern of this species was similar to the results in the past JARPA/JARPAII surveys (Hakamada *et al*., 2014). As in previous surveys, no mother and calf pair of the Antarctic minke whale was observed in this survey. Humpback whales were the most frequently sighted large whale species and widely distributed in the research area (Figure 3d) and somewhat overlapping in distribution with Antarctic minke whales. However, many sighted areas of Antarctic minke whales were near the ice edge (65°S, 140-145°E), where no humpback whales were sighted.

The duplicate number of sightings (determined on the number of sightings made by the IOP that were also observed by the TOP Barrel) was 16 (Table 2e).

Sighting survey with IO mode was also conducted for other large whale species (Table 2e).

Blue whales distributed in the western part of the research area (Figure 3a), while fin whales were found widely in the research area (Figure 3b). These observations were almost the same as in the past JARPA/JARPAII surveys (Matsuoka and Hakamada, 2014). One southern right whale was sighted in the most east part of the northern stratum (Figure 3e). Solitary large sperm whales were many found in the eastern part of the research area (Figure 3f). One school of killer whale (8 whales) was identified as Type B in the southern stratum of the research area.

The present sighting survey complements the work of the IDCR/SOWER programme. The importance of monitoring trends in abundance in cetacean species is of general conservation and management importance, especially in the context of documenting the recovery of species/populations that had been extensively depleted by commercial whaling. These surveys are also important to investigate recent changes in species composition (Figure 4, Matsuoka and Hakamada, 2014).

Figure 5a shows the breakdown of research time, in hours by effort code in the research area. Figures 5b and 5c show the breakdown of research time, in hours of wind speed and visibility (minke whale visibility) in the research area, respectively.

Low and middle latitudinal sighting survey

During transit from Japan to the research area, the sighting surveys were conducted by *YS3* and *KY7* from 2 to 11 December, 2016 in the area between 20°S and 60°S outside of national EEZs. The searching effort was 955.4n.miles. From the research area to Japan, the sighting survey was conducted by *KY7* from 9 to 19 January, 2017 in the area between 20°S and 60°S outside of national EEZs. The searching effort was 531.2n.miles. Three baleen whale species (blue, fin and sei whales) and at least two toothed whale species (sperm and killer whales) were observed. Table 2c and 2d summarized all sightings observed during transit to the research area and from the research area.

Other research activities

Sighting distance and angle experiment

A training for this experiment was conducted on 14 December for 1 hour 40 minutes by *YS3* and 18 December for 2 hour 17 minutes by *KY7*. The actual experiments were successfully completed on 7 January for 4 hour 13 minutes by *YS3* (136 trials), 31 December for 45 minutes and 8 January for 3 hour 28 minutes by *KY7* (128 trials). The results of this experiment will be used for the calculation of abundance estimates.

Photo-ID

A total of 9 blue, 1 southern right and 10 humpback whales were successfully photo-identified during this survey (Tables 3a and 3b). A total of 24 blue whales, 1 southern right whale 36 humpback whales and 21 killer whales were photographed in 2015/2016 NEWREP-A survey (Isoda *et al*., 2016; Mogoe *et al*., 2016). These data will be registered to the ICR catalogue and submission of photographs to relevant international catalogues (e.g. Matsuoka and Pastene, 2014).

Biopsy sampling for large whales

A total of 10 biopsy samples were collected (Tables 4a and 4b), including 2 blue, 1 southern right, 7 humpback whales. Biopsy samples were stored at -20°C for future genetic analyses. A total of 8 biopsy samples of blue whale, 7 of fin whale, 1 of southern right whale, 15 of humpback whale and 9 of killer whale were collected in 2015/2016 NEWREP-A survey (Isoda *et al*., 2016; Mogoe *et al*., 2016). These samples will be used in future genetic and some analyses (e.g. Pastene *et al*., 2014; Kanda *et al.*, 2014).

Marine debris observation

A total of 8 marine debris objects were observed during the survey in the research area (Table 5). In the Antarctic, comprehensive observations of marine debris (on the sea surface, ingestions, entanglements) has been carried out by JARPA and JARPAII and the effect of marine debris on whales was expected to be limited (Isoda *et al*., 2014). Observation of marine debris will continue as one of the research activities of NEWREP-A. These data will be registered to the ICR database and reported in the future (e.g. Isoda *et al*., 2014).

Report of the IWC oversight

The oversight report was shown in Appendix 4.

Sighting data storage

The sighting data were already submitted to the IWC secretary dated 30 April, 2017.

ACKNOWLEDEGMENTS

We thanks the following persons and organizations: the Fisheries Agency of the Government of Japan for logistic support and funding for this research survey; scientists from ICR and other organizations for logistic support and for useful suggestions for the field and analytical works. In particular we thank the colleagues of the National Research Institute of Far Seas Fisheries (Yokohama), and Lars Kleivane, Norway, for discussions on the satellite tagging system. We are also indebted to researchers, all officers, crew of the *Yushin-Maru No.3* and the *Kaiyo-Maru No.7* for support in the field.

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TABLES AND FIGURES

Table 1a. Narrative of the 2016/17 NEWREP-A dedicated sighting survey.

Event	*Yushin-Maru No.3*	*Kaiyo-Maru No.7*
Pre-cruise meeting	15 November 2016	4 November 2016
Vessels departed Shiogama (YS3) and Hachinohe (KY7), Japan	17 November 2016	16 November 2016
Start transit survey	2 December 2016	2 December 2016
Finish transit survey	11 December 2016	11 December 2016
Vessels started survey in the research area	13 December 2016	13 December 2016
Vessels completed survey in the research area	14 January 2017	8 January 2017
Start transit survey	-	9 January 2017
Finish transit survey	-	19 January 2017
Vessels arrived Shimonoseki (YS3) and Ogasawara (KY7), Japan	31 March 2017	3 February 2017
Post-cruise meeting	31 March 2017	9 February 2017

Table 1b. Way Points (WP) in the southern strata.

WP	Latitude			Longitude			Leg no.	mode	course	plan	effort	covered (%)	area code	vessel
101	64	35.3	S	130	00.0	E	101	NSP	131	10.2	10.3	101	51	YS3
102	64	42.0	S	130	18.0	E	102	IO	37	54.7	53.8	101	51	YS3
103	63	58.5	S	131	34.0	E	103	NSP	37	54.7	51.8	98	51	YS3
104	63	15.0	S	132	48.0	E	104	IO	130	43.2	41.4	96	51	KY7
105	63	42.5	S	134	02.4	E	105	NSP	130	43.2	-	-	51	KY7
105A	64	10.0	S	135	18.0	E	105	NSP	180	21.0	63.9	100	51	KY7
106	64	31.0	S	135	18.0	E	106	IO	47	44.9	27.6	61	51	KY7
107	64	00.5	S	136	33.7	E	107	NSP	47	44.9	29.4	66	51	KY7
108	63	30.0	S	137	48.0	E	108	IO	144	55.7	53.4	96	51	KY7
109	64	15.0	S	139	02.0	E	109	NSP	144	55.7	-	-	51	KY7
109A	65	00.0	S	140	18.0	E	109	NSP	180	17.0	68.6	94	51	KY7
110	65	17.0	S	140	18.0	E	110	IO	57	38.2	33.0	86	51	KY7
111	64	56.0	S	141	33.5	E	111	NSP	57	38.2	33.4	87	51	YS3
112	64	35.0	S	142	48.0	E	112	IO	118	36.4	35.6	98	51	YS3
113	64	52.5	S	144	02.5	E	113	NSP	118	36.4	-	-	51	YS3
113A	65	10.0	S	145	18.0	E	113	NSP	180	30.0	64.9	98	51	YS3
114	65	40.0	S	145	18.0	E	114	IO	35	55.2	43.7	79	51	YS3
115	64	55.0	S	146	34.0	E	115	NSP	35	55.2	54.0	98	51	YS3
116	64	10.0	S	147	48.0	E	116	IO	107	34.1	31.6	93	51	YS3
117	64	20.0	S	149	02.8	E	117	NSP	107	34.1	-	-	51	YS3
117A	64	30.0	S	150	18.0	E	117	NSP	180	25.0	58.5	99	51	YS3
118	64	55.0	S	150	18.0	E	118	IO	61	36.7	13.1	36	51	YS3
119	64	37.5	S	151	33.3	E	119	NSP	61	36.7	35.6	97	51	YS3
120	64	20.0	S	152	48.0	E	120	IO	122	37.9	37.8	100	51	KY7
121	64	40.0	S	154	02.6	E	121	NSP	122	37.9	22.7	60	51	KY7
122A	65	00.0	S	155	18.0	E	-	-	-	-	-	-	51	KY7
122B	63	45.0	S	155	18.0	E	122	IO	102	34.0	31.0	91	51	YS3
123	63	52.5	S	156	32.9	E	123	NSP	102	33.9	33.8	100	51	YS3
124	64	00.0	S	157	48.0	E	124	IO	135	45.9	45.4	99	51	YS3
125	64	32.5	S	159	02.3	E	125	NSP	135	46.9	-	-	51	YS3
125A	65	05.0	S	160	18.0	E	125	NSP	180	130.0	175.1	99	51	YS3
126	67	15.0	S	160	18.0	E	126	IO	49	38.8	37.7	97	51	YS3
127	66	50.0	S	161	33.7	E	127	NSP	49	38.7	29.2	75	51	YS3
128	66	25.0	S	162	48.0	E	128	IO	136	42.1	38.0	90	51	YS3
129	66	55.0	S	164	02.3	E	129	NSP	136	32.1	30.8	96	51	YS3
130	67	18.0	S	165	00.0	E	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	-	1419.5	1284.8	91	-	-

Table 1c. Way Points (WP) in the northern strata.

WP	Latitude			Longitude			Leg no.	mode	course	plan	effort	covered (%)	area code	vessel
201	61	28.3	S	130	00.0	E	201	IO	144	11.5	11.0	96	53	KY7
202	61	37.6	S	130	14.2	E	202	NSP	144	60.5	51.2	85	53	KY7
203	62	26.4	S	131	30.2	E	203	IO	144	60.3	36.3	60	53	KY7
204	63	15.0	S	132	48.0	E	204	IO	36	60.5	49.5	82	53	YS3
205	62	26.1	S	134	05.7	E	205	NSP	36	60.5	50.9	84	53	YS3
206	61	37.4	S	135	21.5	E	206	IO	36	60.5	60.3	100	53	YS3
207	60	48.8	S	136	35.8	E	207	NSP	36	60.5	60.4	100	53	YS3
208	60	00.0	S	137	48.0	E	208	IO	153	77.2	75.9	98	53	YS3
209	61	08.8	S	138	58.9	E	209	NSP	153	77.2	73.0	95	53	YS3
210	62	17.6	S	140	12.4	E	210	IO	153	77.2	74.1	96	53	YS3
211	63	26.4	S	141	28.7	E	211	NSP	153	77.2	72.4	94	53	YS3
212	64	35.0	S	142	48.0	E	212	NSP	27	77.1	56.7	73	53	KY7
213	63	26.3	S	144	07.4	E	213	IO	27	77.2	16.1	21	53	KY7
214	62	17.5	S	145	23.7	E	214	NSP	27	77.1	20.8	27	53	KY7
215	61	08.8	S	146	37.2	E	215	IO	27	77.2	62.8	81	53	KY7
216	60	00.0	S	147	48.0	E	216	NSP	152	73.9	67.1	91	53	KY7
217	61	05.0	S	148	59.1	E	217	IO	152	73.9	52.0	70	53	KY7
218	62	10.0	S	150	12.6	E	218	NSP	152	73.9	25.9	35	53	KY7
219	63	15.0	S	151	28.9	E	219	IO	152	73.9	58.1	79	53	KY7
220	64	20.0	S	152	48.0	E	220	IO	28	73.9	32.4	44	53	YS3
221	63	15.0	S	154	07.1	E	221	NSP	28	73.9	71.6	97	53	YS3
222	62	10.0	S	155	23.3	E	222	IO	28	73.9	73.4	99	53	YS3
223	61	05.0	S	156	36.8	E	223	NSP	28	73.9	17.6	24	53	YS3
224	60	00.0	S	157	48.0	E	224	IO	161	102.1	68.9	67	53	YS3
225	61	36.3	S	158	57.0	E	225	NSP	161	102.1	46.4	45	53	YS3
226	63	12.6	S	160	09.7	E	226	IO	161	102.1	101.7	100	53	YS3
227	64	48.8	S	161	26.5	E	227	NSP	161	102.1	101.6	100	53	YS3
228	66	25.0	S	162	48.0	E	228	IO	19	102.1	99.8	98	53	YS3
229	64	48.8	S	164	09.5	E	229	NSP	19	66.4	64.7	97	53	YS3
230	63	46.2	S	165	00.0	E	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	-	2159.6	1652.3	77	-	-

Table 1d. Summary of searching effort (time and distance) and time (hours) spent on experiments.

Yushi-Maru No.3 and Kaiyo-Maru No.7	Start YS3 / KY7	End YS3 / KY7	NSP		IO		Photo-ID, Biopsy, Satellite experiment	Estimated angle and distance training / experiment	Oceanographic observations, Net sampling, Calibration for echosounder
	Date	Date	Time	Dist.	Time	Dist.	Time	Time	Time
	Time	Time	(hh:mm:ss)	(n.m.)	(hh:mm:ss)	(n.m.)	(hh:mm:ss)	(hh:mm:ss)	(hh:mm:ss)
Transit survey to research area	2-Dec. / 2-Dec.	11-Dec. / 11-Dec.	82:21:04	955.4	-	-	0:10:48	-	-
	8:45 / 10:01	14:22 / 18:00							
Research area	13-Dec. / 13-Dec.	14-Jan. / 8-Jan.	133:42:48	1542.0	120:35:11	1395.1	13:06:52	12:24:36	64:50:16
	6:00 / 6:00	9:31 / 15:18							
Transit survey from research area	- / 9-Jan.	- / 19-Jan.	48:00:13	531.2	-	-	-	-	-
	- / 6:00	- / 16:05							
Total	2-Dec. / 2-Dec.	14-Jan. / 19-Jan.	264:04:05	3028.6	120:35:11	1395.1	13:17:40	12:24:36	64:50:16
	8:45 / 10:01	9:31 / 16:05							

Table 2a. Number of sightings for large whale species in the research area, by stratum and species.

Species	West-North of area V				West-South of area V				Sub total				Total	
	Primary		Secondary		Primary		Secondary		Primary		Secondary			
	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Blue whale	7	8	0	0	4	5	0	0	11	13	0	0	11	13
Fin whale	16	49	0	0	5	18	0	0	21	67	0	0	21	67
Sei whale	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Antarctic minke whale	37	63	3	7	75	153	0	0	112	216	3	7	115	223
Like Antarctic minke whale	3	3	3	3	1	1	0	0	4	4	3	3	7	7
Humpback whale	132	254	0	0	121	262	0	0	253	516	0	0	253	516
Southern right whale	1	1	0	0	0	0	0	0	1	1	0	0	1	1
Baleen whale	10	11	0	0	7	14	0	0	17	25	0	0	17	25
Sperm whale	14	14	0	0	16	16	0	0	30	30	0	0	30	30
Southern bottlenose whale	3	5	0	0	1	3	0	0	4	8	0	0	4	8
Unidentified whale	10	10	0	0	7	8	1	1	17	18	1	1	18	19

Table 2b. Number of sightings for small cetaceans in the research area, by stratum and species.

Species*	West-North of area V				West-South of area V				Sub total				Total	
	Primary		Secondary		Primary		Secondary		Primary		Secondary			
	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Killer whale	1	3	0	0	3	23	0	0	4	26	0	0	4	26

*Small cetaceans are outside the competence of the IWC.

Table 2c. Number of sightings for large whale species observed during this survey including transit and research area.

Species	Transit to research area				Research area				Transit from research area				Sub total				Total	
	Primary		Secondary		Primary		Secondary		Primary		Secondary		Primary		Secondary			
	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Blue whale	1	2	1	3	11	13	0	0	0	0	0	0	12	15	1	3	13	18
Fin whale	1	1	0	0	21	67	0	0	0	0	0	0	22	68	0	0	22	68
Sei whale	10	32	0	0	0	0	0	0	0	0	0	0	10	32	0	0	10	32
Antarctic minke whale	0	0	0	0	112	216	3	7	0	0	0	0	112	216	3	7	115	223
Like Antarctic minke whale	0	0	0	0	4	4	3	3	0	0	0	0	4	4	3	3	7	7
Humpback whale	0	0	0	0	253	516	0	0	0	0	0	0	253	516	0	0	253	516
Southern right whale	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
Baleen whale	8	9	1	1	17	25	0	0	0	0	0	0	25	34	1	1	26	35
Sperm whale	2	2	0	0	30	30	0	0	13	14	0	0	45	46	0	0	45	46
Southern bottlenose whale	0	0	0	0	4	8	0	0	0	0	0	0	4	8	0	0	4	8
Unidentified whale	2	2	3	5	17	18	1	1	2	2	0	0	21	22	4	6	25	28

Table 2d. Number of sightings for small cetaceans observed during transit and research surveys.

Species*	Transit to research area				Research area				Transit from research area				Sub total				Total	
	Primary		Secondary		Primary		Secondary		Primary		Secondary		Primary		Secondary			
	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Killer whale	0	0	0	0	4	26	0	0	1	5	0	0	5	31	0	0	5	31

*Small cetaceans are outside the competence of the IWC.

Table 2e. Identification of duplicate sightings during surveys in Independent Observer (IO) mode. Duplicate status was based on the number of sightings made by the Independent Observer Platform (IOP) that were observed also by the Topmen in the Standard TOP Barrel. Status codes: D - Definite duplicate, P - Possible duplicate, R - Remote duplicate, N - Not duplicate.

Species	Number of sightings made by IOP	Duplicate Status			
		D	P	R	N
Blue whale	5	5	0	0	0
Fin whale	8	7	0	0	1
Antarctic minke whale	25	16	0	0	9
Humpback whale	75	57	2	0	16
Baleen whale	3	2	0	0	1
Sperm whale	3	3	0	0	0
Southern bottlenosed whale	1	1	0	0	0
Killer whale	1	1	0	0	0
Unidentified whale	5	3	0	0	2

Table 3a. Summary of the photo-ID data by the dedicated sighting survey.

Species	Number of individuals photographed
Blue whale	9
Southern right whale	1
Humpback whale	10
Total	20

Table 3b. Summary of the photo-identification and biopsy data with accompanying photo-ID data. Code of whale species; B - Blue, R - Southern right, H - Humpback. Code of opportunity of shoot; E: Excellent, G: Good, P: Possible, U: Unsure. Code of position of shoot; FL: Flukes, HD: Head, LL: Left lateral, RL: Right lateral, LD: Left dorsal, RD: Right dorsal, DM: Distinctive marking (elsewhere), OT: Other.

Vesl.	Date	Sight No.	Species	Scl. size	Sighted Position Lat.	[min.]	Long.	[min.]	Start time of BX	End time of BX	Experiment duration	Est. body length of target ind. [m]	Number of marked individual	Number of shoot	Opportunity of shoot	Position of shoot	Biopsy sample no.	Notes
YS3	20161203	1	B	2	-26	53.6	106	37.4	17:50:30	18:01:18	00:10:48	26.2	1	3	P	RL,RD	-	-
YS3	20161214	2	B	2	-63	09.8	132	56.6	08:51:00	09:17:18	00:26:18	25.8,22.3	2	12	G	LL,LD	-	-
YS3	20161214	12	B	1	-62	28.6	134	02.4	17:34:02	18:00:12	00:26:10	23.5	1	9	G	LL,RL	-	-
YS3	20161215	6	H	1	-62	11.3	134	29.1	09:04:30	09:20:52	00:16:22	12.3	1	3	P	RL,RD	-	-
YS3	20161218	3	H	1	-62	08.5	140	02.4	09:01:49	09:24:20	00:22:31	12.7	1	7	G	LL,LD,RD,DM	J16YS3H001	-
YS3	20161218	7	B	1	-62	19.1	140	14.1	12:04:52	12:36:17	00:31:25	24.3	1	12	G	LL,LD,RL,RD	J16YS3B001	-
YS3	20161218	20	B	1	-62	35.5	140	31.9	14:52:06	15:11:41	00:19:35	26.5	1	11	G	LL,RL,RD	J16YS3B002	-
YS3	20161219	16	H	2	-63	14.1	141	14.8	09:09:41	09:15:51	00:06:10	13.1,8.1	2	5	G	LL	J16YS3H002	Mother and calf pair(sample from mother animal)
YS3	20161225	5	H	2	-64	33.2	147	10.3	13:10:38	13:35:12	00:24:34	13.3,11.1	2	11	G	LL,LD,RD,RL	J16YS3H003 J16YS3H004	-
YS3	20170106	11	H	2	-66	25.0	162	48.4	13:50:47	14:14:23	00:23:36	13.9,13.0	2	15	G	HD,FL,LD,RL,RD	J16YS3H005 J16YS3H006	-
YS3	20170110	22	B	1	-65	10.5	160	18.0	15:52:16	16:28:07	00:35:51	23.7	1	7	G	LL,LD,RD	-	Opportunistic
YS3	20170114	2	R	1	-63	52.1	164	55.1	07:31:57	07:43:20	00:11:23	14.8	1	11	G	HD	J16YS3R001	-
KY7	20161214	19	H	2	-63	27.6	133	21.9	12:47:49	13:32:21	00:44:32	13.5,12.0	2	6	P	RD,LD	J16KY7H001	-
KY7	20161219	38	B	2	-64	29.3	139	25.9	17:00:24	18:00:22	00:59:58	24.8,22.4	2	7	G	RD,LD	-	-

Table 4a. Summary of biopsy samples collected by the dedicated sighting survey.
*: Results of the biopsy sampling on feasibility study and telemetry in the Antarctic minke whale are presented by Appendices 1 and 2.

Species	Number of individuals collected
Blue whale	2
Southern right whale	1
Humpback whale	7
Total	10

Table 4b. Summary of the biopsy data and encounter duration. Code of whale species; B - Blue, F - Fin, R - Southern right, H - Humpback. For codes of struck position see Kasamatsu *et al*. (1986).

Vesl.	Sheet number	Date	Sight No.	Species	Scl. size	Sighted Position Lat.	[min.]	Long.	[min.]	Start time of BX	End time of BX	Experiment duration	Est. body length of target ind. [m]	Number of shoot	Number of hit	Position struck	Number of sample (ind.)	Sample No.	Shooting equipment	Notes
YS3	BY301	20161203	1	B	1	-26	53.6	106	37.4	17:50:30	18:01:18	00:10:48	26.2	1	0	-	0	-	Larsen	-
YS3	BY302	20161214	2	B	2	-63	09.8	132	56.6	08:51:00	09:17:18	00:26:18	25.8	1	0	-	0	-	Larsen	-
YS3	BY304	20161214	12	B	1	-62	28.6	134	02.4	17:34:02	18:00:12	00:26:10	23.5	2	1	C1	0	-	Larsen	-
YS3	BY307	20161215	6	H	1	-62	11.3	134	29.1	09:04:30	09:20:52	00:16:22	12.3	1	0	-	0	-	Larsen	-
YS3	BY313	20161218	3	H	1	-62	08.5	140	02.4	09:01:49	09:24:20	00:22:31	12.7	3	1	LC1	1	J16YS3H001	Larsen	-
YS3	BY314	20161218	7	B	1	-62	19.1	140	14.1	12:04:52	12:36:17	00:31:25	24.3	1	1	RD1	1	J16YS3B001	Larsen	-
YS3	BY315	20161218	20	B	1	-62	35.5	140	31.9	14:52:06	15:11:41	00:19:35	26.5	3	1	B1p	1	J16YS3B002	Larsen	-
YS3	BY316	20161219	9	F	2	-62	59.3	140	58.3	06:47:54	07:05:29	00:17:35	18.1	2	0	-	0	-	Larsen	-
YS3	BY317	20161219	16	H	2	-63	14.1	141	14.8	09:09:41	09:15:51	00:06:10	13.1	2	1	C3	1	J16YS3H002	Larsen	Mother & calf pair (sample from mother animal)
YS3	BY320	20161225	5	H	2	-64	33.2	147	10.3	13:10:38	13:35:12	00:24:34	13.3,11.1	4	3	A,Blp,RC2	2	J16YS3H003 J16YS3H004	Larsen	-
YS3	BY323	20170106	11	H	2	-66	25.0	162	48.4	13:50:47	14:14:23	00:23:36	13.9,13.0	6	2	LC1,LC2	2	J16YS3H005 J16YS3H006	Larsen	-
YS3	BY326	20170110	22	B	1	-65	10.5	160	18.0	15:52:16	16:28:07	00:35:51	23.7	0	0	-	-	-	Larsen	No chance to shoot
YS3	BY328	20170114	2	R	1	-63	52.1	164	55.1	07:31:57	07:43:20	00:11:23	14.8	2	2	C2	1	J16YS3R001	Larsen	-
KY7	BY701	20161214	19	H	2	-63	27.6	133	21.9	12:47:49	13:32:21	00:44:32	13.5 12.0	4	1	D1	1	J16KY7H001	Larsen	-
KY7	BY702	20161219	38	B	2	-64	29.3	139	25.9	17:00:24	18:00:22	00:59:58	24.8 22.4	0	0	-	-	-	Larsen	No chance to shoot

Table 5. Summary of marine debris observations.

No.	Date	Latitude (xx-xxS)	Longitude (xxx-xxE)	Description
1	2016/12/14	63-06S	132-33E	single fishing float
2	2016/12/15	62-01S	134-45E	driftwood
3	2016/12/18	62-44S	140-42E	drum can
4	2016/12/18	62-49S	140-47E	single fishing float
5	2017/1/5	64-48S	161-26E	single fishing float
6	2017/1/6	66-47S	163-41E	fishing floats
7	2017/1/6	66-48S	163-45E	single fishing float
8	2017/1/6	66-51S	163-51E	single fishing float

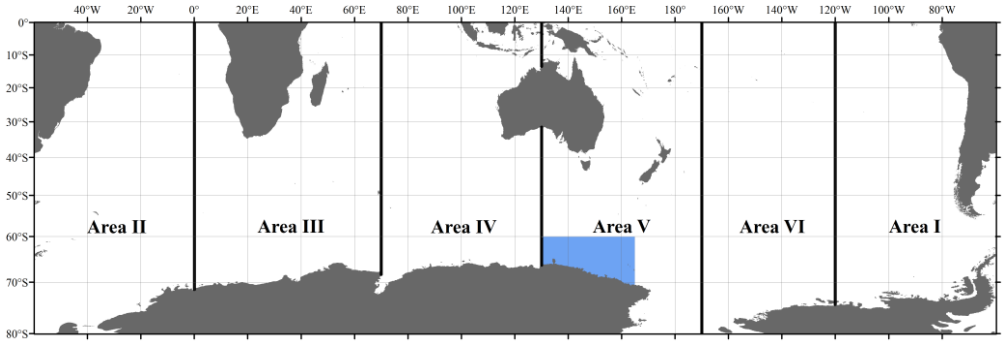

Figure 1a. Research area of the 2016/17 NEWREP-A dedicated sighting survey. Blue area indicates the researched area of the dedicated sighting survey in 2016/17 NEWREP-A.

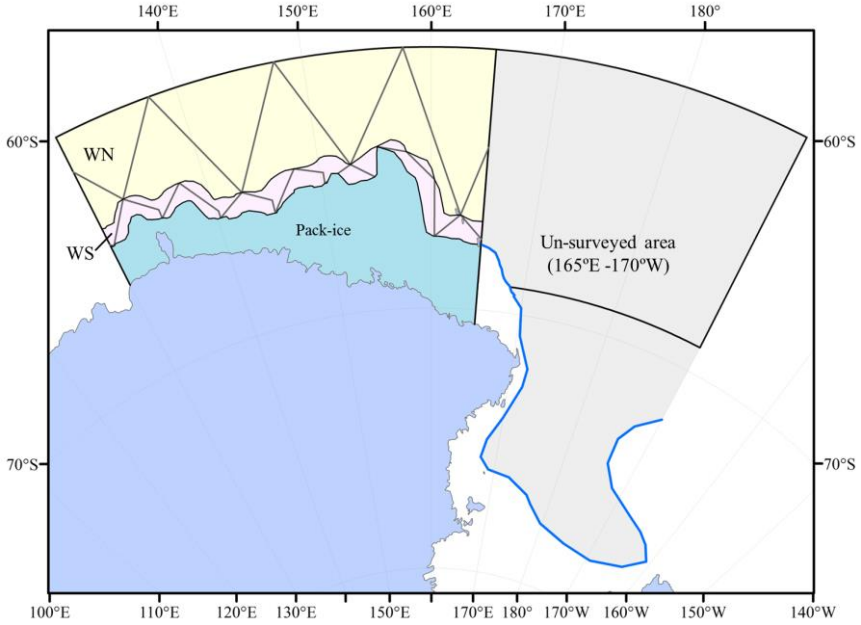

Figure 1b. Research area (130°E-165°E) and trackline of the 2016/17 NEWREP-A dedicated sighting survey. WN: West-North stratum, WS: West-South stratum. Blue line indicates assumed ice edge line.

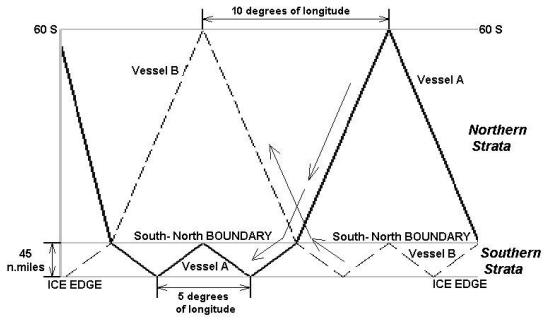

Figure 1c. Basic design of the pre-determined trackline. Two vessels alternately survey the northern and southern strata each crossing the trackline at the way-point between two strata.

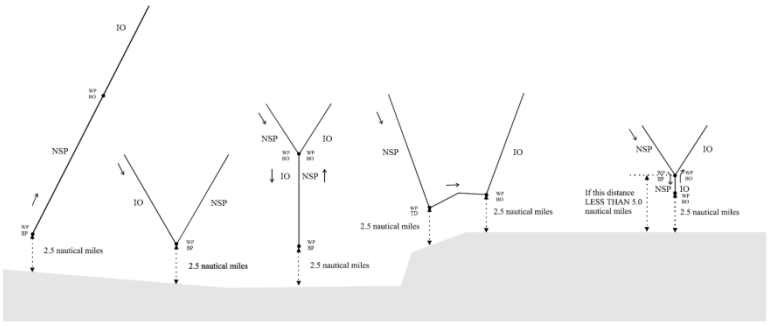

Figure 1d. Standard procedures for modifications to the cruise trackline in the southern strata (IWC, 2008). If the ice edge is encountered prior to reaching a planned waypoint, 2.5 n.miles from the estimated ice edge, the vessel shall follow the ice edge, off-effort, until survey can be resumed on the planned trackline. If the ice edge is not encountered on reaching a planned ice edge waypoint, research shall be conducted on a bisector. Survey mode is to be changed at the planned waypoint (unless the ice edge is within 5 n.miles of the waypoint), and again on reversing direction when the true ice edge is encountered.

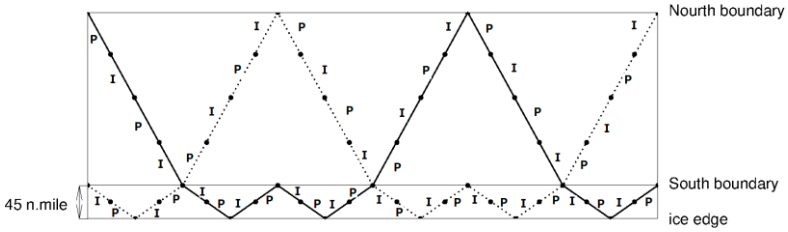

Figure 1e. The survey modes (NSP (P) and IO (I) modes) were set alternately in each trackline.

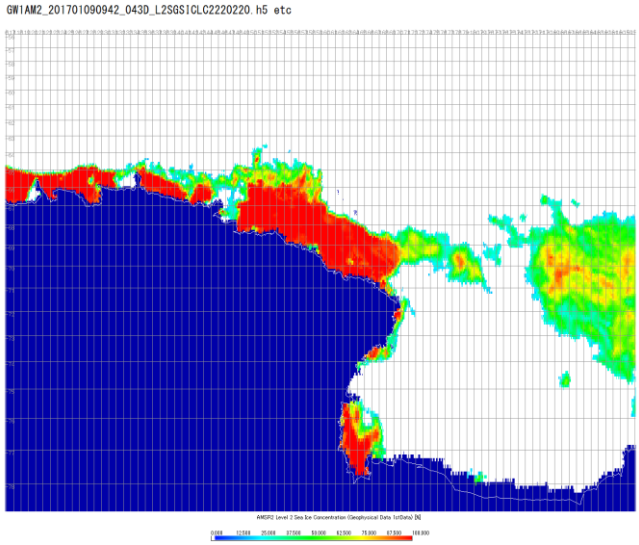

Figure 2. The pack-ice distributions in the research area, dated 9 January 2017 using observational data acquired by the Advanced Microwave Scanning Radiometer 2 (AMSR2). Data from the Japan Aerospace Exploration Agency (JAXA), http://global.jaxa.jp/projects/sat/gcom_w/.

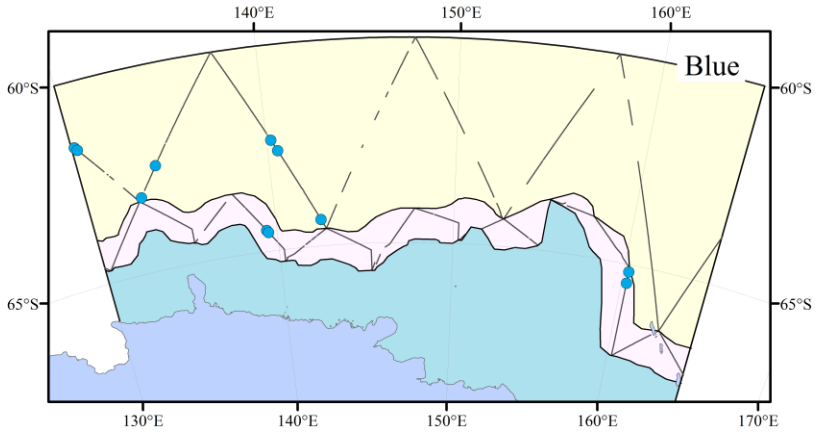

Figure 3a. Primary searching effort and associated primary sighting positions of blue whales in the research area.

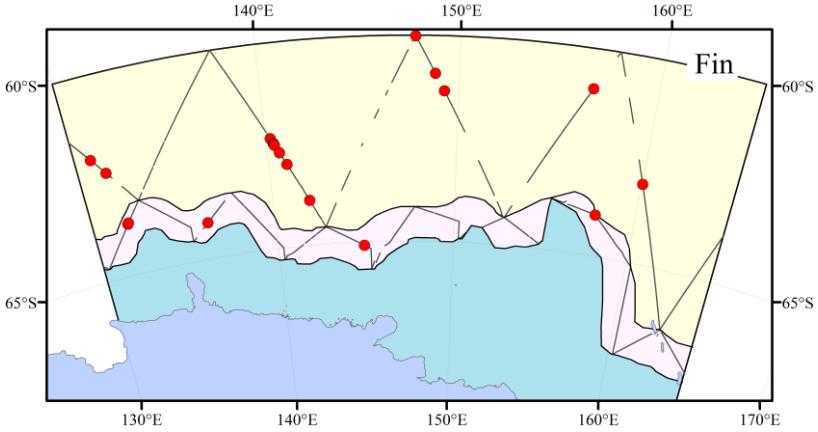

Figure 3b. Primary searching effort and associated primary sighting positions of fin whales in the research area.

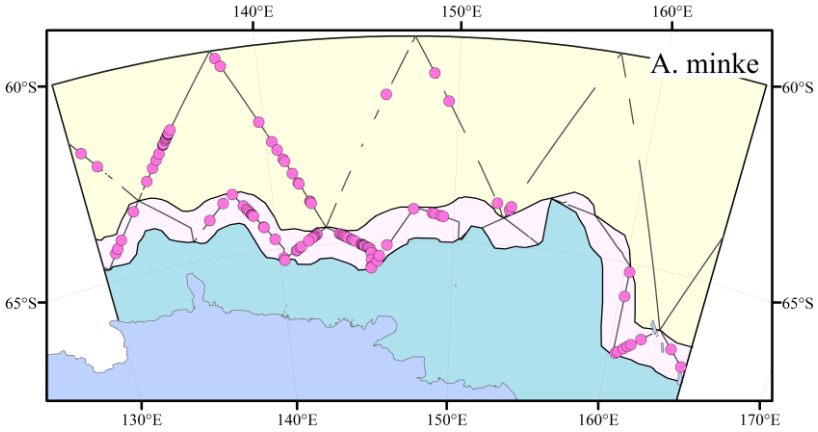

Figure 3c. Primary searching effort and associated primary sighting positions of Antarctic minke whales in the research area.

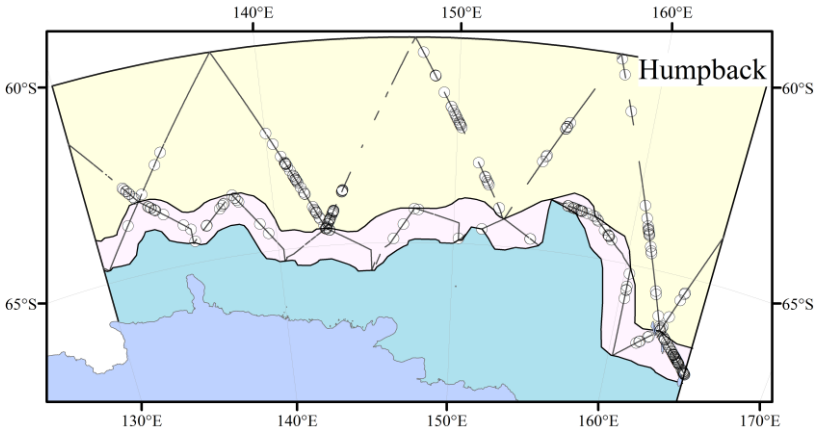

Figure 3d. Primary searching effort and associated primary sighting positions of humpback whales in the research area.

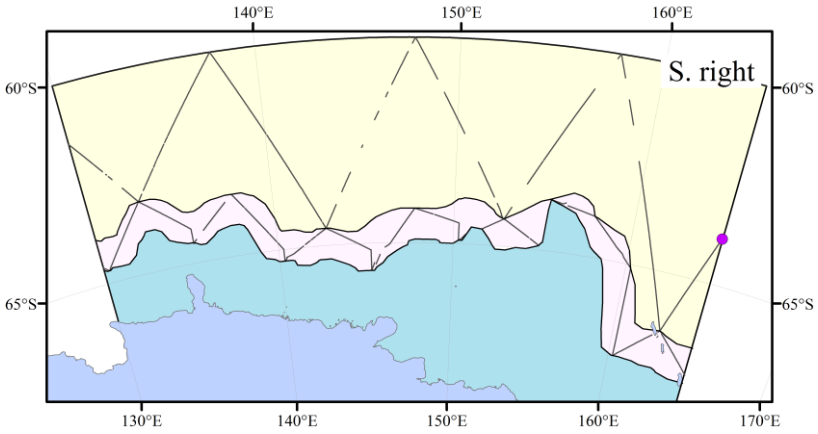

Figure 3e. Primary searching effort and associated primary sighting positions of southern right whale in the research area.

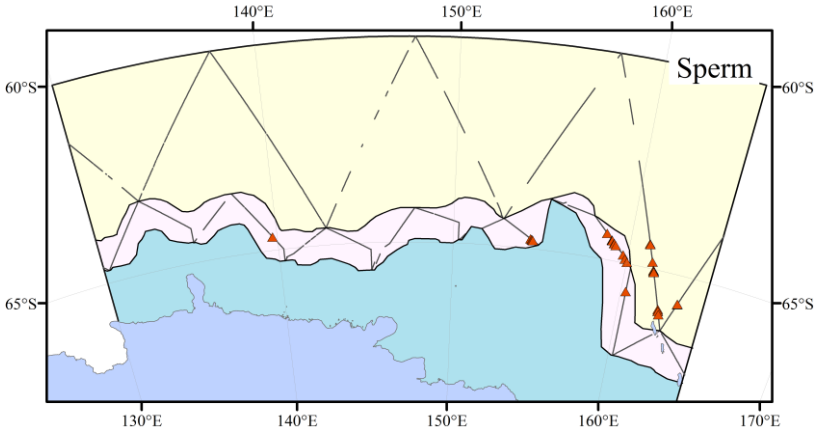

Figure 3f. Primary searching effort and associated primary sighting positions of sperm whales in the research area.

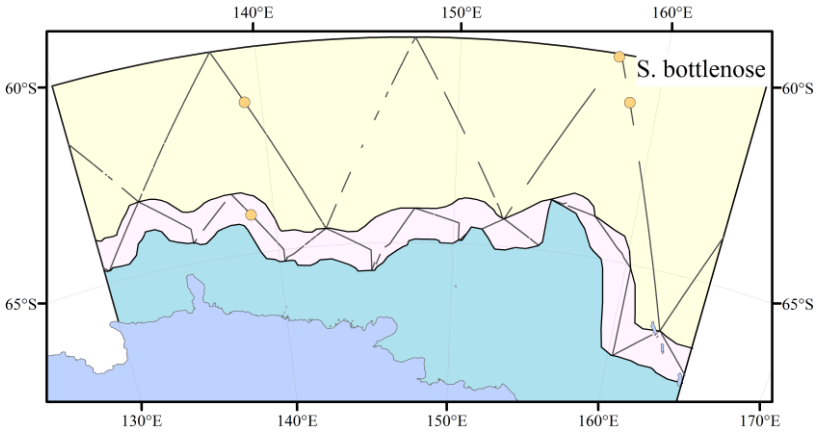

Figure 3g. Primary searching effort and associated primary sighting positions of southern bottlenose whales in the research area.

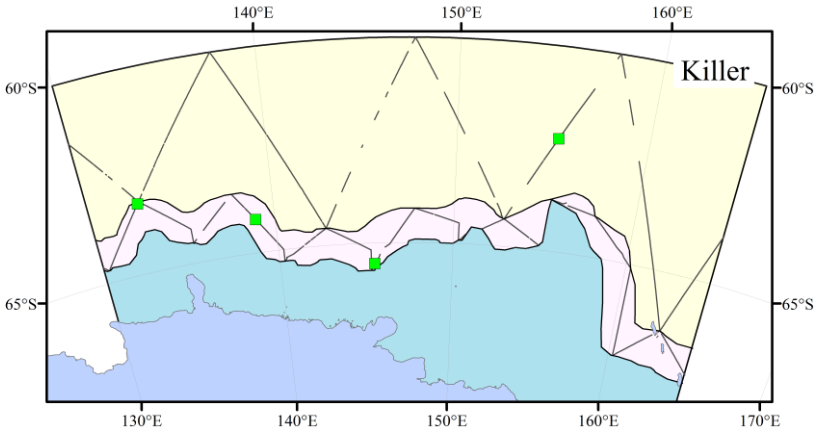

Figure 3h. Primary searching effort and associated primary sighting positions of killer whales in the research area.

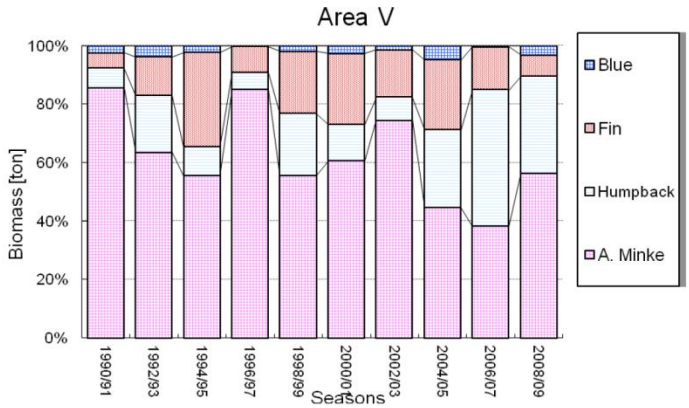

Figure 4. Estimated biomass of blue, fin, humpback and Antarctic minke whales in Area V (south of 60°S) between 1990/91 and 2008/09 seasons based on JARPA and JARPAII sighting data (Matsuoka and Hakamada, 2014).

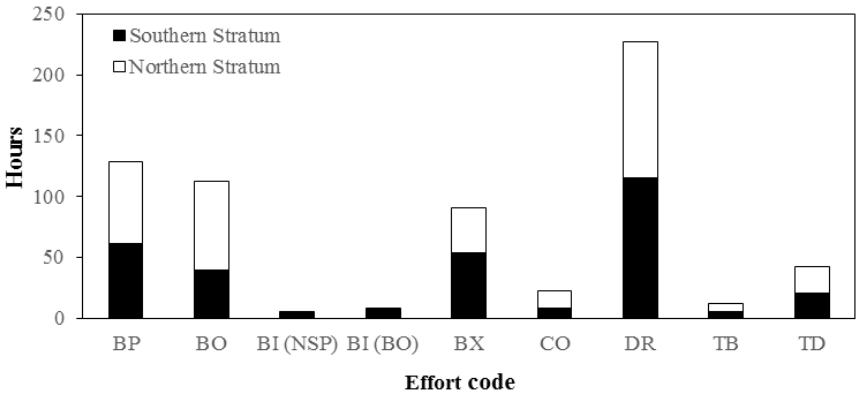

Figure 5a. Breakdown of research time in hours, by effort code in the research area. BP: Normal Passing mode searching (NSP), BO: Passing with Independent Observer searching (IO), BI: NSP and BO with in the ice area, BX: Sighting distance and angle estimate experiment, Photo-ID, Biopsy experiments, telemetry experiments, Net sampling and Oceanographic observation, CO: Confirmation of school, DR: Drifting, TB: Time back to trackline, TD: Top down steaming.

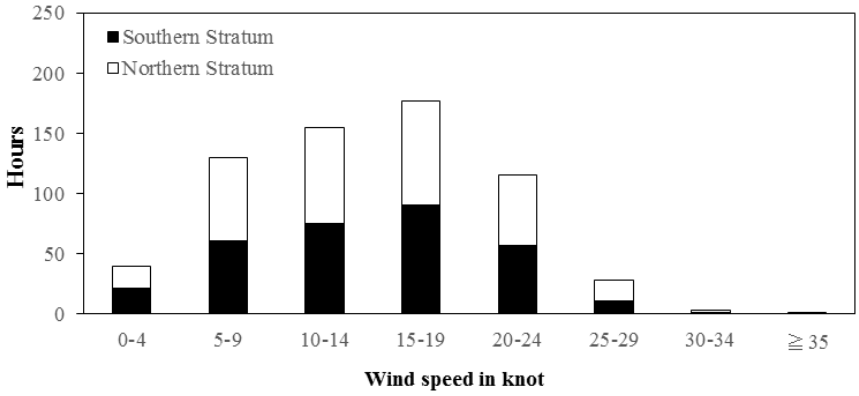

Figure 5b. Breakdown of research time in hours in the research area, by wind speed in knots.

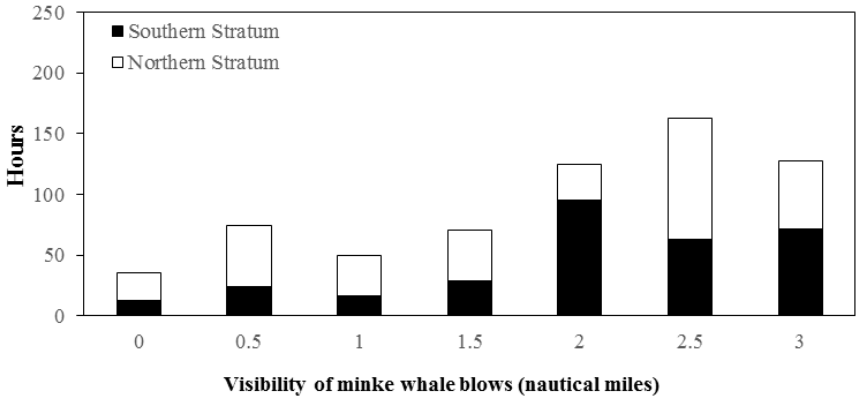

Figure 5c. Breakdown of research time in hours in the research area, by visibility (minke whale visibility) in nautical mile.

Appendix 1

Results of the feasibility study on biopsy sampling on Antarctic minke whale under the NEWREP-A

Introduction

The NEWREP-A research plan includes a feasibility study on biopsy sampling in Antarctic minke whale to be undertaken along the dedicated sighting surveys. On this particular study, the NEWREP-A review workshop made the following recommendations (IWC, 2015): 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).

According to the timeline of the NEWREP-A, and in response to the NEWREP-A review workshop recommendations, the feasibility study on biopsy sampling of Antarctic minke whale will be carried out during the first three surveys, and the design will take into consideration the others recommendations from the NEWREP-A review workshop as much as possible. Design of the feasibility study will take into consideration the previous experience accumulated from the IDCR/SOWER (Ensor *et al*., 2001; 2004) and JARPA (Nishiwaki, 2000) surveys. The evaluation of this technique for Antarctic minke whale will be provided at the 2018 IWC SC meeting.

As stated in the NEWREP-A research plan, final evaluation of non-lethal techniques such as biopsy sampling on Antarctic minke whale should consider the following criteria: i) whether the same data sought can be obtained by this non-lethal method; ii) whether it is of sufficient quality for analysis (i.e. accuracy); iii) whether the cost to obtain the data is realistic and reasonable; and iv) whether enough data can be obtained in terms of quantity for statistical analyses.

At the 2015/16 survey the main purpose was the training of the research personnel with the Larsen system. 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 for the 2016/17

Feasibility study of biopsy sampling on Antarctic minke whales would be based on the Larsen system. The Larsen system is considered one of the most efficient methods for biopsy sampling and it is used regularly during the IWC POWER surveys in the North Pacific. It was also used during the former IWC IDCR/SOWER cruises.

In the northern (: 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.

In the southern stratum the study design will try to respond recommendation c) above from the NEWREP-A review workshop. School of more animals and solitary animal 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.

Results

In the northern stratum, nine solitary Antarctic minke whales were targeted for the feasibility biopsy sampling (Figure 1), and a total of 3 hours and 33 minutes was spent in those trials. Biopsy sample was collected from one animal (Table 1). The trials in the northern stratum were possible mainly at low wind speed classes (:0-5; 6-10 kt), however sampling was inefficient.

In the southern stratum, six Antarctic minke whale schools were targeted for the feasibility biopsy sampling (Figure 1). School sizes were: 1, 1, 1, 3, 5 and 12. A total of 2 hours and 38 minutes was spent in those trials. Biopsy samples were collected from five animals (Table 1). The trials in the southern stratum were conducted at each wind speed class. The sampling time was short at low wind speed rather than high wind speed.

Following recommendations from the NEWREP-A review workshop, the weights of the biopsy samples were obtained. The weight ranged from 0.30g and 1.05g with an average of 0.67g.

Preliminary statistical analysis comparing the efficiency of lethal and biopsy sampling

A total of 11 biopsy were sampled from 24 trials in the experiments conducted in 2015/16 and 2016/17. A total of 666 animals were taken by the lethal sampling from 689 trials (Table 2).

A generalized linear model (GLM) with sampling success as response variable, adjusting for confounders factors (sampling method, research year, Beaufort scale, visibility and sampling vessels) was performed based on data from the NEWREP-A in 2015/2016 and 2016/2017. Table 3 shows the coefficient estimates of each explanatory variable in the selected models. The best model with lowest BIC (Schwarz 1978), suggested as explanatory variables only the 'sampling method'. The success of biopsy sampling was significantly lower than lethal sampling ($p < 0.05$, Table 3). The estimates and the standard errors of success proportions of biopsy and lethal sampling were 0.967 ± 0.007 and 0.458 ± 0.102, respectively.

Further statistical analyses will be conducted after the third feasibility study is completed in 2017/18, and a final evaluation of biopsy sampling technique for the Antarctic minke whale will be presented to the 2018 IWC SC meeting.

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Ensor, P., Matsuoka, K., Marques, F., Miura, T., Murase, H., Pitman, R., Sakai, K. and Van Waerebeek, K. 2001. 2000-2001 International Whaling Commission-Southern Ocean Whale and Ecosystem Research (IWCSOWER) Circumpolar Cruise, Areas V, VI and I. Paper SC/53/IA5 presented to the IWC Scientific Committee, May 2002 (unpublished). [Paper available at the IWC Office].

Ensor, P., Matsuoka, K., Komiya, H., Ljungblad, D., Miura, T., Morse, L., Olson, P., Olavarria, C., Mori, M. and Sekiguchi, K. 2004. 2003-2004 International Whaling Commission-Southern Ocean Whale and Ecosystem Research (IWC-SOWER) Circumpolar Cruise, Areas V. Paper SC/56/IA13 presented to the IWC Scientific Committee, May 2004 (unpublished). [Paper available at the IWC Office].

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Schwarz, G. 1978. Estimating the dimension of a model. *Ann. Stat.* 6(2):461-464.

Table 1. Summary of feasibility biopsy sampling in Antarctic minke whales during the 2016/17 dedicated sighting survey.

Vesl.	Experiment number	Date	Sight No.	Scl. size	Sighted Position Lat.	[min.]	Long.	[min.]	Start time of BX	End time of BX	Experiment duration	Est. body length of target ind. [m]	Number of shoot	Number of hit	Position struck	Number of sample (ind.)	Sample No.	Shooting equipment	Stratum	Wind speed (knots)	Notes
YS3	BY303	20161214	9	1	-62	33.1	133	55.2	15:39:19	16:05:23	00:26:04	5.8	2	0	-	0	-	Larsen	northern	6-10kt	-
YS3	BY305	20161215	2	1	-62	22.8	134	11.0	06:26:18	06:39:49	00:13:31	7.2	0	0	-	0	-	Larsen	northern	0-5kt	No chance to shoot
YS3	BY306	20161215	5	1	-62	14.6	134	24.0	07:43:40	08:11:29	00:27:49	6.5	2	0	-	0	-	Larsen	northern	6-10kt	-
YS3	BY308	20161215	10	1	-62	01.9	134	43.6	10:45:57	11:10:11	00:24:14	6.3	1	0	-	0	-	Larsen	northern	0-5kt	-
YS3	BY309	20161215	22	1	-61	47.9	135	05.4	13:08:36	13:53:40	00:45:04	7.8	1	0	-	0	-	Larsen	northern	0-5kt	-
YS3	BY310	20161215	25	1	-61	43.5	135	12.3	14:45:11	15:01:31	00:16:20	8.0	1	1	C1	1	J16YS3M001	Larsen	northern	6-10kt	-
YS3	BY311	20161216	2	1	-60	11.9	138	00.1	17:39:43	18:08:14	00:28:31	8.0	0	0	-	0	-	Larsen	northern	6-10kt	No chance to shoot
YS3	BY312	20161217	1	1	-60	24.2	138	12.8	07:40:15	07:59:17	00:19:02	5.7	1	0	-	0	-	Larsen	northern	6-10kt	-
YS3	BY318	20161220	3	3	-64	44.0	142	16.0	14:16:08	14:49:24	00:33:16	7.1	3	1	A	1	J16YS3M002	Larsen	southern	21-25kt	-
YS3	BY319	20161224	1	5	-65	02.6	144	45.7	06:38:08	07:05:11	00:27:03	8.1	3	1	LC2	1	J16YS3M003	Larsen	southern	11-15kt	-
YS3	BY321	20161226	4	12	-64	18.0	148	47.4	09:49:16	10:21:38	00:32:22	8.4	3	2	LC2	1	J16YS3M004	Larsen	southern	6-10kt	-
YS3	BY322	20161228	2	1	-64	03.0	153	09.1	08:55:05	09:07:31	00:12:26	6.1	1	0	-	0	-	Larsen	northern	16-20kt	-
YS3	BY324	20170106	33	1	-66	48.2	163	45.1	17:29:10	17:34:17	00:05:07	5.8	1	1	LC1	1	J16YS3M005	Larsen	southern	6-10kt	-
YS3	BY325	20170107	23	1	-67	09.3	164	38.1	08:39:06	08:56:15	00:17:09	6.3	1	1	RB1	1	J16YS3M006	Larsen	southern	0-5kt	-
YS3	BY327	20170111	5	1	-65	48.6	160	18.0	07:45:43	08:29:27	00:43:44	6.2	1	0	-	0	-	Larsen	southern	16-20kt	-

Table 2. Success proportions, sampled whale numbers and target whale (experiment) numbers in Antarctic minke whale of biopsy and lethal sampling in the NEWREP-A for 2015/16-2016/2017.

Method	Research year	Number of target whales	Number of sampled whales	Success proportion
Biopsy	2015/2016	9	5	0.556
	2016/2017	15	6	0.400
	Total	24	11	0.458
Lethal	2015/2016	349	333	0.954
	2016/2017	340	333	0.979
	Total	689	666	0.967

Table 3. Results of generalized linear model analyses with estimates of success of biopsy and lethal sampling in Antarctic minke whales as explanatory variables.

	Estimate	Std. Error	z value	Pr (>|z|)
(Intercept)	3.3658	0.2121	15.870	$p < 0.05$
Method1	-3.5328	0.4613	-7.658	$p < 0.05$

Null deviance: 285.14 on 712 degrees of freedom; Residual deviance: 234.72 on 711 degrees of freedom.

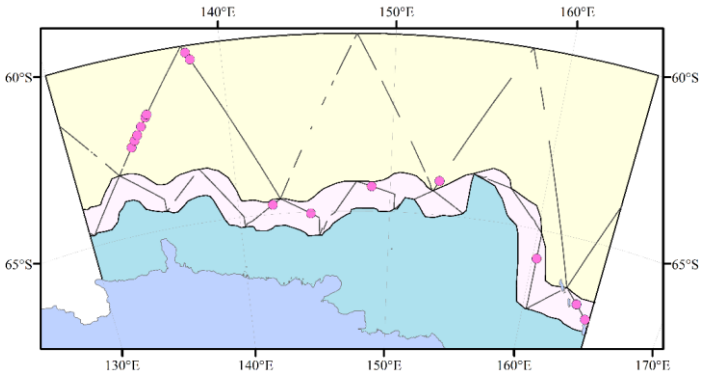

Figure 1. Geographic position of feasibility biopsy sampling on Antarctic minke whales by the 2016/17 dedicated sighting survey.

Appendix 2

Results of the feasibility study on satellite tracking of Antarctic minke whale under the 2016/17 NEWREP-A

Introduction

As stated in the timeline of the NEWREP-A plan, the feasibility study on telemetry in the Antarctic minke whale will be undertaken along with the dedicated sighting surveys, at an early stage of the first six-year period of NEWREP-A. On this particular study, the NEWREP-A Review Panel made the following recommendations (IWC, 2015): 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.

Consequently, in planning this feasibility study, effort was 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.

Study design

As in the first feasibility survey, the experiment was based on a pneumatic tool (the whale tag launcher: Aerial Rocket Tag System: ARTS, Lars Kleivane and Restech Norway A/S, Norway) and satellite tag (SPOT6, Wildlife computers, WA, USA). Satellite tags were shot by this tool from the bow deck and carried a blubber penetration-type mount system for whales. The harpoon heads function to anchor under the skin. The tagged whales were also target of biopsy sampling using the Larsen system. Originally the experiment had been planned with 2 dedicated sighting vessels, but the experiment were assigned to a dedicated sighting vessel (*Kaiyo-Maru No.7*) and a sighting/sampling vessel (*Yushin-Maru No.1*) for logistical reason in this season. As mentioned above, the attachment system was discussed previously with colleagues from the National Research Institute of Far Seas Fisheries (NRIFSF, Yokohama), and with Norwegian colleagues.

Location data were obtained from six classes of accuracy: 3, 2, 1, 0, A and B. The location classes 1–3 have estimated accuracies of < 1500m. The location class 0 has estimated accuracies of > 1500m. The location classes A and B have no estimated location accuracy (Argos User's Manual, 2016). In the context of migration route and destination all three classes of low-accuracy positions contribute important information to the tracks of whales and the errors seem insignificant relative to the scale of whale movements (Vikingsson and Heide-Jørgensen, 2015).

Results

A total of seven trials were made (Table 1). Four satellite tags were deployed on Antarctic minke whales. Three of the tagged whales were also sampled for biopsy samples. Of the four satellite tags, three satellite tags successfully provided positions data (Argos No. 160299, 160296, 162662).

Argos No.160299 was deployed on a whale of estimated body length of 8.0m. The position of the whale was tracked for a period of 39 days. Tagged whale moved to eastward along the ice edge and stayed in polynya about 133°E (Figure 1). Argos No.160296 was deployed on a whale of estimated body length of 7.8m. The position of the whale was tracked for a period of 79 days. Tagged whale moved to eastward along the ice edge and stayed in polynya about 133°E (Figure 2). Argos No.162662 was deployed on a whale of estimated body length of 8.2m. The position of the whale was tracked for a period of 15 days. Tagged whale entered into the Prydz bay and moved east-northward in the Prydz Bay (Figure 3).

Preliminary evaluation and future surveys

Three of satellite tags were deployed on Antarctic minke whales successfully received location data. These data are now under analyses and details will be reported to the future IWC/SC meeting. The attachment systems and techniques improved steadily. Track duration in this season was longer than in 2015/16 season. The methods to extend the period with location information should be further discussed before the third field study in 2017/18.

References

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Table and Figure

Table 1. Summary of the feasibility satellite tagging study for Antarctic minke whales in 2016/17 NEWREP-A.

Vesl.	Sheet number	Date	Sight No.	Scl. size	Sighted Position Lat.	[min.]	Long.	[min.]	Start time of BX	End time of BX	Experiment duration	Est. body length of target ind. [m]	Number of shoot	Number of hit (ind.)	Position struck	ARGOS No.	Shooting equipment	Notes
YS1	ST101	20170103	7	4	-65	07.0	111	58.8	11:48:07	12:47:22	00:59:15	8.0,8.3	2	2	RE,LB1a	160299,160297	LK-ARTS	Biopsy sample No. J16YS1M001,J16YS1M002
YS1	ST102	20170103	9	4	-65	10.6	111	58.0	13:16:09	13:50:03	00:33:54	8.5	1	0	-	-	LK-ARTS	
YS1	ST103	20170103	11	6	-65	07.5	111	58.7	14:30:14	15:12:42	00:42:28	7.8	2	1	RC1	160296	LK-ARTS	Biopsy sample No. J16YS1M003
YS1	ST104	20170201	7	1	-66	49.0	62	33.0	14:26:33	14:55:58	00:29:25	8.2	1	1	LB1p	162662	LK-ARTS	
YS1	ST105	20170217	8	1	-67	19.1	66	27.4	16:08:45	16:36:42	00:27:57	8.3	0	0	-	-	LK-ARTS	No chance to shoot
YS1	ST106	20170304	8	1	-66	53.6	59	18.1	15:19:18	15:25:23	00:06:05	8.9	0	0	-	-	LK-ARTS	No chance to shoot
KY7	ST701	20161219	15	3	-63	50.8	138	21.8	09:42:59	10:32:09	00:49:10	8.3	1	0	-	-	LK-ARTS	No chance to shoot

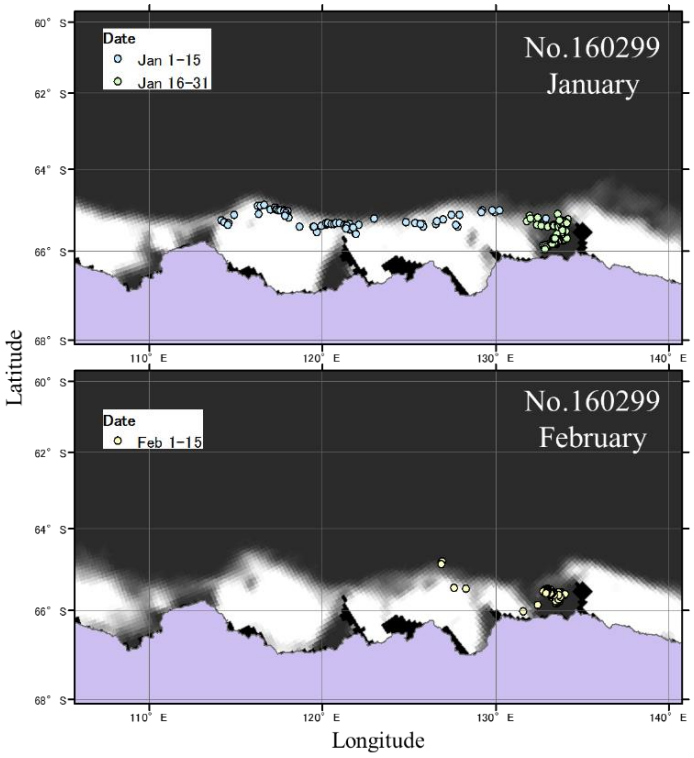

Figure 1. Tracking positions of the Antarctic minke whale (No.160299) with monthly sea ice concentration January (upper) and February (lower). Location data in this figure are used Location Classes of 3, 2, 1, 0, A and B.

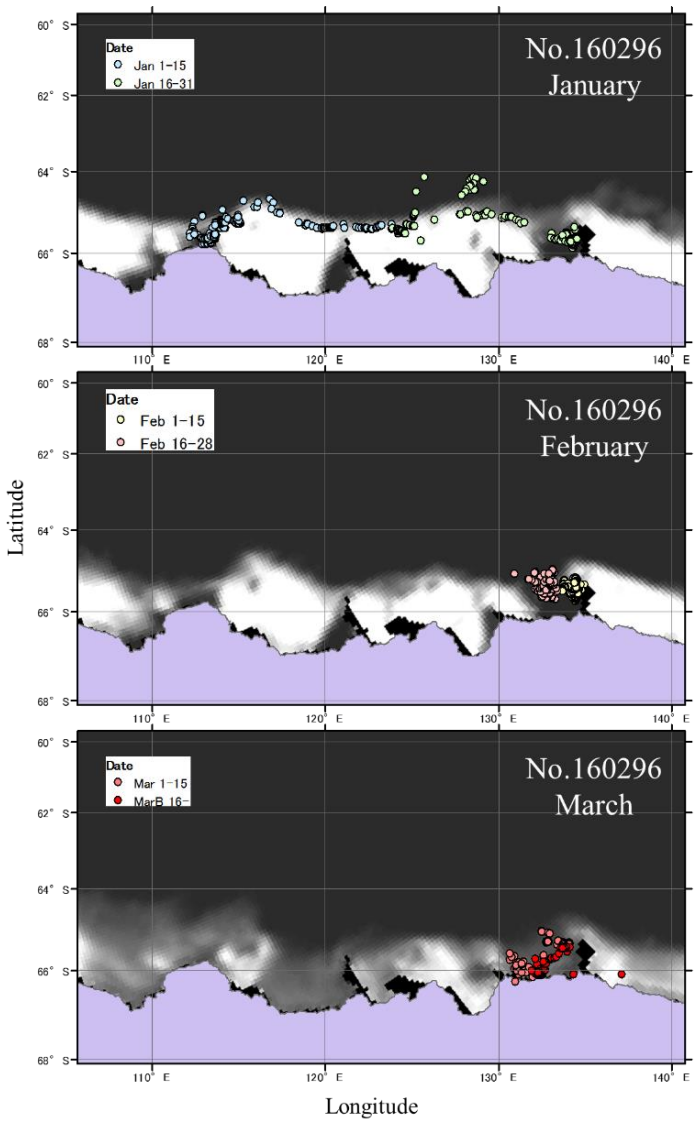

Figure 2. Tracking positions of the Antarctic minke whale (No.160296) with monthly sea ice concentration January (upper), February (middle) and March (lower). Location data in this figure are used Location Classes of 3, 2, 1, 0, A and B.

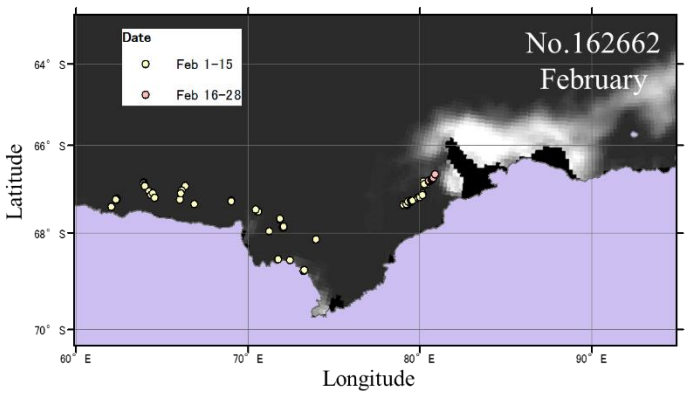

Figure 3. Tracking positions of the Antarctic minke whale (No.162662) with monthly sea ice concentration, February. Location data in this figure are used Location Classes of 3, 2, 1, 0, A and B.

Appendix 3

Ship specifications of *Yushin-Maru No.3* and *Kaiyo-Maru No.7*

Vessel photos:

Yushin-Maru No.3

Kaiyo-Maru No.7

Vessel specifications:

	Yushin-Maru No.3	*Kaiyo-Maru No.7*
Call sign	7JCH	JFCL
Length overall [m]	69.61	60.02
Molded breadth [m]	10.8	10.60
Gross tonnage [GT]	742	649
Barrel height [m]	19.5	17.0
Upper bridge height [m]	11.5	9.0
Bow height [m]	6.5	4.8
Engine power [PS / kW]	5280 / 3900	2100 / 1544

Appendix 4

Oversight for the 2016/17 NEWREP-A dedicated sighting survey

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The plan of this survey was presented to the 2016 IWC/SC meeting (Hakamada *et al*., 2016) and endorsed by the Scientific Committee (IWC, 2016). The research activities to be conducted during the 2016/17 survey are the same as in the original plan presented to SC65b in 2014 (Matsuoka *et al*., 2014). On behalf of the IWC Scientific Committee I carried out the oversight work during the 2016/17 NEWREP-A dedicated sighting survey. This is a brief report of the oversight activities conducted on that survey.

Preparatory work

I participated in a pre-cruise meeting carried out in Shiogama, Miyagi, Japan on 15 November 2016 and Hachinohe, Aomori, Japan on 4 November 2016. The survey organizers, researchers and crew members also participated in that meeting. During the meeting the organizers explained the objective of the survey and the procedure to be used for sighting surveys, experiments and krill and oceanographic survey. The planned sighting procedure was in order with that agreed by the Scientific Committee. Research vessels were available for the surveys, the R/V *Yushin-Maru No.3* (YS3) (742GT) and *Kaiyo-Maru No.7* (KY7) (649GT). These vessels were assigned to cover the research area, south of 60°S in IWC Antarctic Area V included the Ross Sea, and in the longitudinal range of 130°E-170°W. These vessels were assigned to cover predetermined transects, normal passing mode and passing with Independent Observer mode. Two experienced researchers were assigned to each vessel.

Oversight period and method

I was carried out the oversight work through the planning and the execution of this sighting survey conducted by the Institute of Cetacean Research (ICR). The research activities in the research vessels were oversight by examining the daily report prepared by the researchers on board. In some instances telephone calls were made for further clarification of the activities, procedure and sightings made. Geographical positions and weather information of the each vessel were tracked every day from ICR. Thus the total survey was oversighted.

Brief narrative of the oversight vessel

The duration of this cruise was 135 days for YS3. The YS3 departed from Shiogama, in Japan on 17 November and started the transit survey on 2 December and completed on 11 December. They started survey in the research area on 13 December and completed the research area on 14 January when the western sector of the Area V was finished, for the backup plan of NEWREP-A. The vessel departed from the research area on 10 March, the transit survey of the vessel cancelled for logistical reason. The vessel arrived at Shimonoseki, in Japan on 31 March.

The duration of this cruise was 80 days for KY7. The KY7 departed from Hachinohe, in Japan on 16 November and started the transit survey on 2 December and completed on 11 December. They started survey in the research area on 13 December and concluded the research area on 8 January. The vessel left the research area and conducted the transit survey from 9 to 19 January. The vessel arrived at Ogasawara, in Japan on 3 February.

Post-cruise meeting

I participated in a post-cruise meeting held on 9 February 2017 in Tokyo (KY7) and 31 March 2017 in Shimonoseki (YS3). Survey organizers, researchers and the captain participated in that meeting. Apart to discuss and assess the results of the surveys, the researchers engaged in the verification and checking of data.

Conclusion

All equipment and the survey method of vessel were the same as in the past sighting surveys. The design of the survey strata and tracklines were improved to cover each stratum completely. The planned sighting procedure was in accordance with the guideline agreed by the SC (IWC, 2012). Objectives and procedure of the survey were explained to the captains, officers, crew and researcher in advance. I then endorse the information and data obtained during the 2016/17 NEWREP-A dedicated sighting survey.

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