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INTERNATIONAL WHALING COMMISSION

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ABSTRACT

The results of the 2015/16 NEWREP-A dedicated whale sighting survey in Antarctic Area IV (south of 60^0S) are reported. One dedicated sighting vessel (SV) was engaged and successfully conducted the research for 50 days, from 27 December 2015 to 14 February 2016 in the eastern part of Areas IV (115°E - 130°E, 25% of the Area IV) using two survey modes, and based on IWC/IDCR-SOWER survey procedures. The total searching distance in the research area was 1,542.7n.miles (2,857km), including 741.5n.miles covered in Normal Passing mode (NSP) and 801.2n.miles in Independent Observer (IO) mode. Survey coverage was 93% in the northern strata and 82% in the southern stratum. Five baleen whale species: blue (15 schools / 27 individuals), fin (14/39), Antarctic minke (186/538), southern right (1/1) and humpback (513/1,179) and at least two toothed whale species (sperm (8/8), killer (16/158)), were sighted in the research area. Antarctic minke whales tended to distribute in the southern stratum, especially north of ice edge. Humpback whales were the most frequently sighted large whale species and were widely distributed in the research area. Blue whales are sighted in the southern stratum, especially in the south-east stratum. Estimated Angle and Distance Experiments were conducted as in previous years. Routine photo-id and biopsy sampling on large whales were also conducted. A total of 69 individuals were successfully photographed including 21 blue, one southern right, 27 humpback and 20 killer whales. A total of 33 biopsy (skin and blubber) samples was also successfully collected from seven blue, seven fin, one southern right, ten humpback and eight killer whales using the Larsen-gun system. No marine debris was observed. The survey procedure including IO mode data was in accordance with the SC guidelines. The sighting data were validated and already submitted to the IWC secretary. During this survey, feasibility studies on telemetry and biopsy sampling of Antarctic minke whales were started, and results are presented in this paper. Also krill and oceanographic surveys were conducted along the track-lines designed for sighting. Results of the krill and oceanographic surveys are presented by Wada *et al*. (2016).

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 modeling, Objective II (iii): Estimation of prey consumption by the Antarctic minke whale and its nutritional condition, Objective II (iv): Ecosystem modeling (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.

A research plan for the 2015/16 NEWREP-A dedicated sighting survey was submitted to the International Whaling Commission Scientific Committee (IWC SC) in 2015 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 was to cover Area V using two research vessels. After the IWC SC meeting, it became clear that the available budget allocated to the sighting survey could fund only one vessel, not two vessels. Therefore, the proponents decided to make changes onto the original research plan on the research area and the track-line for the 2015/16 survey. Nonetheless, the research activities to be conducted during the 2015/16 survey were the same as in the original plan presented to the IWC SC in 2015. The only difference was the research area, i.e. the revised survey was going to cover the sector between 115°E and 130°E, which is part of Area IV that was not covered in the 2014/15 survey. It was considered feasible to cover this sector with only one vessel.

The main research objective of this survey was to collect systematic sighting data for the abundance estimates of Antarctic minke whales and other baleen whale species in Area IV, including the collection of data for estimates of g(0). Following recommendations from the NEWREP-A review workshop, the start of feasibility studies on biopsy sampling and telemetry of Antarctic minke whales was planned for this survey (results of the feasibility studies on biopsy sampling and telemetry on Antarctic minke whale are presented in Appendices 1 and 2, respectively).

As recommended at the 2010 IWC SC meeting, a small group was established to discuss the survey design of the present survey (e.g. track-lines design, survey mode, etc.), with the aim that such design is consistent with previous JARPAII and IWC/SOWER surveys and analyses (IWC, 2013).

This paper presents the results of the Japanese dedicated sighting survey in the 2015/16 season under the NEWREP-A in the Antarctic Area IV between 115°E and 130°E, which is the part of Area IV that was not covered in the 2014/15 survey (Matsuoka *et al*., 2015). Krill and oceanographic surveys were also conducted. Results of these surveys are presented by Wada *et al*. (2016).

SURVEY DESIGN

Research area

The research area was set south of 60°S, in the east part of Area IV (115°E-130°E; Figure 1a). The research area was divided into northern and southern strata (Figure 1b).

Research vessel

One dedicated sighting vessel (SV), the R/V *Yushin-Maru No.3* (YS3) (742GT), was engaged in the research. It was equipped with a top barrel platform (TOP), Independent Observer Platform (IOP) and an upper bridge platform. Vessel specifications and photo are provided in Annex A.

Track-line

In the northern and southern strata, the survey track lines 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, 2005).

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 (northern strata) or 26 knots (southern strata).

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

Sighting effort 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 were consistent with 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.

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 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.

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 behaviour), 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 with other sightings in the vicinity. Counts of individuals provided in the sighting summary represent best estimates of school sizes in the research area, except when indicated otherwise'.

Attending scientists and responsibilities

The original research plan welcomed the participation of international researchers. No official application for participation was received from international researchers. Three experienced Japanese researchers were selected for this survey. These researchers had enough experience conducting line transect surveys, biopsy sampling and photo-id experiments in the Antarctic through the JARPA/JARPAII 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)
Tatsuya ISODA - sighting, photo-ID, biopsy and satellite tagging
Shinya KAWABE - sighting data, photo-ID and biopsy
Atsushi WADA - krill abundance and oceanographic data

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-gun 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 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 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, 2005; 2008).

RESULTS AND DISCUSSION

The cruise itinerary

The duration of this cruise was 115 days. The YS3 departed Shiogama, Japan on 30 November 2015 and started the transit survey on 14 December 2015, which was completed on 26 December 2015. It started survey in the research area on 27 December 2015, which was completed on 14 February 2016. The vessel left the research area and started the transit survey on 15 February 2016, arriving in Shiogama on 23 March 2016 (Table 1a).

Summary of sightings

Antarctic research area
YS3 was engaged in the research for 50 days, from 27 December 2015 to 14 February 2016 in part of Area IV (115°E - 130°E, 25% of the Area IV; Figure 1b).

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

Tabulations of all track line Waypoint (WP) are shown in Tables 1b and 1c, and the searching effort in Table 1d. 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 and 2b, respectively. Satellite data indicated large polynya in the research area (120°E) in late December. Sea ice north of this polynya was melted in early January therefore it was possible to survey this area (Figure 2).

The total searching distance in the research area was 1,542.7n.miles (2,857km), including 741.5n.miles in NSP and 801.2n.miles in the IO modes. The searching effort coverage was 93% in the northern strata and 82% in the southern stratum.

Figures 3a to 3d show the geographical distribution of the sightings in the research area for the main whales sighted. Five baleen whale species and at least two toothed whale species were sighted in the research area (Table 2a).

Antarctic minke whales distributed mainly in the southern stratum (Figure 3b). There was high density areas of Antarctic minke whales at about 30 to 40n.miles north of ice edge. Same as in previous surveys no mother and calf pair of Antarctic minke whale was observed in the research area. Humpback whales were the most frequently sighted species in this research area (Figure 3b). The number of sightings of humpback whales was about two times higher (in number of individuals) than that of Antarctic minke whales, and was considerably higher than those of other species. Humpback whales were widely distributed in the research area and just north of the high

density areas of Antarctic minke whales. These distribution patterns were almost same as in previous studies (Murase *et al*., 2014).

Duplicate sightings determined on the number of sightings made by the IOP that were observed also by the TOP Barrel. Duplicate and not duplicate sightings of Antarctic minke whales were 24 (duplicate: 21, possible duplicate: 3) and 12, respectively (Table 2c).

Identification of duplicate sightings was also conducted for whale species other than Antarctic minke whale during surveys in IO mode (Table 2c). To determine whether g(0) is significantly different from one, analyses on duplicate sightings will be conducted for those whale species where sufficient data are obtained during the NEWREP-A program (Government of Japan, 2015a).

Blue whales tended to distribute in the southern stratum, and especially in the south-east of the stratum (65°S, 129°E) (Figure 3a). Fin whales were found widely in the research area (Figure 3a). These observations were almost the same as in past JARPA/JARPAII surveys (Hakamada *et al*., 2014). One southern right whale was sighted in the eastern part of the southern stratum (Figure 3c). Solitary large sperm whales were found between near ice edge (Figure 3c). Killer whales were sighted mainly in the southern stratum (Figure 3d). Two schools of killer whale (30 whales) were identified as Type A and seven schools (39 whales) as Type B.

The present sighting survey complements the work of the IDCR/SOWER programme which has been finished. 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 of Antarctic minke whale in the research area, respectively.

Low and middle latitudinal sighting survey
During transit from Japan to the research area, the sighting surveys were conducted from 14 to 26 December 2015 in the area between 20°S and 60°S outside of national EEZs. The searching effort was 581.0n.miles. From the research area to Japan, the sighting survey was conducted from 15 February to 7 March 2016 in the area between 20°S and 60°S outside of national EEZs. The searching effort was 180.7n.miles. One sei whale was observed. Table 2b summarized all sightings observed during transit to and from the research area.

Other research activities

Sighting distance and angle experiment
A training was conducted in 30 December for 1 hour 42 minutes, and the actual experiments (136 trials) were successfully conducted on 17 January for 4 hour 4 minutes. The results of this experiment will be used for the calculation of abundance estimates.

Photo-ID
A total of 21 blue, 1 southern right, 27 humpback and 20 killer whales were successfully photo-identified during this cruise (Tables 3a and 3b). A total of ten blue whale, five southern right whale and 13 humpback whale were photographed between 2011/12 and 2013/14 JARPAII surveys (Matsuoka *et al*., 2014). A total of eight blue, 45 humpback, and 39 southern right whales were collected photo-ID in 2014/15 season (Matsuoka *et al*., 2015). 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 33 biopsy samples were collected (Tables 4a and 4b), including seven blue whales, seven fin, one southern right, ten humpback and eight killer whales (type A: 1 individual, type B: seven individuals). Biopsy samples were stored at -20°C for future genetic analyses. A total of four biopsy samples of southern right whale, five of humpback whale were collected between 2011/12 and 2013/14 JARPAII surveys (Matsuoka *et al*., 2014). A total of three biopsy samples of blue whale, nine of fin whale, ten of humpback whale and 39 of southern right whale were collected in 2014/15 season (Matsuoka *et al*., 2015). These samples will be used in future genetic analyses (e.g. Pastene *et al*., 2014, Kanda *et al*, 2014).

Marine debris observation
No marine debris was observed during the survey in the research area. 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 Annex B.

Sighting data storage

The sighting data were already submitted to the IWC secretary and receipt confirmed by 31 May 2016.

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Table 1a. Itinerary of the 2015/16 NEWREP-A dedicated sighting survey.

Event	Dates
Pre-cruise meeting	20 November 2015
Vessel departed Shiogama, Japan	30 November 2015
Start transit survey	14 December 2015
Finish transit survey	26 December 2015
Vessel arrives at the research area (50 days in the research area)	27 December 2015
Vessel completes surveys in the research area	14 February 2016
Start transit survey	15 February 2016
Post-cruise meeting	21 February 2016
Finish transit survey	7 March 2016
Vessel arrives Shiogama, Japan	23 March 2016

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

WP	Latitude			Longitude			Leg no.	mode	course	plan	effort	covered (%)	area code	vessel
140	63	48.5	S	115	0.0	E	140	NSP	227	12.60	12.67	101%	42	YS3
141	63	40.0	S	115	21.0	E	141	IO	327	58.80	54.60	93%	42	YS3
142	64	29.0	S	116	34.9	E	142	NSP	327	58.80	54.02	92%	42	YS3
143	65	18.0	S	117	51.0	E	143	IO	283	32.90	32.30	98%	42	YS3
143A	64	40.0	S	117	51.0	E	143	IO	180	38.00	37.27	98%	42	YS3
144	64	47.5	S	119	5.9	E	144	NSP	283	32.90	23.13	70%	42	YS3
145A	64	55.0	S	120	21.0	E	-	-	-	-	-	-	42	YS3
145B	65	35.0	S	120	21.0	E	145	IO	95	31.20	28.40	91%	42	YS3
146	65	37.5	S	121	36.0	E	146	NSP	95	31.10	28.26	91%	42	YS3
146A	65	40.0	S	122	51.0	E	146	NSP	180	29.00	12.90	44%	42	YS3
147	66	9.0	S	122	51.0	E	147	IO	31	60.80	50.60	83%	42	YS3
148	65	17.0	S	124	7.2	E	148	NSP	31	60.80	53.01	87%	42	YS3
149	64	25.0	S	125	21.0	E	149	IO	131	42.20	41.18	98%	42	YS3
150	64	52.5	S	126	35.4	E	150	NSP	131	42.20	28.57	68%	42	YS3
150A	65	20.0	S	127	51.0	E	150	NSP	180	22.00	22.02	100%	42	YS3
151	65	42.0	S	127	51.0	E	151	IO	33	58.10	44.49	77%	42	YS3
152	64	53.5	S	129	7.1	E	152	NSP	33	41.50	24.86	60%	42	YS3
153	64	18.9	S	130	0.0	E	153	-	-	-	-	-	42	YS3
154	64	5.0	S	130	21.0	E	-	-	-	-	-	-	-	-
301	66	0.0	S	118	42.0	E	301	NSP	152	25.60	22.55	88%	42	YS3
302	66	22.5	S	119	11.8	E	302	IO	152	25.60	16.51	64%	42	YS3
302A	66	45.0	S	119	42.0	E	302	IO	180	9.00	8.62	96%	42	YS3
303	66	54.0	S	119	42.0	E	303	NSP	360	9.00	5.83	65%	42	YS3
303A	66	45.0	S	119	42.0	E	303	NSP	28	25.60	16.20	63%	42	YS3
304	66	22.5	S	120	12.2	E	304	IO	28	22.80	17.58	77%	42	YS3
305	66	2.4	S	120	38.8	E	-	-	-	-	-	-	42	YS3
Total	-	-	-	-	-	-	-	-	-	770.50	635.57	82%	-	-

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

WP	Latitude			Longitude			Leg no.	mode	course	plan	effort	covered (%)	area code	vessel
240	60	19.0	S	115	0.0	E	240	IO	29	21.70	21.70	100%	44	YS3
241	60	0.0	S	115	21.0	E	241	NSP	155	81.60	75.92	93%	44	YS3
242	61	13.8	S	116	31.5	E	242	IO	155	81.50	80.34	99%	44	YS3
243	62	27.5	S	117	44.8	E	243	NSP	155	81.60	80.77	99%	44	YS3
244	63	41.3	S	119	1.2	E	244	IO	155	81.60	78.70	96%	44	YS3
245A	64	55.0	S	120	21.0	E	-	-	360	-	-	-	44	YS3
245B	65	35.0	S	120	21.0	E	245	NSP	202	90.60	72.36	80%	44	YS3
246	64	11.3	S	121	41.5	E	246	IO	202	90.50	79.40	88%	44	YS3
247	62	47.6	S	122	58.1	E	247	NSP	202	90.60	89.88	99%	44	YS3
248	61	23.8	S	124	11.1	E	248	IO	202	90.60	88.15	97%	44	YS3
249	60	0.0	S	125	21.0	E	249	NSP	330	70.70	70.60	100%	44	YS3
250	61	1.3	S	126	32.3	E	250	IO	330	70.70	69.61	98%	44	YS3
251	62	2.5	S	127	46.0	E	251	NSP	330	70.80	47.91	68%	44	YS3
252	63	3.8	S	129	2.2	E	252	IO	330	52.10	51.74	99%	44	YS3
253	63	48.9	S	130	0.0	E	-	-	-	-	-	-	44	YS3
254	64	5.0	S	130	21.0	E	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	-	974.60	907.08	93%	-	-

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

Yushi-Maru No.3	Start	End	NSP		IO		Photo-ID, Biopsy, Satellite	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	14-Dec. 8:05	26-Dec. 18:00	47:27:29	581.0	0:00:00	0.0	0:00:00	0:00:00	0:00:00
Research area	27-Dec. 6:00	14-Feb. 18:00	66:45:38	741.5	73:06:23	801.2	46:24:52	5:46:39	33:33:21
Transit survey from research area	15-Feb. 6:00	7-Mar. 18:00	15:57:53	180.7	0:00:00	0.0	0:55:27	0:00:00	0:00:00
Total	14-Dec. 8:05	7-Mar. 18:00	130:11:00	1503.1	73:06:23	801.2	47:20:19	5:46:39	33:33:21

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

Species	East-South of area IV				East-North of area IV				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	9	19	4	6	2	2	0	0	11	21	4	6	15	27
Fin whale	2	7	6	18	5	13	1	1	7	20	7	19	14	39
Sei whale	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Antarctic minke whale	134	411	41	95	7	14	4	18	141	425	45	113	186	538
Humpback whale	240	575	82	189	141	308	50	107	381	883	132	296	513	1,179
Southern right whale	1	1	0	0	0	0	0	0	1	1	0	0	1	1
Baleen whale	9	10	1	1	3	5	1	1	12	15	2	2	14	17
Sperm whale	6	6	1	1	1	1	0	0	7	7	1	1	8	8
Killer whale	10	125	3	18	3	15	0	0	13	140	3	18	16	158
Unid. whale	7	7	4	4	5	5	0	0	12	12	4	4	16	16

Table 2b. Number of sightings during transit to and from the research area, by species.

Species	Transit to R.A.				Research area				Transit from R.A.				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	0	0	2	2	11	21	4	6	0	0	0	0	11	21	6	8	17	29
Fin whale	0	0	0	0	7	20	7	19	0	0	0	0	7	20	7	19	14	39
Sei whale	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	1	1
Antarctic minke whale	1	1	3	4	141	425	45	113	0	0	0	0	142	426	48	117	190	543
Humpback whale	0	0	6	21	381	883	132	296	0	0	0	0	381	883	138	317	519	1,200
Southern right whale	0	0	1	1	1	1	0	0	0	0	0	0	1	1	1	1	2	2
Baleen whale	0	0	1	1	12	15	2	2	0	0	0	0	12	15	3	3	15	18
Sperm whale	2	2	2	2	7	7	1	1	0	0	0	0	9	9	3	3	12	12
Killer whale	0	0	0	0	13	140	3	18	0	0	0	0	13	140	3	18	16	158
Unid. whale	0	0	0	0	12	12	4	4	0	0	0	0	12	12	4	4	16	16

Table 2c. 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	3	2	0	0	1
Fin whale	1	1	0	0	0
Antarctic minke whale	36	21	3	0	12
Humpback whale	170	140	11	0	19
Baleen whale	5	1	0	0	4
Sperm whale	2	2	0	0	0
Killer 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	21
Southern right whale	1
Humpback whale	27
Killer whale	20
Total	69

Table 3b. Summary of the photo-identification and biopsy data with accompanying photo-ID data. LD: Left dorsal; RD: Right dorsal, HD: Head.

Vesl.	Date	Sight No.	Species	Scl. size	Sighted Position Lat.	[min.]	Long.	[min.]	Area	Est. body length of target ind. [m]	Number of marked individual	Number of shoot	Opportunity of shoot	Position of shoot	Format	Biopsy sample	Biopsy sample no.	Notes.
YS3	20151224	2	H	3	-64	0.02	134	27.76	99	-, -, -	2	3	G	RD, FL	digital	N	-	Opportunistic
YS3	20151228	1	H	1	-63	59.68	129	17.80	42	12.6	1	3	G	LD, RD, FL	digital	N	-	Opportunistic
YS3	20151230	1	H	2	-63	58.56	127	37.99	42	13.2, 14.0	2	17	G	RD, FL	digital	N	-	-
YS3	20151230	3	H	1	-64	0.20	127	40.19	42	13.1	1	5	G	RD, FL	digital	N	-	-
YS3	20151230	4	H	2	-64	0.86	127	39.00	42	14.4, 13.5	2	11	G	LD, RD, FL	digital	Y	J15YS3H001, J15YS3H002	-
YS3	20151230	14	K	7	-64	33.24	126	51.63	42	6.5, 6.2, 6.0, -	4	5	G	LD, RL, DM	digital	N	-	-
YS3	20151231	6	B	1	-64	20.95	125	35.35	42	24.5	1	9	G	LD, RD, RL	digital	N	-	-
YS3	20160106	2	K	7	-62	39.36	128	31.51	44	4.8, 2.6	2	6	G	LL	digital	N	-	-
YS3	20160112	7	B	1	-62	36.39	123	8.02	44	23.8	1	12	G	LL, RL	digital	Y	J15YS3B001	-
YS3	20160113	39	K	5	-64	19.87	121	33.46	44	4.2, 2.0	2	6	P	LD, LL	digital	Y	J15YS3K001	-
YS3	20160115	9	B	1	-65	19.35	120	36.41	44	26.1	1	8	G	RL, LL, LD	digital	N	-	-
YS3	20160117	19	B	2	-64	50.57	119	36.67	42	26.8, 22.5	2	12	G	RL, RD, LL, LD	digital	N	-	-
YS3	20160117	28	B	1	-64	42.52	118	16.06	42	25.3	1	7	G	LL, LD, RL, RD	digital	N	-	-
YS3	20160119	28	K	3	-63	55.65	115	44.33	42	6.4, 4.8, 4.2	3	8	G	RL, HD, RD, LD, DM	digital	Y	J15YS3K002, J15YS3K003	-
YS3	20160119	50	H	2	-63	54.56	115	6.08	42	13.3, 12.8	2	13	G	LD, FL, LL, RL, HD	digital	Y	J15YS3H003	-
YS3	20160119	51	H	3	-63	54.65	115	6.16	42	13.6, 13.3, 9.8	3	15	G	LD, HD, RD, FL	digital	Y	J15YS3H004	-
YS3	20160120	1	H	1	-64	6.29	115	56.02	42	13.1	1	8	G	FL, RD, LD, HD, DM	digital	N	-	-
YS3	20160120	3	H	1	-63	48.25	115	55.85	42	12.2	1	14	G	LD, RD, HD, DM, FL	digital	N	-	-
YS3	20160120	10	H	1	-63	28.49	115	54.73	42	12.4	1	9	G	FL, RD, RL	digital	N	-	-
YS3	20160125	60	K	3	-64	23.68	119	46.76	44	4.6, 3.7	2	7	P	LL	digital	Y	J15YS3K004, J15YS3K005	-
YS3	20160131	65	K	23	-65	37.85	121	40.57	42	5.2	1	9	G	LL, RL	digital	Y	J15YS3K006	-
YS3	20160204	11	H	1	-64	52.65	124	42.11	42	13.1	1	8	G	LD, OT, RD, FL, HD	digital	Y	J15YS3H005	-
YS3	20160205	8	H	2	-64	37.63	125	3.19	42	13.3, 12.6	2	7	G	LD, RD, RL	digital	Y	J15YS3H006	-
YS3	20160205	13	H	1	-64	25.72	125	22.61	42	12.8	1	15	G	LD, RD, OT, FL, LL	digital	Y	J15YS3H007	-
YS3	20160205	67	R	1	-64	52.05	126	33.96	42	13.3	1	6	G	HD	digital	Y	J15YS3R001	-
YS3	20160206	2	H	1	-64	54.12	126	39.81	42	13.6	1	5	P	FL, RD	digital	N	-	-
YS3	20160206	7	K	11	-64	57.09	126	50.05	42	5.8, 3.7, 3.5, 2.1	4	11	G	LL, RL	digital	Y	J15YS3K007	-
YS3	20160207	1	H	2	-65	6.72	127	10.58	42	13.8, 13.6	2	10	G	RD, LD, LL	digital	Y	J15YS3H008	-
YS3	20160207	11	K	8	-65	9.83	127	28.60	42	5.3, 5.0	2	9	G	RL, RD, LL	digital	Y	J15YS3K008	-
YS3	20160207	15	H	2	-65	15.31	127	36.53	42	-, -	1	1	P	FL	digital	N	-	Opportunistic
YS3	20160207	24	B	2	-65	34.06	128	6.42	42	29.5, 24.6	2	10	G	LL, RL	digital	Y	J15YS3B002	-
YS3	20160209	24	B	2	-65	11.24	128	39.38	42	26.8, 24.5	2	9	G	LL, RL	digital	N	-	-
YS3	20160209	30	B	2	-65	8.18	128	28.91	42	27.5, 23.0	2	10	G	RL, LL	digital	Y	J15YS3B003	-
YS3	20160209	36	H	2	-65	1.39	128	54.8	42	12.6, 11.9	2	8	G	RD, LD	digital	Y	J15YS3H009	-
YS3	20160209	47	B	3	-64	53.44	129	7.53	42	25.3, 24.6	2	11	G	RL, LL	digital	Y	J15YS3B004	Mixed school of fin whale
YS3	20160209	51	B	2	-64	46.53	129	17.92	42	25.8, 23.7	2	13	G	RL, LL	digital	Y	J15YS3B005	-
YS3	20160210	1	B	4	-64	39.98	129	27.87	42	26.5, 25.7, 23.4, 22.3	4	15	G	RL, LL, OT	digital	Y	J15YS3B006, J15YS3B007	-
YS3	20160210	5	B	1	-64	38.50	129	30.13	42	24.4	1	3	G	LL	digital	N	-	-
YS3	20160210	10	H	1	-64	24.94	129	50.79	42	11.2	1	14	G	LD, DM, RD	digital	Y	J15YS3H010	-

Table 4a. Summary of biopsy samples collected by the dedicated sighting survey.

Species	Number of individuals collected
Blue whale	7
Fin whale	7
Southern right whale	1
Humpback whale	10
Killer whale	8
Total	33

*: Results of the feasibility biopsy sampling and telemetry in the Antarctic minke whale are presented by Isoda *et al*., (2016).

Table 4b. Summary of the biopsy data and encounter duration.

Vesl.	Sheet number	Date	Sight No.	Species	Scl. size	Sighted Position Lat.	[min.]	Long.	[min.]	Area	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	20151230	1	H	2	-63	58.56	127	37.99	42	9:26:57	9:38:11	00:11:14	-	0	0	-	0	-	Larsen	No chance to shoot
YS3	BY302	20151230	4	H	2	-64	0.86	127	39.00	42	9:59:09	10:05:16	00:06:07	14.4, 13.5	2	2	RD2, RD1	2	J15YS3H001, J15YS3H002	Larsen	-
YS3	BY303	20151230	14	K	7	-64	33.24	126	51.63	42	15:02:21	15:53:40	00:51:19	6.5	1	1	LC3	0	-	Larsen	-
YS3	BY304	20151231	5	F	1	-64	22.27	125	45.00	42	12:58:17	13:30:23	00:32:06	-	0	0	-	0	-	Larsen	No chance to shoot
YS3	BY305	20151231	6	B	1	-64	20.95	125	35.35	42	14:15:31	15:02:12	00:46:41	-	0	0	-	0	-	Larsen	No chance to shoot
YS3	BY308	20160101	9	F	4	-64	29.43	125	33.93	42	9:29:17	10:09:22	00:40:05	-	0	0	-	0	-	Larsen	No chance to shoot
YS3	BY309	20160101	16	F	5	-64	24.08	125	7.78	42	13:33:12	13:51:20	00:18:08	22.5	1	1	LD1	1	J15YS3F001	Larsen	-
YS3	BY311	20160106	2	K	7	-62	39.36	128	31.51	44	14:49:09	15:31:52	00:42:43	4.8, 2.6	2	0	-	0	-	Larsen	-
YS3	BY313	20160112	7	B	1	-62	36.39	123	8.02	44	11:25:10	11:45:42	00:20:32	23.8	2	2	RC2	1	J15YS3B001	Larsen	-
YS3	BY315	20160112	22	F	2	-63	10.00	122	38.03	44	17:19:30	17:56:44	00:37:14	23.7, 10.5	4	1	RC1	1	J15YS3F002	Larsen	-
YS3	BY317	20160113	39	K	5	-64	19.87	121	33.46	44	13:23:47	13:35:45	00:11:58	4.2	2	1	LC3	1	J15YS3K001	Larsen	-
YS3	BY318	20160113	44	F	4	-64	24.78	121	28.78	44	14:32:41	15:17:02	00:44:21	23.2, 22.8	3	1	RB1a	1	J15YS3F003	Larsen	-
YS3	BY319	20160115	9	B	1	-65	19.35	120	36.41	44	16:50:19	17:31:56	00:41:37	-	0	0	-	0	-	Larsen	No chance to shoot
YS3	BY321	20160117	19	B	2	-64	50.57	119	36.67	42	13:16:43	14:03:29	00:46:46	-	0	0	-	0	-	Larsen	No chance to shoot
YS3	BY322	20160117	28	B	1	-64	42.52	118	16.06	42	16:48:55	17:34:13	00:45:18	-	0	0	-	0	-	Larsen	No chance to shoot
YS3	BY323	20160119	28	K	3	-63	55.65	115	44.33	42	9:33:36	10:09:50	00:36:14	6.4, 4.8, 4.2	4	2	RD2, LB1p	2	J15YS3K002, J15YS3K003	Larsen	-
YS3	BY324	20160119	50	H	2	-63	54.56	115	6.08	42	14:29:56	14:41:13	00:11:17	13.3	2	1	RC1	1	J15YS3H003	Larsen	-
YS3	BY325	20160119	51	H	3	-63	54.65	115	6.16	42	14:41:33	14:47:27	00:05:54	13.6	2	1	LC1	1	J15YS3H004	Larsen	-
YS3	BY327	20160125	60	K	3	-64	23.68	119	46.76	44	13:16:29	13:51:45	00:35:16	4.6, 3.7	2	2	LC3, LG1	2	J15YS3K004, J15YS3K005	Larsen	-
YS3	BY332	20160131	9	F	2	-65	37.03	120	28.88	42	6:29:00	6:53:30	00:24:30	20.3	2	2	RC1, LB1p	1	J15YS3F004	Larsen	-
YS3	BY333	20160131	10	F	6	-65	38.13	120	24.47	42	6:54:40	7:06:26	00:11:46	22.7, 20.5	2	2	LC1	2	J15YS3F005, J15YS3F006	Larsen	-
YS3	BY334	20160131	65	K	23	-65	37.85	121	40.57	42	11:27:20	11:45:11	00:17:51	5.2	1	1	LC2	1	J15YS3K006	Larsen	-
YS3	BY339	20160204	11	H	1	-64	52.65	124	42.11	42	15:20:03	15:38:17	00:18:14	13.1	2	2	LB1p, RC1	1	J15YS3H005	Larsen	-
YS3	BY340	20160205	8	H	2	-64	37.63	125	3.19	42	10:08:52	10:21:35	00:12:43	13.3	2	2	RC1, RC2	1	J15YS3H006	Larsen	-
YS3	BY341	20160205	13	H	1	-64	25.72	125	22.61	42	13:55:43	14:10:38	00:14:55	12.8	2	2	RC2, RC1	1	J15YS3H007	Larsen	-
YS3	BY342	20160205	67	R	1	-64	52.05	126	33.96	42	18:32:03	18:42:44	00:10:41	13.3	2	2	LA	1	J15YS3R001	Larsen	-
YS3	BY343	20160206	2	H	1	-64	54.12	126	39.81	42	7:44:59	7:52:38	00:07:39	-	0	0	-	0	-	Larsen	No chance to shoot
YS3	BY344	20160206	7	K	11	-64	57.09	126	50.05	42	8:33:01	9:08:31	00:35:30	5.8	2	2	LC3, RC2	1	J15YS3K007	Larsen	-
YS3	BY345	20160207	1	H	2	-65	6.72	127	10.58	42	6:02:12	6:16:42	00:14:30	13.8	2	2	LB1a	1	J15YS3H008	Larsen	-
YS3	BY346	20160207	11	K	8	-65	9.83	127	28.60	42	7:40:30	8:13:04	00:32:34	5.3	1	1	LC2	1	J15YS3K008	Larsen	-
YS3	BY348	20160207	24	B	2	-65	34.06	128	6.42	42	15:00:49	15:59:36	00:58:47	24.6	2	2	LB1p, LC1	1	J15YS3B002	Larsen	-
YS3	BY350	20160209	24	B	2	-65	11.24	128	39.38	42	7:35:13	8:00:15	00:25:02	-	0	0	-	0	-	Larsen	No chance to shoot
YS3	BY351	20160209	30	B	2	-65	8.18	128	28.91	42	8:06:55	8:45:33	00:38:38	27.5	2	2	LC2, LC3	1	J15YS3B003	Larsen	-
YS3	BY352	20160209	36	H	2	-65	1.39	128	54.80	42	10:33:59	10:42:43	00:08:44	11.9	2	2	RD2, RC2	1	J15YS3H009	Larsen	-
YS3	BY353	20160209	47	B	3	-64	53.44	129	7.53	42	13:11:57	13:45:51	00:33:54	25.3	3	2	LC1	1	J15YS3B004	Larsen	Mixed school of fin whale
YS3	BY354	20160209	51	B	2	-64	46.53	129	17.92	42	14:09:57	14:39:19	00:29:22	23.7	2	2	LD1, LB1p	1	J15YS3B005	Larsen	-
YS3	BY355	20160209	54	F	6	-64	43.20	129	23.08	42	15:18:26	15:42:15	00:23:49	21.0	2	2	RC1	1	J15YS3F007	Larsen	-
YS3	BY356	20160210	1	B	4	-64	39.98	129	27.87	42	6:37:05	7:42:28	01:05:23	23.4, 22.3	6	4	RC1, RB1a	2	J15YS3B006, J15YS3B007	Larsen	-
YS3	BY357	20160210	5	B	1	-64	38.50	129	30.13	42	6:37:05	7:00:00	00:22:55	-	0	0	-	0	-	Larsen	No chance to shoot
YS3	BY358	20160210	10	H	1	-64	24.94	129	50.79	42	8:56:35	9:07:50	00:11:15	11.2	2	2	LC1, LD1	1	J15YS3H010	Larsen	-
YS3	BY359	20160227	3	SE	1	-49	45.91	-174	27.35	02	11:40:18	12:35:45	00:55:27	12.8	2	0	-	0	-	Larsen	-

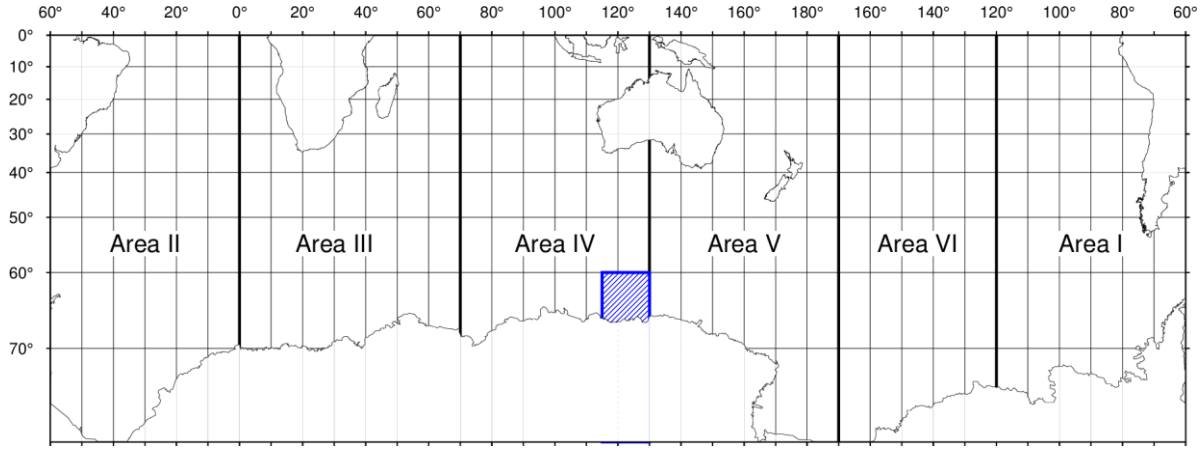

Figure 1a. Research area of the 2015/16 NEWREP-A dedicated whale sighting survey.

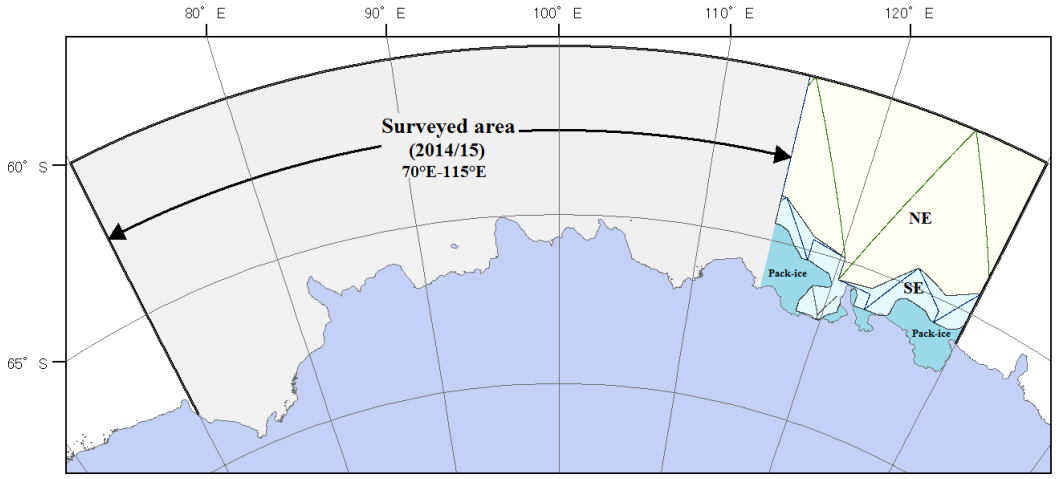

Figure 1b. Research area (115ºE-130ºE) and trackline of the 2015/16 NEWREP-A dedicated whale sighting survey. NE: North-Eastern stratum, SE: South-Eastern stratum.

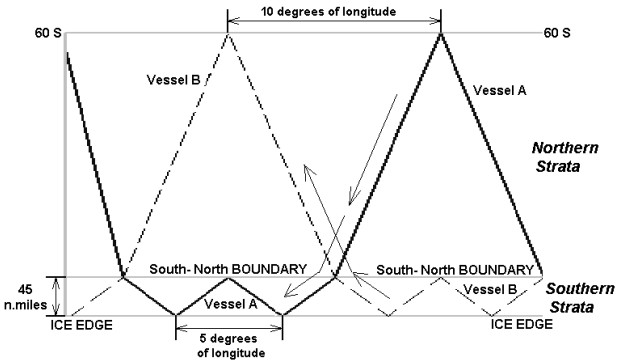

Figure 1c. Basic design of the pre-determined track line. Two vessels alternately survey the northern and southern strata each crossing the track line at the way-point between two strata.

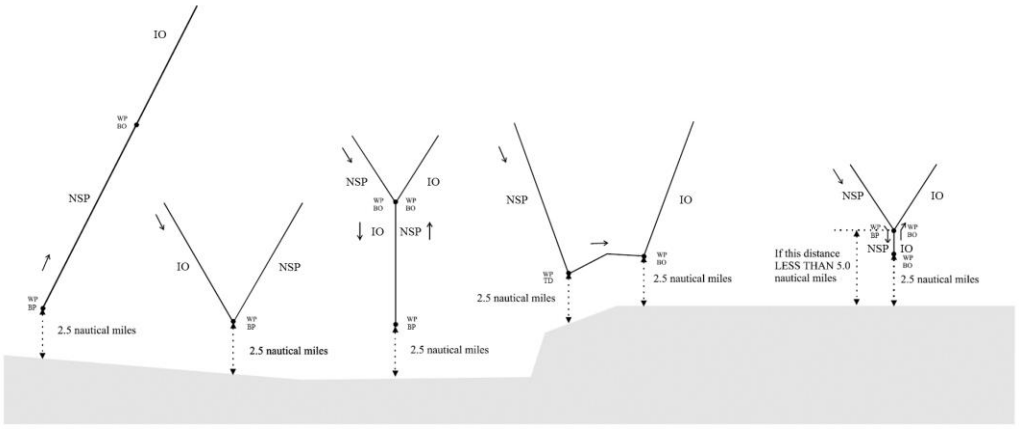

Figure 1d. Standard procedures for modifications to the cruise trackline in the southern strata (IWC, 2008). If the ice edge is encountered prior to reaching a planned waypoint, 2.5 n.miles from the estimated ice edge, the vessel shall follow the ice edge, off-effort, until survey can be resumed on the 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.

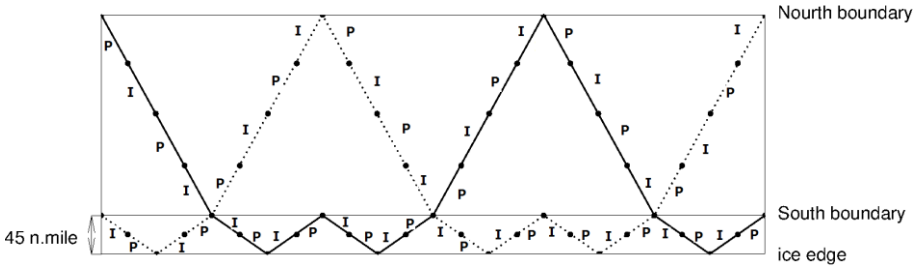

Figure 1e. The survey modes (NSP (P) and IO (I) modes) were set alternately in each trackline.

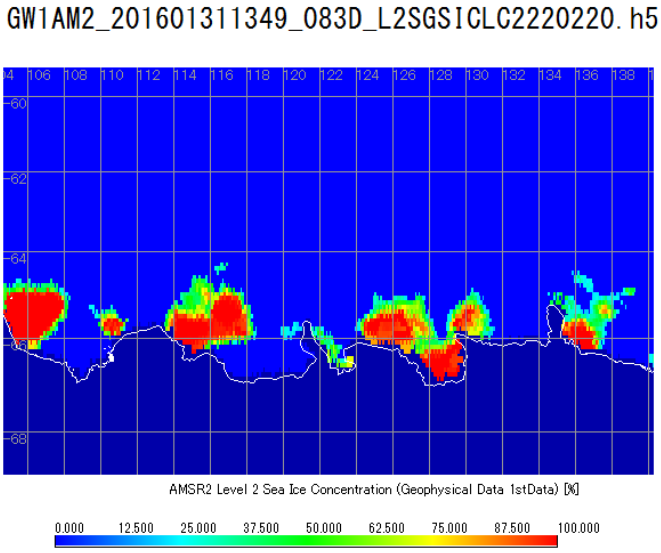

Figure 2. The pack-ice distributions and location of the large polynias in the research area, dated 31 January 2016 using observational data acquired by the Advanced Microwave Scanning Radiometer 2 (AMSR2). Data from the Japan Aerospace Exploration Agency (JAXA), http://global.jaxa.jp/projects/sat/gcom_w/.

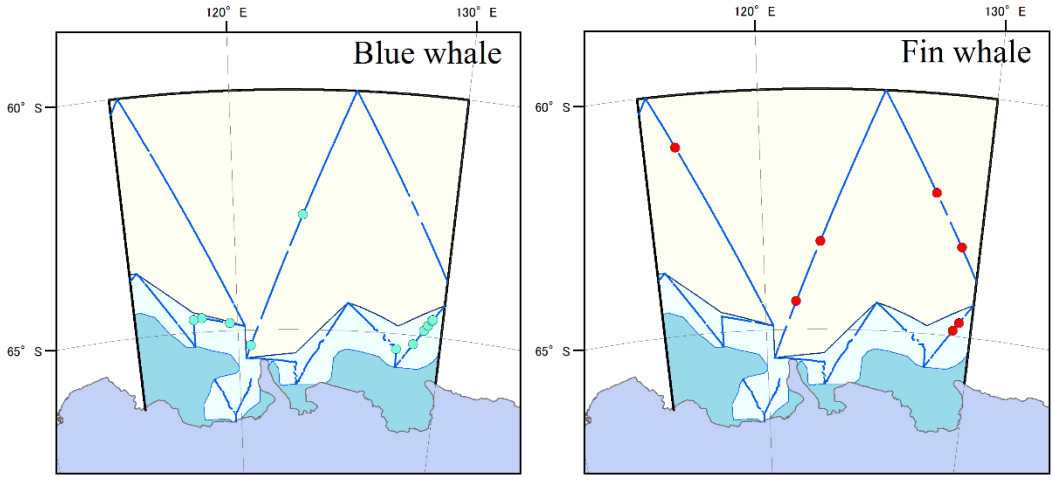

Figure 3a. Primary searching effort and associated primary sighting positions of blue whales (left) and fin whales (right) in the research area.

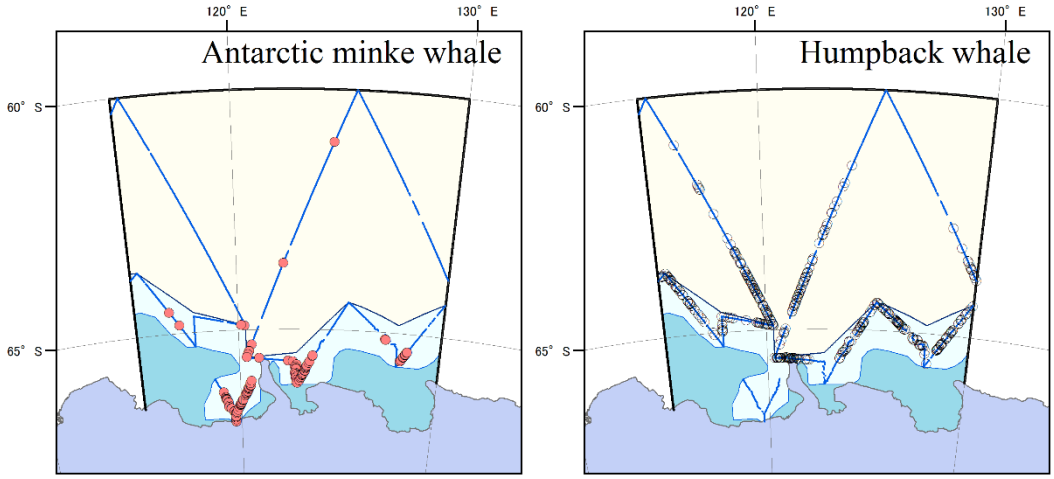

Figure 3b. Primary searching effort and associated primary sighting positions of Antarctic minke whales (left) and humpback whales (right) in the research area.

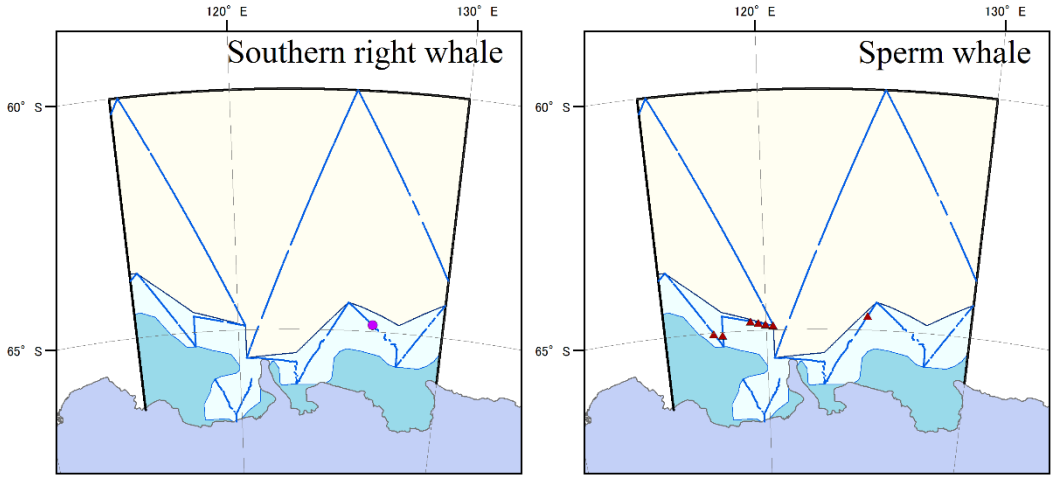

Figure 3c. Primary searching effort and associated primary sighting positions of southern right whale (left) and sperm whales (right) in the research area.

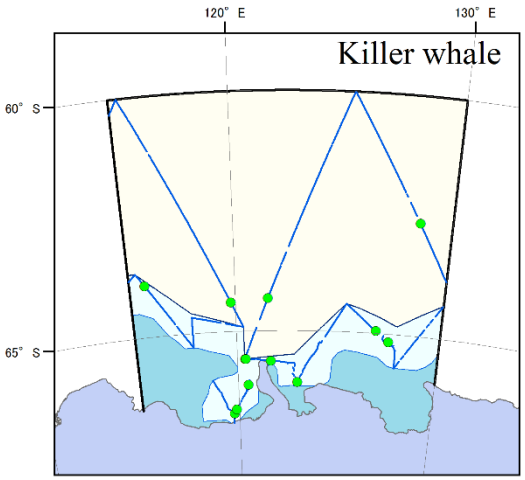

Figure 3d. Primary searching effort and associated primary sighting positions of killer whales in the research area.

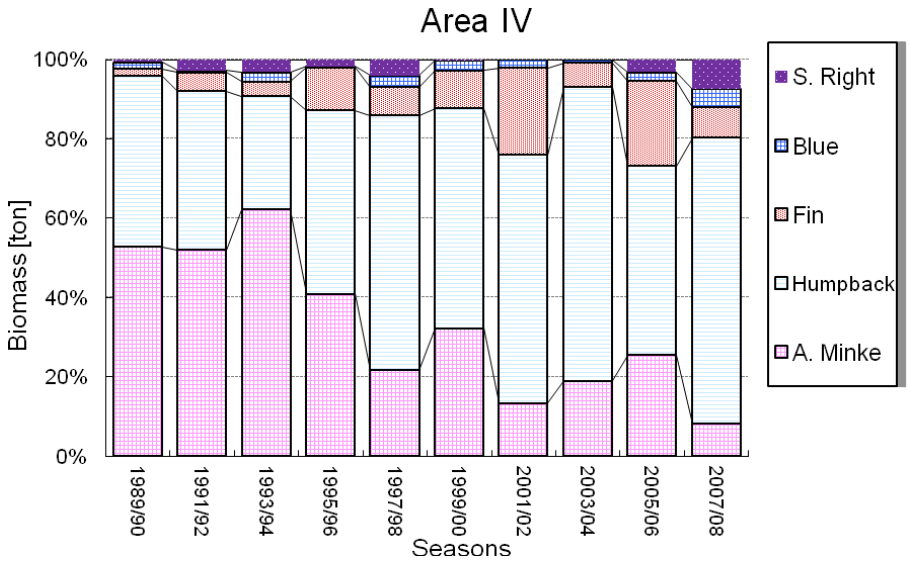

Figure 4. Estimated biomass of blue, fin, humpback, Antarctic minke and southern right whales in Area IV (south of 60°S) between 1989/90 and 2007/08 seasons based on JARPA and JARPAII sighting data (Matsuoka and Hakamada, 2014).

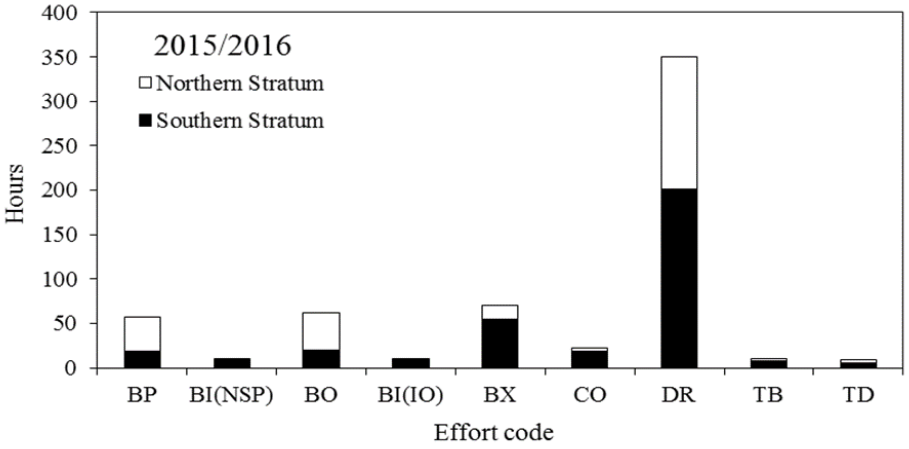

Figure 5a. Breakdown of research time in hours, by effort code in the research area. BP: Passing mode searching, BO: Independent Observer with Passing mode (IO) searching, BI: NSP or BO with in the ice area, BX: Distance and angle estimate experiment, Photo-ID, Biopsy experiments, Satellite experiments,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

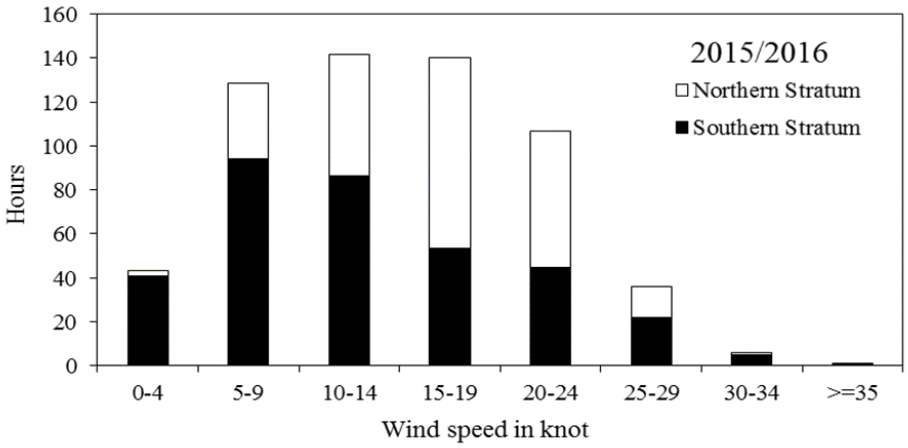

Figure 5b. Breakdown of research time in hours in the research area, by wind speed in knots.

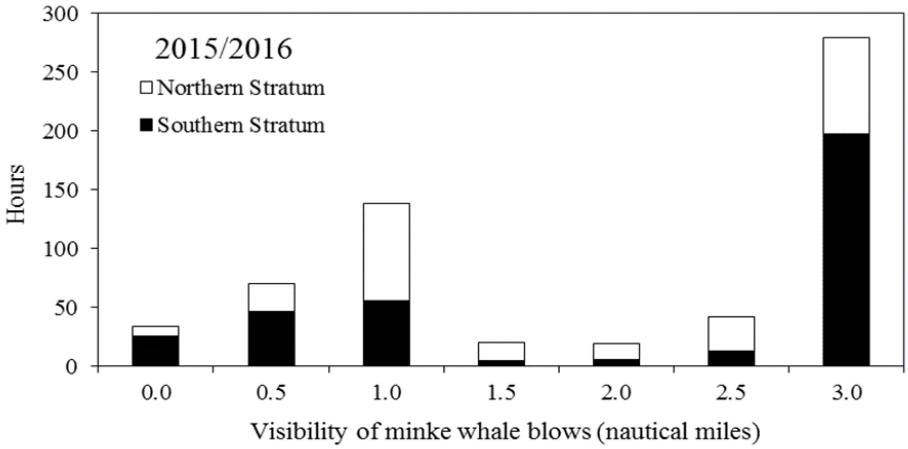

Figure 5c. Breakdown of research time in hours in the research area, by visibility in nautical mile.

Appendix 1

Results of the first 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-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. Final evaluation of this technique for Antarctic minke whale should 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.

Study design for the 2015/16

Feasibility study of biopsy sampling on Antarctic minke whales would be based on the Larsen-gun system. The Larsen gun is considered one of the most efficient method 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.

As noted in the study plan, the objective in this year would be the training of research personnel with the Larsen biopsy gun on Antarctic minke whales. A total of 10 trials was planned. A whale would be followed for an upper limit of 30 minutes and attempts should be made on solitary whale. The information suggested by the NEWREP-A recommendation d) above should be collected for each trial.

Results

Nine solitary Antarctic minke whales were targeted for the feasibility biopsy sampling in open seas of the north and south strata (Figure 1), and a total of 3 hours and 26minutes was spent in those trials. Biopsy samples were collected from 5 animals (Table 1). The average time for obtaining a biopsy sample was 41 minutes.

Following s recommendation from the NEWREP-A review workshop, the weights of the biopsy samples were obtained. The weight ranged from 0.20g and 1.20g with an average of 0.62g.

The efficiency of feasibility biopsy sampling was summarized preliminarily by Sea States (Beaufort wind scale) (Table 2). At the Beaufort scales 1 and 2 the average sampling time was less than 20 minutes, however, at the scales 3 and 4 the average sampling time higher. There was no chance to shoot at scale 5≦ because the difficulty to approach the whale under such conditions.

Preliminary evaluation and future surveys

The main aim of this survey was the training of research personnel with the Larsen biopsy gun on Antarctic minke whales and it is considered that such aim was achieved. This time the biopsy trials were focused on single animals and evaluated according to the Beaufort scales. Although the sample size is too small for a comprehensive evaluation, it seems that efficiency increase at low Beaufort scales. The number of trials should be increased and other factors considered for a more comprehensive evaluation. This will be attempted in the next survey.

Future studies should also consider other recommendation from the NEWREP-A review workshop, particularly recommendation c) above to mimic the sampling strategy developed for lethal sampling (e.g. when dealing with schools >2).

Finally it should be noted that the value of biopsy samples for the NEWREP-A research objectives should be evaluated in parallel with the results of feasibility studies of analytical approaches that potentially use biopsy samples (e.g. DNA-M, stable isotopes, hormones) (Government of Japan, 2015).

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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).

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Nishiwaki, S. 2000. Performance of biopsy skin sampling for minke whales during the JARPN and JARPA surveys using the ICR air gun. Paper SC/52/O5 presented to the IWC Scientific Committee, May 2000 (unpublished). 8pp.

Table 1. Summary of feasibility biopsy sampling in Antarctic minke whales.

Vesl.	Experiment number	Date	Sight No.	Scl. size	Sighted Position Lat.	[min.]	Long.	[min.]	Area	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.	Sea state (Beaufort wind scale)
YS3	BY312	20160110	1	1	-61	5.87	124	26.40	44	16:40:23	17:04:47	00:24:24	6.7	2	2	RC3, RC2	1	J15YS3M004	Larsen	-	4
YS3	BY314	20160112	15	1	-62	58.68	122	48.45	44	14:10:04	14:42:35	00:32:31	-	0	0	-	0	-	Larsen	No chance to shoot	3
YS3	BY316	20160113	7	1	-63	37.60	122	12.49	44	8:50:20	9:08:43	00:18:23	5.1	2	1	LC3	1	J15YS3M005	Larsen	-	3
YS3	BY320	20160117	3	1	-64	54.71	120	17.72	42	11:26:35	11:39:17	00:12:42	6.4	2	1	RC2	1	J15YS3M006	Larsen	-	2
YS3	BY326	20160119	58	1	-64	15.61	115	38.36	42	17:01:45	17:29:39	00:27:54	7.2	2	2	RA	1	J15YS3M007	Larsen	-	1
YS3	BY328	20160126	5	1	-65	44.42	119	25.34	42	11:04:43	11:39:02	00:34:19	-	0	0	-	0	-	Larsen	No chance to shoot	5
YS3	BY336	20160201	13	1	-65	59.67	123	5.12	42	14:12:32	14:20:03	00:07:31	8.8	1	1	RC3	1	J15YS3M009	Larsen	-	1
YS3	BY337	20160202	3	1	-65	58.95	123	2.36	42	8:44:05	9:00:39	00:16:34	-	0	0	-	0	-	Larsen	No chance to shoot	6
YS3	BY338	20160202	6	1	-66	3.67	123	11.23	42	9:08:26	9:40:29	00:32:03	-	0	0	-	0	-	Larsen	No chance to shoot, Whale moved into the pack ice	6

Table 2. Sea state and efficiency of feasibility biopsy sampling in Antarctic minke whales.

Sea state (Beaufort wind scale)	Number of experiments	Targeted individuals	Number of shoots	Number of hits	Number of samples (ind.)	Effort (minute)	Success rate	Effort required for one sample
	(a)	(b)	(c)	(d)	(e)	(f)	(e)/(b)	(f)/(e)
1	2	2	3	3	2	0:35:25	100%	0:17:43
2	1	1	2	1	1	0:12:42	100%	0:12:42
3	2	2	2	1	1	0:50:54	50%	0:50:54
4	1	1	2	2	1	0:24:24	100%	0:24:24
5≦	3	3	0	0	0	1:22:56	0%	-
Total	9	9	9	7	5	3:26:21	56%	0:41:16

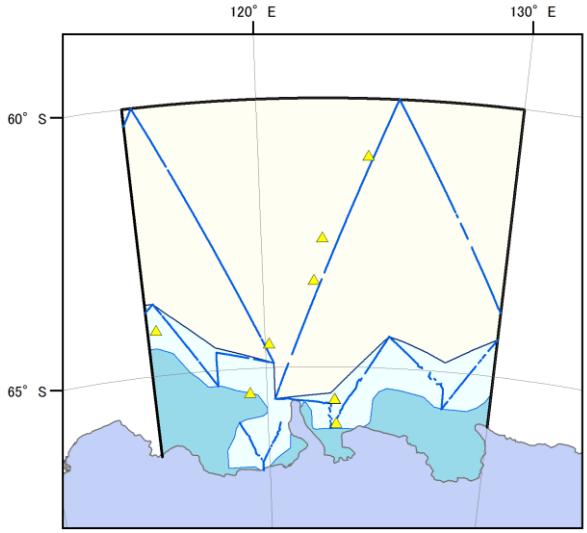

Figure 1. Geographic position of biopsy trials on Antarctic minke whales.

Appendix 2

Results of the first feasibility study on satellite tracking of Antarctic minke whale under the 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. 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 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.

Same as in the feasibility study on biopsy sampling, final evaluation of satellite tracking techniques 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.

Study design

The focus of the field survey in the first year would be on the attachment system.

The study 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 and dummy 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-gun system.

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).

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.

Results

A total of 16 trials were made (Table 1). Three dummy tags were deployed into two whales and seven satellite tags were deployed into seven whales. A total of six biopsy samples were collected (1 dummy tagged whales and 5 satellite tagged whales).

Of the seven satellite tags, three satellite tags successfully provided positions data (Argos No. 152155, 152156, 152159). Argos No. 152155 was deployed on a whale of estimated body length of 7.2m, at position 64°16′S, 115°38′E on 19 January 2016 (Figure 1). Geographical positions data were received in 9 opportunities, during a period from 18 to 22 February 2016 (five days). These data were only location classes A and B. The whale moved southwards and remained near the ice edge.

Argos No. 152156 was deployed on a whale of estimated body length of 8.6m, at position 64°36′S, 124°59′E on 1 January 2016 (Figure 1). The first signal with position was received on 31 January 2016. The position of the whale was tracked for a period of 13 days until 12 February 2016. A total of 134 geographical positions data were

received. Among them, 37 positions data were location classes 1-3. The tagged whale moved to southeast and then eastwards along the ice edge.

Argos No. 152159 was deployed on a whale of estimated body length of 8.2m, at position 65°34′S, 128°03′E on 8 February 2016 (Figure 1). A total of 68 position data were received during the periods from 8 February to 13 March 2016 (six days). Among them, 11 positions were location classes 1-3. The whale stayed near the pack ice area, and then moved to the southwest.

Preliminary evaluation and future surveys

A number of satellite trials (16) were made and a number of dummy (3) and satellite (10) tags were deployed into Antarctic minke whales. The authors considered that the aim of this first field study focused on the attachment system, was achieved partially. The attachment system should be further considered together with the performance of satellite tagging.

Only three of seven satellite tags provided information of locations of the whales, but for a shorter period. Then apart from a further evaluation of the attachment system under different sea conditions, methods to extend the period with location information should be discussed before the second field study in 2016/17.

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Vikingsson, G.A. and Heide-Jørgensen, M.P. 2015. First indications of autumn migration routes and destination of common minke whales tracked by satellite in the North Atlantic during 2001‑2011. *Marine Mammal Science*, 31(1): 376-385.

Table 1. Summary of the feasibility satellite tagging study for Antarctic minke whales in 2015/16.

Vesl.	Experiment number	Date	Sight No.	Species	Scl. size	Sighted Position Lat.	[min.]	Long.	[min.]	Area	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	ARGOS No.	Shooting equipment	Notes.	Biopsy experiment No.	Biopsy sample No.
YS3	ST301	20151231	10	M	2	-64	19.99	125	22.96	42	15:34:26	16:19:00	0:44:34	6.1	2	1	RC1	Dummy tag	LK-ARTS	-	BY306	J15YS3M001
YS3	ST302	20160101	7	M	1	-64	28.47	125	30.01	42	8:28:20	8:47:37	0:19:17	6.7	1	1	RD1	152154	LK-ARTS	-	BY307	J15YS3M002
YS3	ST303	20160101	21	M	2	-64	34.26	124	45.40	42	14:29:34	14:52:10	0:22:36	-	0	0	-	-	LK-ARTS	No chance to shoot		
YS3	ST304	20160101	22	M	5	-64	36.40	124	59.34	42	15:24:25	15:55:02	0:30:37	8.6	3	1	RC1	152156	LK-ARTS	-	BY310	J15YS3M003
YS3	ST305	20160115	7	M	3	-65	18.47	120	37.18	44	15:50:08	16:22:43	0:32:35	8.4	1	0	-	Dummy tag	LK-ARTS	-		
YS3	ST306	20160119	58	M	1	-64	15.61	115	38.36	42	17:32:24	17:49:14	0:16:50	7.2	2	1	LA	152155	LK-ARTS	-	BY326	J15YS3M007
YS3	ST307	20160129	20	M	4	-66	37.21	119	28.28	42	9:43:35	10:04:55	0:21:20	8.6	2	0	-	-	LK-ARTS	-		
YS3	ST308	20160129	23	M	8	-66	41.11	119	36.71	42	10:32:06	11:08:59	0:36:53	8.7	1	1	RB2	152157	LK-ARTS	-	BY330	J15YS3M008
YS3	ST309	20160129	42	M	3	-66	53.92	119	42.11	42	14:39:27	14:48:31	0:09:04	-	0	0	-	-	LK-ARTS	No chance to shoot		
YS3	ST310	20160129	43	M	1	-66	51.41	119	42.51	42	15:01:59	15:07:03	0:05:04	8.3	2	1	RB2	152158	LK-ARTS	-	BY331	-
YS3	ST311	20160201	5	M	5	-66	0.72	122	50.33	42	7:58:24	8:07:11	0:08:47	8.0	1	1	LD3	152160	LK-ARTS	-	BY335	-
YS3	ST312	20160207	6	M	1	-65	9.10	127	15.29	42	6:41:43	7:05:02	0:23:19	-	0	0	-	-	LK-ARTS	No chance to shoot		
YS3	ST313	20160207	20	M	1	-65	20.06	128	4.68	42	12:40:49	12:47:11	0:06:22	-	0	0	-	-	LK-ARTS	No chance to shoot		
YS3	ST314	20160207	21	M	6	-65	22.15	128	3.66	42	13:13:38	13:34:14	0:20:36	8.7	1	0	-	Dummy tag	LK-ARTS	-		
YS3	ST315	20160207	22	M	5	-65	26.07	128	3.23	42	13:54:01	14:11:36	0:17:35	8.3	2	2	RD2, RC1	Dummy tag	LK-ARTS	-	BY347	-
YS3	ST316	20160208	10	M	25	-65	34.49	128	2.86	42	14:52:28	14:57:32	0:05:04	8.2	1	1	LB1p	152159	LK-ARTS	-	BY349	J15YS3M010

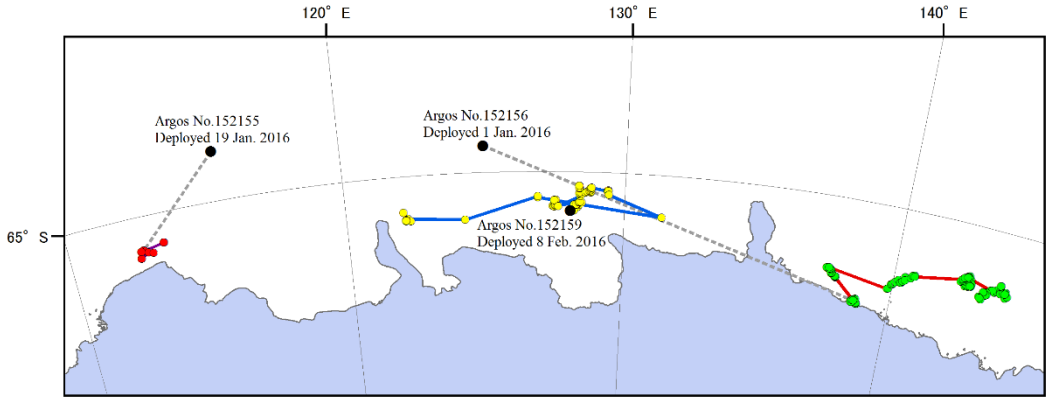

Figure 1. Movement of three satellite-tagged Antarctic minke whales. Location data in this figure are used Location Classes of 3, 2, 1, 0, A and B. Black circle: deployed position; circles: positions of signals; dotted line: from deployed position to first position of transmitted location data.

Annex A

Ship specifications of *Yushin-Maru No.3*

Vessel photo:

Vessel specification:

	Yushin-Maru No.3
Call sign	7JCH
Length overall [m]	69.61
Molded breadth [m]	10.8
Gross tonnage (GT)	742
Barrel height [m]	19.5
Upper bridge height [m]	11.5
Bow height [m]	6.5
Engine power [PS / kW]	5280 / 3900

Annex B
Oversight for the 2015/16 Japanese Antarctic dedicated sighting survey

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The plan of this survey was presented to the 2014 IWC/SC meeting (Matsuoka *et al*., 2014) and endorsed by the Scientific Committee (IWC, 2014). The research activities to be conducted during the 2015/16 survey are the same as in the original plan presented to SC65b in 2014. On behalf of the IWC Scientific Committee I carried out the oversight work during the 2015/16 Japanese Antarctic 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 on 20 November 2015. The survey organizers, researchers and crewmembers also participated in that meeting. During the meeting the organizers explained the objective of the survey and the procedure to be used for both sighting surveys and experiments. The planned sighting procedure was in order with that agreed by the Scientific Committee. Research vessel was available for the survey, the R/V *Yushin-Maru No.3* (YS3) (742GT). This vessel was assigned to cover the research area, south of 60°S in IWC Area IV, and in the longitudinal range of 115°E-130°E. The vessel was assigned to cover pre-determined transects, normal passing mode and passing with Independent Observer mode. Two experienced researchers were assigned to vessel.

Oversight period and method
Oversight activity was carried from the *Nisshin-Maru*. I was on board this vessel during the whole cruise period (between 1st December and 24 March). Thus the total survey was oversighted. The research activities in the other vessel were oversight by examining the daily report prepared by the researchers on board the *Nisshin-Maru*. In some instances telephone calls were made for further clarification of the activities, procedure and sightings made. Geographical positions and weather information of YS3 was tracked three times per day from the *Nisshin-Maru*.

Brief narrative of the oversight vessel
The duration of this cruise was 115 days. The YS3 departed from Shiogama, Japan on 30 November and started the transit survey on 14 December and completed on 26 December. They started survey in the research area on 27 December and complete the research area 14 February. The vessel left the research area and started the transit survey on 15 February, and arrived at Shiogama on 23 March.

Post-cruise meeting
I participated in a post-cruise meeting held on 21 February 2016 on the *Nisshin-Maru* in the Antarctic. 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 track lines were improved to cover each strata completely. The planned sighting procedure was in accordance with the guideline agreed by the SC (IWC, 2005). 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 2015/16 Japanese Antarctic dedicated sighting survey.

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