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TATSUYA ISODA[1], TAIKI KATSUMATA[1], MASAHIRO YAMAZAKI[2], NOBUO ABE[2] and KOJI MATSUOKA[1]

[1]*Institute of Cetacean Research, 4-5 Toyomi-cho, Chuo-ku, Tokyo 104-0055, Japan*
[2]*Kyodo Senpaku Co. Ltd., 4-5 Toyomi-cho, Chuo-ku, Tokyo 104-0055, Japan*

Contact e-mail: isoda@cetacean.jp

ABSTRACT

The results of the second survey of the Japanese Abundance and Stock structure Surveys in the Antarctic (JASS-A) are reported. A dedicated sighting vessel (SV) was engaged in the survey based on the line transect method for 28 days, from 10 January to 6 February 2021 in the eastern part of Area IIIW (015°E–035°E). The survey design was based on IWC/IDCR-SOWER survey procedures and two survey modes were used, Normal Passing mode (NSP) and Independent Observer mode (IO). The total searching distance in the research area was 1,744.3n.miles (3,230.4km), including 887.3n.miles covered in NSP mode and 857.0n.miles in IO mode. The survey coverage was 68% in the northern stratum and 90% in the southern stratum. Four baleen whale species, Antarctic blue (24 schools/29 individuals), fin (136/228), Antarctic minke (51/120), humpback (359/697) and at least three toothed whale species, sperm (6/6), southern bottlenose (6/16) and killer (4/13) whales, were sighted in the research area. Antarctic blue whales were most sighted in the southern stratum of the research area. Fin whales were found mainly in the northern stratum. Antarctic minke whales were mainly distributed near the ice edge. Humpback whales were the most frequently sighted whale species, and widely distributed in the research area. Estimated Angle and Distance Experiments were completed in the research area. Routine photo-ID and biopsy sampling on large whales were also conducted during the whole survey (including transit), and a total of 62 photo-IDs (20 Antarctic blue, 41 humpback and one killer whales), were obtained. A total of 54 biopsy (skin and blubber) samples were also collected from eight Antarctic blue, 15 fin, 14 Antarctic minke, 16 humpback and one Bryde's whales (in the transit area) using the Larsen system. Seven and ten satellite tags were deployed on fin and Antarctic minke whales, respectively. Time-Depth Recorders (TDR) tags were deployed on two humpback whales. Oceanographic observation was conducted at 99 stations using the eXpendable Conductivity, Temperature and Depth (XCTD). No marine debris were observed in the research area. Data and samples collected in this survey will be analyzed in conjunction with data and samples obtained during past research programs in the Antarctic (JARPA, JARPAII, NEWREP-A), in the context of the primary and secondary objectives of the JASS-A.

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

INTRODUCTION

The Japanese Abundance and Stock-structure Surveys in the Antarctic (JASS-A) has two main research objectives (MO) and five secondary research objectives (SO). The MO1 is 'Study of the abundance and abundance trends of large whale species in the Indo-Pacific region of the Antarctic'. Abundance and abundance trends of whales in the Antarctic is essential for conservation and management purposes. Many whale species were depleted in the past. Some of them have shown signs of recovery in recent years, and it is important to monitor their recovery process and how such recovery could affect other whale species in the ecosystem. MO2 is 'Study of the distribution, movement and stock structure of large whale species in the Indo-Pacific region of the Antarctic'. Stock structure information is important to interpret distribution and abundance data. Genetic stocks are demographically independent units and therefore each stock will respond in a different way to changes that have occurred in the ecosystem. Ideally abundance estimates should be based on the geographical and temporal boundaries of genetic stocks (Government of Japan, 2019a, 2019b, 2019c).

The SO1 of JASS-A are: 'Investigation of the oceanographic conditions in the Indo-Pacific region of the Antarctic'; SO2: 'To investigate the spatial and temporal trend of marine debris on sea surface'; SO3: 'To conduct feasibility studies to evaluate the utility of genetics data to estimate abundance'; SO4: 'To continue with feasibility studies to evaluate the utility of non-lethal techniques for whale biological research'; and SO5: 'Feasibility study on the utility of Unmanned Aerial Vehicle (UAV) for obtaining information relevant for abundance estimate of large whales' (Government of Japan, 2019a; 2019b; 2019c).

The JASS-A was started because it was considered important to continue with the whale and ecosystem surveys in the Indo Pacific region of the Antarctic through dedicated sighting surveys and other non-lethal techniques to investigate primarily abundance, abundance trends and stock structure of large whales.

The approach of JASS-A is systematic vessel-based sighting surveys utilizing the Line Transect Method. Surveys is designed and conducted following the protocols included in the 'Requirements and Guidelines for Conducting Surveys and Analyzing Data within the Revised Management Scheme' (IWC, 2012). Sighting protocols are the same as those used in the former IDCR/SOWER surveys (Matsuoka *et al*., 2003).

The data collected through the JASS-A can be analyzed in conjunction with the data collected by the previous JARPA/JARPAII, NEWREP-A and IDCR/SOWER in the same region so that the analyses can be based on a long and consistent data set.

This paper presents the results of the second JASS-A survey conducted in the 2020/21 austral summer season in the eastern part of Antarctic Area III (IIIW). The plan for the survey had been presented to the 2020 IWC/SC meeting (Matsuoka *et al*., 2020) and endorsed by the SC (IWC, 2020).

SURVEY DESIGN

All research activities conducted on Antarctic and high seas international waters reported here, were authorized under permit SUIKAN 2-1826 issued by Fisheries Agency, Government of Japan.

Research area

The research area covered by the survey was Area IIIW (015°E–035°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

The dedicated sighting vessel (SV) *Yushin-Maru No.2* (*YS2*) (747GT) was engaged in the survey. This vessel was equipped with a top barrel platform (TOP), Independent Observer Platform (IOP) and an upper bridge platform. Vessel specifications and photo are provided in Appendix 1.

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 in a 10 degrees longitudinal band, respectively (Figure 1c). Track line design and location of the searching effort were shown Figures 1d and 1e. 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 and acceptable weather conditions

Research hours were consistent with previous IWC/SOWER survey procedures. Research effort began 60 minutes after sunrise and ended 60 minutes before sunset, with a maximum of 12–hour research per day (approximately 06:00–19:00). Time-zone changes were recorded at 30–minute intervals, effective from 01:00h. Schedules were adhered to local 'ship' time ranging between +2.0 and +9.0 UTC (Table 1b). 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 1.5n.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.

Survey modes

Sighting activities were classified into two principal types: 'On-effort' and 'Off-effort'. 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 classified as '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) Passing with abeam Closing 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; 2012).

For NSP mode, there were two primary observers on the TOP. These observers conducted searching for cetaceans by using angle board and binoculars with reticles (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; 2012).

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 with reticles (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 required only to clarify information without distracting them from their normal search procedure. These observers reported sighting-information to the researchers and other observers on the upper bridge for data recording. In the case of sighting of some rare species (e.g. Antarctic 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; 2012). Captain and helmsman (primary observers) were at the upper bridge using binoculars with reticles (7x), regardless of the research mode. Also present on the upper bridge normally was the chief engineer (or an alternate) and three researchers.

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).

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 0.3n.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

Three experienced Japanese researchers participated in the survey. They had enough experience conducting line transect surveys, biopsy sampling, photo-identification (photo-ID), satellite tagging experiments and oceanographic survey in the Antarctic through the JARPA/JARPAII and NEWREP-A programs or other research programs. One of the co-authors (KM, Institute of Cetacean Research, ICR) was the responsible person for this survey, and same as in recent surveys, acted as the oversight person on behalf of the IWC SC.

Tatsuya ISODA- Cruise Leader, sighting and satellite tagging
Taiki KATSUMATA - sighting, photo-ID, biopsy and oceanographic survey
Masahiro YAMAZAKI - sighting, photo-ID and biopsy

Other research activities

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

Photo-ID
Photo-ID experiments were carried out on an opportunistic basis, mainly using Canon EOS 7D Mark II with a 100–400 mm image-stabilized lens. GPS locations were recorded in the metadata of each picture by the camera's built-in GPS. Generally, whales were approached within 15–20 m. Adults, juveniles, and females accompanied by calves were approached for photo identification. Photo-ID experiments involved a minimum of one photographer (maximum three) on the bow, with additional photographers in the TOP barrel and IO barrel or upper bridge. Priority species for photo-ID were Antarctic blue, southern right and humpback whales. Photo-ID data is used for matching exercise to investigate distribution and movement of those large whales.

Biopsy sampling
Biopsy sampling experiments were carried out on an opportunistic basis. Priority species for biopsy sampling was Antarctic blue, fin, southern right and humpback whales. The Larsen system (Larsen, 1998) was used for all biopsy attempts on all species. The biopsy darts consisted of a carbon fibre shaft, which is high-pressure moulded to a polyethylene float that also functions as a stop to limit penetration into the tissue. In the float end of the dart, a threaded insert is used for attaching the screw-on biopsy-sampling tip. The biopsy tip is a stainless-steel cylinder with a 9 mm outer diameter, an internal diameter of 7 mm and three internal barbs for sample retention. All collected samples were stored at -20°C. Biopsy samples are used for studies on stock structure of large whale based on genetic analyses, feasibility studies to evaluate the utility of genetics data to estimate abundance and non-lethal techniques to get biological and feeding ecology information from large whale. The biopsy samples are then imported to Japan under the CITES Japan Management Authority i.e., Fisheries Agency, Government of Japan: Permit/Cert. No. SUIKAN. 2-1826.

Satellite tagging
Satellite tagging experiment was based on a pneumatic tool (LK-ARTS, Skutvik, Norway) and a blubber penetration type satellite tag (SPOT6, Wildlife computers, WA, USA) with a mount anchor system for whales. The experiments were conducted following the same protocols during the NEWREP-A surveys (Konishi *et al*., 2020). The tagged whale was also target of a biopsy sampling using the Larsen system. The target species for this experiment were fin and Antarctic minke whales. To investigate the breeding areas of Antarctic minke whale in the low latitudes, tagging was attached to the whales in the Antarctic during late period of this cruise as much as possible (e.g. between end of January and early February). The data of satellite tagging is used to the study of movement, distribution and the stock structure of this species.

Data logger tagging
The preliminary experiment was conducted for developing a technique for obtaining information on dive time of large whales. The technique is based on satellite-linked Time-Depth Recorders (TDR) tags (SPLASH 333, Wildlife computers, WA, USA) with implantable anchor, and use the same protocols as the satellite tagging. The data of mean dive-time is a key parameter to evaluate availability bias relevant to abundance estimates. Also, the technique can be used for studies on feeding ecology (e.g. Friedlaender *et al*., 2014).

Oceanographic survey
Oceanographic observations were conducted per 45° and 15° latitudinal degrees along the track lines in the northern and southern strata of the research area, respectively. The vertical distribution of water temperature and salinity were recorded from sea surface to 1,850 m water depth using XCTD system (eXpendable Conductivity, Temperature and Depth, Tsurumi-Seiki Co., Ltd., Yokohama, Japan) (TSK, 2019). Oceanographic surveys using XCTD system were conducted in the same protocols as in the previous JARPA/JARPAII surveys (Watanabe *et al*., 2014). The oceanographic observations are important to clarify the relationship between the oceanographic conditions and whales.

Marine debris observation
During the research hours, floating macro debris was recorded south of 60°S. For each recorded marine debris, the items recorded were date of the observation, angle, distance, time of initial sighting, geographical location (longitude and latitude), type of debris, size by visual observation and photographs. Data of JASS-A of floating macro debris was registered to the ICR database and will be analyzed in conjunction with the data sets of marine debris produced by JARPA/JARPAII and NEWREP-A in the Indo-Pacific region of the Antarctic (e.g. Isoda *et al*., 2014; Murase *et al*., 2020).

Feasibility study on the utility of Unmanned Aerial Vehicle (UAV)
In this season, a preliminary experiment was conducted for collecting aerial images of whale, using small UAV. We used the DJI phantom 4 Pro (DJI, 2018), which works with GLONASS/GPS satellite positioning systems and onboard camera features a 1-inch 20MP CMOS sensor, with a field of view of 84° and a focal length of 8.8 mm/24 mm (35 mm format equivalent). It was launched and landed at the bow deck of *YS2*, and was operated within line-of-sight by a pilot and/or a person for supporting navigation. Images were attempted for whales lying flat at the surface with a straight body axis.

Data entry system on board

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 was validated and stored at the ICR.

RESULTS AND DISCUSSION

Brief narrative of the survey

The *YS2* departed Shiogama, Miyagi, Japan on 4 December 2020. The transit survey was started on 20 December, arriving in off Maputo, Republic of Mozambique on 2 January 2021. Transit between off Maputo and the Antarctic research area was conducted between 2 and 10 January. The *YS2* started the sighting survey in Area IIIW at 60°00'S; 026°41'E on 10 January, and completed it at 68°17'S; 015°00'E on 6 February. The transit between the Antarctic research area and off Maputo was conducted between 6 and 17 February. *YS2* departed off Maputo on 20, and arrived in Shiogama on 22 March (Tables 1a and 1b).

Research effort in the research area

The *YS2* was engaged in the research for 28 days, from 10 January to 6 February 2021. (Figure 1b). Tabulations of all track line Waypoint (WP) are shown in Tables 1c and 1d, the searching effort and time spent on experiments in Table 1e. The starting longitudinal line in this survey was randomly set in the western part of Area IIIW (000°-015°E) same as in the 2019/2020 JASS-A survey. The design of legs 151–156 was modified by allocated days and expected searching distance per day. The total searching effort was 1,744.3n.miles (3,230.4km); 887.3n.miles in NSP mode during 84 hour 59 minutes of research and 857.0n.miles in IO mode during 83 hour 27 minutes of research. In the northern stratum, the total searching effort was 1,097.7n.miles (NSP: 528.3n.miles; IO: 569.4n.miles), and the searching effort coverage was 68%. In the southern stratum, the total searching effort was 646.6n.miles (NSP: 359.0n.miles; IO: 287.6n.miles), and the searching effort coverage was 90%. Therefore, a good distribution of effort within the both strata and by survey mode was achieved. The total experimental time for photo-ID, biopsy sampling, satellite tagging and distance and angle experiment, was 31 hour 41 minutes. Figures 6a–c shows the breakdown of research time in hours by effort, wind speed and visibility (minke whale visibility) in the research area.

Whale sighting in the research area

Four baleen whale species and at least three toothed whale species were sighted in the research area. The dominant whale species in the research area was the humpback whale (359 schools/697 individuals) followed by the fin whale (136/228). Sightings of other species were as follows; Antarctic minke (51/120), Antarctic blue (24/29), sperm (6/6), southern bottlenose (6/16), killer whales (4/13) and Ziphiidae (10/16) (Table 2a). Figures 3a to 3d show the geographical distribution of the primary sightings in the research area for the main whales sighted.

Primary and secondary sighting of humpback whale were 352/687 and 7/10, respectively (Table 2a). Two mother and calf pairs were observed at 60°37'S; 017°00'E and 62°04'S; 025°28'E, and the estimated body lengths of one of the pairs was 12.4m and 8.3m. Density index (DI: schools sighted/ 100n. miles searching distance) based on primary sightings was 0.23 in the northern stratum and 0.15 in the southern stratum. Mean school size was 2.2 in the northern stratum and 1.3 in the southern stratum. The large aggregation of 4 schools totalling 44 humpback whales (include one mother and calf pair) were observed at around 62°03'S; 025°29'E. This species was distributed across the entire north to south extent of the research area (Figure 3b). In Area III East (035°E–070°E) in the NEWREP-A 2018/19 dedicated sighting survey, humpback whales were widely distributed at high density throughout the research area, with DIs being high (northern stratum: 0.19 and southern stratum: 0.22) (Mogoe *et al*., 2019), as almost same the DIs in this survey. In the western part of Area IIIW (000°–015°E) in the 2019/2020 JASS-A survey, this species was broadly distributed in the research area, but the DIs was low (northern stratum: 0.06 and southern stratum: 0.03) (Isoda *et al*, 2020). In the 2004/2005 SOWER cruise in Area IIIW, humpback whales were sighted frequently in the southern stratum east of longitude 015°E with so limited sighting in the 000°–015°E (Ensor *et al*, 2005). The pattern of distribution and density of this species in the western and eastern parts of Area IIIW seems to be different.

Primary and secondary sightings of fin whale were 131/218 and 5/10, respectively (Table 2a). No mother and calf pairs were observed. The DIs based on primary sightings was 0.11 in the northern stratum and 0.02 in the southern stratum. Mean school size was 1.7 in the northern stratum and 1.2 in the southern stratum. This species was mainly distributed in the northern stratum (Figure 3a). In the 2004/2005 SOWER cruise, the species was rarely observed in the sector 000°–035°E, and only in the southern stratum (Ensor *et al*, 2005). In the 2005/2006 and 2006/2007 SOWER cruises in the area 000°–020°E (Ensor *et al*, 2006; 2007), there were many sightings between 55°S and 60°S and no or rarely sighted in the survey of vicinity of the ice edge. In the 2019/2020 JASS-A survey (000°–

015°E), this species was distributed in the northern and southern strata, as the same in this survey, with DIs of 0.06 and 0.02, respectively. An increasing trend in abundance of this species was suggested (Matsuoka and Hakamada, 2014). Fin whales in this survey had shown a rapid increase in the number of sightings and seems to expand distribution area, in comparison with those in past SOWER cruises.

Primary and secondary sightings of Antarctic minke whale were 36/60 and 15/60, respectively (Table 2a). As in previous surveys, no mother and calf pair of the Antarctic minke whale was observed. Mean school size was 1.4 in the northern stratum and 1.8 in the southern stratum. Aggregation of 29 animals was sighted off effort at 69°08'S 019°11'E (near the ice edge). The DI based on primary sightings was 0.01 in the northern stratum and 0.04 in the southern stratum. The DI in the northern and southern stratum based on past SOWER cruises in Area IIIW were 0.01–0.03 and 0.10–0.14, respectively (Matsuoka *et al*., 2003). The DI of the northern stratum in this survey was not widely different from the DIs in the past SOWER cruises but DI of the southern stratum was less than the DIs in the past SOWER. In this survey, this species was most sighted in the west of the research area in the southern stratum between 018°E and 021°E (near the ice edge) and was sighted infrequently in the southern stratum in the east of the research area and the northern stratum (Figure 3b). In 2004/2005 SOWER cruise, Antarctic minke whale was mainly sighted in the southern stratum of west of 020°E in Area IIIW (Ensor *et al*, 2005). In Area IIIW (000°E–035°E) in the NEWREP-A 2018/19 of sighting results by the sighting and sampling vessels, this species was more distributed the west of 025°E in the southern stratum than the east of 025°E in the southern stratum (Figure 1 in Appendix of Bando *et al*., 2019). In the western part of Area IIIW (000°–015°E) in the 2019/2020 JASS-A survey, this species was abundant near the ice edge, in addition, many sightings occurred in the western side of the northern stratum, and the DIs (the northern stratum: 0.04 and the southern stratum: 0.14) higher than the DIs in this survey (Isoda *et al*, 2020). The distribution and density of this species in Area IIIW may be tended to high in the western part.

Primary and secondary sightings of Antarctic blue whale were 23/28 and 1/1, respectively (Table 2a). One mother and calf pair was observed at 65°36'S; 034°45'E and the estimated body length of the mother and calf were 27.8m and 13.2m, respectively. The schools sighted comprised: 21 solitary animals, one pair, and two groups of three. During the 2004/2005 SOWER cruise in the sector 000°–020°E, blue whales were only recorded in the southern stratum with a wide distribution from the pack ice to about 40n.miles from the ice (Ensor *et al*, 2005) and in the western part of Area IIIW (000°–015°E) in the 2019/2020 JASS-A survey, this species was abundant in the southern stratum (Isoda *et al*, 2020). In this survey, this species was most sighted in the southern stratum (Figure 3a), similar to the situation in the 2004/2005 SOWER cruise and the 2019/2020 JASS-A survey. A large aggregation of 26 whales was observed at position 68°32'S; 019°16'E in the 2004/2005 SOWER cruise (Ensor *et al*, 2005). No large aggregation was observed in both strata in the present survey however nine schools (13 individuals) were sighted with concentrations within 35 n.miles of in the vicinity of 67°10'S; 030°10'E.

Solitary large sperm whales were sighted as primary sightings (six individuals) and they were found in the northern stratum between latitude 64°S and 65°S, with the exception of one sighting. Killer whales were sighted as primary sightings (4/13) and the types were undetermined (Table 2a, Figure 3c). Southern bottlenose whales were sighted as primary sightings (6/16) and only found in the northern stratum. Ziphiidae whales were sighted as primary sightings (10/16), and they were observed mainly in the northern stratum (Table 2a, Figure 3d).

IO results

Resight data were recorded for a total of 389 sightings during the IO Mode survey (Table 2c). Duplicates were those sightings made by the IOP that were also observed by the TOP barrel. For humpback whales, there were 251 school sightings made by TOP or IOP and 116 schools made by IOP. A breakdown of the numbers of the 116 include 82 for "Definite duplicate", 4 for "Possible duplicate", 1 for "Remote duplicate", 29 for "Not duplicate". For fin whales, there were 87 school sightings made by TOP or IOP and 38 schools made by IOP. A breakdown of the numbers of the 38 schools include 29 for "Definite duplicate" and 9 for "Not duplicate". For Antarctic minke whales, there were 14 school sightings made by TOP or IOP and 5 schools made by IOP. A breakdown of the numbers of the 5 include 3 for "Definite duplicate" and 2 for "Not duplicate". These data will be used for to estimate whale abundance considering estimated g(0).

Sighting survey in the transit area

Sighting survey was conducted between south of 10°S and the research area, excluding areas of the foreign countries EEZs. Sighting was made on using passing mode (Tables 1a and 1e). In transit from 10°S to the Republic of Mozambique EEZ, sighting survey was conducted from 20 to 31 December. The searching effort was 519.7n.miles and total sightings included Bryde's (1/1; sighted position 27°17'S; 039°29'E) and Antarctic minke (1/1; sighted position 29°01'S; 050°09'E) whales (Table 2b). Biopsy sample of both whales were collected. In transit from the Republic of South Africa EEZ to the research area in the Antarctic, sighting survey was conducted from 4 to 10 January. The searching effort was 283.0n.miles and total sightings included fin (8/13) and humpback

(3/6) whales (Table 2b). A mother and calf pair of fin whale was observed at 39°12'S; 32°41'E, biopsy sample was collected from mother, and estimated body length of the mother and calf were 24.3m and 11.1m, respectively.

In transit from the Antarctic research area to the Republic of South Africa EEZ (include during transit in the research area), sighting survey was conducted from 6 to 17 February. The searching effort was 474.8n.miles and the total sightings included fin (9/16), humpback (22/36), and sperm (2/2) whales (Table 2b). During the transit in the research area, biopsy samples were collected from three fin and five humpback whales and satellite tags were attached to the two fin whales. A further biopsy samples were collected from two fin whales (a school comprising five whales) at 43°49'S; 19°12'E and one humpback whale at 38°58'S; 26°55'E. In transit from the Republic of Mozambique EEZ to 10°S, sighting survey was conducted from 22 February to 4 March. The searching effort was 593.4n.miles and a sperm whale (1/1) was sighted (Table 2b). A total of experimental time in transit survey for photo-ID, biopsy sampling and satellite tagging was 5 hour 29 minutes.

Other research activities

Sighting distance and angle experiment
A training for this experiment was conducted on 13 January for 1 hour 35 minutes. The actual experiments were successfully completed on 1 February for 4 hour 57 minute (128 trials). The results of this experiment will be used for the calculation of abundance estimates.

Photo-ID
A total of 20 Antarctic blue, 41 humpback and one killer whales were successfully photo-identified during whole survey (Table 3). These data will be registered to the ICR catalogue and submission of photographs to relevant international catalogues (e.g. Matsuoka and Pastene, 2014). Data will be available to the national and international scientific community through established data access protocols of ICR.

Biopsy sampling for large whales
A total of 54 biopsy samples were collected (Table 4), including eight Antarctic blue, 15 fin, 14 Antarctic minke, 16 humpback and one Bryde's whales during whole survey. The nine of 14 biopsied Antarctic minke and six of 15 biopsied fin whales were attached satellite tags. Biopsy samples were stored at -20°C. These samples will be used in genetic analyses and studies to evaluate the utility of non-lethal techniques for whale biological research (e.g. Pastene *et al.*, 2014; Kanda *et al.*, 2014; Inoue *et al.*, 2019).

Satellite tagging (for details, see Appendix 2)
A total of 23 trials for fin whales and a total of 10 trials for Antarctic minke whales were made. Seven and ten satellite tags were deployed on fin and Antarctic minke whales, respectively. Figure 4 show satellite deployed positions of seven fin and ten Antarctic minke whales. Tracking data of both species will contribute to the elucidation of the timing of departure from Antarctic feeding area to low latitude breeding area.

Data logger tagging
The tags were successfully deployed on two humpback whales and the data (position, time and depth) were collected from each tag. Biopsy samples were also collected from the same whales. This experiment will be conducted further in the next field surveys for to obtain information on diving behaviour of large whales.

Oceanographic survey
Oceanographic observation was conducted by XCTD at 99 stations on the survey track lines, including transit survey south of 60°S (Table 5, Figure 5). Oceanographic data will be analysed in conjunction with the data collected by the previous JARPA/JARPAII, NEWREP-A, and in the same protocols as in the previous surveys (Watanabe *et al*., 2014).

Marine debris observation
No marine debris objects were observed during the survey in the research area.

Feasibility study on the utility of Unmanned Aerial Vehicle (UAV)
A total of ten Antarctic blue, seven fin and two humpback whales were successful in collecting whale images (movies can access at https://www.youtube.com/channel/UCz3c9IIMiQPVeryAogmJIig). These data will be registered to the photo-ID catalogue of ICR and will be available to the national and international scientific community through established data access protocols of ICR.

Report of the IWC oversight

The oversight report was shown in Appendix 3.

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TABLES AND FIGURES

Table 1a. Narrative of the 2020/21 JASS-A dedicated sighting survey.

Date (y/m/d)	Event
2020/11/20	Planning meeting at Tokyo, Japan
2020/12/03	Pre-cruise meeting at Shiogama, Japan
2020/12/04	*YS2* departed at Shiogama, Japan
2020/12/20	Started transit survey at 10°-11'S; 089°-26'E (High sea)
2020/12/25	Interrupted transit survey at 18°-50'S; 067°-00'E (Entering Mauritius EEZ)
2020/12/28	Resumed transit survey at 26°-10'S; 052°-28'E (High sea)
2020/12/31	Interrupted transit survey at 26°-09'S; 038°-35'E (Entering Mozambique EEZ)
2021/01/02	*YS2* bunkered off Maputo, Mozambique (25°-58'S, 032°-47'E)
2021/01/04	Resumed transit survey at 33°-44'S; 032°-59'E (High sea)
2021/01/10	Finished transit survey and started survey in the research area at 60°-00'S; 026°-41'E
2021/02/06	Completed survey in the research area (28 days) and start transit survey at 68°-17'S; 015°-00'E
2021/02/17	Interrupted transit survey at 33°-14'S; 033°-16'E (Entering South Africa EEZ)
2021/02/20	*YS2* bunkered off Maputo, Mozambique (25°-58'S; 032°-48'E)
2021/02/22	Resumed transit survey at 26°-08'S; 038°-35'E (High sea) and interrupted transit survey at 26°-17'S; 040°-32'E (Entering Madagascar EEZ)
2021/02/25	Resumed transit survey at 24°-27'S; 051°-50'E (High sea) and interrupted transit survey at 23°-58'S; 053°-09'E (Entering France (Reunion) EEZ)
2021/02/28	Resumed transit survey at 18°-57'S; 066°-42'E (High sea)
2021/03/04	Finished transit survey at 10°-30'S; 085°-20'E
2021/03/22	*YS2* arrived and post cruise meeting at Shiogama, Japan.

Table 1b. Summary of the 'Ship's Time Adjustment' Schedule.UTC: Coordinated Universal Time; JST: Japan Standard Time.

Date (y/m/d)	Ah'd/Ab'k	Balance	Ship's time	Remarks
2020/12/04	-	UTC+9.0h	JST	Departed Japan (Shiogama)
2020/12/08	Ab'k 30min	UTC+8.5h	JST-0.5h	-
2020/12/09	Ab'k 30min	UTC+8.0h	JST-1.0h	-
2020/12/12	Ab'k 30min	UTC+7.5h	JST-1.5h	-
2020/12/13	Ab'k 30min	UTC+7.0h	JST-2.0h	-
2020/12/15	Ab'k 30min	UTC+6.5h	JST-2.5h	-
2020/12/16	Ab'k 30min	UTC+6.0h	JST-3.0h	-
2020/12/18	Ab'k 30min	UTC+5.5h	JST-3.5h	-
2020/12/21	Ab'k 30min	UTC+5.0h	JST-4.0h	-
2020/12/23	Ab'k 30min	UTC+4.5h	JST-4.5h	-
2020/12/25	Ab'k 30min	UTC+4.0h	JST-5.0h	Interrupted transit survey entering Mauritius EEZ
2020/12/27	Ab'k 30min	UTC+3.5h	JST-5.5h	-
2020/12/28	Ab'k 30min	UTC+3.0h	JST-6.0h	Resumed transit survey leaving France (Reunion) EEZ
2020/12/30	Ab'k 30min	UTC+2.5h	JST-6.5h	-
2020/12/31	Ab'k 30min	UTC+2.0h	JST-7.0h	Interrupted transit survey entering Mozambique EEZ
2021/02/23	Ah'd 30min	UTC+2.5h	JST-6.5h	-
2021/02/24	Ah'd 30min	UTC+3.0h	JST-6.0h	-
2021/02/26	Ah'd 30min	UTC+3.5h	JST-5.5h	-
2021/02/27	Ah'd 30min	UTC+4.0h	JST-5.0h	-
2021/03/02	Ah'd 30min	UTC+4.5h	JST-4.5h	-
2021/03/03	Ah'd 30min	UTC+5.0h	JST-4.0h	-
2021/03/06	Ah'd 60min	UTC+6.0h	JST-3.0h	-
2021/03/09	Ah'd 60min	UTC+7.0h	JST-2.0h	-
2021/03/12	Ah'd 60min	UTC+8.0h	JST-1.0h	-
2021/03/16	Ah'd 60min	UTC+9.0h	JST	-
2021/03/22	-	UTC+9.0h	JST	Arrived at Japan (Shiogama)

Table 1c. Way Points (WP) in the southern stratum.

WP	Latitude			Longitude			Survey	Course	Plan	Effort	Coverage
	deg	min	N/S	deg	min	E/W	mode		(n.miles)	(n.miles)	
251	66	24.3	S	35	00.0	E	NSP	217°	32.3	38.0	82%
251A	66	50.0	S	34	11.0	E	NSP	180°	13.8		
252	67	03.8	S	34	11.0	E	IO	300°	34.1	29.9	88%
253	66	46.9	S	32	55.7	E	NSP	300°	34.2	34.1	100%
254	66	30.0	S	31	41.0	E	IO	222°	43.8	42.8	98%
255	67	02.5	S	30	26.9	E	NSP	222°	43.8	47.9	91%
255A	67	35.0	S	29	11.0	E	NSP	180°	9.0		
256	67	44.0	S	29	11.0	E	IO	360°	9.0	59.7	98%
256A	67	35.0	S	29	11.0	E	IO	325°	51.8		
257	66	52.5	S	27	54.9	E	NSP	325°	51.8	46.3	89%
258	66	10.0	S	26	41.0	E	-	-	-	-	-
258A	67	25.0	S	26	41.0	E	IO	308°	37.0	30.1	81%
259	67	02.5	S	25	25.4	E	NSP	308°	37.0	35.7	96%
260	66	40.0	S	24	11.0	E	IO	220°	45.6	43.7	96%
261	67	15.0	S	22	56.9	E	NSP	220°	45.6	77.4	94%
261A	67	50.0	S	21	41.0	E	NSP	180°	37.1		
262	68	27.0	S	21	41.0	E	-	-	-	-	-
262A	68	40.0	S	21	41.0	E	IO	233°	33.6	31.2	93%
263	69	00.0	S	20	26.5	E	NSP	233°	33.6	27.0	80%
264	69	20.0	S	19	11.0	E	IO	322°	44.4	25.4	57%
265	68	45.0	S	17	55.0	E	NSP	322°	44.4	42.8	96%
266	68	10.0	S	16	41.0	E	IO	260°	28.3	24.8	88%
267	68	15.0	S	15	26.2	E	NSP	260°	9.9	9.8	99%
268	68	16.7	S	15	00.0	E	-	-	-	-	-
Total									720.1	646.6	90%

Table 1d. Way Points (WP) in the northern stratum.

WP	Latitude			Longitude			Survey	Course	Plan	Effort	Coverage
	deg	min	N/S	deg	min	E/W	mode		(n.miles)	(n.miles)	
151	65	45.0	S	35	00.0	E	NSP	147°	68.9	66.1	96%
152	64	47.5	S	33	29.7	E	IO	147°	68.9	64.0	93%
153	63	50.0	S	32	02.5	E	NSP	147°	68.9	40.9	59%
154	62	52.5	S	30	38.3	E	IO	147°	68.9	31.6	46%
155	61	55.0	S	29	16.7	E	NSP	147°	68.9	30.2	44%
156	50	57.5	S	27	57.7	E	IO	147°	68.9	63.9	93%
157	60	00.0	S	26	41.0	E	NSP	016°	80.1	0.0	0%
158	61	17.0	S	25	56.4	E	IO	016°	80.1	68.7	86%
159	62	34.0	S	25	10.0	E	NSP	016°	80.1	28.4	35%
160	63	51.0	S	24	21.4	E	IO	016°	80.1	70.0	87%
161	65	08.0	S	23	30.5	E	NSP	016°	80.1	60.2	75%
162	66	25.0	S	22	37.2	E	IO	016°	80.1	20.2	25%
163A	67	42.0	S	21	41.0	E	-	-	-	-	-
163B	68	40.0	S	21	41.0	E	NSP	166°	67.1	64.3	96%
164	67	35.0	S	20	57.8	E	IO	166°	67.1	66.0	98%
165	66	30.1	S	20	16.6	E	NSP	166°	67.1	32.2	48%
166	65	25.1	S	19	37.1	E	IO	166°	67.1	61.4	91%
167	64	20.1	S	18	59.2	E	NSP	166°	67.1	40.4	60%
168	63	15.1	S	18	22.7	E	IO	166°	67.1	39.8	59%
169	62	10.1	S	17	47.6	E	NSP	166°	67.1	44.8	67%
170	61	05.0	S	17	13.7	E	IO	166°	67.1	57.8	86%
171	60	00.0	S	16	41.0	E	NSP	015°	64.7	59.6	92%
172	61	02.5	S	16	08.1	E	IO	015°	64.7	26.0	40%
173	62	05.1	S	15	34.0	E	NSP	015°	62.5	61.2	98%
174	63	05.5	S	15	00.0	E	-	-	-	-	-
Total									1,622.7	1,097.7	68%

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

Survey Sections	Date and time		Searching effort (distance [n.miles] and time)				Experiments time	
	Start	End	NSP		IO		Photo-ID, Biopsy, Satellite tag experiment	Estimated angle and distance training/ experiment
Transit survey (10°S - Entering MZ EEZ)	2020/12/20 06:10	2020/12/31 17:20	519.7	45:03:53	-	-	00:29:33	-
Transit survey (Leaving SA EEZ - 60°S)	2021/01/04 12:00	2021/01/10 8:30	283.0	24:17:36	-	-	00:33:15	-
Research area (Area IIIW 015°E - 035°E)	2021/01/10 08:47	2021/02/06 14:30	887.3	84:59:16	857.0	83:27:51	25:08:12	6:33:16
Transit survey (015°E - Entering SA EEZ)	2021/02/06 14:30	2021/02/17 11:51	474.8	41:38:29	-	-	04:17:28	-
Transit survey (Leaving MZ EEZ - 10°S)	2021/02/22 11:32	2021/03/04 16:35	593.4	50:02:24	-	-	-	-
Total	2020/12/20 06:10	2021/03/04 16:35	2,758.2	246:01:38	856.8	83:27:51	30:37:40	06:33:16

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

Species	Eastern part of Area IIIW (015°E–035°E)								Sub-total				Total	
	Southern stratum				Northern stratum									
	Primary		Secondary		Primary		Secondary		Primary		Secondary			
	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Antarctic blue whale	21	25	1	1	2	3	0	0	23	28	1	1	24	29
Fin whale	14	17	0	0	117	201	5	10	131	218	5	10	136	228
Like fin whale	0	0	0	0	2	2	0	0	2	2	0	0	2	2
Antarctic minke whale	23	42	12	57	13	18	3	3	36	60	15	60	51	120
Like minke whale	0	0	0	0	1	1	0	0	1	1	0	0	1	1
Humpback whale	96	128	4	7	256	559	3	3	352	687	7	10	359	697
Like humpback whale	0	0	0	0	1	1	0	0	1	1	0	0	1	1
Baleen whale	4	4	0	0	4	4	0	0	8	8	0	0	8	8
Sperm whale	1	1	0	0	5	5	0	0	6	6	0	0	6	6
Killer whale (Undetermined)	2	7	0	0	2	6	0	0	4	13	0	0	4	13
Southern bottlenose whale	0	0	0	0	6	16	0	0	6	16	0	0	6	16
Ziphiidae	2	2	0	0	8	14	0	0	10	16	0	0	10	16
Mesoplodon	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unidentified whale	2	2	1	1	4	4	0	0	6	6	1	1	7	7

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

Species	Transit From 10°S to R.A.				Eastern part of Area IIIW (015°E-035°E) Southern stratum				Eastern part of Area IIIW (015°E-035°E) Northern stratum				Transit From R.A. to 10°S				Sub-total				Total	
	Primary		Secondary		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.	Sch.	Ind.	Sch.	Ind.
Antarctic blue whale	0	0	0	0	21	25	1	1	2	3	0	0	0	0	0	0	23	28	1	1	24	29
Fin whale	8	13	0	0	14	17	0	0	117	201	5	10	7	13	2	3	146	244	7	13	153	257
Like fin whale	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	2	2	0	0	2	2
Bryde's whale	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
Antarctic minke whale	1	1	0	0	23	42	12	57	13	18	3	3	0	0	1	1	37	61	16	61	53	122
Like minke whale	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
Humpback whale	3	6	0	0	96	128	4	7	256	559	3	3	16	23	6	13	371	716	13	23	384	739
Like humpback whale	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
Baleen whale	0	0	0	0	4	4	0	0	4	4	0	0	0	0	0	0	8	8	0	0	8	8
Sperm whale	0	0	0	0	1	1	0	0	5	5	0	0	3	3	0	0	9	9	0	0	9	9
Killer whale (Undetermined)	0	0	0	0	2	7	0	0	2	6	0	0	0	0	0	0	4	13	0	0	4	13
Southern bottlenose whale	0	0	0	0	0	0	0	0	6	16	0	0	1	4	0	0	7	20	0	0	7	20
Ziphiidae	5	7	0	0	2	2	0	0	8	14	0	0	5	11	0	0	20	34	0	0	20	34
Mesoplodon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unidentified whale	1	1	0	0	2	2	1	1	4	4	0	0	2	2	0	0	9	9	1	1	10	10

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 all schools sighted by TOP & IOP	Number of schools sighted by IOP	Duplicate Status			
			D	P	R	N
Antarctic blue whale	13	5	3	0	0	2
Fin whale	87	38	29	0	0	9
Like fin whale	1	0	0	0	0	0
Antarctic minke whale	14	5	3	0	0	2
Like minke whale	1	0	0	0	0	0
Humpback whale	251	116	82	4	1	29
Baleen whale	4	2	0	0	0	2
Sperm whale	7	3	3	0	0	0
Killer whale (Undetermined)	2	0	0	0	0	0
Southern bottlenose whale	1	1	0	0	0	1
Ziphiidae	6	3	2	0	0	1
Unidentified whale	2	1	0	0	0	1

Table 3. Summary of the photo-ID data by 2020/21 JASS-A.

Photo-ID	Transit From 10°S to R.A.	Eastern part of Area IIIW (015°E–035°E)		Transit From R.A. to 10°S	Total
		Southern stratum	Northern stratum		
Antarctic blue whale	0	17	3	0	20
Humpback whale	0	11	18	12	41
Killer whale	0	1	0	0	1
Total	0	29	21	12	62

Table 4. Summary of biopsy samples collected by 2020/21 JASS-A.

Biopsy	Transit From 10°S to R.A.	Eastern part of Area IIIW (015°E–035°E)		Transit From R.A. to 10°S	Total
		Southern stratum	Northern stratum		
Antarctic blue whale	0	7	1	0	8
Fin whale	1	0	9	5	15
Bryde's whale	1	0	0	0	1
Antarctic minke whale	1	13	0	0	14
Humpback whale	0	5	5	6	16
Total	3	25	15	11	54

Table 5. Summary of Oceanographic observations by 2020/21 JASS-A.

Area	Transit From 10°S to R.A.	Eastern part of Area IIIW (015°E–035°E)		Transit From R.A. to 10°S	Total
		Southern stratum	Northern stratum		
Number of stations	1	38	49	11	99

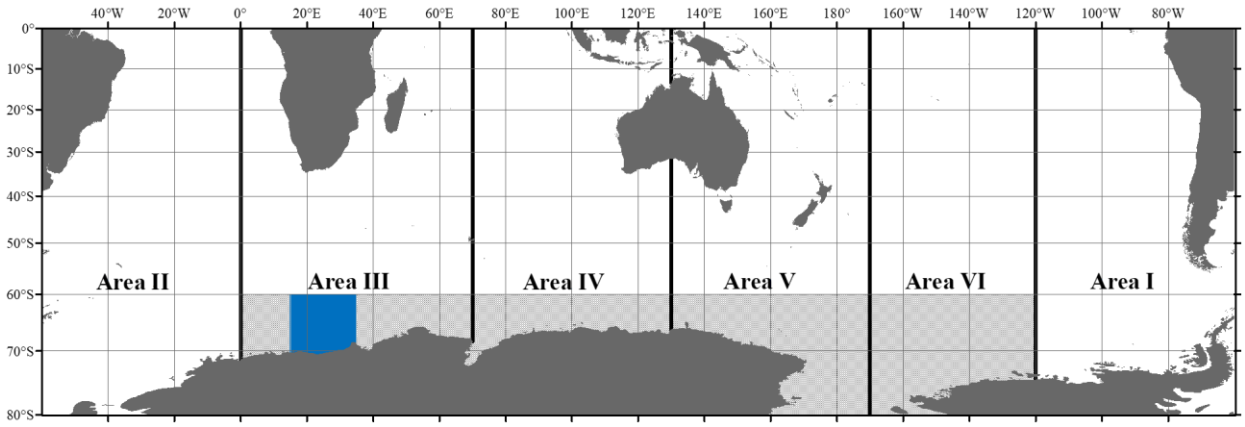

Figure 1a. Research area of the JASS-A dedicated sighting survey. Blue area indicates the researched area of the dedicated sighting survey in 2020/21 JASS-A.

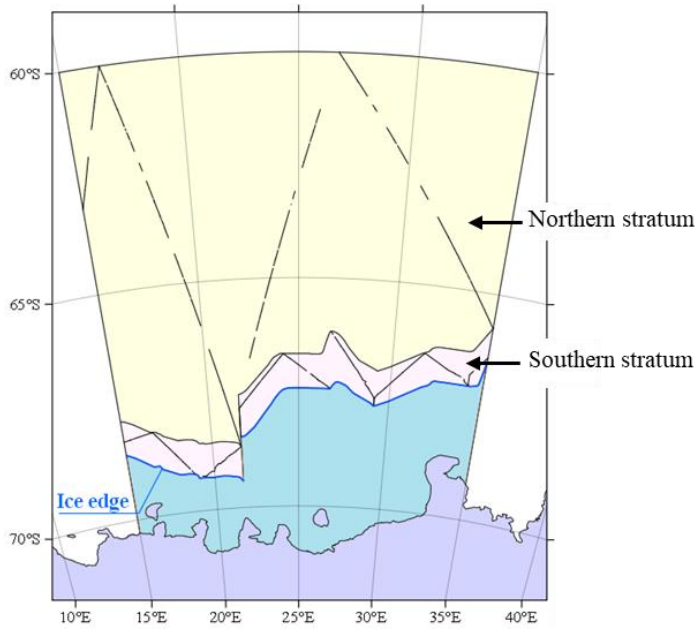

Figure 1b. Research area (015°E–035°E) and track line of the 2020/21 JASS-A dedicated sighting survey.

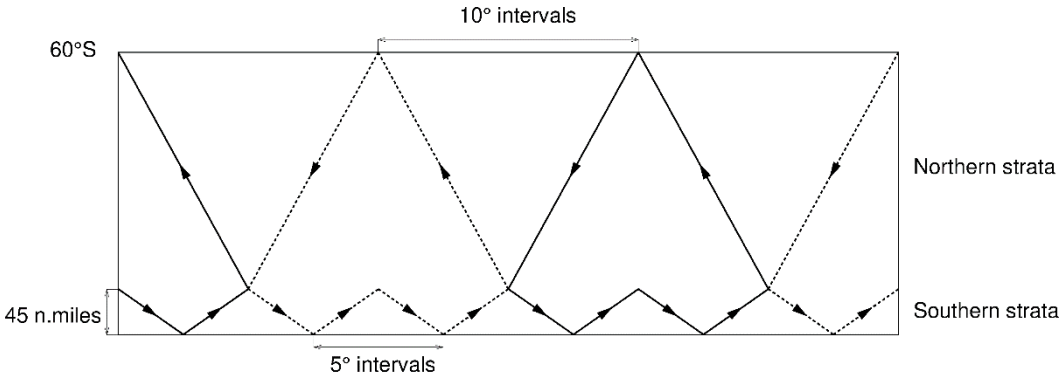

Figure 1c. Basic design for pre-determined cruise track lines in the Antarctic using one vessel. Track lines are decided based on the original longitudinal line, which is selected at random. The interval of legs and number of legs in each stratum could be changed in consideration of delay caused by bad weather conditions and other factors. Considerable flexibility may be needed by the Cruise Leader in determining the final cruise tracks.

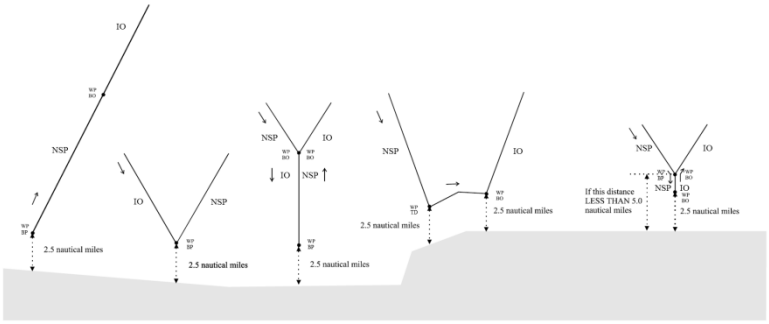

Figure 1d. Standard procedures for modifications to the cruise track line in the southern strata (IWC, 2008). If the ice edge is encountered prior to reaching a planned waypoint, 2.5n.miles from the estimated ice edge, the vessel shall follow the ice edge, off-effort, until survey can be resumed on the planned track line. 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 5n.miles of the waypoint), and again on reversing direction when the true ice edge is encountered.

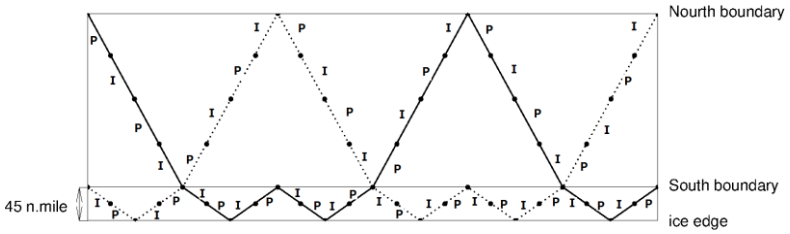

Figure 1e. The survey modes (NSP (P) and IO (I) modes) were set alternately in each track line.

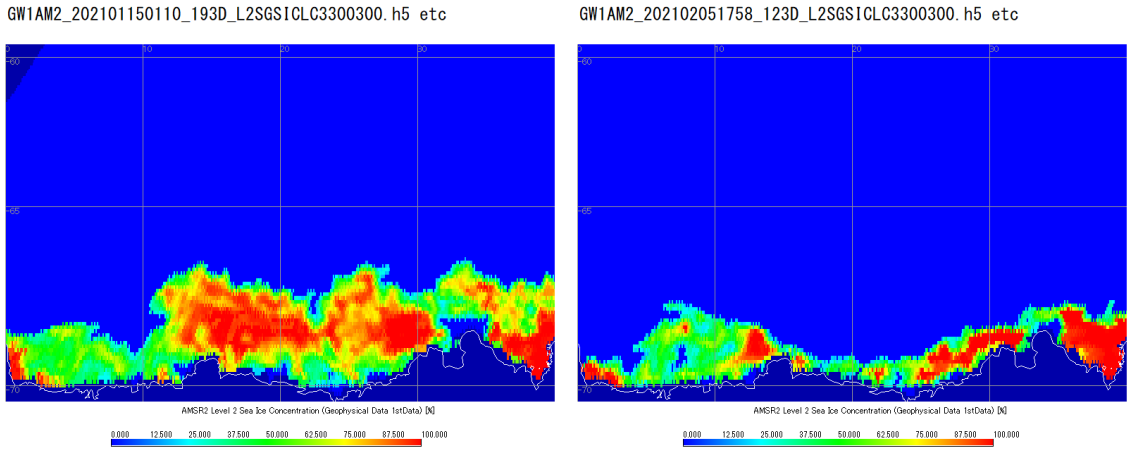

Figure 2. The pack-ice distributions in the research area, dated 15 January (left) and 5 February (right) 2021 using observational data acquired by the Advanced Microwave Scanning Radiometer 2 (AMSR2). Data from the Japan Aerospace Exploration Agency (JAXA), http://global.jaxa.jp/projects/sat/gcom_w/.

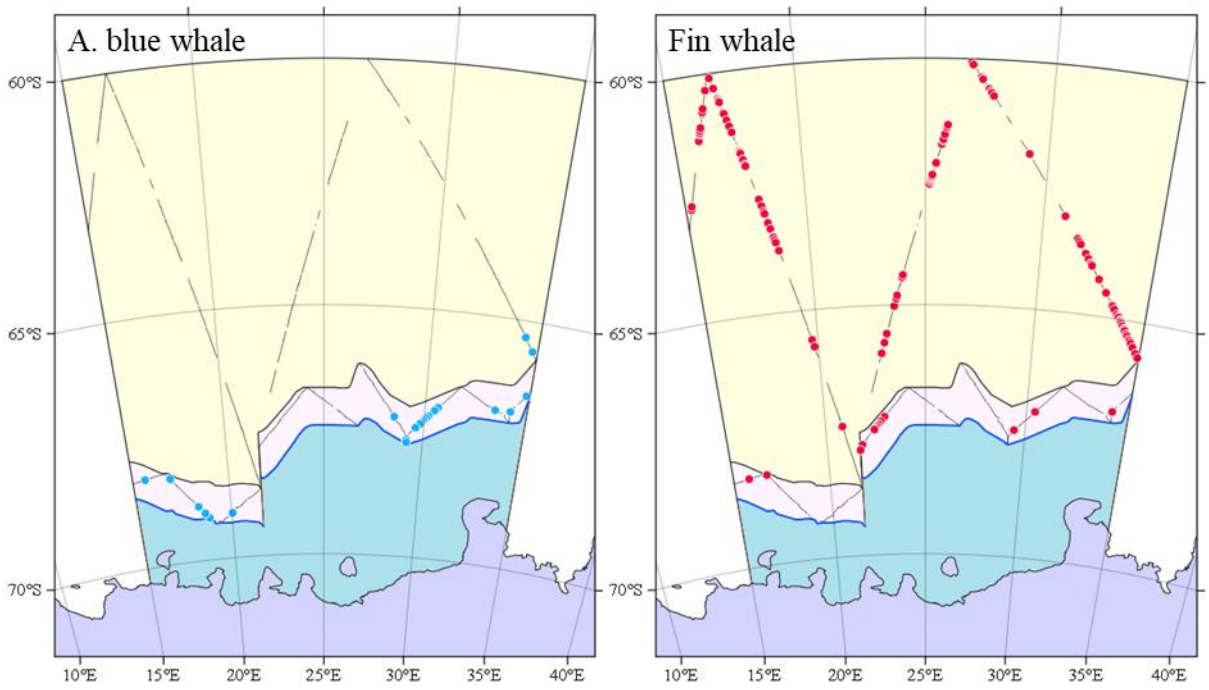

Figure 3a. Primary sighting positions of Antarctic blue (left) and fin (right) whales with searching effort in the research area.

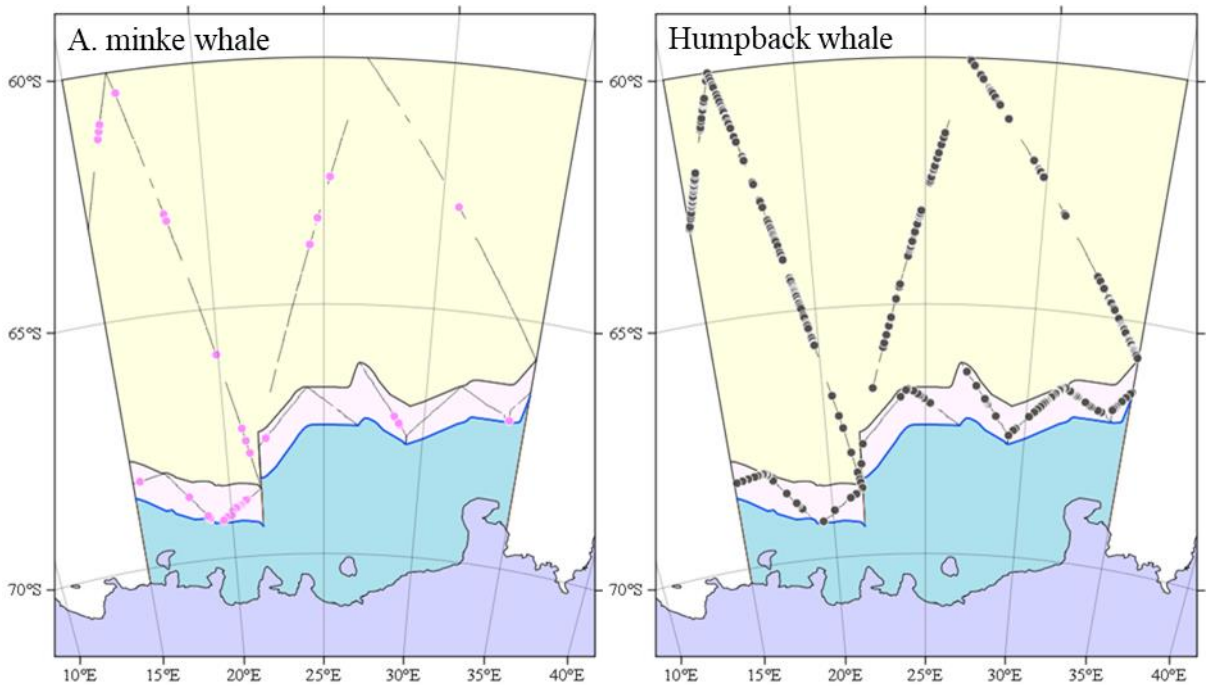

Figure 3b. Primary sighting positions of Antarctic minke (left) and humpback (right) whales with searching effort in the research area.

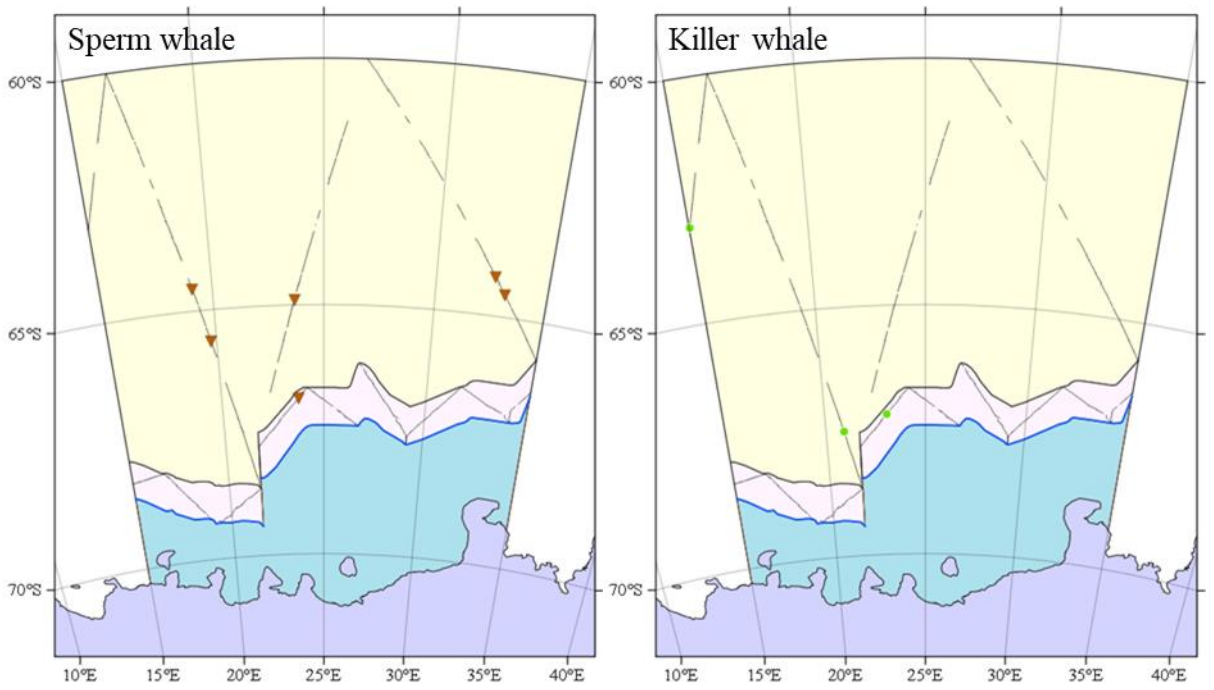

Figure 3c. Primary searching positions of sperm (left) and Killer (right) whales with searching effort in the research area.

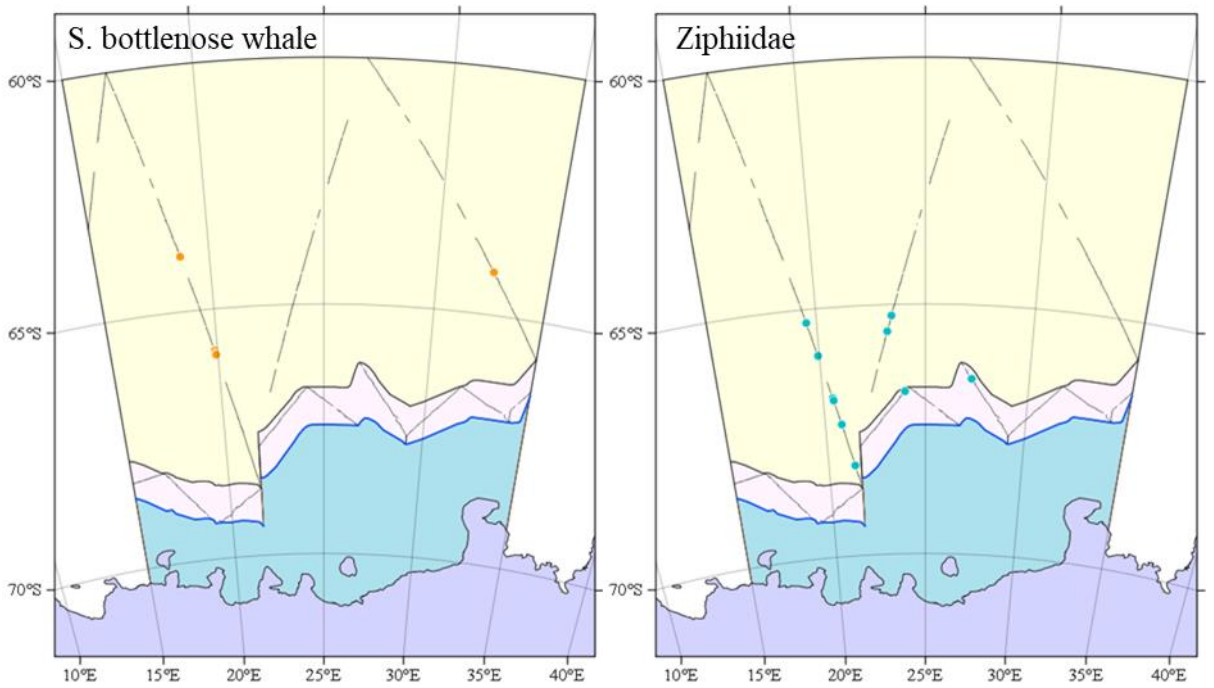

Figure 3d. Primary sighting positions of southern bottlenose whale (left) and Ziphiidae (right) with searching effort in the research area.

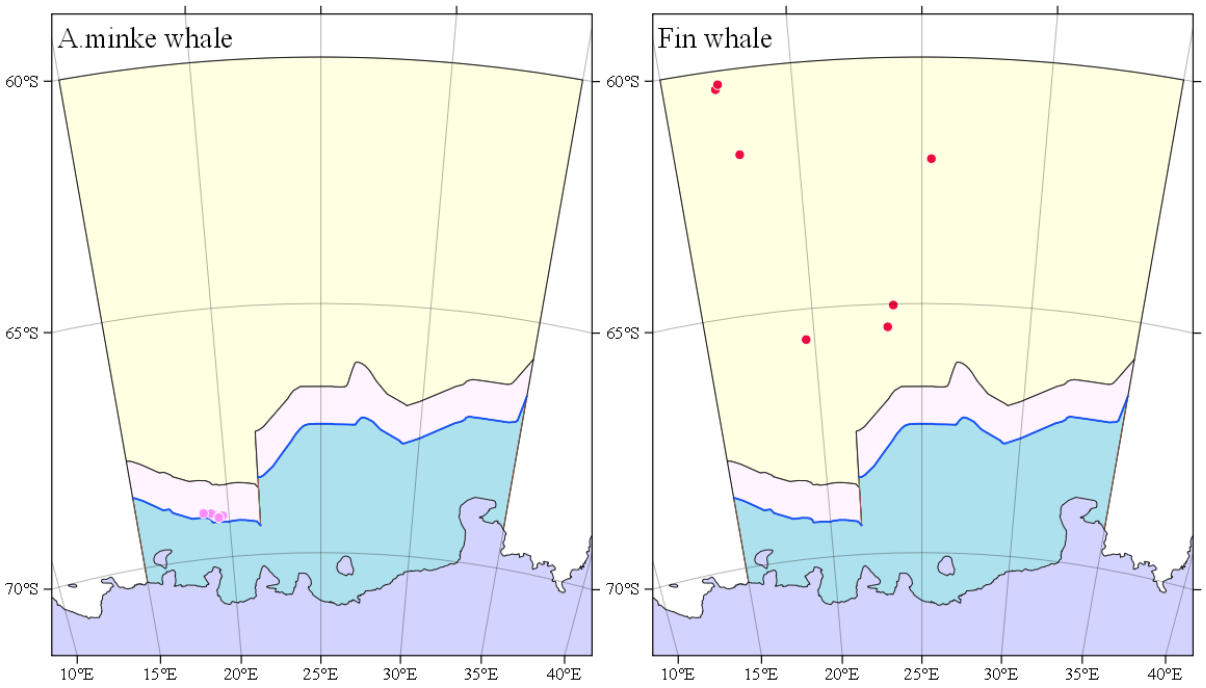

Figure 4. Satellite deployed positions of Antarctic minke (left) and fin (right) whales in the research area.

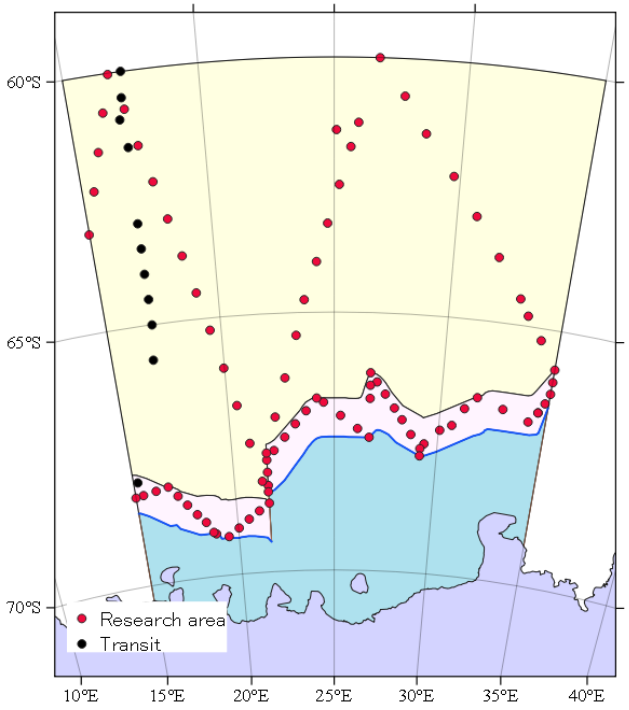

Figure 5. Oceanographic observation stations (XCTD casting points) in the 2020/21 JASS-A.

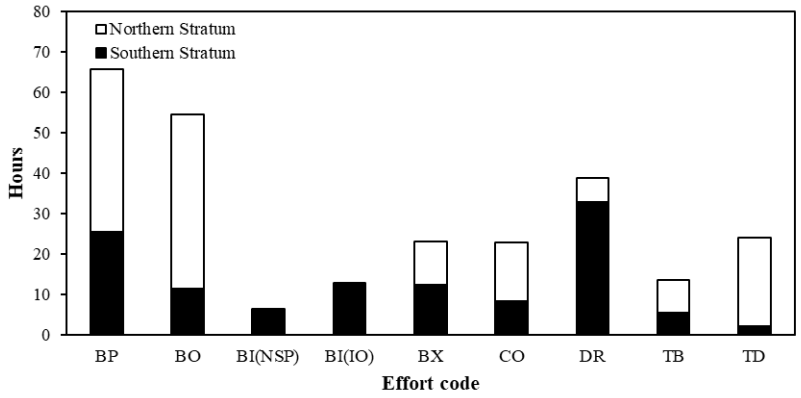

Figure 6a. Breakdown of research time in hours, by effort code in the research area. BP: Normal Passing mode searching (NSP); BO: Passing with Independent Observer searching (IO); BI: NSP and BO with in the ice area; BX: Sighting distance and angle estimate experiment, Photo-ID, Biopsy experiments, Satellite tagging experiments; CO: Confirmation of school; DR: Drifting; TB: Time back to track line; TD: Top down steaming.

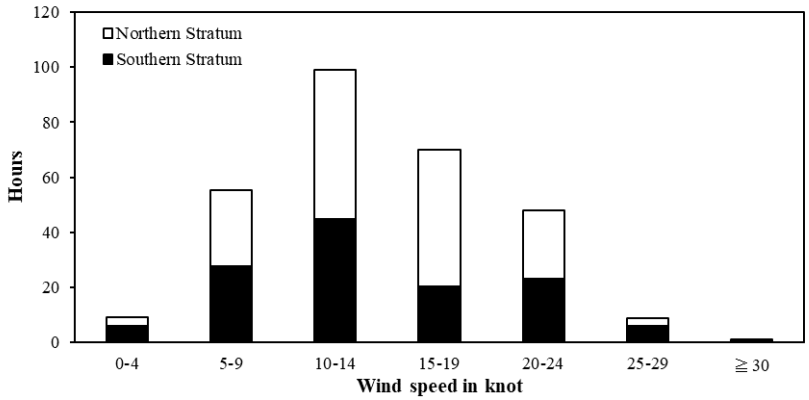

Figure 6b. Breakdown of research time in hours in the research area, by wind speed in knots.

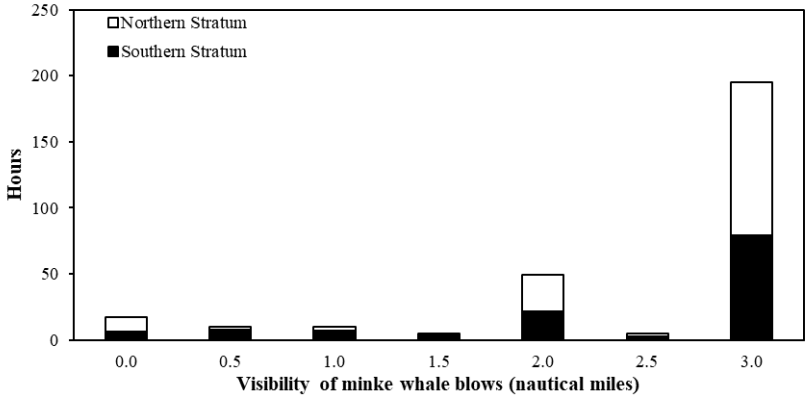

Figure 6c. Breakdown of research time in hours in the research area, by visibility (minke whale visibility) in nautical mile.

Appendix 1

Ship specifications of *Yushin-Maru No.2*

Vessel photos:

Yushin-Maru No.2

Vessel specifications:

	Yushin-Maru No.2
Call sign	JPPV
Length overall [m]	69.61
Molded breadth [m]	10.8
Gross tonnage [GT]	747
Top barrel height [m]	19.5
IO platform heigh [m]	13.5
Upper bridge height [m]	11.5
Bow height [m]	6.5
Engine power [PS / kW]	5,280 / 3,900

Appendix 2

RESULTS OF THE SATELLITE-MONTORED TRACKINGS OF ANTARCTIC MINKE AND FIN WHALES UNDER THE JASS-A CRUISE IN 2020/2021

Kenji Konishi, Tatsuya Isoda and Taiki Katsumata

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

Satellite-monitored tagging is a part of main objective 2 in JASS-A program regarding distribution, movement and stock structure of baleen whales (Government of Japan, 2019). Implantable satellite-monitored tags in a stainless-steel housing (113 mm SPOT6 with triangle stop plate; Wildlife Computers, Redmond, Washington, USA) were used for tracking whales. The tags were deployed with the Air Rocket Transmitter System (ARTS) (LK-ARTS, Skutvik, Norway), a pneumatic air launcher. The tags were deployed from the bow deck (6.5 m height from sea surface) of the R/V *Yushin-Maru No.2* (747GT, 70m-length). Skin biopsies were also collected for genetic analyses using a biopsy Larsen gun system (Larsen, 1998). Biopsies were simultaneously sampled after the deployment of the satellite tags if possible and stored at -20°C for later molecular analyses. The detail of the deployment system is described in Konishi *et al*. (2020).

The tag deployments were conducted during end of January to early February 2021 in the eastern part of Area IIIW (015°E - 035°E). The tags were deployed on ten Antarctic minke whales and seven fin whales (Table 1; **Figures 1** and **2**). The tracking for three minke and a fin whales were still ongoing by 8th March 2021. Antarctic minke whales appear to move westward along the westward flowing Antarctic Coastal Current after the deployments then some individuals stayed at coastal area but an individual moved back to eastern area (ID181835: **Figure 1**). Fin whales likely to stay the area where they were tagged but a fin whale occurred at lower latitude of 45°S which is far north from the deployment position (ID196142 **Figure 2**). Antarctic minke whales tended to occur at rather southern area near the vicinity of ice edge and the sea shore than fin whales as well as the trackings in 2019/20 JASS-A (Appendix 2 in Isoda *et al*. 2020). These tracking data will be analyzed with those of previous and the coming years to investigate distribution, movement and stock structures of these whales.

Tracked records of the whales will be analyzed in line with the objectives and schedule of JASS-A program. Further improvements of the technique will be considered and applied in future surveys.

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Konishi, K., Isoda, T., Bando, T., Minamikawa, S. and Kleivane, L. 2020. Antarctic minke whales find ice gaps along the ice edge in foraging grounds of the Indo-Pacific sector (60° E and 140° E) of the Southern Ocean', *Polar Biology*. 43(4), pp. 343–357. doi: 10.1007/s00300-020-02638-x.

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Table 1

Summary of the satellite-monitored tags satellite for Antarctic minke and fin whales in 2020/21 JASS-A cruise until 8th Marth 2021. Three minke and a fin whales are under tracking at the date.

No.	Vessel	Date	Species	School size	Latitude (degree East)	Longitude (degree South)	Estimated body length (m)*	PTT ID	Biopsy samples
1	YS2	2021/1/22	Fin	2	23.2	65.6	17.6	196148	Y
2	YS2	2021/1/22	Fin	1	23.6	65.0	23.8	196142	N
3	YS2	2021/1/24	Fin	3	25.4	62.1	21.3	196155	Y
4	YS2	2021/1/28	Fin	3	17.5	61.7	21.6	181859	Y
5	YS2	2021/1/30	Fin	3	19.7	65.6	21.7	196159	Y
6	YS2	2021/2/2	Ant. minke	6	19.8	69.2	7.1	181836	Y
7	YS2	2021/2/2	Ant. minke	3	19.2	69.1	8.2	181857	Y
8	YS2	2021/2/2	Ant. minke	29	19.2	69.1	7.8	66621	Y
9	YS2	2021/2/2	Ant. minke	29	19.2	69.1	7.2	181834	Y
10	YS2	2021/2/3	Ant. minke	29	19.2	69.1	7	181842	N
11	YS2	2021/2/3	Ant. minke	5	19.1	69.1	6.8	181826	Y
12	YS2	2021/2/3	Ant. minke	8	19.4	69.2	8.1	181835	Y
13	YS2	2021/2/3	Ant. minke	8	19.4	69.2	8.3	196161	Y
14	YS2	2021/2/3	Ant. minke	8	19.4	69.2	7.7	196166	Y
15	YS2	2021/2/4	Ant. minke	7	18.7	69.1	8.6	196153	Y
16	YS2	2021/2/9	Fin	2	17.0	60.5	21.3	196150	Y
17	YS2	2021/2/9	Fin	1	17.1	60.3	21.8	196151	Y

* Body lengths of whales were estimated by the researcher on board.

Tagging experiments in No.8-10 and 12-14 were conducted for same schools, respectively.

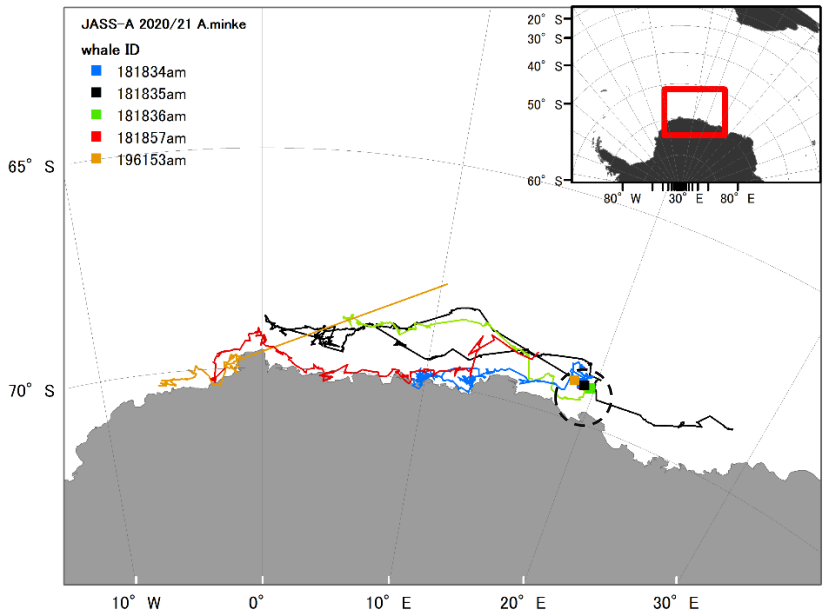

Figure 1 Tracking lines of five Antarctic minke whales until 8th March 2021. The lines are drawn by all ARGOS Location Classes. The dotted line circle shows the area deployments (colored square symbols) for Antarctic minke whales were conducted.

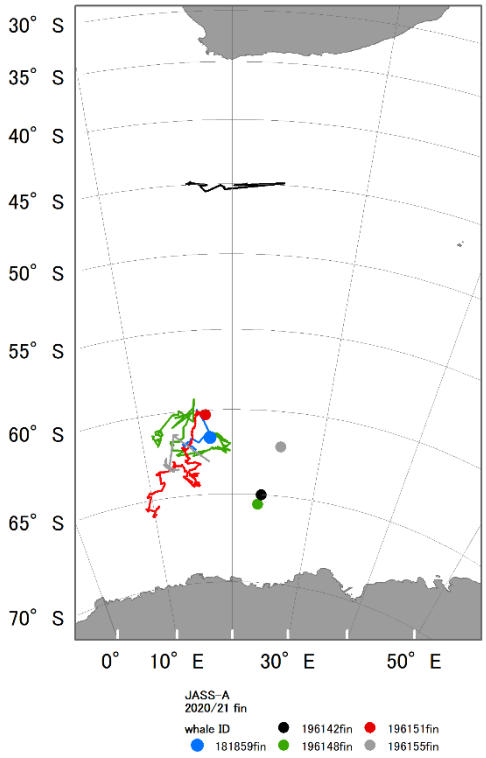

Figure 2 Tracking lines of five fin whales until 8th March 2021. The lines are drawn by all ARGOS Location Classes. Color filled circle symbols are positions of deployments.

Appendix 3

Oversight for the 2020/2021 JASS-A dedicated sighting survey

Koji Matsuoka

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

The plan of this survey was presented to the 2020 IWC/SC meeting (Matsuoka *et al*, 2020) and endorsed by the Scientific Committee (IWC, 2020). On behalf of the IWC Scientific Committee I carried out the oversight work during the 2020/21 JASS-A dedicated sighting survey. This is a brief report of the oversight activities conducted on that survey.

Preparatory work

I participate in planning meeting held in Tokyo, Japan on 20 November 2020. During the meeting, logistical aspects for the cruise and operations of the ship were finalized. I also participated in pre-cruise meeting carried out in Shiogama, Japan on 3 December. The survey organizers, cruise leader, researchers, captain and crew members joined in pre-cruise meeting. During the meeting the organizers explained the objective of the survey and the procedure to be used for sighting surveys, experiments and oceanographic survey using latest sea ice information of the research area. 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.2* (*YS2*) (747GT). This vessel was assigned to cover the research area, south of 60°S in IWC Antarctic Area III West and in the longitudinal range of 015°–035°E, and also to cover predetermined transects, normal passing mode and passing with Independent Observer mode. Cruise leader and two experienced researchers were assigned to the 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 vessel was oversight by examining the daily report prepared by the cruise leader and researchers on board with weather forecast and sea ice information. In some instances, telephone calls were made for further clarification of the activities, procedure and sightings made. Geographical positions and weather information of the vessel was tracked every day from ICR. Thus, the total survey was oversighted.

Brief narrative of the oversight vessel

The duration of this cruise was 109 days. The *YS2* departed from Shiogama, in Japan on 4 December 2020 and started the transit survey on 20 December. They bunkered off Maputo, Mozambique on 2 January 2021. The transit survey was completed and started survey in the research area on 10 January. They completed the research area when the eastern part of the Area III West was finished and started the transit survey on 6 February. It bunkered off Maputo, Mozambique on 20 February 2020. The transit survey was completed on 4 March and the vessel arrived at Shiogama, in Japan on 22 March.

Post-cruise meeting

I participated in a post-cruise meeting held on 22 March 2021 in Shiogama, in Japan. Survey organizers, cruise leader, researchers and captain also 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 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 2020/21 JASS-A dedicated sighting survey.

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