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Report and highlights of the dedicated sighting survey under the Japanese Abundance and Stock structure in the Antarctic (JASS-A) in the 2023/24 austral summer season

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ABSTRACT

The results of the sighting survey of the Japanese Abundance and Stock structure Surveys in the Antarctic (JASS-A) in the 2023/24 austral summer season are reported. Two dedicated sighting vessels were engaged in the line transect method survey in a part of Antarctic Area IV (70°E–100°E) for 36 days, from 7 January to 11 February 2024. For the survey, the research area was divided into northern and southern strata and Prydz Bay. In addition, surveys were conducted in the coastal ice-free waters in the Davis Sea. The total searching distance in the research area was 3,278.3 n.miles (6,071.4 km). Four baleen whale species and at least two toothed whale species were sighted in the research area. Other research activities such as biopsy sampling, photo-ID, satellite tagging, and oceanographic observations were also conducted. The data and samples collected are required for the main and secondary research objectives of JASS-A program.

INTRODUCTION

Long-term systematic surveys on whales and the ecosystem in the Antarctic, such as the JARPA/JARPAII[1], NEWREP-A[2] and IWC IDCR/SOWER[3], obtained important data pertaining to the study of abundance and abundance trends of large whales and their biology as well as the role of whales in the Antarctic ecosystem. All these research programs have been terminated. The last NEWREP-A survey was carried out in the 2018/19 austral summer season.

The Japanese Abundance and Stock structure Surveys in the Antarctic (JASS-A) commenced in the 2019/20 austral summer season because it was considered important to continue with the whale and ecosystem surveys in the Indo-Pacific region of the Antarctic Ocean through dedicated sighting surveys and other non-lethal research techniques. JASS-A has two main research objectives, i) the study of the abundance and abundance trends of large whale species, and ii) the study of the distribution, movement and stock structure of large whale species. JASS-A also has several secondary research objectives related to oceanography, marine debris, genetic data to estimate abundance, whale biology and study on the utility of Unmanned Aerial Vehicle (UAV). The JASS-A program was presented to the 2019 meeting of IWC SC[4] (GOJ, 2019a), the 2019 meeting of CCAMLR-EMM[5] (GOJ, 2019b) and the 2019 meeting of NAMMCO SC[6] (GOJ, 2019c).

The approach of JASS-A is systematic vessel-based sighting surveys utilizing the line transect method. Surveys are designed and conducted following the protocols included in the 'Requirements and Guidelines for Conducting Surveys and Analysing 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; IWC, 2008). The JASS-A surveys are conducted alternatively in IWC Management

[1] Japanese Whale Research Programs under Special Permit in the Antarctic, Phases I and II

[2] New Scientific Whale Research Program in the Antarctic Ocean

[3] International Decade for Cetacean Research/Southern Ocean Whale and Ecosystem Research

[4] International Whaling Commission-Scientific Committee

[5] Commission for the Conservation of Antarctic Marine Living Resources-Working Group on Ecosystem Monitoring and Management

[6] North Atlantic Marine Mammal Commission-Scientific Committee

Areas III, IV, V and VI by one or two specialized vessels, over a tentative period of eight austral summer seasons.

The first to fourth JASS-A surveys were carried out in the 2019/20, 2020/21, 2021/22 and 2022/23 austral summer seasons, respectively, and covered the sector 000°–035°E of Antarctic Area III West and 145°W–120°W of Antarctic Area VI East.

The fifth JASS-A survey was carried out in the 2023/24 season and covered the sector 70°E–100°E of Antarctic Area IV. This paper presents a summary of the 2023/24 JASS-A survey results.

SURVEY DESIGN

Research area

The research area of JASS-A is comprised of IWC Management Areas III, IV, V and VI, south of 60°S (Figure 1). The research area in the 2023/24 season was a part of Antarctic Area IV (70°E–100°E), south of 60°S (Figure 1). The area was divided into northern and southern strata. The boundary between these strata was defined by a line 45 n.miles from the northern edge of the pack-ice (Figure 2). In addition, an area in the coastal ice-free waters south of 65°30'S, which was formed at the Davis Sea, an area of the sea along the coast between the West Ice Shelf and the Shackleton Ice Shelf (89°E–95°E). A polynya was formed in mid-January, which could be surveyed only in late in January when ice-free waters were formed. Details of the ice configuration are shown in Figure 3.

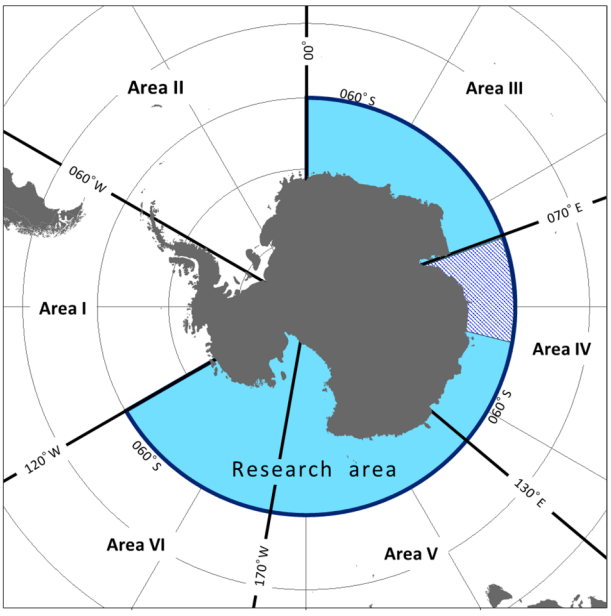

Figure 1. Research area of JASS-A. The shaded area (70°E–100°E) indicates the surveyed area in the 2023/24 austral summer season.

Research vessel

The dedicated sighting vessels *Yushin-Maru* No. 3 (*YS3*) and *Yushin-Maru* No. 2 (*YS2*) were engaged in the survey. The specifications for both vessels are the same and are shown in Figure 4. Eight researchers participated in the survey, five in *YS3* and three in *YS2*. They had experience in conducting line transect surveys, biopsy sampling, photo-identification (photo-ID), satellite tagging and oceanographic survey through the previous JARPA/JARPAII, NEWREP-A, previous JASS-A surveys or other research programs.

Sighting procedures and experiments

The procedures for sighting and experiments were the same as in previous JASS-A surveys. See Isoda *et al.* (2024) for details of the procedures used for sighting surveys and other research activities such as sighting distance and angle experiment, photo-ID, biopsy sampling, satellite tagging, oceanographic survey, marine debris observation, and survey using UAV.

RESULTS OF THE SURVEY

Narrative of the survey

Table 1 shows the itinerary of the survey. The duration of this cruise was 99 days. The *YS3* and *YS2* departed Japan on 8 December 2023. They arrived at the home port on 20 December. The *YS3* and *YS2* started the sighting survey in Antarctic Area IV at 62°57'S; 99°55'E on 7 January, and at 62°03'S; 100°00'E on 7 January 2024, respectively. The *YS3* and *YS2* completed the surveys at position 60°06'N; 84°45'E on 11 February and 62°40'S; 95°36'E on 11 February, respectively. The *YS3* and *YS2* arrived at the home port on 29 February, and finally in Japan on 15 March.

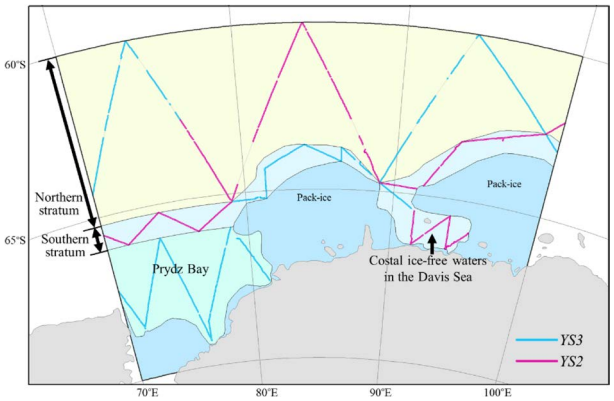

Figure 2. Research area (70°E–100°E) indicating northern, southern strata, Prydz Bay and the coastal ice-free waters searching efforts (blue and red lines for *Yushin-Maru* No. 3 (*YS3*) and *Yushin-Maru* No. 2 (*YS2*), respectively) of the JASS-A survey in the 2023/24 austral summer season.

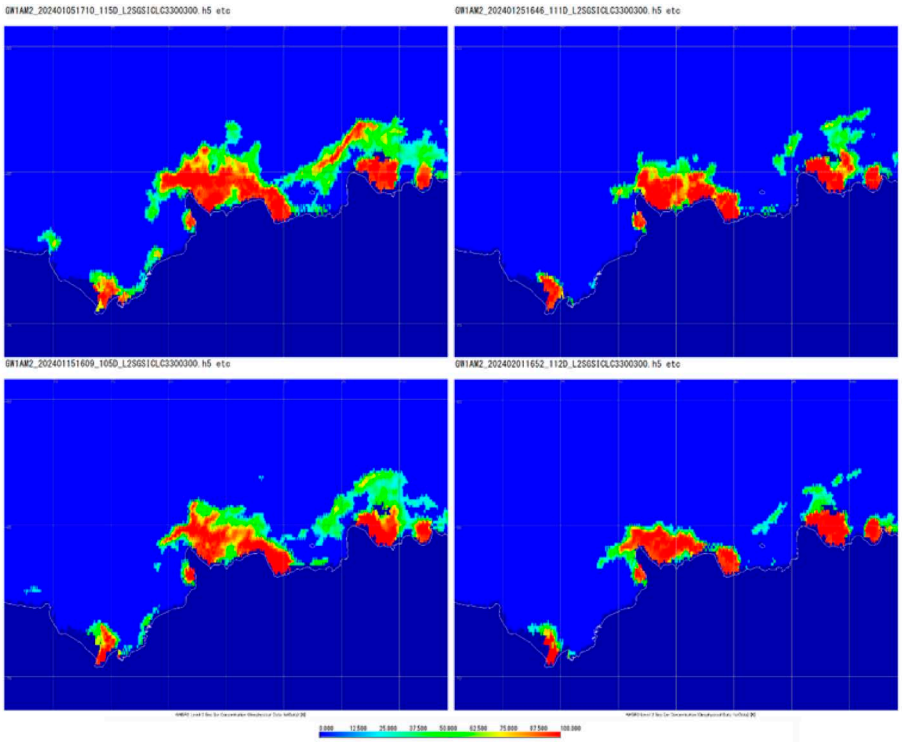

Figure 3. Maps of the pack-ice distributions in the research area for dates 5 January (upper left), 15 January (lower left), 25 January (upper right) and 1 February (lower right) 2024, constructed by Japan Aerospace Exploration Agency (JAXA), based on observational data acquired by the Advanced Microwave Scanning Radiometer 2 (AMSR2). Note that the ice-free waters became accessible to the vessel in late January.

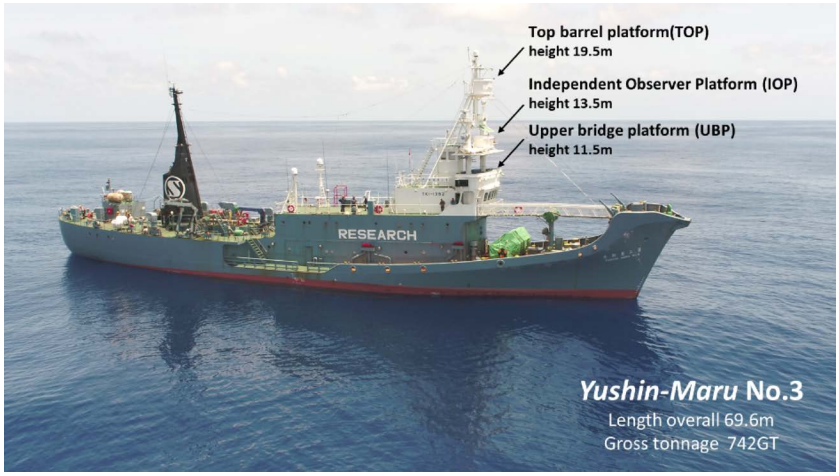

Figure 4. Specifications of the dedicated sighting vessel *Yushin-Maru* No. 3.

Research effort in the research area

Table 2 shows a summary of the searching effort spent during the survey. Both vessels, *YS3* and *YS2* were engaged in the research for 36 days. The total searching effort of both vessels was 3,278.3 n.miles (6,071.4 km); 1,595.0 n.miles in NSP mode during 149 hours 24 minutes of research and 1,683.3 n.miles in IO mode during 155 hours 11 minutes of research.

In the northern stratum, the total searching effort was 1,374.2 n.miles (NSP: 680.2 n.miles; IO: 694.0 n.miles), and the searching effort coverage was 74%. In the southern stratum, the total searching effort was 927.0 n.miles (NSP: 429.2 n.miles; IO: 497.8 n.miles), and the searching effort coverage was 93%. In Prydz Bay, the total searching effort was 682.3 n.miles (NSP: 332.5 n.miles; IO: 349.8 n.miles), and the searching effort coverage was 89%. In the coastal ice-free waters in the Davis Sea, the total searching effort was 294.7 n.miles (NSP: 152.9 n.miles; IO: 141.8 n.miles), and the searching effort coverage was 89%.

Therefore, a good distribution of effort within all strata

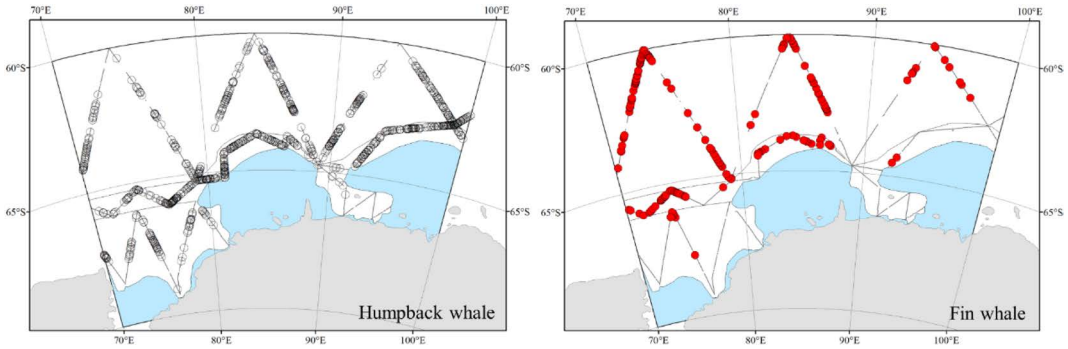

Figure 4a. Geographical distribution of primary sightings of humpback and fin whales during the 2023/24 JASS-A survey.

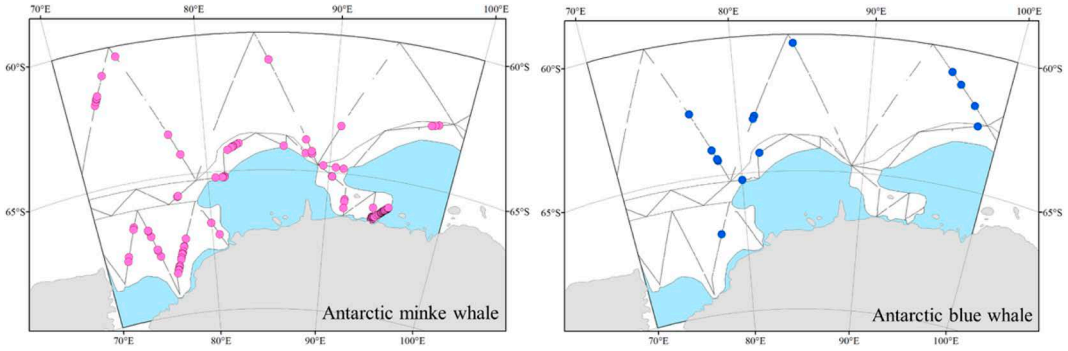

Figure 4b. Geographical distribution of primary sightings of Antarctic minke and Antarctic blue whales during the 2023/24 JASS-A survey.

Table 1
Itinerary of the 2023/24 JASS-A dedicated sighting survey.

Date (y/m/d)	Event
2023/11/13	Planning meeting held at Tokyo, Japan
2023/12/7	Pre-cruise meeting held at Shiogama, Japan
2023/12/8	*YS3* and *YS2* departed Shiogama, Japan
2023/12/10	*YS3* and *YS2* started transit surveys at 29°29'N; 139°23'E and at 29°15'N; 139°35'E, respectively
2023/12/20	*YS3* and *YS2* arrived in the home port (Surabaya, Indonesia)
2024/1/6	*YS3* and *YS2* finished transit surveys at 62°55'S; 99°49'E and at 61°00'N; 99°35'E, respectively
2024/1/7	*YS3* and *YS2* started surveys in the research area at 62°57'S; 99°55'E and at 62°03'S; 100°00'E, respectively
2024/2/11	*YS3* and *YS2* completed surveys in the research area at 60°06'S; 84°45'E and at 62°40'S; 95°36'E, respectively and started transit surveys
2024/2/29	*YS3 and YS2* arrived in the home port (Dili, East Timor)
2024/3/12	*YS3* and *YS2* finished transit surveys at 30°48'N; 131°48'E and at 32°13'N; 139°36'E, respectively
2024/3/15	*YS3* and *YS2* arrived in Japan and post cruise meeting at Setoda and Shiogama, Japan, respectively.

and survey mode was achieved. The total experimental time for photo-ID, biopsy sampling, tagging and distance and angle experiment was 37 hours 03 minutes.

Whale sightings in the research area

Four baleen whale species and at least two toothed whale species were identified in the research area. The dominant whale species sighted in the research area was the humpback whale (874 schools/1,706 individuals) followed by the fin whale (200/467). Sightings of other species were as follows; Antarctic minke (111/178), sperm (42/43), killer (19/263, including Type A, Type B, Type C and undetermined type) whales, Ziphiidae (19/26) and Antarctic blue whale (15/18) (Table 3).

Humpback whales

Humpback whale was distributed in all research areas excepting the south part of coastal ice-free waters in

Table 2

Summary of searching effort and time spent by *YS3* and *YS2* during the 2023/24 JASS-A survey.

Vessel: *YS3* Survey Sections	Date and time		Searching effort (distance [n.miles] and time [hours: minutes: seconds])				Experiments time	
	Start	End	NSP		IO		Photo-ID, Biopsy, Satellite tag experiment	Estimated angle and distance training/experiment
Transit survey (Japan–Entering foreign countries EEZ)	2023/12/10 7:25	2023/12/14 16:48	334.7	28:59:41	—	—	0:00:00	0:00:00
Transit survey (Leaving foreign countries EEZ–Research area)	2023/12/26 6:05	2024/1/6 18:00	820.8	71:14:03	—	—	3:17:13	0:00:00
Research area (Area IV 70°E–100°E)	2024/1/7 6:00	2024/1/16 8:43	195.2	18:11:38	220.1	20:11:36	2:54:46	2:11:54
Coastal ice-free waters in the Davis Sea	2024/1/16 9:15	2024/1/16 17:38	38.3	3:27:56	28.9	2:56:56	0:00:00	0:00:00
Transit in the research area	2024/1/16 17:39	2024/1/19 18:00	—	—	—	—	0:00:00	0:00:00
Research area (Area IV 70°E–100°E)	2024/1/20 6:00	2024/1/24 14:44	117.2	11:34:45	206.1	19:48:56	1:49:16	0:00:00
Transit in the research area	2024/1/24 14:45	2024/1/27 9:36	—	—	—	—	0:00:00	0:00:00
Prydz Bay	2024/1/27 9:37	2024/2/4 15:03	332.6	31:02:48	349.7	31:17:26	5:20:34	0:00:00
Transit in the research area	2024/2/4 15:04	2024/2/5 7:18	—	—	—	—	0:00:00	0:00:00
Research area (Area IV 70°E–100°E)	2024/2/5 7:19	2024/2/11 11:59	158.6	14:36:48	178.8	16:16:42	6:23:52	4:26:28
Transit survey (Research area–Entering foreign countries EEZ)	2024/2/11 12:00	2024/2/26 12:43	918.1	82:46:56	—	—	0:00:00	0:00:00
Transit survey (Leaving foreign countries EEZ–Japan)	2024/3/8 7:40	2024/3/12 17:15	214.6	18:26:34	—	—	0:00:00	0:00:00
Total			3,130.0	280:21:09	983.5	90:31:36	19:45:41	6:38:22

Vessel: *YS2* Survey Sections	Date and time		Searching effort (distance [n.miles] and time [hours: minutes: seconds])				Experiments time	
	Start	End	NSP		IO		Photo-ID, Biopsy, Satellite tag experiment	Estimated angle and distance training/experiment
Transit survey (Japan–Entering foreign countries EEZ)	2023/12/10 7:25	2023/12/14 17:00	289.1	24:40:52	—	—	0:00:00	0:00:00
Transit survey (Leaving foreign countries EEZ–Research area)	2023/12/26 6:05	2024/1/6 18:00	884.1	77:07:07	—	—	0:53:23	0:00:00
Research area (Area IV 70°E–100°E)	2024/1/7 6:00	2024/1/29 14:17	504.6	47:17:58	457.0	42:17:05	8:20:07	2:29:15
Transit in the research area	2024/1/29 14:18	2024/1/30 17:24	—	—	—	—	1:14:33	0:00:00
Research area (Area IV 70°E–100°E)	2024/1/30 17:25	2024/2/2 16:33	134.0	12:06:43	129.7	11:52:09	1:53:08	0:00:00
Transit in the research area	2024/2/2 16:34	2024/2/5 7:29	—	—	—	—	0:00:00	0:00:00
Coastal ice-free waters in the Davis Sea	2024/2/5 7:30	2024/2/11 11:59	114.5	11:05:39	113.0	10:31:00	0:00:00	0:00:00
Transit survey (Research Area–Entering foreign countries EEZ)	2024/2/11 12:00	2024/2/25 14:45	781.4	67:53:24	—	—	0:00:00	4:35:52
Transit survey (Leaving foreign countries EEZ–Japan)	2024/3/7 8:11	2024/3/12 16:45	225.2	18:37:47	—	—	0:00:00	0:00:00
Total			2,932.9	258:49:30	699.7	64:40:14	12:21:11	7:05:07

Table 3
Number of sightings made during the 2023/24 JASS-A survey in the research area, by stratum and species.

Species	Area IV (70°E–100°E)																Sub-total				Total	
	Southern stratum				Northern stratum				Prydz Bay				Costal ice-free waters in the Davis Sea									
	Prim.		Second.		Prim.		Second.		Prim.		Second.		Prim.		Second.		Prim.		Second.			
	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	3	4	0	0	11	13	0	0	1	1	0	0	0	0	0	0	15	18	0	0	15	18
Fin whale	58	127	0	0	129	314	6	10	7	16	0	0	0	0	0	0	194	457	6	10	200	467
Like fin whale	5	11	0	0	2	2	0	0	0	0	0	0	0	0	0	0	7	13	0	0	7	13
Antarctic minke whale	21	28	0	0	14	20	3	3	26	43	1	1	44	81	2	2	105	172	6	6	111	178
Like Antarctic minke whlae	2	2	0	0	0	0	0	0	2	2	1	1	0	0	1	1	4	4	2	2	6	6
Humpback whale	385	740	8	9	363	721	20	35	89	188	3	5	6	8	0	0	843	1,657	31	49	874	1,706
Like humpback whale	6	7	0	0	13	18	0	0	1	1	0	0	1	1	0	0	21	27	0	0	21	27
Baleen whales	3	3	1	1	9	9	1	2	0	0	0	0	0	0	0	0	12	12	2	3	14	15
Sperm whale	22	23	1	1	6	6	0	0	5	5	1	1	7	7	0	0	40	41	2	2	42	43
Southern bottlenose whale	8	18	1	1	2	3	1	2	0	0	0	0	0	0	0	0	10	21	2	3	12	24
Mesoplodon	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	1	3
Killer whale (Undetermined)	3	50	1	5	2	21	0	0	1	2	0	0	5	56	0	0	11	129	1	5	12	134
Killer whale (Type A)	1	17	0	0	0	0	0	0	2	11	0	0	0	0	0	0	3	28	0	0	3	28
Killer whale (Type B)	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	1	4
Killer whale (Type C)	0	0	0	0	0	0	0	0	3	97	0	0	0	0	0	0	3	97	0	0	3	97
Ziphiidae	6	10	0	0	11	14	1	1	0	0	0	0	1	1	0	0	18	25	1	1	19	26
Unidentified whales	5	5	0	0	11	14	0	0	2	3	0	0	3	3	0	0	21	25	0	0	21	25

Prim.: primary sighting, Second.: secondary sighting, Sch.: schools, Ind.: indivisuals

the Davis Sea (Figure 4a). According to previous surveys (Kasamatsu *et al.*, 1989; Ensor *et al.*, 1999; Matsuoka *et al.*, 2015), humpback whales were mainly distributed in the northern stratum in late 1990's and were distributed in the entire research area after 2010's, especially in the southern stratum and Prydz Bay. In Areas IV, both estimates of annual rate of increase of humpback whales, 13.6% (95% CI=8.4–18.7%), and estimates of abundance for humpback whales may suggest that are close to the carrying capacity of the population (Hakamada and Matsuoka, 2014). The study of spatial distribution in this area suggested humpback whales expanded their habitat closer to the shelf break (800 m isobath), where Antarctic minke whales are mainly distributed, as their abundance rebounded and humpback whales were rarely distributed on the shelf (Murase *et al.*, 2014). Our results indicate that the habitat of humpback whales extended further south of this area, encompassing Prydz Bay.

Fin whales

Fin whale was mainly distributed in the northern and southern strata (Figure 4a). The compared density between previous surveys (Kasamatsu *et al.*, 1989; Ensor *et al.*, 1999; Matsuoka *et al.*, 2015) and the present survey showed that there was not only a clear and rapid increase in the northern stratum but also in the southern stratum and Prydz Bay in later seasons. The increase in the density of this species in the survey area is thought to reflect its population recovery, as it has recently expanded its distribution area to the whole research area.

Antarctic minke whales

Antarctic minke whale was mainly distributed in the southern part of the research area (Figure 4b) with higher concentrations observed in the southernmost part of coastal ice-free waters in the Davis Sea. In particular, the high-density distribution observed in the coastal ice-free waters in the Davis Sea could be indicative that remarkable changes in the main distribution have occurred. It is thought that is caused by the geographical expansion of fin and humpback whales as mentioned above, which was confirmed in this survey. This result is similar with the interpretation of Fujise and Pastene (2021) that a large proportion of Antarctic minke whale population could have been moving into in polynias within sea ice fields in recent years, reflecting perhaps a response of this species to the geographical expansion of humpback and fin whales to the south.

The spatial distributions of Antarctic minke, humpback and fin whales in this survey showed remarkable changes regarding previous surveys. The current hypothesis of cascading distribution effects borrows from the inter-

ference prediction of competition among these whale species. In this way humpback whales may be expanding their range southward due to the recovery of the fin whale population, and the expansion of fin whales' distribution range, as well as reaching their own carrying capacity, may lead to further localization of Antarctic minke whales' distribution range.

Antarctic blue whales
Antarctic blue whale was sighted in the northern, southern stratum and Prydz Bay (Figure 4b), however it was mainly distributed in the northern stratum. The density of the present survey was higher than the density of previous surveys, suggesting that the Antarctic blue whale population recovery has continued in recent years.

Duplicate sightings
Duplicates sightings were those sightings made concurrently by both the IOP and TOP barrel observers during the IO mode survey. These data will be used to estimate $g(0)$, which in turn will be used to adjust estimates of abundance. There was a total of 148 duplicates involving several whale species.

Other research activities
Table 4 shows a summary of results of different experiments.

Sighting distance and angle experiment
The sighting distance and angle experiment was conducted in order to evaluate the accuracy of sighting distance and angle provided by primary observers. The results of this experiment will be used for the calculation of abundance estimates. The actual experiments were successfully completed on 6 February for 128 trials in *YS3*, and on 17 February for 144 trials in *YS2*.

Photo-ID
Photo-ID data is used for individual matching exercise to investigate distribution and movement of large whales. A total of 16 Antarctic blue, 94 humpback, 5 southern right and 84 killer whales were successfully photo-identified during the entire survey. These data will be registered into the Institute of Cetacean Research (ICR) database (see Matsuoka and Pastene, 2014).

Biopsy sampling for whales
Biopsy samples are used for genetic studies on stock structure of large whales and for other feasibility studies related to the specific objectives of the JASS-A. For the entire survey, a total of 54 biopsy samples were collected from 8 Antarctic blue, 9 fin, 3 Antarctic minke, 24 humpback, 3 sei, 4 southern right and 3 killer whales, using the Larsen system (Larsen, 1998). Biopsy samples were stored at −20°C.

Satellite tagging
Satellite tagging is used for the study of movement, distribution and stock structure of whales. The satellite-monitored tags (SPOT and SPLASH-types, Wildlife Computers, Redmond, Washington, USA) were deployed with the Air Rocket Transmitter System (ARTS) (LK-ARTS, Skutvik, Norway). The detail of deployment system, protocols and research results to date were described in Konishi *et al.* (2020). During the whole survey, 6 fin, 2 Antarctic minke and 3 humpback whales were tagged.

Oceanographic survey
Oceanographic observations are important to understand the relationship of whales and the physical environment. 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 profiler, Tsurumi-Seiki Co., Ltd., Yokohama, Japan; probe type: XCTD-4N) with Digital Converter MK-150N (*YS3*) and MK-150P (*YS2*) at 148 stations (Figure 5).

Marine debris observation
Studies on marine debris in the Antarctic are very scarce. It is important to continue with this kind of survey in order to monitor future trends in the occurrence of marine debris. One fishing buoy was observed in the research area. These data will be registered into the ICR database and reported in the future (e.g. Isoda *et al.*, 2021).

Feasibility study on the utility of UAV
The VTOL-UAV ASUKA conducted a successful autonomous flight of a total distance of 297.5 n.miles (551 km) and collected aerial images related to whale sighting surveys and basic data on improving UAV ASUKA's performance for long-distance autonomous flights in the polar region.

Sighting survey in low-middle latitude area
Sighting surveys in low-mid latitude areas have the potential to collect data on seasonal movement and possible breeding grounds of whale species. JASS-A has been collecting information on cetaceans by conducting sighting surveys in the low-middle latitude area using the opportunity of a round-trip cruise to the Antarctic, excluding waters of foreign countries EEZs.

Table 4
Summary of the results of experiments conducted during the 2023/24 JASS-A survey.

Experiments	Results and descriptions
Sighting distance and angle experiment	272 trials completed
Photo-ID	Obtained from 16 Antarctic blue, 94 humpback, 5 southern right and 84 killer whales
Biopsy sampling	Collected from 8 Antarctic blue, 9 fin, 3 Antarctic minke, 24 humpback, 3 Sei, 4 southern right and 3 killer whales
Satellite tagging	Deployed on 6 fin, 2 Antarctic minke and 3 humpback whales
Oceanographic survey	148 XCTD casts
Marine debris observation	1 fishing buoy was observed in the research area
UAV autonomous flight and collected aerial images	297.5 n.miles flew with 13 autonomous flights

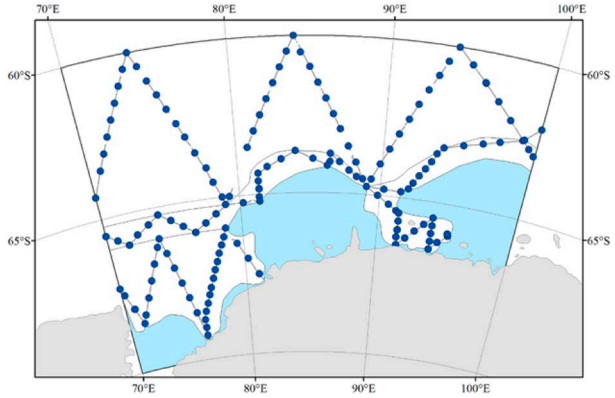

Figure 5. Oceanographic stations (XCTD casting points) at the 2023/24 JASS-A survey.

In transit from homeport in Japan to boundary of the foreign countries EEZ, sighting survey was conducted by both vessels from 10 to 14 December (Table 2). The total searching effort of both vessels was 623.8 n.miles (Table 2) and sperm whale (16/31) were sighted.

In transit from the boundary of the foreign countries EEZ to the starting position in the Antarctic research area, sighting survey was conducted by both vessels from 26 December to 6 January (Table 2). The total searching effort of both vessels was 1,704.9 n.miles (Table 2). Total sightings included blue (1/1), fin (1/1), Antarctic minke (1/1), humpback (2/3), southern right (4/5), sei (14/24), sperm (1/1), Ziphiidae (2/6) and *Mesoplodon* (2/9) whales. Biopsy sample was collected from 4 southern right and 3 sei whales.

In transit from the ending position in the Antarctic research area to the boundary of the foreign countries EEZ, sighting survey was conducted by *YS3* from 11 to 26 February and *YS2* from 11 to 25 February (Table 2). The searching effort was 1,699.5 n.miles (Table 2) and the total sightings included fin (1/1), sperm (14/24), killer (3/10), Ziphiidae (4/8) and *Mesoplodon* (6/16) whales.

In transit from the foreign countries EEZ to homeport in Japan, sighting survey was conducted by *YS3* from 8 to 12 March and *YS2* from 7 to 12 March (Table 2). The total searching effort of both vessels was 439.8 n.miles and the total sightings included Bryde's (2/2) and killer (1/3) whales.

A total of experimental time in transit survey for photo-ID, biopsy sampling, satellite tagging and estimated angle and distance experiment was 8 hour 46 minutes (Table 2).

HIGHLIGHTS OF THE SURVEY

The 2023/24 JASS-A survey covered a portion of Area IV (70°E–100°E) and was successful in collecting sighting data required for cetacean abundance estimation of in this area. The survey conducted in Prydz Bay and the coastal ice-free waters in the Davis Sea, in addition to the northern and southern strata, was of particular importance in understanding the current distribution of large baleen whales. Several other data necessary for understanding stock structure, movement and the environment of whales were collected during the survey. The data collected through the JASS-A will be analysed in conjunction with the data collected by the previous JARPA/JARPA, NEWREP-A and IDCR/SOWER surveys in the same region so that the analyses can be based on a long and consistent data set, enabling a thorough and unique understanding of long-term population dynamics.

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Appendix 1.

Photographs from the 2023/24 JASS-A survey in Antarctic Area IV

Photo 1. Antarctic blue whale.

Photo 2. Antarctic blue whale mother and calf (calf on far side).

Photo 3. Fin whale blow.

Photo 4. Antarctic minke whales.

Photo 5. Breaching humpback whale.

Photo 6. Diving humpback whale.

Photo 7. Southern right whale sighted during the low-middle latitude area survey.

Photo 8. Killer whales (type A).

Photo 9. VTOL-UAV ASUKA taking off from onboard.

Photo 10. Photo shooting humpback whales for individual identification.

Photo 11. Sighting survey in the iceberg belt.

Photo 12. Biopsy specimen of a humpback whale.