SC/68D/ASI/04

Sub-committees/working group name: ASI

Outline of the research plan for the 2022/2023 JASS-A survey in Area VIE

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ABSTRACT

This paper outlines the objectives and survey procedures of the 2022/2023 sighting survey under the Japanese Abundance and Stock structure Surveys in the Antarctic (JASS-A program). This program started in the 2019/2020 austral summer season. The main research objectives of JASS-A are 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 oceanographic, marine debris and whale biology. The research program is based on systematic sighting surveys utilizing the Line Transect Method, and is conducted alternatively in IWC Areas III, IV, V and VI by one or two specialized vessels, during a tentative period of eight austral summer seasons. The objective of this paper is to outline the objectives, survey procedures and schedule of the 2022/2023 JASS-A survey in Area VIE (145°W-130°W) of the South-Pacific region of the Antarctic.

INTRODUCTION

In the austral summer season 2021/2022 Japan carried out the third survey under the new research program called Japanese Abundance and Stock-structure Surveys in the Antarctic (JASS-A). The main research objectives of JASS-A are 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 oceanographic, marine debris and whale biology. The field work of JASS-A consists basically of dedicated sighting surveys and other non-lethal techniques to investigate primarily abundance, abundance trends and stock structure of large whales (the main objectives of the JASS-A).

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

The research plan of the JASS-A was submitted to the IWC SC meeting in 2019 (Government of Japan, 2019a) as well to the 2019 CCAMLR-EM workshop (GOJ, 2019b) and to the NAMMCO-SC meeting (GOJ, 2019c). The previous three sighting surveys under the JASS-A were successfully conducted in the Antarctic Area III-West (0°E-35°E) and eastern part of Area VI-East (130°W-120°W) during the 2019/2020 and 2021/2022 austral summer seasons (Isoda *et al.*, 2020; 2021; 2022).

The objective of this paper is to outline the objectives, methodology and research schedule of the 2022/2023 JASS-A in a part of Area VIE (145°W–130°W), in the South-Pacific region of the Antarctic.

RESEARCH OBJECTIVES AND RELEVANCE

The research objectives, general methodology and schedule of JASS-A were explained in details in GOJ (2019a). The research objectives and relevance under which the 2022/2023 survey will be conducted are repeated here.

Main Objectives

MO1: 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 are 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: 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.

Overall JASS-A, in conjunction with the work already done under the previous research programs, will provide information to allow the determination of the status of the stocks of large whales that are found in waters of the Indo-Pacific region of the Antarctic in summer, and provide the necessary scientific background for future sustainable utilization.

Secondary Objectives
The secondary objectives of JASS-A are:

SO1: Investigation of the oceanographic conditions in the Indo-Pacific region of the Antarctic.

Oceanographic structure and dynamics are important information to interpret changes in the Antarctic ecosystem. Changes in oceanographic conditions will affect distribution and krill biomass and in turn the abundance and distribution of whales. Changes in oceanographic conditions might indicate an effect of climate changes.

SO2: To investigate the spatial and temporal trend of marine debris on sea surface.

Studies on marine debris in the Antarctic are very scarce with only a few records made in sub-Antarctic and Antarctic islands and a single systematic survey in the Antarctic waters. It is important to continue with this kind of survey to monitor the future trends in the occurrence of marine debris.

SO3: To conduct feasibility studies to evaluate the utility of genetics data to estimate abundance.

Systematic sighting surveys utilizing the Line Transect Method is the most used method to estimate abundance of whales. Basic line-transect surveys however, are not always appropriate, especially for rare species/populations. Also in the case of the Antarctic it is not possible to utilize line-transect methodology for areas inside the pack-ice e.g. polynias where whales are also distributed. Genetic-based methods can assist in the abundance estimates in such cases.

SO4: To continue with feasibility studies to evaluate the utility of non-lethal techniques for whale biological research.

During the NEWREP-A several studies were carried out to investigate the feasibility of novel non-lethal approaches to address some of the main objective of the NEWREP-A on Antarctic minke whale e.g. progesterone analysis in blubber to investigate reproductive status (Inoue *et al*., 2019), and stable isotopes for investigation whale's prey items. There is the need to continue with the investigation on the utility of such techniques in large whales.

SO5: Feasibility study on the utility of Unmanned Aerial Vehicle (UAV) for obtaining information relevant for abundance estimate of large whales.

RESEARCH PLAN FOR THE 2022/2023 SURVEY

Research area
A part of the IWC Management Area VIE (145°W-130°W) (Figure 1).

Research period and schedule
The duration of the survey including transit is planned to be 99 days. The home port will be an appropriate locality in the South Pacific. The number of days dedicated to research in Antarctic waters is planned to be 28

days. The low and middle latitudinal sighting surveys between 0°S-60°S is also planned during a round-trip transit to the Antarctic Ocean (except foreign EEZ). The tentative schedule of the survey is as follows:

Tentative survey schedule for the 2022/2023 JASS-A survey.

Date	*Yushin-Maru No.2 (YS2) and Yushin-Maru No.3 (YS3)*
04-Dec-2022	Pre-cruise meeting
05-Dec-2022	Vessels depart Shiogama and Shimonoseki
22-Dec-2022	Vessels arrive at the home port
24-Dec-2022	Pre-cruise meeting
25-Dec-2022	Vessels depart the home port
10-Jan-2023	Vessels start survey in the research area
06-Feb-2023	Vessels completes survey in the research area
22-Feb-2023	Vessels arrive at the home port
24-Feb-2023	Post-cruise meeting
25-Feb-2023	Vessels leaves the home port
13-Mar-2023	Vessels arrives in Shiogama, and Setoda, Japan

Research vessel
Two vessels will be used for this survey, the *Yushin-Maru No. 2* (*YS2*) and *Yushin-Maru No. 3* (*YS3*) (Table 1 and Figure 2). These vessels are equipped with top barrel (TOP), independent observer platform (IOP) and upper bridge platform (UBP). The vessel will be also equipped with instruments required for the oceanographic survey.

Researchers on board
A maximum of 4 experienced researchers will be on board of each vessel to conduct sightings, photo-id, biopsy, satellite tagging experiments, oceanographic survey and the feasibility aerial survey using the UAV.

Sighting survey

Guidelines for sighting survey
The plan outlined here follows the 'Requirements and Guidelines for Conducting Surveys and Analysing Data within the Revised Management Scheme (RMS)' (IWC, 2012).

Stratification of the research area
Area VIE will be divided into southern and northern strata. The boundary between southern and northern strata is defined by a line 45n.miles from the ice-edge (Figure 3).

Track line design
Basically, the survey track line for the vessel will consist of two legs in the northern stratum at 5° longitudinal degree intervals and four legs in the southern stratum at 2°30' longitudinal degree intervals in a 10 degrees longitudinal band following Nishiwaki *et al*. (2014). Usually, the vessel alternately surveys the northern and southern strata each crossing the track line at the way-point between two strata (Figure 4).

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. The proposed track lines (given an assumed ice edge) and strata are shown in Figure 4. Note that these tracks are based on 'guess estimated' of ice conditions in an unpredictable area. Considerable flexibility may be needed by the Cruise Leader in determining the final cruise tracks.

Research hours, acceptable weather conditions and number of observers on effort
Research hours will be consistent with those in previous IWC/SOWER surveys. Research will start 60 minutes after sunrise and will end 60 minutes before sunset, with a maximum 12-hour research day (approximately 06:00–19:00). Time-zone changes will be recorded in 30-minute intervals, effective from 01:00h. Schedules will adhere to local 'ship' time ranging between +9.0 and +15.0 GMT. Data collected throughout the survey and all associated reporting will be in accord with the local 'ship' time. The searching activity will be conducted when the weather conditions are suitable for observations: visibility (minke whale visibility) better than 1.5n. miles and the wind speed less than 21 knots in the northern stratum and less than 26 knots in southern stratum.

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

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

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

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

IO data will be obtained on both Antarctic minke and other large whale species.

Number of primary observers
For consistency, the number of primary observers will be the same as in previous IWC/IDCR-SOWER and NEWREP-A surveys:

TOP: Two topmen (primary observer) observe from the TOP barrel at all times using reticules binoculars with the angle board, regardless of the research mode is conducted.

IOP: One topman (primary observer) will be in the IOP barrel whenever full searching effort using reticules binoculars with the angle board is conducted during the IO mode.

UBP: Captain and helmsman (primary observers) will be at the upper bridge using binoculars with reticules, regardless of the research mode. Also present on the upper bridge, whenever the sighting survey is conducted, will normally be the chief engineer (or an alternate). There will be four researchers on the vessel.

During the survey, the number of researchers searching from the upper bridge should be standardised.

Identification of species
Guidelines for species identification will be 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 judgment 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 will be used in determining group size:

'Schools where the number of animals, or an accurate estimated range of the number of animals, is determined are classified as confirmed schools. The data from the confirmed schools are used in the analysis to determine a mean school size. Therefore it is critical that the schools that are confirmed are representative in size of the schools that are in the survey area. Normally, schools believed to be confirmed for school size are approached to within 1n.mile for large whales and to within 0.3 n.miles for minke whales. Obviously, there are differences in the environmental conditions and behaviour of the animals for every sighting, however, (with particular reference to minke whale sightings) every effort should be made to be as consistent as possible in regard to the maximum time spent on identification of species and confirmation of numbers. Normally, if the sighting is thought to be minke whales, no more than 20 minutes (after closure has been completed) should be spent trying to complete these tasks. (Otherwise there is the potential for confusion with other sightings in the vicinity).' (IWC, 2008).

Other field research activities

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

Photo-id
Photo-identification and biopsy sampling experiments will be carried out on an opportunistic basis based on the same protocols and equipment used during NEWREP-A and previous JASS-A surveys. Target species will be the blue, humpback, southern right and killer whales. High priority species are the first three.

Biopsy
Biopsy sampling experiments will be carried out on an opportunistic basis based on the same protocols and equipment used during NEWREP-A and previous JASS-A surveys. Target species will be the blue, fin, southern right and humpback whales. High priority species are the first three. Details of the protocols will be discussed at the pre-cruise meeting.

Satellite tagging
Telemetry experiments will be conducted following the same protocols and equipment used during the NEWREP-A and previous JASS-A surveys (Konishi *et al*., 2020). The target species for this experiment will be the Antarctic minke, fin and blue whales. High priority species are the first two. To investigate the breeding areas of thiese species in the low latitudes, tagging will be 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 study of data logger tagging experiments will be conducted to obtain information on dive time of large whales using the satellite-linked TDR tags (SPLASH 333, Wildlife computers, WA, USA etc). The target species for this experiment will be the Antarctic minke and fin whales. The data of mean dive-time and diving behaviour of the animal are a key parameter for abundance estimate considering availability bias.

Oceanographic survey
Oceanographic surveys will be conducted following the same protocols and equipment used during the NEWREP-A and previous JASS-A surveys. Observation would be conducted at least at one station per day on the track line using eXpendable Conductivity, Temperature and Depth (prove type: XCTD-4N).

Marine debris observation
During the research time, marine debris on the sea surface will be recorded during the normal sighting surveys. Date of the observation, geographical location (longitude and latitude) of the observation and type of debris will be recorded.

Feasibility study on the utility of Unmanned Aerial Vehicle (UAV)
A preliminary aerial survey using the UAV "ASUKA" (Matsuoka and Yoshida, 2021) will be conducted. In addition, aerial images of whale will be collected using the DJI phantom 4 Pro and the Inspire pro 2 with GLONASS/GPS satellite positioning systems. The ASUKA will be operated within line-of-sight by a pilot and/or a person for supporting navigation. These images will be used for photogrammetry studies of whales.

Data and reports

Data format
The survey will be conducted using the same data forms as on the NEWREP-A and previous JASS-A surveys (Matsuoka *et al*., 2016).

Data entry system
Researchers will input the data collected on weather, effort, sighting and experiments 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 NEWREP-A and previous JASS-A surveys. The data will be validated and stored at the Institute of Cetacean Research (ICR).

Cruise report
A cruise report will be prepared once the survey is completed, which will include a narrative of the survey, an evaluation on whether the survey was conducted under the original guidelines, and a list of the samples and data collected during the survey.

Others

Identification of home port organiser
It will be the responsibility of the Japanese scientists to identify a port organizer in the home port.

Necessary permits
All research activities conducted in the Antarctic and high sea international waters planned here will be authorized under research permit by the Fisheries Agency of Japan. The CITES permits will also be required to ship the all biopsy samples to ICR from the high sea.

Meetings
Arrangements for pre- and post-cruise meetings will be the responsibility of Japanese scientists.

Opportunity for research collaboration
Scientists from ICR will play the leading role in order to pursue the research activities (field and analytical) and achieve the research objectives of JASS-A, in collaboration with scientists from other domestic research organizations such as Fisheries Research Institute of the Japan Fisheries Research and Education Agency , and the Tokyo University of Marine Science and Technology.

Foreign scientists are welcomed to collaborate in the JASS-A program both in field and analytical activities, following the established ICR protocols for research collaboration. Interested persons should contact the first author of this report (matsuoka@cetacean.jp).

ACKNOWLEDGEMENTS

We acknowledge the Governments of Japan (Fisheries Agency of Japan) for their assistance in the research permit and funding for this cruise. We also acknowledge the support of the JASS-A steering group for the preparation of this survey.

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Table 1. Specifications of the vessels to be engaged in the 2022/23 season dedicated sighting survey under the JASS-A.

	Yushin-Maru No.2	*Yushin-Maru No.3*
Call sign	JPPV	7JCH
Length overall [m]	69.61	69.61
Molded breadth [m]	10.8	10.8
Gross tonnage [GT]	747	742
Top barrel height [m]	19.5	19.5
IO platform height [m]	13.5	13.5
Upper bridge height [m]	11.5	11.5
Bow height [m]	6.5	6.5
Engine power [PS/kW]	5,280/3,900	5,280/3,900

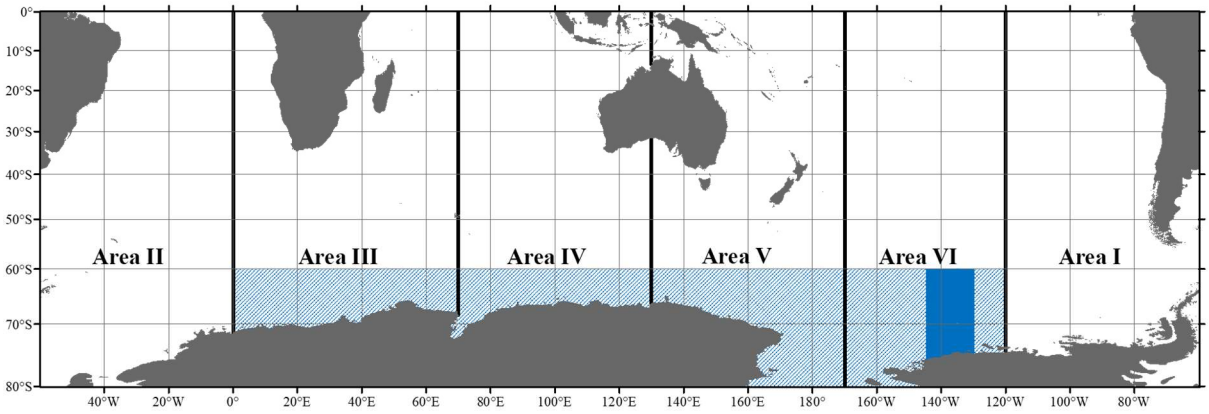

Figure 1. The research area in the Antarctic Area VIE (145°W-130°W) of the 2022/2023 JASS-A survey.

Figure 2. Research vessels to be used in the 2022/23 JASS-A dedicated sighting survey: *Yushin-Maru No. 2* (left) and *Yushin-Maru No. 3* (right).

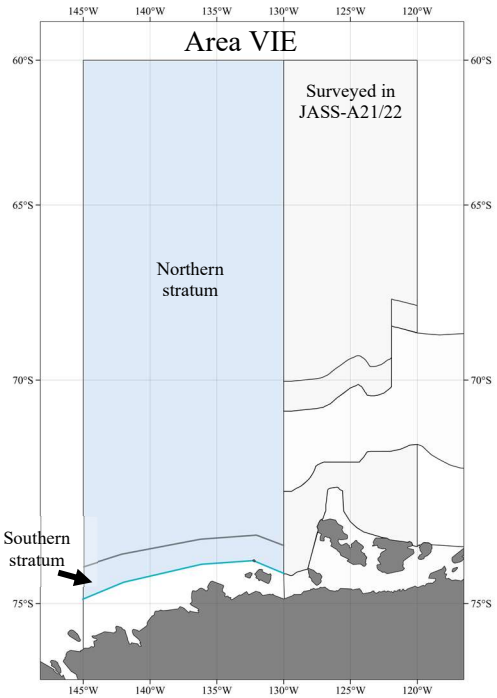

Figure 3. Sectors and strata to be covered by the dedicated sighting survey in Area VIE in the 2022/2023 JASS-A survey. The blue area indicates the 2022/2023 research area and the blue line indicates assumed ice edge line.

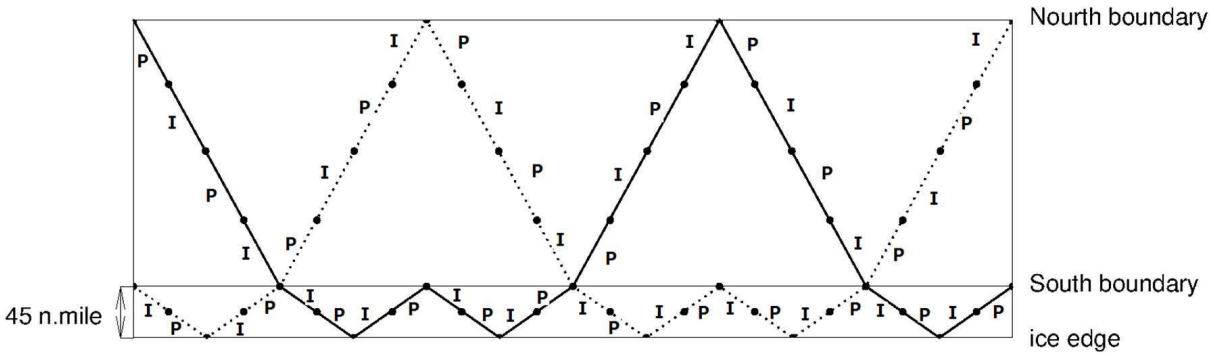

Figure 4. Basic design for pre-determined cruise track lines in the Antarctic using two vessels. Track lines are decided based on the original longitudinal line, which is selected at random. The interval of legs and number of legs in each stratum could be changed in consideration of delay caused by bad weather conditions and other factors. 'I' indicates that the survey will be conducted under IO mode and 'P' indicates that the survey will be conducted in NSP mode (passing mode with abeam closing mode). Considerable flexibility may be needed by the Cruise Leader in determining the final cruise tracks.