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Research plan for Japan's dedicated cetacean sighting surveys in the North Pacific Ocean in summer 2021

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ABSTRACT

This document outlines the plan for a systematic vessel-based sighting survey in the North Pacific in 2021. The main objective of this survey is to estimate the abundance of large whale species in the North Pacific Ocean for appropriate management and conservation of stocks. The survey will be conducted using the research vessels *Yushin-maru No. 1 (YS1)* and *Kaiyo-maru No. 7 (KY7)* in August-September 2021, and will cover the area comprised between 30°-53°N, 150°E-155°W. For more precise abundance estimation of whales, distance and angle estimation experiments will be conducted. Furthermore, photo-identification experiments on blue, North Pacific right, humpback and killer whales will be collected on an opportunistic basis. Biopsy skin samples of large whale species such as blue, fin, sei, North Pacific right, humpback and killer whales and satellite tagging experiments for fin, sei and common minke whales will be also conducted.

KEYWORDS: LARGE WHALES, SIGHTING SURVEY, NORTH PACIFIC

INTRODUCTION

In the western North Pacific dedicated cetacean sighting surveys have been conducted by the Institute of Cetacean Research (ICR) since 1997. The sighting surveys were based on the survey procedures of the International Whaling Commission/Southern Ocean Whale and Ecosystem Research (IWC/SOWER) and more recently the IWC/Pacific Ocean Whale and Ecosystem Research (IWC/POWER). Based on the collected data, the distribution pattern of large whales such as blue, fin, sei, Bryde's, common minke, humpback, right and sperm whales and abundance estimate of those whale species were investigated and reported to the IWC SC (IWC, 2001; 2010; 2016; Hakamada *et al.*, 2017; 2019). The National Research Institute of Fisheries Resources Institute (NRIFRI) has also conducted dedicated sighting survey for cetaceans in the North Pacific since the 1980s (Buckland *et al.*, 1992; Miyashita and Kato, 2004; 2005).

Sighting surveys were conducted under the New Scientific Whale Research Program in the western North Pacific (NEWREP-NP) in 2018 and 2019 (Government of Japan, 2017; IWC, 2017).

As in the previous sighting surveys during 2018-2020, the surveys in 2021 are planned considering the following aspects:

- a) The use of the independent observer (IO) mode survey to estimate $g(0)$,
- b) The setting of the appropriate survey track order to avoid double-counting,
- c) The setting of temporal stratification based on information on the migration pattern of each target species/population.

As in previous surveys, the design, protocols, and implementation of the 2021 surveys will follow the 'Requirements and Guidelines for Conducting Surveys and Analyzing Data within the Revised Management Scheme (RMS)' (IWC, 2012). Data collected in this survey will be used for abundance estimates, which is essential for appropriate conservation and management of large whales in the North Pacific.

The objective of this paper is to outline the research plan for dedicated sighting surveys in the North Pacific in summer 2021.

OUTLINE OF THE 2021 RESEARCH PLAN

Research vessels

The sighting surveys will be based on the research vessels *Yushin-maru No. 1 (YS1)* and *Kaiyo-maru No. 7 (KY7)* (Figure 1). These vessels are equipped with a top barrel platform (TOP), independent observer platform

(IOP) and upper bridge. The ICR research data collecting system is set on the vessels. Specifications of the vessels are shown in Table 1.

Research schedule

The sighting surveys will be conducted from August to September. The tentative survey itineraries for *YSI* and *KY7* are shown in Tables 2A and 2B, respectively. The planned numbers of research days are 45 and 35 days for *YSI* and *KY7*, respectively.

Researchers on board and oversight person

Experienced researchers on line transect whale sighting surveys, biopsy sampling, photo-id and satellite tag experiments will be selected in each vessel. Koji Matsuoka (ICR) will be the responsible person for these surveys.

Research area and track line design

The research area will be comprised between 30°-53°N and 150°E-155°W, avoiding foreign countries waters (Figure 2). Hereafter, light blue and green areas in Figure 2 are referred as pelagic block and offshore block, respectively.

Table 3 shows the waypoints (WP) in the research area. The *YSI* will start the survey at WP101 and will end at WP108 in the pelagic block. The *KY7* will start the survey at WP201 and will end at WP209 in the offshore block. All vessels will survey in ascending order of WP number.

The planned searching distances in each vessel are 2,662.8 n.miles (*YSI*) and 2,628.2 n.miles (*KY7*) in the research area, respectively. The start points of the track lines will be decided at random using the Distance program ver. 7.0 (Thomas *et al.*, 2010), and the number of lines (width in the longitude) is decided by the research schedule following IWC survey guideline (IWC, 2012).

Survey modes

Sighting activities 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 (two primary observers and four secondary observers will be always present).

The sighting survey will be conducted using (1) Passing with abeam closing mode (NSP) and (2) Passing with Independent Observer mode (IO) 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. 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 hours-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 two primary observers on the IOP. These observers on TOP and IOP platforms 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 hours-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.

Experiments

Distance and angle experiment

Distance and angle measurement experiment consists of the following two steps. Distance and angle measurement training will be conducted at the first stage of the survey. The experiment to evaluate

measurement error will be conducted at the last stage of the survey. Observers on each vessel will be 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 acceptable weather and sighting conditions.

Photo-id

Photo-identification experiments will be carried out on an opportunistic basis. Protocols for photo-id are similar to those used in the IWC-POWER surveys. Target species will be the blue North Pacific right, humpback and killer whales. The first three species have high priority.

Biopsy

Biopsy sampling experiments will be carried out large whale species such as blue, fin, sei, North Pacific right, humpback and killer whales on an opportunistic basis using Larsen system for investigating stock structure. The first four species have high priority. Protocols for biopsy sampling are similar to those used in the IWC-POWER surveys.

Satellite tagging

Routine telemetry experiments will be conducted following the same protocols and equipment used during the JASS-A surveys (see also Konishi *et al.*, 2020) to examine movement of these species for ecological and genetic studies. The target species for this experiment will be fin, sei and common minke whales.

Data logger tagging

The feasibility study of data logger tagging experiments will be conducted in order to obtain information on dive time of large whales using the satellite-linked Time-depth-Recorder (TDR) tags. The target species for this experiment will be the fin, sei and common minke whales. The data of mean dive-time and diving behaviour of the animal are key results for abundance estimate considering availability bias.

DATA STORAGE

The researcher will input data collected (weather, effort, sighting and from experiments data) to the computer on board during the survey as was done for the previous surveys conducted by ICR (e.g. IWC-SOWER, JARPAII/JARPNII). These data will be stored at the ICR and provided to the IWC secretariat by Japan as an observer nation.

Scientists at the ICR will analyze the sighting data collected using the methods developed and modified by previous studies such as a design-based abundance estimation using line transect data assuming $g(0)=1$, if possible, abundance estimation considering $g(0)$ estimate and model-based abundance estimation (e.g., Hakamada *et al.*, 2009; Matsuoka *et al.*, 2011; Okamura and Kitakado, 2004; Murase *et al.*, 2016). Collaboration work with NRIFRI will be conducted for abundance estimation of cetaceans in the surveyed area.

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Table 1. Specification of the research vessels participating in the 2021 sighting surveys.

	<i>Yushin-Mar</i> No. 1	<i>Kaiyo-Mar</i> No. 7
Call sign	JLZS	JECL
Length overall [m]	69.61	60.02
Molded breadth [m]	10.4	10.6
Gross tonnage [GT]	724	649
Top barrel height [m]	19.5	17.5
IO platform height [m]	13.5	12.7
Upper bridge height [m]	11.5	9.6
Bow height [m]	6.5	4.5
Engine power [PS/kW]	5,280/3,900	2,100/1,544

Table 2A. Tentative itinerary of the *YSI* in the 2021 sighting survey.

Date	Event
4-Aug	<i>YSI</i> depart Shimonoseki, Japan
11-August	<i>YSI</i> arrive at the starting point in the research area (eastern side)
24-September	<i>YSI</i> complete the research area and move to Shiogama
30-September	<i>YSI</i> arrive Shiogama, Japan

Table 2B. Tentative itinerary of the *KY7* in the 2021 sighting survey.

Date	Event
6-August	<i>KY7</i> depart Shiogama, Japan
8-August	<i>KY7</i> arrive at the starting point in the research area (western side)
11-September	<i>KY7</i> complete the research area and move to Shiogama
18-September	<i>KY7</i> arrive Shiogama, Japan

Table 3. Waypoint (WP) in each survey block during the sighting survey in 2021. Asterisks (*) indicate that sighting survey will not be conducted between the WP and next WP.

Waypoint for the *YSI*

WP	Lat			Lon		
101	42°	59.0'	N	155°	0.0'	W
102	51°	25.5'	N	159°	25.9'	W *
103	51°	25.6'	N	159°	44.4'	W
104	40°	0.0'	N	165°	35.3'	W
105	48°	55.5'	N	171°	11.4'	W *
106	48°	44.6'	N	172°	6.9'	W
107	40°	0.0'	N	177°	35.6'	W
108	43°	29.4'	N	180°	0.0'	

Waypoint for the *KY7*

WP	Lat			Lon		
201	31°	14.1'	N	150°	0.0'	E
202	30°	0.0'	N	151°	31.2'	E
203	35°	0.0'	N	157°	47.9'	E
204	30°	0.0'	N	164°	4.7'	E
205	34°	43.4'	N	170°	0.0'	E
206	37°	8.5'	N	170°	0.0'	E
207	40°	0.0'	N	171°	35.6'	E
208	30°	0.0'	N	176°	55.3'	E
209	35°	55.7'	N	180°	0.0'	

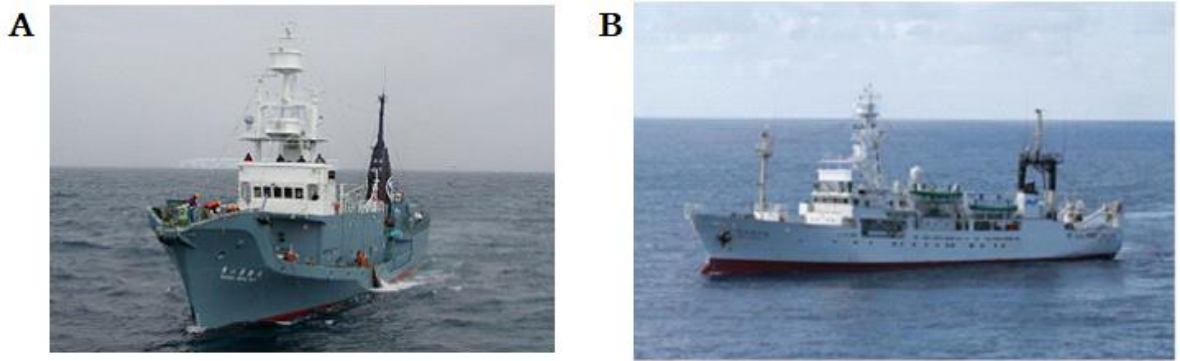


Figure 1. Research vessels participating in the dedicated sighting surveys in 2021: A) *Yushin-Maru No. 1*, B) *Kaiyo-Maru No. 7*.

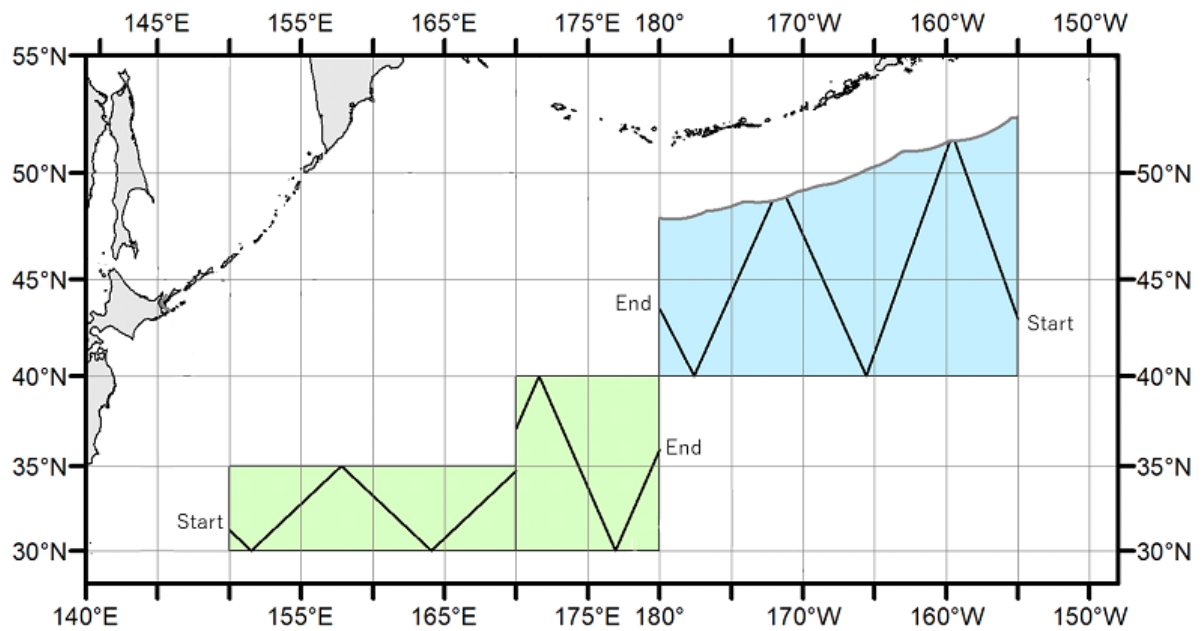


Figure 2. Research areas (light blue is the pelagic block to be covered by *YS1*; green is the offshore block to be covered mainly by *KY7*), and pre-determined track lines (black zigzag lines) of the 2021 sighting survey from August to September.