

Technical Report (not peer reviewed)

Results of the IWC-Pacific Ocean Whale and Ecosystem Research (IWC-POWER) dedicated sighting survey in 2021—An overview—

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ABSTRACT

This paper outlines the main results of the 2021 dedicated sighting survey of the International Whaling Commission-Pacific Ocean Whale and Ecosystem Research (IWC-POWER). The IWC-POWER surveys are designed and implemented by the IWC Scientific Committee, in special partnership with the Government of Japan. The surveys have been conducted since 2010 as the first phase with the long-term objective: ‘(to) provide information to allow determination of the status of populations (and thus stock structure is inherently important) of large whales that are found in the North Pacific waters and provide the necessary scientific background for appropriate conservation and management actions’. The 2021 survey was conducted successfully between 2 August and 30 September 2021 in the eastern North Pacific by the Japanese R/V *Yushin-Maru* No. 2. The following whale species were sighted in the survey area: blue (6 schools / 7 individuals), fin (77/113), sei (23/37), Bryde’s (20/22), sperm (14/14) and killer (1/4) whales. Photo-identification data were collected from 7 blue, 31 fin, 15 sei 13 Bryde’s and 3 killer whales. A total of 19 biopsy samples were collected from 3 blue, 9 fin, 4 sei, 2 Bryde’s and 1 killer whales. A total of 88 objects of marine debris were observed and recorded. Data collected during this survey will be used mainly for abundance estimation and stock structure purposes.

INTRODUCTION

The International Whaling Commission-Pacific Ocean Whale and Ecosystem Research (IWC-POWER) program is an international research effort in the North Pacific coordinated by the IWC and designed by the IWC Scientific Committee (SC) in special partnership with the Government of Japan. Scientists from the Institute of Cetacean Research and cooperating institutes such as Tokyo University of Marine Science and Technology participate regularly in the IWC-POWER program, both in designing and implementing the surveys. The IWC-POWER surveys in the North Pacific follow the series of IWC International Decade for Cetacean Research/Southern Ocean Whale and Ecosystem Research (IDCR/SOWER) surveys conducted in the Antarctic since 1978.

The long-term objective of the IWC-POWER is to ‘provide information to allow determination of the status of populations (and thus stock structure is inherently important) of large whales that are found in the North Pacific waters and provide the necessary scientific background for appropriate conservation and management actions.’ The first survey of this program was conducted in 2010 and the most recent one in 2021 as the first phase

(IWC, 2021).

The IWC SC is close to completing the first phase of the IWC-POWER, which is related to its short-term priorities. The IWC SC is preparing for the second phase related to medium-term priorities, based on the results of the first phase (see Matsuoka, 2020).

Originally, the 2021 IWC-POWER was planned to be conducted in the region east of the Kuril archipelago within the Russian EEZ, and Japan submitted the research application to the Russian Federation. However, Russia sent a note verbale to Japan stating that the government could not accept the application. No reason was given. As a result, the 2021 IWC-POWER was conducted following the back-up plan in the eastern North Pacific waters.

The objective of this document is to present an overview of the results of the 2021 IWC-POWER survey. Details can be found in Murase *et al.* (2022). For general background of the IWC-POWER including objectives, research area and general methodology, see Matsuoka (2020).

RESULTS OF THE 2021 IWC-POWER SURVEY

The main results of the 2021 IWC-POWER survey are summarized here based on Murase *et al.* (2022).

Table 1
The 2021 IWC-POWER survey itinerary.

Date	Event
1 August 2021	Pre-cruise meeting in Shiogama
2 August	Vessel departs Shiogama
17 August	Vessel starts the survey in the research area
18 September	Vessel completes the survey in the research area
30 September	Vessel arrives in Shiogama
1 October	Post-cruise meeting in Shiogama

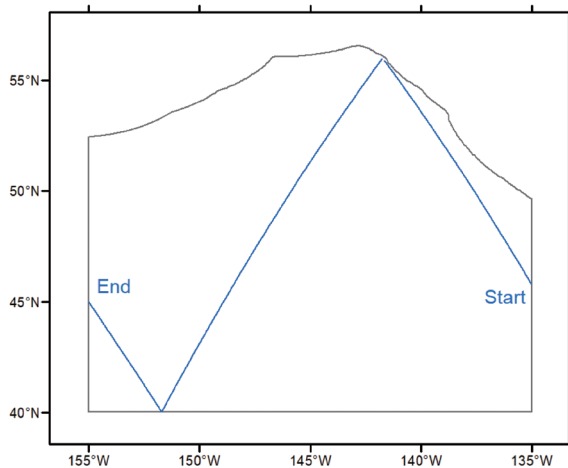


Figure 1. Research area and survey track lines with start and end points for the 2021 IWC-POWER survey.



Figure 2. Photograph of the R/V *Yushin-Maru* No. 2 used in the 2021 IWC-POWER survey.

Itinerary

The survey was conducted between 2 August and 30 September 2021 by the Japanese R/V *Yushin-Maru* No. 2. The itinerary is shown in Table 1.

Table 2

Specifications of the R/V *Yushin-Maru* No. 2 used in the 2021 IWC-POWER survey.

Call sign	JPPV
Length overall [m]	69.61
Molded breadth [m]	11.5
Gross tonnage (GT)	747
Barrel height [m]	19.5
IO barrel height [m]	13.5
Upper bridge height [m]	11.5
Bow height [m]	6.5
Engine power [PS/kW]	5303/3900

Research area

The research area was between 40°00'N and US and Canadian EEZ boundaries, between 135°00'W and 155°00'W, comprised entirely of the high seas (Figure 1). The areas between 150°00'W and 155°00'W, and between 135°00'W and 150°00'W were surveyed in the 2011 and 2012 POWER surveys, respectively, although the timing of the surveys were different from the 2021 POWER survey.

Research vessel and scientific personnel

The R/V *Yushin-Maru* No. 2 was used for this survey. The vessel is shown in Figure 2 and its specifications in Table 2.

Three international researchers were nominated by the IWC SC for this survey:

Hiroto Murase (Japan)—Cruise Leader (CL)/Chief Scientist
James W. Gilpatrick, Jr. (US)—Photo-ID
Isamu Yoshimura (Japan)—sighting data, marine debris and biopsy sample management

Searching effort

Survey trackline coverage in the research area was 77.2% (1,562.5 n.miles of a planned distance of 2,022.4 n.miles), with a total of 833.7 n.miles in Passing with abeam closing mode (NSP) and 728.8 n.miles in Independent Observer passing mode (IO). The effort spent in sighting and several experiments are shown in Table 3.

Summary of the sightings

During the survey in the research area, the following sightings were made: blue (6 schools / 7 individuals), fin (77/113), sei (23/37), Bryde's (20/22), sperm (14/14) and killer (1/4) whales (Table 4). These data will be used to estimate abundance of several species.

Table 3

Summary of the searching effort (time and distance) and experimental time (hours) in the survey area of the 2021 IWC-POWER survey.

Area	Leg No.	Start	End	NSP		IO		NSP+IO		Photo-ID, Biopsy, TDR tag	Estimated angle and distance training/experiment
	Start	Date	Date	Time	Dist. (n.m.)	Time	Dist. (n.m.)	Time	Dist. (n.m.)	Time	Time
	End	Time	Time								
Research Area (between 150°W and 135°W)	101	17-Aug.	11-Sep.	59:04:25	624.30	52:33:36	552.83	111:38:01	1177.13	14:08:44	6:40:47
	121	12:43	14:27								
Research Area (between 155°W and 150°W)	121	11-Sep.	16-Sep.	19:45:13	209.44	16:26:07	175.99	36:11:20	385.43	0:24:46	0:00:00
	127	14:27	13:54								

Table 4

Number of sightings for all species observed in the research area during the 2021 IWC-POWER survey (original track lines), by effort mode. NSP: Normal Passing with abeam closing mode; IO: Independent Observer mode, OE: Top down (TD) and drifting (DR). Numbers of Individuals include the number of calves.

Species	NSP			IO			OE			Total		
	Sch.	Ind.	Calf	Sch.	Ind.	Calf	Sch.	Ind.	Calf	Sch.	Ind.	Calf
Blue whale	2	3	0	4	4	0	0	0	0	6	7	0
Fin whale	39	58	1	37	54	3	1	1	0	77	113	4
Like fin whale	0	0	0	1	1	0	0	0	0	1	1	0
Sei whale	14	26	0	8	10	0	1	1	0	23	37	0
Like sei whale	1	2	0	0	0	0	0	0	0	1	2	0
Bryde’s whale	11	13	1	9	9	0	0	0	0	20	22	1
Sperm whale	9	9	0	5	5	0	0	0	0	14	14	0
Baird’s beaked whale	1	3	0	0	0	0	0	0	0	1	3	0
Ziphiidae	1	2	0	3	6	0	0	0	0	4	8	0
Killer whale	1	4	0	0	0	0	0	0	0	1	4	0
Striped dolphin	0	0	0	1	74	0	0	0	0	1	74	0
Common dolphin	1	84	2	3	410	8	0	0	0	4	494	10
Pacific white-sided dolphin	3	85	3	1	157	7	0	0	0	4	242	10
Northern right whale dolphin	1	107	4	0	0	0	0	0	0	1	107	4
Dalli type Dall’s porpoise	10	55	0	5	42	0	0	0	0	15	97	0
Unid. type Dall’s porpoise	3	11	0	2	2	0	0	0	0	5	13	0
Unid. dolphin	2	13	0	0	0	0	0	0	0	2	13	0
Unid. small cetacean	1	1	0	1	1	0	0	0	0	2	2	0
Unid. cetacean	2	2	0	3	3	0	0	0	0	5	5	0
Unid. large baleen whale	7	7	0	5	6	0	0	0	0	12	13	0

Geographical distribution by species

Blue whale (Balaenoptera musculus)

Blue whales were mainly distributed in the northern part

of the research area (Figure 3). Sea surface temperatures at the sighting positions were between 12.7°C and 13.6°C.

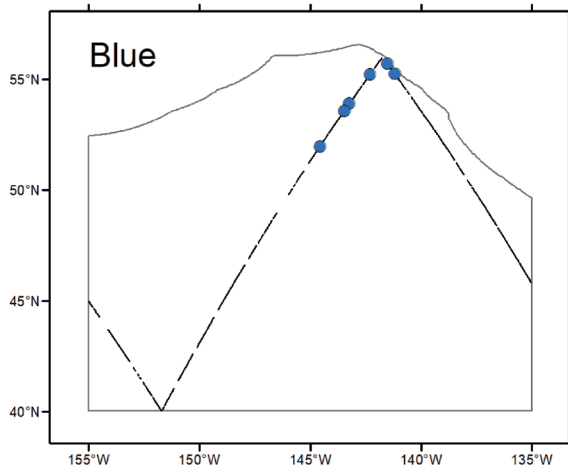


Figure 3. The searching effort (black line) and sighting positions (blue circles) of blue whales during the 2021 IWC-POWER survey.

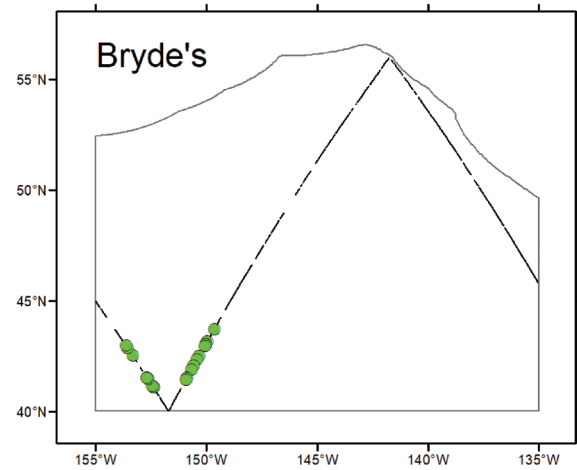


Figure 6. The searching effort (black line) and sighting positions (green circles) of Bryde's whales during the 2021 IWC-POWER survey.

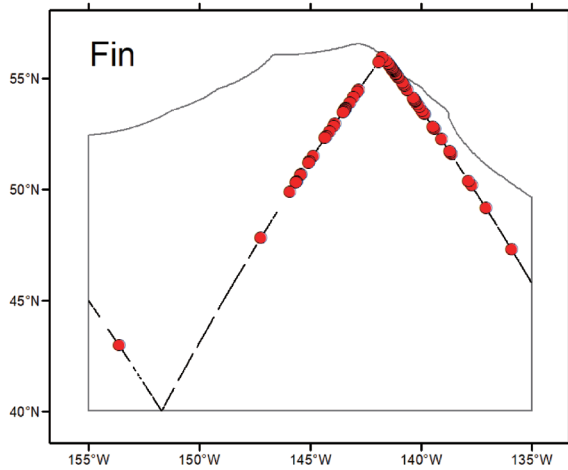


Figure 4. The searching effort (black line) and sighting positions (red circles) of fin whales during the 2021 IWC-POWER survey.

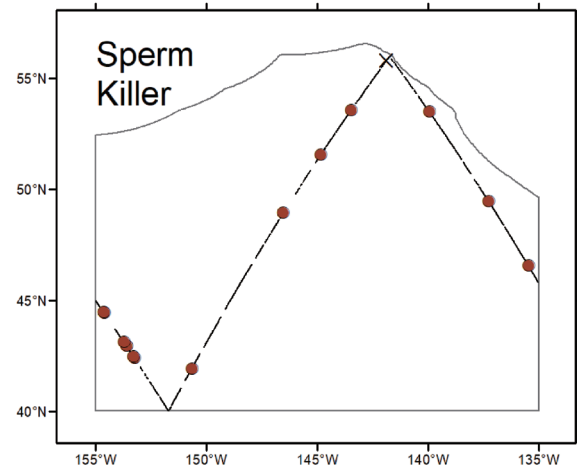


Figure 7. The searching effort (black line) and sighting positions of sperm and killer whales (brown circles and black cross, respectively) during the 2021 IWC-POWER survey.

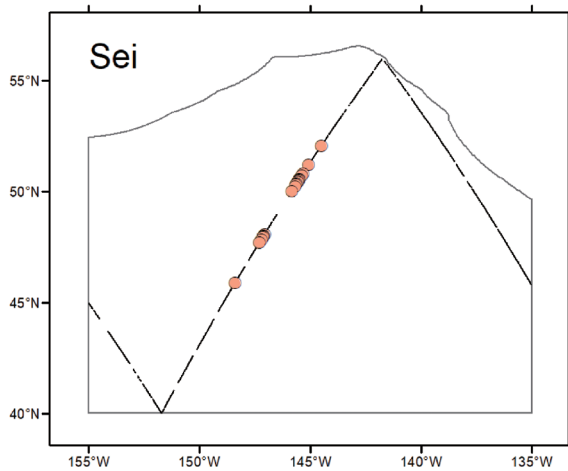


Figure 5. The searching effort (black line) and sighting positions (orange circles) of sei whales during the 2021 IWC-POWER survey.

Fin whale (Balaenoptera physalus)

Fin whales were mainly distributed in the northern part of the research area (Figure 4). Sea surface temperatures at the sighting positions were between 12.7°C and 19.7°C.

Sei whale (Balaenoptera borealis)

Sei whales were distributed in mid-latitudes of the research area (Figure 5). Sea surface temperatures at the sighting positions were between 13.0°C and 16.1°C.

Bryde's whale (Balaenoptera edeni brydei)

Bryde's whales were distributed in the southern part of the research area (Figure 6). Sea surface temperatures at the sighting positions were between 17.4°C and 21.3°C.

Table 5

Summary of the Photo-ID experiments for each species conducted in the 2021 IWC-POWER research area.

Photo-ID	Blue	Fin	Sei	Bryde's	Killer	Total
Between longitude 150°W and 135°W	7	31	15	2	3	58
Between longitude 155°W and 150°W	0	0	0	11	0	11

Table 6

Summary of the number of species-specific biopsy samples collected in the 2021 IWC-POWER research area.

Biopsy samples	Blue	Fin	Sei	Bryde's	Killer	Total
Between longitude 150°W and 135°W	3	9	4	1	1	18
Between longitude 155°W and 150°W	0	0	0	1	0	1



Figure 8. Researchers and crew of the 2021 IWC-POWER survey with the *Yushin-Maru* No. 2 in the background. The picture was taken at the end of the cruise in Shiogama.

Sperm (Physeter macrocephalus) and killer whales (Orcinus Orca)

Sperm whales were widely distributed in the research area (Figure 7). Sea surface temperatures at the sighting positions were between 12.7°C and 20.0°C. A total of 1 school (4 individuals) of killer whales was sighted in the northern part of the research area where the sea surface temperature was 13.1°C.

Identification of duplicated sightings

Resight data were recorded for a total of 108 sightings during IO Mode involving several baleen whale species. These data will be used to estimate $g(0)$, which in turn will be used to adjust abundance estimates.

Photo-ID experiments

Photo-ID data were obtained for a total of 69 whales: blue (7 individuals), fin (31), sei (15) Bryde's (13) and killer (3) whales (Table 5). Images collected during the survey were uploaded to the IWC master photographic database in Adobe Lightroom (LR) (Anon, 2020). Photo-ID data will

be used to study movement, distribution and stock structure of the species involved.

Biopsy sampling

Biopsy samples were collected using the Larsen sampling system from 19 individual whales: 3 blue, 9 fin, 4 sei, 2 Bryde's and 1 killer whales (Table 6). Every biopsy sampling was documented photographically. All biopsy samples were catalogued and stored in cryo-vials frozen at a temperature of -30°C on the vessel. These samples will be used for molecular genetics analyses on stock identification.

Marine macro debris observation

During the survey, a total of 88 marine macro debris objects were observed. All items were recorded 'on effort' (i.e. during the first 15 minutes of each hour).

Feasibility experiment of dive behavior tagging

During the survey, satellite linked dive behavior tags were experimentally deployed as a feasibility study at the dis-

cretion of Japan. The tags were attached to 2 fin and 3 sei whales and the data were obtained via satellite. Detailed analysis will be conducted by Japanese scientists and the results will be reported to relevant scientific communities.

HIGHLIGHTS OF THE SURVEY

It is concluded that the 2021 IWC-POWER survey was completed successfully by a group of international scientists (Figure 8) and that valuable data were collected for several cetacean species. Such data will allow for studies on distribution, abundance and stock structure of large cetaceans in this particular area of the North Pacific.

There are two aspects of this survey that should be highlighted. The first aspect is a seasonal change in the distribution of baleen whales. Although the 2021 POWER survey area was covered by the 2011 and 2012 POWER surveys, the survey timing in 2021 was approximately a month later than the previous two surveys. From the results, it appeared that the distribution of baleen whales has shifted northward. For instance, the Bryde's whale, a tropical species, was sighted in the southern part of the 2021 survey area while none was sighted in the previous two surveys. Such a change will be investigated in future studies.

The second aspect is the success of the feasibility experiment of dive behavior tagging. This was the first attempt of this kind of experiment in the IWC-POWER surveys. The obtained data could be used to correct availability bias in future abundance estimation work.

Although the IWC-POWER survey within the Russian EEZ has not been completed, it is anticipated that the IWC-POWER program will move toward its second phase, which will be designed after examining in details the results from the first phase between 2010 and 2021.

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