

Technical Report (not peer reviewed)

Results of the IWC-Pacific Ocean Whale and Ecosystem Research (IWC-POWER) dedicated sighting survey in 2023 —An overview—

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ABSTRACT

This paper outlines the main results of the 2023 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: ‘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 2023 survey was conducted successfully between 28 July and 5 October 2023 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 (9 schools/9 individual), fin (70/109), sei (63/82), humpback (1/1), sperm (25/26) and killer (3/5) whales. North Pacific right whales (4/5) were also sighted during the transit from the research area to Dutch Harbor. Photo-identification data were collected from 4 right, 7 blue, 30 fin and 9 sei whales. A total of 19 biopsy samples were collected from 4 blue, 8 fin and 7 sei whales. A total of 146 sonobuoys were deployed, of which 143 were successful, for a total of over 538.28 monitoring hours. A total of four SPOT 177S satellite tags were deployed on four blue whales. Five SPLASH-f-333 satellite tags each were deployed on fin and sei whales. Two drifting buoy recorders (Long-term Drifting Buoy Recorder, LT-DBR) were deployed during the cruise. A seabird sighting survey was conducted as a feasibility study and a total of 115 survey blocks along tracklines up to 15 minutes long was covered with sightings of 27 species of seabirds. 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 (ICR) and the cooperative 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 that have been conducted in the Antarctic since 1978 (Matsuoka *et al.*, 2003).

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 2023 as Phase I (IWC, 2024a). The Phase I survey would be completed in 2025 and the IWC SC is preparing for the next phase related to medium and long-term priorities, based on the results of the first phase (IWC, 2024b).

The objective of this document is to present an overview of the 2023 IWC-POWER focusing on the results within the survey area. The details are provided in Murase *et al.* (2024). For a general background of the IWC-POWER including objectives, research area and general methodology are described in Matsuoka (2020).

Table 1
The 2023 IWC-POWER survey itinerary.

Date (ship's time)	Event
27-Jul-2023	Pre-cruise meeting held at Shiogama
28-Jul	Vessel departed from Shiogama
5-Aug	Vessel arrived at Dutch Harbor
7-Aug	Vessel departed from Dutch Harbor
7-Aug	Pre-cruise meeting held on YS2 off Dutch Harbor
9-Aug	Vessel started the survey in the research area
13-Sep	Vessel completed the survey in the research area
22-Sep	Vessel arrived at Dutch Harbor
24-Sep	Post-cruise meeting held at Dutch Harbor
25-Sep	Vessel departed from Dutch Harbor
5-Oct	Vessel arrived at Shiogama
6-Oct	Post-cruise meeting held at Shiogama

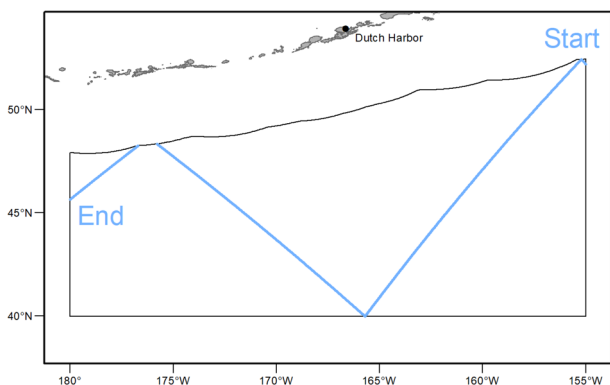


Figure 1. Research area (thin black line) and survey track lines (blue line) with start and end points for the 2023 IWC-POWER survey.

OVERVIEW OF RESULTS OF THE 2023 IWC-POWER SURVEY

Itinerary

The survey was conducted between 28 July and 5 October 2023 by the Japanese R/V *Yushin-Maru* No. 2. The itinerary is shown in Table 1.

Research area

The research area for IWC-POWER 2023 was off the southern Aleutian Islands bounded by 40°00'N, the US exclusive economic zone (EEZ) boundary to the north, 180°00' and 155°00'W, comprised entirely of the high seas (Figure 1). As a part of the transit survey, a small-scale opportunistic sighting survey mainly targeting North Pacific right whale was conducted south of the Alaska Peninsula between 155°00.0'W and 157°24.0'W (all within the US EEZ) from 17 to 20 September.

Table 2
Specifications of the R/V *Yushin-Maru* No. 2.

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]	5,303/3,900

Research vessel and scientific personnel

The R/V *Yushin-Maru* No. 2 was used for this survey. The specifications of the vessel are given in Table 2.

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

Hiroto Murase (Japan): Cruise Leader (CL)
 Jessica Crance (USA): Acoustics and photo-ID
 Bernardo Alps (USA): Photo-ID data management and seabird sighting
 Isamu Yoshimura (Japan): sighting data, marine debris and biopsy sample management

Searching effort

The survey was conducted using methods based on the guidelines of the IWC SC. Survey trackline coverage in the research area was 84.6% (1,476.57 n.miles of a planned distance of 1,745.00 n.miles), with a total of 742.29 n.miles in Normal Passing with abeam closing mode (NSP) and 734.18 n.miles in Independent Observer passing mode (IO) (Table 3). Additionally, 172.80 n.miles were surveyed during transit between Japan to and from Dutch Harbor, and Dutch Harbor to and from the research area.

Summary of the sightings

During the survey in the research area, sightings of blue (9 schools/9 individuals), fin (70/109), sei (63/82), humpback (1/1), sperm (25/26) and killer (3/5) whales were observed (Table 4). North Pacific right whales (4/5) were also observed during the small-scale opportunistic sighting survey conducted as a part of the transit survey from the research area to Dutch Harbor. These data will be mainly used to estimate abundance of several species.

Geographical distribution by species

Blue whale (Balaenoptera musculus)

Blue whales were mainly distributed in the northern part of the area to the west of 165°W (Figure 2). Sea surface

Table 3

Summary of the searching effort (time and distance) and experimental time (hours) in the survey area of the 2023 IWC-POWER. NSP: Normal Passing with abeam closing mode, IO: Independent Observer mode.

Area	Area Code	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.)		
		End	Time	Time								
Research Area (Leg 101–132)	88 (All High Sea)	101	9-Aug.	13-Sep.	64:27:50	742.29	63:25:17	734.28	127:53:07	1476.57	16:29:19	10:12:30
		127	6:00	13:38								

Table 4

Number of sightings for all species observed in the research area during the 2023 IWC-POWER survey (original tracklines), by effort mode. NSP: Normal Passing with abeam closing mode, IO: Independent Observer mode, OE: Top down (TD) and drifting (DR), Sch.: schools, Ind.: individuals. 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	1	1	0	8	8	0	0	0	0	9	9	0
Fin whale	28	44	3	39	57	2	3	8	0	70	109	5
Like fin whale	0	0	0	2	3	0	0	0	0	2	3	0
Sei whale	34	49	0	27	31	0	2	2	0	63	82	0
Like sei whale	1	2	0	1	1	0	0	0	0	2	3	0
Common minke whale	2	2	0	0	0	0	0	0	0	2	2	0
Humpback whale	0	0	0	1	1	0	0	0	0	1	1	0
Sperm whale	12	13	0	12	12	0	1	1	0	25	26	0
Like sperm whale	0	0	0	1	1	0	0	0	0	1	1	0
Mesoplodon	0	0	0	1	3	0	0	0	0	1	3	0
Ziphiidae	3	8	0	4	4	0	0	0	0	7	12	0
Killer whale	3	5	0	0	0	0	0	0	0	3	5	0
Risso’s dolphin	1	13	0	0	0	0	0	0	0	1	13	0
Common dolphin	3	143	13	1	66	3	0	0	0	4	209	16
Pacific white-sided dolphin	5	250	11	1	19	1	0	0	0	6	269	12
Northern right whale dolphin	2	72	4	1	13	1	0	0	0	3	85	5
Dalli type Dall’s porpoise	4	22	1	7	22	0	1	4	0	12	48	1
Unid. type Dall’s porpoise	6	24	0	2	5	0	0	0	0	8	29	0
Unid. large baleen whale	5	5	0	14	14	0	1	1	0	20	20	0
Unid. dolphin	2	35	0	1	4	0	0	0	0	3	39	0
Unid. large cetacean	2	2	0	4	4	0	0	0	0	6	6	0
Unid. small cetacean	0	0	0	2	2	0	0	0	0	2	2	0
Unid. cetacean	2	2	0	4	4	0	0	0	0	6	6	0

temperatures of the sighting positions were between 12.9 and 18.5°C.

Fin whale (Balaenoptera physalus)

Fin whales were primarily observed in the northern part of the research area (Figure 3). Sea temperatures ranged from 11.6 to 23.1°C.

Sei whale (Balaenoptera borealis)

Sei whales were mainly distributed in the northern part of the area (Figure 4). Sea surface temperatures ranged from 11.3 to 17.4°C.

Humpback whale (Megaptera novaeangliae)

One school (one individual) of humpback whale was observed (Figure 5). Sea temperature at the sighting posi-

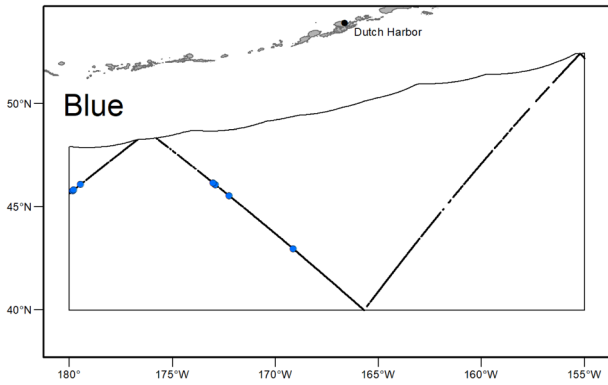


Figure 2. The searching effort (black lines) and sighting positions (blue circles) of blue whales during the 2023 IWC-POWER survey.

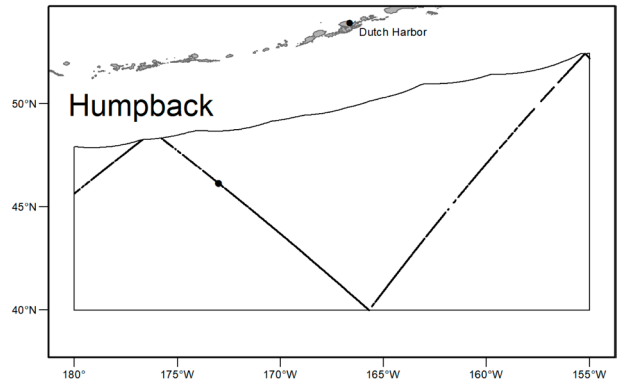


Figure 5. The searching effort (black lines) and the sighting position (black circle) of humpback whale during the 2023 IWC-POWER survey.

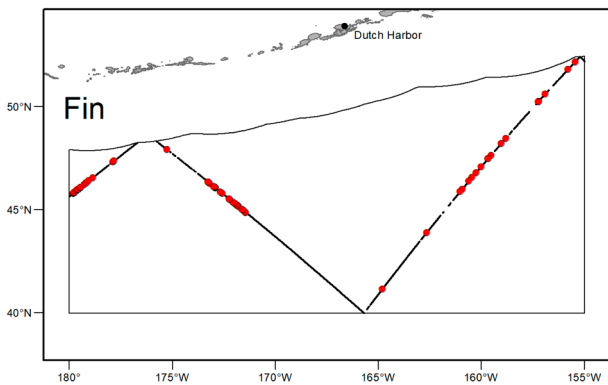


Figure 3. The searching effort (black lines) and sighting positions (red circles) of fin whales during the 2023 IWC-POWER survey.

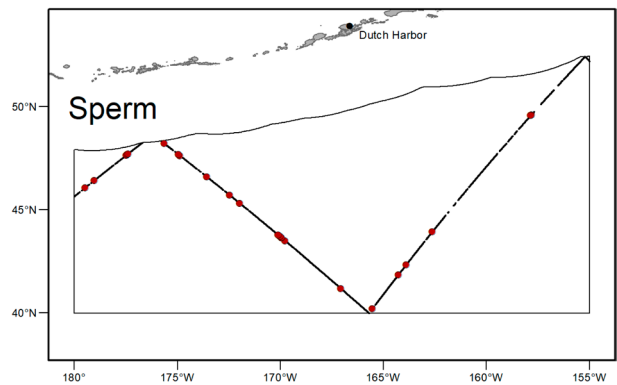


Figure 6. The searching effort (black lines) and sighting positions of sperm whales (brown circles) during the 2023 IWC-POWER survey.

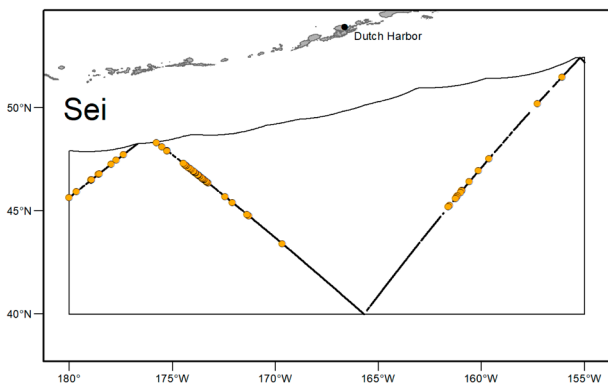


Figure 4. The searching effort (black lines) and sighting positions (orange circles) of sei whales during the 2023 IWC-POWER survey.

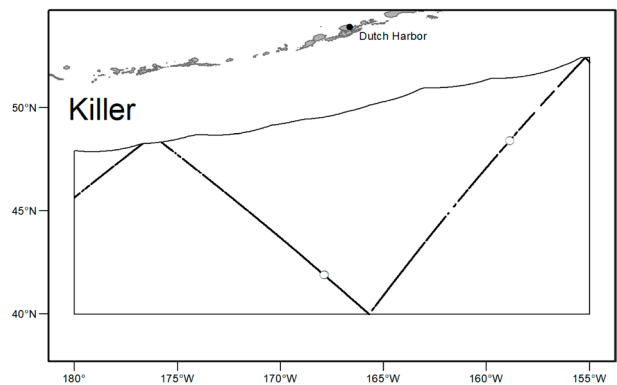


Figure 7. The searching effort (black lines) and sighting positions of killer whales (white circles) during the 2023 IWC-POWER survey.

tion was 12.9°C.

Sperm (*Physeter macrocephalus*)

Sperm whales were widely distributed throughout the research area (Figure 6). Sperm whales were recorded in waters with sea surface temperatures (SSTs) ranging from 11.6 to 23.3°C.

Killer whale (*Orcinus orca*)

A total of 3 schools (5 individuals) were sighted (Figure 7). Killer whales were recorded in waters with SSTs ranging from 11.8 to 20.7°C.

Identification of duplicated sightings

Resight data were recorded for a total of 117 sightings

Table 5

Summary of the Photo-ID'd experiments, by each species conducted during the entire 2023 IWC-POWER.

Photo-ID	Right	Blue	Fin	Sei	Total
Entire 2023 IWC-POWER	4	7	30	9	50

Table 6

Summary of the number of species-specific biopsy samples collected in the 2023 IWC-POWER research area.

Biopsy samples	Blue	Fin	Sei	Total
Entire 2023 IWC-POWER	4	8	7	19

during IO Mode involving several baleen whale species. These data will be used to estimate $g(0)$, which in turn will be used to correct abundance estimates.

Photo-ID experiments

Photo-ID data were obtained from a total of 50 individuals: North Pacific right (4 individuals), blue (7), fin (30), sei (9) whales (Table 5). Images collected during the survey were uploaded to the IWC master photographic database in Adobe Lightroom (LR) Classic. Photo-ID data will be used to study movement, distribution and stock structure of the species involved.

Biopsy sampling

Biopsy samples were collected during the entire cruise including transits for 19 individual whales: 4 blue, 8 fin and 7 sei whales (Table 6). Every biopsy sampling was documented photographically. All biopsy samples were catalogued and stored on the vessel in cryo-vials frozen at a temperature of -30°C . These samples will be used for molecular genetics analyses on stock identification.

Sonobuoys

A total of 146 sonobuoys were deployed during the cruise. Of these, 143 transmitted successfully, for a total of over 538.28 monitoring hours. The most common species detected were sperm and fin whales, detected on 107 (74.8%) and 81 (56.6%) buoys, respectively. Killer whales were the next most common detected on 53 buoys (37.1%), followed by blue whales (33, 23.1%), common dolphins (10, 6.9%), humpback whales (8, 5.6%), North Pacific right whales (7, 4.9%), Pacific white-sided dolphins (6, 4.2%), and sei whales (4, 2.8%).

Estimated Angle and Distance Experiment

The Estimated Angle and Distance Experiment was conducted on 22 September for 6 hours 33 minutes whilst in

the research area. A total of 84 trials were conducted for each platform (TOP and IO barrels and upper bridge). The data will be used to calibrate observed angle and distance based on known angle and distance.

Marine macro debris observation

A total of 95 marine debris objects were observed. 56 items were recorded 'on effort' (i.e., during the first 15 minutes of each hour) and 39 items were recorded during 'off effort'.

Satellite tagging studies

Two types of satellite tags were deployed during the cruise: SPOT 177S for monitoring the horizontal movement and SPLASH-f-333 for recording dive data with assumption that those data could be used to estimate availability bias (both types were manufactured by Wildlife Computers Inc., US). A total of four SPOT 177S satellite tags were deployed on four blue whales. Five SPLASH-f-333 satellite tags each were deployed on fin and sei whales.

Deployment of Long-term Drifting Buoy Recorder (LT-DBR)

Two drifting buoy recorders (Long-term Drifting Buoy Recorder, LT-DBR) were deployed during the cruise on behalf of Jay Barlow (US) to record acoustic data from beaked whales in the central North Pacific. LT-DBRs can record higher frequency sounds and remain deployed for considerably longer (months vs hours) than sonobuoys.

Feasibility study of seabird sighting survey

A feasibility study of seabird sighting survey was conducted along with cetacean sighting survey. The researcher wrote down the summary of species and approximate numbers seen within 300m from the vessel, from 0° to 90° on the starboard side for the first 15 minutes of each effort hour (except during off-effort) in a similar manner to marine debris. The seabird sighting survey was conducted only in the research area. This was the first attempt to conduct a seabird sighting survey within the framework of POWER programme. A total of 115 survey blocks along tracklines up to 15 minutes long was covered with sightings of 27 species of seabirds.

HIGHLIGHTS OF THE SURVEY

It is concluded that the 2023 IWC-POWER survey was completed successfully by a group of international scientists and crews (Figure 8), and that valuable data were collected for several cetacean species. Such data will allow studies on distribution, abundance and stock structure in this particular area of the North Pacific.



Figure 8. Researchers and crew of the 2023 IWC-POWER survey with the *Yushin-Maru* No. 2 in the background. The picture was taken at the end of the cruise in Dutch Harbor.

There are three aspects of this survey that should be highlighted. The first aspect is a seasonal change in distribution of baleen whales. The research area for 2023 cruise was surveyed in 2010 and 2011, but these surveys were conducted from mid-July to mid-August while the 2023 survey was conducted from mid-August to mid-September. As the results, it appeared that the distributions of baleen whales were shifted northward. Such a change will be investigated in a future study.

The second aspect is sightings of North Pacific right whales during the transit between the research area and Dutch Harbor. The obtained data are worthwhile examining for conservation and management of this endangered species, although the survey was opportunistically conducted within a limited time frame.

The third aspect is conducting three new experiments (satellite tagging for horizontal movement study of blue whale, deployment of LT-DBR and a feasibility study of seabird sighting survey) in the history of the IWC-POWER. They were accomplished through the cooperation of the crews and researchers.

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