

Technical Report (not peer reviewed)

Results of the IWC-Pacific Ocean Whale and Ecosystem Research (IWC-POWER) dedicated sighting survey in 2020

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ABSTRACT

This paper outlines the main results of the 2020 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 (SC), in special partnership with the Government of Japan. 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.’ To fulfill this objective, the IWC-POWER originally identified short and medium-term activities and priorities. The IWC-POWER is close to successfully completing its first-phase (2010–2021) related to the short-term priorities. It has also updated the medium-term priorities for this second phase. The 2020 survey was conducted successfully between 11 July and 24 September in the central North Pacific by the Japanese R/V *Yushin-Maru* No. 2. The following whale species were sighted during the entire survey: blue (22 schools /31 individuals), fin (29/32), sei (131/181), Bryde’s (6/8), common minke (3/3), humpback (7/8), sperm (56/90) and killer (18/71) whales. Photo-identification data were collected from 26 blue, 3 humpback and 17 killer whales. A total of 65 biopsy samples were collected from 13 blue, 9 fin, 38 sei, 1 Bryde’s, 2 humpback and 2 killer whales. A total of 67 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 (ICR) 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.

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 2020 (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).

The objective of this document is to summarize the results of the 2020 IWC-POWER survey (Murase *et al.*, 2021). For a general background of the IWC-POWER including objectives, research area, and general methodology, see Matsuoka (2020).

RESULTS OF THE 2020 IWC-POWER SURVEY

The main results of the 2020 IWC-POWER survey are summarized here based on Murase *et al.* (2021).

Table 1
The 2020 IWC-POWER survey itinerary.

Date	Event
10 July 2020	Pre cruise meeting at Shiogama, Japan
11 July	Vessel departs Shiogama
18 July	Vessel arrives in the research area and starts the first part of the research
12 August	Vessel completes research and starts transit survey to Kushiro, Japan
17 August	Vessel arrives in Kushiro for replacement of researchers
19 August	Mid-cruise meeting at Kushiro
20 August	Vessel departs Kushiro
26 August	Vessel arrives research area and starts second part of the research
17 September	Vessel completes research and starts transit to Shiogama
24 September	Vessel arrives in Shiogama
25 September	Post-cruise meeting at Shiogama

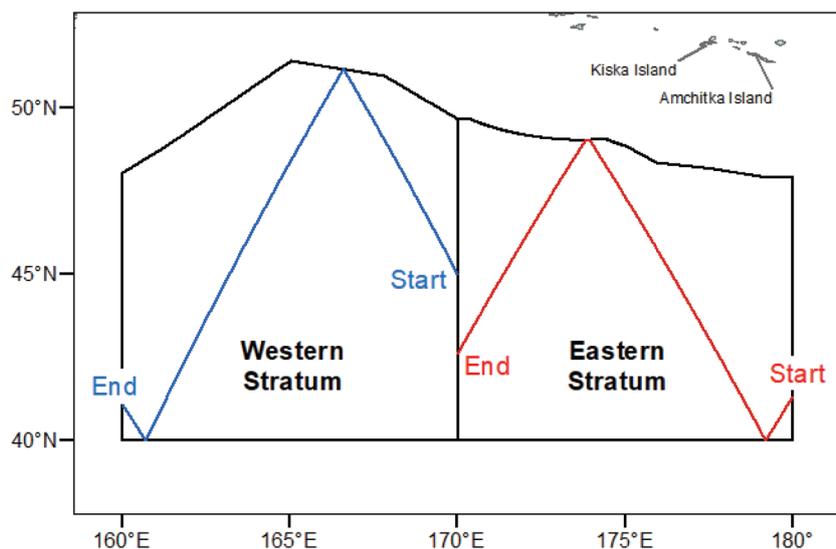


Figure 1. Research area and survey track lines with start and end points for the 2020 IWC-POWER survey.

Itinerary

The survey was conducted between 11 July and 24 September 2020 by the Japanese R/V *Yushin-Maru* No. 2. The itinerary is shown in Table 1.

Research area

The research area was between 160°E and 180° (Figure 1).

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.

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

- Koji Matsuoka (Japan)—cruise leader/chief scientist, sighting, photo-ID, 1st half
- Hiroto Murase (Japan)—cruise leader/chief scientist, sighting, 2nd half
- Isamu Yoshimura (Japan)—sighting data, marine debris and biopsy sample managements, 1st half
- Taiki Katsumata (Japan)—sighting, photo-ID data management, biopsy sample management, whole cruise
- Souya Fujii (Japan)—sighting, biopsy sample management, marine debris, 2nd half

Searching effort

A total of 981.7 n.miles (NSP: 491.1 n.miles, IO: 490.7 n.



Figure 2. Photography of the R/V Yushin-Maru No. 2.

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]	5303/3900

miles) and 921.2 n.miles (NSP: 450.9 n.miles, IO: 470.3 n.miles) of the original track line were surveyed in the western and eastern strata, respectively. Survey track line coverage in the entire research area was 84.0% (1,903.0 of the planned distance of 2,264.9 n.miles), with a total of 942.0 n.miles in NSP and 961.0 n.miles in IO. A total of 521.3 n.miles was surveyed during transit surveys between the port and the research area. The effort spent in sighting and several experiments is shown in Table 3.

Summary of the sightings

During the entire survey, blue (22 schools /31 individuals), fin (29/32), sei (131/181), Bryde’s (6/8), common minke (3/3), humpback (7/8), sperm (56/90) and killer (18/71) whales were observed. Several dolphin species were also sighted (Table 4). These data will be used to estimate abundance of several species.

Geographical distribution

Blue whale (Balaenoptera musculus)

Blue whales were the third most frequently encountered baleen whale species throughout the survey. They were mainly distributed in the northern part of the western stratum. No blue whales were observed in the eastern

Table 3

Summary of the searching effort (time and distance), experimental time (hours) and the area code during the 2020 survey. R.A.: research area.

Area	Area Code	Leg No.	Start	End	NSP		IO		NSP+IO		Photo-ID, Biopsy	Estimated angle and distance training/experiment
					Time	Dist. (n.m.)	Time	Dist. (n.m.)	Time	Dist. (n.m.)		
Shiogama to R.A. (Leg 001)	1 High Sea	001	12 Jul.	18 Jul.	10:13:51	120.14	14:16:00	167.5	24:29:51	287.64	1:19:35	0:00:00
		—	6:00	8:52								
Eastern stratum (Leg 201–217)	83 High Sea	201	18 Jul.	12 Aug.	40:10:17	450.9	41:53:28	470.34	82:03:45	921.24	18:14:19	3:17:12
		217	8:52	13:54								
R.A. to Kushiro (Leg 002)	1 High Sea	002	12 Aug.	16 Aug.	0:00:00	0.00	0:00:00	0.00	0:00:00	0.00	0:00:00	0:00:00
		—	13:54	12:00								
Kushiro to R.A. (Leg 003)	2 High Sea	003	21 Aug.	26 Aug.	20:04:53	233.68	0:00:00	0.00	20:04:53	233.68	1:04:09	7:19:58
		—	6:00	7:21								
Western stratum (Leg 101–118)	82 High Sea	101	26 Aug.	17 Sep.	43:12:57	491.06	43:22:42	490.67	86:35:39	981.73	24:30:59	0:00:00
		118	7:21	7:33								
R.A. to Shiogama (Leg 004)	2 High Sea	004	17 Sep.	22 Sep.	0:00:00	0.00	0:00:00	0.00	0:00:00	0.00	0:00:00	0:00:00
		—	7:33	12:00								
Total			12 Jul.	22 Sep.	113:41:58	1,295.78	99:32:10	1,128.51	213:14:08	2,424.29	45:09:02	10:37:10
			6:00	12:00								

Table 4

Number of sightings for all species observed in the research area during the 2020 IWC-POWER survey (original track lines and transit 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	Research area			Research area			Research area			Transit			Total		
	NSP			IO			OE			NSP					
	Sch.	Ind.	Calf	Sch.	Ind.	Calf	Sch.	Ind.	Calf	Sch.	Ind.	Calf	Sch.	Ind.	Calf
Blue whale	10	15	1	11	15	0	1	1	0	0	0	0	22	31	1
Fin whale	15	16	1	10	12	1	0	0	0	4	4	0	29	32	2
Like fin	0	0	0	2	2	0	0	0	0	0	0	0	2	2	0
Sei whale	50	65	1	51	68	2	4	5	1	26	43	0	131	181	7
Like sei	5	5	0	7	7	0	0	0	0	0	0	0	12	12	0
Bryde's whale	2	3	1	1	1	0	0	0	0	3	4	1	6	8	2
Like Bryde's	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0
Common minke whale	2	2	0	1	1	0	0	0	0	0	0	0	3	3	0
Humpback whale	1	1	0	6	7	0	0	0	0	0	0	0	7	8	0
Sperm whale	14	25	0	25	25	0	1	1	0	16	39	1	56	90	1
Killer whale	9	30	2	5	25	0	0	0	0	4	16	2	18	71	4
<i>Mesoplodon</i> spp.	2	4	0	1	3	0	0	0	0	1	2	1	4	9	1
Ziphiidae	1	2	0	2	5	0	0	0	0	1	1	0	4	8	0
Risso's dolphin	1	43	1	2	85	1	0	0	0	0	0	0	3	128	2
Striped dolphin	0	0	0	2	121	3	0	0	0	2	205	12	4	326	15
Common dolphin	8	326	15	4	229	21	0	0	0	28	1,032	43	40	1,587	79
Pacific white-sided dolphin	4	113	3	4	176	10	0	0	0	1	85	8	9	374	21
Northern right whale dolphin	0	0	0	3	197	0	0	0	0	0	0	0	3	197	0
Dalli type Dall's porpoise	7	38	0	6	42	0	0	0	0	2	20	0	15	100	0
Unid. type Dall's porpoise	4	24	0	4	14	0	0	0	0	9	50	0	17	88	0
Unid. Pilot whale	1	18	0	0	0	0	0	0	0	0	0	0	1	18	0
Unid. Dolphin	0	0	0	3	93	0	0	0	0	1	28	0	4	121	0
Unid. Cetacean	3	6	0	1	4	0	0	0	0	0	0	0	4	10	0
Unid. large baleen whale	4	4	0	12	15	0	0	0	0	2	3	0	18	22	0

stratum. In the research area a total of 22 schools (31 individuals, including 1 mother and calf pair) were sighted (Figure 3). Surface temperatures of the sighting positions ranged between 10.4°C and 18.0°C.

Fin whale (Balaenoptera physalus)

Fin whales were the second most frequently encountered baleen whale species in the research area, and they were widely distributed throughout both the western and eastern strata. Fin whales were mainly distributed north of 45°N of the research area but some aggregations

were also observed to the south (Figure 4). A total of 25 schools (28 individuals) were observed in the research area, including two mother and calf pairs. A total of 2 schools (2 individuals) of 'Like fin' were recorded; these appeared to be fin whale blows but the white right lower jaw could not be confirmed. Surface temperatures of the sighting positions ranged between 9.3°C to 21.2°C.

Sei whale (Balaenoptera borealis)

Sei whales were the most frequently encountered baleen whale species in the research area, and they were

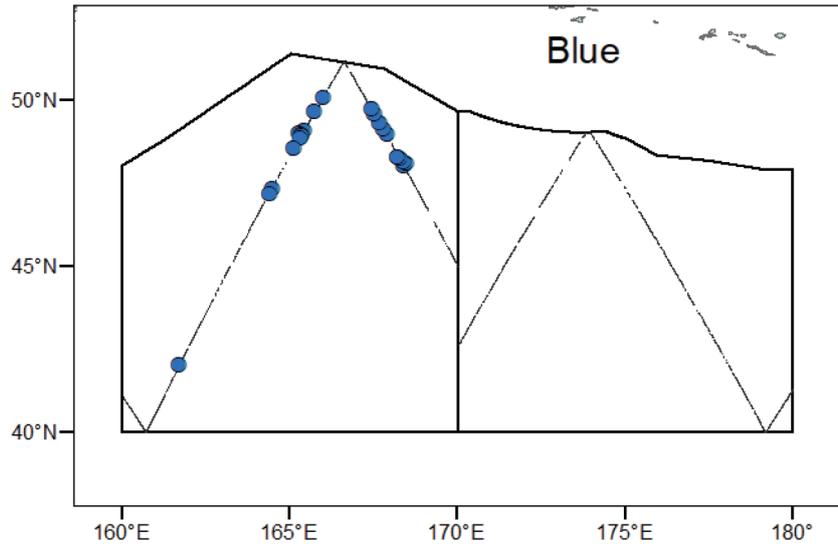


Figure 3. The searching effort (thin line) and sighting positions (blue circles) of blue whales during the 2020 IWC-POWER survey.

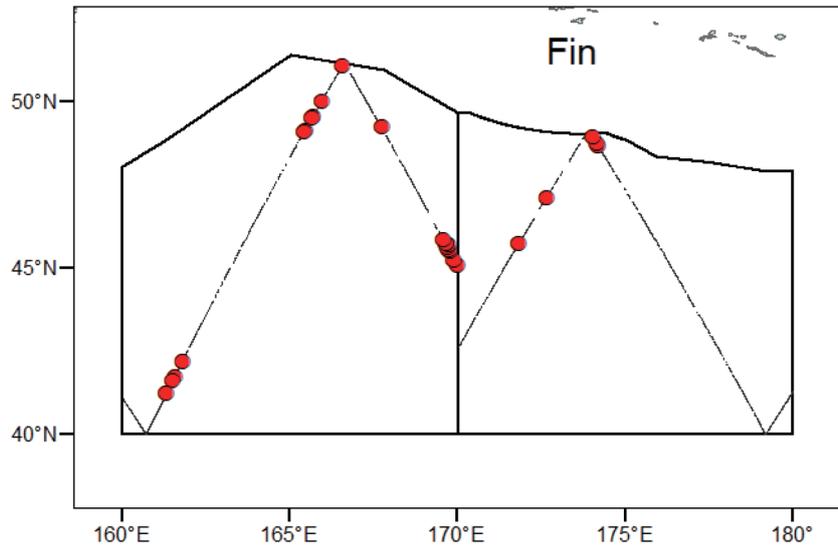


Figure 4. The searching effort (thin line) and sighting positions (red circles) of fin whales during the 2020 IWC-POWER survey.

widely distributed throughout both the western and eastern strata (Figure 5). In the research area a total of 105 schools (138 individuals, including 7 mother and calf pairs) were sighted (Table 4). Observed mean school size was 1.38. Surface temperatures of the sighting positions ranged between 8.9°C to 17.8°C. A total of 12 schools and 12 individuals of ‘Like sei’ were recorded; these appeared to be sei whale blows or body but the rostral ridge of the head could not be confirmed.

Bryde’s whale (Balaenoptera edeni brydei)

Bryde’s whales were distributed south of 45°N of the research area (Figure 6). In the research area a total of 3 schools (4 individuals, including 1 mother and calf pair)

were sighted in the research area (Table 4). Observed mean school size was 1.33. A total of 1 school and 1 individual of ‘Like Bryde’s’ were recorded; these appeared to be Bryde’s whale blows or body but the three ridges in the head could not be confirmed by. Surface temperatures of the sighting positions ranged between 12.5°C and 18.4°C.

Common minke whale (Balaenoptera acutorostrata)

Common minke whales were the least frequently sighted baleen whale species in the research area. They were sighted only in the northern part of the western stratum (Figure 7). In the research area a total of 3 schools (3 individuals) were observed (Table 4). Surface tempera-

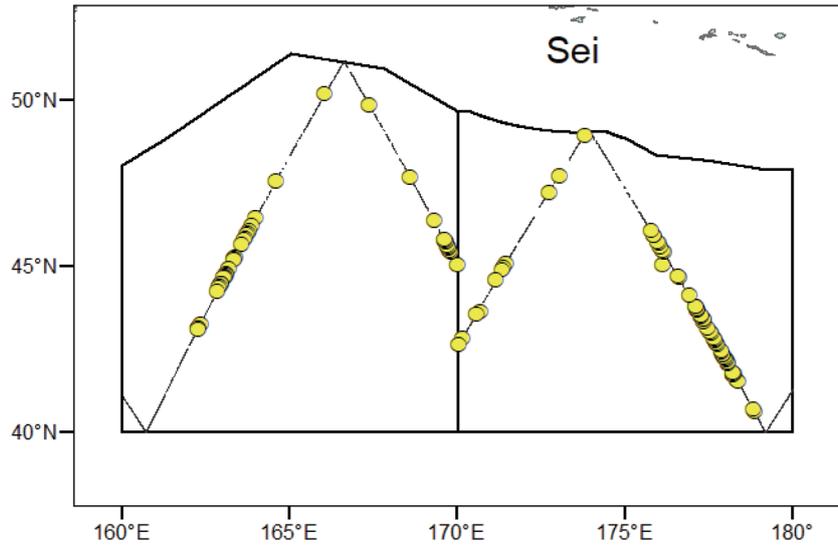


Figure 5. The searching effort (thin line) and sighting positions (yellow circles) of sei whales during the 2020 IWC-POWER survey.

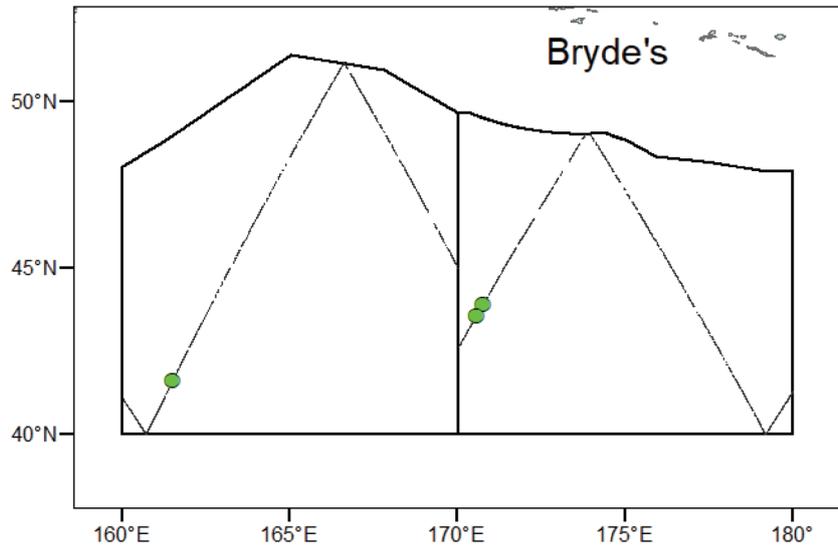


Figure 6. The searching effort (thin line) and sighting positions (yellow circles) of Bryde's whales during the 2020 IWC-POWER survey.

tures of the sighting positions ranged between 10.4°C to 14.2°C. During this survey, sea states averaged 4–5 on the Beaufort scale, which is considered to be unsuitable for sightings of common minke whales.

Humpback whale (Megaptera novaeangliae)

Humpback whales were distributed close to the northern boundary of the research area (Figure 8). In the research area a total of 7 schools (8 individuals) were sighted (Table 4). Surface temperatures of the sighting positions ranged between 9.4°C and 10.8°C.

Sperm whale (Physeter macrocephalus)

Sperm whales were widely distributed throughout the

research area (Figure 9). In the research area a total of 40 schools (51 individuals) was sighted (Table 4). Surface temperatures of the sighting positions ranged between 8.9°C to 18.1°C.

Killer whale (Orcinus Orca)

Killer whales were mainly sighted in the northern part of the research area (Figure 10). In the research area a total of 14 schools (55 individuals, including 2 mother and calf pairs) were sighted (Table 4). Surface temperatures of the sighting positions ranged between 9.0°C to 17.8°C.

Identification of duplicated sightings

A total of 153 resightings were made during IO Mode

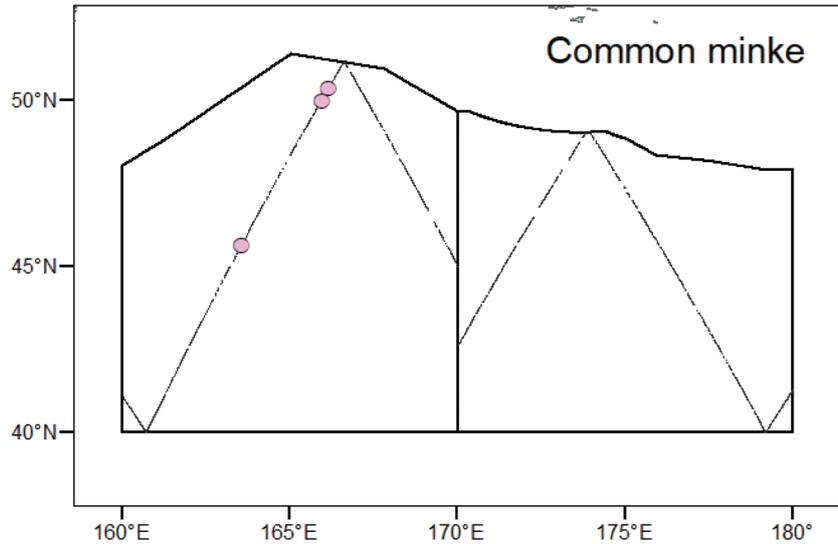


Figure 7. The searching effort (thin line) and sighting positions (pink circles) of common minke whales during the 2020 IWC-POWER survey.

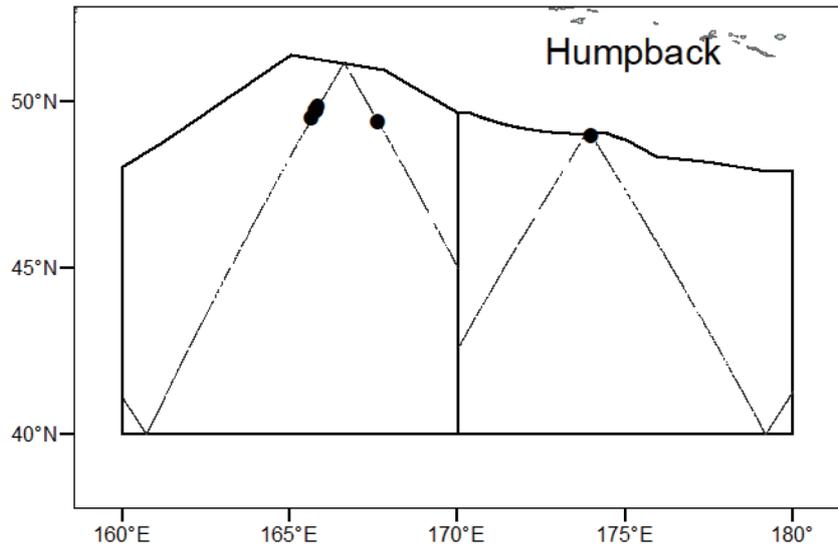


Figure 8. The searching effort (thin line) and sighting positions (black circles) of humpback whales during the 2020 IWC-POWER survey.

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 47 whales: blue (26 individuals), fin (1), humpback (3) and killer (17) whales (Table 5). Images collected during the survey were uploaded to the IWC master photographic database in Adobe Lightroom (LR) (Anon, 2020). Preliminary coding was completed for all cetacean images (4,054), including the allocation of species name, sighting number, school size and biopsy effort. Photo-ID data will be used to study movement, distribution and stock structure of the spe-

cies involved.

Biopsy sampling

Biopsy samples were collected using the Larsen sampling system from 65 individual whales: 13 blue, 9 fin, 38 sei, 1 Bryde's, 2 humpback, and 2 killer whales (Table 6, Figure 11a). All biopsy samples (Figure 11b) 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.

Marine macro debris observation

During the survey, a total of 67 marine macro debris objects were observed. These included 15 single fishing

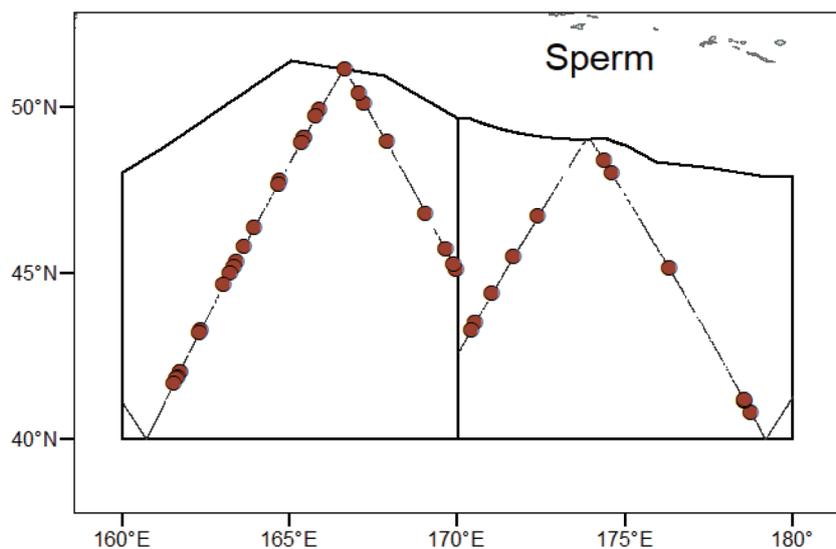


Figure 9. The searching effort (thin line) and sighting positions (red triangles) of sperm whales during the 2020 IWC-POWER survey.

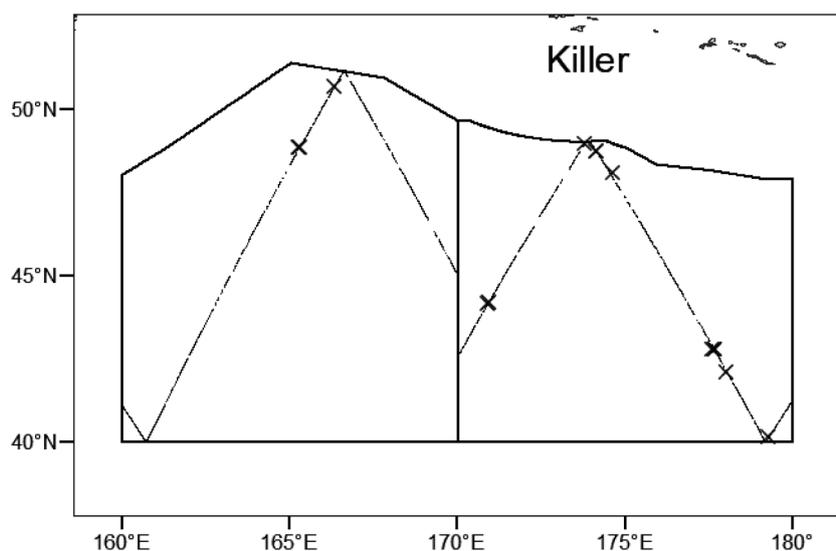


Figure 10. The searching effort (thin line) and sighting positions (black cross) of killer whales during the 2020 IWC-POWER survey.

Table 5

Summary of the Photo-ID'd experiments, by each species conducted during the 2020 IWC-POWER survey. R.A.: research area.

Photo-ID.	Blue	Fin	Humpback	Killer	Total
Transit from Japan to Eastern Stratum (R.A.) (High Sea, area code 1)	0	0	0	0	0
Eastern Stratum (High Sea, area code 83)	0	1	1	14	16
Transit from Eastern Stratum (R.A.) to Kushiro (High Sea, area code 1)	0	0	0	0	0
Transit from Kushiro to Western Stratum (R.A.) (High Sea, area code 2)	0	0	0	2	2
Western Stratum (All High Sea, area code 82)	26	0	2	1	29
Transit from Western Stratum (R.A.) to Japan (All High Sea, area code 2)	0	0	0	0	0
Total	26	1	3	17	47

Table 6

Summary of the number of species-specific biopsy samples collected during the 2020 IWC-POWER survey. R.A.: research area.

Biopsy samples	Blue	Fin	Sei	Bryde's	Humpback	Killer	Total
Transit from Japan to Eastern Stratum (R.A.) (All High Sea, area code 1)	0	0	5	0	0	0	5
Eastern Stratum (All High Sea, area code 83)	0	0	27	1	0	0	28
Transit from Eastern Stratum (R.A.) to Kushiro (High Sea, area code 1)	0	0	0	0	0	0	0
Transit from Kushiro to Western Stratum (R.A.) (High Sea, area code 2)	0	1	2	0	0	0	3
Western Stratum (All High Sea, area code 82)	13	8	4	0	2	2	29
Transit from Western Stratum (R.A.) to Japan (All High Sea, area code 2)	0	0	0	0	0	0	0
Total	13	9	38	1	2	2	65

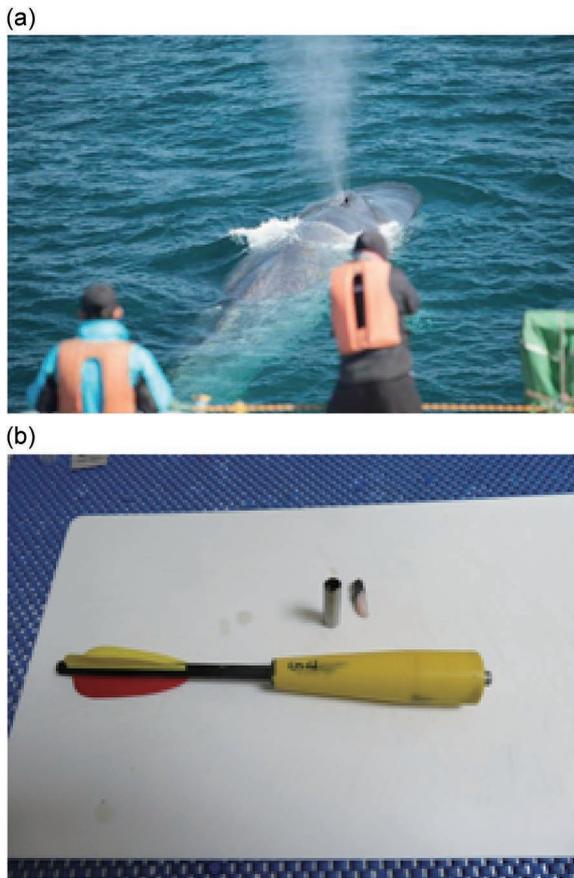


Figure 11. (a) Biopsy sampling of blue whale during the 2020 IWC POWER survey using the Larsen sampling system. (b) Dart and tip and fin whale skin sample (black skin and blubber) collected by the Larsen system.

floats, 10 styrofoam pieces (less than 1 square meter) and 8 plastic bottles (clear, 500–2,000 mL). All items were recorded 'on effort' (i.e., during the first 15 minutes of each hour).

HIGHLIGHTS OF THE SURVEY

It is concluded that the 2020 IWC-POWER survey was completed successfully by a group of international scien-



Figure 12. Researchers and crew of the 2020 IWC-POWER survey with the *Yushin-Maru* No. 2 in the background. The picture was taken during a mid-cruise meeting in Kushiro.

tists (Figure 12) 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.

There are two aspects of this survey that should be highlighted. The first aspect is the hot spot of blue whales detected southeast off Kamchatka Peninsula as shown in Figure 3. Many blue whales (21 schools/ 31 individuals) were sighted in the northern part of the western side of the research area (north of 45°N). This hot spot was also reported during the JARP/JARPNII and NEWREP-NP surveys (e.g., Matsuoka and Hakamada, 2019). Photo-ID data and biopsy samples obtained from different research programs will allow studies on stock structure for this particular spot.

The second aspect is the continuous distribution of sei whales in the sector comprised between 160°E and 180° detected in this survey (Figure 5). In past surveys only a limited sighting effort was spent in the sector 170°E–180°, so the continuous distribution in this sector confirmed in this survey is an important piece of information to assist

the interpretation of stock structure of the species.

With the completion of this survey, the waters north of 40°N between 160°E and 135°W have been covered since 2010, with the only exception being the Russian EEZ. From 2021, 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.

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