Technical Reports of the Institute of Cetacean Research (2023) pp. 34–46

Technical report (not peer reviewed)

Report and highlights of the Japanese dedicated sighting surveys in the North Pacific in 2022

Yujin KIM*, Taiki KATSUMATA, Tatsuya ISODA and Koji MATSUOKA

Institute of Cetacean Research, 4–5 Toyomi-cho, Chuo-ku, Tokyo 104–0055, Japan

**Contact e-mail: kim@cetacean.jp*

ABSTRACT

This paper presents the results of vessel-based sighting surveys conducted in 2022 by the Institute of Cetacean Research in the North Pacific. The research area was set between 35°N–46°N and 140°E–175°W. The surveys were conducted between 7 April and 10 November involving three seasons: spring, late summer and autumn. The spring and late summer surveys were conducted to examine the distribution and abundance of whales, and the autumn survey was conducted to investigate the migration of sei whales using satellite tags. The research vessels *Yushin-Maru, Yushin-Maru* No. 2 and *Kaiyo-Maru* No. 7 were engaged in the surveys. A total of 8,340.9 n.miles was searched in the research area. Coverage of the searching efforts on the planned cruise track line was 81.1%. In total, eight large whale species, including blue (3 schools/3 individuals), fin (105/165), sei (32/44), Bryde's (248/274), common minke (151/172), humpback (52/62), North Pacific right (1/1) and sperm (198/375) whales were sighted during the whole research. Photo-ID images were collected from blue (n=2), humpback (n=7), North Pacific right (n=1) and killer (n=2) whales. Biopsy skin samples using a Larsen system were collected from fin (n=1), sei (n=16), Bryde's (n=6), common minke (n=6) and North Pacific right (n=1) whales. Satellite tags were attached on fin (n=1), sei (n=16), Bryde's (n=5) and common minke (n=1) whales. Data collected during these surveys will be used in studies on abundance, distribution, movement and stock structure of several whale species.

INTRODUCTION

Dedicated cetacean sighting surveys in the western North Pacific were conducted in the late summer season since 1995 as a part of the Japanese Whale Research Program under Special Permit in the western North Pacific (JARPN/JARPNII) and the New Scientific Whale Research Program in the western North Pacific (NEWREP-NP) based on the survey procedures of the International Whaling Commission/Southern Ocean Whale and Ecosystem Research (IWC/SOWER) (IWC, 2008). Based on the collected data, the distribution patterns of large whales such as blue, fin, sei, Bryde's, common minke, humpback, North Pacific right and sperm whales, and abundance estimates of common minke, sei, and Bryde's whales were investigated and reported to the IWC Scientific Committee (SC) (IWC, 2001; 2010; 2016).

The Fisheries Resources Institute (FRI) has also conducted dedicated sighting surveys for cetaceans in the North Pacific since the 1980s (Buckland *et al.*, 1992; Miyashita *et al.*, 1995; Miyashita and Kato, 2004; 2005; Shimada, 2004; Kanaji *et al.*, 2012). In 2019 the Government of Japan decided to continue the sighting surveys in the North Pacific (IWC, 2019) under the rational that the collection of sighting data to estimate abundance and biopsy/photo-identification data to examine stock structure have contributed in the past to the work on management and conservation of large whales by the IWC SC (IWC, 2016).

This paper reports the results of the Japanese dedicated sighting surveys conducted during 7 April and 10 November 2022 involving three seasons: spring, late summer and autumn.

SURVEY DESIGN

Research period and area

In 2022, the surveys were conducted in three seasons: spring, late summer and autumn. The objective of spring and late summer surveys was the study of distribution and abundance of large whales from poorly documented seasons. Autumn survey aimed to study the movement and southern migration of sei whales using satellite tags. Figure 1 illustrates the research areas covered in each season.

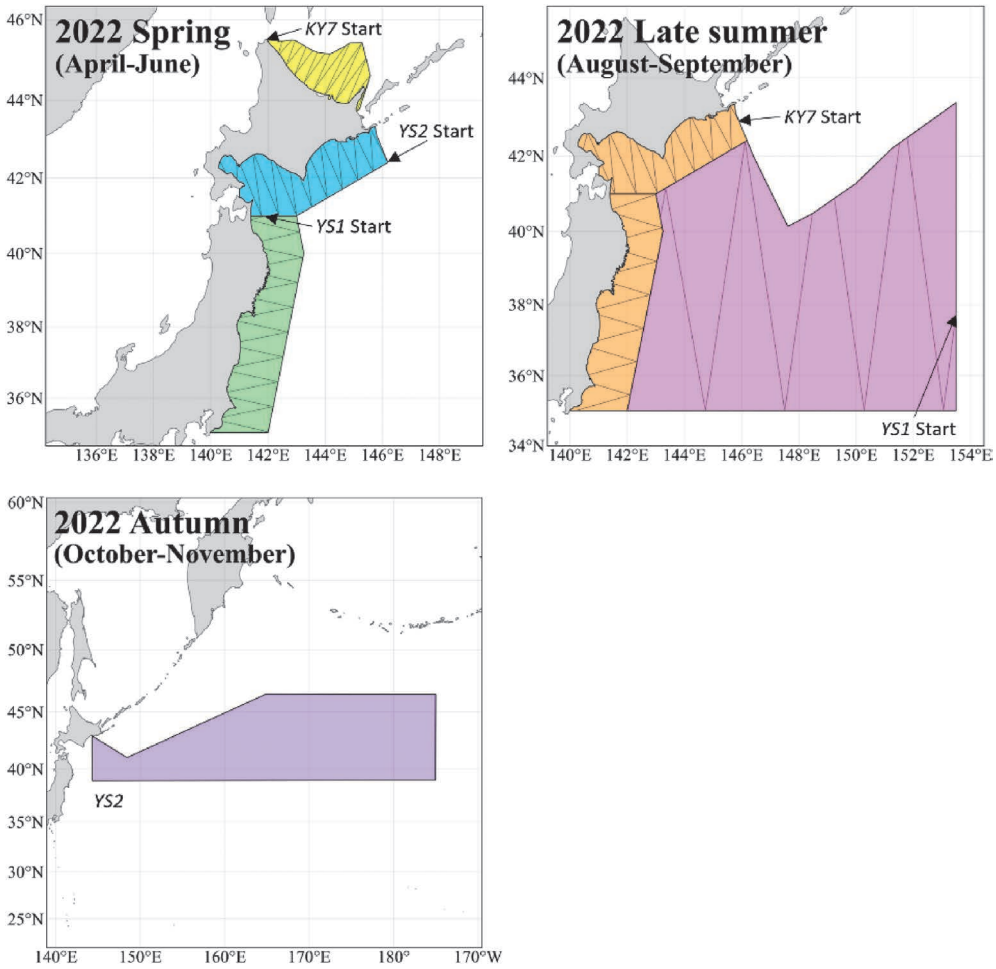

Figure 1. Research areas covered by the 2022 dedicated sighting surveys in each season. Upper left: spring survey. *Kaiyo-Maru* No. 7 (*KY7*) covered the yellow area, *Yushin-Maru* (*YS1*) covered the green area, and *Yushin-Maru* No. 2 (*YS2*) covered the blue area. Upper right: late summer survey. *KY7* covered the orange area, and *YS1* covered the pink area. Lower left: autumn survey. *YS2* covered the purple area. The autumn survey did not have a pre-determined track line.

In spring (April to June), the research area was set up between 35°N–46°N and 140°E–146°E. In late summer (August to September), the research area was set up between 35°N–44°N and 140°E–154°E. Finally, in autumn season (October to November), the research area was set up between 38°N–46°N and 141°E–175°W.

Research vessels

The sighting surveys in 2022 were conducted by the research vessels *Yushin-Maru* (*YS1*), *Yushin-Maru* No. 2 (*YS2*) and *Kaiyo-Maru* No. 7 (*KY7*) (Figure 2). The vessels were equipped with a top barrel platform (TOP), IO barrel platform (IOP) and upper bridge.

Track line design

The pre-determined track lines in spring and late summer surveys are shown in Figure 1. The start points of the track lines were decided randomly using the 'Distance program ver. 7.3' (Thomas *et al.*, 2010) and the number of the line (width in the longitude) was decided by the research schedule based on the IWC survey guidelines (IWC, 2012). The autumn survey did not set track lines because the objective in this season was not abundance estimates but satellite tagging of sei whales.

Sighting procedure

The sighting surveys were conducted using (1) Normal Passing mode (NSP), (2) Normal Closing mode (ASP) and (3) Passing with Independent Observer mode (IO) in order to estimate whale abundance considering estimated $g(0)$. The survey modes adopted for each survey are shown in Table 1. Three survey modes followed the protocol endorsed for the SOWER surveys (e.g. Matsuoka *et al.*, 2003; IWC, 2008; 2012). As data from late summer survey are used to estimate the abundance of large whales, the IO mode was also adopted for this survey, as

Figure 2. Research vessels participating in the 2022 dedicated sighting surveys: *Yushin-Maru* (*YS1*) (upper left), *Yushin-Maru* No. 2 (*YS2*) (upper right) and *Kaiyo-Maru* No. 7 (*KY7*) (lower left).

Table 1
Summary of the survey modes and searching conditions by each seasonal survey during the 2022 dedicated sighting surveys.

Season	Vessel	Survey mode	Searching conditions		
			Visibility (n.miles)	Wind speed (kt)	Searching speed (kt)
Spring	*KY7*, *YS1*, *YS2*	Normal Passing mode	≥2.0	17.0>	10.0≥
Late summer	*KY7*, *YS1*	Normal Passing mode Passing with Independent Observer mode	≥2.0	17.0>	10.0≥
Autumn	*YS2*	Normal Closing mode	≥2.0	21.0>	11.5≥

this survey can provide important data to calculate $g(0)$.

For NSP and ASP mode, there were two primary observers in the top barrel (TOP) and two in the upper bridge (captain and helmsman). All primary observers conducted searching for cetaceans by using angle board and scaled binoculars (7x).

For IO mode, there were two primary observers on the TOP and two in the independent observer platform (IOP). These observers conducted searching for cetaceans by using angle board and scaled binoculars (7x). There was no open communication between the IOP and the TOP. The observers and researchers on the upper bridge communicated to the TOP (or IOP) independently, only to clarify information and did not distract the top-men from their normal searching procedure. These primary observers report sighting-information to researchers and other observers on the upper bridge for data recording.

The survey effort began 60 minutes after sunrise and ended 60 minutes before sunset, with a maximum of 12 hours per day (maximum 06:00–19:00, including 30 minutes for mealtime for lunch and supper, when surveying in IO mode) when the weather conditions were acceptable for observations. Detailed search conditions for each survey are shown in Table 1.

Experiments

Table 2 describes the details of the planned experiments for each survey. Distance and angle experiments were conducted in the middle of the survey period. The experiment was conducted to evaluate measurement error and followed the protocol of the IWC/SOWER and IWC-POWER surveys (IWC, 2012).

When large cetaceans such as blue and humpback whales were found, photo-id images were obtained using Canon EOS 7D Mark II (with 100–400 mm lens) from the bow or upper deck. Further, biopsy skin sampling using

the Larsen system (Larsen, 1998) was conducted when blue, fin, sei and humpback whales were sighted. The satellite tagging experiment using the Air Rocket Transmitter System (LK-ARTS) was also conducted for fin, sei, Bryde's and common minke whales.

RESULTS

Brief narrative of the surveys

Spring (April–June)

KY7 departed Hakodate, Hokkaido, Japan on 7 April, and started the survey in the research area on 8 April. *KY7* paused the survey on 4 May for a scheduled port call, and entered Hakodate, on 6 May for refueling and disembarkation of researchers. On 11 May, *KY7* departed Hakodate, and resumed the survey on 12 May. The survey was completed on 7 June. *KY7* arrived in Hakodate on 9 June.

YS1 and *YS2* departed Shiogama, Miyagi, Japan on 14 April. *YS1* and *YS2* started the survey in the research area on 15 April and completed it on 21 May. *YS1* and *YS2* arrived in Shiogama on 23 May.

Late summer (August–September)

YS1 and *KY7* departed Shiogama on 2 August and 3 August, and started the surveys on 3 and 4 August, respectively. On 24 August, *KY7* suspended the survey and entered Hakodate for refueling. *KY7* departed Hakodate and recommenced the survey on 25 August. *KY7* completed the survey on 16 September and arrived in Shiogama on 17 September. *YS1* completed the survey on 22 September and arrived in Shiogama on 30 September.

Autumn (October–November)

The *YS2* departed Shiogama on 17 October and began the survey on 18 October. The vessel completed the survey on 9 November and arrived in Shiogama on 10 November.

Searching effort

A summary of searching effort and coverage in each seasonal survey is shown in Table 3. A total of 8,340.9 n.miles (15,447.3 km) were searched in all seasonal surveys.

Table 2

Experiments planned in each seasonal survey during the 2022 dedicated sighting surveys.

Season	Vessel	Planned experiments
Spring	*KY7*, *YS1*, *YS2*	Photo-ID, biopsy, satellite tagging, distance and angle experiments
Late summer	*KY7*, *YS1*	Photo-ID, biopsy, satellite tagging, distance and angle experiments
Autumn	*YS2*	Photo-ID, biopsy, satellite tagging

Table 3

Summary of the survey periods and searching effort by each seasonal survey in the 2022 dedicated sighting surveys.

Season	Vessel	Research period	Planned cruise track (n.miles)	Searching effort NSP (n.miles)	Searching effort IO (n.miles)	Searching effort Total (n.miles)	Coverage of effort (%)
Spring	*KY7*	2022/04/08–05/04	1,019.2	781.9	–	781.9	76.7
		2022/05/12–06/07	1,019.2	607.9	–	607.9	59.6
	YS1	2022/04/15–05/21	1,298.1	1,139.7	–	1,139.7	87.8
	YS2	2022/04/15–05/21	1,317.4	936.1	–	936.1	71.1
	Sub total	—	4,653.9	3,465.6	–	3,465.6	74.5
Late summer	*KY7*	2022/08/04–08/24	1,122.3	484.9	463.1	948.0	84.5
		2022/08/25–09/16	965.7	439.4	407.9	847.3	87.7
	YS1	2022/08/03–09/22	3,060.8	1,351.2	1,339.2	2,690.4	87.9
	Sub total	—	5,148.8	2,275.5	2,210.2	4,485.7	87.1
Autumn	*YS2*	2022/10/18–11/09	—	389.6*	—	389.6	—
Total		—	9,802.7	6,130.7	2,210.2	8,340.9	81.1

* Searching effort ASP (n.miles).

Sightings

Spring

Tables 4a and 4b show the total sightings for large and small cetacean species, respectively, made in spring season 2022. The sighting locations of each species are shown in Figure 3 together with sea surface temperature (SST).

Blue whale

This species was not sighted in the spring season.

Fin whale

A total of 96 schools (153 individuals including three mother and calf pairs) were sighted north of 40°N (Figure 3). The range of SST in the sighting positions was 1.8°C–9.2°C (mean SST: 5.2°C), and the mean school size was 1.59. One biopsy sample was collected from one individual. The Density Index (DI: schools of primary sighted/100 n. miles searching distance) of *KY7* in April and May were 4.48 and 8.39, respectively while the DIs of *YS1* and *YS2* were 0.09 and 0.11, respectively.

Sei whale

This species was not sighted in the spring season.

Bryde's whale

A total of 14 schools (19 individuals including one mother and calf pair) were sighted south of 38°N (Figure 3). The range of SST at the sighting positions was 8.8°C–21.0°C (mean SST: 18.6°C). Observed mean school size was 1.36. The DI of *YS1* was 0.44.

Common minke whale

This species was the most frequently sighted species in the spring season (149 schools and 170 individuals) (Figure 3). One mother and calf pair was sighted at position 42°40'N, 145°03'E. The mean school size was 1.14 and the range of SST at the sighting positions was 1.3°C–

Table 4a

Total number of sightings of large whales made in spring 2022, by research vessel and species.

Species	*KY7* (Apr.)		*KY7* (May)		*YS1*		*YS2*		Total	
	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Fin whale	39	46	55	105	1	1	1	1	96	153
Bryde's whale	0	0	0	0	14	19	0	0	14	19
Common minke whale	59	67	84	96	2	2	4	5	149	170
Humpback whale	1	1	1	1	32	38	12	15	46	55
North Pacific right whale	0	0	0	0	0	0	1	1	1	1
Sperm whale	0	0	2	4	30	59	3	3	35	66

Sch.: Schools, Ind.: Individuals.

Table 4b

Total number of sightings of small cetaceans made in spring 2022, by research vessel and species.

Species	*KY7* (Apr.)		*KY7* (May)		*YS1*		*YS2*		Total	
	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Baird's beaked whale	10	36	9	46	2	11	0	0	21	93
Common dolphin	0	0	0	0	1	25	0	0	1	25
Northern form short-finned pilot whale	0	0	0	0	6	66	0	0	6	66
Southern form short-finned pilot whale	0	0	0	0	0	0	1	30	1	30
Risso's dolphin	0	0	0	0	2	18	0	0	2	18
Killer whale	11	89	7	73	7	19	1	3	26	184
True type Dall's porpoise	0	0	0	0	17	114	16	90	33	204
Dalli type Dall's porpoise	0	0	1	7	1	8	0	0	2	15
Unidentified type Dall's porpoise	0	0	11	30	18	150	8	32	37	212
Ziphiidae	0	0	0	0	5	9	3	5	8	14
Mesoplodon spp.	0	0	0	0	4	5	0	0	4	5

Sch.: Schools, Ind.: Individuals.

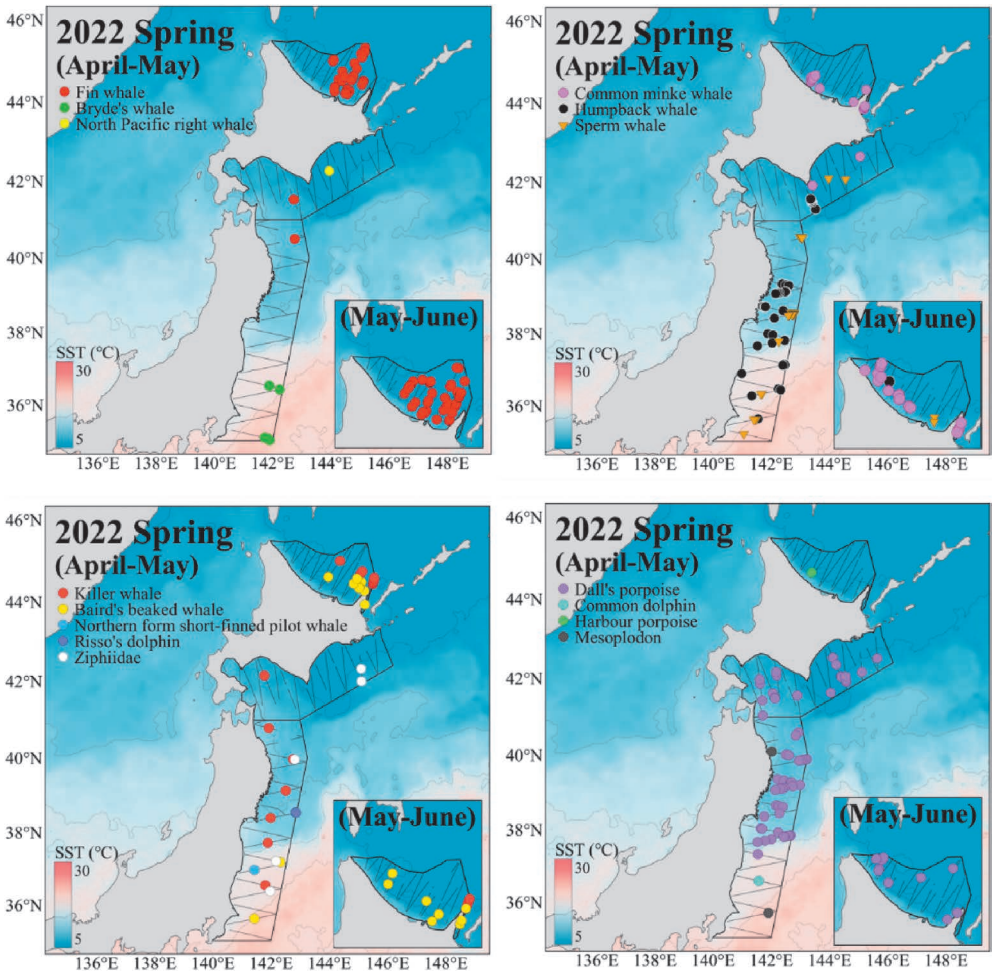

Figure 3. The locations of large and small cetaceans sighted during the spring season 2022. Rolling 32 days average sea surface temperature data from 23 April to 23 May 2022 and 9 May to 9 June obtained by MODIS-Aqua (Original data: Ocean color web, from https://oceancolor.gsfc.nasa.gov/ (Accessed 2023-4-20)), are also shown.

15.9°C (mean SST: 5.2°C). The DIs of *KY7* in April and May were 2.05 and 3.62, respectively. The DI of *YS2* was 0.21. Six biopsy samples were collected, and one satellite tag was attached to one individual.

Humpback whale

A total of 46 schools (55 individuals including one mother and calf pair) were sighted (Figure 3). The mother and calf pair was sighted at 36°48'N, 142°02'E. Observed mean school size was 1.20. The range of SST in the sighting positions was 2.9°C–21.0°C (mean SST: 9.1°C). The DI of *KY7* in May was 0.33. The DIs of *YS1* and *YS2* were 2.19 and 0.21, respectively. Seven individuals were photographed.

North Pacific right whale

One school (one individual) of estimated body length of 12.1 m was sighted at 42°16'N, 143°57'E (Figures 3 and 4). The SST in the sighting position was 5.3°C. This individual was photographed and a biopsy sample was obtained.

Figure 4. A North Pacific right whale sighted in spring 2022 (17 May) during the 2022 dedicated sighting surveys.

The DI of *YS2* was 0.11.

Sperm whale

A total of 35 schools (66 individuals) were sighted (Figure 3). The range of SST in the sighting positions was 1.5°C–

21.1°C (mean SST: 9.6°C). Because the opportunity to approach the schools was limited, there was little information on school size, body length and calves. The mean school size was 1.89 when the school size was confirmed. The DIs differed markedly between seasonal surveys, 0.33 for *KY7*, 2.19 for *YS1* and 0.21 for *YS2*.

Small cetaceans

Five species of the the family Delphinidae, three species of the family Phocoenidae and three species of the family Ziphiidae were sighted (Table 4b). The most common species sighted was the Dall's porpoise (72/431), followed by killer whale (26/184). Dall's porpoises were sighted primarily at the 37°N–41°N latitudinal band in April–May, and north of 44°N in May–June. Killer whales and Baird's beaked whales were mainly sighted north of 44°N.

Late summer

Tables 5a and 5b show the total sightings for large and small cetacean species, respectively, made in late summer season 2022. The sighting locations of each species are shown in Figure 4 together with SSTs.

Blue whale

This species was not sighted in the late summer season.

Fin whale

Four schools (four individuals) were sighted north of 39°N (Figure 5). Mean school size was 1.00. The SST in the sighting position was 18.9°C–22.2°C (mean SST: 21.2°C). The DIs were 0.11 and 0.11 by *KY7* (August) and *YS1*, respectively.

Table 5a

Total number of sightings of large whales made in late summer 2022, by research vessel and species.

Species	*KY7* (Aug.)		*KY7* (Sep.)		*YS1*		Total	
	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Fin whale	1	1	0	0	3	3	4	4
Bryde's whale	18	18	23	24	190	210	231	252
Common minke whale	2	2	0	0	0	0	2	2
Humpback whale	2	3	0	0	0	0	2	3
Sperm whale	16	73	10	24	130	203	156	300

Sch.: Schools, Ind.: Individuals.

Table 5b

Total number of sightings of small cetaceans made in late summer 2022, by research vessel and species.

Species	*KY7* (Aug.)		*KY7* (Sep.)		*YS1*		Total	
	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Baird's beaked whale	7	35	17	103	3	28	27	166
Common dolphin	0	0	0	0	13	787	13	787
Northern form short-finned pilot whale	1	18	1	95	0	0	2	113
Southern form short-finned pilot whale	0	0	0	0	2	89	2	89
Risso's dolphin	1	45	3	70	7	59	11	174
Pacific white-sided dolphin	5	293	0	0	0	0	5	293
Killer whale	0	0	0	0	1	8	1	8
Melon-headed whale	0	0	1	15	0	0	1	15
Spotted dolphin	0	0	0	0	1	45	1	45
Striped dolphin	0	0	0	0	22	1,273	22	1,273
Bottlenose dolphin	1	10	2	20	0	0	3	30
True type Dall's porpoise	3	29	0	0	0	0	3	29
Dalli type Dall's porpoise	0	0	0	0	0	0	0	0
Unidentified type Dall's porpoise	4	38	1	3	2	22	7	63
Ziphiidae	0	0	7	23	57	117	64	140
Mesoplodon spp.	0	0	3	9	2	5	5	14

Sch.: Schools, Ind.: Individuals.

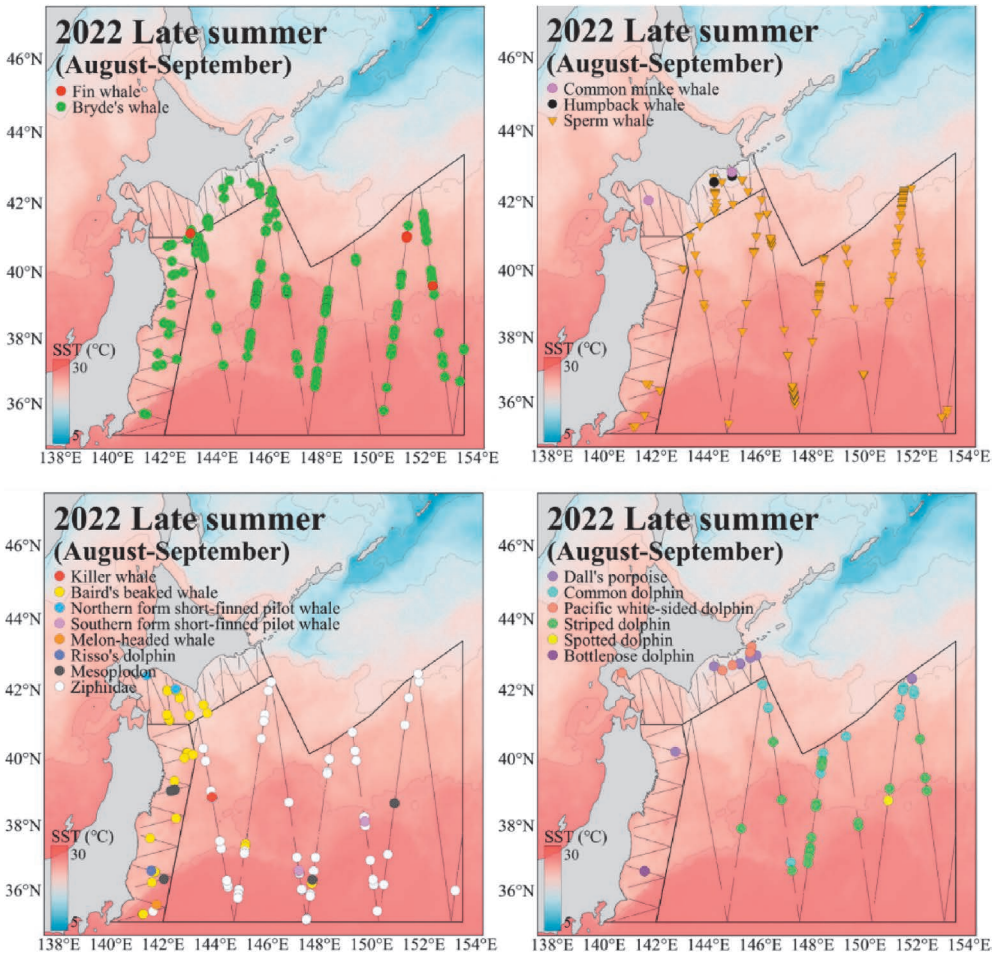

Figure 5. The locations of large and small cetaceans sighted during the late summer. Rolling 32 days average sea surface temperature data from 21 August to 21 September 2022 obtained by MODIS-Aqua (Original data: Ocean color web, from https://oceancolor.gsfc.nasa.gov/ (Accessed 2023-4-20)), are also shown.

Sei whale

This species was not sighted in the late summer season.

Bryde's whale

Bryde's whales were the most frequently sighted species in this season (Figure 5). A total of 231 schools (252 individuals) were sighted. Mean school size was 1.09. The range of SST at the sighting positions was 16.2°C–27.4°C (mean SST: 23.0°C). The DIs were 1.90, 2.71 and 6.91 by *KY7* (August), *KY7* (September) and *YS1*, respectively.

Common minke whale

Two schools (two individuals) were sighted north of 42°N (Figure 5). The SSTs in the sighting position were 14.4°C and 21.7°C. The DI of *KY7* (August) was 0.21.

Humpback whale

Two schools (three individuals) were sighted (Figure 5). Mean school size was 1.50. The SST at the sighting position were 16.4°C and 21.4°C. The DI of *KY7* (August) was 0.21.

Sperm whale

A total of 156 schools (300 individuals including one mother and calf pair) were sighted in this season (Figure 5). A school consisting of 22 sperm whales was sighted at 42°15'N, 144°16'E. Mean school size was 1.92. The range of the SST in the sighting position was 16.0°C–29.6°C (mean SST: 22.2°C). The DIs were 1.69, 1.18 and 4.68 for *KY7* (August), *KY7* (September) and *YS1*, respectively.

Small cetaceans

In this season, ten species of the family Delphinidae, three species of the family Phocoenidae and three species of the family Ziphiidae, were sighted (Table 5b). The most common sighted species was the striped dolphins (22/1,273), followed by the common dolphins (13/787). Pacific white-sided dolphins and Dall's porpoises were mainly sighted north of 40°N. Common dolphins and striped dolphins were sighted primarily east of 145°E.

Baird's beaked whales were sighted mainly west of 143°E. The species of the family Ziphiidae were sighted east of 143°E.

Duplicate sightings

A total of 26 and 104 re-sightings of large cetaceans were recorded during IO mode throughout this season involving several species.

Autumn

Tables 6 shows the total sightings for large and small cetacean species, made in autumn 2022. The sighting location of each species is shown in Figure 6 together with SSTs.

Blue whale

Three schools (three individuals) with body lengths of 17.8 m, 23.8 m and 24.1 m were sighted west of 150°E (Figure 6). The range of SST was 9.7°C–17.2°C (mean SST: 12.5°C). Two individuals were photographed.

Fin whale

Five schools (eight individuals) were sighted (Figure 6). Mean school size was 1.60, and the range of SST at the sighting positions was 11.7°C–14.8°C (mean SST: 13.6°C).

Table 6

Total number of sightings of large whales and small cetaceans made in autumn 2022, by research vessel and species.

Species	*YS2*	
	Sch.	Ind.
Blue whale	3	3
Fin whale	5	8
Sei whale	32	44
Bryde's whale	3	3
Humpback whale	4	4
Sperm whale	7	9
Northern right whale dolphin	1	6
Risso's dolphin	1	8

Sch.: Schools, Ind.: Individuals.

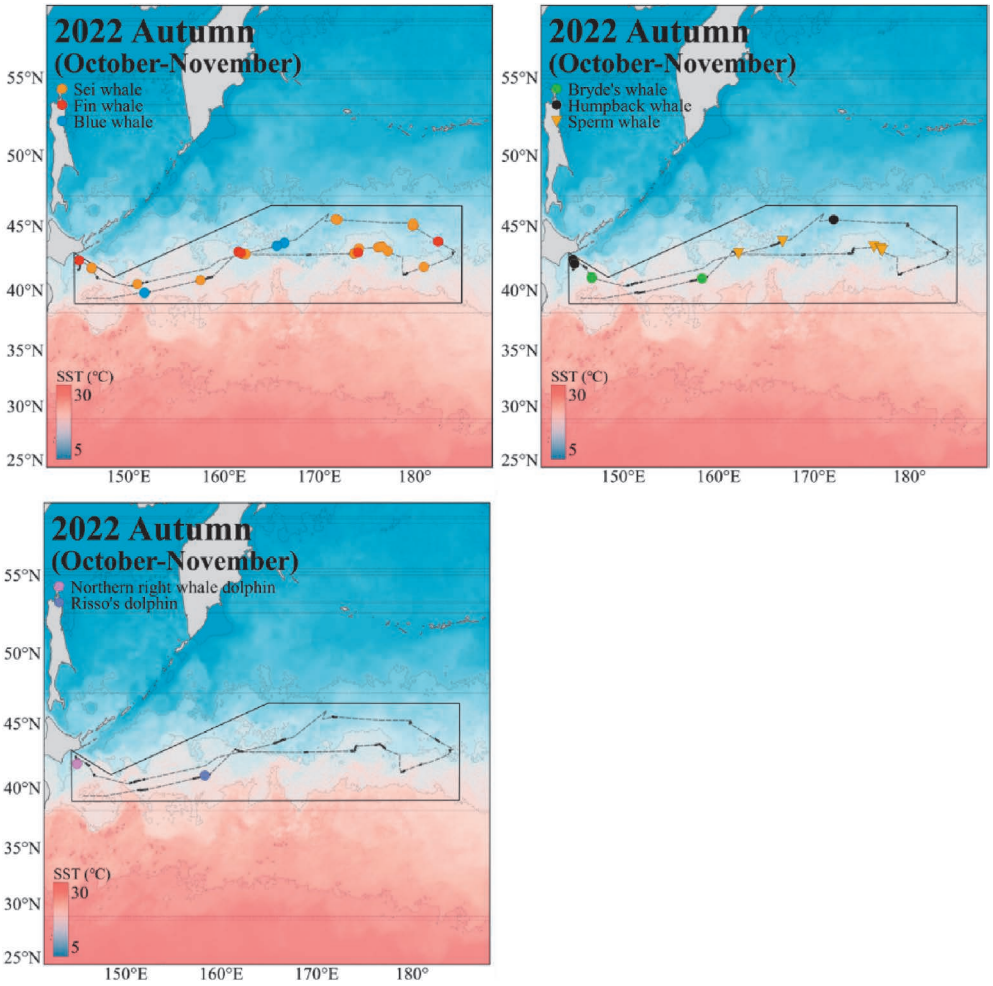

Figure 6. The locations of large and small cetaceans sighted during autumn 2022. Rolling 32-days average sea surface temperature data from 16 October to 16 November 2022 obtained by MODIS-Aqua (Original data: Ocean color web, from https://oceancolor.gsfc.nasa.gov/ (Accessed 2023-4-20)), are also shown.

Sei whale

A total of 32 schools (44 individuals) were sighted (Figure 6). The range of SST at the sighting positions was 10.1°C–17.8°C (mean SST: 13.4°C). Mean school size 1.38. Biopsy samples were collected from 16 individuals, and satellite tags were attached on 16 individuals.

Bryde's whale

Three schools (three individuals) were sighted (Figure 6) with estimated body lengths of 11.3 m, 11.8 m, and 12.8 m. SST at the sighting position were 14.6°C, 14.9°C and 18.5°C.

Common minke whale

This species was not sighted in the autumn season.

Humpback whale

Four schools (four individuals) were sighted (Figure 6). The range of SST in the sighting position was 10.4°C–12.9°C (mean SST: 11.6°C).

Sperm whale

In total, seven schools (nine individuals) were sighted (Figure 6). Mean school size was 1.29. The range of SST was 10.7°C–15.0°C (mean SST: 13.7°C).

Small cetaceans

In this season, two species of the family Delphinidae were sighted (Table 6): Risso's dolphin (1/8) and northern right whale dolphin (1/6).

Experiments

Sighting distance and angle experiment

In spring, the Estimated Angle and Distance Experiment was conducted by *KY7* on 26 April and 28 May. It was conducted on 5 May by *YS1* and on 11 May by *YS2*. In late summer, the experiment was conducted on 15 September by *KY7* and on 3 September by *YS1*. The results of this experiment will be used for calibrating the sighting distances and angle data used for the calculation of abundance estimates.

Photo-ID

The number of individual photographed is shown in Table 7, by species. All photographs were stored in the ICR catalogs and will be used for investigating the stock structure and movement of those cetacean species in the future.

Biopsy sampling

A total of 30 biopsy samples were collected during the 2022 dedicated sighting surveys. Table 8 shows the number of biopsies, by seasonal survey, research vessels and

Table 7

Numbers of individuals photographed during the 2022 dedicated sighting surveys, by seasonal survey, research vessel and species.

Species	Spring				Late summer			Autumn	Total
	KY7 (Apr.)	*KY7* (May)	*YS1*	*YS2*	*KY7* (Aug.)	*KY7* (Sep.)	*YS1*	*YS2*	
Blue whale	0	0	0	0	0	0	0	2	2
Humpback whale	1	1	4	1	0	0	0	0	7
North Pacific right whale	0	0	0	1	0	0	0	0	1
Killer whale	0	2	0	0	0	0	0	0	2
Total	1	3	4	2	0	0	0	2	12

Table 8

Numbers of biopsy samples collected during the 2022 dedicated sighting surveys, by seasonal survey, research vessel and species.

Species	Spring				Late summer			Autumn	Total
	KY7 (Apr.)	*KY7* (May)	*YS1*	*YS2*	*KY7* (Aug.)	*KY7* (Sep.)	*YS1*	*YS2*	
Fin whale	0	0	0	1	0	0	0	0	1
Sei whale	0	0	0	0	0	0	0	16	16
Bryde's whale	0	0	6	0	0	0	0	0	6
Common minke whale	0	3	2	1	0	0	0	0	6
North Pacific right whale	0	0	0	1	0	0	0	0	1
Total	0	3	8	3	0	0	0	16	30

species. All samples were stored at the ICR laboratory and will be used in genetic analyses for investigating the stock structure of those species in the future.

Satellite tagging

Satellite tag attachments were attempted during each seasonal survey, but attachments only occurred during spring and autumn. The number of individuals tagged is shown in Table 9, by seasonal survey, research vessel and species. A total of 16 sei whales were tagged, all in autumn. These were evenly attached among the sightings (Figure 7). Tracking data obtained from satellite tags will contribute to the elucidation of the movement of whales in each season and the timing of the start of migration between high latitude feeding areas and low latitude breeding areas.

HIGHLIGHTS OF THE SURVEY

The sighting surveys conducted in 2022 were completed successfully. They provided unique data obtained not only in the late summer, but also in the spring and autumn seasons for which information on cetacean distribution and abundance have been very scarce. Some main characteristics of the surveys are summarized below.

A large number of fin and common minke whales were sighted in April–June in the Japanese side of the Sea of Okhotsk. Common minke whales were mainly sighted east coast of the Shiretoko Peninsula and west coast of 144°E. On the other hand, fin whales were sighted east of 144°E which suggests that these species were separated in distribution at the western coast of the Sea of Okhotsk. Direct feeding behavior was not observed, but seabirds were concentrated close to the sighting positions of fin and common minke whales. From this, it is possible that these two species were distributed in this area for feeding during this season.

A large number of humpback whales were sighted in April–June in the southern part of the Pacific side of Japan. Most of humpback whales were sighted south of 40°N probably during their northward migratory path. At the same time, it was confirmed that Bryde's whales were also distributed south of 37°N, although in small numbers.

The August-September survey covered the North Pacific from the coast of Japan to 154°E, providing important late summer sighting data for Bryde's and sperm whales. At the same time, several sighting data for fin, common minke and humpback whales were obtained in

Table 9

Numbers of individuals attached with satellite tags, by each season and research vessel in 2022.

Species	Spring				Late summer			Autumn	Total
	KY7 (Apr.)	*KY7* (May)	*YS1*	*YS2*	*KY7* (Aug.)	*KY7* (Sep.)	*YS1*	*YS2*	
Fin whale	0	0	0	1	0	0	0	0	1
Sei whale	0	0	0	0	0	0	0	16	16
Bryde's whale	0	0	5	0	0	0	0	0	5
Common minke whale	0	0	0	1	0	0	0	0	1
Total	0	0	5	2	0	0	0	16	23

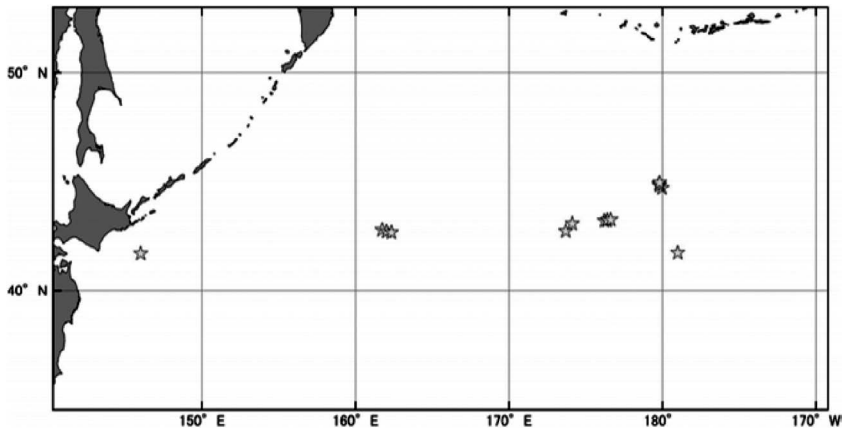

Figure 7. The locations of tagged sei whales during autumn 2022. Locations were obtained from photographs taken at the time of the tagging.

this season. These three species were sighted north of 40°N. Compared to previous surveys conducted during the same seasons and same research area (Katsumata *et al.*, 2021), Bryde's whales in 2022 were more northernly distributed. The northward extention of this species could have been influenced by higher monthly mean SSTs between 41°N–43°N than in 2020 (Figure 8). The monthly mean SST between 41°N–43°N was higher than in 2020, which could explain the northward migration of this species.

Consistent with previous surveys in 2020 (Katsumata *et al.*, 2021), no common minke whales were sighted in the pelagic part. Murase *et al.* (2023) reported the mean SST for sighting position of this species over the past four years (2002, 2004, 2005, 2006) was 15.5°C. In this season, the monthly mean SST at the research area was higher than 16°C, and cold water below 16°C formed north of 43°N. From this, it is considered that common minke whales distribution was shifted to the north in 2022.

In October–November, a large number of sei whales were sighted in the northwest side of the Pacific. Sei whales were distributed in high density near 180°, and the SST in this area was in the 10°C range. Although just a single feeding behavior was observed, this area could be a feeding area for this species because seabirds were concentrated around the sighting positions. Satellite tags were successfully attached on 16 individuals to study the movement and southern migration of sei whales. The study of the migration will contribute to resource management by assisting the interpretation of the genetic analyses on stock structure. Several blue, fin, humpback and sperm whales were also sighted in this area.

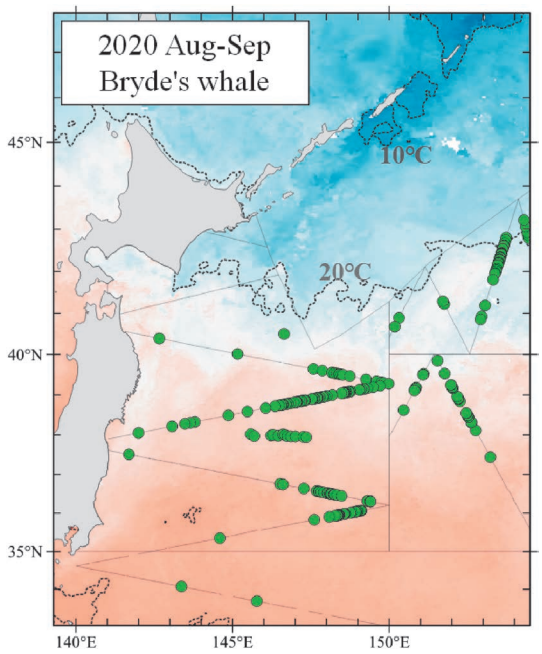

Figure 8. Sighting position of Bryde's whales and monthly SSTs in the 2020 sighting survey (modified from Katsumata *et al.*, 2021).

As in the previous surveys, the 2022 surveys collected data on small cetaceans in the same way as large cetaceans. The analyses of these data will provide valuable information on the distribution and abundance of small cetaceans in different seasons.

ACKNOWLEDGEMENTS

We acknowledge the Government of Japan's assistance in providing the research permits and funding for these cruises. We also thank the Captains Koji Maki, Chikamasa Okoshi, Hidenori Kasai, Yasuaki Sasaki, and their officers and crew of the *Yushin-Maru*, *Yushin-Maru* No. 2 and *Kaiyo-Maru* No. 7 for their hard work and dedication that led to the successful execution of these surveys. We express our deep gratitude to Takashi Hakamada and Megumi Takahashi of the Institute of Cetacean Research (Tokyo) for expert support in planning survey design. We thank Yoshihiro Fujise and Tsutomu Tamura and the staff of the Institute of Cetacean Research (ICR) and Kyodo Senpaku Co., Ltd. for their assistance in arrangements and support for the cruise. We also thank Kenji Konishi of ICR for satellite tagging and Mioko Taguchi of ICR for biopsy sample management. Finally, we thank Luis A. Pastene for his assistance in preparing this report and to the Editorial Team of TEREP-ICR for editorial work.

REFERENCES

Buckland, S.T., Cattanach, K.L. and Miyashita, T. 1992. Minke whale abundance in the northwest Pacific and the Okhotsk Sea, estimated from 1989 and 1990 sighting surveys. *Rep. int. Whal. Commn* 42: 387–392.

International Whaling Commission. 2001. Report of the Workshop to Review the Japanese Whale Research Program under Special Permit for North Pacific Minke whales (JARPN). *J. Cetacean Res. Manage.* (Suppl.) 3: 377–413.

International Whaling Commission. 2008. IWC SOWER Cruise 2008/09, Information for Researchers. https://iwc.int/private/downloads/-m4RVc06JhBVw3ymd3oPcw/Guide%20%20for%20Researchers%202008-09.pdf. [Available from the IWC Secretariat].

International Whaling Commission. 2010. The Report of the Expert Workshop to review the Ongoing JARPNII Programme. *J. Cetacean Res. Manage.* (Suppl.) 11 (2): 405–450.

International Whaling Commission. 2012. Requirements and Guidelines for Conducting Surveys and Analyzing Data within the Revised Management Scheme. *J. Cetacean Res. Manage.* (Suppl.) 13: 509–517.

International Whaling Commission. 2016. Report of the Expert Panel of the final review on the western North Pacific Japanese Special Permit Programme (JARPNII). Paper SC/66b/REP/06 presented to the IWC Scientific Committee, June 2016 (unpublished). 96 pp. [Available from the IWC Secretariat].

International Whaling Commission. 2019. Report of the Scientific Committee. Annex Q. *J. Cetacean Res. Manage*. (Suppl.) 20: 394–412.

Kanaji, Y., Iwasaki, T., Kishiro, T. and Miyashita, T. 2012. Cruise report of the sighting and satellite tagging survey for common minke whales in the sub-area 7 in 2011. Paper SC/64/O9 presented to the IWC Scientific Committee, June 2012 (unpublished). 10 pp. [Available from the IWC Secretariat].

Katsumata, T., Yoshida, T., Isoda, T., Yamaguchi, F., Yamazaki, M., Takahashi, M., Murata, H. and Matsuoka, K. 2021. Results of the Japanese dedicated cetacean sighting survey in the western North Pacific in 2020 summer season. Paper SC/68C/ASI/14 presented to the IWC Scientific Committee, April–May 2021 (unpublished). 18 pp. [Available from the IWC Secretariat].

Larsen, F. 1998. Development of a biopsy system primarily for use on large cetaceans. Paper SC/50/O15 presented to the IWC Scientific Committee, May 1998 (unpublished). 8 pp. [Available from the IWC Secretariat].

Matsuoka, K., Ensor, P., Hakamada, T., Shimada, H., Nishiwaki, S., Kasamatsu, F. and Kato, H. 2003. Overview of minke whale sightings surveys conducted on IWC/IDCR and SOWER Antarctic cruises from 1978/79 to 2000/01. *J. Cetacean Res. Manage*. 5 (2): 173–201.

Miyashita, T., Kato, H. and Kasuya, T. 1995. *Worldwide Map of Cetacean Distribution based on Japanese Sighting Data (Volume 1)*. National Research Institute of Far Seas Fisheries, Shimizu, Shizuoka, Japan. 140 pp.

Miyashita, T. and Kato, H. 2004. Plan for the North Pacific minke whale sighting surveys in 2004. Paper SC/56/RMP3 presented to the IWC Scientific Committee, June 2004 (unpublished). 3 pp. [Available from the IWC Secretariat].

Miyashita, T. and Kato, H. 2005. Plan for the minke whale sighting surveys in the North Pacific in 2005. Paper SC/57/NPM2 presented to the IWC Scientific Committee, June 2005 (unpublished). 5 pp. [Available from the IWC Secretariat].

Murase, H., Matsuoka, K. and Watanabe, K. (2023). Effect of sea surface temperature on the distribution of common minke whales off southeastern Hokkaido, Japan, between 2002 and 2006, with notes on the formation of Pacific saury fishing grounds. *Cetacean population studies* 4: 7–18.

Shimada, H. 2004. Abundance estimate of the western North Pacific stock of Bryde's whales using sighting data from 1998 to 2002. Paper SC/56/PFI6 presented to the IWC Scientific Committee, June 2004 (unpublished). 8 pp. [Available from the IWC Secretariat].

Thomas, L., Buckland, S.T., Rexstad, E.A., Laake, J.L., Strindberg, S., Hedley, S.L., Bishop, J.R.B., Marques, T.A. and Burnham, K.P. 2010. Distance software: design and analysis of distance sampling surveys for estimating population size. *Journal of Applied Ecology* 47 (1): 5–14.