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INTERNATIONAL
WHALING COMMISSION

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ABSTRACT

Systematic large-scale vessel-based sighting surveys were conducted in 2021/2022 by Japan to examine the distribution and abundance of large whales in the western North Pacific. In these years, the surveys were conducted in spring, autumn and winter seasons. Previous information on distribution and abundance in these seasons is poor. The research area was set between 35ºN-46ºN and 141E-150ºE. The surveys were conducted between 10 April 2021 and 18 March 2022. The research vessels *Yushin-Maru, Yushin-Maru No.2* and *Kaiyo-Maru No.7* were engaged in the surveys. A total of 4,956.3 n.miles was searched by the passing mode in the research area. In total, seven large whale species including fin (50 school /70 individual), sei (27/31), Bryde's (164/201), common minke (17/18), North Pacific right (1 /1), humpback (70/87) and sperm (168/479) whales were sighted during whole research. Experiments on photo-id, biopsy and satellite tracking were conducted to obtain data and samples for future studies on the distribution, abundance and stock structure of large whales.

KEYWORDS: VESSEL-BASED SIGHTING SURVEY, NORTH PACIFIC, NORTH PACIFIC RIGHT WHALE, FIN WHALE, BRYDE'S WHALE, SEI WHALE, COMMON MINKE WHALE, HUMPBACK WHALE, SPERM WHALE

INTRODUCTION

In the western North Pacific dedicated cetacean sighting surveys were conducted in summer 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). 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 SC (IWC, 2001; 2010; 2016; Pastene *et al*., 2009; Hakamada *et al.*, 2009; Matsuoka *et al*., 2014; 2016; Murase *et al*., 2009). 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, 2010; 2016).

In this year, in addition to the usual summer season survey (Katsumata *et al*., 2022), sighting surveys were also conducted in the spring (April-June), autumn (October-November) and winter (January-March) seasons. The objective of these surveys was to provide basic information on the distribution and abundance of large whales in poorly documented seasons. The research area was set up along the coast of Japan to investigate the distribution of common minke whales in particular. Furthermore, according to Nakamura and Iwase (2020), acoustic signals from fin whales were detected by S-net (Seafloor observation network for earthquakes and tsunamis along the Japan Trench) from early autumn to spring months. The S-net is located off the Pacific coast of eastern Japan from the Japan Trench to the Kuril Islands Trench. In this study, assuming fin whales distribute in mid-latitude waters from autumn to spring, the survey area was set between 35°N -46°N experimentally.

This paper reports the result of the Japanese dedicated sighting surveys conducted during April 2021 to March 2022.

MATERIALS AND METHODS

Research permits
All research activities conducted on Japanese EEZ and high seas international waters reported here were authorized under permit SUIKAN 2-3143, 3-176, 3-262, 3-1745, 3-2527 and 3-2715 issued by Fisheries Agency, Government of Japan.

Research vessels
The surveys were conducted by the research vessels *Yushin-Maru* (*YS1*), *Yushin-Maru No.2* (*YS2*) and *Kaiyo-Maru No.7* (*KY7*). The vessels were equipped with a top barrel platform (TOP), IO barrel platform (IOP) and upper bridge. Specifications of these vessels are shown in Appendix A.

Research area, period and vessel assignment
Spring season (April to June)
Three research areas were set up. The first area (Figure 1a) was set up between 43°N-46°N and 142°E-146°E, and the *KY7* surveyed this area from east to west (survey period: 7 April – 28 April, 2021). The second area (Figure 1b) was set up between 35°N-43°N and 140°E-146°E. The *YS2* surveyed this area from north to south (survey period: 14 April – 31 May, 2021). Finally, the third area (Figure 1c) was set up between 35°N-42°N and 142°E-150°E. This area was divided by 147°E and the *YS1* surveyed from north to south on the west side and from south to north on the east side (survey period: 14 May – 30 June, 2021).

Autumn season (October to November)
The single research area (Figure 1d) was set up between 38°N-42°N and 141°E-147°E. The *KY7* surveyed this area from south to north (survey period: 18 October – 24 November, 2021).

Winter season (January to March)
Two research areas were set up. The first area (Figure 1f) was set up between 38°N-43°N and 140°E-146°E, and the *YS1* surveyed this area from north to south (survey period: 22 January – 10 March, 2022). The second area was set up between 38°N-42°N and 141°E-147°E. The *KY7* surveyed this area from north to south (survey period: 6 March – 21 March, 2022).

Track line design
The survey blocks and pre-determined track lines are shown in Figures 1a to f. The start point of the track lines were decided randomly using the "Distance program ver. 7.0" (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).

Sighting procedure
The sighting survey in the spring season was conducted using (1) Normal Passing mode (NSP) and (2) Passing with Independent Observer mode (IO) in order to estimate whale abundance considering estimated *g(0)*. The sighting survey in the autumn and winter season was conducted using only Normal Passing mode (NSP). Both survey modes followed the protocol endorsed for the IWC/SOWER surveys (e.g. Matsuoka *et al*., 2003; IWC, 2008, 2012).

For NSP 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, when the weather conditions were acceptable for observations: visibility better than 2.0 n.miles and wind speed less than 17 knots in the spring and winter season, and less than 21knots in the autumn season. The searching speed was planned to be 10.5 knots in the spring and autumn season and less than 10 knots in the winter with slight adjustment to avoid vibration of the vessel.

Research personnel
One or two researchers were on board of each research vessel. The researchers had considerable experience in whale

line-transect surveys in the North Pacific and the Antarctic as well as experience conducting photo-ID and biopsy experiments through participation in the IWC/POWER and NEWREP-NP programs.

Spring
Yushin-Maru (*YS1*)
Seiichiro Teruya (Japan)– sighting data, photo-ID, biopsy, satellite tag
Kosuke Maehashi (Japan)– sighting data, photo-ID, biopsy, satellite tag
Yushin-Maru No.2 (*YS2*)
Isamu Yoshimura (Japan)– sighting data, photo-ID, biopsy, satellite tag
Reiko Nagata (Japan)– sighting data
Kaiyo-Maru No.7 (*KY7*)
Futoshi Yamaguchi (Japan) – sighting data, photo-ID, biopsy, satellite tag
Autumn
Kaiyo-Maru No.7 (*KY7*)
Taiki Katsumata (Japan) – sighting data, photo-ID, biopsy, satellite tag
Nana Sawada (Japan) – sighting data
Winter
Yushin-Maru (*YS1*)
Riki Ohmukai (Japan)– sighting data, photo-ID, biopsy, satellite tag
Kaiyo-Maru No.7 (*KY7*)
Shinya Kawabe (Japan) – sighting data, photo-ID

Experiments
Distance and angle experiments were conducted in the spring season to evaluate measurement error. The experiments were conducted late in the survey following 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 the upper deck. Further, biopsy skin sampling using the Larsen system (Larsen, 1998) was conducted when North Pacific right, blue, fin, sei, Bryde's, common minke and humpback whales were sighted. A satellite tagging experiment using the Air Rocket Transmitter System (LK-ARTS) was also conducted for fin, sei, Bryde's and common minke whales.

RESULTS AND DISCUSSION

Searching effort
A summary of searching effort in each survey is shown in Table 1. A total of 4,956.3 n.miles were searched in the whole research area and seasons. In the spring season, the total searching effort was 2,292.9 n.miles; in the autumn season 978.7 n.miles; and in the winter season1684.8 n.miles.

Sightings
Sightings were summarized by each vessel in Table 2. The sighting location of each species in each season is shown in Figures 1a to f.

Sightings by seasons
Spring season
The *KY7* sighted two large whale species, fin (25/32) and common minke (4/4) whales (Figure 1a). The *YS2* sighted five large whale species including fin (3/3), Bryde's (5/8), common minke (6/6), humpback (33/42) and sperm (29/54) whales (Figure 1b). The *YS1* sighted six large whale species including fin (1/1), sei (20/24), Bryde's (145/178), common minke (5/6), humpback (15/17) and sperm (83/190) whales (Figure 1c). This season, sei and Bryde's whale were sighted nearly 1° north of the previous survey in 2019 (Katsumata *et al*., 2020). The sea surface temperatures around 40 °N and 145 °E were about 5 °C warmer in previous years (Figures 1a-c), which may affect the distribution and migration of these whales.

Autumn season
In total five large whale species were sighted: fin (2/2), sei (7/7), Bryde's (14/15), humpback (17/22) and sperm (6/19) whales (Figure 1d). In this season, sea surface temperatures were also warmer along the Pacific coast than in previous years (Figures 1d). S-net recorded the sounds of fin whales, and these were confirmed visually. In this season, sei whales were also sighted in coastal areas in previous surveys in 2019 and 2020 (Katsumata *et al*., 2020; Matsuoka *et al*., 2021), but it tends to be sighted only offshore this year. The sea surface temperatures north of 40 °N were about 1–2 °C warmer in previous years (Figures 1d), which may affect the distribution and migration of these whales. However, humpback whales tended to be found along the coast, as in 2019 and 2020 surveys. The effect of water temperature seems to vary by species.

Winter season

The *YS1* sighted five large whale species: NP right (1/1), fin (9/13), common minke (1/1), humpback (4/4) and sperm (42/182) whales (Figure 1e). The *KY7* sighted four large whale species: fin (10/18), common minke (1/1), humpback (1/2) and sperm (8/34) whales (Figure 1f). Sea surface temperatures were 5 ºC lower in this season along the Pacific coast than in previous years (Figures 1e-f). S-net recorded the sounds of fin whales, and more fin whales were sighted than in any other season. One highlight of this survey is that fin whales and North Pacific right whales were visually observed in eastern Hokkaido and Sanriku at this season.

Experiments

Photo-id

Photographs were taken of North Pacific right (n=1) and humpback (n=13) whales (Table 3). All photographs were stored in the ICR catalogs and will be used for investigating their stock structure and movement in the future.

Biopsy sampling

Allocation of research time to biopsy sampling was initially restricted with the aim of maximizing the sighting searching effort to cover the research area. A total of 26 biopsy samples were collected from North Pacific right (n=1), fin (n=7), sei (n=13) and humpback (n=5) whales (Tables 4). All samples were stored at the ICR laboratory and will be used in genetic analyses for investigating stock structure of large whales in the future.

Satellite tracking

Detailed results of satellite tracking experiments are shown in Appendix B.

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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. Comn* 42:387-92.

Hakamada, T., Matsuoka, K. and Miyashita, T. 2009. Distribution and the number of western North Pacific common minke, Bryde's, sei and sperm whales distributed in JARPNII Offshore component survey area. SC/J09/JR15. 18pp. [Paper available at the IWC Office].

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.* 3 (Supp.):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.

International Whaling Commission. 2010. The Report of the Expert Workshop to review the ongoing JARPN II Programme. *J. Cetacean Res. Manage.* 11 (Supp.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.* 13 (Supp.):509-517

International Whaling Commission. 2016. Report of the Expert Panel of the final review on the western North Pacific Japanese Special Permit programme (JARPN II). SC/66b/REP/06. 96pp. [Paper available at the IWC Office].

International Whaling Commission. 2019. Report of the Scientific Committee. Annex U: Statement from Japan regarding Japan's withdrawal from the IWC. 1pp. Nairobi, Kenya, 2019. [Paper available at the IWC Office].

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. SC/64/O9. 10pp. [Paper available at the IWC Office].

Katsumata, T., Yoshimura. I., Tsunekawa. M., Kawabe. S. and Matsuoka, K. 2020. Results of the Japanese dedicated cetacean sighting survey in the western North Pacific in 2019 and 2020. SC/68b/ASI18. 18 pp. [Paper available at the IWC Office].

Katsumata, T., Takahashi, M., Teruya, S., Watanabe, R., Irie, A. and Matsuoka, K. 2022. Results of the Japanese dedicated cetacean sighting survey in the North Pacific in 2021 summer season. SC/68d/ASIxx. 18 pp. [Paper available at the IWC Office].

Larsen, F. 1998. Development of a biopsy system primarily for use on large cetaceans. SC/50/o15. 8pp. [Paper available at the IWC Office].

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.

Matsuoka, K., Hakamada, T. and Miyashita, T. 2014. Recent sightings of the North Pacific Right (*Eubalaena japonica*) whales in the western North Pacific based on JARPN and JARPN II surveys (1994 to 2013). SC/65b/BRG11. 8pp. [Paper available at the IWC Office].

Matsuoka, K., Katsumata, T., Yoshimura, I., Yamaguchi, F., Ohmukai, R., Konishi. K., Tahakashi, M. and Hakamada, T. Results of the Japanese dedicated cetacean sighting survey in the western North Pacific in autumn and winter season 2020/21. SC/68c/ASI10. 14pp. [Paper available at the IWC Office].

Miyashita, T., Kato, H. and Kasuya, T. 1995. *Worldwide Map of Cetacean Distribution based on Japanese Sighting Data (Volume 1)*. pp43-56.

Miyashita, T. and Kato H. 2004. Plan for the North Pacific minke whale sighting surveys in 2004. SC/56/RMP3. 3pp. [Paper available at the IWC Office].

Miyashita, T. and Kato H. 2005. Plan for the minke whale sighting surveys in the North Pacific in 2005. SC/57/NPM2. 5pp. [Paper available at the IWC Office].

Murase, H., Hakamada, T., Kiwada, H., Inagake, D., Okazaki, M., Tojyo, N. and Matsuoka, K. 2009. Preliminary results of estimation of sei whale (*Balaenoptera borealis*) distribution and abundance in the whole North Pacific basin. Appendix 2. 11pp. *In:* Hakamada, T., Examination of the effects on whale stocks of future JARPN II catches. SC/J09/JR36. 56pp. [Paper available at the IWC Office].

Nakamura, T. and Iwase, R. 2020. Spatiotemporal distribution of fin whale signals in northeast Japan. Poster presented at: JpGU – AGU joint meeting 2020. 12 July – 15 July, 2020. Virtual meeting.

Pastene, L,A., Hatanaka, H., Fujise, Y., Kanda, N., Murase, H., Tamura, T., Miyashita, T. and Kato, H., 2009. The Japanese Whale Research Program under Special Permit in the western North Pacific Phase-II (JARPN II): origin, objectives and research progress made in the period 2002-2007, including scientific considerations for the next research period. SC/J09/JR1 (Rev 1). 73pp.

Shimada, H. 2004. Abundance estimate of the western North Pacific stock of Bryde's whales using sighting data from 1998 to 2002. SC/56/PIF6. 8pp.

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.

Table 1. Summary of the survey periods and searching effort by each season.

Season	Vessel	Survey period in the research area	Searching effort (n.miles)
Spring	*KY7*	2021/04/7 - 2021/04/28	514.1
	YS2	2021/04/14 - 2021/05/31	810.2
	YS1	2021/5/14 - 2021/6/30	968.6
Autumn	*KY7*	2021/10/18 - 2021/11/24	978.7
Winter	*YS1*	2022/01/22 - 2022/03/10	1,135.7
	KY7	2022/03/6 - 2022/03/21	549.1
Total			4,956.3

Table 2. Numbers of sightings by species, vessel and season.

Species	KY7 2021 Apr				YS2 2021 Apr-May				YS1 2021 May-June				KY7 2021 Oct-Nov				YS1 2022 Jan-Mar				KY7 2022 Mar				Total			
	Prim.		Second.		Prim.		Second.		Prim.		Second.		Prim.		Second.		Prim.		Second.		Prim.		Second.		Prim.		Second.	
	sch.	Ind.	sch.	Ind.	sch.	Ind.	sch.	Ind.	sch.	Ind.	sch.	Ind.	sch.	Ind.	sch.	Ind.	sch.	Ind.	sch.	Ind.	sch.	Ind.	sch.	Ind.	sch.	Ind.	sch.	Ind.
Fin whale	24	30	1	3	2	2	1	1	1	1	0	0	2	2	0	0	6	8	3	5	9	17	1	1	44	60	6	10
Sei whale	0	0	0	0	0	0	0	0	18	21	2	3	7	7	0	0	0	0	0	0	0	0	0	0	25	28	2	3
Bryde's whale	0	0	0	0	4	7	1	1	145	178	0	0	14	15	0	0	0	0	0	0	0	0	0	0	163	200	1	1
Common Minke whale	2	2	2	2	6	6	0	0	4	5	1	1	0	0	0	0	1	1	0	0	1	1	0	0	14	15	3	3
North Pacific right whale	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	0
Humpback whale	0	0	0	0	30	37	3	5	15	17	0	0	15	19	2	3	3	3	1	1	1	2	0	0	64	78	6	9
Sperm whale	0	0	0	0	29	54	0	0	83	190	0	0	5	16	1	3	42	182	0	0	8	34	0	0	167	476	1	3

Table 3. Numbers of photo-id by species, vessel and season.

Species	*YS2* 2021 Apr-May	*YS1* 2021 May-Jun	*KY7* 2021 Oct-Nov	*YS1* 2022 Jan-Mar	*KY7* 2022 Mar	Total
North Pacific right whale	0	0	0	1	0	1
Humpback whale	7	4	1	0	1	13

Table 4. Numbers of biopsy samples by species, vessel and season.

Species	*YS2* 2021 Apr-May	*YS1* 2021 May-Jun	*YS1* 2022 Jan-Mar	Total
Fin whale	2	0	5	7
Sei whale	0	13	0	13
North Pacific right whale	0	0	1	1
Humpback whale	4	1	0	5

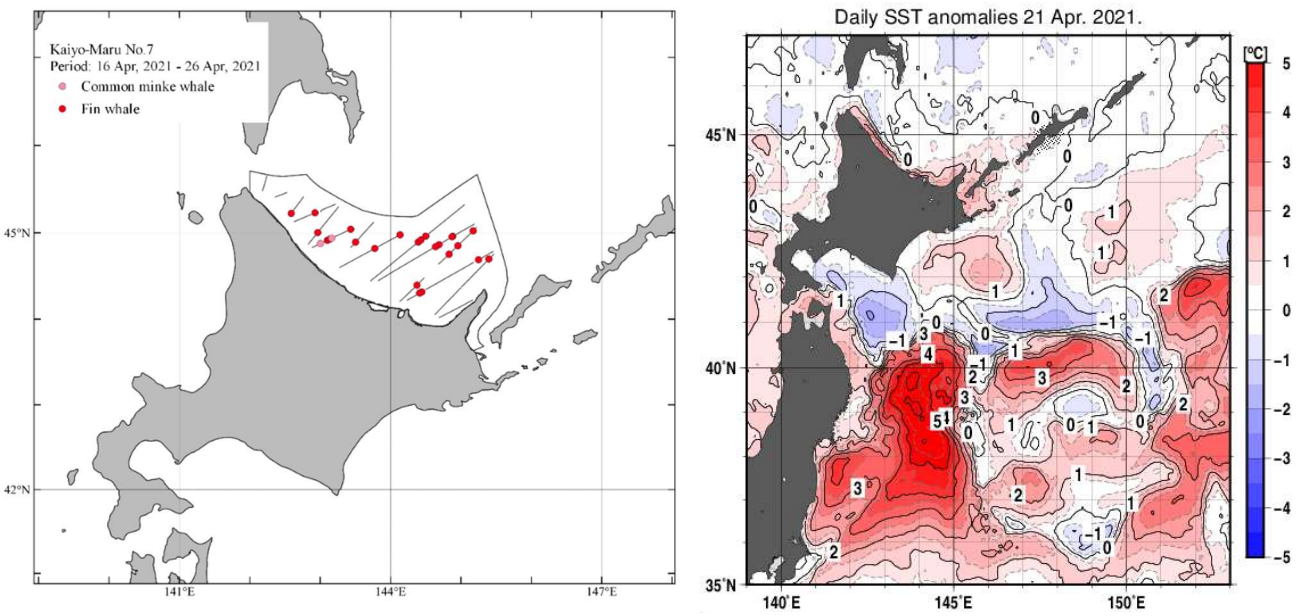

Figure 1a. The survey area and sighting locations of large whales by *KY7* in the spring season (left) and sea surface temperature anomalies in the middle date of survey period analyzed from satellite and buoy/vessel observations for the period 1991-2020 (right; from the Japan Meteorological Agency website https://www.data.jma.go.jp/gmd/kaiyou/data/db/kaikyo/daily/sst_HQ.html).

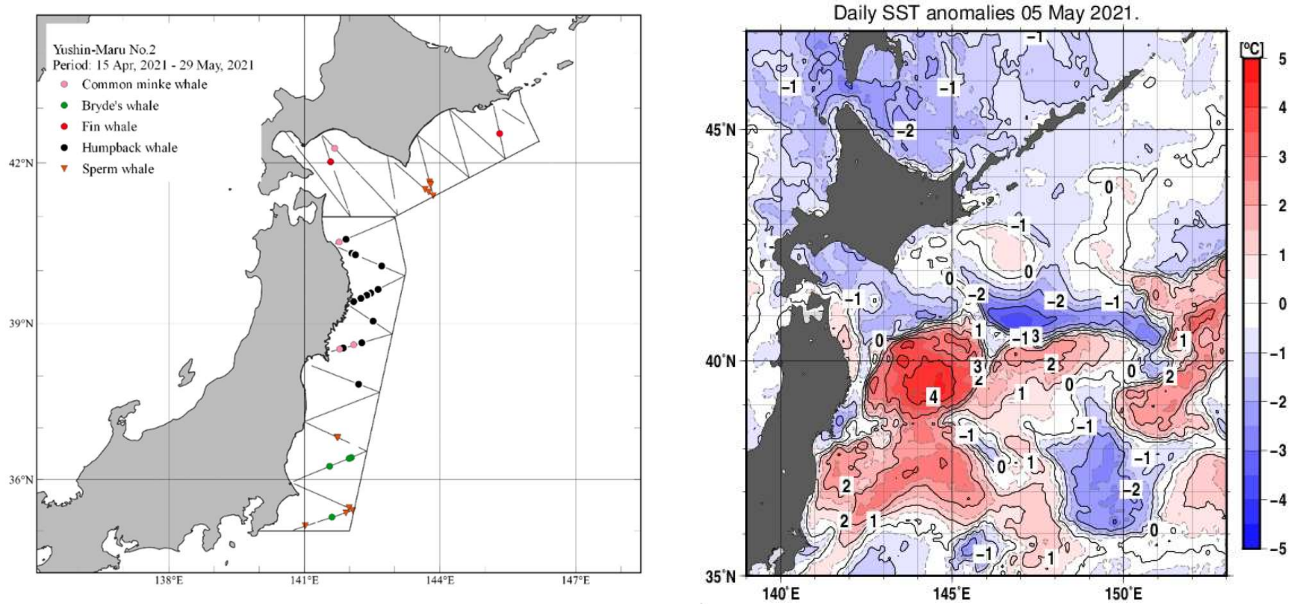

Figure 1b. The survey area and sighting locations of large whales by *YS2* in the spring season (left) and sea surface temperature anomalies in the middle date of survey period analyzed from satellite and buoy/vessel observations for the period 1991-2020 (right; from the Japan Meteorological Agency website https://www.data.jma.go.jp/gmd/kaiyou/data/db/kaikyo/daily/sst_HQ.html).

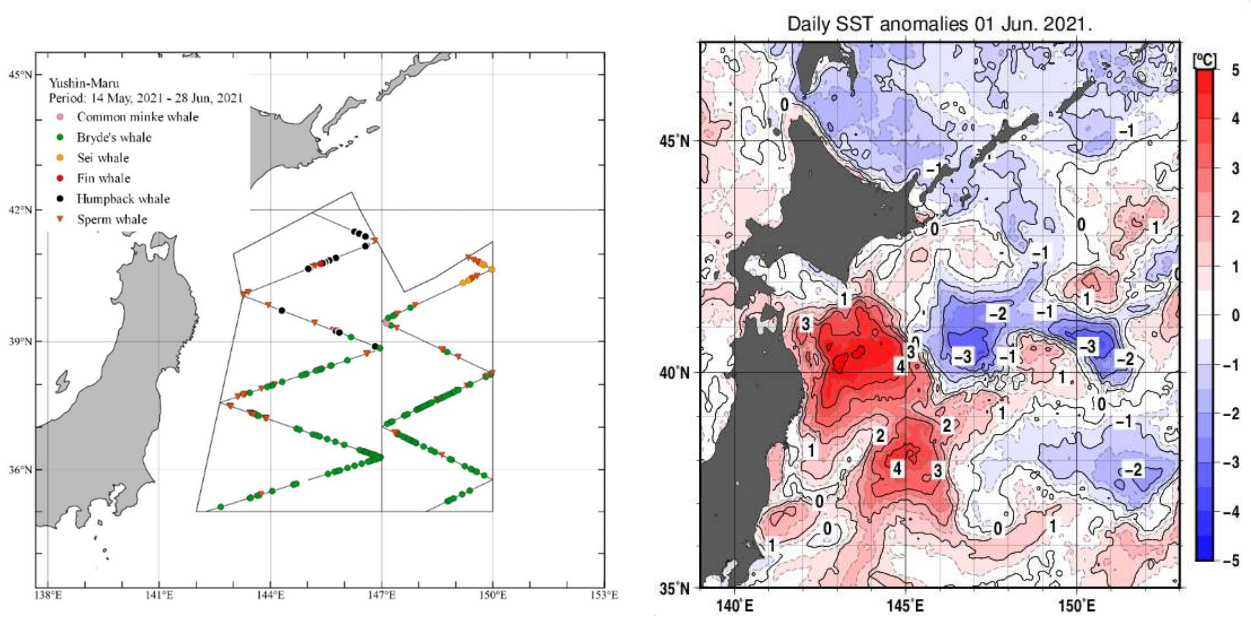

Figure 1c. The survey area and sighting locations of large whales by *YS1* in the spring season (left) and sea surface temperature anomalies in the middle date of survey period analyzed from satellite and buoy/vessel observations for the period 1991-2020 (right; from the Japan Meteorological Agency website https://www.data.jma.go.jp/gmd/kaiyou/data/db/kaikyo/daily/sst_HQ.html).

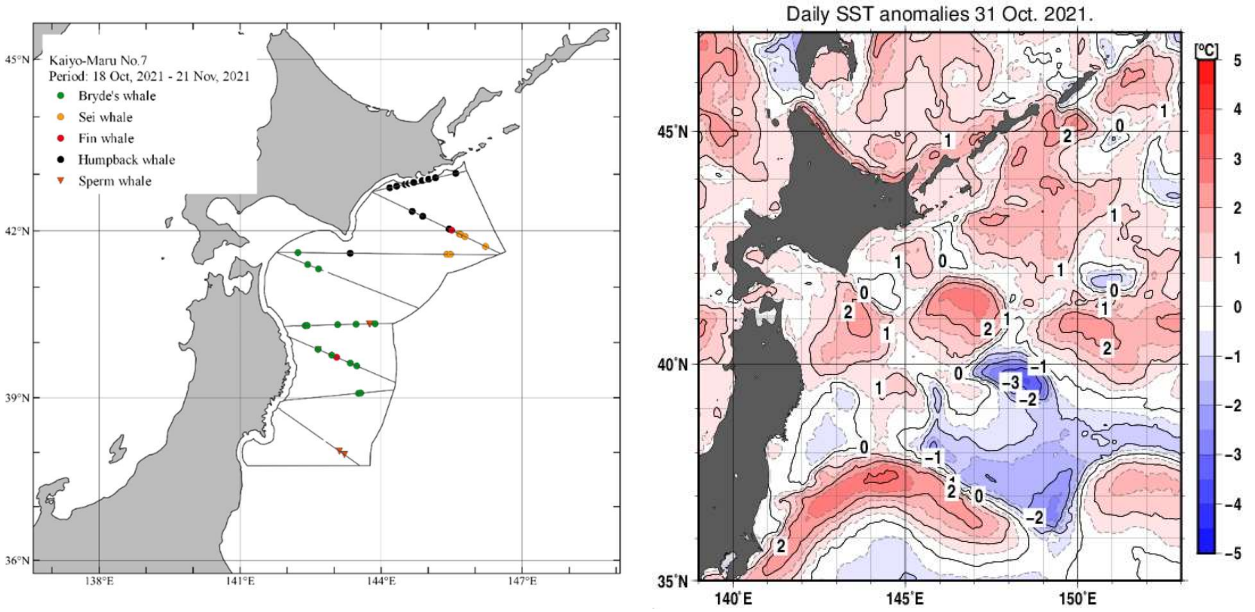

Figure 1d. The survey area and sighting locations of large whales by *KY7* in the autumn season (left) and sea surface temperature anomalies in the middle date of survey period analyzed from satellite and buoy/vessel observations for the period 1991-2020 (right; from the Japan Meteorological Agency website https://www.data.jma.go.jp/gmd/kaiyou/data/db/kaikyo/daily/sst_HQ.html).

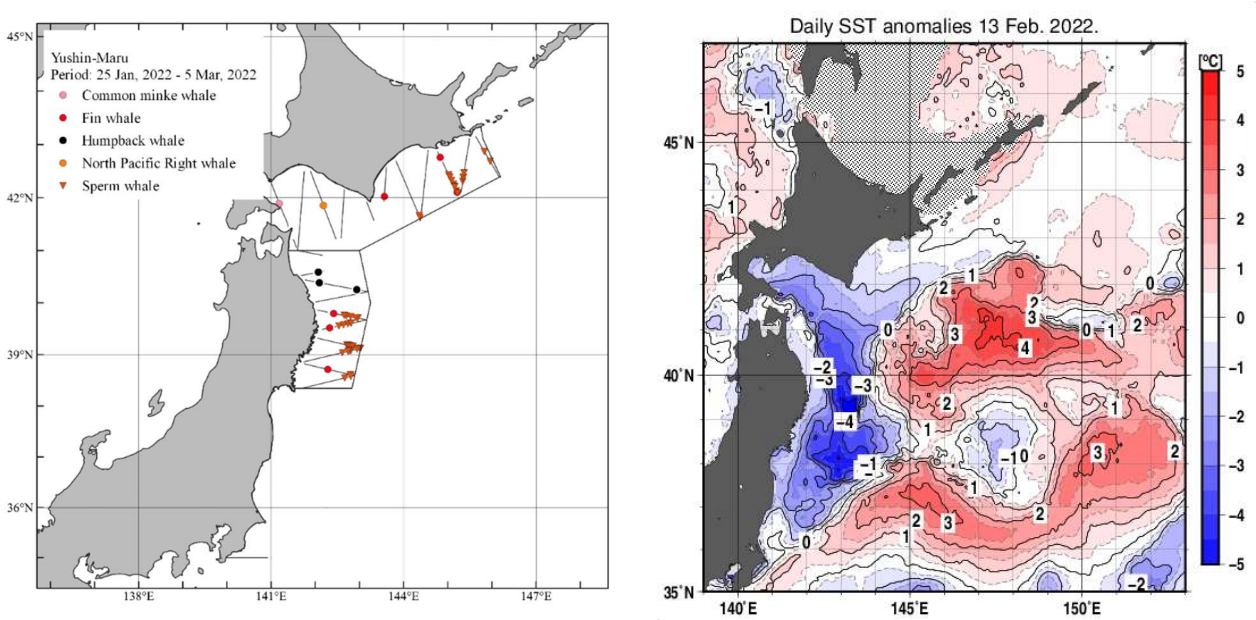

Figure 1e. The survey area and sighting locations of large whales by *YS1* in the winter season (left) and sea surface temperature anomalies in the middle date of survey period analyzed from satellite and buoy/vessel observations for the period 1991-2020 (right; from the Japan Meteorological Agency website https://www.data.jma.go.jp/gmd/kaiyou/data/db/kaikyo/daily/sst_HQ.html).

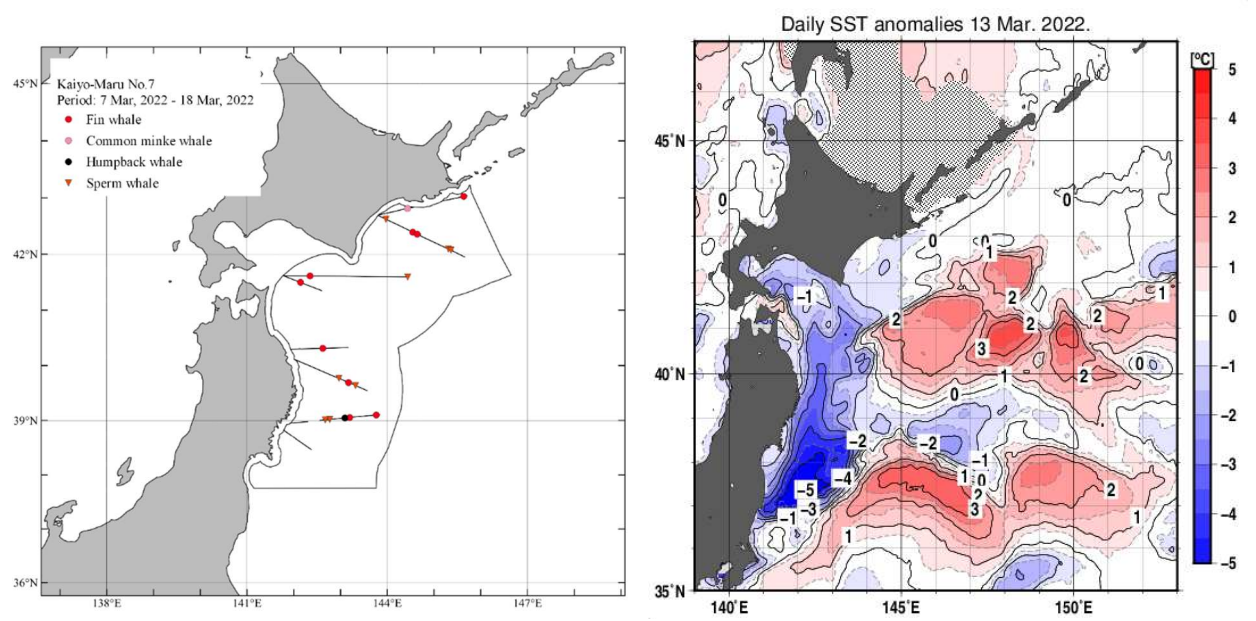

Figure 1f. The survey area and sighting locations of large whales by *KY7* in the winter season (left) and sea surface temperature anomalies in the middle date of survey period analyzed from satellite and buoy/vessel observations for the period 1991-2020 (right; from the Japan Meteorological Agency website https://www.data.jma.go.jp/gmd/kaiyou/data/db/kaikyo/daily/sst_HQ.html).

Appendix A. Ship specifications of *Yushin-Maru, Yushin-Maru No.2* and *Kaiyo-Maru No.7.*

Ship photos: Left: *Yushin-Maru*, Middle: *Yushin-Maru No.2*, Right: *Kaiyo-Maru No.7*

Ship specifications:

	Yushin-Maru	*Yushin-Maru No.2*	*Kaiyo-Maru No.7*
Call sign	JLZS	JPPV	JECL
Length overall [m]	69.61	69.61	60.02
Gross tonnage (GT)	724	747	649
TOP barrel height [m]	19.5	19.5	17.5
IO barrel height [m]	13.5	13.5	12.7
Upper bridge height [m]	11.5	11.5	9.6
Bow height [m]	6.5	6.5	4.5
Engine power [PS / kW]	5280/3900	5280/3900	2100 / 1544

Appendix B.

RESULTS OF THE SATELLITE-MONITORED TRACKING EXPERIMENT DURING THE SPRING 2021 AND WINTER 2022 SURVEY CRUISE

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Satellite-monitored tag is a useful tool to monitor distribution, movement and stock structure of baleen whales. Implantable satellite-monitored tags (113 mm SPOT6 with triangle stop plate; Wildlife Computers, Redmond, Washington, USA) were used for tracking whales. The tagging experiments were conducted by a sighting vessel (*Yushin-Maru*). The tags were deployed with the Air Rocket Transmitter System (ARTS) (LK-ARTS, Skutvik, Norway), a pneumatic air launcher. Biopsies were simultaneously sampled after the deployment of the satellite tags if possible and stored at -20°C for later molecular analyses. The detail of the deployment system is described in Konishi *et al*. (2020).

Nine sei and three fin whales were successfully tracked in spring 2021 and winter 2022, respectively (Table 1). Some tracked sei whales moved to Japan's coastal area and other sei whales spread for east or northeast area during their spring feeding season (Figure 1). The moving speeds were slow and track directions were not stable as they were in feeding activities.
Deployments for fin whales were conducted off northern Japan in February in 2022 (Figure 2). The tracked fin whales all moved to south and then moved to southeast offshore area. The tracking of two fin whales ended in the end of February and March, and another tracking was still ongoing by 30 March. In this latter case, the fin whale occurred above the continental shelf and also in deeper water off continental slope. These and previous tracking data will be analyzed to investigate distribution, movement and stock structures of two whale species.

REFERENCES

Konishi, K., Isoda, T., Bando, T., Minamikawa, S. and Kleivane, L. 2020. Antarctic minke whales find ice gaps along the ice edge in foraging grounds of the Indo-Pacific sector (60° E and 140° E) of the Southern Ocean', *Polar Biology*. 43(4), pp. 343–357. doi: 10.1007/s00300-020-02638-x.

Table 1

Summary of the satellite-monitored tags satellite during spring cruise in 2021 and winter cruise in 2022 in the western North Pacific.

No.	Vessel	Date	Species	School size	Longitude (degree North)	Latitude (degree East)	PTT ID	Biopsy samples
1	YS1	20210619	SE	1	40.3	149.2	181838	y
2	YS1	20210619	SE	1	40.4	149.4	196141	y
3	YS1	20210622	SE	2	40.8	149.6	196143	y
4	YS1	20210623	SE	2	40.9	149.8	181827	y
5	YS1	20210623	SE	2	40.9	149.8	196144	y
6	YS1	20210624	SE	1	40.8	149.8	196162	y
7	YS1	20210624	SE	2	41.0	149.9	196163	n
8	YS1	20210625	SE	1	41.0	149.6	196169	n
9	YS1	20210625	SE	1	40.8	149.3	196156	y
10	YS1	20220207	F	1	42.0	143.6	199003	y
11	YS1	20220219	F	2	40.8	142.2	199023	y
12	YS1	20220219	F	2	40.8	142.2	198994	y

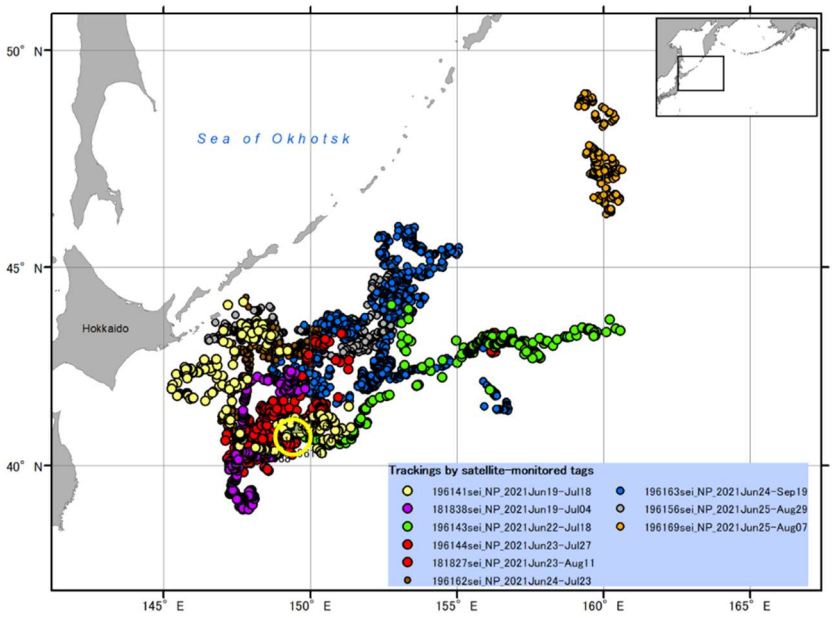

Figure 1. Track locations of sei whales tagged in June-September 2021. The red triangle symbol is the position of deployment. Yellow circle shows the main deployment area in the survey cruise in June.

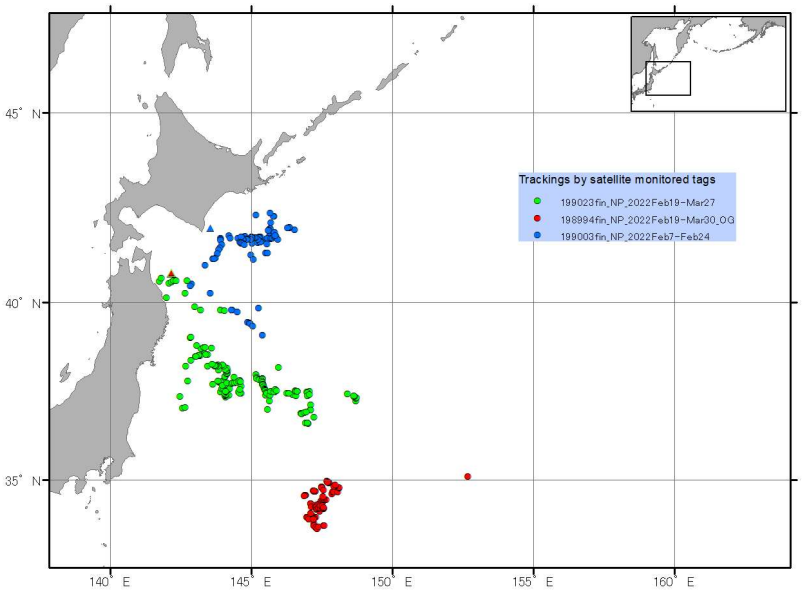

Figure 2. Track locations of fin whales tagged in February 2022. The triangle symbols are the position of deployment. Triangle symbols show the deployment positions. The deployment positions of two tags are overlapped. All Argos location qualities are used in this map.