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INTERNATIONAL WHALING COMMISSION

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ABSTRACT

A systematic large-scale and vessel-based sighting survey was conducted in 2017 by Japan to examine the distribution and abundance of large whales in the western North Pacific. The research area was set between 34° N and 45° N and between 140° E and 150° E (sub-areas 7CN and 7CS for common minke whale). The survey was conducted between 28 April and 27 May. The research vessels *Yushin-Maru* and *Yushin-Maru No.3* were engaged. A total of 2,022.6 n.miles was searched by the passing mode in the research area. Coverage of the searching efforts of the planned cruise track line was 82.3% for the 7CN and 92.4% for the 7CS, respectively. In total, five large whale species including fin (3 schools / 3 individuals), Bryde's (7/7), common minke (24/25), humpback (15/16), North Pacific right (1/1) and sperm (19/41) whales were sighted during the cruise. Photo-ID images was collected from humpback (16 individuals) and North Pacific (1) whales. Biopsy skin samples using a Larsen system were collected from fin (1), humpback (7) and North Pacific right (1) whales, respectively. The sighting data submitted to the IWC secretary based on the SC guideline and will contribute to the work on management and conservation of large whales by the IWC SC.

KEY WORD: COMMON MINKE WHALE, BRYDE'S WHALE, HUMPBACK WHALE, NORTH PACIFIC RIGHT WHALE, SPERM WHALE, SURVEY VESSEL, NORTH PACIFIC

INTRODUCTION

In the western North Pacific dedicated cetacean sighting surveys based on the survey procedures of the International Whaling Commission/Southern Ocean Whale and Ecosystem Research (IWC/SOWER) have been conducted since 1995 as a part of the Japanese Whale Research Program under Special Permit in the Western North Pacific (JARPN/JARPNII). 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*., 2016, Murase *et al*., 2009). The National Research Institute of Far Seas Fisheries (NRIFSF) has also conducted dedicated sighting survey 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, 2012). In 2017 the Government of Japan planned to continue the sighting surveys in the North Pacific. The collection of sighting data to estimate abundance and biopsy/photo-identification data to examine stock structure have been contributed to the work on management and conservation of large whales by the IWC SC (IWC, 2010, 2017a). This paper reports the result of the Japanese dedicated sighting surveys conducted during mainly July to August in 2017. The plan for this survey had been presented to the 2017 IWC/SC meeting (Hakamada *et al*., 2017) and endorsed by the SC (IWC, 2017b).

MATERIALS AND METHODS

The surveys were conducted in 2017 in the part of the western North Pacific by the research vessel *Yushin-Maru* (YS1) and *Yushin-Maru No.3* (YS3). The vessels were equipped with a top barrel platform (TOP) and upper bridge. Specifications of these vessels are shown in Appendix A.

Research area and period

The research area was set between 34° N and 45° N and between 140° E and 150° E (sub-areas 7CN and 7CS for common minke whale, see Figure 1), during 28 April to 27 May (Table 1).

Track line design

The Survey blocks and pre-determined track lines are shown in Table 2 and Figure 1. The start point of the track lines are decided at random using the "Distance program (ver.6.2)" and the number of the line (width in the longitude) is decided by the research schedule based on the IWC survey guideline (IWC, 2012).

Sighting procedure
Passing mode with abeam closing was used, which followed the protocol endorsed for the IWC/SOWER cruise (IWC, 2008). There were two primary observers in the top barrel (TOP) and the upper bridge (captain and helmsman), respectively. On the TOP, two observers conducted searching for cetaceans by using scaled binoculars (7x). On the upper bridge, two primary observers also searched for cetaceans and recorded sighting information. The survey was conducted 12 hours per day from 6:00 a.m. to 6:00 p.m. basically when the weather conditions were suitable for observations: visibility better than 2.0 n.miles and wind speed less than 21 knots. The vessel searching speed was planned to be 11.5 knots with slight adjustment to avoid vibration of vessel.

Research personnel
One researcher was on board of each research vessel. The researchers had considerable experience on whale line transect surveys in the North Pacific and Antarctic as well as experience conducting photo-ID and biopsy experiments through participation in the IWC/IDCR-SOWER and JARPN II Programs.

Yushin-Maru (YS1)
Yu Ueda (Japan) – sighting data, photo-ID, biopsy
Yushin-Maru No.3 (YS3)
HTakashi Kominami (Japan)– sighting data, photo-ID, biopsy

Experiments
Distance and angle experiments were conducted earlier in the Surveys. The experiment to evaluate measurement error was conducted late in the survey following the protocol of the IWC/SOWER cruise (IWC, 2008). When large cetaceans such as blue, humpback and North Pacific right whales were found, photo-id experiments were conducted. Further, biopsy skin sampling using Larsen system, when blue, fin, sei, humpback, North Pacific right and sperm whales were sighted.

RESULTS AND DISCUSSION

Brief narrative of the Surveys
Research vessels (YS1 and YS3) departed from Shiogama (YS1) and Shimonoseki (YS3), Japan on 28 April and started the survey in the research area on 30 April for YS1 and 1 May for YS3, respectively (Table 1). The YS1 surveyed in the 7CN and YS3 surveyed in the 7CS. They surveyed on the pre-determined trackline from north to the south in each stratum (Tables 2a and 2b, Figure 1). The vessels left the research area on 23 May (YS3) and 26 May (YS1), and arrived at their port on 27 May.

Searching effort
A summary of the period covered and sighting effort in each Survey block is shown in Table 3. A total of 1,052.0 n.miles (planned cruise track was 1,277.8 n.miles, 82.3 % searching effort coverage) in the sub-area 7CN, and 970.6 n.miles (planned cruise track was 1,051.0 n.miles, 92.4% covered) in the sub-area 7CS were searched, respectively. A total of 2,791.8 n.miles were searched in the whole research area.

Sightings
Sightings made are summarized by the whole research period (Table 4) and sighting location of each species in the research area are shown in Figures 2a to 2e.

Estimated Angle and Distance
The Estimated Angle and Distance Training Exercise were conducted early in the Surveys. During the exercise the observers familiarized themselves with distance estimates from the TOP and Upper Bridge. The Estimated Angle and Distance Experiment were conducted on 21 May by YS1, and 29 May by YS3.

Fin Whale
A total of 3schools (3 individuals) of this species were sighted in the northern part of 7CN and 7CS (Figure 2a). Observed mean school size was 1.00. Range of the estimated body length confirmed was 14.5 – 19.7 meters. Range of sea temperature of sighting position was 4.9°C – 13.3°C.

Bryde's Whale
Because of beginning of the migration season of this species, they were only sighted in the southern part of 7CS (7 schools and 7 individuals) (Table 4 and Figure 2a). Observed mean school size was 1.00. Range of the estimated body length was 11.8 – 13.1 meters. Range of the sea temperature of the sighting position was 18.2°C – 22.1°C. In general, Bryde's whales are widely distributed in summer (from July to September) in the western North Pacific north of 35ºN based on the recent JARPNII dedicated sighting surveys (Shimada, 2004; Pastene *et al*., 2009; Hakamada *et al.*, 2017).

Common minke whale
This species were sighted most frequently in the research area (24 schools and 25 individuals). No mother and calf pair was observed. They mainly sighted in the offshore part of 7CN and middle part of 7CS (Figure 2b). There were no sighting of this species in the coastal region of 7CN. Range of the estimated body length was 4.6-8.3 meters. Range of sea temperature of sighting position was 3.1°C – 16.9°C.

Humpback whale
Humpback whales were sighted frequently for baleen whales in the research area (15 schools and 16 individuals, including one mother and calf pair). They were mainly sighted in the western part of 7CN and northern part of 7CS (Figure 2b). Observed mean school size was 1.07 (n=15). Range of the estimated body length was 9.1 – 13.2 meters except calves. Range of sea temperature of sighting position was 2.9°C – 10.0 °C.

North Pacific right whale
North Pacific right whale was most rare species for baleen whales in the research area (a solitary school). It was sighted in the northern part of the research area (Figure 2c). Estimated body length from top barrel by experienced observer was 12.3 meters. The sea temperature of sighting position was 4.6°C. Head of this animal was photographed and a biopsy sample was also collected (Table 5 and 6b).

Sperm Whale
Sperm whales were the most frequently sighted toothed whales in the whole research area (Tables 4 and Figure 2c). A total of 19 schools (41 individuals) were observed during the Survey. Observed mean school size was 2.15 (n=19). Because of limited approaching to the schools, there was little information for body length and calves. Range of the sea temperature of the sighting position was 10.5°C – 21.6°C.

Experiments
Sighting distance and angle experiment
A training was conducted in 2 May for 1 hour 52 minutes, and the actual experiments (104 trials) were successfully conducted on 21 May for 3 hours 16 minutes by YS1. A training was conducted in 1 May for 1 hour 16 minutes, and the actual experiments (80 trials) were successfully conducted on 19 May for 3 hours 46 minutes by YS2. The results of this experiment will be used for the calculation of abundance estimates.

Photo-ID experiments
Photographs were taken from humpback (18) and North Pacific right (1) whales (Table 5). All photographs were stored at the ICR catalogue such as North Pacific right whale database (Matsuoka *et al*., 2014) and will be used for investigating their stock structure in the future.

Biopsy
All of the biopsy attempts were made using the Larsen system (Larsen, 1998). Allocation of research time to biopsy attempts was initially restricted with the aim of maximizing the searching effort to cover the research area. A total of 2 biopsy samples were collected from fin (1), humpback (7) and North Pacific right (1) whale individuals (Tables 6a and 6b). All samples were stored at the ICR laboratory and will be used for investigating their stock structure in the future.

Report of the IWC oversight and data submission to the IWC
Detailed report of the IWC oversight was shown in Appendix B. All equipment and the survey method were the same as in the past sighting surveys. The design of the survey blocks and track lines was improved to cover each survey block based on the IWC guidelines. The planned sighting procedure was in accordance with the guidelines agreed by the SC (IWC, 2012). Objectives and procedure of the survey were explained to the captains, officers, crew and researcher in advance. Sighting data was sent to the IWC secretary and confirmed on 20 February 2018.

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Table 1. Cruise itinerary of this survey.

Date	Event
28-April-2017	Vessels departed at Shiogama (YS1) and Shimonoseki (YS3), Japan
30-April-2017	YS1 arrived at the starting point in the research area (7CN)
1-May-2017	YS3 arrived at the starting point in the research area (7CS)
23-May-2017	YS3 completed the research (23 days in the 7CS)
26-May-2017	YS1 completed the research (27 days in the 7CN)
27-May-2017	Vessels arrived Shiogama (YS1) and Shimonoseki (YS3), Japan

Table 2a. Waypoint (WP) in the research area 7CN (upper tables) and 7CS (bottom table). Asterisks (*) indicate that sighting survey will not be conducted between the WP and next WP.

7CN	WP	Lat.				Lon.				
	101	43	-	2.3	N	145	-	50.1	E	
	102	43	-	15.0	N	145	-	33.5	E	*
	103	43	-	12.1	N	145	-	32.0	E	
	104	42	-	16.7	N	145	-	54.6	E	*
	105	42	-	16.5	N	145	-	54.2	E	
	106	43	-	0.2	N	145	-	1.7	E	*
	107	43	-	1.4	N	145	-	0.3	E	
	108	43	-	1.5	N	145	-	0.3	E	*
	109	43	-	3.9	N	144	-	51.3	E	
	110	43	-	1.4	N	144	-	52.4	E	*
	111	42	-	59.0	N	144	-	53.5	E	
	112	42	-	1.4	N	145	-	19.6	E	*
	113	42	-	1.3	N	145	-	19.3	E	
	114	42	-	59.4	N	144	-	13.1	E	*
	115	42	-	58.5	N	144	-	9.3	E	
	116	41	-	46.1	N	144	-	44.6	E	*
	117	41	-	46.0	N	144	-	44.4	E	
	118	42	-	43.1	N	143	-	42.2	E	*
	119	42	-	37.5	N	143	-	35.2	E	
	120	41	-	30.7	N	144	-	9.6	E	*

7CN	WP	Lat.				Lon.				
	121	41	-	30.7	N	144	-	9.5	E	
	122	42	-	18.1	N	143	-	19.7	E	*
	123	41	-	57.2	N	143	-	12.3	E	
	124	41	-	15.3	N	143	-	34.6	E	*
	125	41	-	15.3	N	143	-	34.6	E	
	126	42	-	14.5	N	142	-	34.1	E	*
	127	42	-	26.7	N	142	-	11.5	E	
	128	41	-	0.0	N	142	-	59.6	E	
	129	42	-	34.2	N	141	-	25.3	E	*
	130	42	-	33.0	N	141	-	22.4	E	
	131	41	-	0.0	N	142	-	12.8	E	
	132	42	-	34.3	N	140	-	37.1	E	*
	133	42	-	34.1	N	140	-	36.4	E	
	134	41	-	57.4	N	140	-	55.9	E	*
	135	41	-	56.9	N	140	-	56.2	E	
	136	41	-	56.1	N	140	-	56.6	E	*
	137	41	-	43.3	N	141	-	3.4	E	
	138	41	-	21.8	N	141	-	14.7	E	

7CS	WP	Lat.				Lon.				
	201	35	-	7.1	N	140	-	10.7	E	
	202	35	-	7.2	N	140	-	10.2	E	*
	203	35	-	13.7	N	140	-	24.5	E	
	204	35	-	34.1	N	142	-	8.3	E	
	205	35	-	51.9	N	140	-	45.3	E	*
	206	36	-	3.9	N	140	-	37.6	E	
	207	36	-	23.7	N	142	-	20.4	E	
	208	36	-	44.0	N	140	-	44.2	E	*
	209	36	-	52.9	N	140	-	47.9	E	
	210	37	-	12.8	N	142	-	32.6	E	
	211	37	-	31.6	N	141	-	2.2	E	*
	212	37	-	42.0	N	141	-	0.9	E	
	213	38	-	1.4	N	142	-	44.7	E	
	214	38	-	16.3	N	141	-	31.6	E	*
	215	38	-	33.3	N	141	-	29.0	E	
	216	38	-	49.4	N	142	-	56.9	E	
	217	39	-	2.7	N	141	-	50.2	E	*
	218	39	-	24.0	N	141	-	57.4	E	
	219	39	-	36.9	N	143	-	9.0	E	
	220	39	-	50.7	N	141	-	58.8	E	*
	221	40	-	8.9	N	141	-	52.4	E	
	222	40	-	23.8	N	143	-	9.1	E	
	223	40	-	46.1	N	141	-	25.1	E	*
	224	40	-	48.1	N	141	-	24.7	E	
	225	41	-	0.0	N	142	-	17.7	E	*

Table 3. Summary of the survey periods and searching effort (n.miles).

Sub-area	Cruise period (y/m/d)	Research area period	Planned cruise track (n.miles)	Searching effort (n.miles)	Coverage of effort (n.miles)
7CN	2017/4/28-5/27	2017/4/30- 5/26	1,277.8	1,052.0	82.3%
7CS	2017/4/28-5/27	2017/5/1- 5/23	1,051.0	970.6	92.4%
Total	2017/4/28-5/27	2017/4/30- 5/26	2,328.8	2022.6	86.9%

Table 4. Number of sightings by species and stratum in the research area including transit survey between port and the research area.

Species	Transit to R.A.		7CN		7CS		Transit from R.A.		Total	
	sch.	Ind.	sch.	Ind.	sch.	Ind.	sch.	Ind.	sch.	Ind.
Fin whale	1	1	1	1	1	1	0	0	3	3
Bryde's whale	0	0	0	0	7	7	0	0	7	7
Common minke whale	0	0	12	12	12	13	0	0	24	25
Like minke	0	0	1	1	0	0	0	0	1	1
Humpback whale	0	0	9	9	6	7	0	0	15	16
North Pacific right whale	0	0	1	1	0	0	0	0	1	1
Sperm whale	0	0	1	2	18	39	0	0	19	41
Unid. Large whale	0	0	1	1	0	0	0	0	1	1

Table 5. Number of photo-ID individuals photographed, by each stratum.

Photo-ID	7CN	7CS	Total
Humpback whale	11	7	18
North Pacific right whale	1	0	1
Total	12	7	19

Table 6a. Number of biopsy samples collected, by each stratum.

Biopsy	7CN	7CS	Total
Fin whale	0	1	1
Humpback whale	2	5	7
North Pacific right whale	1	0	1
Total	3	6	9

Table 6b. Number of biopsy samples collected, by each stratum. Including one mother and calf pair in the Southern strata.

Vesl.	Sheet	Date	Sight	Sp.	Scl.	Sighted Position				Start time	End time	Experiment	Est. body length	number	number	Position	number	Sample	Shooting
	number		No.		size	Lat.	[min.]	Long.	[min.]	of BX	of BX	duration	of target ind. [m]	of shoot	of hit	struck	of sample	No.	equipment
YSl	BY101	20170430	7	R	1	42	17.45	145	54.31	13:07:28	13:49:07	00:41:39	12.3	1	1	RB1p	1	J17NYSlR01	Larsen
YSl	BY102	20170502	5	H	1	42	12.71	145	6.24	13:46:52	14:10:29	00:23:37	9.4	2	0	-	0	-	Larsen
YSl	BY103	20170511	1	H	1	41	38.95	143	21.98	14:55:35	15:16:41	00:21:06	12.3	2	0	-	0	-	Larsen
YSl	BY104	20170512	2	H	1	41	29.18	143	27.26	14:56:31	15:31:08	00:34:37	12.8	2	1	LC1	1	J17NYSlH01	Larsen
YSl	BY105	20170512	5	H	1	41	18.78	143	31.16	17:46:42	18:23:35	00:36:53	13.0	1	0	-	0	-	Larsen
YSl	BY106	20170517	4	H	1	41	56.28	142	28.47	12:40:56	13:23:13	00:42:17	11.2	1	0	-	0	-	Larsen
YSl	BY107	20170518	5	H	1	41	2.83	142	57.79	7:12:48	7:49:32	00:36:44	12.7	2	1	C1	1	J17NYSlH02	Larsen
YSl	BY108	20170518	10	H	1	41	15.14	142	44.51	9:56:21	11:03:55	01:07:34	10.8	6	0	-	0	-	Larsen
YS3	BY301	20170429	1	F	1	38	1551	136	16.24	17:16:07	17:38:58	00:22:51	14.5	2	1	RA	1	J17NYYS3FO1	Larsen
YS3	BY302	20170501	2	H	1	40	38.49	142	2	12:58:14	13:33:31	00:35:17	11.5	2	1	RC3	1	J17NYYS3HO1	Larsen
YS3	BY303	20170502	1	H	2	40	36.91	142	7.56	06:30:14	07:20:52	00:50:38	7.7,12.6	5	1	RC2	1	J17NYYS3HO2	Larsen
YS3	BY304	20170502	5	F	1	40	13.96	142	18.43	16:22:02	17:15:56	00:53:54	16.3	4	0	-	0	-	Larsen
YS3	BY305	20170502	6	H	1	40	12.68	142	11.99	17:54:55	18:18:06	00:23:11	9.1	3	1	RC3	1	J17NYYS3HO3	Larsen
YS3	BY306	20170503	3	H	1	39	48.04	142	12.18	10:23:38	11:04:49	00:41:11	9.6	2	1	RC1	1	J17NYYS3HO4	Larsen
YS3	BY307	20170507	1	H	1	38	40.96	142	10.81	09:41:26	10:15:43	00:34:17	13.2	2	1	C2	1	J17NYYS3HO5	Larsen
YS3	BY308	20170508	1	H	1	38	35.85	141	43.13	7:16:26	7:52:02	00:35:36	12.5	0	0	-	0	-	Larsen
YS3	BY309	20170509	9	K	3	38	3.34	142	34.89	11:08:48	11:28:17	00:19:29	99.9	0	0	-	0	-	Larsen

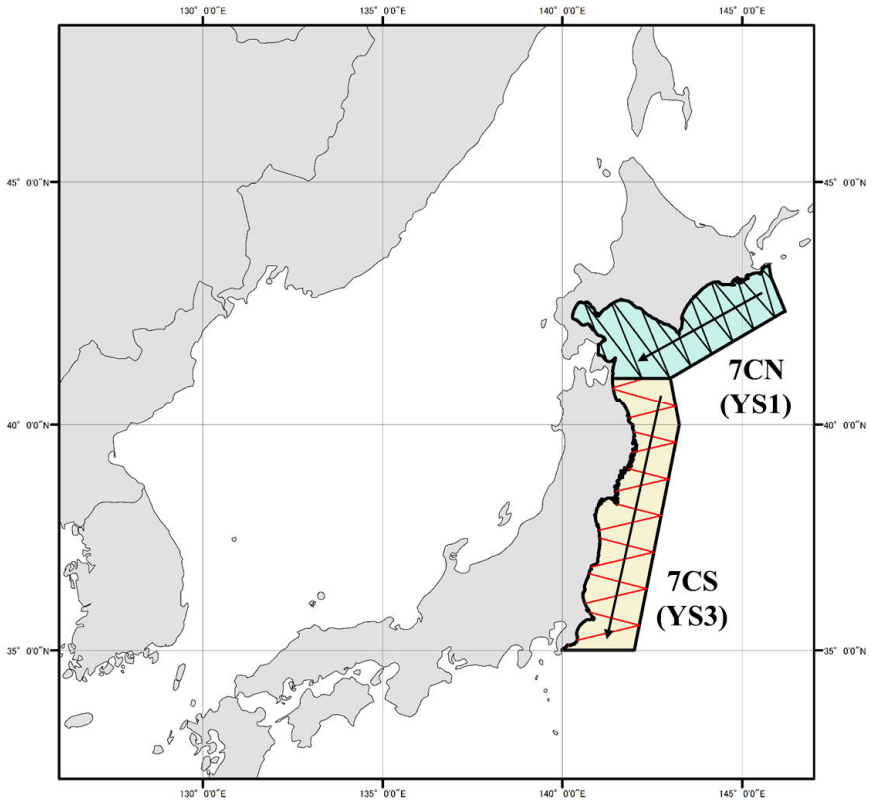

Figure 1. The 2017 research area and pre-determined track lines. Survey order followed a WP number in sequence (Table.

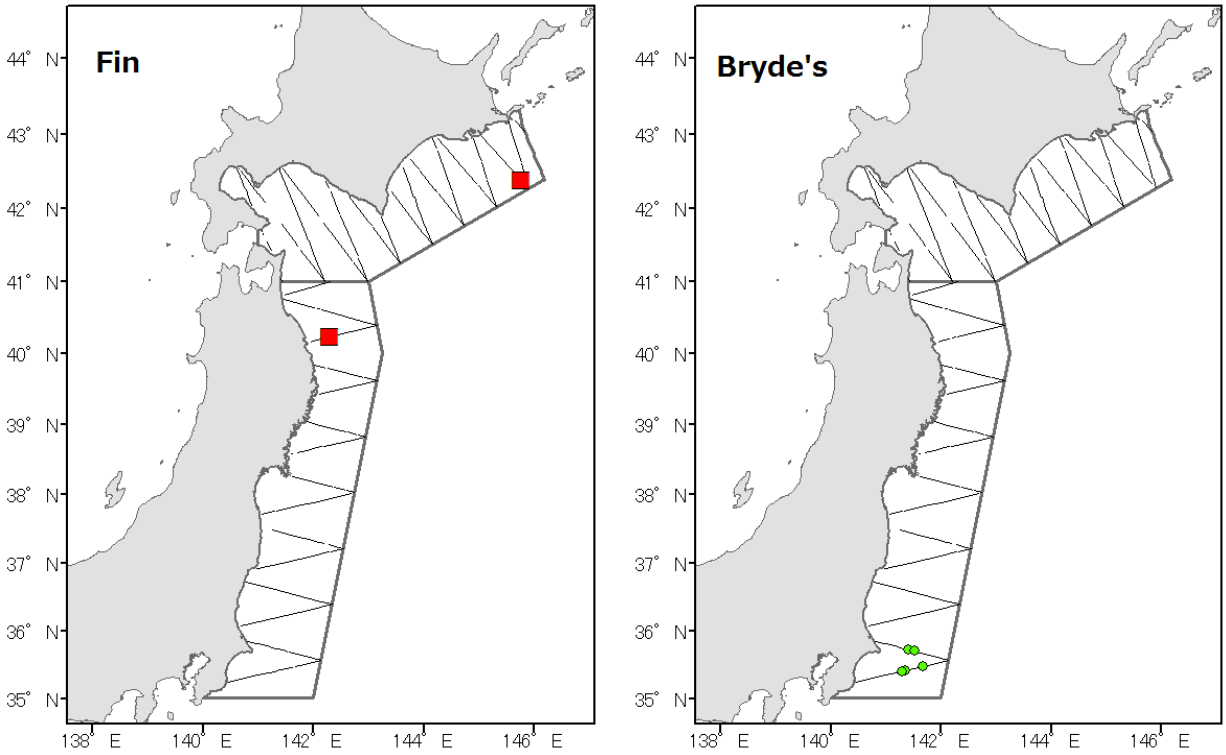

Figure 2a. Sighting locations of fin (left) and Bryde's (right) whales in the research area.

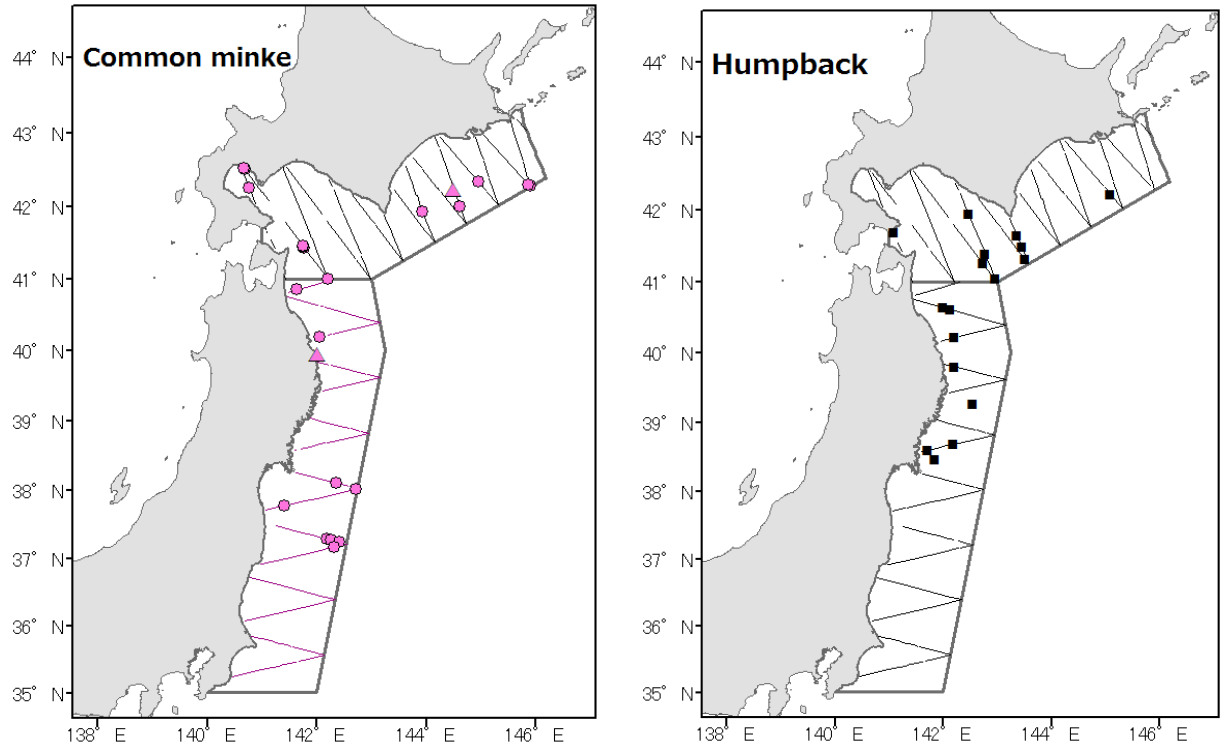

Figure 2b. Sighting locations of common minke (left) and humpback (right) whales in the research area.

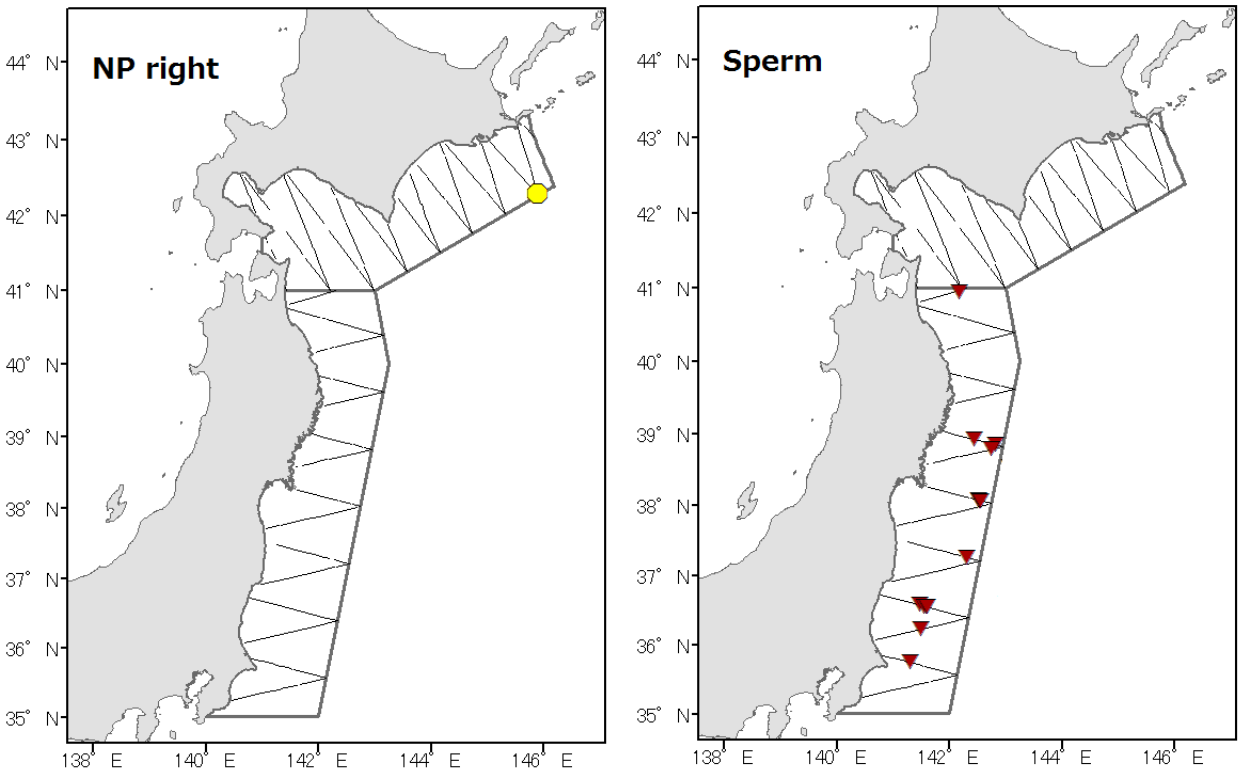

Figure 2c. Sighting locations of North Pacific right (left) and sperm (right) whales in the research area.

APPENDIX A. SHIP SPECIFICATIONS OF *YUSHIN-MARU AND YUSHIN-MARU NO.3*.

Ship photo:

Ship specifications:

	Yushin-Maru	*Yushin-Maru No.3*
Call sign	JLZS	7JCH
Length overall [m]	69.61	69.61
Gross tonnage (GT)	724	742
TOP barrel height [m]	19.5	19.5
IO barrel height [m]	13.5	13.5
Upper bridge height [m]	11.5	11.5
Bow height [m]	6.5	6.5
Engine power [PS / kW]	5280 / 3900	5280 / 3900

Appendix B. **Oversight for the 2017 Japanese dedicated sighting survey in the western North Pacific**

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The plan of this survey was presented to the 2017 IWC/SC meeting (Hakamada *et al*., 2017) and endorsed by the Scientific Committee (IWC, 2017). On behalf of the IWC Scientific Committee I carried out the oversight work during the 2017 Japanese dedicated sighting survey in the western North Pacific. This is a brief report of the oversight activities conducted on that survey.

Preparatory work

The pre-cruise meeting carried out at Shimonoseki on 27 April 2017. The survey organizers, researchers and crewmembers also participated in that meeting. During the meeting the organizers explained the objective of the survey and the procedure to be used for both sightings and experiments. The planned sighting procedure was in order with that agreed by the Scientific Committee. The research vessels *Yushin-Maru* and *Yushin-Maru No.3* were engaged for this survey.

The research area was set between 34° N and 45° N and between 140° E and 150° E. The survey was conducted between 28 April and 27 May. The vessels were assigned to cover pre-determined transects in these areas by the passing with abeam closing mode (NSP). Two experienced researchers were assigned to work on board each vessel.

Oversight method and period

The research activities of the vessels were oversight by e-mail communication and by examining the daily report prepared by each researchers on board. In some instances Inmarsat satellite telephone calls were made for further clarification of the activities, procedure and sightings made. Further, geographical positions and weather information of each vessel were tracked each other per day. Over sight activity were carried between 28 April and 27 May.

Brief narrative of the oversight vessel

Research vessels (YS1 and YS3) departed Japan on 28 April and started the survey in the research area on 30 April. The YS1 surveyed in the sub-area 7CN, and YS2 surveyed in the sub-area 7CS. The vessels left the research area and arrived at their port on 27 May.

Post-cruise meeting

I participated in a post-cruise meeting held on 27 May 2017 at Tokyo. Survey organizers, researchers and the Captain participated in that meeting. Apart to discuss and assess the results of the surveys, the researchers engaged in the verification and checking of data.

Conclusion

All equipment and the survey method of each vessel were the same as in the past sighting surveys. The design of the survey strata and track lines were improved to cover each strata completely. The planned sighting procedure was in accordance with the guideline agreed by the SC (IWC, 2012). Objectives and procedure of the survey were explained to the captains, officers, crew and researcher in advance. I then endorse the information and data obtained during the 2017 Japanese dedicated sighting survey in the western North Pacific.

Reference

IWC. 2012. Requirements and Guidelines for Conducting Surveys and Analysing Data within the Revised Management Scheme. J. Cetacean Res. Manage. (Suppl2.) 11:507-18.

IWC. 2017. Report of the Scientific Committee. Annex G. 23pp. Bled, Slovenia, 2017. [Paper available at the IWC Office].

Hakamada, T., Matsuoka, K. and Miyashita, T., 2017. Research plan for a cetacean sighting surveys in the Western North Pacific in 2017. SC/67a/ASI08. 6pp. [Paper available at the IWC Office].