Cruise report of the Japanese cetacean sighting survey in the western North Pacific in 2011

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ABSTRACT

Three systematic vessel-based sighting surveys were conducted in 2011 by Japan to examine the distribution and abundance of large whales in the Western North Pacific. The research area for 'Survey 1' was set between 43° N and 51° N and between 157° E and 170° E (sub-area 9N). The research area for 'Survey 2' was set between 35° N and 43° N and between 157° E and 170° E (sub-area 9S). The research area for 'Survey 3' was set between 35° N and 45° N, and between 150° E and 157°E (sub-area 8). Surveys 1 and 2 were conducted between 5 and 31 May and Survey 3 between 17 and 31 May. The research vessels *Yushin-Maru* (Survey 1) ,*Yushin-Maru No.2* (Survey 2) and *Yushin-Maru No.3* (Survey 3) were engaged in these surveys. A total of 1,466.0 n.miles, 1,492.8 n.miles and 1,101.5 n.miles were searched in Surveys 1, 2 and 3, respectively and a total searching distance on the track line was 4,060.3 n.miles in the Passing mode in the whole research area Blue whales were mainly sighted in Survey 3 around 38°N. Fin, humpback and North Pacific right whales were mainly sighted in Surveys 1 and 3. Sei whales were mainly sighted in Surveys 1 and 2. Common minke whales were sighted in Surveys 1 and 3. Sperm whales were widely sighted in the whole research area. In total, eight species including seven baleen whales (blue (4 schools / 4 individuals), fin (23/31), sei (32/51), Bryde's (3/6), common minke (3/3), humpback (27/35) and North Pacific right whales (13/20) and one toothed whale (sperm whale (60/116)) were sighted during the Surveys. Few encounters of common minke whales may be attributed to insufficient allocation of searching effort in the coastal waters and such a small number of sightings appear not to be suitable for estimating abundance of this species. Concentration areas of sei whales in Survey 2, humpback whales in Surveys 1 and 3 and North Pacific right whales in Survey 1 were observed, respectively. Photo-ID photographs were successfully taken from blue (3 individuals), humpback (5) and North Pacific right (19) whales. Biopsy skin samples were also successfully collected from blue (2), fin (2), humpback (2) and North Pacific right (14) whales.

KEY WORD: SEI WHALES, BRYDE'S WHALE, COMMON MINKE WHALES, BLUE WHALES, NORTH PACIFIC RIGHT WHALES, SPERM WHALES, 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, Pastene *et al*., 2007, 2008, 2009, Hakamada *et al.*, 2009, Matsuoka *et al*., 2009). The National Research Institute of Far Seas Fisheries (NRIFSF) also conducts dedicated sighting survey for cetaceans in the North Pacific since the 1980s (Buckland *et al.*, 1992; Miyashita and Kato, 2004; 2005). In 2011 the Government of Japan planed 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 will contribute to the work on management and conservation of large whales by the IWC SC (IWC, 2010).

This paper reports the results of the Japanese dedicated sighting surveys conducted in 2011 spring. The plan of these three 'Surveys' had been presented to the 2011 IWC/SC meeting (Matsuoka *et al*., 2011) and endorsed by the SC (IWC, 2011).

MATERIALS AND METHODS

Three 'Surveys' were conducted in 2011 in the western North Pacific, 'Survey 1' by the research vessel *Yushin-Maru* (YS1), 'Survey 2' by the *Yushin-Maru No.2* (YS2) and 'Survey 3' by the *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 Table 1.

Research area and period

The research area for Survey 1 was set between 43° N and 51° N and between 157° E and 170° E. The research area for Survey 2 was set between 35° N and 43° N and between 157° E and 170° E. The research area for Survey 3 was set between 35° N and 45° N, and between 150° E and 157°E (Figure 1). All Surveys were planned for May, Surveys 1 and 2 between 5 and 31 May and Survey 3 between 17 and 31 May (Table 2).

Track line design

The Survey blocks and pre-determined track lines are shown in Figures 1. Start point of the Track lines are decided based on the origin longitude line which were selected at random, and the number of the line (width in the longitude) is decided by the research schedule based on the IWC guideline (IWC,2005).

Sighting procedure

Passing mode with closing during the abeam 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 7:00 a.m. to 7:00 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 planed 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, Antarctic and West Africa as well as experience conducting photo-id and biopsy experiments through participation in the IWC/IDCR-SOWER and JARPN II Programs. Koji Matsuoka (Institute of Cetacean Research) was the oversight persons on behalf of the IWC/SC.

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. Biopsy skin sampling of blue, fin, sei, Bryde's, humpback, North Pacific right and sperm whales was opportunistically collected.

RESULT AND DISCUSSION

Brief narrative of the Surveys

Vessels (YS1 and YS2) departed from Shimonoseki, Japan on 28 April for Survey 1 and Survey 2 and started each survey in the research area on 5 May. These vessels finished research area on 31 May and arrived at Shimonoseki on 6 June. Vessel (YS3) departed from Shimonoseki, Japan on 13 May for Survey 3 and started survey in the research area on 17 May. The vessel finished research area on 31 May and arrived at Shimonoseki on 6 June (Table 2).

Searching effort

A summary of the period covered and sighting effort in each Survey is shown in Table 2. During Survey 1 a total of 1,466.0 n.miles were searched (61.5% covered); during Survey 2 a total of 1,492.8 n.miles were searched (51.7 % covered) in the passing mode. During Survey 3 a total of 1,101.5 n.miles were searched (71.8 % covered) in the passing mode.

Sightings

Sightings made are summarized in Table 3, by Survey and species. Figures 2a, 2b and 2c show the location of

these sightings.

Blue Whale
Blue whales were mainly sighted in Survey 3 around 38°N between 150°E and 157°E. A total of 4 schools (4 individuals) of blue whales were observed in the Surveys 2 and 3 (Figure 2a). Observed mean school size was 1.00 (n=4). No mother and calf pair was observed. Range of the estimated body length of blue whales confirmed was 21.8 – 22.5 meters. Range of the sea temperature of the sighting position of blue whales was 13.0°C - 16.2°C. It was known that there were some sightings of this species in this area during July to August between 1964 and 1990 (Miyashita *et al*., 1995). It is recognized that this area is still important area of this species. This information is important and useful for the future sighting survey planning in the North Pacific.

Fin Whale
Fin whales were mainly sighted in Surveys 1 and 3. A total of 23 schools (31 individuals) of this species were sighted (Figure 2a). High density was observed between 157°E- 170°E (45°N-50°N). Observed mean school size was 1.35 (n=23). One mother and calf pair was observed. Range of the estimated body length confirmed was 14.2 – 22.1 meters except calf. Range of the sea temperature of the sighting position was 2.9°C – 16.3°C.

Sei Whale
Sei whales were mainly sighted in Surveys 2 and 3 and were the most frequently sighted baleen whale species (32 schools, 51 individuals). High density was observed between 155°E- 170°E (35°N-40°N) (Figure 2b). Observed mean school size was 1.59 (n=32). Five mother and calf pairs were observed. Range of the estimated body length was 9.8 – 14.5 meters except calves. Range of the sea temperature of the sighting position was 6.4°C - 18.0°C. For the distribution, it was known that there were some sightings of this species in this area during July to August between 1964 and 1990 (Miyashita *et al*., 1995). The 2010 IWC/Japan joint Cetacean Sighting Survey in the North Pacific showed that sei whales were widely distributed between 170°E- 170°W (from 40°N to 47°N) during July to August (Matsuoka *et a*l., 2011). JARPNII dedicated sighting Survey showed that this species was widely distributed from the Japanese coast to 170ºE during July to August (Hakamada *et al*, 2009). It is confirmed therefore that this species is widely distributed in the North Pacific (Murase *et al*., 2009). This information is also important and useful for the future sighting Survey planning in the North Pacific (IWC, 2010).

Bryde's Whale
Bryde's whales were not sighted frequently in the Surveys. A total of 3 schools (6 individuals) were observed (Figure 2b). Observed mean school size was 2.00 (n=3). All schools (3) were mother and calf pairs. Range of the estimated body length was 12.0 – 12.6 meters except calves. Range of the sea temperature of the sighting position was 18.3°C - 18.6°C. Bryde's whales are widely distributed in summer in the western North Pacific south of 40ºN based on the recent Japan/NRIFSF and JARPN/JARPN II catches ((Shimada, 2004; Pastene *et al*., 2009). During the present sightings of this species were limited because a large sighting effort was spent north of 40°N and timing of the Surveys did not coincide with the migration of the species to the southern part of the research area.

Common minke whale
Only 3 schools (3 individuals) of this species were sighted during the Surveys (Figure 2b). No mother and calf pair was observed. Range of the sea temperature of the sighting position was 3.7°C - 16.6°C. Also few minke whales were observed during a sighting/tagging survey in the Japanese coastal waters during April to June 2011 (2 schools / 2 individuals) (Kanaji *et al*., 2012). The few encounters were attributed to insufficient allocation of searching effort in the coastal waters and anomalous condition of the ocean caused by the earthquake and tsunami occurred 11 March 2011 (including many aftershocks during the research period) (Kanaji *et al*., 2012). They also noted that during the survey period a lot of marine debris was observed in the survey area. Because detection of common minke whale is usually triggered by brief surfacing, which is hard to detect. Direct marine debris might have significantly disturbed the search of whales (Kanaji *et al*., 2012).

Humpback whale
Humpback whales were mainly sighted in Surveys 1 and 3 and were the second most frequently sighted baleen whale species (27 schools, 35 individuals). High density was observed between 150°E - 158°E (37°N-40°N), and 165°E - 170°E (46°N-51°N) (Figure 2a). Observed mean school size was 1.30 (n=27). Five mother and calf pairs were observed. Range of the estimated body length was 8.8 – 13.2 meters except calves. Range of the sea temperature of the sighting position was 2.8°C – 16.3°C.

North Pacific right whale
One of the highlights of these Surveys was several sightings of North Pacific right whales (13 schools, 20 individuals). This species were mainly sighted in Surveys 1 and 3. High density was observed between 157°E - 165°E (46°N-48°N), and 152°E - 153°E (42°N-43°N) (Figure 2a). Observed mean school size was 1.54 (n=20). Two mother and calf pairs were observed. Range of the estimated body length was 10.7 – 14.8 meters except calves. Range of the sea temperature of the sighting position was 2.7°C - 4.2°C.

Sperm Whale
Sperm whales were widely sighted in the whole research area and were the most frequently encountered toothed whale species in the research area (Figure 2c). A total of 60 schools (116 individuals) were observed during the Surveys. Observed mean school size was 1.93 (n=60). Because of limited closing to the schools, there was no information for body length and calves. Range of the sea temperature of the sighting position was 3.0°C - 17.5°C.

Experiments
Estimated Angle and Distance
The Estimated Angle and Distance Training Exercise were conducted earlier 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 19 May in Survey 1, 16 May in Survey 2 and 26 May in Survey 3.

Photo-ID experiments
Photographs were taken from 4 humpback and 16 North Pacific right whales in Survey 1, from 1 blue whale in Survey 2, and from 2 blue, 1 humpback and 3 North Pacific right whales in Survey 3. A total of 3 individuals of blue, 5 individuals of humpback and 19 individuals of North Pacific right whales were photographed (Table 4 and 6). All photographs were stored at the ICR catalogue.

Biopsy
All of the biopsy attempts were made using the compound crossbow system. 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 20 biopsy samples were collected from 2 blue, 2 fin, 2 humpback and 14 North Pacific right whales (Table 5 and 6). All samples were stored at the ICR laboratory.

Report of the IWC oversight
The plan of the Surveys was presented to the 2011 IWC/SC meeting (Matsuoka *et al*., 2011) and endorsed by the Scientific Committee (IWC, 2011). Koji Matsuoka carried out the oversight work through the planning and the execution of this sighting survey conducted by the Institute of Cetacean Research (ICR) in April-May 2011 on behalf of the SC. The research vessels, *Yushin-Maru*, *Yushin-Maru No.2* and *Yushin-Maru No.3* was planned to operate the cruises. All equipments and the survey method were same as the past sighting surveys. The design of the Survey blocks and track lines was improved to cover each Survey block with uniform probability. The planned sighting procedure was in accordance with the guideline agreed by the SC (IWC, 2005). Objectives and procedure of the survey were explained to the captains, officers, crew and researcher in advance. Sighting data was already sent to the IWC secretary.

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Table 1. Specification of the research vessels.

	Yushin-Maru	*Yushin-Maru No.2*	*Yushin-Maru No.3*
Call sign	JLZS	JPPV	7JCH
Length overall [m]	69.61	69.61	69.61
Gross tonnage (GT)	720	747	742
Barrel height [m]	19.5	19.5	19.5
Upper bridge height [m]	11.5	11.5	11.5
Bow height [m]	6.5	6.5	6.5
Engine power [PS / kW]	5280 / 3900	5280 / 3900	5280 / 3900

Table 2. Summary of the survey periods and searching effort (n.miles), by Survey.

Survey	Research area	Cruise period	Research area period	Searching effort (n.miles)
1 (YS1)	Sub-area 9N	2011.4.28-6.6	2011.5.5-5.31	1,466.0
2 (YS2)	Sub-area 9S	2011.4.28-6.6	2011.5.5-5.31	1,492.8
3 (YS3)	Sub-area 8	2011.5.13-6.6	2011.5.17-5.31	1,101.5
Total	-	-	-	4,060.3

Table 3. Number of sightings by species and Survey.

Survey	1 (YS1)				2 (YS2)				3 (YS3)				Total			
Species	Primary		Secondary		Primary		Secondary		Primary		Secondary		Primary		Secondary	
	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.
Blue whale	0	0	0	0	1	1	0	0	3	3	0	0	4	4	0	0
Fin whale	13	18	2	3	1	2	0	0	7	8	0	0	21	28	2	3
Sei whale	0	0	0	0	28	44	1	1	3	6	0	0	31	50	1	1
Bryde's whale	0	0	0	0	0	0	0	0	3	6	0	0	3	6	0	0
Common minke whale	1	1	0	0	1	1	0	0	1	1	0	0	3	3	0	0
Like minke	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Humpback whale	13	19	0	0	0	0	0	0	11	13	3	3	24	32	3	3
Right whale	11	17	0	0	0	0	0	0	2	3	0	0	13	20	0	0
Sperm whale	13	31	1	1	17	30	1	1	26	51	2	2	56	112	4	4
Unid. large whale	8	10	3	3	3	3	0	0	6	6	4	4	17	19	7	7

Table 4. Number of individuals photographed, by species and Survey.

Photo-ID	Survey 1 (YS1)	Survey 2 (YS2)	Survey 3 (YS3)	Total
Blue whale	0	1	2	3
Humpback whale	4	0	1	5
Right whale	16	0	3	19
Total	20	1	6	27

Table 5. Number of biopsy samples collected, by species and Survey.

Biopsy	Survey 1 (YS1)	Survey 2 (YS2)	Survey 3 (YS3)	Total
Blue whale	0	0	2	2
Fin whale	0	0	2	2
Humpback whale	1	0	1	2
Right whale	12	0	2	14
Total	13	0	7	20

Table 6. Summary of the photo-ID and biopsy experiments. LD: Left dorsal; LL: Left lateral; RD: Right dorsal; RL: Right lateral; HD: Head; OT: Other.

Survey	Date	Sighting No.	Species	School size	Number of individuals photographed	Photo-ID result	Number of biopsy	Sample ID
Survey 1 (YS1)	6-May	7	Humpback	2	2	LD, RD	0	-
	8-May	1	Humpback	1	1	LD	0	-
	21-May	1	Right	1	1	HD, OT	1	J11NYS1R01
	21-May	5	Right	1	1	HD, OT	1	J11NYS1R02
	27-May	2	Right	2	2	HD	2	J11NYS1R03, J11NYS1R04
	27-May	3	Right	1	1	HD	0	-
	27-May	4	Right	1	1	HD, OT	1	J11NYS1R05
	28-May	2	Right	1	1	HD	1	J11NYS1R06
	28-May	3	Right	1	1	HD	1	J11NYS1R07
	28-May	4	Humpback	1	1	RD, LD	1	J11NYS1H01
	29-May	3	Right	2	2	HD	0	-
	30-May	2	Right	2	2	HD, OT	3	J11NYS1R08, J11NYS1R09, J11NYS1R10
	30-May	4	Right	2	2	HD, OT	1	J11NYS1R11
	30-May	7	Right	2	2	HD	1	J11NYS1R12
Survey 2 (YS2)	16-May	1	Blue	1	1	LL, RL	0	-
Survey 3 (YS3)	19-May	1	Right	1	1	HD	1	J11NYS3R01
	19-May	2	Right	2	2	HD	1	J11NYS3R02
	22-May	5	Blue	1	1	RD	1	J11NYS3B01
	22-May	7	Humpback	1	1	RD	1	J11NYS3H01
	26-May	4	Fin	1	0	-	1	J11NYS3F01
	26-May	6	Blue	1	1	RD, LD	1	J11NYS3B02
	27-May	5	Fin	1	0	-	1	J11NYS3F02

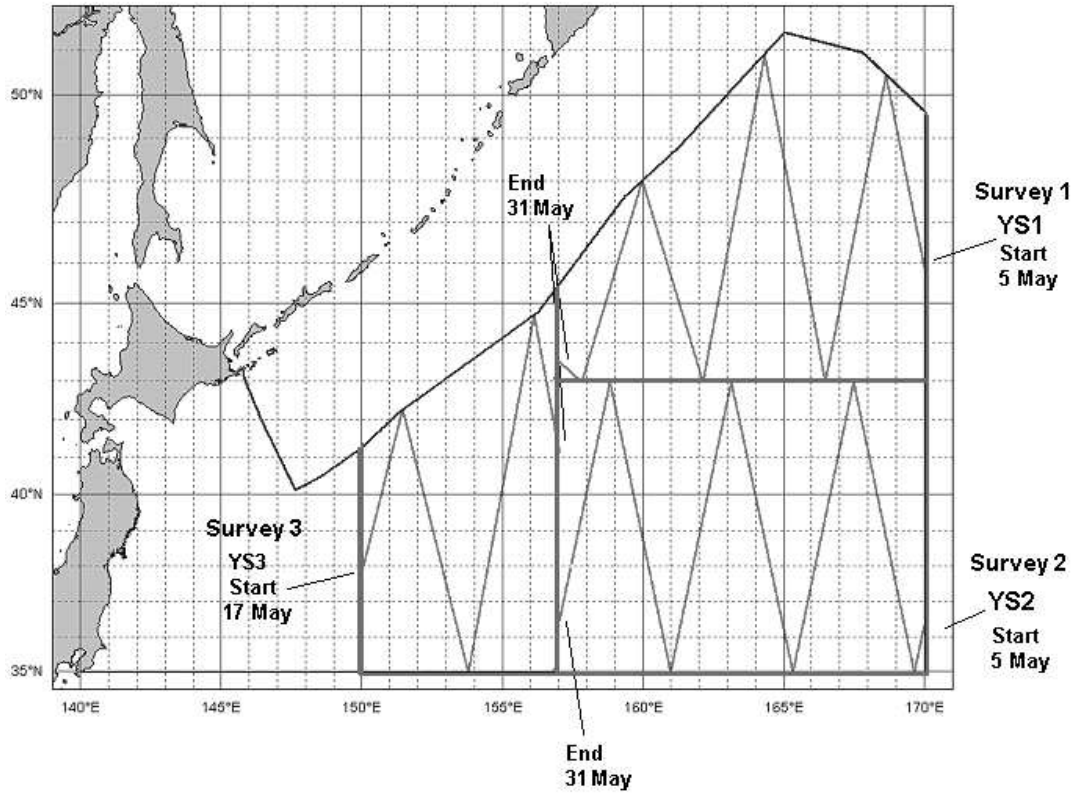

Figure 1. Pre-determined track line for three Surveys in 2011.

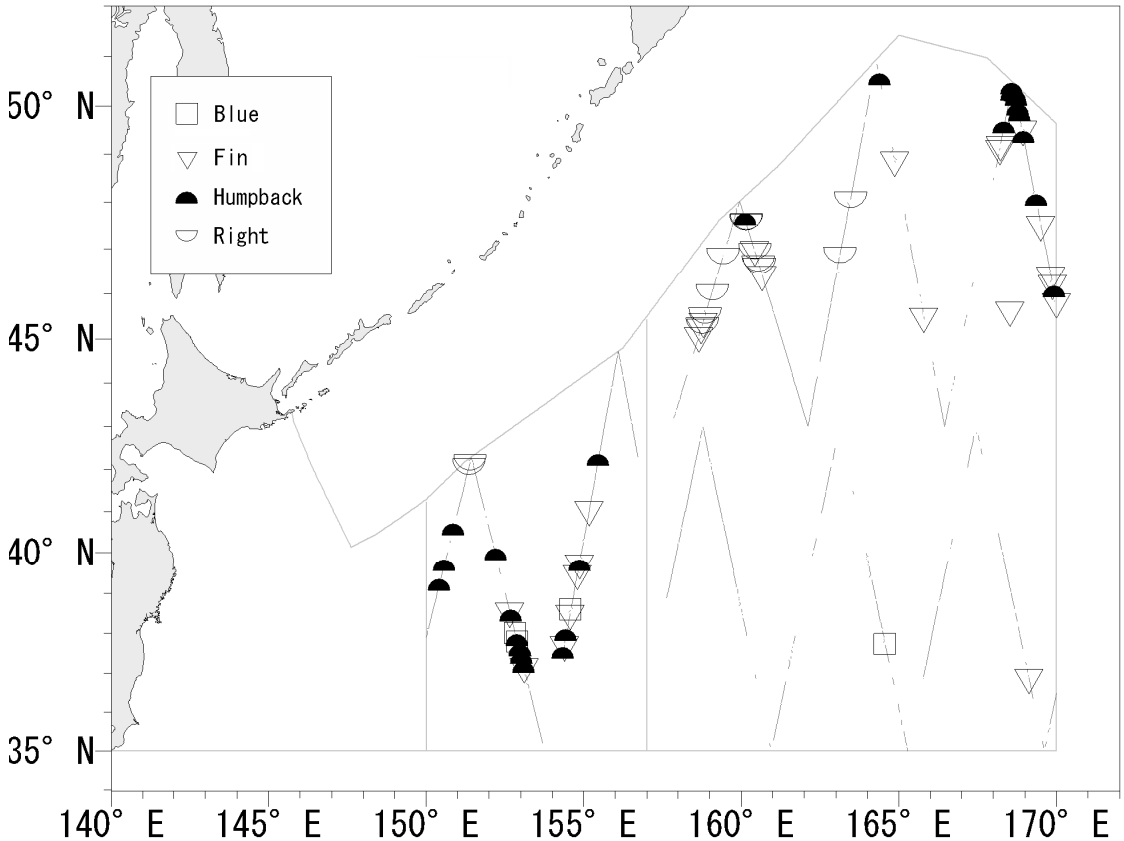

Figure 2a. Positions of blue (square), fin (triangle), humpback (black half circle) and North Pacific right (white half circle) whales sighted during three Surveys including searching effort (red line).

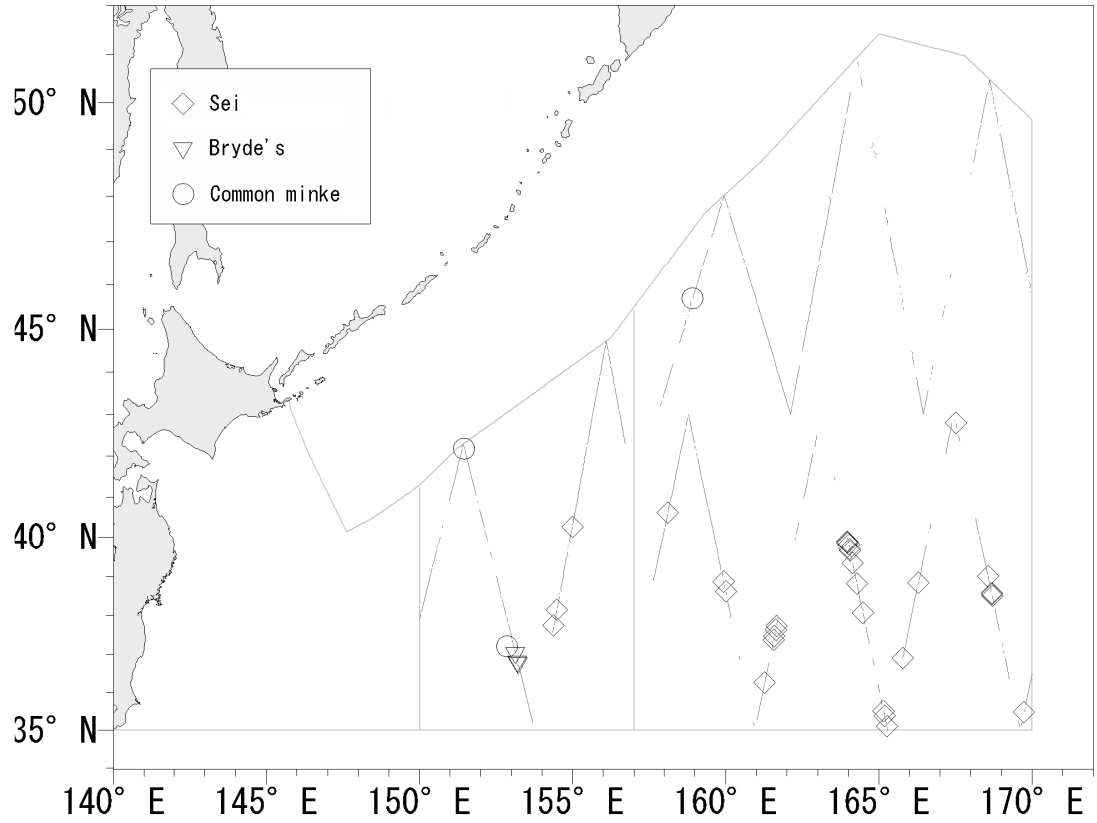

Figure 2b. Positions of sei (diamond), Bryde's (triangle) and common minke (white circle) whales sighted during three Surveys including searching effort (red line).

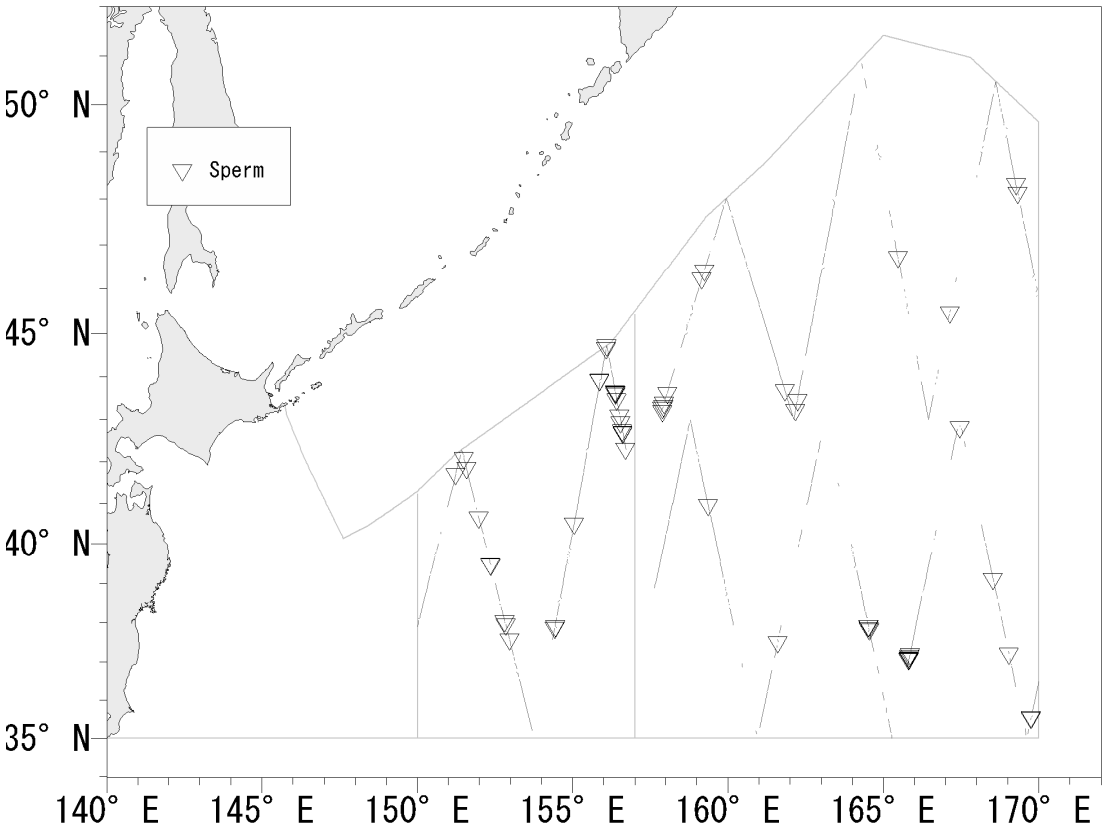

Figure 2c. Positions of sperm whales observed during three Surveys including searching effort (red line).