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Methodology and procedure of the dedicated sighting surveys in JARPNII (2008-2013) - Offshore component

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INTERNATIONAL WHALING COMMISSION

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ABSTRACT

The survey procedures used by dedicated sighting vessels (SV) of JARPNII "offshore" component are described. The main objective of these surveys was to examine the distribution and estimate the abundance of mainly common minke, sei and Bryde's whales for purposes of elucidating feeding ecology and ecosystem, management and conservation. The survey periods and research areas were set based on the target species for each year. The survey procedures were consistent during 2008 to 2013. The survey plans were submitted to the IWC Scientific Committee (SC) every year since 2010 and were endorsed as the IWC oversite surveys, based on the recommendations from the SC members. Following the IWC guidelines, the results of each survey were reported to the SC and all sighting data (weather, effort, sighting and distance & angle estimation experiment records) were submitted to the IWC secretariat every year. Analyses of these sighting surveys data are described in the documents on the distribution and abundance of whales for this meeting.

INTRODUCTION

At the 2002 SC meeting, Japan presented the results of feasibility studies of the Second phase of the Japanese Whale Research Program under Special Permit in the Western North Pacific (JARPNII) which was conducted in 2000 and 2001 (Government of Japan, 2002a). Japan also announced a new research plan for the full-scale JARPNII at the 2002 SC meeting and began the program in 2002 in compliance with Article VIII of the International Convention for the Regulation of Whaling. The objectives of the full-scale JARPNII are: i) to collect data on feeding ecology and ecosystem studies, including cetacean prey consumption and preferences, to build ecosystem models, ii) to monitor environmental pollutants in cetaceans and the marine ecosystem, and iii) to elucidate the stock structure of whales (Government of Japan, 2002b).

The dedicated sighting surveys were conducted independently from the whale sampling research activity and the sighting data are used for abundance estimates. Based on the collected data the distribution patterns of large whales such as blue, fin, sei, Bryde's, common minke, humpback, 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; 2009). These data were analyzed and results of abundance estimates and distribution information were submitted to this meeting (Hakamada *et al,* 2016: SC/F11/JR11, Hakamada and Matsuoka, 2016a: SC/F16/JR12, 2016b SC/F16/JR13 and 2016c SC/F16/JR14, Murase *et al* 2014: SC/F16/JR8 and 2016: SC/F16/JR7, Sasaki *et al*., 2013: SC/F16/JR10, Matsuoka *et al*., 2016: SC/F16/JR9, Pastene *et al*., 2016: SC/F16/JR50).

This paper describes the dedicated sighting survey procedure of the JARPNII offshore component between 2008 and 2013. Methodologies of whole JARPNII surveys are described in Tamura *et al*., (2016): SC/F16/JR1 and Bando *et al.* (2016): SC/F16/JR4 for the offshore component.

SIGHTING SURVEY METHODOLOGY

JARPNII has been conducted with the consistent research methods. Tables 1 and 2 shows an outline of JARPNII dedicated sighting surveys from 2008 to 2014. The survey periods were set in summer during May to September.

Research area

The research area for the offshore survey component was mainly sub-areas 7, 8 and 9 (for common minke whales). These areas were further stratified into blocks based on oceanographic information (particularly of Kuroshio and Oyashio effects) (Figure 1). Sub-area 7 was divided into the four small blocks (7CN, 7CS, 7W and 7E) were stratified based on the satellite water temperature information. Sub-areas 8 and 9 were not stratified (IWC, 2014).

Research Vessels
There were five research vessels used for dedicated sighting survey from 2008 to 2013 JARPNII. Among them, one or two vessels were operated in each season in the offshore components. The *Kyoshin-Maru No.2* (KS2: 372GT), *Kaiko-Maru* (KK1: 860.25 GT), *Yushin-Maru* (YS1: 724GT), *Yushin-Maru No.2* (YS2: 747GT) and *Yushin-Maru No.3* (YS3: 742GT) have been used. They are equipped with a top barrel platform (TOP) and upper bridge (Table 2 and Figures 3a to 3c). The ICR research data collecting system is set on each vessel. Specifications of the vessels are shown in Table 2. These vessels also conducted the distance and angle estimation experiments, photo-ID and biopsy experiments.

Design of track lines
The survey blocks and pre-determined track lines are shown in Table 1 and Figures 2a to 2e. The Longitudinal start point of the track lines are decided at random using the "Distance program (ver.6.0) " and the number of the line (width in the longitude) is decided by the research schedule based on the IWC survey guideline (IWC, 2005). These lines were established independently from those for whale sampling surveys.

Primary searching activity
Sighting surveys follow the protocol endorsed for the IWC/SOWER cruise (IWC, 2008). There are two primary observers in the both the top barrel platform (TOP) and the upper bridge (Captain and Helmsman), respectively. On the TOP, two observers conduct searching for cetaceans by using scaled binoculars (7x). On the upper bridge, two primary observers also search for cetaceans and record sighting information. The surveys were conducted for 12 hours per day from 6:00 a.m. to 6:00 p.m (local time). Basically when the weather conditions were suitable for observations: visibility better than 2.0 n.miles, and the wind speed less than 21 knots. The vessel speed was planned to be 11.5 knots with slight adjustment to avoid vibration of the vessels. The sighting surveys were conducted under the passing mode (NSP mode; even if sighting was made on the predetermined track line, the vessel did not approach the whale directly and searching from the top barrel was uninterrupted). Closing was performed mainly on sightings of baleen whales in order to confirm species, school size, and to conduct experiments if they were blue, humpback, right or fin whales. Sightings of whales were classified as primary and secondary sightings. The primary sightings were those seen in normal searching mode (on-effort), i.e. NSP (two primary observers searched from the top barrel of the vessel on the predetermined track-line). The secondary sightings were those seen during off-effort (e.g. during confirming whales, no observer in the top barrel or the vessel engages in other work) or off the research time. Researchers on board recorded all sighting information. The sighting record includes date and time of the sighting, position of the vessel, classification of the survey mode and the sightings (primary or secondary), angle and distance from the vessel, species and school size, estimated body length, etc.

Experiments
Distance and angle measurement training was conducted at the first stage of the survey every year. The experiment to evaluate measurement error was conducted around the last stage of the survey following the protocol for the IWC/SOWER cruise (IWC, 2008). When large cetaceans such as blue, North Pacific right and humpback whales are found, photographs were taken for photo-identification. Biopsy skin sampling of blue, fin, sei, Bryde's, common minke, humpback, North Pacific right and sperm whales were collected (with effort data including weather data) for investigating stock structure.

Data entry and analysis
The researchers inputted data collected (weather, effort, sighting and from experiments data) to the computer on board during the survey as was the case for previous IWC-SOWER and POWER cruises. These data were stored at the Institute of Cetacean Research (ICR) and submitted to the IWC secretariat based on the IWC/SC Guidelines (IWC, 2005). Scientists at the ICR analyzed these data using the methods developed and modified by Hakamada *et al.*, (2009a and 2009b), Matsuoka *et al*., (2011) and by Okamura *et al.* (2004).

SUMMARY OF EACH SIGHTING SURVEY
Details are described in each cruise report of JARPNII during 2008 to 2013 (see References, Tables 1 and 2).

2008 survey (Figure 2a)
Apart from the sampling activities, an independent track line for dedicated sighting survey was conducted by the *Kyoshin-Maru No.2* between 1 July and 29 August, and by the *Kaiko-Maru* between 27 July and 31 August. The total searching distance was 5,147.1n.miles. A total of 11 schools (11 individuals) of common minke, sei (71/139), Bryde's (193/292), sperm (134/294), blue (18/23), fin (51/75), humpback (10/10) and right whale (5/6) were sighted in the sub-areas 7, 8 and 9 (Tamura *et al*., 2009).

2009 survey (Figure 2b)
Apart from the sampling activities, an independent track line for dedicated sighting survey was conducted by the *Yushin-Maru* in sub-areas 8 and 9 between 24 May and 19 June. The total searching distance was 2,617 n.miles. A total of 9 schools (11 individuals) of common minke, sei whale (52 schools / 96 individuals), Bryde's (6/6), sperm (37/120), fin (4/6) and humpback (2/2) whales were sighted in the sub-areas 8 and 9. No photo-ID was conducted and 2 biopsy samples from sei whales were collected (Bando *et al.*, 2010) and by the *Kaiko-Maru* in sub-areas 8 and 9 between 23 May and 23 June. A total of 2 schools (2 individuals) of common minke, sei whale (15 schools / 24 individuals), Blue (1/1), Bryde's (40/55), sperm (37/120), fin (2/3), humpback (17/26) and sperm (55/119) whales were sighted in the sub-areas 8 and 9 (Miyashita *et al.*, 2010).

2010 survey (Figures 2b and 2c)
The systematic vessel sighting survey was conducted in 2010 summer to examine the distribution of sei and Bryde's whales and for abundance estimations in the Western and Central North Pacific. The plan was endorsed by the IWC/SC. The first cruise was conducted in the area of 35ºN-40ºN and 157ºE-170ºW from 9 June to 18 July, and the second cruise was in the area of 32ºN-37ºN and 145ºE-180º E (dateline) from 20 July to 17 August. The main target species was sei whale for the first cruise and Bryde's whale for the second cruise. The research vessel *Yushin-maru No.3* was engaged for this survey. Distance and angle estimation experiment was conducted for abundance estimation. Concentration areas of sei, Bryde's and blue whales in the first cruise and Bryde's whale in the second cruise were observed. Biopsy skin samples were successfully collected from sei (7) and Bryde's (6) whales for assessing stock structure. 17 schools of blue whales were photographed (Matsuoka *et al.*,2011).

2011 survey (Figure 2c)
The plan was endorsed by the IWC/SC. The research area for 'Survey 1' was set between 43º N and 51º N and between 157º E and 170º E. 'Survey 2' was set between 35º N and 43º N and between 157º E and 170º E. 'Survey 3' was set between 35º N and 45º N, and between 150º E and 157ºE. 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 all 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 38ºN. 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 whale species (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 species (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. 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.. Photographs for photo-ID 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 (Matsuoka *et al.*, 2012).

2012 survey (Figure 2d)
The main objective was to examine the distribution and estimate the abundance of common minke and Bryde's whales for the management and conservation purposes. The plan was endorsed by the IWC/SC. The first survey for common minke whales was conducted using the *Yushin-Maru No.3* between 17 May and 30 June in the area comprised between 35ºN-44ºN and 140ºE-150ºE. The second survey for Bryde's whale was conducted by the *Yushin-Maru* and *Yushin-Maru No.2* between 20 August and 3 October in the area comprised between 30ºN-40ºN and 130ºE-170ºE. An additional survey (third survey) for common minke whales was conducted by the *Yushin-Maru No.3* between 14 September and 1 October in the area between 41ºN-44ºN and 141ºE-150ºE. For the objective of abundance estimation routine distance and angle estimation experiments were conducted (Matsuoka *et al.*, 2013).

2013 survey (Figure 2e)
The research area was set between 35º N and 44º N and between 140º E and 157º E (sub-areas 7W, 7E and 8 for common minke whale). The survey was conducted between 18 May and 26 June. The research vessels *Yushin-Maru* and *Yushin-Maru No.2* were engaged in this survey. A total of 3,470.1 n.miles was searched in this survey. Successful coverage of the searching efforts of each sub-area was 74% for sub-area 7W&7E and 73% for sub-area 8, respectively. In total, eight species including seven baleen whales, blue (2 school / 2 individual), fin (26/35), sei (33/56), Bryde's (39/55), common minke (7/7), North Pacific right (1/1) and humpback (66/88)

whales and sperm whale (75/225) were sighted during the survey. Concentration areas of sei, Bryde's and humpback whales were observed. Photographs for photo-ID were successfully taken from blue (2 individuals), North Pacific right (1) and humpback (22) whales. Biopsy skin samples were also successfully collected from blue (1) and humpback (6) whales including a mother and calf pair of humpback whale (Matsuoka *et al*., 2014).

REPORT F THE IWC OVERSIGHT AND DATA SUBMISSION TO THE IWC

All equipment and the survey method were the consistent between 2008 and 2013 surveys. Detailed reports of the IWC oversight were submitted to the IWC/SC every year since 2010. 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 were in accordance with the guidelines agreed by the SC (IWC, 2005). Objectives and procedure of the survey were explained to the captains, officers, crew and researchers in advance. Each sighting data were sent to the IWC secretary and confirmed at each IWC/SC meeting (e.g. IWC, 2013).

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Table 1. Summary of JARPNII dedicated sighting surveys – Offshore component (2008-2013).

Year	Cruise period		Research area period		Research area	Vessel	Reference
	Start	End	Start	End			
2008	2008/7/2	2008/8/31	2008/7/5	2008/8/29	Sub-area 8, 9	*Kaiko-Maru*	SC/64/NPM3
	2008/7/2	2008/8/31	2008/7/6	2008/8/28	Sub-area 8, 9	*Kyoshin-Maru No.2*	
2009	2009/5/22	2009/6/25	2009/5/23	2009/6/23	Sub-area 8, 9	*Yushin-Maru*	SC/64/NPM3
	2009/5/22	2009/6/25	2009/5/24	2009/6/19	Sub-area 8, 9	*Kaiko-Maru*	
2010	2010/6/9	2010/7/18	2010/6/11	2010/7/17	35N-40N, 157E-170W	*Yushin-Maru No.3*	SC/62/O16, SC/63/O6
	2010/7/20	2010/8/17	2010/7/20	2010/8/16	32N-37N, 145E-180E	*Yushin-Maru No.3*	SC/62/O16, SC/63/O6
2011	2011/4/28	2011/6/6	2011/5/5	2011/5/31	Sub-area 9N	*Yushin-Maru*	SC/64/O6
	2011/4/28	2011/6/6	2011/5/5	2011/5/31	Sub-area 9S	*Yushin-Maru No.2*	
	2011/5/13	2011/6/6	2011/5/17	2011/5/31	Sub-area 8	*Yushin-Maru No.3*	
2012	2012/5/17	2012/6/30	2012/5/18	2012/6/29	Sub-area 7	*Yushin-Maru No.3*	SC/64/IA6, SC/65a/O4
	2012/8/20	2012/10/3	2012/8/23	2012/9/24	30N-40N, 140E-170E	*Yushin-Maru, Yushin-Maru No.2*	
	2012/9/14	2012/10/1	2012/9/15	2012/9/27	Sub-area 7	*Yushin-Maru No.3*	
2013	2013/5/18	2013/6/26	2013/5/21	2013/6/21	35N-44N, 140E-157E	*Yushin-Maru*	SC/65a/IA13, SC/65b/IA6
					35N-44N, 140E-157E	*Yushin-Maru No.2*	

Table 2. Specifications of the research vessels.

Name	*Kyoshin-Maru No.2*	*Kaiko-Maru*	*Yushin-Maru*	*Yushin-Maru No.2*	*Yushin-Maru No.3*
Code	KS2	KK1	YS1	YS2	YS3
Signal letter	JFHR	JGDW	JLZS	JPPV	7JCH
Gross tonnage (Register)	372	860.25	724	747	742
Length overall (m)	68.18	61.90	69.61	69.61	69.61
Barrel height (m)	17.0	19.5	19.5	19.5	19.5
IOP height (m)	10.5	14.5	13.5	13.5	13.5
Upper bridge height (m)	8	9	11.5	11.5	11.5
Main engine output (kW)	1544	1471	3900	3900	3900

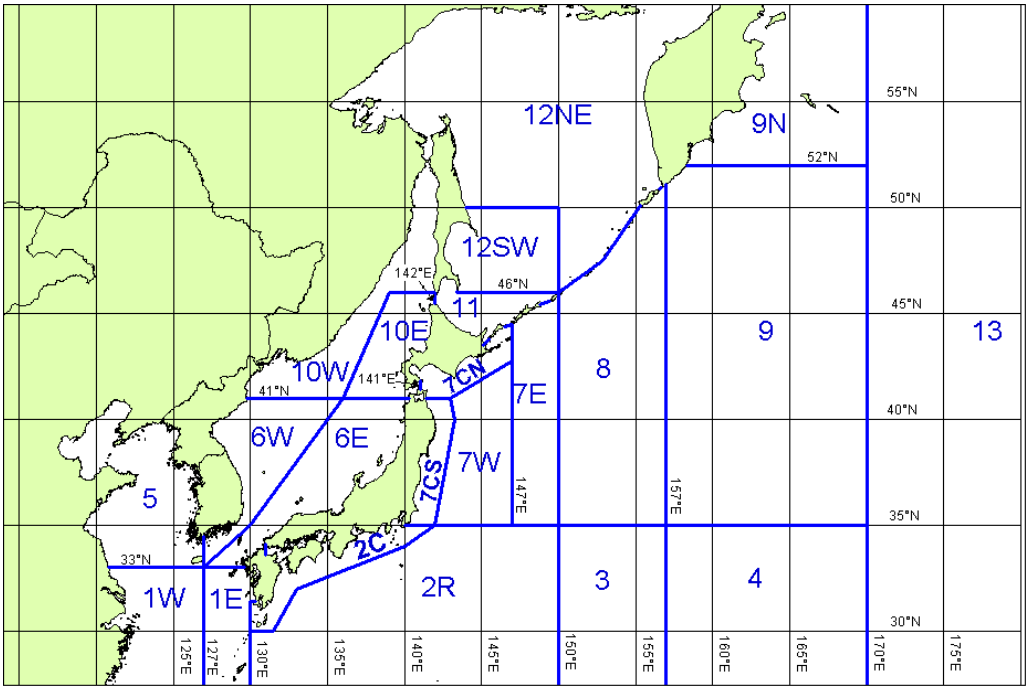

Figure 1. The sub-area for common minke whale in the western North Pacific (IWC, 2014).

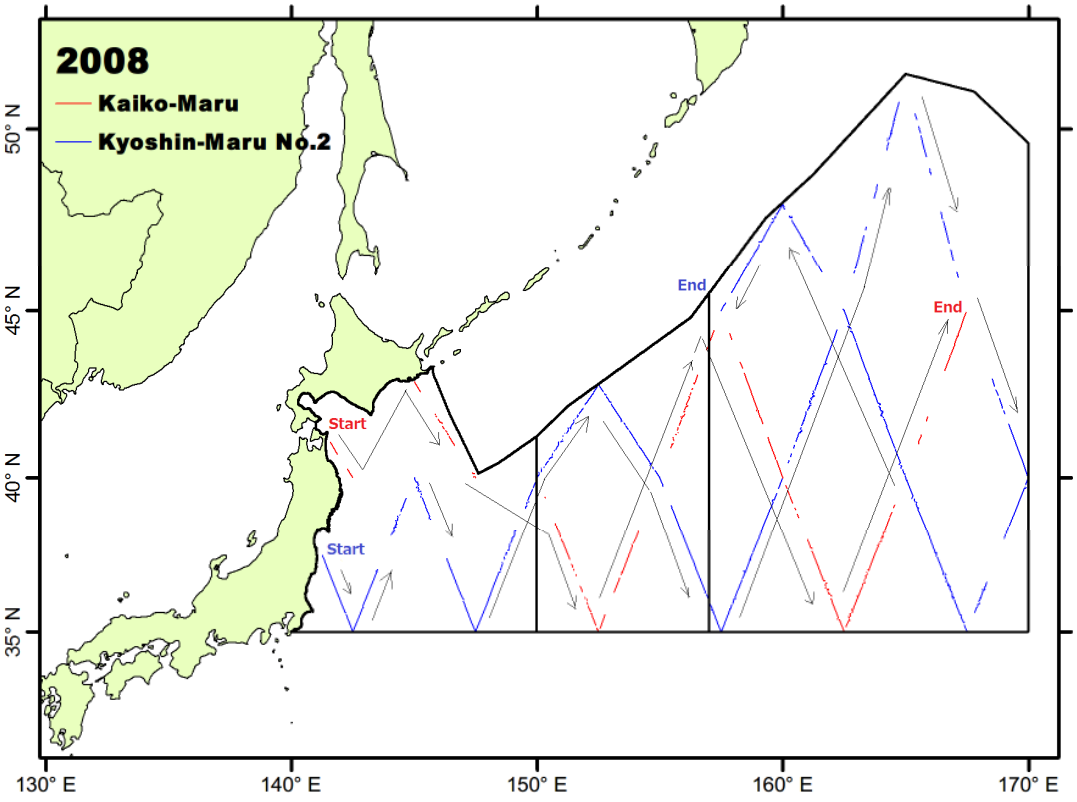

Figure 2a. Survey route for off-shore component and effort (2008).

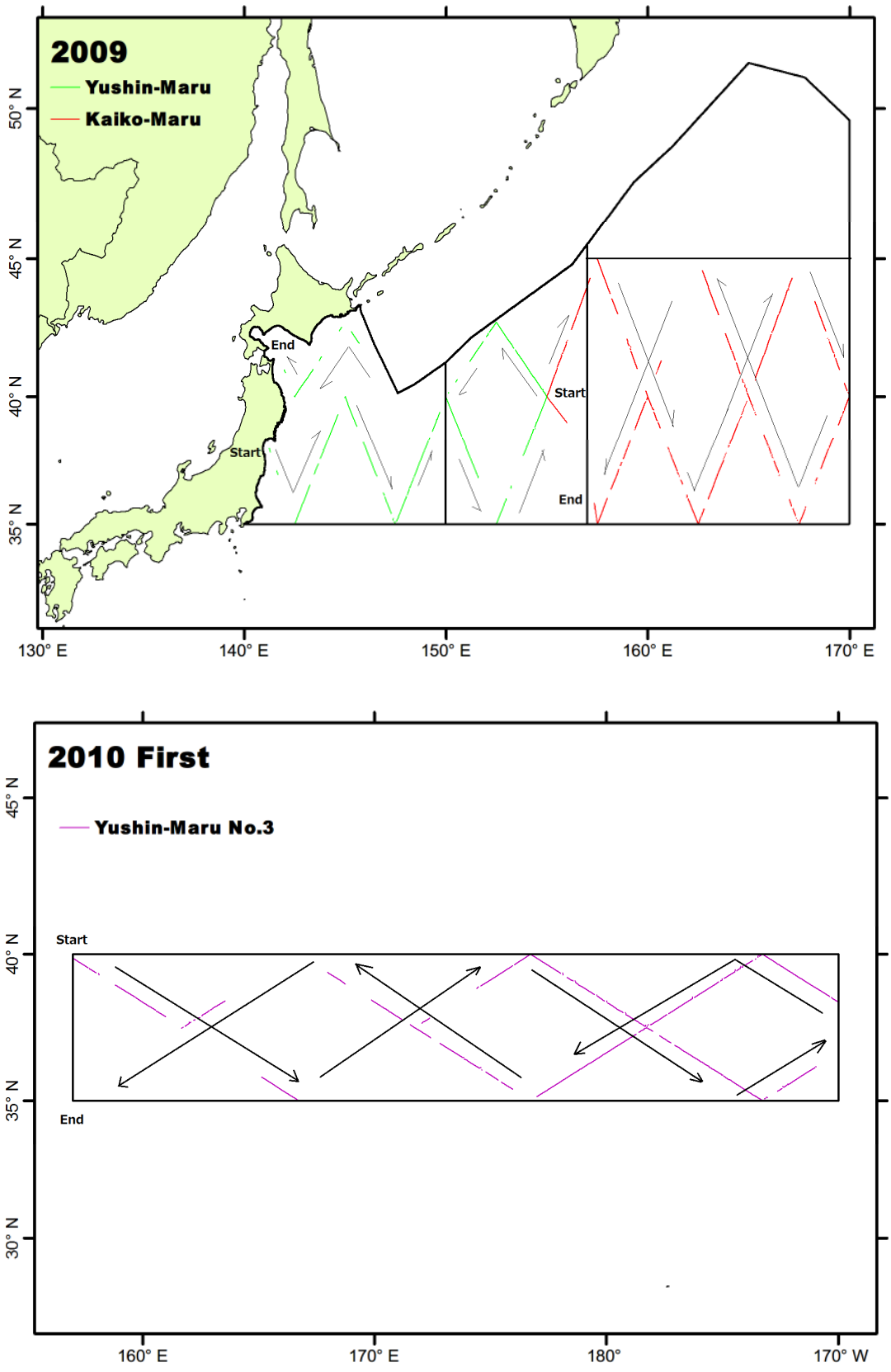

Figure 2b. Survey route for off-shore component and effort (2009 and 2010 (first period).

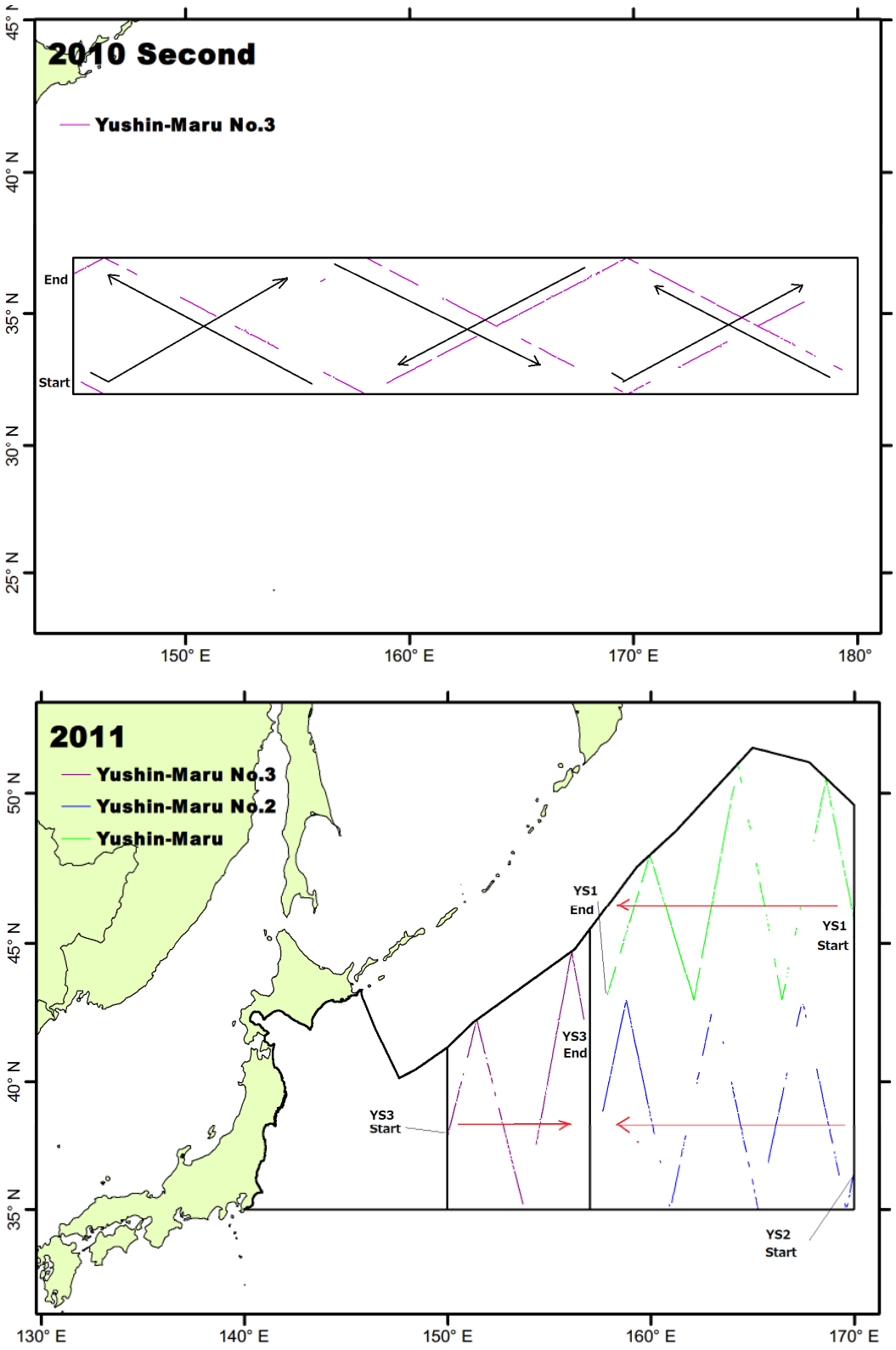

Figure 2c. Survey route and searching effort (Top: 2010 (second periods), Bottom: 2011).

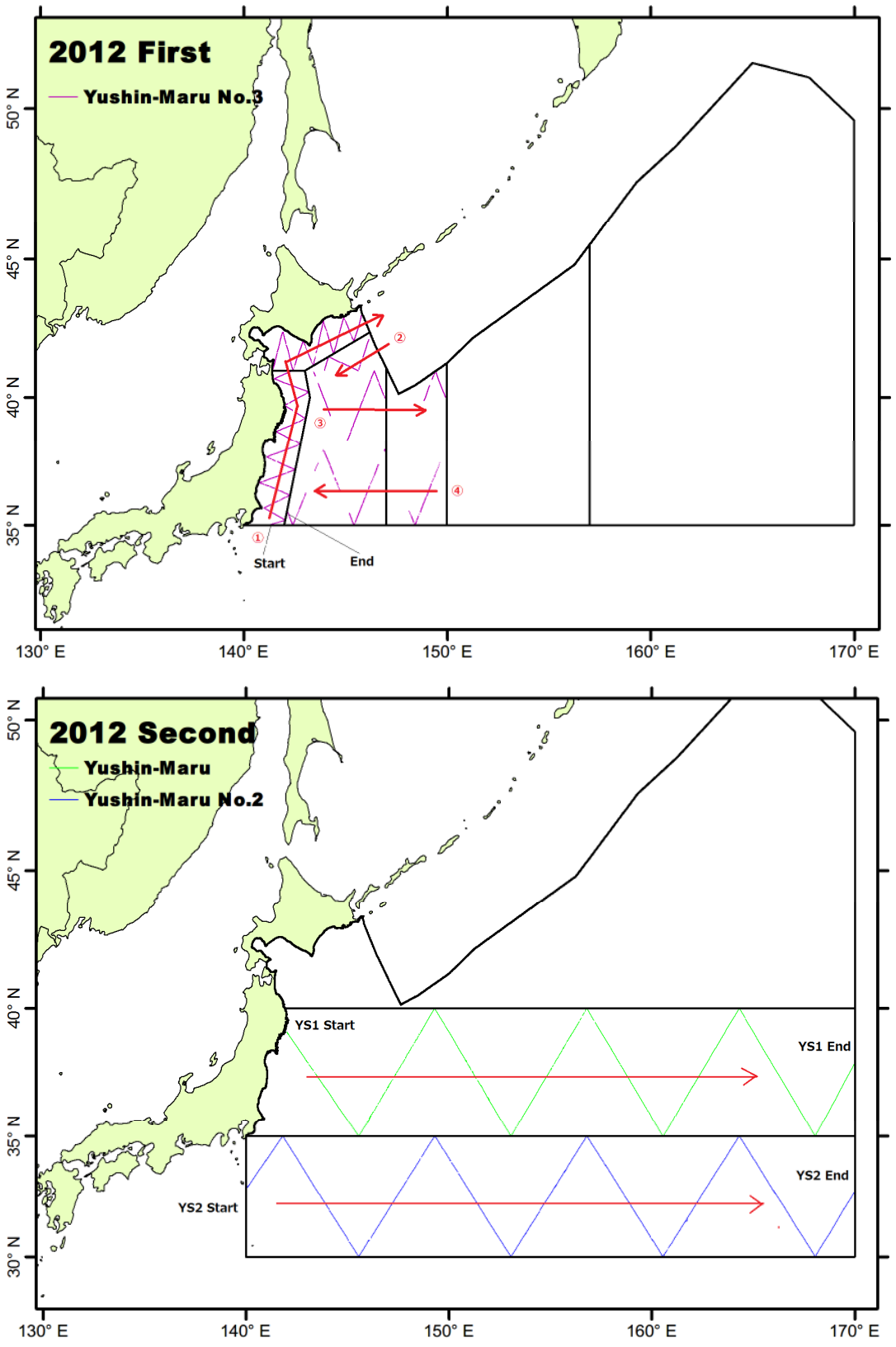

Figure 2d. Survey route for off-shore component and effort (2012 first and second periods).

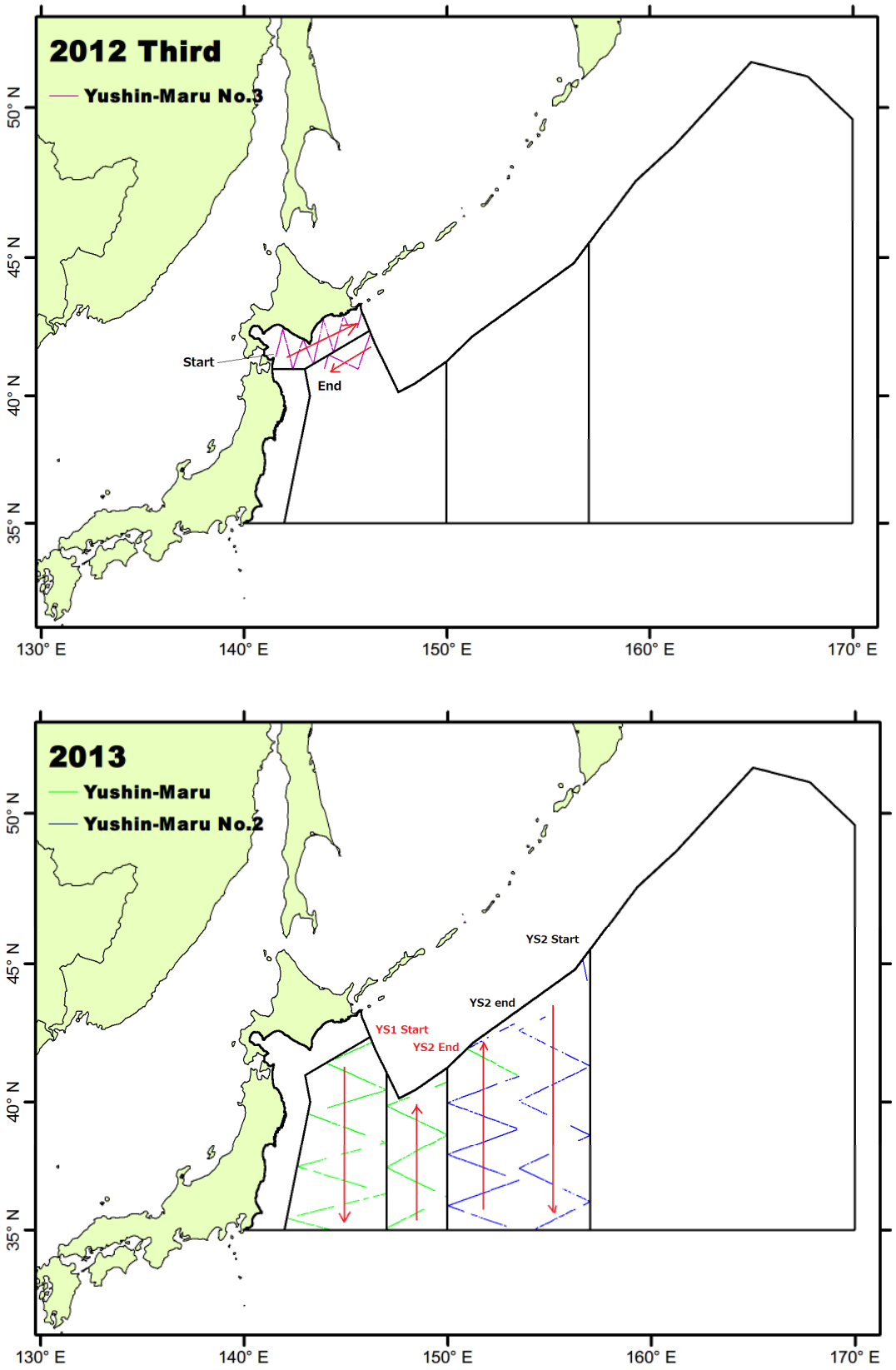

Figure 2e. Survey route for off-shore component and effort (2012 third period and 2013).

Figure 3a. Dedicated sighting survey vessels: *Kyoshin-Maru No.2 (left) and Kaiko-Maru (right).*

Figure 3b. Dedicated sighting survey vessels: *Yushin-Maru* (left) *and Yushin-Maru No.2* (right).

Figure 3c. Dedicated sighting survey vessel: *Yushin-Maru No.3.*