# Methodology and survey procedures under the JARPNII -offshore component- during 2008 to 2014 with special emphasis on whale sampling procedures

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**ABSTRACT**

The methodology and survey procedures of the Japanese Whale Research Program under Special Permit in the western North Pacific (JARPNII) offshore component surveys conducted during 2008 to 2014 is summarized in this paper. The research was conducted alternately in the early season (May-July) and the late season (June-August). The research has three components. 1) whale sampling survey, 2) co-operative whale sampling survey and acoustic/trawl prey survey and 3) whale sighting survey. In the whale sampling survey, two or three sighting/sampling vessels (SSVs) conducted sighting and whale sampling survey on predetermined track lines. The zigzag-shaped track line was set reflecting previous sighting information of targeted whale species and sea conditions. Furthermore, Special Monitoring Surveys (SMS) were conducted in areas where the density of targeted whale species was expected to be high. Track lines for the SMS were designed independently from the original track lines. A maximum of 100 common minke, 50 Bryde's, 100 sei and 10 sperm whales were taken each year from 2008 to 2013. Following the 31 March, 2014 Judgment of the International Court of Justice (ICJ), the Government of Japan voluntarily reviewed the state of JARPNII, which resulted in the suspension of sampling of sperm and common minke whales and, 25 of the 50 Bryde's and 10 of the 100 sei whales were studied by only using non-lethal methods in the 2014 survey. For the co-operative whale sampling survey and acoustic/trawl prey surveys, some special blocks were set and surveys of each component were conducted concurrently. The whale sighting survey by sighting vessels (SVs) was conducted every year independently from the whale sampling survey.

## 1. BACKGROUND

In conformity to Article VIII of the International Convention for the Regulation of Whaling, JARPNII was authorized by the Government of Japan (Government of Japan, 2002). After two seasons of feasibility research in 2000 and 2001, the full-scale research of JARPNII started in 2002 season. The full-scale study aimed at i) feeding ecology and ecosystem, ii) monitoring of environmental pollutants in cetaceans and the marine ecosystem and iii) to elucidate the stock structure (Government of Japan, 2002).

The full scale JARPNII consists of two components. The 'offshore' survey, which was conducted by the *Nisshin Maru* research unit and two 'coastal' surveys (Sanriku and Kushiro), which was conducted by small type catcher boats. The coastal component covers the temporal and spatial gaps, which could not be covered by the *Nissin Maru* unit (Government of Japan, 2002).

The offshore component of JARPNII has three research components, 1) whale sampling survey, 2) co-operative survey of whale sampling survey and acoustic/trawl prey survey and 3) whale sighting survey. The research area of the offshore component is set in sub-areas 7, 8 and 9, and the target species and sample size for the lethal component were set as 100 common minke, 100 sei, 50 Bryde's and 10 sperm whales (Government of Japan, 2002; 2004).

An expert workshop to review the JARPNII programme was conducted at 2009 using data and samples collected

during the feasibility (2000 and 2001) and the first six years (2002 to 2007) surveys (IWC, 2010) and a review of survey methodology during that period was presented to the meeting (Kishiro, *et al*., 2009, Kiwada *et al*., 2009, Murase *et al*., 2009, Tamura *et al*., 2009a).

After 2007, surveys have been conducted with almost same manner. However, in 2014, following the 31 March, 2014 Judgement of the International Court of Justice (ICJ), the Government of Japan voluntarily reviewed the state of JARPNII, which resulted in the suspension of sampling of sperm and common minke whales and 25 of the 50 Bryde's and 10 of the 100 sei whales will be studied by only using non-lethal methods in the 2014 survey.

This paper summarized the methodology and survey procedure of JARPNII offshore component conducted during 2008 to 2014 with special emphasis on whale sampling procedures.

## 2. GENERAL METHODOLOGY

### 2.1 Research area and season

The research area of JARPNII was sub-areas 7, 8 and 9, excluding the EEZ zones of foreign countries (Figure 1). This area is the Western Subarctic Gyre region in the North Pacific (Favorite *et al*., 1976) known as an area of high production capacity. The Oyashio, which is the Western Boundary Current of the gyre, flows into the sea east of Honshu and sustains the high productivity there. The research season extended from spring to autumn. The surveys were conducted alternately in early season (May-July) and late season (June-August).

### 2.2 Research vessels

Following vessels were used for JARPNII offshore component (Table 1).

1) Research base vessel (RB)

*Nisshin-maru* (NM ; Gross tonnage was increased from 8,030 to 8,145)・・・2008 - 2014 seasons

2) Sighting and sampling vessel (SSV)

*Yushin-maru* (YS1; from 720 to 724GT)・・・2008, 2010 – 2014 seasons
*Yushin-maru* No.2 (YS2; 747GT)・・・2008 – 2014 seasons
*Yushin-maru* No.3 (YS3; 742GT)・・・2008, 2009 seasons

3) Scientific echo sounder survey vessel (ESV)

*Kaiko maru* (KK1; 860GT)・・・2008 season
*Shunyo maru* (SHU; 887GT)・・・2008 – 2009, 2012 – 2013 seasons
*Hokko maru* (HK; 1,246GT)・・・2010 – 2011 seasons

4) Dedicated sighting vessel (SV)

*Kaiko maru* (KK1; 860GT)・・・2008 season
*Kyoshin-maru* No.2 (KS2; 372GT)・・・2008 season
*Yushin-maru* (YS1)・・・2009, 2011 – 2014 seasons
*Yushin-maru* No.2 (YS2)・・・2011 – 2014 seasons
*Yushin-maru* No.3 (YS3)・・・2010 – 2014 seasons
*Syonan maru* No.2 (SM2; 712GT)・・・2013 season

### 2.3 Research component

2.3.1 Whale sampling survey

1) Objective

The objective of the whale survey component was sampling of whales for collecting data and samples required to achieve the objectives of JARPNII. Biological surveys of sampled whales was conducted on the research base vessel.

2) Research vessels

Two or three sighting/sampling vessels and one research base vessel (NM) (Table 1).

3) Design of track line

The track lines and the allocation of vessels were set in similar manner as in previous JARPN and the 2000 – 2007 JARPNII surveys (Fujise, 2000; Tamura *et al.*, 2009a). The survey order of sub-area/strata was chosen based on seasonal distribution of whales and logistics, and zigzag-shaped track lines were set in the research area, reflecting the available information such as sea surface temperature. The track line consisted of one main and two parallel courses established seven n.miles apart from main course. Furthermore, in order to secure enough samples, the Special Monitoring Survey (SMS) was conducted in areas where the density of targeted whale species were expected to be high. Track lines in the SMS were designed independently from the original track lines. The track lines of SMS consisted of one main and two parallel courses established seven n. miles apart from main course.

4) Sighting methods

Sighting procedures were similar to the previous surveys of JARPN and 2000 - 2007 JARPNII (Fujise, 2000; Tamura *et al.*, 2009a). Two modes of sighting, *NSC* and *NSS modes* were adopted depending on weather and sea conditions. The condition to conduct surveys under *NSC mode* were similar to those established in Japanese sighting surveys conducted by the National Research Institute of Far Seas Fisheries (*i.e.* visibility of 2 n.miles or more and Beaufort wind scale of 4 or below). The *NSS mode* was used under worse weather and sea condition, though the sampling of whales was still possible. These two survey modes were recorded separately for future analysis.

Basically, each of the SSVs changed the track line every day to avoid possible sighting bias by a fixed position. Starting position of the day was set at a point where one of the SSVs ended the survey in the previous day in the most advanced position. Other SSVs moved to the starting position of next day after the end of the daily survey. These daily arrangements of SSVs were determined by the cruise leader on the research base vessel. The survey was conducted at a speed of 10.5 knots from 1 hour after sunrise to 1 hour before sunset (or maximum from 06:00 to 18:00), with three top men assigned to the barrel.

Sightings of whales were classified into primary and secondary sightings. The primary sightings were those seen in normal searching mode (three observers searched from the top barrel of the vessel on the predetermined track-line). The secondary sightings were those seen in out of normal searching mode (e.g. during confirming or chasing whales, no observer in the top barrel or the vessel engaging in other work).

A researcher on board recorded sighting effort and all of the large whale sightings. The sighting record includes date, time, position of the vessel, survey mode (primary or secondary), angle and distance from the vessel at the sighting, species and school size, estimated body length, etc. Weather information (weather, visibility, wind direction and speed, sea surface water temperature) was recorded every hour.

5) Sampling methods

All common minke, Bryde's, sei and sperm whales of primary and secondary sighting, excluding cow and calf pairs were targeted for sampling. When the sighting of the common minke, Bryde's, sei and sperm whales occurred, the SSV approached the school of whales. Observers on the top barrel counted number of whales in the school and estimated body length of each animal. If a sighting was a solitary whale, it was sampled immediately after the body length estimation. If a school consisted of two or more animals, the researcher assigned a serial number to each individual and the first target whale was chosen using the tables of random sampling numbers (TRS). When two whales were sampled from a school, the second target was selected by the same manner after the first animal was sampled. In this case, the remaining individuals were renumbered according to the latest position in the school.

In addition to the sightings of common minke, sei, Bryde's and sperm whales or whales suspected to be these species, the SSV approached large baleen whales such as blue, fin, right and humpback whales for conducting some experiments (see section 2.5).

2.3.2 Co-operative survey of whale sampling survey and acoustic/trawl prey survey

1) Objective

The co-operative survey of whale sampling survey and acoustic/trawl prey survey has two research units, the whale sampling unit and the prey survey unit. The research was concurrently conducted in the same limited blocks. The objective of this component was to collect data such as stomach contents of whales and biomass of their prey species in the field to estimate prey preferences of whales.

2) Research area and design of track line

In the co-operative survey, small blocks were defined considering environmental information such as sea surface temperature. Zigzag-shaped track lines were set in each small block, and both the whale sampling unit and the prey survey unit concurrently carried out surveys along the same track line.

3) Whale sampling unit

The whale sampling unit consist of two or three sighting/sampling vessels and one research base vessel. This unit conduct whale sampling survey following the methods described in section 2.3.1.

4) Prey survey unit

The prey survey unit consisted of an echo sounder survey vessel. This unit conducted the following prey species surveys along the same track lines with the whale sampling unit.

1) Quantitative echosounder survey
   EK500 (SIMRAD, Norway), 38 kHz and 120 kHz, in 2008 season
   ER60 (SIMRAD, Norway), 38 kHz, 70 kHz and 120 kHz, in 2008, 2009, 2012 and 2013 seasons
   ER60 (SIMRAD, Norway), 38 kHz, 70 kHz 120 kHz and 200 kHz, in 2010 and 2011 seasons
2) Net sampling
   Surface and mid water trawling by mid-water trawl net, in 2008 – 2013 seasons
   MOCNESS (Multiple Opening and Closing Nets Environmental Sampling System), in 2008 and 2009 seasons
   NORPAC (North Pacific Standard Net), in 2008 – 2013 seasons
   IKMT (Isaacs-Kidd Midwater Trawl), in 2008 season
   VMPS (Vertical Multiple Plankton Sampler), in 2010 season
   MOHT (Matsuda-Oozeki-Hu-Trawl), in 2010 and 2011 seasons
   BONGO, in 2012 season
3) Oceanographic survey
   CTD, in 2008 – 2013 seasons
   XCTD, in 2013 season

In the 2008, 2009, 2012 and 2013 seasons, SHU conducted the prey surveys in the research area. In the 2010 and 2011 seasons, HK played the same role. In the 2008 season, KK1 conducted the prey survey and whale sighting survey.

2.3.3 Whale sighting survey

Dedicated sighting vessel (SV: KS2, KK1, YS1, YS2, YS3 and SM2) conducted whale sighting surveys independently from the whale sampling surveys. Track lines of the SVs were designed independently from the SSV's track lines. A researcher on board recorded sighting effort and all of the sightings of large whales. The

sighting record includes date and time of the sighting, position of the vessel, survey mode at sighting (primary or secondary), distance and angle from the vessel, species and school size, estimated body length, etc. Details of the method of the dedicated sighting surveys is described in Matsuoka *et al*., (2016: SC/F16/JR2).

**2.4 Biological survey**

All of the sampled whales were biologically examined by researchers on the research base vessel. Biological surveys, such as measurement of body proportion, stomach content analysis and sampling of tissues were conducted. Table 2 summarized number of sampled whales by species, sub-area and year. Details of biological data and samples are described in Annex 2 of Tamura *et al*., (2016: SC/F16/JR01).

**2.5 Non-lethal surveys**

**2.5.1 Biopsy sampling**

Biopsy sampling experiments were carried out throughout the survey period by SSVs and SVs. A compound crossbow was used for the experiments. Table 3 summarizes number of biopsy samples collected during the 2008 and 2014 JARPNII. A total of 15 blue, three fin, 37 sei, 90 Bryde's, 9 humpback and 19 right whales were sampled by SSVs and SVs.

**2.5.2 Fecal sampling**

Fecal sampling experiments were carried out in the 2014 survey by SSVs and SVs. During the observation for 81.0 hours on 679 sei whales, 21 cases of excretion were observed and three fecal samples were collected. For Bryde's whales, during the observation of 38.1 hours on 158 individuals, three cases of excretion were observed but no sample was collected. Four common minke whales were observed for 0.3 hours but no excretion was observed (Mogoe *et al.*, 2015).

**2.5.3 Photo-ID**

Table 4 summarizes number of photographed whales by photo-ID experiments during the 2008 and 2014 JARPNII. A total of 55 blue, 27 humpback and 27 right whales were photographed by SSVs and SVs.

**2.6 Marine debris**

Marine debris drifting on sea surface was recorded during transit between port and the research area by the research base vessel. Debris in the stomach contents of sampled whales was examined on the research base vessel.

**3. OUTLINE OF RESEARCH CRUISES**

Table 1 summarizes the 2008 to 2014 JARPNII surveys. The followings are brief summaries of each survey. Details of each cruise are described in cruise reports of each survey (Bando *et al*., 2010; 2013; 2014, Tamura, *et al*., 2009b; 2012; 2015, Yasunaga *et al*., 2011). Cruise track lines, sighting positions of large whales and sampled individuals in each of the surveys are shown in Figures 2 - 4.

**3.1. 2008 season** (Tamura *et al*., 2009b)

The seventh full scale research was conducted in sub-areas 7, 8 and 9 from 6 June to 24 August 2008 (80 days including transit), using three SSVs, one SV, two ESVs and one RB. The total searching distance by three SSVs was 5,758 n. miles and 66 common minke, 234 Bryde's, 386 sei and 277 sperm whales were sighted. A total of 59 common minke, 50 Bryde's, 100 sei and two sperm whales was sampled. The dedicated sighting survey was conducted in sub-areas 7, 8 and 9 from 1 July to 31 August 2008 using one SV (KS2) and one ESV/SV (KK1). Total searching distance was 5,147 n. miles and 11 common minke, 292 Bryde's, 139 sei and 294 sperm whales were sighted. Two special blocks were set for the co-operative survey on the prey species and whale sampling. The co-operative survey was conducted from 1 to 26 July in sub-areas 8 and 9 for first period and from 18 July to 5 August in sub-area 7 for second period. One Bryde's whale was tracked by satellite tag for 21 days (Nishiwaki

*et al*., 2009; Murase *et al*., 2016 (SC/F16/JR45)).

**3.2. 2009 season** (Bando *et al*., 2010)

The eighth full scale research was conducted in sub-areas 7, 8 and 9 from 11 May to 29 July 2009 (80 days including transit), using two SSVs, one SV, one ESV and one RB. The total searching distance by SSVs was 3,757 n. miles and 52 common minke, 87 Bryde's, 386 sei and 167 sperm whales were sighted. A total of 43 common minke, 50 Bryde's, 100 sei and one sperm whales was sampled. The dedicated sighting surveys were conducted in sub-areas 8 and 9, using one SV (YS1). The survey was conducted from 24 May to 19 June. Total searching distance was 2,617 n. miles and 11 common minke, six Bryde's, 96 sei and 120 sperm whales were sighted. One special block was set for the co-operative survey on the prey species and whale sampling. The co-operative survey was conducted from 5 to 22 July in sub-areas 8 and 9.

**3.3. 2010 season** (Yasunaga *et al*., 2011)

The ninth full scale research was conducted in sub-areas 7, 8 and 9 from 9 June to 22 August 2010 (75 days including transit), using two SSVs, one SV, one ESV and one RB. The total searching distance by SSVs was 3,749 n. miles and 15 common minke, 136 Bryde's, 333 sei and 193 sperm whales were sighted. A total of 14 common minke, 50 Bryde's, 100 sei and 3 sperm whales was sampled. The dedicated sighting survey was conducted in sub-areas 9 and 13, using one SV (YS3). The survey was conducted from 9 June to 18 July. Total searching distance was 2,488 n. miles and 57 Bryde's, 71 sei and 40 sperm whales were sighted. Two special blocks were set for the co-operative survey on the prey species and whale sampling. The co-operative survey was conducted from 24 to 29 July in sub-areas 8 and 9 for first period and from 30 July to 4 August in sub-area 9 for second period.

**3.4. 2011 season** (Tamura *et al*., 2012)

The 10th full scale research was conducted in sub-areas 7, 8 and 9 from 11 June to 5 September 2011 (87 days including transit), using two SSVs, three SVs, one ESV and one RB. The total searching distance by SSVs was 5,156 n. miles and 53 common minke, 149 Bryde's, 476 sei and 295 sperm whales were sighted. A total of 49 common minke, 50 Bryde's, 95 sei and 1 sperm whale were sampled. The dedicated sighting survey was conducted in sub-areas 8 and 9 from 5 to 31 May by two SVs (YS1, YS2) and from 17 to 31 May by one SV (YS3). Total searching distance was 4,060 n. miles and 3 common minke, six Bryde's, 51 sei and 116 sperm whales were sighted. One special block was set for the co-operative survey on the prey species and whale sampling. The co-operative survey was conducted from 16 to 23 June in sub-areas 8 and 9.

**3.5. 2012 season** (Bando *et al*., 2013)

The 11th full scale research was conducted in sub-areas 7, 8 and 9 from 16 May to 3 August 2012 (80 days including transit), using two SSVs, three SVs, one ESV and one RB. The total searching distance by SSVs was 2,326 n. miles and 86 common minke, 86 Bryde's, 304 sei and 218 sperm whales were sighted. A total of 74 common minke, 34 Bryde's, 100 sei and 3 sperm whales were sampled. Three dedicated sighting surveys were conducted. The first survey was conducted from 17 May to 30 June in sub-area 7 by one SV (YS3), the second survey was conducted from 20 August to 3 October in parts of sub-areas 7, 8 and 9 by two SVs (YS1, YS2) and the third survey was conducted from 14 September to 1 October in sub-area 7 by one SV (YS3). Total searching distance was 2,728 n. miles for the first survey, 2,429 n. miles for the second survey and 728 n. miles for the third survey, respectively. A total of 41 common minke, 49 Bryde's, 14 sei and 168 sperm whales were sighted during the first survey. During the second survey, a total of 134 Bryde's and 251 sperm whales were sighted. A total of 24 common minke, 1 sei and 7 sperm whales were sighted during the third survey. One special block was set for the co-operative survey on the prey species and whale sampling. The co-operative survey was conducted from 28 July to 21 August in sub-areas 8 and 9.

**3.6. 2013 season** (Bando *et al*., 2014)

The 12th full scale research was conducted in sub-areas 8 and 9 from 25 July to 7 October 2013 (75 days including transit), using two SSVs, four SVs, one ESV and one RB. The total searching distance by SSVs was 1,816 n. miles and 3 common minke, 56 Bryde's, 442 sei and 167 sperm whales were sighted. A total of three common minke, 28 Bryde's, 100 sei and 1 sperm whale were sampled. Three dedicated sighting surveys were conducted. The first survey was conducted from 18 May to 26 June in sub-area 7 and 8 by two SVs (YS1, YS2), the second survey was conducted from 20 July to 23 August in sub-areas 8 and 9 by one SV (SM2) and the third survey was conducted from 12 September to 7 October in sub-areas 8 and 9 by one SV (YS3). Total searching distance was 3,470 n. miles for the first survey, 987 n. miles for the second survey and 539 n. miles for the third survey, respectively. A total of seven common minke, 55 Bryde's, 56 sei and 225 sperm whales were sighted during the first survey. During the second survey, a total of 12 Bryde's, 116 sei and 60 sperm whales were sighted. A total of two common minke, 10 Bryde's, 14 sei and 61 sperm whales were sighted during the third survey. One special block was set for the co-operative survey on the prey species and whale sampling. The co-operative whale prey survey was conducted from 24 July to 22 August in sub-areas 8 and 9. The main purpose of the prey survey in this year was recording of underwater behaviour of Bryde's and sei whales by using acoustic transmitters. Transmitters were attached to two sei whales and tracked for 31 hours 59 minutes and 10 hours 11 minutes, respectively. Results of this experiment is reported in Ishii *et al*., (2016: SC/F16/JR25).

**3.7. 2014 season** (Tamura *et al*., 2015)

The 13th full scale research was conducted in sub-areas 7, 8 and 9 from 16 May to 29 July 2014 (75 days including transit), using two SSVs, three SVs and one RB. Following the 31 March, 2014 Judgment of the International Court of Justice (ICJ), the Government of Japan voluntarily reviewed the state of JARPNII which resulted in the suspension of sampling of sperm and common minke whales and 25 of the 50 Bryde's and 10 of the 100 sei whales were studied by only using non-lethal methods in the 2014 survey (Fisheries Agency of Japan, 2015). The total searching distance by SSVs was 3,307 n. miles and 2 common minke, 116 Bryde's, 346 sei and 69 sperm whales were sighted. A total of 25 Bryde's and 90 sei whales were sampled and biopsy samples were collected from 25 Bryde's and 16 sei whales by SSVs. Two dedicated sighting surveys were conducted. The first survey was conducted from 11 May to 29 June in sub-areas 7, 8 and 9 by one SV (YS3), the second survey was conducted from 1 August to 14 September in the southern parts of sub-areas 7, 8 and 9 by two SVs (YS1, YS2). Total searching distance was 2,823 n. miles for the first survey and 2,347 n. miles for the second survey, respectively. A total of two common minke, 42 Bryde's, 333 sei and 69 sperm whales were sighted during first survey. During the second survey, a total of 72 Bryde's and 69 sperm whales were sighted. The co-operative survey on the prey species and whale sampling was not conducted in this season due to logistical reason.

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Table 1. Outline of JARPNII research activity between 2008 and 2014.

| Year | Research area | Research periods (days) | Research vessels[*1] | | | |
|---|---|---|---|---|---|---|
| | | | RB | SSV | SV | ESV |
| 2008 | 7,8,9 | 10 Jun. - 18 Aug. (70) | NM | YS1, YS2, YS3 | KS2, (KK1[*2]) | SHU, KK1 |
| 2009 | 7,8,9 | 14 May - 25 Jul. (73) | NM | YS2, YS3 | YS1 | SHU |
| 2010 | 7,8,9 | 13 Jun. - 18 Aug. (67) | NM | YS1, YS2 | YS3 | HK |
| 2011 | 7,8,9 | 16 Jun. - 30 Aug. (76) | NM | YS1, YS2 | YS1, YS2, YS3 | HK |
| 2012 | 7,8,9 | 21 May - 28 Jul. (69) | NM | YS1, YS2 | YS1, YS2, YS3 | SHU |
| 2013 | 8,9 | 30 Jul. - 2 Oct. (65) | NM | YS1, YS2 | YS1, YS2, YS3, SM2 | SHU |
| 2014 | 7,8,9 | 20 May - 25 Jul. (67) | NM | YS1, YS2 | YS1, YS2, YS3 | |

[*1] RB: Research base vessel, SSV: Sighting and sampling vessel, SV, Dedicated sighting vessel, ESV: Scientific echo sounder vessel.

[*2] KK1 conducted sighting and echo sounder survey.

Table 2. Sample size of whales collected in each sub-area and year.

| Year | Common minke | | | | Bryde's | | | | Sei | | | | Sperm | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SA7 | SA8 | SA9 | Total | SA7 | SA8 | SA9 | Total | SA7 | SA8 | SA9 | Total | SA7 | SA8 | SA9 | Total |
| 2008 | | 5 | 54 | 59 | 26 | 9 | 15 | 50 | | 33 | 67 | 100 | 1 | | 1 | 2 |
| 2009 | 19 | 17 | 7 | 43 | | 27 | 23 | 50 | | 31 | 69 | 100 | | | 1 | 1 |
| 2010 | | | 14 | 14 | 1 | | 49 | 50 | 10 | 15 | 75 | 100 | | 3 | | 3 |
| 2011 | 47 | | 2 | 49 | 37 | 4 | 9 | 50 | 1 | 29 | 65 | 95 | 1 | | | 1 |
| 2012 | 71 | 3 | | 74 | | 16 | 18 | 34 | | 34 | 66 | 100 | 3 | | | 3 |
| 2013 | | | 3 | 3 | | 18 | 10 | 28 | | 10 | 90 | 100 | | | 1 | 1 |
| 2014 | | | | 0 | 13 | 10 | 2 | 25 | | 21 | 69 | 90 | | | | 0 |
| Total | **137** | **25** | **80** | **242** | **77** | **84** | **126** | **287** | **11** | **173** | **501** | **685** | **5** | **3** | **3** | **11** |

Table 3. Number of biopsy samples collected between 2008 and 2014.

| Year | Blue | Fin | Sei | Bryde's | Humpback | Right |
|---|---|---|---|---|---|---|
| 2008 | 3 | | 1 | | 1 | 4 |
| 2009 | 6 | | 9 | | | |
| 2010 | | | 7 | 6 | | |
| 2011 | 4 | 2 | | 1 | 2 | 14 |
| 2012 | 1 | 1 | 4 | 42 | | 1 |
| 2013 | 1 | | | | 6 | |
| 2014 | | | 16 | 41 | | |
| Total | **15** | **3** | **37** | **90** | **9** | **19** |

Table 4. Number of identified whales by Photo-ID experiment.

| Year | Blue | Humpback | Right |
|---|---|---|---|
| 2008 | 4 | | 4 |
| 2009 | 7 | | |
| 2010 | 23 | | |
| 2011 | 6 | 5 | 19 |
| 2012 | 1 | 10 | 2 |
| 2013 | 2 | 11 | 1 |
| 2014 | 12 | 1 | 1 |
| Total | **55** | **27** | **27** |

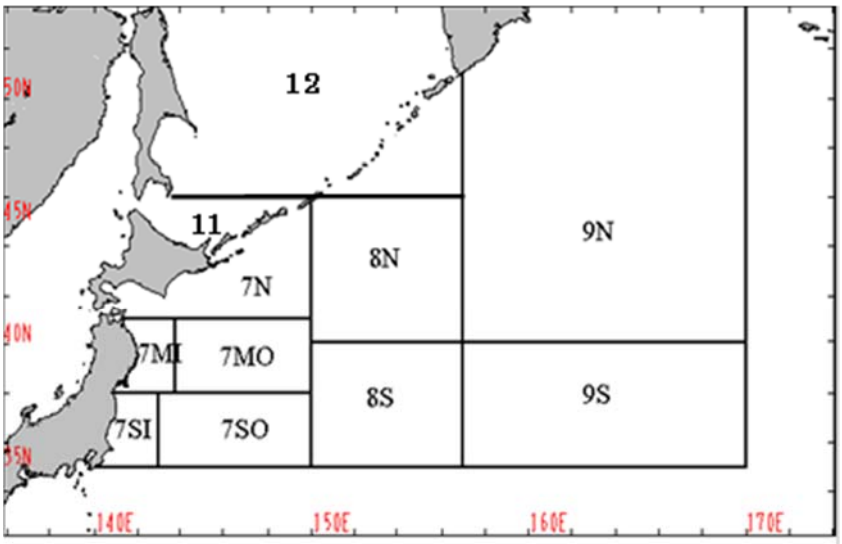


Figure 1. Research area, sub-area and strata of JARPNII offshore component.

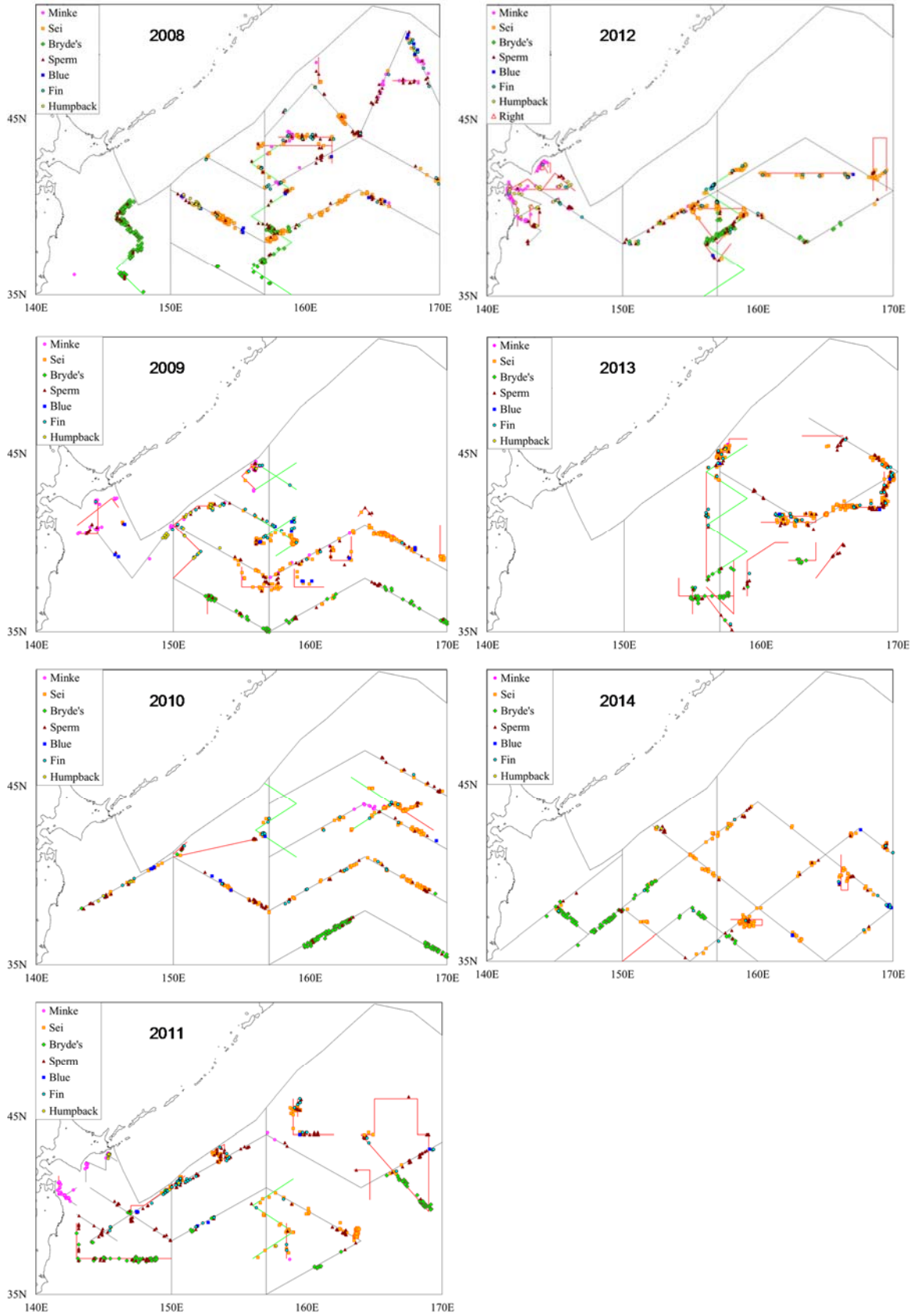


Figure 2. Outline of cruise track-lines and sighting positions of large whales made by SSVs during 2008 to 2014 JARPNII surveys (Black line: Whale sampling survey, Green line: Co-operative survey, Red line: Special monitoring survey).

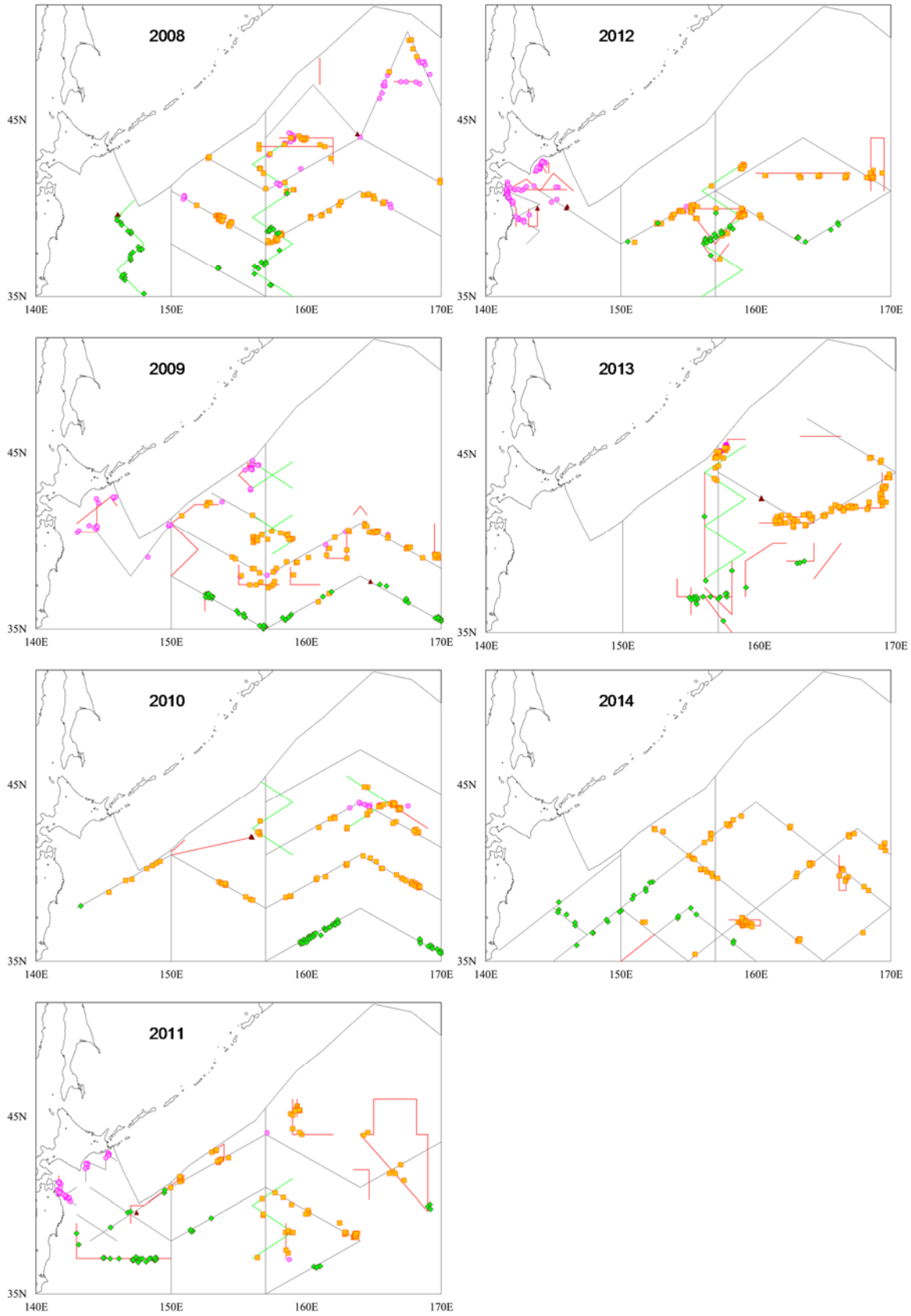


Figure 3. Outline of cruise track-lines and sighting positions of the sampled common minke (●), sei (■), Bryde's (◆) and sperm (▲) whales during 2008 to 2014 JARPNII surveys (Black line: Whale sampling survey, Green line: Co-operative survey, Red line: Special monitoring survey).

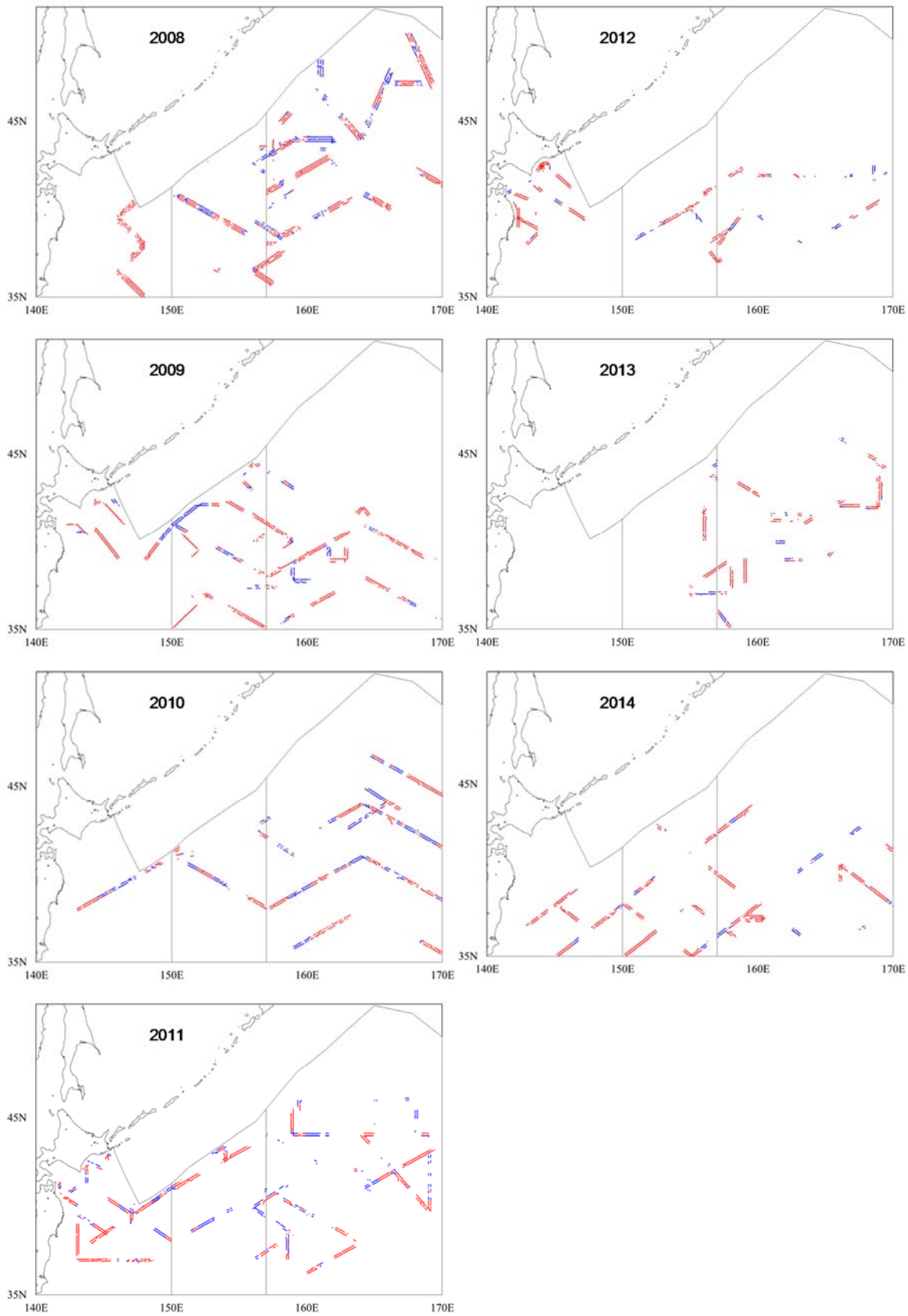


Figure 4. On effort cruise tracks made by SSVs during 2008 to 2014 JARPNII surveys.
Red line: *NSC* mode; Blue line: *NSS* mode.