SC/67A/NH/07 Rev1

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INTERNATIONAL WHALING COMMISSION

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ABSTRACT

The sighting information of the North Pacific right whale in the western North Pacific was summarized based on the sighting data of the Institute of Cetacean Research (ICR: 1994-2016, from April to September) and the National Research Institute of Far Seas Fisheries (NRIFSF: 1982-2011, from January to December including recent the Japanese and Russian joint cruises data). A total of 599,596.7 n.miles were surveyed in the North Pacific. Maps of the Density Index (DI: individuals / 100 n.miles) by 1°X 1° square are provided. North Pacific right whales were mainly distributed north of 42°N in the western North Pacific, including 10 mother and calf pairs. High density areas were observed north of 46°N in the far south east Kamchatka and in the Okhotsk Sea. There were no sightings in the Sea of Japan. Surface temperature in the location of the sightings ranged from 2.7 to 16.6°C. A northward migration pattern was observed from the Pacific to the Sea of Okhotsk during the winter to summer. A total of 61 individuals were photographed and a total of 28 biopsy samples were collected by the ICR. This information is useful to investigate the offshore seasonal distribution, migration pattern and stock structure of this species in the western North Pacific. Further analysis and collaborations are required to improve information on seasonal distribution, migration pattern, abundance estimation and stock structure of this species.

KEY WORDS: PACIFIC OCEAN, SURVEY VESSEL, DISTRIBUTION, NORTH PACIFIC RIGHT WHALE

INTRODUCTION

North Pacific right whale (*Eubalaena japonica*), mainly feed on copepods and other small invertebrates such as krill, and they migrate annually between low latitude water winter breeding grounds and colder water summer feeding grounds. Because they are slow swimming species, floating after death, and provide considerable quantities of commercially valuable whale oil, they were a highly desirable target species (Omura, 1969, 1986). For the western stock, recent information is very limited. Omura (1986) suggested two migration routes along both sides of the Japanese main island, based on historical whaling data: a Sea of Japan route to the Sea of Okhotsk and a Pacific route to the Kuril Islands and Bering Sea. It was noted that the Kuril Island and Kamchatka coasts and offshore areas are likely to be major summer feeding areas, based on historical and additional recent records (Vladimirov, 1993, Brownell *et al*. 2001, Clapham *et al*. 2004, Josephson *et al.* 2008, Sekiguchi *et al.*, 2014). Miyashita and Kato (1998) presented a preliminary estimate of 922 animals, based on sighting survey results in the Sea of Okhotsk (28 animals in 16 groups); however, Brownell *et al*. (2001) argued that too little information was available to have any confidence in that estimate. Hakamada and Matsuoka (2016) estimated the number of North Pacific right whales in the part of the Western North Pacific, as 1,147 (in 2011 and 2012) from May to June and 416 (in 2008) from July to August. In this paper, we examined North Pacific right whale distribution patterns using a combination of two major sighting datasets (ICR and NRIFSF) in the Western North Pacific and the Okhotsk Sea.

MATERIAL AND METHODS

Sighting data used in this analysis

ICR sighting data

The JARPN (1994-1999) and JARPN II (2000-2016) included systematic whale sighting surveys with and without

sampling activity. The research area of the JARPN and JARPN II was the Pacific waters north of 35°N in sub-areas 7, 8 and 9, for common minke whales except the 200 n.miles EEZ of foreign countries. In the Sea of Okhotsk, it covered only sub-area 11 also except the Russian EEZ. All whale species sighted are recorded during the sighting surveys. Details of the outline of the JARPN and JARPN II surveys were reviewed by Fujise (2000), Tamura *et al*. (2008) and Matsuoka *et al*., (2016). Sighting data (effort and primary sightings) from JARPN (1994-1999) and JARPN II (2000-2016) systematic sighting surveys collected by sighting and sampling vessel (SSV) and dedicated sighting vessel (SV) were used for this analysis. An outline of the sighting surveys are follows;

The sighting procedure of JARPN II (2000-2016) was not significantly changed during the JARPN (1994-1999) surveys with only minor changes of the sighting procedure. The research vessels were equipped with a barrel, where three top men conducted sighting observation. On the upper bridge, a captain, a gunner, a helmsman and a researcher also conducted the sightings. The sighting activity was continued if weather permitted during daytime from 30 minutes after sunrise to 30 minutes before the sunset. Searching was conducted under closing mode by taking into consideration the sea condition at the time of the searching, under the normal weather conditions defined as visibility of 2 n.miles or more and wind speed under 21 knot.

When a cetacean school which seemed to be minke whales or other large cetaceans was sighted in the research area, the ship closed to the school in order to identify the species, estimate the school size and obtain other biological information (number of calves, estimated body length etc.). To improve the estimation of the distance to the school and the angle from the bow, training was conducted in the early part of each cruise by each vessel. Distance was estimated by using the scale in the binocular and angle was estimated using an angle board. Surface temperatures were recorded at each whale sighting.

NRIFSF sighting data

NRIFSF started dedicated sighting surveys in the North Pacific in the early 1980's. The sighting method and procedure have been based on the IWC/IDCR southern hemisphere cetacean sighting surveys. These methods and procedures have been almost the same as the ICR sighting surveys described above except for the followings; some vessels did not have a top barrel, normal closing made was the main survey mode but some cruise used abeam closing mode.

Early Russian data

The historical data from Russian vessels were collected during complex ecosystem studies focused mainly on fish stocks. However that data give some information on right whale distribution in 1980-1990s.

RESULTS AND DISCUSSIONS

Searching effort and sightings of North Pacific Right whales

ICR sighting data

This species was the rarest baleen whale sighted in the western North Pacific. Table 1a shows the summary of the primary whale sightings during the JARPN (1994-1999) and JARPNII (2000-2016) surveys from April to September. A total of 213,425.4 n.miles was surveyed. This species was mainly distributed north of 39°N in the research area from May to September (60 schools and 83 individuals). Observed mean schools size was 1.38 individuals (n=60) including 10 mother and calf pairs. Surface temperature ranged from 2.7°C to 16.6°C.

NRIFSF sighting data including Japanese and Russian joint cruises in the Okhotsk Sea

Table 1b shows the summary of the sightings by the NRIFSF surveys (1982-2003). A total of 386,171.3 n.miles was surveyed. This species was mainly distributed north of 39°N in the research area from May to September (35 schools and 52 individuals). Observed mean schools size was 1.49 individuals (n=35). Surface temperature ranged from 3.8°C to 17.3°C.

Combined primary searching efforts and the primary sightings of whales

A total of 599,596.7 n.miles was surveyed in the western North Pacific including Okhotsk Sea between 1982 and 2016. Figure 1a shows the research area and the primary searching effort (n,mile) of the ICR sighting data (JARPN and JARPN II: 1994-2016, from April to September) by Lat.1°× Long.1° square. The research area was completely covered during the surveys.

Figure 1b shows the combined Density Index (number of primary sightings of individuals / 100 n.mile) of North Pacific right whales by the ICR and the NRIFSF sighting data by Lat.1°× Long.1° square including the Japanese and Russian joint cruises in the Okhotsk Sea. A northward migration pattern was observed from the Pacific to the Sea of Okhotsk during the winter to summer. High density areas were observed north of 46°N in the far south east of Kamchatka and in the Okhotsk Sea. There were no sightings in the Sea of Japan.

According to early studies right whales occur in small numbers in central and northeastern part of the Okhotsk Sea (Berzin 1985). There are also some reports on sightings of right whales to the southeast of Sakhalin Island and by the Okhotsk side of central Kuril Islands (Berzin, Vladimirov, 1986). One whale was sighted in the central part of Sea of Okhotsk in 1989, 6 whales – in 1990 and a total of 34 whales were observed in various parts of the sea in 1992. There were no observations of right whales in the Sea of Japan by Russian vessels since early 1960-s. (Vladimirov, 1993).

Joint Japanese-Russian sighting surveys were conducted in the Sea of Okhotsk in 1998-2011. Table 1c shows the summary of the sightings. Generally right whales were distributed in the central part of the sea, although there was not enough effort in the northern part due to logistical reasons. 2011 survey was conducted in early season (May-June), the only sighted whale was located at above 49°N.

Figure 2 shows the monthly distribution of the density index by the ICR sightings from April to September. A northward migration pattern was observed from the Pacific to the Sea of Okhotsk during the winter to summer. Although the sighting effort in the northern part of the research area was insufficient in June, a northward migration pattern of whales was observed from May to August. The sighting areas of this species seemed to move from the coastal region to the offshore regions and the number of sighting areas decrease from May to September.

Photo-ID database and biopsy samples collected

Photo-ID data and biopsy samples were opportunistically collected during the ICR surveys. A total of 61 individuals were photographed and matching work within this surveys is still ongoing. A total of 28 biopsy samples was collected by ICR (Table1, Figures 3a to 3c). However, a total of 6 individual samples were lost as a result of the 2011 Tsunami on March 11.

New information and further survey requirements

For the western North Pacific, recent information is limited. Distribution pattern of this species were reported using historical catch record (e.g. Nishiwaki, 1966, Omura, 1986, Clapham *et al.*, 2006) and JSV data (5°X 5° square analyses; Miyashita *et al*., 1995, Miyashita and Kato, 1998). There are two migration routes along both sides of Japanese main Island, based on historical whaling data (Omura, 1986). And several scientists have suggested that the Kuril Islands and Kamchatka coasts are likely to be major summer feeding regions, based on historical and recent new information (Matsuoka *et al.*, 2000 and 2009, Brownell *et al*., 2001. Clapham *et al*., 2004, Jefferson *et al*., 2008, Sekiguchi *et al*., 2014). Present information of whale distributions is supported these feeding regions and valuable as new information for this species. Overall, this information is more detailed rather than previous data. This result confirmed that existence of this species in the offshore region during 1994-2016 especially outside of Okhotsk Sea in July to August. According to Miyashita *et al.* (1995), there were no sightings in outside of the Okhotsk Sea in August. As a whole, the main distribution areas of this species were moved northward from 39°N to 49°N from April to September in the western North Pacific, which coincided with previous large-scale distribution pattern by Miyashita *et. al*. (1995). Sightings information near the

foreign 200 n.miles EEZ boundary in the east of Kurile Islands in June was also reported by the R/V *Oshoro-Maru*) in 2012 and 2013 (Sekiguchi *et al*., 2014). New information of stranding and by-catch data in Japan are summarized by NRIFSF and ICR and will be reported to the IWC/SC in near future.

Present information is useful to investigate the offshore seasonal distribution, migration pattern and stock structure of this species in the western North Pacific. Further analysis and collaborations are required to improve information on seasonal distribution, migration pattern, abundance estimation and stock structure of this species.

ACKNOWLEDGMENT

We would like expressing our thanks to all Cruise leaders, Captains, officers, crew and researchers involved on the NRIFSF and the ICR surveys and marine mammal researchers of VNIRO and TINRO-Center (Russian Federation). Our gratitude also to Seiji Ohsumi, Hidehiro Kato, Yoshihiro Fujise, Luis Pastene and Tsutomu Tamura, Megumi Takahashi, Hitomi Sato for their help in the preparation of this paper.

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Table. 1a. Summary of North Pacific right whale sightings during the JARPN and JARPNII (1994-2016) during April to September. Sch.: Number of the primary sightings of schools. Ind.: Number of the primary sightings of individuals. Calf: Number of calves including Ind.. Mss: observed mean school size (Ind. / Sch.). DIS: Density Index (schools / 100 n.miles). DIW: Density Index (individuals / 100 n.miles). SST: Range of surface temperature of the sighting position. Photo-ID: number of individuals, Biopsy sample: number of samples.

Year	Western North pacific						
	Sch.	Ind.	Calf	Mss	WT	Photo-ID	Biopsy sample
1994	1	2	1	2.00	17.0ºC	2	0
1995	2	2	0	1.00	6.8 - 13.2ºC	1	0
1996	0	0	0	-	-	-	-
1997	2	3	0	1.50	3.5 - 7.5ºC	1	0
1998	4	6	2	1.50	3.3 - 13.3ºC	0	0
1999	0	0	0	-	-	-	-
2000	0	0	0	-	-	-	-
2001	2	3	1	1.50	12.0 - 16.9ºC	3	0
2002	2	2	0	1.00	13.4 - 16.0ºC	0	0
2003	5	6	1	1.20	3.0 –-15.7ºC	4	1
2004	2	4	0	2.00	10.3 - 12.7ºC	3	2
2005	2	4	2	2.00	12.3 - 16.6ºC	2	2
2006	11	15	0	1.40	7.8 - 10.3ºC	11	2
2007	1	1	0	1.00	13.3ºC	0	0
2008	5	6	1	1.20	8.8 - 15.1ºC	4	4
2009	1	1	0	1.00	7.5ºC	1	0
2010	0	0	0	-	-	-	-
2011	13	20	2	1.54	2.7 - 4.2ºC	20	14
2012	2	2	0	1.00	8.3 - 13.9ºC	2	1
2013	1	1	0	1.00	13.4ºC	1	0
2014	1	1	0	1.00	13.5ºC	1	0
2015	3	4	0	1.33	2.3-2.4ºC	1	2
2016	0	0	0	-	-	-	-
Total	60	83	10	1.38	2.7 - 16.6 ºC	57	28

Table. 1b. Summary of North Pacific right whale sightings during the NRIFSF sighting surveys (1982-2003). Sch.: Number of the primary sightings of schools. Ind.: Number of the primary sightings of individuals. Mss: observed mean school size (Ind. / Sch.). DIS: Density Index (schools / 100 n.miles). DIW: Density Index (individuals / 100 n.miles). SST: Range of surface temperature of the sighting position. After 2004 data is still analyzing.

Year	Effort	Sch.	Ind.	Mss	DIS	DIW	SST
1982	11,274.5	-	-	-	-	-	-
1983	18,520.3	-	-	-	-	-	-
1984	20,702.9	2	4	2.00	0.01	0.02	16.9-17.3
1985	23,937.9	-	-	-	-	-	-
1986	19,466.7	-	-	-	-	-	-
1987	17,597.7	-	-	-	-	-	-
1988	29,719.5	-	-	-	-	-	-
1989	25,297.0	-	-	-	-	-	-
1990	24,686.4	2	5	2.50	0.01	0.02	8-12.9
1991	19,265.7	1	1	1.00	0.01	0.01	17.0
1992	24,427.0	17	26	1.53	0.07	0.11	8.9-11.8
1993	28,390.2	-	-	-	-	-	-
1994	35,350.2	-	-	-	-	-	-
1995	23,484.6	-	-	-	-	-	-
1996	19,791.1	-	-	-	-	-	-
1997	14,581.5	-	-	-	-	-	-
1998	11,622.8	-	-	-	-	-	-
1999	10,670.5	-	-	-	-	-	-
2000	2,985.0	-	-	-	-	-	-
2001	2,317.0	-	-	-	-	-	-
2002	6,714.6	-	-	-	-	-	-
2003	6,038.7	13	16	1.23	0.22	0.26	3.8-13.4
Total	386,171.3	35	52	1.49	0.01	0.01	3.8-17.3

Table. 1c. Summary of North Pacific right whale sightings during Japanese-Russian cruises 1998-2011 in the Okhotsk Sea. Sch.: Number of the primary sightings of schools. Ind.: Number of the primary sightings of individuals. Calf: Number of calves including Ind. SST: Range of surface temperature of the sighting position.

Year	Period of survey	Sch	Ind	Calf	SST
1998	September	2	2	-	-
2000	July-September	3	3	-	-
2003	July-September	16	20	-	-
2009	July-August	17	29	0	7,4-15,7
2010	July-August	3	4	1	8,4-14,3
2011	May-June	1	1	0	5,8

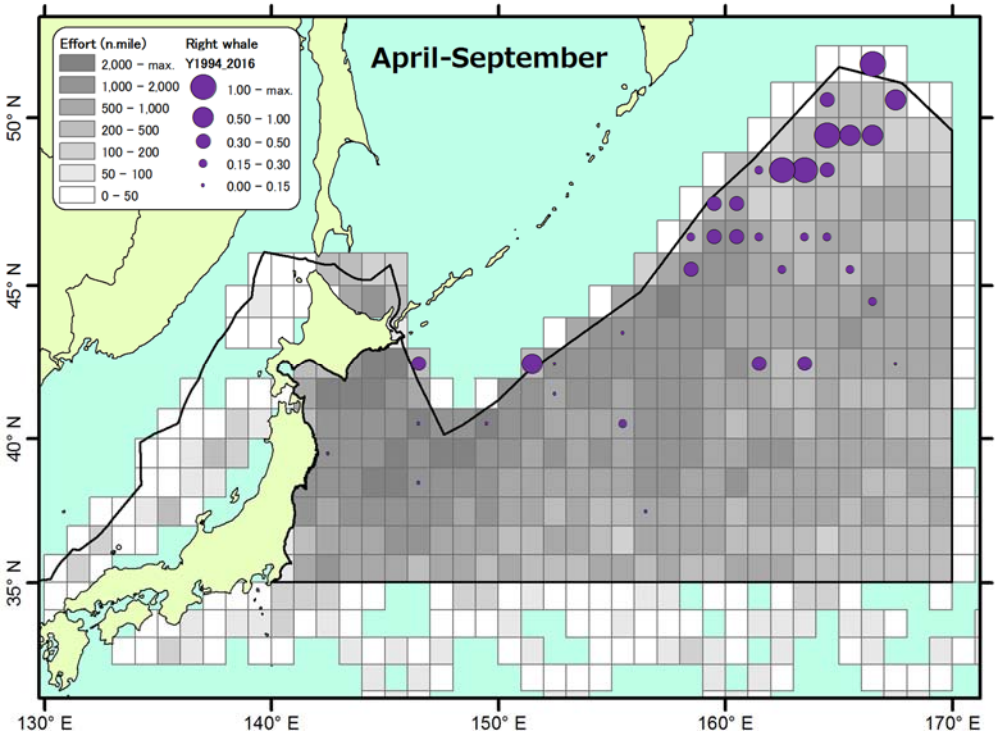

Figure 1a. Distribution of the Density Index (number of primary sightings of individuals / 100 n.mile) of North Pacific right whales during April to September of the ICR surveys (1994 to 2016) by Lat.1°× Long.1°square.

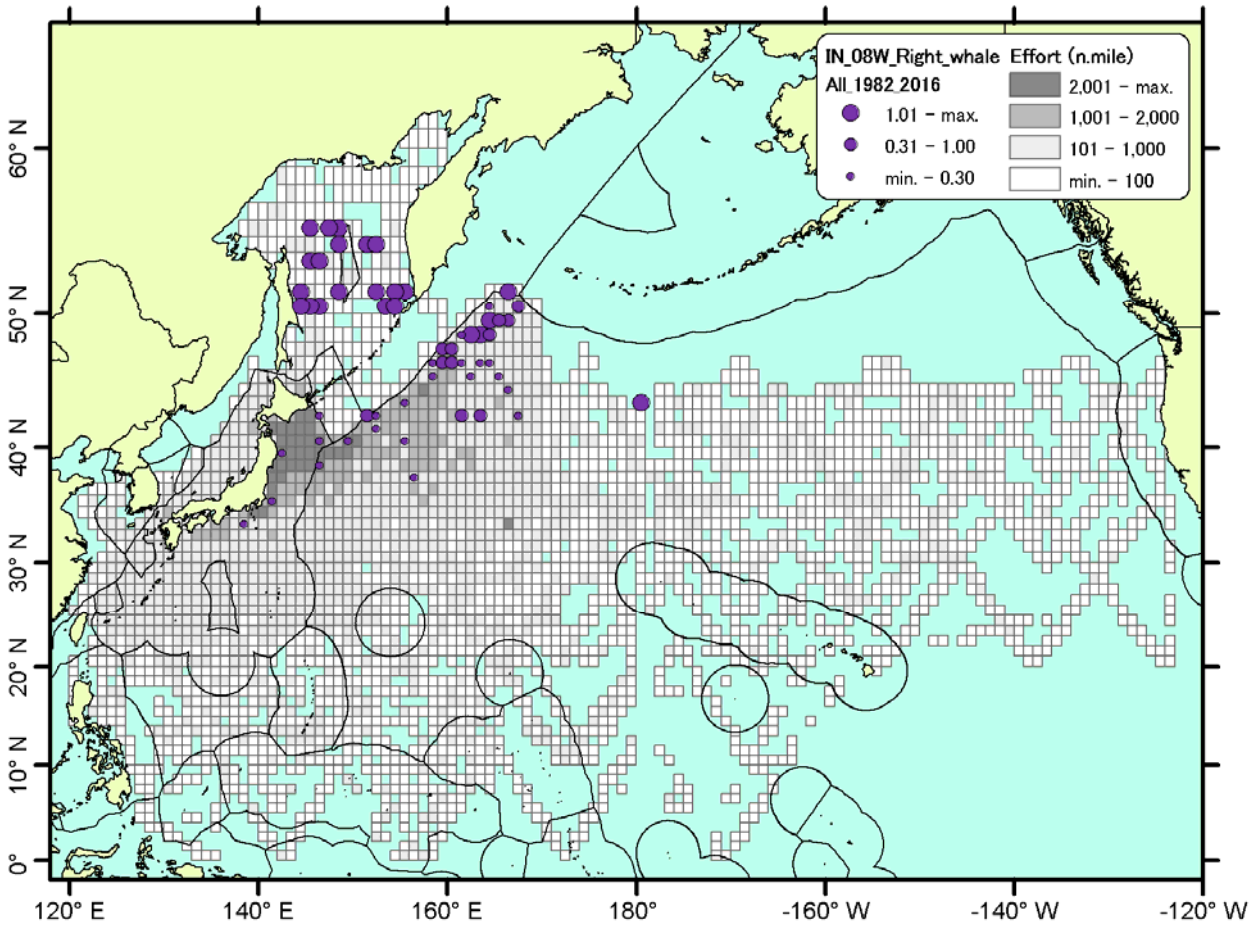

Figure 1b. Combined the Density Index (number of primary sightings of individuals / 100 n.mile) of North Pacific right whales combining whole the ICR (1994-2016) and NRIFSF (1982-2011) datasets for all months by Lat.1°× Long.1°square, including the Japanese and Russian joint cruises in the Okhotsk Sea.

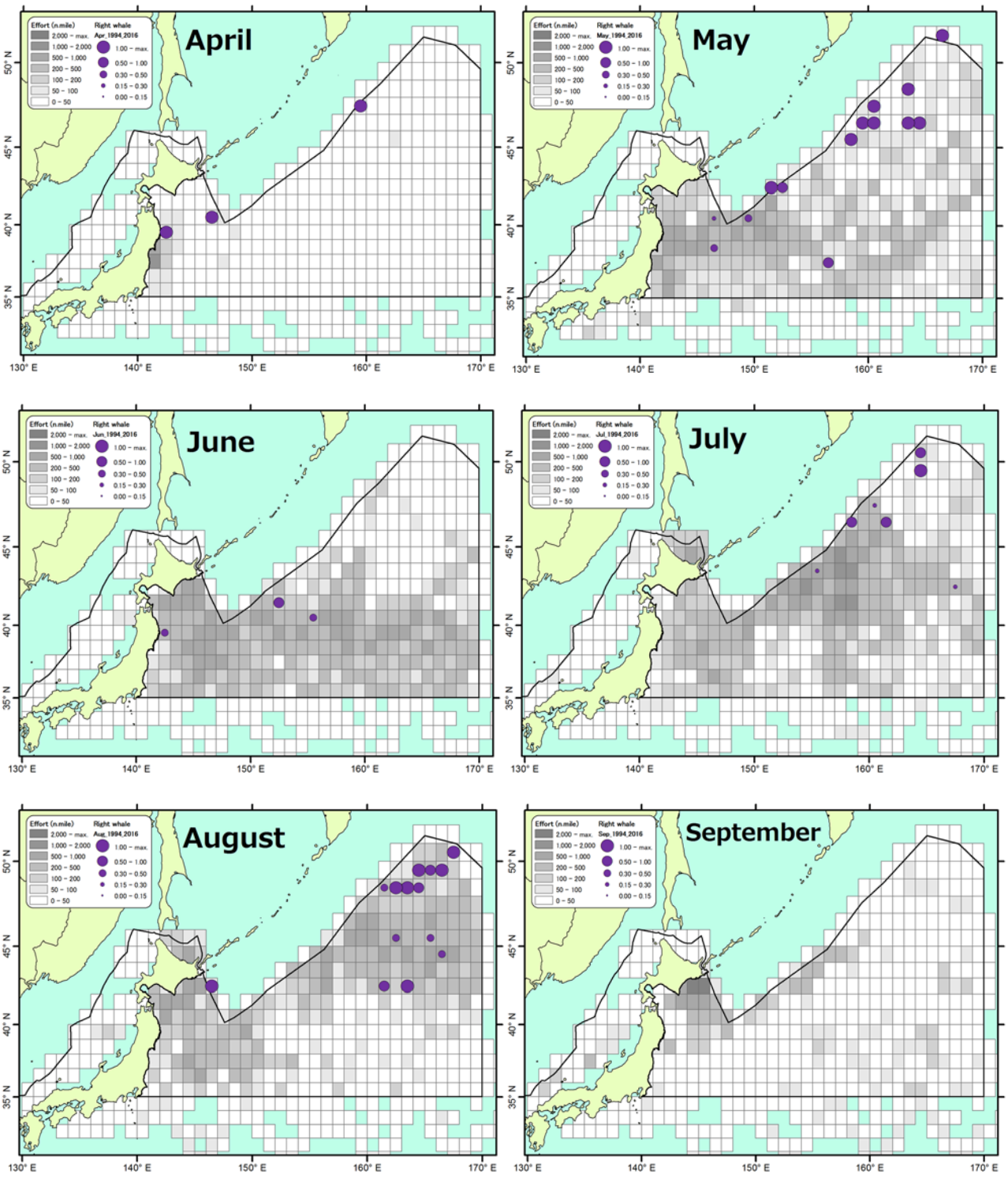

Figure 2. Monthly change of the Density Index (number of primary sightings of whales / 100 n.mile) of North Pacific right whales by the ICR surveys from 1994 to 2016 surveys by Lat.1°× Long.1°square.

Figure 3a. A head of North Pacific right whale sighted in the western North Pacific on 2 August 2006 (left photo), and a long scar on the caudal peduncle keel sighted in the western North Pacific on 1 August 2006 (right photo).

Figure 3b. A mother and calf pair of North Pacific right whale, sighted in the western North Pacific on 2 August 2008 (left), and surfacing of North Pacific right whale, sighted in the western North Pacific on 31 May 2012 (right).

Figure 3c. A white spot on right side of lower jaw sighted in the western North Pacific on 29 May 2011 (left), and scars on back (right) sighted in the western North Pacific on 6 June 2012.