Methodology and survey procedure under the JARPN II – coastal component of Sanriku and Kushiro- during 2008 to 2014, with special emphasis on whale sampling procedures

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ABSTRACT

This paper summarized the methodology of the whale sampling surveys in the coastal component of JARPN II using small-type whaling catcher boat during 2008 to 2014. The coastal component started with two feasibility surveys: one in the autumn of 2002 off Kushiro and the other in the spring of 2003 off Sanriku district under the full JARPN II research plan. The surveys were introduced to cover the temporal and spatial gaps in sampling, which cannot be covered by the *Nisshin Maru* research unit used for offshore sampling. After the two feasibility surveys with a sampling of 50 common minke whales in each year, the coastal component was revised with a maximum sample size of 60 whales for each of the spring and autumn seasons. Both areas were surveyed in every year from 2005, and Expert Workshop to review JARPN II for results from 2002 to 2007 was conducted in 2009. After 2007, surveys have been continued with a same method, except for 2011 (due to the great earthquake disaster occurred in the Sanriku region, spring survey of Sanriku was modified to conduct in Kushiro). In 2014, following the Judgement of the International Court of Justice (ICJ), the government of Japan voluntarily reviewed the state of JARPN II, which resulted in modification of maximum sample size of 60 to 51 whales for each of the seasons, and non-lethal method was introduced into the surveys. The whale sampling procedures were almost same with former 2002 to 2007 surveys, which done by three or four small-type whaling catcher boats in the waters within the maximum of 50 nautical miles from the Kushiro port or the Ayukawa port. A land station with a research head office was established near each of Kushiro and Ayukawa port. The office principally determined searching area and routes of the sampling boats every day, based on the weather conditions and whale distribution, and all boats returned to the port every night. All common minke whales sighted were targeted for sampling, except for cow-calf pairs. Once the boat sampled a whale, she returned to the port. At the port, whales were lifted up from the boat by a crane, and transported to the land station by a freight trailer. All whales sampled were biologically examined at the station in almost the same manner as that for the offshore component. In addition, biopsy sampling and fecal sampling trials for common minke whales was carried out by small-type whaling catcher boats in 2014 surveys.

1.BACKGROUND

The full-scale surveys of the second phase of the Japanese Whale Research Program under Special Permit in the western North Pacific (JARPN II) started in 2002 (Government of Japan, 2002a). The objectives of the surveys are: i) feeding ecology and ecosystem studies, involving prey consumption by cetaceans, prey preferences of cetaceans and ecosystem modeling, ii) monitoring environmental pollutants in cetaceans and marine ecosystem, and iii) stock structure of whales (Government of Japan, 2002a).

The former JARPN (1994-1999) and the JARPN II feasibility study (2000-2001) showed that common minke whales were widely distributed from the offshore to the coastal waters and fed on various prey species such as Japanese anchovy, Pacific saury and walleye pollock (Government of Japan, 2002b; Tamura and Fujise, 2002). Especially, the coastal area of Japan was an important fishing ground and the competition between the whales and fisheries was likely to be severe. However, the *Nisshin-Maru* research vessels could not survey in the near shore areas or in the seasons from late autumn to early spring because of the practical availability of the vessels. Under this situation, sampling of common minke whales in the coastal areas by using small-type whaling catcher boats was introduced as a 'coastal component' to cover the temporal and spatial gaps, in the full-scale JARPN II (Government of Japan, 2002a).

The coastal component started with a two-year feasibility survey to examine the logistic aspects of the methodology (Government of Japan, 2002a). First survey was carried out in the coastal waters off Kushiro, northeast Japan in autumn 2002 (Kishiro, *et al*., 2003) and second survey was conducted in the waters off Sanriku district in spring 2003 (Yoshida, *et al*., 2004). Each survey took 50 common minke whales. After examination of the logistic aspects (Kato, *et al*., 2004), the survey was continued under the full-scale JARPN II with modification of a maximum sample size of 60 whales for each survey in Kushiro and Sanriku (Government of Japan, 2004a). From 2005, both Kushiro and Sanriku surveys have been conducted in every year.

In 2009, the first Expert Workshop to review the JARPN II was conducted for the results of the feasibility and

first six years surveys from 2002 to 2007 (IWC, 2010). A review of the whale sampling procedures of the coastal component during 2002 to 2007 surveys was submitted to the first Workshop (Kishiro, *et al*., 2009).

After 2007, coastal component have been continued with almost same manner, but in March 2011, the great earthquake disaster was occurred in the Sanriku region. Due to this disaster, spring survey of Sanriku in 2011 was modified to conduct in Kushiro in spring season (Yasunaga, *et al*., 2012). After 2011, spring survey of Sanriku was resumed and both Sanriku and Kushiro surveys have been conducted in every year.

In 2014, following the 31 March 2014 Judgement of the International Court of Justice (ICJ), the government of Japan voluntarily reviewed the state of JARPN II, which resulted in modification of maximum sample size of 60 to 51 whales for each of the seasons, and non-lethal method was introduced into the surveys. These modifications were applied for both Sanriku and Kushiro surveys in 2014 (Mogoe, *et.al*., 2015a, and Yoshida, *et.al*., 2015)

The coastal component was conducted by the Institute of Cetacean Research (ICR) for Sanriku, and the National Research Institute of Far Seas Fisheries (NRIFSF) for Kushiro, with cooperation by the Tokyo University of Marine Science and Technology and the Association for Community-Based Whaling. This paper summarized the methodology and survey procedures of the coastal component in 2008 to 2014, with special reference to the whale sampling procedures.

2. GENERAL METHODOLOGY OF THE WHALE SAMPLING SURVEY

Small-type whaling catcher boats are very small sized vessels (Table 1), extremely weak in bad weather conditions such as big waves and strong wind, and cannot stay on the sea for a long period. Thus, a land-based operation system was incorporated for whale sampling in the coastal component. Sampling procedure during 2008 to 2014 was almost same with former 2002 to 2007 surveys (Kishiro, *et al*., 2009). The procedure was designed taking account of operational capacity, ability, and arrangements of the small boats, and different from the random sampling procedures adopted by the JARPN II offshore component using large vessels, but thought to be acceptable in terms of stomach contents collection if the samples evenly cover the area where whales were seen in the targeted small local area (Kato, *et al*., 2004). Table 2 shows an outline of the coastal component surveys in the JARPN II from 2008 to 2014 season.

2.1 Research area and season

As same as former 2002 to 2007 surveys, research area were set in the coastal waters off Kushiro, southeastern part of the Pacific coast of Hokkaido, in autumn season and off the Sanriku district, northeastern part of the Japanese main island, in spring season (Fig. 1). Both waters were known to be major whaling grounds of the past commercial whaling for common minke whales in respective season (Hatanaka and Miyashita, 1997) and also important fishing grounds for other commercially important species such as walleye pollock, Japanese anchovy, sardine, and sand lance. These areas were located in the sub-area 7CN(Kushiro) and 7CS(Sanriku) established by the IWC. In order to maintain freshness of samples for biological examination at the land station, especially, to maintain freshness of stomach contents for feeding study, surveys was mainly conducted within a 30 nautical miles radius from the port in respective area (the Kushiro port or the Ayukawa port), and limited within the maximum of 50 n. miles radius from the port.

2.2 Sampling vessels

Following small-type whaling catcher boats were used as sampling vessels. Details of the boats were shown in Table 1 and Figure 2.

Sumitomo Maru No. 31 (here in after referred as 31S; 32.0GT) … 2008-2010 seasons
Sumitomo Maru No. 51 (51S; 30.0GT)…2011-2014 seasons
Koei Maru No. 8 (8K; 32.0GT)…2011-2014 seasons
Koei Maru No. 75 (75K; 46.2GT)…2008-2010 seasons
Taisho Maru No. 28 (28T; 47.3GT)…2008-2014 seasons
Katsu Maru No.7 (7K; 32.0GT)…2008-2014 seasons
Seiwa Maru (SW; 15.2GT)…2011 season

During the period from 2008 to 2010, four boats (31S, 75K, 28T, 7K) were used. In 2011, 31S was replaced by 51S, and 75K was replaced by 8K. The 8K is renamed vessel of 31S, and actually the same boat (31S). The 75K

was retired in 2011. The SW was introduced once in 2011 spring survey, in which three boats (SW, 7K, 51S) were used. In 2012 and afterwards, four boats (51S, 8K, 28T, 7K) were used.

2.3 Land station (JARPN II research station)

As same as former 2002 to 2007 surveys, a land station with a research head office was established in the respective season for biological sampling, flensing, and commanding the operation of the sampling vessels. In the survey off Kushiro, one station was established in the suburbs of Kushiro City (42°58'N, 144°05'E). In the survey off Sanriku, another station was established in the Ayukawa port area (38°17'N, 141°30'E). The head office continued to communicate with the sampling vessels during the survey, using radio or marine telephone. When the sampling vessel took a whale, the carcass was pulled onto the rear deck of the vessel and she returned to the port. At the port, whale was lifted up from the vessel by a crane, using a wire net and transported to the station by an 11-tons freight trailer (Fig. 3).

2.4 Sighting methods of the sampling vessels

Procedures was almost same as former surveys (Kishiro, *et.al*., 2009). To maintain the ability for sighting and capturing the whales by small boats with few members of the crew, a usual line transect method such as the zigzag shaped track lines was not introduced. Because the small boats are extremely weak in bad weather conditions such as big waves and strong wind, and cannot stay on the sea for a long period, boats departure the port in every morning, and return to the port every night. General procedure was follows:

(1) The predetermined course (direction from the port) at an angle of regular intervals (usually 10-15 degree intervals) are set up by the head office, and allocated to the respective boat (Fig.4A). The boats departure the port with respective course, and start to searching with cruising speed at 10-11 knots.
(2) The boats continue to search along the course until common minke whales are sighted, or boats arrive at 30 n. miles from the port (Fig. 4B). Each boat tries to take her first encountered whale. If the boats missed to catch the targeted whale, they resumed searching along the course.
(3) If boat captured whale, she returned to the port to transport the animal to the research station. During the return cruise, searching is resumed, and other common minke whales sighted are targeted for sampling, when the situation allowed. After the whale was transported to the station, the boat re-departed from the port as match as possible.
(4) After arriving at 30 n. miles from the port, the boats change the course freely within a 50 n. miles radius from the port, and continue to search (Fig. 4C and D).
(5) When the weather or sea state were expected to be changed to worse before arriving at 30 n. miles from the port, then the boats changed the course freely at that point. When the weather changed to more badly (around 2m height of the waves or Beaufort 4 or more), the boats returned to the port.
(6) Searching is principally continued until 30 minutes before sunset, and then all boat return to the port.
(7) The predetermined course is changed every day to cover broad areas.

Searching is carried out from the top barrel (6 to 7 m above the water surface) with almost all crew members (4 to 5 persons) except for persons handling the boat. Searching is also conducted in some times form upper bridge by one or two crews and a researcher. At least one researcher was on board in each of all boats, and recorded information on sighting, sampling and searching effort, e.g., time and location of sighting and sampling, species and school size sighted, and activity and cruise tracks of boat. Weather information (weather, visibility, wind force, and sea surface water temperature) was also recorded for every hour. Sightings of whales were classified into primary and secondary sightings. The primary sightings were those seen during normal searching period (crew searched from the top barrel). The secondary sightings were those seen in out of normal searching, e.g., during closing or chasing target whales, no observer in the top barrel, or off the research time.

To avoid the excessive concentration of the sampling areas, other restricted method to determine the course (direction from the port) was prepared as a sector survey. In that survey, the research area is divided into three or four sectors based on the direction from the port (Fig. 5), and one of those sectors is selected as a restricted searching area. Predetermined course is set within that sector, and the boats cruise within that sector to broad the searching and sampling coverage in the total research area. This method was prepared as a supplemental option, but not implemented during the 2008 to 2014 surveys, because almost whole research area (at least within 30 n. miles from the port) could be covered by usual method in Kushiro surveys. In Sanriku surveys, this supplemental method could not be implemented due to the difficulty in conducting the survey in the outside of the Sendai Bay, where changeable weather condition and bigger wave prevented the small boats. As a result, searching area was concentrated in the middle part of the Sendai Bay in Sanriku surveys.

Resultant cruise trucks of the sampling vessels during 2008 to 2014 Kushiro and Sanriku survey were shown in Figure 6 and 7, respectively. In Kushiro survey, the searching areas almost covered the waters within 30 n. miles from the port in the direction of east and west. In Sanriku survey, the searching areas were concentrated in the southwestern part of the research area (the middle part of the Sendai Bay) as mentioned above.

2.5 Sampling methods

All common minke whales sighted were targeted for sampling. Cow-calf pair was planned to be excluded from the target, but such pairs were not sighted during the surveys. When a sighting consisted of more than one animal, first targeted animal was selected using a random digit table. Sampling was made by 50 mm whaling cannon. In order to avoid the vomit of stomach contents from whale, and to maintain the human safety during the operations, chasing was usually limited to a maximum of 120 minutes against one animal. Distributions of common minke whales sampled by the respective surveys are shown in Figure 8 and 9. Locations of these samples covered almost all of the areas searched by the boats in respective surveys.

2.6 Biological survey

All the whales sampled were biologically examined by researchers on the land station in almost the same manner as that for the offshore component. Research items of the biological studies were summarized in Table 3 and 4, with the number of data and samples obtained. These items were related to the studies on feeding ecology, stock structure, life historical biology and pollution studies.

2.7 Non-lethal survey

Biopsy sampling and fecal sampling trials for common minke whales was carried out by small-type whaling catcher boats in 2014 Sanriku and Kushiro surveys. Details of the methods and results were described by Mogoe, *et. al.*, 2015b, which was submitted to the 66a th IWC Scientific Committee meeting.

2.7.1 Biopsy sampling

Biopsy sampling for common minke whales was attempted using compound crossbow, air gun (LKARTS-Norway), and Larsen gun. In Sanriku survey, biopsy sampling was planned to be attempt after the one animal was lethally sampled by each boat, but no animals were encountered during such period. In Kushiro survey, biopsy sampling was attempted on four days including additional dedicated biopsy surveys. During the period, 11 schools (12 animals) were encountered, 9 animals were targeted for biopsy sampling, and 5 biopsy samples were collected from five animals.

2.7.2 Fecal sampling

In Sunriku survey, searching for excretion was conducted for 44.8 hours on the 49 animals encountered during the lethal and non-lethal surveys, but excretion was not observed. In Kushiro survey, searching was made for 60.6 hours on the 89 animals encountered, and one case of excretion was observed. However, fecal was dispersed before sampling, and could not be collected.

3. OUTLINE OF THE RESPECTIVE SURVEY

Table 2 summarizes outline of the whale sampling surveys in the coastal component of JARPN II from 2008 to 2014 season. Following are summary of procedures and results in respective survey. Details of each survey are described in cruise reports of the JARPN II coastal component (see Reference). Cruise tracks of the respective surveys are shown in Figure 6 and 7. Distributions of common minke whales sampled by the surveys are shown in Figure 8 and 9.

3.1 Sanriku survey

Spring season, off Sanriku, 2008 (Yasunaga, et al., 2009)

The fifth survey off Sanriku district was conducted from 14 April to 18 May 2008 (35 days), using four small-type whaling catcher boat. During the survey, a total of 5,275.9 n.miles (482.0 hours) was searched for whale sampling, 94 schools (96 individuals) of common minke whales were sighted. A total of 60 animals were sampled. Searching efforts were mainly covering at least south-western part of the whole research area and sampling position were clumped in the Sendai Bay. Sampled whales were consisted of 37 females and 23 males (sex ratio: 38.3% of male), and average body length of the animals was 5.91m (SD: 1.01) for females and 5.67m (SD: 1.06) for males, respectively. Dominant prey species were adult and juvenile of Japanese sand lance. Japanese anchovy and krill were observed from one individual each, respectively. Juvenile of the Japanese sand lance in the stomach of minke whales were observed for the first time in Sanriku operation.

Spring season, off Sanriku, 2009 (Yasunaga, et al., 2010)

The sixth survey off Sanriku district was conducted from 22 April to 21 May 2009 (30 days), using four small-type whaling catcher boat. A total of 4,756.1 n.miles (464.0 hours) was searched for whale sampling, 111 schools (112 individuals) of common minke whales were sighted, and 60 animals were sampled. Searching effort was forced in Sendai Bay. Sampled whales were consisted of 33 females and 27 males (sex ratio: 45.0% of male), and average body length of the animals was 5.12m (SD: 0.80) for females and 5.14m (SD: 0.61) for males, respectively. Dominant prey species were adult of Japanese sand lance. Japanese anchovy and krill were observed less frequently.

Spring season, off Sanriku, 2010 (Bando, et al., 2011)

The seventh survey off Sanriku district was conducted from 22 April to 7 June 2010 (47 days), using four small-type whaling catcher boat. A total of 8,957.0 n.miles were searched for whale sampling, and 62 schools (62 individuals) of common minke whales were sighted. Searching effort was forced in Sendai Bay. Total of 45 whales were sampled, and average body length was 5.12m (SD: 0.99, n=27) for female and 6.02m (SD: 1.15, n=18) for males (sex ratio: 40.0% male). Dominant prey species were Japanese sand lance followed by krill. Japanese anchovy was observed in only one of the animals.

Spring season, off Sanriku, 2012 (Yasunaga, et al., 2013)

The eighth survey off Sanriku district was conducted from 12 April to 26 May 2012 (45 days), using four small-type whaling catcher boat. Because of logistical constraint and the accident at the Fukushima nuclear power stations, the southern boundary line of the research area 1 was set in the administrative boundary between Miyagi and Fukushima Prefecture (due east of 37.54°N from land until 141.50°E), and we cannot used the Port Ayukawa as a home port because of the damage caused by disaster and tsunami of the Great East Japan Earthquake in 11 March 2011. In this survey, we switch the home port from Ayukawa to Ishinomaki, but land station was placed in Ayukawa, which is the same spot past survey. A total of 6,488.1 n.miles were searched for whale sampling. During the research, a total of 6,488.1 n.miles (630.1 hours) were searched and 95 schools (97 individuals) of common minke whales were sighted. The mean body length of sampled whales was 5.34m (SD: 0.97, n=31) for female and 5.10m (SD: 0.82, n=29) for male (sex ratio: 48.3% of male). Dominant prey species were adult and juvenile Japanese sand lances in the whales sampled in Sendai Bay. Also Japanese anchovies and krill ware found which sampled in the outside of Sendai Bay.

Spring season, off Sanriku, 2013 (Yasunaga, et al., 2014)

The ninth survey off Sanriku district was conducted from 18 April to 3 June 2013, using four small-type whaling catcher boats. The survey in this year was still affected by the disaster. The southern boundary line of the research Area1 and 2 were set in the administrative boundary between Miyagi and Fukushima Prefecture (due east of 37.54°N) , and we used the Port Ishinomaki as a home port. A total of 7,188.3 n.miles (709.3 hours) were surveyed and 59 schools (59 individuals) of common minke whales were sighted. A total of 34 animals were sampled. Average body length of the animals was 5.21 m (SD: 0.60, n=17) for females and 5.02 m (SD: 1.12, n=17) for males (sex ratio: 50.0% of male). Dominant prey species sampled in the Sendai Bay were juvenile Japanese sand lances, and those collected outside Sendai Bay were Japanese anchovies.

Spring season, off Sanriku, 2014 (Mogoe, et al., 2015)

The tenth survey off Sanriku district was conducted from 26 April to 11 June 2014 (47 days), using four small-type whaling catcher boats. Port Ayukawa recovered and the home port of the whaling catcher boats were placed. The southern boundary line of the research area was still set same as 2013 research. The survey was carried out from 26 April to 11 June 2014. During the survey, a total of 5745.1n.miles (571.1 hours) was surveyed. The 51 schools (51 individuals) of common minke whales were detected and 30 animals were caught. Average body length of the sampled animals was 5.78m (SD: 1.10, n=14) for females and 5.92m (SD: 1.11, n=16) for males (sex ratio: 53.3 % of male). Dominant prey species were adult sand lance (58.6%), followed by Japanese sardine (13.8%), juvenile sand lance (10.3%), krill (10.3%), and mackerels (6.9%). Japanese sardine and mackerels were the first observation in JARPN II off Sanriku surveys.

3.2 Kushiro survey

Autumn season, off Kushiro, 2008 (Yoshida, et al., 2009)

The sixth survey off Kushiro was conducted from 9 September to 20 October 2008 (50 days), using four small-type whaling catcher boats. During the survey, a total of 5,381.4 nautical miles (521.3 hours) was searched, all the 108 schools (110 individuals) of common minke whales were detected, and a total of 50 individuals were sampled. Average body length of the animals was 5.97 m (SD=1.12, *n*=32) for males and 5.61 m (SD=1.14, *n*=18) for females (sex ratio: 64.0% of male). The dominant prey species found from whale forestomach was walleye pollock (58.0%), followed by Japanese anchovy (34.0%), krill (4.0%), and Japanese common squid (2.0%). Pacific saury was also had, but only two individuals were detected from whale forestomach.

Autumn season, off Kushiro, 2009 (Kishiro, et al., 2010)

The seventh survey off Kushiro was conducted from 5 September to 17 October 2009 (59 days), using four small-type whaling catcher boats. During the survey, a total of 5,136.2 n. miles (493.8 hours) was searched, 106 schools (107 individuals) of common minke whales were sighted and 59 whales were sampled. Average body length was 6.13m (SD=1.10, n=36) for males and 5.12m (SD=0.60, n=23) for females (sex ratio: 61.0% of male). The dominant prey species found in the forestomach contents was walleye Pollock (40.7%), followed by krill (32.2%), Japanese anchovy (22.0%), and Japanese common squid (1.7%). Pacific saury was not found.

Autumn season, off Kushiro, 2010 (Yoshida, et al., 2011)

The eighth survey off Kushiro was conducted from 7 September to 6 October 2010 (60 days), using four small-type whaling catcher boats. During the survey, a total of 4,151.6 nautical miles (385.0 hours) was searched, all the 125 schools (126 individuals) of common minke whales were detected, and 60 individuals were sampled. Average body length of males was 5.80 m (SD=1.06, *n*=41) and 5.44 m (SD=0.63, *n*=19) for females (sex ratio: 68.3% of male). Dominant prey species walleye pollock (60.0%), followed by Japanese anchovy (36.7%) and unidentified fish (3.3%). No other prey species were observed.

Spring season, off Kushiro, 2011 (Yasunaga, et al., 2012)

On 11 March 2011, the Ayukawa town, including all research facilities of JARPN II there, was destroyed by a large earthquake and tsunami. From these, the spring coastal survey in 2011 could not be conducted at Ayukawa. Instead, the spring survey was conducted at Kushiro. The survey was conducted from 25 April to 10 June (47 days), using three small-type whaling catcher boats. A total of 3,867.4 n.miles (375.2 hours) was searched and 36 schools (43 individuals) of common minke whales were sighted. All the 17 animals was sampled. Average body length of the animals was 6.70 m (SD=0.84, *n*=9) for males and 6.29 m (SD=1.02, *n*=8) for females (sex ratio: 52.9% of male). Dominant prey species found in the forestomach were walleye pollock (71.4%) and krill was observed less frequently (28.6%).

Autumn season, off Kushiro, 2011 (Kishiro, et al., 2012)

The ninth autumn survey off Kushiro was conducted from 9 September to 30 October 2011 (52 days), using four small-type whaling catcher boats. During the survey, a total of 5,367.8 n. miles (515.0 hours) was searched, 144 schools (150 individuals) of common minke whales were sighted and 60 whales were sampled. Average body length of sampled whales was 6.24m (SD=1.06, n=35) for males and 6.05m (SD=1.08, n=25) for females (sex ratio: 58.3% of male). Dominant prey species was Japanese anchovy (61.7%), followed by walleye Pollock (26.7%), and krill (8.3%). Pacific saury and Japanese common squid were not observed.

Autumn season, off Kushiro, 2012 (Yoshida, et al., 2013)

The tenth autumn survey off Kushiro was conducted from 9 September to 28 October 2012 (50 days), using four small-type whaling catcher boats. During the survey, a total of 4,843.7 nautical miles (464.6 hours) was searched and the 95 schools (104 individuals) of common minke whales were encountered. From the common minke whales, 48 animals were sampled. Average body length of males was 6.09m (SD=0.94, *n*=27) and 5.92m (SD=1.32, *n*=21) for females (sex ratio: 56.3% of male). Dominant prey species was walleye pollock (45.8%), followed by Japanese sardine (31.3%), mackerel (6.2%), Japanese anchovy (6.2%), Japanese common squid

(6.2%), krill (2.1%), and unidentified fish (2.1%). In the present survey, the frequency of whales feeding on Japanese anchovy was much low in comparison with the previous surveys, while Japanese sardine and mackerels were first detected from whale stomach.

Autumn season, off Kushiro, 2013 (Kishiro, et al., 2014)

The eleventh autumn survey off Kushiro was conducted from 6 September to 25 October 2013 (50 days), using four small-type whaling catcher boats. During the survey, a total of 4,629.7 n. miles (451.8 hours) was searched, 126 schools (142 individuals) of common minke whales were sighted and 58 whales were sampled. Average body length of sampled whales was 6.77m (SD=0.88, n=41) for males and 6.55m (SD=1.39, n=17) for females (sex ratio: 70.7%). The dominant prey species found in the stomach was Japanese sardine (63.8%), followed by walleye pollock (22.4%), mackerel (6.9%), krill (5.2%) and Japanese common squid (1.7%). Japanese anchovy and Pacific saury could not be found in the stomach.

Autumn season, off Kushiro, 2014 (Yoshida, et al., 2015)

The twelfth autumn survey off Kushiro was conducted from 5 to 24 September 2014 (20 days), with additional period for sighting survey in 2-3 September. The survey was carried out using four small-type whaling catcher boats. During the 20 days, a total of 2576.1 nautical miles (250.9 hours) was searched and the 99 schools (109 individuals) of common minke whales were encountered. Of these, 51 animals were collected. Average body length of males was 6.28m (SD=1.08, *n*=35) and 6.44m (SD=0.98, *n*=16) for females (sex ratio: 68.6%). Dominant prey species was walleye pollock (58.8%), followed by Japanese sardine (35.3%), mackerel (3.9%) and medusa fish (2.1%).

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Table 1. Details of the small-type whaling catcher boats used in the coastal component of the JARPN II.

Vessel	Size (tons)	Length (m)	Width (m)	Horsepower (HP)	Number of the crew[1]
Smitomo Maru No.31 (31S)	32.00	19.96	4.30	330	6 to 7
Smitomo Maru No.51 (51S)	30.00	21.31	4.45	987	6 to 7
Koei Maru No.8 (8K)[2]	32.00	19.96	4.30	330	6 to 7
Koei Maru No.75 (75K)	46.24	25.17	4.62	380	6 to 7
Taisho Maru No.28 (28T)	47.31	25.53	4.64	380	6 to 7
Katsu Maru No.7 (7K)	32.00	19.97	4.30	400	6 to 7
Seiwa Maru (SW)	15.20	15.10	3.20	160	6

[1]excluding researcher

[2]renamed vessel of 31S

Table 2. Outline of the whale sampling surveys in 2008-2014 coastal component of the JARPN II. 28T: *Taisho Maru* No.28; 31S: *Sumitomo Maru* No.31; 7K: *Katsu Maru* No.7; 75K: *Koei Maru* No.75; 8K: *Koei Maru* No.8; 51S: *Sumitomo Maru* No.51; SW: *Seiwa Maru*

Area	Year	Season	Survey period [days]	Sampling vessels	Survey distance (n.miles)	Collected sample size
Sanriku	2008	Spring	14 April - 18 May [35]	28T, 31S, 7K, 75K	5,275.9	60
	2009	Spring	22 April - 21 May [30]	28T, 31S, 7K, 75K	4,756.1	60
	2010	Spring	22 April - 7 June [47]	28T, 31S, 7K, 75K	8,957.0	45
	2012	Spring	12 April - 26 May [45]	28T, 8K, 7K, 51S	6,488.1	60
	2013	Spring	18 April - 3 June [47]	28T, 8K, 7K, 51S	7,188.3	34
	2014	Spring	26 April - 11 June [47]	28T, 8K, 7K, 51S	5,745.1	30
Kushiro	2008	Autumn	9 Sept.- 20 Oct. [42]	28T, 31S, 7K, 75K	5,381.4	50
	2009	Autumn	5 Sept.- 17 Oct. [43]	28T, 31S, 7K, 75K	5,136.2	59
	2010	Autumn	7 Sept.- 26 Oct. [50]	28T, 31S, 7K, 75K	4,151.6	60
	2011	Spring	25 April - 10 June [47]	7K, 51S, SW	3,867.4	17
	2011	Autumn	9 Sept.- 30 Oct. [52]	28T, 8K, 7K, 51S	5,367.8	60
	2012	Autumn	9 Sept.- 28 Oct. [50]	28T, 8K, 7K, 51S	4,843.7	48
	2013	Autumn	6 Sept.- 25 Oct. [50]	28T, 8K, 7K, 51S	4,629.7	58
	2014	Autumn	5 Sept.- 24 Sept. [20]	28T, 8K, 7K, 51S	2,576.1	51

Table 3. Summary of biological data and samples collected in 2008 to 2014 coastal component (Sanriku survey).

Samples and data	Sanriku					
	2008	2009	2010	2012	2013	2014
Body length and sex	60	60	45	60	34	30
External body proportion	60	60	45	60	34	30
Photographic record and external character	60	60	45	60	34	30
Diatom film record	60	60	45	60	34	30
Body scar record	60	60	45	60	34	30
Measurements of blubber thickness (5 points)	60	60	45	60	34	30
Detailed measurements of blubber thickness (11 points)	5	-	1	1	1	-
Body weight	60	60	45	60	34	30
Body weight by parts	5	-	1	1	1	-
Skin tissues for DNA study	60	60	45	60	34	30
Muscle, liver, kidney, spleen, blubber, heart and ventral groove for various analysis	60	60	45	60	34	30
Urine for various analysis	11	14	13	15	10	30
Muscle, liver, kidney, and blubber for heavy metal analysis	60	60	-	60	34	30
Muscle, liver, kidney, and blubber for organochlorine analysis	60	60	45	60	34	30
Muscle and blubber for byproduct analysis	-	-	45	-	-	-
Collection of blood plasma	45	54	41	54	25	23
Muscle and vertebra for lipid analysis	5	-	1	1	1	-
Mammary grand; lactation status, measurement and histological sample	37	33	27	31	17	14
Uterine horn; measurements and endometrium sample	37	33	27	31	17	14
Collection of Ovary	37	33	27	31	17	14
Photographic record of fetus	7*	1	1	2*	-	2*
Fetal sex (identified by visual observation)	-	-	1	-	-	-
Fetal length and weight	5	1	1	2*	-	2*
Skin tissues for DNA study of fetus	-	-	-	-	-	1
External measurement of fetus	5	1	1	2*	-	1
Muscle, liver, kidney, heart, blubber and skin tissues of fetus	5	1	1	2*	-	1
Eye lens of foetus for age determination	-	-	-	-	-	1
Collection of fetus	2*	1	-	2*	-	2*
Testis and epididymis; weight and histological sample	21	27	18	29	17	16
Stomach contents, convenient record	60	60	45	60	34	30
Volume and weight of stomach content in each compartment	60	60	45	60	34	30
Observation of marine debris in stomach	60	60	45	60	34	30
Stomach contents for feeding study	52	55	45	48	17	26
Stomach contents for multipurpose study	-	-	3	-	-	-
Record of external parasites	60	60	45	60	34	30
Earplug for age determination	60	60	45	60	34	29
Tympanic bulla for age determination	60	60	45	60	-	-
Eye lens for age determination	60	56	45	60	34	30
Largest baleen plate for morphologic study and age determination	60	60	45	60	34	3
Baleen plate measurements (length and breadth)	60	60	45	60	34	30
Photographic record of baleen plate series	60	60	45	60	34	30
Length of baleen series	60	60	45	60	34	30
Vertebral epiphyses sample	60	57	45	9	3	10
Number of ribs	60	60	45	60	34	30
Skull measurement (length and breadth)	60	55	44	60	34	30
Brain weight	-	-	1	-	-	-
Skull measurement (43 points)	-	-	-	-	9	3**
Measurements of flipper pigment	-	-	-	-	23	30**
Collection and measurement of pelvic bone	-	-	-	-	7	2**
Measurement of the skull around nasal bone	-	-	-	-	-	28**
Content of large intestine	-	-	-	-	-	3
External measurement of nostril	-	-	-	-	-	30**

*: including a fetus of sex unidentified; **: including one female fetus.

Table 4. Summary of biological data and samples collected in 2008 to 2014 coastal component (Kushiro survey).

Samples and data	Kushiro							
	2008	2009	2010	2011*	2011	2012	2013	2014
Body length and sex	50	59	60	17	60	48	58	51
External body proportion	50	59	60	17	60	48	58	51
Photographic record and external character	50	59	60	17	60	48	58	51
Diatom film record	50	59	60	17	60	48	58	51
Body scar record	50	59	60	17	60	48	58	51
Measurements of blubber thickness (5 points)	45	59	60	17	60	48	58	51
Detailed measurements of blubber thickness (11 points)	5	2	1	-	2	-	1	-
Body weight	50	59	60	17	60	48	58	51
Body weight by parts	5	2	1	-	2	-	1	-
Skin tissues for DNA study	50	59	60	17	60	48	58	51
Muscle, liver, kidney, spleen, blubber, heart and ventral groove for various analysis	50	59	60	17	60	48	58	51
Urine for various analysis	20	21	15	8	10	8	18	16
Muscle, liver, kidney, and blubber for heavy metal analysis	50	59	60	17	60	48	58	51
Muscle, liver, kidney, and blubber for organochlorine analysis	50	59	60	17	60	48	58	51
Muscle and blubber for byproduct analysis	50	59	60	17	60	48	58	51
Collection of blood plasma	35	58	42	15	59	44	44	37
Muscle and vertebra for lipid analysis	5	2	1	-	2	-	1	-
Mammary grand; lactation status, measurement and histological sample	18	23	18	8	25	21	17	16
Uterine horn; measurements and endometrium sample	18	23	19	8	25	21	17	16
Collection of Ovary	18	23	19	8	25	21	17	16
Photographic record of fetus	1	-	-	1	-	3	3	2
Fetal sex (identified by visual observation)	1	-	-	1	-	3	3	2
Fetal length and weight	1	-	-	1	-	3	3	2
Skin tissues for DNA study of fetus	1	-	-	1	-	3	3	2
External measurement of fetus	1	-	-	-	-	3	3	2
Muscle, liver, kidney, heart, blubber and skin tissues of fetus	1	-	-	-	-	3	3	2
Eye lens of fetus for age determination	-	-	-	-	-	-	3	1
Collection of fetus	-	-	-	1	-	3	-	2
Testis and epididymis; weight and histological sample	32	36	41	9	35	27	41	35
Stomach contents, convenient record	50	59	60	17	60	48	58	51
Volume and weight of stomach content in each compartment	50	59	60	17	60	48	58	51
Observation of marine debris in stomach	50	59	60	17	60	48	58	51
Stomach contents for feeding study	47	49	48	17	50	42	54	50
Stomach contents for multipurpose study	3	8	2	1	1	2	3	3
Record of external parasites	50	59	60	17	60	48	58	51
Earplug for age determination	49	58	60	17	60	47	58	51
Tympanic bulla for age determination	49	59	60	17	59	47	-	-
Eye lens for age determination	50	59	60	17	60	48	58	51
Largest baleen plate for morphologic study and age determination	50	59	60	17	60	48	58	-
Baleen plate measurements (length and breadth)	50	59	60	17	59	48	58	51
Photographic record of baleen plate series	50	59	60	17	60	48	58	51
Length of baleen series	50	59	60	17	60	48	58	51
Vertebral epiphyses sample	49	59	60	17	32	24	43	30
Number of ribs	50	59	60	17	60	48	58	51
Skull measurement (length and breadth)	49	59	60	17	60	47	58	50
Brain weight	5	2	1	-	2	-	1	-
Skull measurement (43 points)	-	23	15	13	21	9	4	-
Measurements of flipper pigment	-	-	-	-	-	43	48	50
Collection and measurement of pelvic bone	-	59	60	17	60	6	8	4**
Measurement of the skull around nasal bone	-	-	-	-	-	-	-	-
Content of large intestine	-	-	-	-	-	-	-	6
External measurement of nostril	-	-	-	-	-	-	-	-

*: spring survey; **: including one fetus.

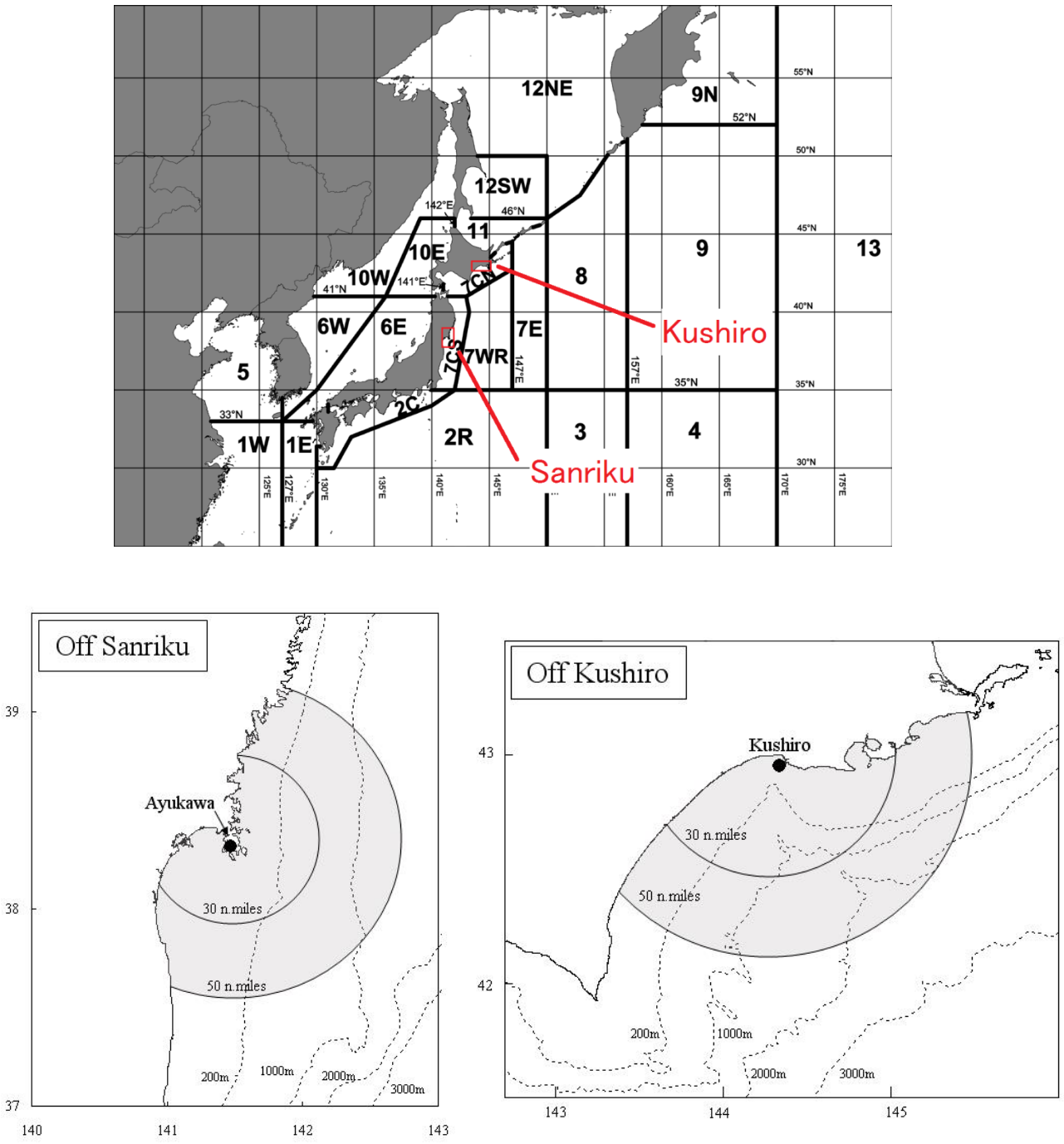

Fig. 1. Research areas of the whale sampling surveys in the coastal component of the JARPN II.

Fig. 2. Small-type whaling catcher boats used in the coastal component of the JARPN II.

A: *Sumitomo Maru* No. 51(51S); B: *Taisho Maru* No.28 (28T); C: *Koei Maru* No.8 (8K); D: *Katsu Maru* No.7 (7K)

Fig.3. Left photo: At the port, sampled whale was lifted up from vessel by a crane, using a wire net and transported to the station by a freight trailer. Right photo: The JARPN II research station established in the suburbs of Kushiro for biological examination.

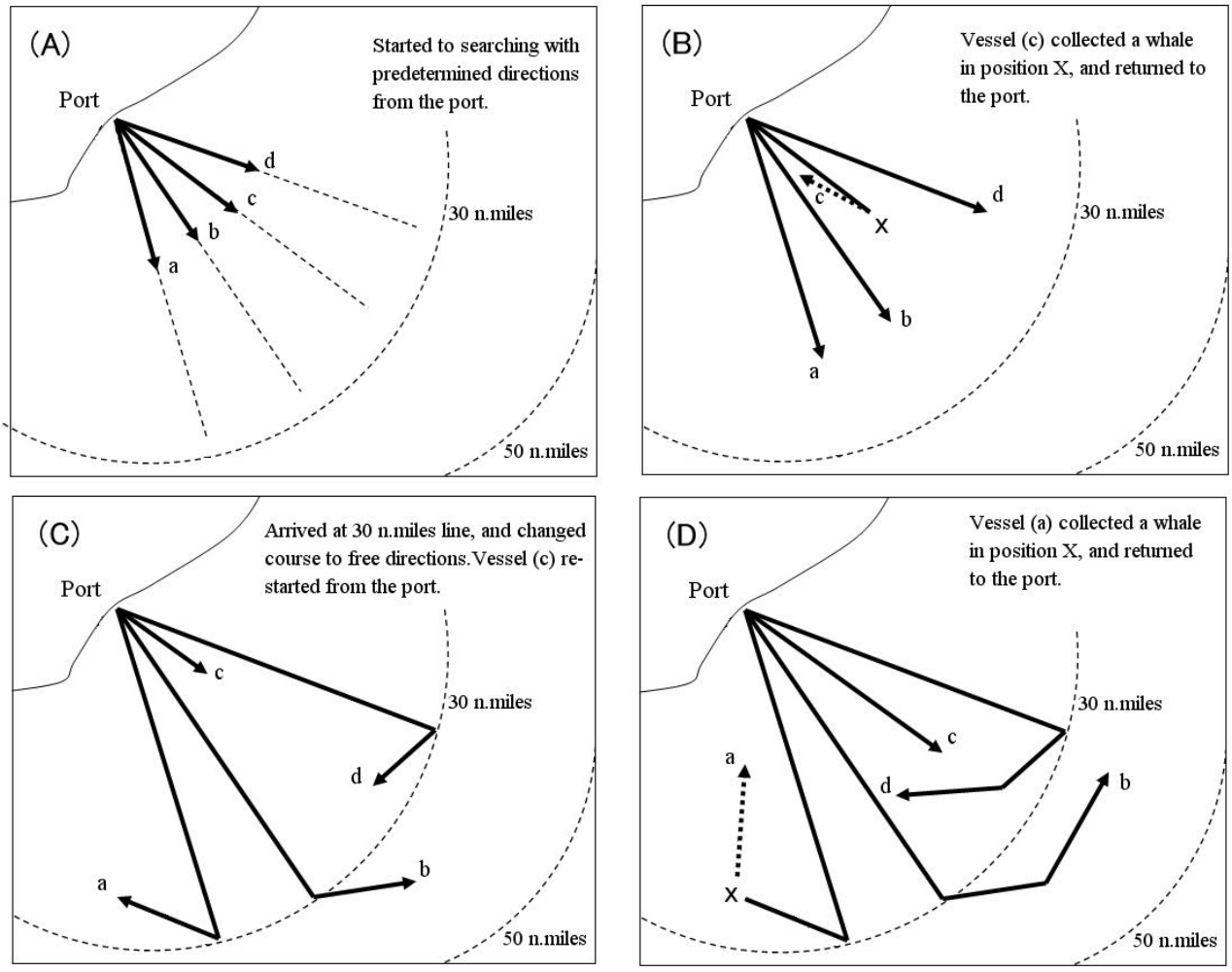

Fig.4. Schematic diagram of the manner of searching for whale sampling in the research area in the coastal component of the JARPN II. Arrows with letters 'a' to'd' indicate examples of the movements of respective small-type whaling catcher boat.

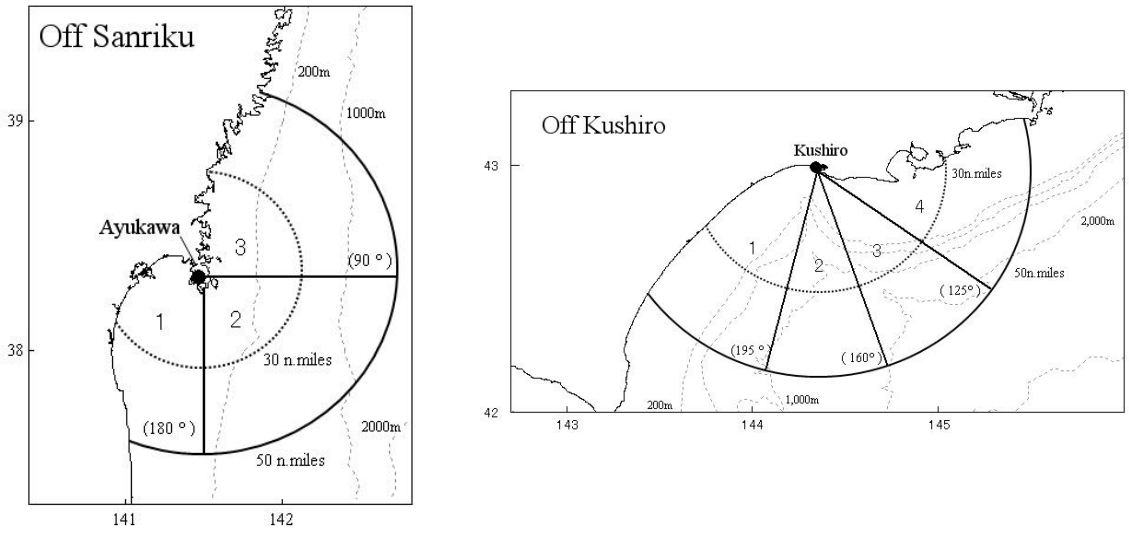

Fig.5. Allocation of the sectors for research area of the coastal component of the JARPN II.

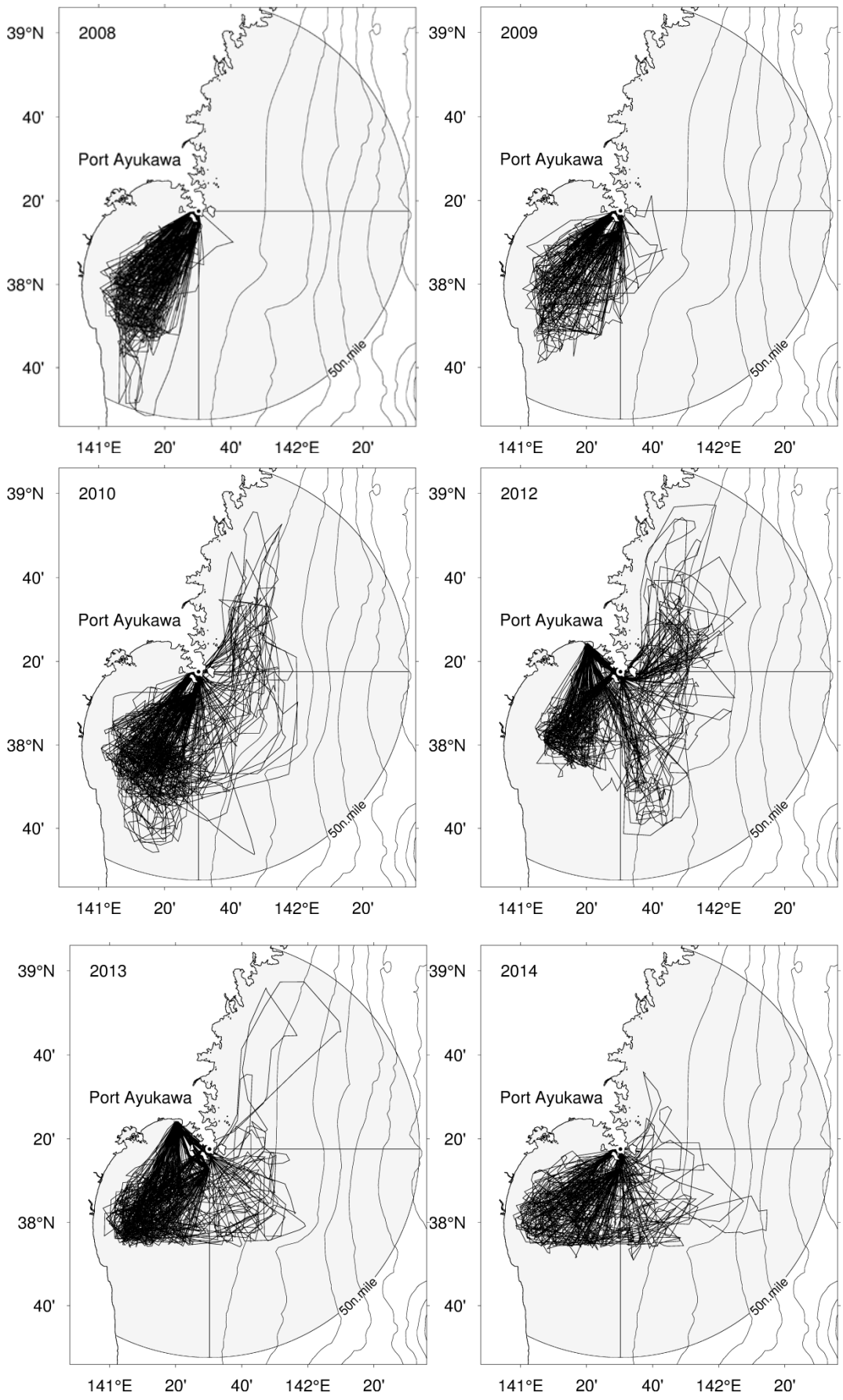

Fig.6. Cruise tracks of the whale sampling surveys off Sanriku in 2008 to 2014

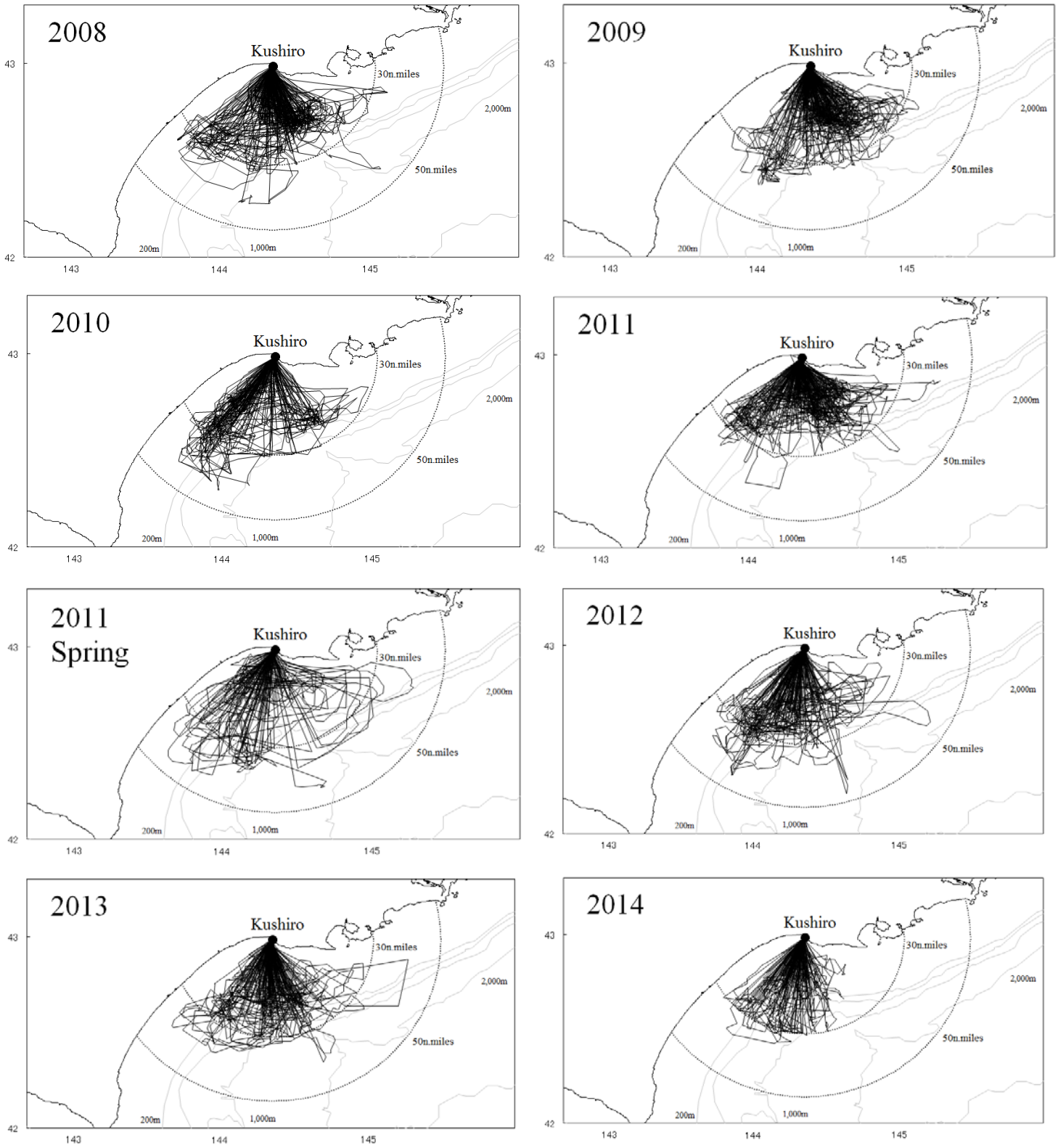

Fig.7. Cruise tracks of the whale sampling surveys off Kushiro in 2008 to 2014

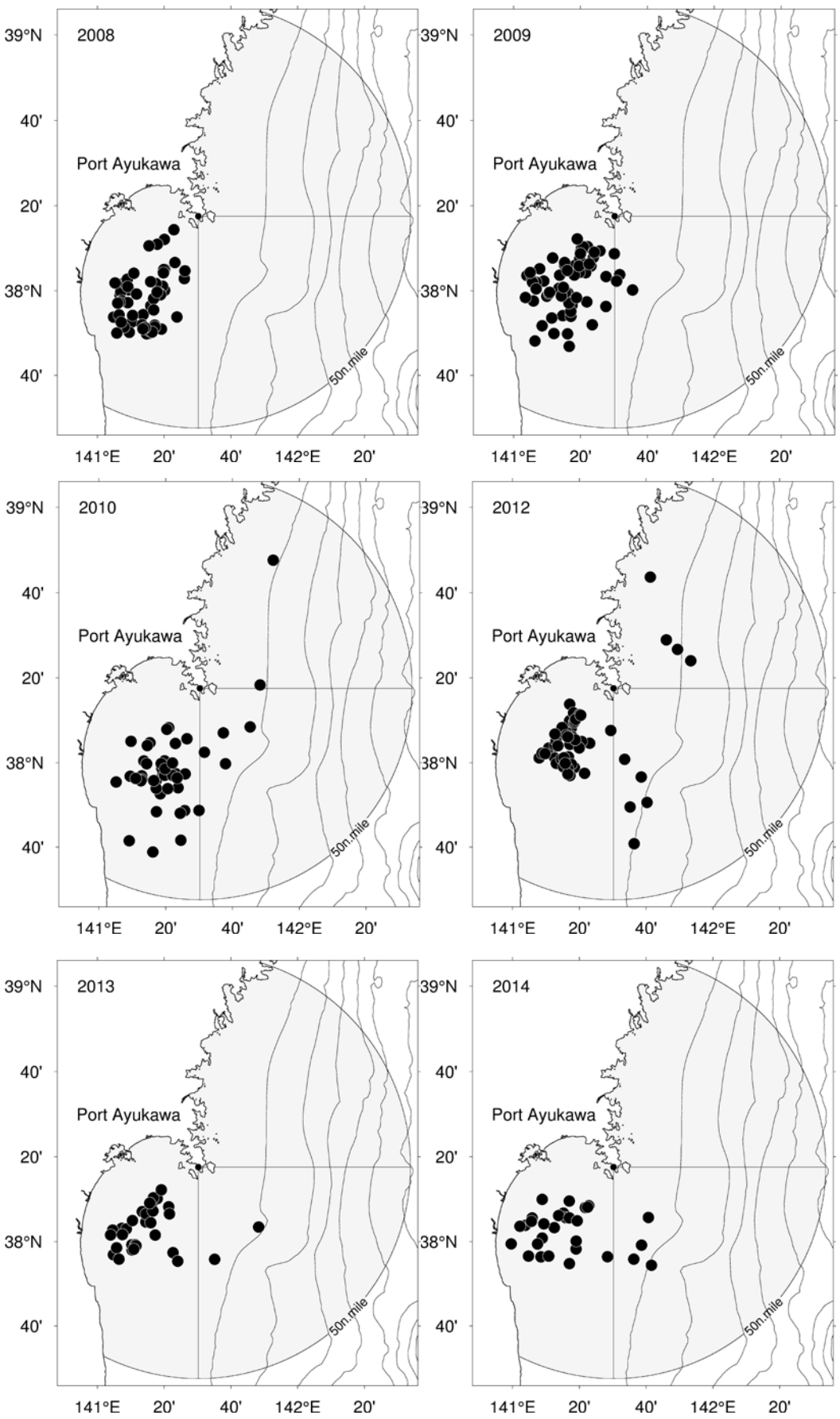

Fig.8. Distributions of common minke whales sampled by the coastal component off Sanriku in 2008 to 2014.

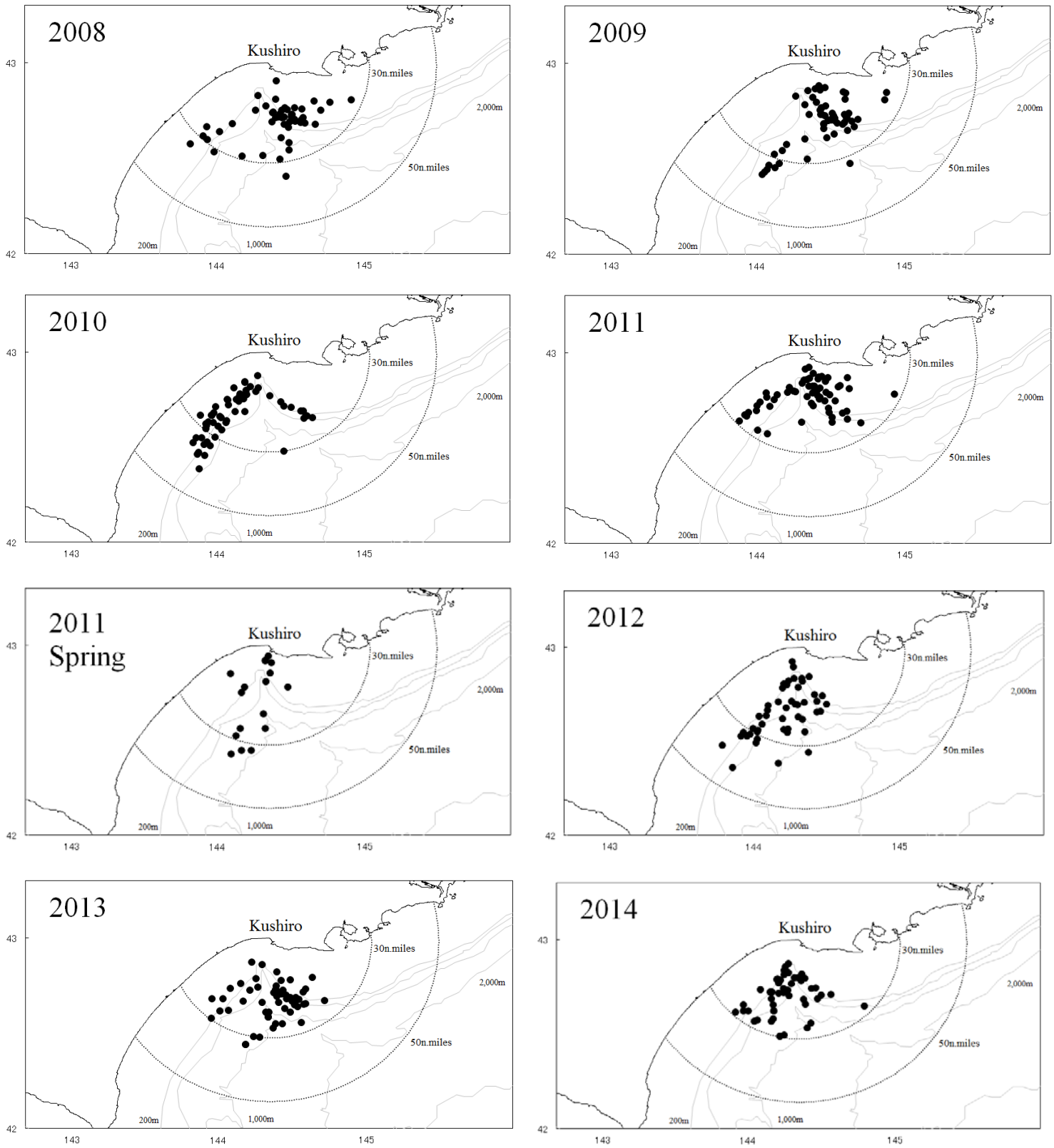

Fig.9. Distributions of common minke whales sampled by the coastal component off Kushiro in 2008 to 2014.