

SC/67A/SCSP/07

Cruise Report of the Second Phase of the Japanese Whale Research Program under Special Permit in the Western North Pacific (JARPN II) in 2016 (Part III) - Coastal component off Kushiro -

Hideyoshi Yoshida, Shimetani, K., Maeda, H., Nakamura, G., Nakai, K., Inoue, S., Hirose, A., Hayashi, R., Akagi, M., Nakajyo, K., Nishimura, F., Asano, H., Fukami, A., Kumagai, S., Kanbayashi, J., Kuwagaki, A., Miyashita, T., and Kato, H.



INTERNATIONAL
WHALING COMMISSION

Cruise Report of the Second Phase of the Japanese Whale Research Program under Special Permit in the Western North Pacific (JARPN II) in 2016 (Part III) - Coastal component off Kushiro -

HIDEYOSHI YOSHIDA¹, KAZUTOYO SHIMETANI², HIKARI MAEDA¹, GEN NAKAMURA³, KAZUYOSHI NAKAI⁴, SATOKO INOUE⁴, AYUMI HIROSE³, RYOTARO HAYASHI³, MINORU AKAGI³, KEN NAKAJYO³, FUTABA NISHIMURA³, HIROKO ASANO³, AYA FUKAMI³, SAEKO KUMAGAI², JYUN KANBAYASHI², AYANO KUWAGAKI², TOMIO MIYASHITA¹, SHINGO MINAMIKAWA¹, YU KANAJI¹, HIROKO SASAKI¹, RYOTA YAMADA³, AI KAKINUMA⁵, AND HIDEHIRO KATO³.

¹ National Research Institute of Far Seas Fisheries, Fisheries Research Agency, 2-12-4 Fukuura, Kanazawa-ku, Yokohama, Kanagawa 236-8648, Japan

² Association for Community-Based Whaling, Hakata-Kaiseki Building 2F, Hakata-Eki-Higashi, Hakata-ku, Fukuoka 812-0013, Japan

³ Tokyo University of Marine Science and Technology, 4-5-7 Konan, Minato-ku, Tokyo 108-0075, Japan

⁴ The Institute of Cetacean Research, 4-5, Toyomi-cho, Chuo-ku, Tokyo, 104-0055, Japan.

⁵ Tokyo University of Agriculture, 196 Yatsusaka, Abashiri, Hokkaido 099-2493, Japan.

Contact e-mail: hideka@fra.affrc.go.jp

ABSTRACT

The JARPN II coastal component off Kushiro, northeast Japan (middle part of the sub-area 7CN) was conducted from 5 September to 31 October 2016. The survey was conducted using four small-type whaling catcher boats as sampling vessels in coastal waters within 50 nautical miles from Kushiro port. All the whales collected were landed at the JARPN II research station for biological examination. During the survey, a total of 6,051.6 nautical miles (622.9 hours) was searched and the 39 schools (40 individuals) of common minke whales were encountered. Sightings of 39 schools (64 animals) of humpback whales, of two schools (three individuals) of fin whales, a Bryde's whale, and of five schools (11 individuals) of sperm whales were also obtained. Of 40 common minke whales encountered, 21 animals were collected. One Bryde's whale was mistakenly shot. Average body length of male common minke whales collected was 7.09m (SD=0.53, Range=6.00-7.75m, n=8) and 7.07m (SD=1.01, Range=5.07-8.85m, n=13) for females. The seven animals of 8 males were sexually mature and 6 of 13 females attained to sexual maturity. The three mature females were pregnant. Dominant prey species detected from whale forestomach was Japanese sardine (*Sardinops melanostictus*, 38.1%), followed by walleye pollock (*Theragra chalcogramma*, 28.6%) and mackerels (*Scomber japonicus* and *S. australasicus*, 28.6%). Japanese anchovy, which was one of the major prey species in the previous surveys off Kushiro, was not found from whale forestomach. The observation coincided with an increase in catch of Japanese sardine by fisheries around Kushiro, where the species was much caught after an interval of around 30 years. During the surveys, faecal searching was made for 20.3 hours on 35 animals encountered, but excretion was not observed. A total of 62.3 hours (10.0% of a total searching efforts) was allocated to the dedicated sighting surveys for biopsy sampling. An animal encountered were targeted, however no sample was collected.

KEYWORDS: COMMON MINKE WHALE; NORTH PACIFIC; COASTAL WATERS OF JAPAN; FOOD/PREY; ECOSYSTEM; SCIENTIFIC PERMITS.

BACKGROUND

The full-scale survey of the second phase of the Japanese Whale Research Program under Special Permit in the Western North Pacific (JARPN II) was started in 2002. The survey mainly aimed at 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 the marine ecosystem, and iii) elucidation of stock structure of whales (Government of Japan, 2002a).

The full-scale JARPN II consists of two survey components, i.e., offshore and coastal components. The JARPN surveys (1994-1999) and the JARPN II feasibility study (2000-2001) revealed that common minke

whales are widely distributed from offshore waters into coastal waters and feed on various prey species such as Japanese anchovy, Pacific saury, and walleye pollock (Government of Japan 2002b; Tamura and Fujise 2002). Both the waters are very important fishing grounds. Thus, it is thought that the waters are also very important area for the full-scale JARPN II program. However, the *Nisshin Maru* research vessels can not be operated in near shore areas, because of their movement restrictions in shallow waters and the presence of fishing gear and many boats. Furthermore, the research vessels are not available from autumn to early spring. In order to cover the temporal and spatial gap of these vessels, in the full-scale JARPN II, sampling of common minke whales in coastal waters using small-type whaling catcher boats was planned (Government of Japan, 2002a).

In the first two years of the full-scale JARPN II, feasibility studies were conducted, to examine the logistic aspects of the methodology in the coastal component. The first feasibility study was carried out in coastal waters off Kushiro in autumn 2002 and the second one was in coastal waters off Sanriku in spring 2003 (Kishiro *et al.* 2003, Yoshida *et al.* 2004). Since no logistic problem occurred in the studies, it was concluded that the coastal survey could be continued as the component of the full-scale JARPN II, using the same methodology (Government of Japan 2004b, Kato *et al.* 2004), while the survey was revised to be conducted twice a year and to collect 60 common minke whales in each of spring and autumn (Government of Japan 2004a).

The first revised full-scale survey was carried out in coastal waters off Kushiro in autumn 2004 (Kishiro *et al.* 2005), then the coastal survey was conducted annually from 2005 to 2008 (Kishiro *et al.* 2006, 2008, Yoshida *et al.* 2007, 2009). In January 2009, the JARPN II review workshop was carried out in Japan under the IWC/SC, where the progress made in the first six years of the full-scale JARPN II (2002-2007) was reviewed by the scientific specialists. Because there was no critical problem in the survey methodology, the coastal components were continued from 2009 to 2013 (Kishiro *et al.* 2010, 2012, 2014, Yoshida *et al.* 2011, 2013), under the original research plan (Government of Japan 2004a).

Following the March 31, 2014 Judgment of the International Court of Justice (ICJ) in the case Whaling in the Antarctic (Australia v. Japan: New Zealand intervening), the Government of Japan voluntarily reviewed the state of JARPN II. Overall research objectives, the research area and research methodology remain the same as those specified in the original JARPN II research plan (Government of Japan, 2004a). This voluntary review resulted in modification of maximum lethal sample size of 60 to 51 for each survey, and non-lethal method was introduced to the surveys. The modifications were applied in the 2014 surveys (Mogoe, *at al.*, 2015, and Yoshida, *et al.*, 2015). The 2016 survey was conducted following the same framework and modifications introduced in 2014.

Here, we show results of the 2016 survey conducted off Kushiro. The National Research Institute of Far Seas Fisheries (NRIFSF) of the Fisheries Research Agency planned and conducted the survey, under cooperation of the ICR, Tokyo University of Marine Science and Technology, and the Association for Community-Based Whaling. The present survey was the last coastal survey conducted off Kushiro under the JARPNII.

MATERIALS AND METHODS

Research area

Research area was set in the same waters where the previous JARPN II coastal surveys off Kushiro were conducted in 2002-2013 (Kishiro *et al.* 2003, 2005, 2006, 2008, 2010, 2012, 2014, 2016, Yasunaga *et al.* 2012, Yoshida *et al.* 2007, 2009, 2011, 2013, 2014): the area was in coastal waters within 50 nautical miles from Kushiro port, southeastern Hokkaido (Fig. 1). The area is included in the middle part of the sub-area 7CN, established by the IWC.

Research vessels, station, and period

Four small-type whaling catcher boats were used as sampling vessels: *Taisho Maru* No. 3 (19.0GT), *Koei Maru* No. 8 (32.0GT), *Katsu Maru* No.7 (32.0GT), and *Sumitomo Maru* No.51 (30.0GT). All the common minke whales collected were landed at the JARPN II research station established in the Kushiro port, for biological examination. Research period was set for 57 days, from 5 September to 31 October, 2016.

Searching and sampling methods

Searching and sampling methods were almost same with those for the first coastal survey off Kushiro in

2002 (Kishiro *et al.* 2003). The research head office established in the research station controlled the sampling vessels during the survey. In order to avoid concentration of searching effort in an area, searching areas and direction of vessels were determined by the office, from weather conditions, whale distribution, and information on fishing grounds of coastal fisheries. After vessels left the port, they principally continued to cruise along the predetermined direction until arriving at 15-30 n. miles from the port, then change their direction chosen by themselves and continued searching within the research area. Searching was carried out in the daytime and vessels returned to the port every night. A researcher was on board each of vessels and recorded sighting and sampling information, e.g., coordinates and time of common minke whale sighting and sampling made, weather conditions, and vessel activity. Sighting information was also recorded for other baleen whales and sperm whales. Searching was conducted by crews and researchers from the top barrel and upper bridge of vessels running at around 11 knots. All common minke whales sighted were targeted for sampling, except cow-calf pair. When a school consisted of more than 1 animal, an individual was selected randomly from the school and then collected. Once a vessel caught a whale, it returned to the Kushiro port, to transport the animal to the research station. While returning to the port, other common minke whales encountered were also targeted for sampling, if the situation allowed. At the port, animals were lifted from the vessel by the crane, using a wire net and then carried to the station by the 11-ton freight trailer. At that time, body weight of animals was measured using the truck scale.

Practicability survey for biopsy and faecal sampling from the vessel

Biopsy sampling and faecal sampling trials for common minke whales was carried out by small-type whaling catcher boats. Biopsy sampling was tried during the dedicated sighting surveys conducted at the outside of the whale sampling activities. Searching and chasing methods was same as the whale sampling survey mentioned above. The Larsen guns were used for sampling. Faecal searching was conducted as much as possible for the whales encountered and chased for both the whale sampling and biopsy sampling. If the excretion were observed, faecal samples were planned to be collected using the plankton net.

Biological research on common minke whales collected

All the whales collected were examined by biological researchers at the research station. Research items are listed in Table 2. These items were related to studies on feeding ecology, stock structure, life history and pollutions.

RESULTS

Searching effort made by sampling vessels

The sampling survey was started on 5 September and finished on 31 October. Of the 57 days, vessels conducted searching for 34 days (59.6%). The remaining days were not suitable for survey, from bad weather conditions, e.g., low atmospheric pressure and thick fog. Cruise tracks made by the vessels are shown in Figure 2. Searching distance and time are given in Table 1. Searching distance and time are defined as distance and time recorded under searching activity conducted by crews from the top barrel of the vessels. During the survey, a total of 6051.6 nautical miles (622.9 hours) was searched.

Sightings made by vessels

All the 39 schools (40 individuals) of common minke whales were sighted during the searching (Table 1, Fig. 2). No cow-calf pairs were encountered. Cruise tracks were widely distributed in coastal waters within 30 nautical miles from Kushiro port, and sightings of common minke whales were recorded in searching area with concentration on continental slope southeast and southwest of Kushiro. Density index of common minke whales was calculated as 0.59 for DI (the number of primary sightings of schools per 100 nautical miles searching) and 0.06 for SPUE (the number of primary sightings of schools per 1 hour searching). During the survey, 39 schools (64 animals) of humpback whales, two schools (three individuals) of fin whales, a Bryde's whale, and five schools (11 individuals) of sperm whales were also obtained (Table 1, Fig. 3). The Bryde's whale sighting was first record collected at the coastal component off Kushiro.

Sampling of common minke whales

Of the 40 common minke whales encountered, 21 animals were collected for biological examination. In the sampling process, struck and lost was not occurred. Sighting positions of animals collected are shown in Figure 2.

Practicability survey for biopsy and faecal sampling from the vessel

A total of 62.3 hours (10.0% of a total searching efforts) was allocated to the dedicated sighting surveys for biopsy sampling. An animal encountered were targeted, but no chance for shooting the darts resulted in no sample collected. To 35 animals encountered during the Kushiro survey, observation of excretion was conducted for 20.3 hours. No such behaviour was observed.

Body length, sex ratio, and maturity of animals caught

Research items of biological examination for the 21 animals collected are summarized in Table 2, with the number of data and samples obtained. The individuals consisted of 8 males and 13 females. Sex ratio of males to all animals was 38.1%. Average body length was 7.09m (SD=0.53, range=6.00-7.75m) for males and 7.07m (SD=1.01, range=5.07-8.85m) for females (Table 3). In males, the most dominant length class was 7.0 m (Fig. 4). It was 6.0m and 7.5m for females. Male with a single testis weight of 290g or more and female having at least one corpus luteum or albicans in their ovaries were determined as sexually mature. In males, 7 of 8 individuals (87.5%) were sexually mature (Table 4). In females, 6 of 13 individuals (46.2%) were sexually mature. The three mature females were pregnant. The foetus were a male with 174 cm of body length and two female (144.8cm and 119.2cm).

Prey species found from common minke whale forestomach

Stomach contents of the 21 animals were examined. Following the same methods used in the JARPN II feasibility survey conducted in 2001 (Fujise, *et al.*, 2002), stomach contents were weighed to the nearest 0.1 kg, by each of four chambers. Weights were recorded both including and excluding liquid contents. A small quantity of stomach contents was collected and frozen for laboratory analysis. Weight of forestomach contents including liquid ranged from 2.2 kg to 81.3 kg. Average weight was 34.1 kg. Forestomach contents found from the whales are listed in Table 5 and Figure 5. An individual had empty stomach. Dominant prey species detected from whale forestomach was Japanese sardine (*Sardinops melanostictus*, 38.1%), followed by walleye pollock (*Theragra chalcogramma*, 28.6%) and mackerels (*Scomber japonicus* and *S. australasicus*, 28.6%). Japanese sardine and mackerels were observed from forestomach throughout the survey period, but walleye pollocks were detected at early stage of the survey. Japanese anchovy (*Engraulis japonicas*) and Pacific saury (*Cololabis saira*) were not observed.

Figure 6 shows prey species found in forestomach of common minke whales by their sexual maturity stage. The three species were found from stomach of both mature and immature animals.

Observation of marine debris

Marine debris was detected from stomach of a male, which swallowed a small piece of the plastic product.

Mistaken shot of a Bryde's whale

On 20 September, one Bryde's whale was mistakenly shot. Sighting position of the animal was 42-36.9N and 144-32.3E. Following the instructions of Fisheries Agency of Japan, the animal was immediately released at the sea. No biological examination and samplings were conducted. There had been no sighting record of Bryde's whales off Kushiro during the coastal component of JARPNII. Estimated body length of the animal was 6.5m, equivalent to the one of common minke whales collected off Kushiro (see, Fig. 4). It was therefore suspected that crews had misidentified the Bryde's whale as a common minke whale. In order to prevent similar case from occurring, the FAJ reinstructed all the crews involved to carefully and thoroughly identify whale species before shooting.

DISCUSSION

At the coastal component off Kushiro, bad weather conditions, e.g., low atmospheric pressure and thick fog, often prevented sampling vessels from research activities. At the present survey, sampling vessels could conduct searching for 34 days of the 57 days survey period (59.6%). The ratio was lower in October (51.6%) than in September (65.4%), which suggests more unstable weather in October. Density index of common minke whales recorded in the present survey (DI=0.59) was extremely low, when it is compared with results of the past surveys (e.g., 1.46 in 2015 and 3.30 in 2014). Possibly, the low density of migrating whales resulted from high sea surface temperature (SST) recorded in the present survey. Usually, off Kushiro, common minke whales were encountered at the waters with the SST less than 20 °C. The normal SST recorded off Kushiro in September was also less than 20 °C (Fig. 8). However, in 2016, it was higher than 20 °C. The SST cooled down to less than 20 °C in October and the DI increased from 0.54 in September to

0.66 in October. The low density of migrating whales in September and worse weather in October would obstruct the sampling operation. In the present survey, first sighting of the Bryde's whale was recorded off Kushiro. Possibly, the animal migrated to the waters, from the high SST.

Figure 4 shows body length compositions of common minke whales caught in 2016, with results of the previous surveys. In the past surveys, animals with various body lengths were collected. However, in the present survey, animals with small body length less than 5.0m were not collected, though sample size was small. The body length composition in the present survey appears to be similar to those recorded in the 2004 survey, where number of animals with small body length was extremely less than that of large whales. In contrast, more small animals were collected in the 2008-2010 surveys. These results suggest that growth stage of migrating animals are different among years, possibly from environmental condition including prey species distribution.

Dominant prey species detected from whale forestomach was Japanese sardine, followed by walleye pollock and mackerels (see, Table 5 and Fig. 5). Japanese anchovy and Pacific saury were not observed. When the JARPNII coastal component off Kushiro was started in 2002, commercial catch of Japanese sardine around Kushiro was very small. While no Japanese sardine was detected from stomach of whales collected at the 2002 survey, Japanese anchovy was found most frequently (Figure. 5). In 2012, Japanese sardine was first detected from whale stomach at Kushiro. After that, the sardine is one of the major prey species, replacing the Japanese anchovy. The change of prey species in recent years coincide with fisheries catch off Kushiro. In autumn 2012, the Japanese sardine was much caught after an interval of around 30 years and then the high catch level is kept. These results suggest that the stomach contents of whales reflect the large-scale change of occurrence of prey species.

ACKNOWLEDGMENTS

We acknowledge Dr. Seiji Ohsumi (ICR) and Yoshihiro Fujise (ICR), and Messrs. Yuki Morita and Ryuta Fujio (the Fisheries Agency of Japan), for their guidance in the survey design and support. Crew of research vessels, staff of the research station in Kushiro, and the Association for Community-Based Whaling assisted in important aspects of the survey. We also thank the Kushiro fisheries cooperative association, the municipal office of Kushiro, Hokkaido government Kushiro sub-prefectural office, and Hokkaido government office, for their kind assistance.

REFERENCES

- Fujise, Y., Tamura, T., Bando, T., Watanabe, H., Kiwada, H., Otani, S., Kanda, N., Yasunaga, G., Mogoe, T., Konishi, K., Inamori, M., Shigemune, H. and Tohyama, D. 2002. Cruise report of the feasibility study of the Japanese Whale Research Program under Special Permit in the western North Pacific-Phase II (JARPN II) in 2001. Paper SC/54/O16 submitted to the 54th IWC Scientific Committee, 51pp.
- Government of Japan, 2002a. Research plan for cetacean studies in the western North Pacific under special permit (JARPN II). Paper SC/54/O2 submitted to the 54th IWC Scientific Committee.
- Government of Japan (Fujise, Y., Kawahara, S., Pastene, L.A. and Hatanaka, H. eds.), 2002b. Report of 2000 and 2001 feasibility study of the Japanese Whale Research Program under Special Permit in the western North Pacific-Phase II (JARPN II). Paper SC/54/O17 submitted to the 54th IWC Scientific Committee, 202pp.
- Government of Japan, 2004a. Revised research plan for cetacean studies in the western North Pacific under special permit (JARPN II). Paper SC/56/O1 submitted to the 56th IWC Scientific Committee, 14pp.
- Government of Japan (Fujise, Y., Tamura, T., Kato, H. and Kawahara, S. eds.), 2004b. Some considerations of the feasibility components of the JARPN II research plan. Paper SC/56/O2 submitted to the 56th IWC Scientific Committee, 36pp.
- Kasamatsu, F. and Hata, T. 1985. Notes on minke whales in the Okhotsk Sea-West Pacific Area. Report of International Whaling Commission, 35:299-304.
- Kasamatsu, F. and Tanaka, T. 1992. Annual changes in prey species of Minke whales taken off Japan 1948-1987. *Nippon Suisan Gakkaishi* 58:637-651.
- Kishiro, T., Kato, H., Ohizumi, H., Yoshida, H., Saito, T., Isoda, T., Tabata, S., Sakakibara, M., Saino, S., Hara, T., Hayashi, T., Miyashita, T., Fukudome, K., Kiwada, H., and Kawahara, S. 2003. Report of the 2002 JARPN II survey in the western North Pacific. Part II: Coastal component - Coastal Survey off Kushiro, northeast Japan. Paper SC/55/O8 submitted to the 55th IWC Scientific Committee, 26pp.
- Kishiro, T., Kato, H., Yoshida, H., Miyashita, T., Ryono, T., Tabata, S., Okamoto, R., Yasui, K., Sato, H., Morita, Y., Saino, S., Hara, T., Ebisui, T., Kuroishi, H., Nishiwaki, S., and Kawahara, S. 2005. Cruise report

- of the coastal survey on common minke whales off Kushiro, northeast Japan: the 2004 JARPN II survey (Part II) - Coastal component. Paper SC/57/O4 submitted to the 57th IWC Scientific Committee, 37pp.
- Kishiro, T., Kato, H., Yoshida, H., Miyashita, T., Ryono, T., Tabata, S., Yasui, K., Sato, H., Morita, Y., Kumagaya K., Tokuda, D., Nakai, K., Funabashi, N., Ebisui, T., Wakatsuki, T., Sakaguchi, M., Houhana, T., Nishiwaki, S., and Kawahara, S. 2006. Cruise report of the second phase of the Japanese Whale Research Program under Special Permit in the Western North Pacific - Coastal component off Kushiro in 2005. Paper SC/58/O10 submitted to the 58th IWC Scientific Committee, 32pp.
- Kishiro, T., Kato, H., Yoshida, H., Miyashita, T., Iwasaki, T., Kanaji, Y., Ryono, T., Tabata, S., Morita, Y., Okamoto, R., Maeda, H., Nagatsuka, S., Ogawa, N., Nakai, K., Ebisui, T., Matsumoto, A., Gokita, A., Kiwada, H. and Kawahara, S. 2008. Cruise report of the Second phase of the Japanese Whale Research Program under Special Permit in the western North Pacific (JARPN II) in 2007 - Coastal component off Kushiro. Paper SC/60/O7 submitted to the 60th IWC Scientific Committee, 33pp.
- Kishiro, T., Yoshida, H., Tamura, T., Konishi, K., Kanda, N., Okamoto, R., and Kato, H. 2009. Relationship between body size, maturity, and feeding habit of common minke whales off Kushiro in autumn season, from 2002-2007 whale sampling surveys under the JARPN II coastal components off Kushiro. Paper SC/J09/JR13 submitted to the JARPN II Review Workshop, Tokyo, January 2009, 25pp.
- Kishiro, T., Kato, H., Yoshida, H., Yasunaga, G., Tabata, S., Nakamura, G., Maeda, H., Inoue, S., Miyagawa, N., Okamoto, R., Oikawa, H., Watanabe, H., Iwasaki, T., Kanaji, Y., Minamikawa, S., Otani, S., Ishikawa, H., Kanda, N., Gokita, A., Yamazaki, K., and Yonehara, Y. 2010. Cruise report of the Second phase of the Japanese Whale Research Program under Special Permit in the western North Pacific (JARPN II) in 2009 - Coastal component off Kushiro. Paper SC/62/O6 submitted to the 62th IWC Scientific Committee, 13pp.
- Kishiro, T., Kato, H., Ito, N., Yasunaga, G., Hara, T., Nakamura, G., Maeda, H., Inoue, S., Miyakawa, N., Ishida, K., Kadowaki, I., Oikawa, H., Miyashita, T., Iwasaki, T., Kanaji, Y., Minamikawa, S., Watanabe, H., Kumagai, S., Sato, H., and Kitayama, K. 2012. Cruise report of the Second phase of the Japanese Whale Research Program under Special Permit in the western North Pacific (JARPN II) in 2011 (Part III) - Coastal component off Kushiro, autumn survey. Paper SC/64/O5 submitted to the 64th IWC Scientific Committee, 14pp.
- Kishiro, T., Yoshida, H., Ito, N., Nakamura, G., Miyakawa, N., Tamai, N., Kadowaki, I., Fukumoto, A., Takahashi, M., Furuyama, Y., Oota, Y., Maeda, H., Miyashita, T., Kumagai, S., Hara, T., Kimura, Y., Sakamoto, N., Kobayashi, N., Suzuki, N., Kanaji, Y., Mogoe, T., Nakai, K., and Kato, H. 2014. Cruise report of the Second phase of the Japanese Whale Research Program under Special Permit in the western North Pacific (JARPN II) in 2013 (Part III) - Coastal component off Kushiro. Paper SC/65b/SP04 submitted to the 65^bth IWC Scientific Committee, 13pp.
- Kishiro, T., Yoshida, H., Ito, N., Mogoe, T., Nakamura, G., Maeda, H., Miyakawa, N., Hirose, A., Ota, M., Kato, K., Hayashi, R., Yoshii, K., Kim, Y., Miyashita, T., Kumagai, S., Hitomi, S., Kimura, Y., Hiruda, H., Katsumata, T., Nakai, K., and Kato, H. 2016. Cruise report of the Second phase of the Japanese Whale Research Program under Special Permit in the western North Pacific (JARPN II) in 2015 (Part III) - Coastal component off Kushiro. Paper SC/66b/SP03 submitted to the 66^bth IWC Scientific Committee, 13pp.
- Kato, H., Kishiro, T., Yoshida, H. and Kawahara, S. 2004. Feasibility of coastal surveys in the JARPN II, from the viewpoint of logistics. Appendix 1, pp4-12. *In*: Government of Japan (Fujise, Y., Tamura, T., Kato, H. and Kawahara, S. eds.), Some considerations of the feasibility components of the JARPN II research plan. Paper SC/56/O2 submitted to the 56th IWC Scientific Committee, 36pp.
- Mogoe, T., Tamura, T., Kishiro, T., Yasunaga, G., Yoshida, H., Bando, T. and Kato, H. 2015. Preliminary evaluation of biopsy and fecal sampling efficiency, and working plan for non-lethal method research in JARPNII. Paper SC/66a/SPxx submitted to IWC Scientific Committee. May 2015, (unpublished).
- Tameishi, H. 2000. Migration and fishing ground of Pacific saury, *Nihon Suisan Gakkaishi*, 66:304-305. (In Japanese)
- Tamura, T. and Fujise, Y. 2002. Geographical and seasonal changes of the prey species on minke whale in the Northwestern Pacific. *ICES Journal of Marine Science*, 59:516-528.
- Torisawa, M. 2004. Changes in commercial fisheries off Kushiro. *Hokusuishi Dayori*, 63:1-7. (In Japanese) <http://www.fishexp.hro.or.jp/exp/central/report/DAYORI/dayori63/kusiro.pdf>
- Yasunaga, G., Ito, N., Wada, A., Kiwada, H., Sato, H., Maeda, H., Nakamura, G., Inoue, S., Miyakawa, N., Kitayama, K., Ishikawa, Y., Suzuki, N., Tsutusmi, T., Kadowaki, I. and Kato, H. 2012. Cruise report of the Second phase of the Japanese Whale Research Program under Special Permit in the western North Pacific (JARPN II) in 2011 (Part II) - Coastal component off Kushiro, spring survey. Paper SC/64/O4 submitted

- to the 64th IWC Scientific Committee, 12pp.
- Yoshida, H., Kato, H., Kishiro, T., Iwasaki, T., Miyashita, T., Ryono, T., Tabata, S., Sakakibara, M., Saino, S., Hara, T., Hayashi, T., Tomizawa, Y., Tamai, K., Okamoto, R., Fukuoka, M., Watanabe, H., Tsunekawa, M. and Kawahara, S. 2004. Report of the coastal survey on common minke whales off Sanriku coast, northeast Japan: the Japanese whale research program under special permit in the western North Pacific – Phase II (JARPN II) in 2003 (Part II) – Coastal component. Paper SC/56/O14 submitted to the 56th IWC Scientific Committee, 31pp.
- Yoshida, H., Kato, H., Kishiro, T., Miyashita, T., Iwasaki, T., Minamikawa, S., Ryono, T., Tabata, S., Morita, M., Sato, H., Okamoto, R., Toyoda, Y., Nakamura, G., Ebisui, T., Nakai, K., Matsumoto, A., Nishiwaki, S., and Kawahara, S. 2007. Cruise report of the second phase of the Japanese Whale Research Program under Special Permit in the Western North Pacific (JARPN II) in 2006 - Coastal component off Kushiro. Paper SC/59/O7 submitted to the 59th IWC Scientific Committee, 43pp.
- Yoshida, H., Kato, H., Kishiro, T., Miyashita, T., Iwasaki, T., Kanaji, Y., Yasunaga, G., Oikawa, H., Ryono, T., Tabata, S., Okamoto, R., Maeda, H., Matsumoto, A., Ogawa, N., Nagatsuka, S., Inoue, S., Hiruda, H., Gokita, A., Matsunaga, H., and Yamasaki, K., 2009. Cruise report of the second phase of the Japanese Whale Research Program under Special Permit in the Western North Pacific (JARPN II) in 2008 (Part II) - Coastal component off Kushiro. Paper SC/61/O5 submitted to the 61th IWC Scientific Committee, 10pp.
- Yoshida, H., Ito, N., Kishiro, T., Miyashita, T., Iwasaki, T., Minamikawa, S., Kanaji, Y., Oikawa, H., Tabata, T., Kumagai, S., Nakamura, G., Maeda, H., Inoue, S., Miyakawa, N., Ishikawa, Y., Shimizu, K., Yonehara, Y., Kitayama, K., Tsutsumi, T., and Kato, H. 2011. Cruise report of the second phase of the Japanese Whale Research Program under Special Permit in the Western North Pacific (JARPN II) in 2010 (Part III) - Coastal component off Kushiro. Paper SC/63/O4 submitted to the 63th IWC Scientific Committee, 10pp.
- Yoshida, H., Ito, N., Kishiro, T., Miyashita, T., Yasunaga, G., Hara, T., Nakamura, G., Maeda, H., Inoue, S., Tsutsumi, T., Ishida, K., Tamai, N., Kadowaki, I., Oka, S., Takahashi, M., Fukumoto, A., Kumagai, S., Sato, H., Sakamoto, N., Kitayama, K., Kobayashi, N. and Kato, H. 2013. Cruise report of the Second phase of the Japanese Whale Research Program under Special Permit in the western North Pacific (JARPN II) in 2012 (Part III) - Coastal component off Kushiro. Paper SC/65a/O6 submitted to the 65th IWC Scientific Committee, 12pp.
- Yoshida, H., Ito, N., Kishiro, T., Miyashita, T., Nakai, K., Nakamura, G., Maeda, H., Ishida, K., Takahashi, M., Ota, M., Furuyama, Y., Kato, K., Hayashi, R., Hiruda, H., Kumagai, S., Kasamoto, N., Kimura, Y., Teshima, I and Kato, H. 2015. Cruise report of the Second phase of the Japanese Whale Research Program under Special Permit in the western North Pacific (JARPN II) in 2014 (Part III) - Coastal component off Kushiro. Paper SC/66a/SP7 submitted to the 66th IWC Scientific Committee, 13pp.

Table 1. Searching days, distances, hours, and number of cetacean sightings made during the 2016 JARPN II coastal component off Kushiro.

Period	Days	Distances (n. miles)	Hours	Species	Number of sightings*		
					Primary (Ind/Sch)	Secondary (Ind/Sch)	Total (Ind/Sch)
9/5-10/31	57	6,051.6	622.9	Common minke whale	37/36	3/3	40/39
				Like minke whale	18/18	1/1	19/19
				Fin whale	3/2	0/0	3/2
				Humpback whale	58/35	6/4	64/39
				Bryde's whale	1/1	0/0	1/1
				Sperm whale	7/4	1/1	8/5

*: The number probably includes some duplicated sightings made by plural vessels.

Table 2. Summary of biological data and samples collected during the 2016 JARPN II coastal survey off Kushiro.

Samples and data	Number of animals		
	Male	Female	Total
Body length and sex	8	13	21
External body proportion	8	13	21
Photographic record and external body character	8	13	21
Diatom film record	8	13	21
Body scar record	8	13	21
Measurements of blubber thickness (five points)	8	13	21
Detailed measurements of blubber thickness (11 points)	0	1	1
Body weight	8	13	21
Body weight by parts	0	1	1
Skin tissues for DNA analysis	8	13	21
Muscle, liver, kidney, spleen, blubber, and heart for various analysis	8	13	21
Urine for various analysis	1	2	3
Muscle, liver, kidney, and blubber for heavy metal analysis	8	13	21
Muscle, liver, kidney, and blubber for organochlorine analysis	8	13	21
Collection of blood plasma	7	11	18
Mammary gland; lactation status, measurement and histological sample	-	13	13
Uterine horn; measurements and endometrium sample	-	13	13
Collection of ovary	-	13	13
Photographic record of foetus	1	2	3
Foetal length and weight	1	2	3
External body measurements of foetus	1	2	3
Skin tissues for DNA study of foetus	1	2	3
Muscle, liver, kidney, heart, blubber and skin tissues of foetus	1	2	3
Eye lens of foetus for age determination	1	2	3
Collection of foetus	1	1	2
Testis and epididymis; weight and histological sample	8	-	8
Stomach contents, convenient record	8	13	21
Volume and weight of stomach content in each compartment	8	13	21
Observation of marine debris in stomach	8	13	21
Collection of stomach contents for feeding study	8	13	21
Record of external parasites	8	13	21
Earplug for age determination	8	13	21
Eye lens for age determination	8	13	21
Baleen plate with V-shape notch on its outer edge for age determination	0	0	0
Baleen plate measurements (length and breadth)	8	13	21
Photographic record of baleen plate series	8	13	21
Length of baleen series	8	13	21
Vertebral epiphyses sample	8	12	20
Number of ribs	8	13	21
Skull measurement (length and breadth)	8	13	21
Content of large intestine	1	4	5
Measurement of flipper white patch	8	13	21

Table 3. Body length (m) of common minke whales collected in the 2016 JARPNII coastal component off Kushiro.

Period	Male					Female				
	Mean	S.D.	Min.	Max.	<i>n</i>	Mean	S.D.	Min.	Max.	<i>n</i>
9/5-9/15	7.36	0.31	6.95	7.75	5	6.47	-	-	-	1
9/16-9/30	7.01	-	-	-	1	7.16	0.90	6.24	8.19	4
10/1-10/15	6.00	-	-	-	1	7.78	0.74	7.23	8.85	4
10/16-10/31	6.96	-	-	-	1	6.41	1.14	5.07	7.85	4
Total (9/5-10/31)	7.09	0.53	6.00	7.75	8	7.07	1.01	5.07	8.85	13

Table 4. Composition of sexual maturity of common minke whales collected in the 2016 JARPNII coastal component off Kushiro.

Period	Male				Female						Sex ratio (%males)
	Im	M	Total	Maturity*	Im	R	P	Total	Pregnancy*	Maturity*	
9/5-9/15	0	5	5	100.0	1	0	0	1	-	0.0	83.3
9/16-9/30	0	1	1	100.0	2	1	1	4	50.0	50.0	20.0
10/1-10/15	1	0	1	0.0	1	1	2	4	66.7	75.0	20.0
10/16-10/31	0	1	1	100.0	3	1	0	4	0.0	33.3	20.0
Total (9/5-10/31)	1	7	8	87.5	7	3	3	13	50.0	46.2	38.1

Im: Immature; M: Mature; R: Resting; P: Pregnant; *: %.

Table 5. Number of common minke whales by major prey species found in forestomach, collected in the 2016 JARPN II coastal component off Kushiro.

Period	Number of whales (%)				All
	Walleye pollock	Japanese sardine	Mackerels	Empty	
9/5-9/15	3 (50.0)	2 (33.3)	1 (16.7)	0 (0.0)	6 (100.0)
9/16-9/30	3 (60.0)	2 (40.0)	0 (0.0)	0 (0.0)	5 (100.0)
10/1-10/15	0 (0.0)	1 (20.0)	3 (60.0)	1 (20.0)	5 (100.0)
10/16-10/31	0 (0.0)	3 (60.0)	2 (40.0)	0 (0.0)	5 (100.0)
All (9/5-10/31)	6 (28.6)	8 (38.1)	6 (28.6)	1 (4.8)	21 (100.0)

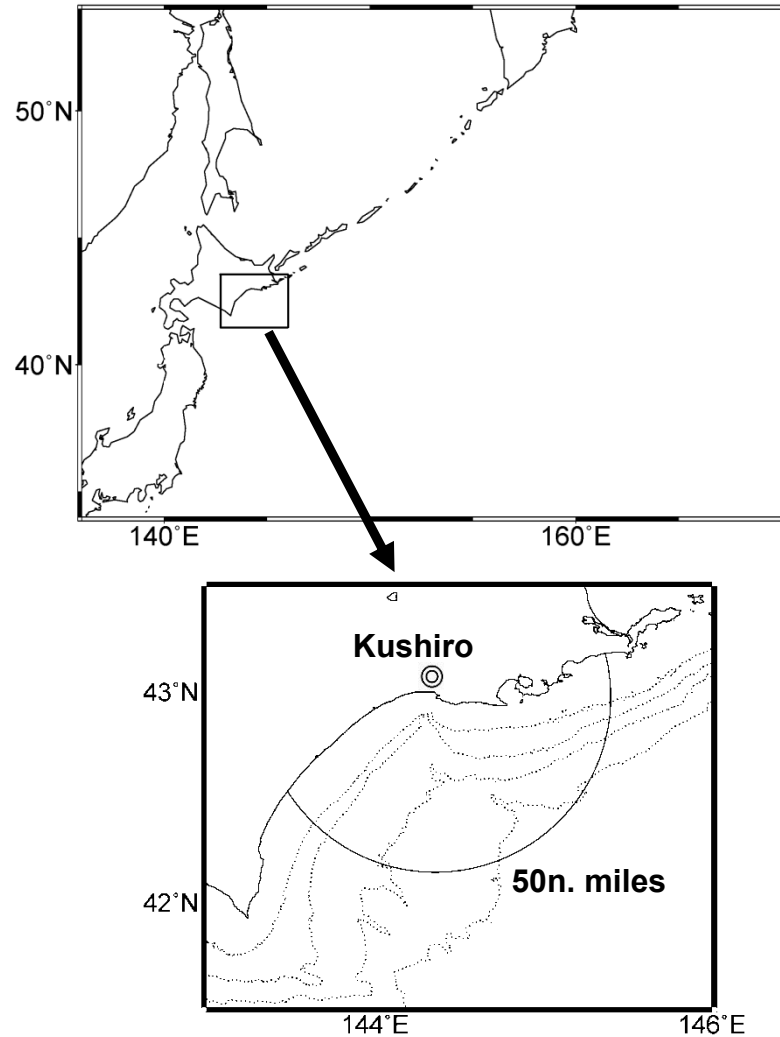


Figure 1. Research area set for the 2014 JARPN II coastal survey off Kushiro. Isobaths are 100m, 200m, 1000m, and 2000m.

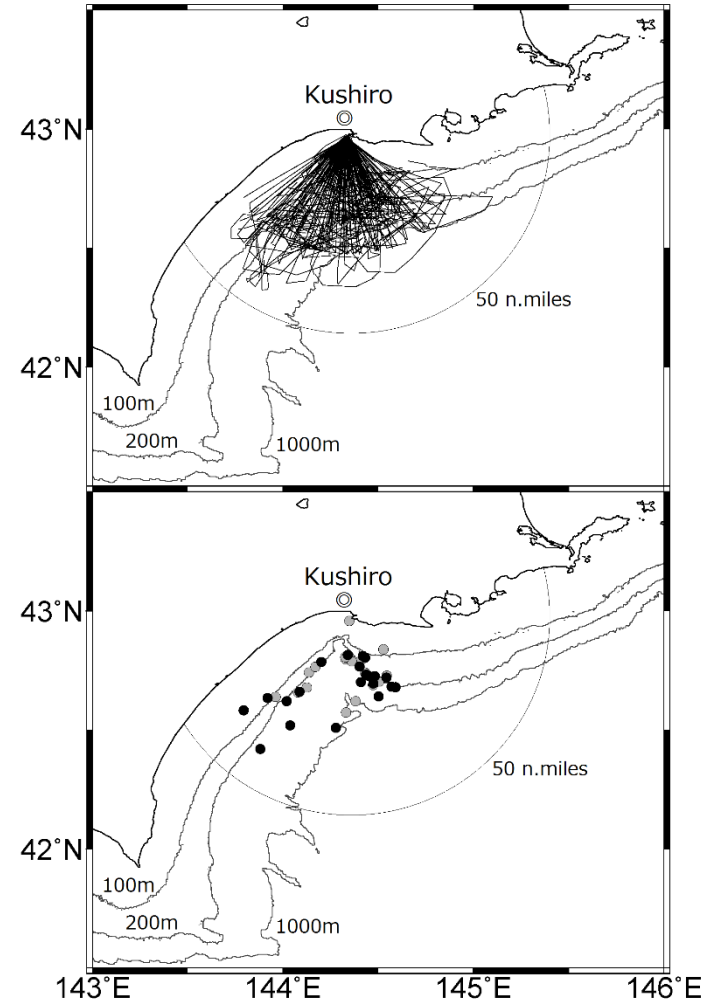


Figure 2. Cruise tracks (upper) and sighting positions (lower) of common minke whales made by sampling vessels during the 2016 JARPN II coastal survey off Kushiro. Black circles are sighting positions of common minke whales collected. Isobaths are 100m, 200m, and 1000m.

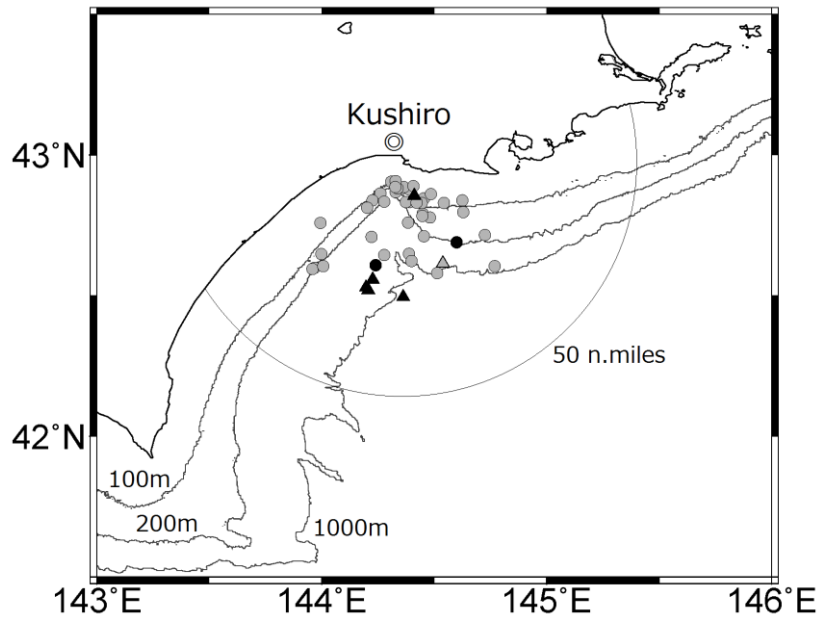


Figure 3. Sighting positions of humpback (gray circle), fin (black circle), Bryde's (gray triangle) and sperm (black triangle) whales made by sampling vessels during the 2016 JARPN II coastal survey off Kushiro. Isobaths are 100m, 200m, and 1000m.

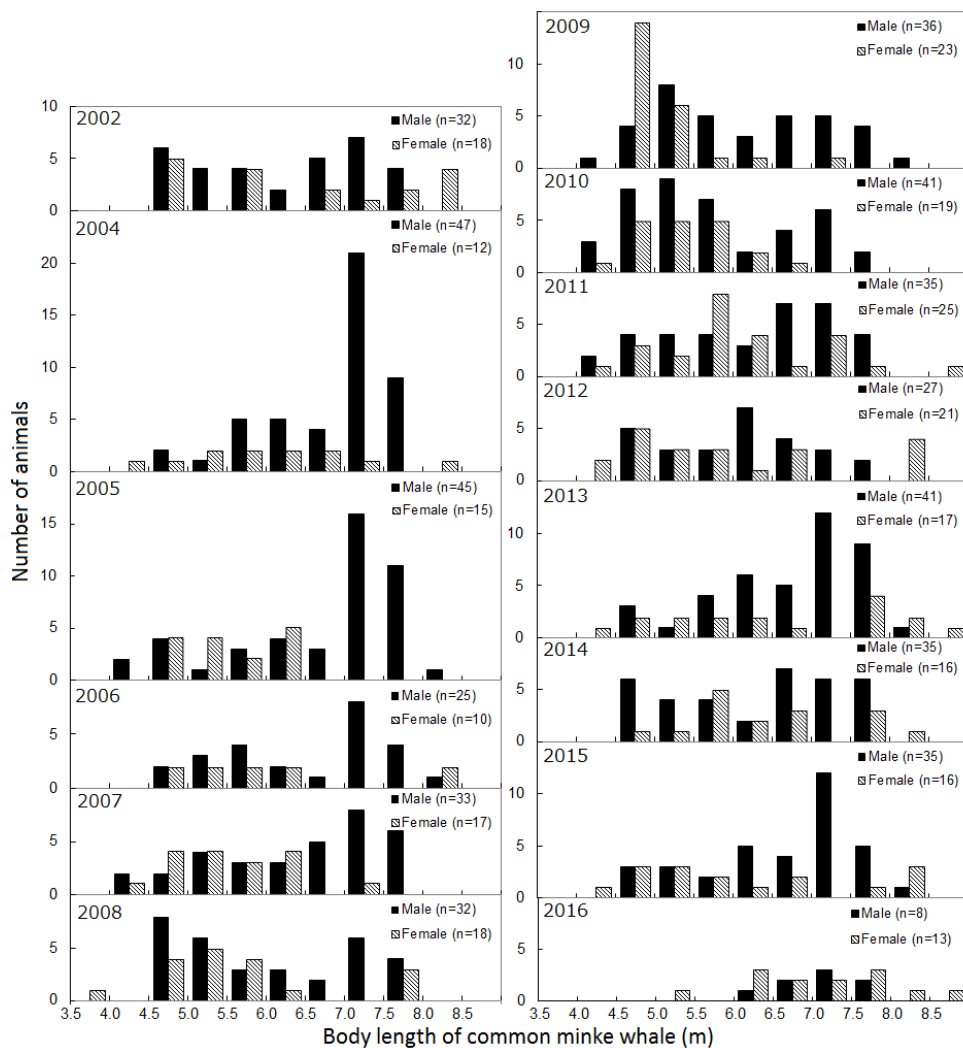


Figure 4. Body length frequency of common minke whales sampled during the 2016 JARPN II coastal survey off Kushiro, with results of the previous 2002-2015 surveys.

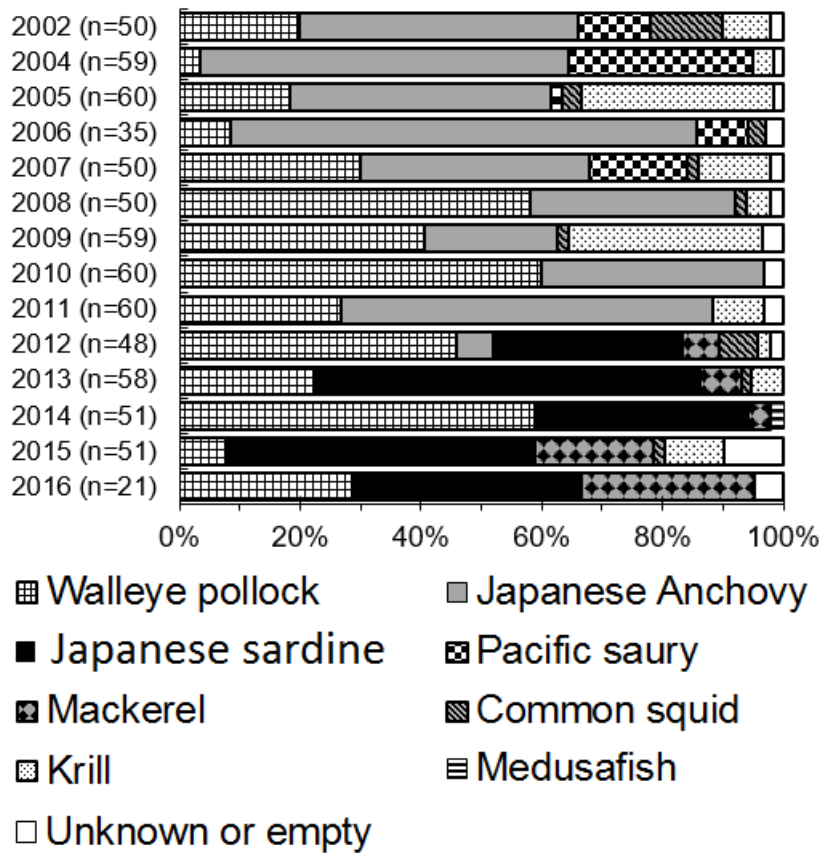


Figure 5. Composition of prey species of common minke whales sampled during the 2016 JARPN II coastal survey off Kushiro, with results of the previous 2002-2015 surveys.

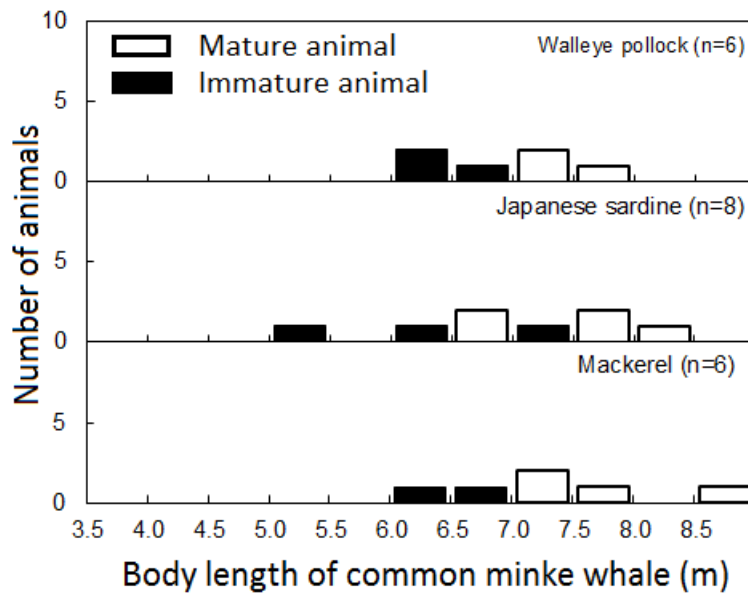


Figure 6. Sexual maturity and body length frequency of common minke whales by their prey species found in forestomach in the 2016 JARPN II coastal survey off Kushiro.

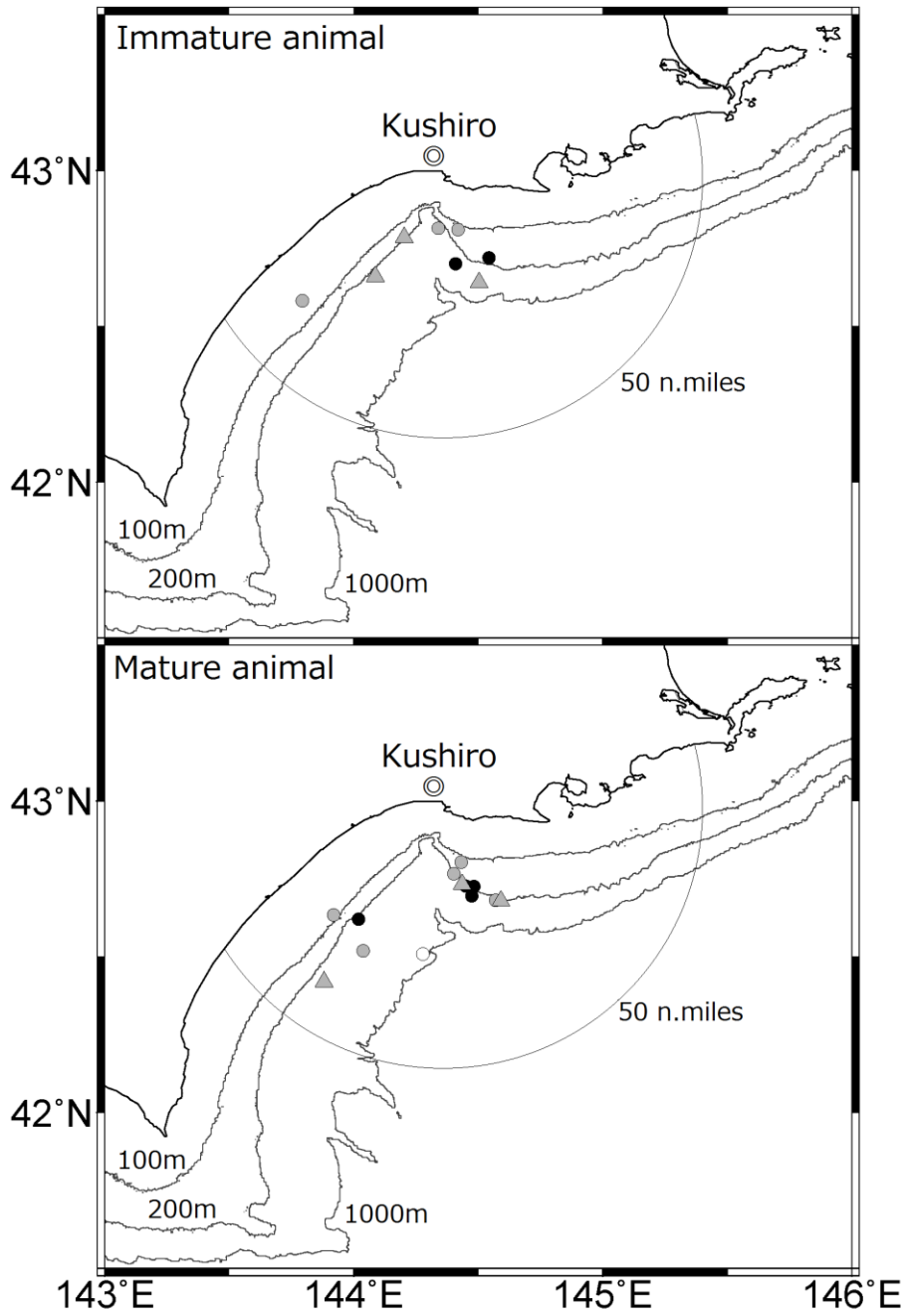


Figure 7. Sighting positions of common minke whales collected during the 2016 JARPN II coastal survey off Kushiro, shown by their maturity stage and prey species. Walleye Pollock (gray triangle), Japanese sardine (gray circle), mackerel (black circle), and empty (white circle). Isobaths are 100m, 200m, and 1000m.

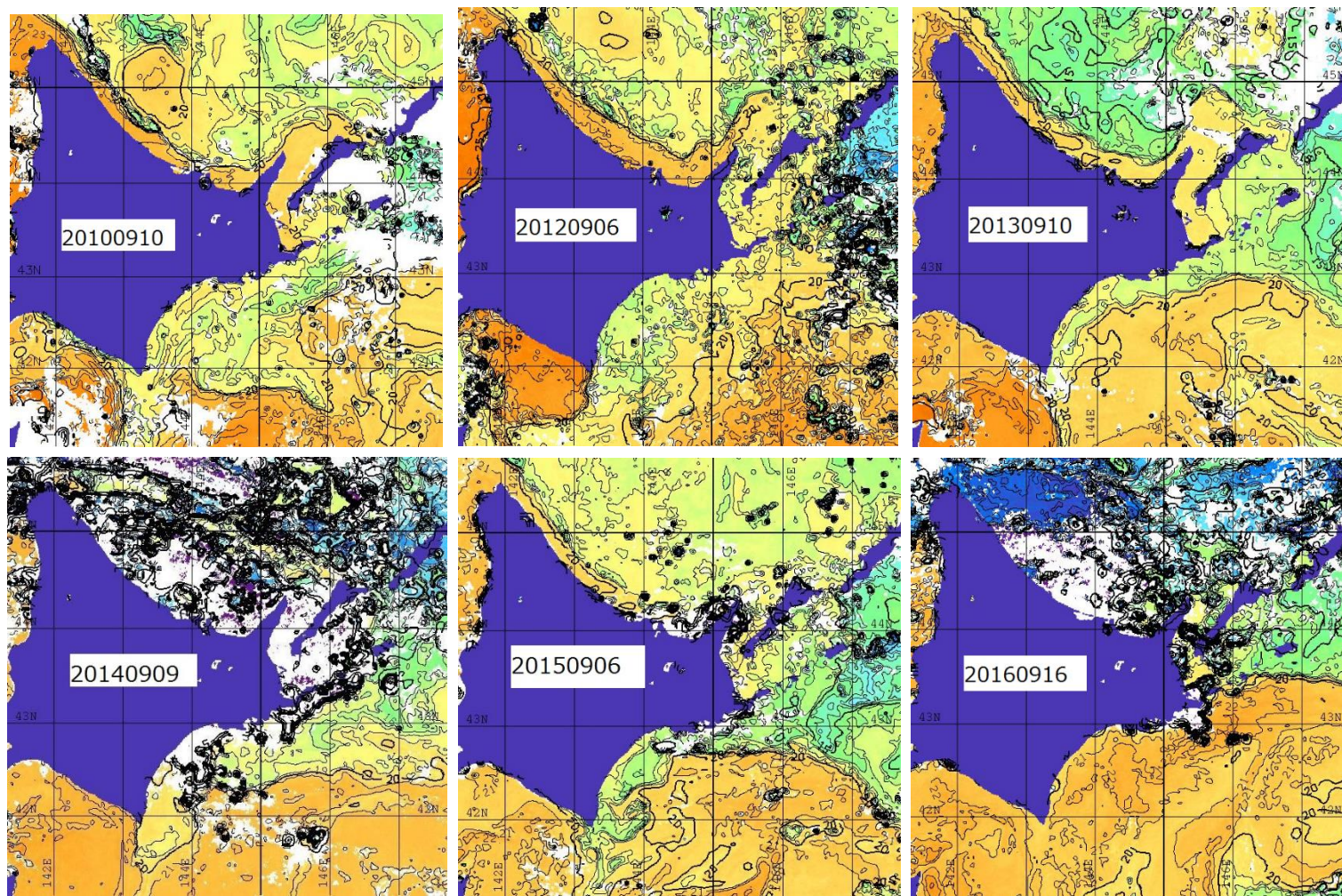


Figure 8. SST recorded off Kushiro, derived from AVHRR of NOAA satellite system (<http://www.suigi.pref.iwate.jp/index/siteprev>).