

Cruise Report of the New Scientific Whale Research Program in the western North Pacific (NEWREP-NP) in 2017- Pacific coastal component off Hachinohe and Kushiro

Tatsuya Isoda, Genta Yasunaga, Hideyoshi Yoshida, Toshihiro Mogoe, Nobuyuki Ito, Kazutoyo Shimetani, Gen Nakamura, Hikari Maeda, Satoko Inoue, Saeko Kumagai, Mutsuo Goto, Futaba Nishimura, Yujin Kim, Yuko Asano, Minoru Akagi, Ken Nakajo, Ryuji Yamamoto, H



INTERNATIONAL
WHALING COMMISSION

Cruise Report of the New Scientific Whale Research Program in the western North Pacific (NEWREP-NP) in 2017- Pacific coastal component off Hachinohe and Kushiro

TATSUYA ISODA¹⁾, GENTA YASUNAGA¹⁾, HIDEYOSHI YOSHIDA²⁾, TOSHIHIRO MOGOE¹⁾, NOBUYUKI ITO³⁾, KAZUTOYO SHIMETANI³⁾, GEN NAKAMURA⁴⁾, HIKARI MAEDA²⁾, SATOKO INOUE¹⁾, SAEKO KUMAGAI³⁾, MUTSUO GOTO¹⁾, FUTABA NISHIMURA⁴⁾, YUJIN KIM⁴⁾, YUKO ASANO⁴⁾, MINORU AKAGI⁴⁾, KEN NAKAJO⁴⁾, RYUJI YAMAMOTO⁴⁾, HIKARU WATANABE⁴⁾, NOZOMI SONOBE⁴⁾, CHERI SHIBATA⁴⁾, TOMOKO AGARI⁴⁾, TAIKI KATSUMATA⁴⁾, RIKIO SAZAWA³⁾, TORU HATANAKA³⁾, TOSHIMASA TAKAHASHI³⁾, AKIHIDE HATSUSE³⁾, TATSUTOSHI INOUE³⁾, MITSUNORI KOBATA³⁾, AKIRA TAKEUCHI³⁾, SYUICHI MATSUMOTO³⁾, MASAYUKI MIYOSHI³⁾, HIROFUMI SEKO³⁾, YASUKI MONGUCHI³⁾ and HIDEHIRO KATO⁴⁾

¹ The Institute of Cetacean Research, 4-5, Toyomi-cho, Chuo-ku, Tokyo, 104-0055, Japan

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

³ Association for Community-Based Whaling, Hakata-Kaiseki Building 2F, Hakata-Eki-Higashi, Hakata-ku, Fukuoka 812-0013, Japan

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

Contact e-mail: isoda@cetacean.jp

ABSTRACT

The first survey of the NEWREP-NP Pacific coastal component was conducted in sub-areas 7CS off Sanriku (Hachinohe) and 7CN off Kushiro. The survey in Hachinohe was conducted from 18 July to 20 August 2017, using two small-type whaling catcher boats as sighting/sampling vessels and six small fisheries boats supporting the sighting vessels. The survey in Kushiro was conducted from 1 September to 31 October 2017, using four small-type whaling catcher boats as sighting/sampling vessels. Searching for common minke whales and sampling took place in coastal waters about 50 n. miles from Hachinohe and Kushiro Ports. All common minke whales sampled were landed at the NEWREP-NP research stations established in Hachinohe and Kushiro, where biological examination was conducted. During the survey in Hachinohe, a total of eight primary sightings (eight individuals) of common minke whale were made during 4,297.1 n.miles of searching distance (456.2 hours). Three common minke whales (one immature and two mature males) were sampled. The dominant prey species was the Japanese sardine. During the survey in Kushiro, a total of 45 primary sightings (47 individuals) of common minke whale were made during 7,038.5 n.miles of searching distance (724.0 hours). A total of 35 common minke whales (22 males and 13 females) were sampled. The dominant prey species was the Japanese sardine. Biological samples and data required for Primary Objective I and Ancillary Objectives I and II of NEWREP-NP were obtained from all animals sampled. The target sample size of 80 common minke whales however could not be attained, because both surveys were greatly affected by bad weather and sea conditions, for example thick fog and strong cold wind were frequent in Hachinohe and low atmospheric pressure involving typhoons affected the Kushiro area.

KEYWORDS: COMMON MINKE WHALE; NORTH PACIFIC; SCIENTIFIC PERMITS

INTRODUCTION

The research plan for the New Scientific Whale Research Program in the western North Pacific (NEWREP-NP) was finalized taking into account recommendations and suggestions from the NEWREP-NP review workshop (IWC, 2017) and the International Whaling Commission Scientific Committee (IWC SC) (IWC, 2018). The NEWREP-NP research plan can be found at <http://www.jfa.maff.go.jp/j/whale/attach/pdf/index-6.pdf> (GOJ, 2017).

The NEWREP-NP has two primary objectives and three ancillary objectives. Primary Objective I related to common minke whale and the three ancillary objectives are relevant for the field activities of the coastal component of NEWREP-NP reported in this document.

Primary Objective I, which is ‘Contribution to optimizing the establishment of a sustainable catch limit for common minke whales in the coastal waters of Japan’ is composed of four Secondary Objectives as follows: I (i): Investigate the spatial and temporal occurrence of J stock common minke whales around Japan, by sex, age and reproductive status; I (ii): Estimate the abundance of the J and O stocks in coastal waters of Japan; I (iii): Verify that there is no structure in the O stock common minke whale in the Pacific side of Japan; and I (iv): Improve RMP trials by incorporating age data in their conditioning (GOJ, 2017).

The three Ancillary Objectives are the following I: ‘Investigation of the influence of environmental changes on whale stocks’; II: ‘Examination of the effects of pollutants on whales’; and III: ‘Study of distribution, movement

and stock structure of large whales with particular emphasis on blue and North Pacific right whales' (GOJ, 2017).

The rationale for Primary and Ancillary objectives and the required data to fulfill the objectives are given in the research plan for NEWREP-NP (GOJ, 2017). The most relevant samples and data for Primary Objective I are earplugs for age determination, reproductive organs for determination of sexual maturity, tissue samples for genetic analyses on stock structure, and sighting data for abundance estimates.

The sample size of common minke whale in the Pacific side of Japan was determined in relation to Secondary Objective I (iv) above. The sample size was determined to be 107 O stock animals, of which 43 are to be taken in offshore areas and 64 in the Pacific coastal areas (see details in Annex 11 of GOJ, 2017). Allowing for sampling of some J stock animals, the sample size in the Pacific coastal area was determined to be 80 animals.

This paper reports the results of the first Pacific coastal surveys of NEWREP-NP conducted in 2017 in sub-areas 7CS off Sanriku (Hachinohe) and 7CN off Kushiro. The Institute of Cetacean Research (ICR) conducted these surveys in cooperation with the National Research Institute of Far Seas Fisheries (NRIFS), the Japan Fisheries Research and Education Agency, Tokyo University of Marine Science and Technology and the Association for Community-Based Whaling.

SURVEY DESIGN

Research area

Sub-areas 7CN and 7CS were the primary research areas (Figure 1). A land-based operation system was incorporated for whale sampling. Land stations with a research head office were established at Hachinohe (sub-area 7CS) and Kushiro (7CN). The research areas were set approximately within 50 n. miles from Hachinohe and Kushiro ports.

Research period

Research period in Hachinohe was set for 34 days, from 18 July to 20 August 2017. Research period in Kushiro was set for 61 days, from 1 September to 31 October, 2017.

Target species for lethal sampling and sample sizes

The target species was the common minke whale. The sample size in the Pacific side of Japan was 80 animals.

Research vessels and research station

In the Hachinohe survey two small-type whaling catcher boats were used as sighting/sampling vessels: *Koei Maru No. 8* (32.0GT) and *Katsu Maru No.7* (32.0GT). In addition six small fisheries boats acted as sighting vessels for supporting the small-type whaling catcher boats: *Yusei Maru* (7.9 GT), *Ryouyu Maru* (7.9 GT), *Yushin Maru* (8.5 GT), *Miyoshi Maru No.3* (7.7 GT), *Sachi Maru* (9.1 GT), *Kaishou Maru* (7.3 GT).

In the Kushiro survey, four small-type whaling catcher boats were used as sighting/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).

Land stations with a research head office were established in Hachinohe and Kushiro for biological examinations and commanding the operation of the sampling vessels.

Whale sampling survey procedures

The standard survey procedure of searching and sampling for the Pacific coastal component of off Sanriku (Hachinohe) and off Kushiro was based on Research Plan for NEWREP-NP (GOJ, 2017, see Annex 6).

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 30 nautical 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 everyday. A researcher was on board each of the 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 large whale species. 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 pairs. 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 land-station of 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 an 11-ton freight trailer.

Biological measurements and sampling procedure

All the whales sampled were biologically examined by researchers at the land station. The items of the biological research are summarized in Table 1.

Morphometric and body weight

After photographing the lateral side of each whale, a series of standard measurements were taken, including body length to the nearest 1cm and body proportion at 23 different points (to the nearest 1cm). Skull measurements (length and greatest breadth to the nearest 0.5cm) were taken for most whales using a large pair of vernier calipers. Measurements of blubber thickness were taken at five points on the lateral side of the body. Girth dimensions are taken from all animals sampled. Body weights of each whale are measured using the crane scale or the track scale.

Definition of sexual maturity

The maturity of the females was determined by the presence of at least one corpus luteum or corpus albicans in either ovary. In the case where no corpus luteum or corpus albicans was observed, the female was categorized as immature. Reproductive status of female whales was classified into four categories (ovulating, pregnant, resting and pregnant and lactating), based upon observation of the ovary, uterus, and mammary gland. Pregnancy of the animal was defined based on conceptus with placental development in the uterus. The definition of male sexual maturity was defined preliminary based on the weight of one testis. If the heavier testis was over 0.29kg (Bando unpublished data), the whales were determined as sexually mature. Body length and weight of fetuses were measured in the same manner as in adult whales.

Earplug sampling

Both left and right earplugs were collected for age determination by the routine procedure (Omura, 1963). After removing the mandibles, the proximal part of the earplug was exposed along the surrounding external part of the ear canal from the tympanic bulla using a knife for subsequent incision. The external part of the ear canal was carefully cut open so as not to incise the earplug, and then the earplug was collected with glove-finger using a scalpel. 'Gelatinized Extraction Method' (Maeda *et al.*, 2013) was used to reduce damage when extracting for small common minke whales sampled (body length < 7m). Earplugs were fixed and stored in 10% formalin solution.

Stomach contents

Conventional stomach content records were obtained from all sampled whales. Prey species from the fore- and main-stomach contents were weighed for each whale sampled and a part of stomach contents was stored at -20°C or in 10% formalin solution for later examination.

Other biological samples

Ocular lenses of all whale sampled and fetuses with body length less than 10cm were collected, and stored at -80°C for age estimation purposes. Ovary, mammary gland and endometrium from female animals were dissected from the uterus and stored at -20°C for reproductive study. Tissue samples of testis from male animals for the histological observation were collected and fixed using 10% formalin solution. After measurements of blubber thickness (five points), blubber samples were taken from all specimens for the study of feeding ecology and pollutants studies. Muscle and liver were sampled and stored at -20°C for pollutant studies. Skin samples were collected and fixed in ethanol solution (70%) for genetic studies.

RESULTS

General narrative of the coastal survey off Hachinohe

Searching effort by sighting/sampling vessels

The survey was conducted for 34 days, from 18 July to 20 August 2017. Because of continued unsuitable weather conditions, *e.g.*, heavy wind, high wave, and thick fog, sighting activity by sighting/sampling vessels was conducted only for 11 days (32.4%). The track-lines are shown in Figure 2, and sighting efforts are shown in Table 2. A total of 4,297.1 n. miles (456.2 hours) was searched (sighting/sampling vessels: 996.6 n. miles/99.5

hours and supporting sighting vessels: 3,300.5 nautical miles /356.3 hours). Cruise tracks were mainly distributed in coastal waters within 30 n. miles from Hachinohe port.

Sightings and sampling

Common minke whales were sighted at the continental slope at distances of about 20 to 40 n. miles from Hachinohe. A total of eight sightings (eight individuals) of common minke whale were made (Table 2, Figure 2). No cow-calf pairs were encountered. Three common minke whales were sampled. Sighting positions of common minke whales sampled are shown in Figure 2. Density Index (DI: the number of primary sightings of common minke whale schools per 100 n. miles searching) was 0.19. During the survey, one sighting (one individual) of humpback whale and two sightings (nine individuals) of sperm whales were also made (Table 2, Figure 2).

Biological survey

Samples and data required for Primary Objective I of NEWREP-NP, including body length measurement, earplugs and reproductive organs were obtained for all whales sampled. The three common minke whales sampled consisted of two mature and one immature males, and their body length were 7.55m, 7.00m and 5.72m, respectively. Body length frequency of common minke whales sampled off Hachinohe, compared with results of the previous 2003-2016 JARPNII surveys off Ayukawa are shown in Figure 3.

The dominant prey species was Japanese sardine (*Sardinops melanostictus*) (Figure 4).

The total biological items collected (twenty-eight items required for Primary Objective I, and Ancillary Objectives I and II), are shown in Table 1.

General narrative of the coastal survey off Kushiro

Searching effort by sighting/sampling vessels

The survey was conducted for 61 days, from 1 September to 31 October 2017. Because unsuitable weather conditions, e.g., low atmospheric pressure, sighting activity by sighting/sampling vessels was conducted only for 32 days (52.5%). The track-lines are shown in Figure 5, and sighting efforts are shown in Table 2. A total of 7,038.5 n. miles (724.0 hours) was searched. Cruise tracks were distributed in coastal waters within 30 n. miles from Kushiro port

Sightings and sampling by vessels

Sightings of common minke whales were made mainly on the continental slope south to southeast of Kushiro. A total of 45 sightings (47 individuals) of common minke whale were made (Table 2, Figure 5). No cow-calf pairs were encountered. 35 common minke whales were sampled. Sighting positions of common minke whales sampled are shown in Figure 5. DI was calculated at 0.64. During the survey, 73 sightings (106 individuals) of humpback whales, 17 sightings (25 individuals) of fin whales, three sightings (four individuals) of sei whales and two sightings (two individuals) of sperm whales were also made (Table 2, Figure 6).

Biological survey

Samples and data required for Primary Objective I of NEWREP-NP, including body length measurement, earplugs and reproductive organs were obtained from all whales sampled. The 35 common minke whales sampled consisted of 22 males and 13 females. Table 3 summarizes the information on their body length. Average body length was 5.70 m (SD=1.03, range=4.62-7.48 m) for males and 6.45m (SD= 1.63, range= 4.71-8.58m) for females. Body length frequencies of common minke whales sampled off Kushiro, compared with results of the previous 2003-2016 JARPNII surveys off Kushiro are shown in Table 3 and Figure 7. The dominant body length class was 4.5-5.0 m. Table 4 summarizes the information on sexual maturity composition. Sex ratio of males was 62.9 %. Maturity rate of both sexes were low (38.5 % in females and 27.3 % in males).

Table 5 and Figure 8 show the information on forestomach contents. The dominant prey species detected was Japanese sardine (frequency of appearance: 94.3%), followed by mackerels *Scomber japonicus* and/or *S. australasicus* (frequency of appearance: 2.9%). No Japanese anchovy (*Engraulis japonicas*) or Pacific saury (*Cololabis saira*) were observed, which were the main prey species during the 2000's JARPNII surveys.

The total biological items collected (twenty-eight items required for Primary Objective I and Ancillary Objectives I and II) are shown in Table 1.

DISCUSSION

The first coastal survey of NEWREP-NP in the Pacific side of Japan was conducted in two research areas, Hachinohe and Kushiro. While surveys have been conducted previously in Kushiro, this was the first time the

survey was conducted in Hachinohe in sub-area 7CS. All data and samples identified in the NEWREP-NP research plan as required for Primary Objective I and Ancillary Objectives I and II were obtained from the common minke whales sampled. However the sample size of 80 animals could not be attained. Several reasons including logistic, weather condition and distributional pattern of the animals could explain the smaller sample size attained in the survey.

The surveys were greatly affected by bad weather and sea conditions, for example thick fog and strong cold wind were frequent in Hachinohe and low atmospheric pressure involving typhoons affected the Kushiro area. There was also changeable weather conditions within a day. Especially, northeasterly to easterly surface winds are frequent and strongly blow from the Pacific Ocean toward the Tohoku District including Hachinohe in summer. The winds have been called 'Yamase' and are classified as local winds, which is cool, wet and usually associated with low-level clouds and dense fog. The summer of 2017 experienced unusually strong 'Yamase' (Japan Meteorological Agency, 2017) so that the weather and climate conditions in 2017 were very severe for the survey.

The proportion of Japanese sardine has increased in the stomach contents in off Sanriku since 2012 and off Kushiro since 2014 (Figures 4 and 8), which coincided with increased catches of this species in commercial fisheries in the same area (Yukami *et al.*, 2017). These observations suggest replacement of fish species, because the dominant prey species of common minke whales had been alternately replaced among Japanese anchovy, Japanese sardine and sand lance (*Ammodytes personatus*) in waters off Sanriku from every five to ten years for 1960's -1980's (Kasamatsu and Tanaka, 1992). This could involve changes in distribution of common minke whales, with whales distributed in more offshore waters.

To deal with these factors future coastal surveys in the Pacific side of Japan will cover Ayukawa in April, Hachinohe in May and Kushiro in September and October to match the migration and higher availability of common minke whales. Furthermore, a large whale sampling vessel (*Yushin Maru*- type vessel) will be introduced preliminarily in 2018 to expand the survey area (more than 30 miles from the coast).

Data and samples obtained from this survey will be validated and stored at the Institute of Cetacean Research (ICR), Japan, and are available to national (Japan) and international scientists under established guidelines (see <http://www.icrwhale.org/pdf/NEWREP-NP> and A Protocol.pdf). Catch data record will be submitted to the IWC secretary, as in the previous surveys.

ACKNOWLEDGMENTS

We thank the following persons and organizations: the Fisheries Agency of Japan, the Institute of Cetacean Research and National Research Institute of Far Seas Fisheries and Tokyo University of Marine Science and Technology, for their support and guidance in the survey design; crew of research vessels, staff of the research stations in Hachinohe and Kushiro, and the Association for Community-Based Whaling for logistical assistance.

REFERENCES

- Government of Japan. 2017. Research Plan for New Scientific Whale Research Program in the western North Pacific (NEWREP-NP). <http://www.jfa.maff.go.jp/j/whale/attach/pdf/index-6.pdf>.
- International Whaling Commission. 2017. Report of the Scientific Committee. Report of the Expert Panel Workshop on the Proposed Research Plan for New Scientific Whale Research Programme in the western North Pacific (NEWREP-NP). *J. Cetacean Res. Manage. (Suppl.)* 19.
- International Whaling Commission. 2018. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 19: in press.
- Japan Meteorological Agency. 2017. Unseasonable weather on the Pacific coast side of the North and East Japan, and hot climate in Okinawa Prefecture and Amami islands of Kagoshima Prefecture in the early August 2017 (in Japanese). <http://www.jma.go.jp/jma/press/1708/17a/japan20170817.html>
- Kasamatsu, F. and Tanaka, S. 1992. Annual changes in prey species of minke whales taken off Japan 1948-87. *Nippon Suisan Gakkaishi*. 58: 637-51.
- Maeda H., Kawamoto T. and Kato H. 2013. A study on the improvement of age estimation in common minke whales using the method of gelatinized extraction of earplug. *NAMMCO Sci Publ* 10. 17pp.
- Omura, H. 1963. An improved method for collection of ear plugs from baleen whales. *Norsk Hvalfangst-Tidende*. 10: 279-83.
- Yukami, R., Watanabe, C., Kamimura, Y., Furuichi, S. Akamine, T. and Kishida, T. 2017. Stock assessment and evaluation for Pacific stock of Japanese sardine, *Sardinops melanostictus*, (fiscal year 2016), pp 15-52. In: *Marine fisheries stock assessment and evaluation for Japanese waters (fiscal year 2016/2017)*. Fisheries Agency and Fisheries Research and Education Agency of Japan.

Table 1.
Summary of biological data and samples collected during the 2017 NEWREP-NP Pacific coastal component off Hachinohe and Kushiro.

Data or samples	Number of animals				Total
	Off Sanriku (Hachinohe)		Off Kushiro		
	Male	Female	Male	Female	
Catching date and location ^{1,2,3}	3	-	22	13	38
Photographic record and external body character ¹	3	-	22	13	38
Sex and body length ^{1,2,3}	3	-	22	13	38
External body proportion ^{1,2,3}	3	-	22	13	38
Diatom film record ¹	3	-	22	13	38
Body scar record ¹	3	-	22	13	38
Record of external parasites ¹	3	-	22	13	38
Measurements of blubber thickness (five points) ^{2,3}	3	-	22	13	38
Detailed measurements of blubber thickness (11 points) ^{2,3}	0	-	0	0	0
Body weight ^{2,3}	3	-	22	13	38
Body weight by parts ^{2,3}	0	-	0	0	0
Skin tissues for DNA analysis ^{1,3}	3	-	22	13	38
Muscle, liver, kidney and blubber for chemical study ^{1,2,3}	3	-	22	13	38
Muscle, liver, kidney, spleen, blubber and heart for various analysis ^{1,2,3}	3	-	22	13	38
Urine for various analysis	1	-	5	2	8
Collection of blood plasma ³	2	-	16	9	27
Mammary gland; lactation status, measurement and histological sample ^{1,2,3}	-	-	-	13	13
Uterine horn; measurements and endometrium sample ^{1,2,3}	-	-	-	13	13
Collection of ovary ^{1,2,3}	-	-	-	13	13
Photographic record of foetus ¹	-	-	-	2	2
Foetal length and weight ¹	-	-	-	2	2
External body measurements of foetus ¹	-	-	-	1	1
Skin tissues for DNA study of foetus ^{1,3}	-	-	-	2	2
Muscle, liver, kidney, heart, blubber and skin tissues of foetus ^{1,2,3}	-	-	-	1	1
Ocular lens of foetus for age determination ^{1,3}	-	-	-	1	1
Collection of whole body of foetus ¹	-	-	-	1	1
Testis and epididymis; weight and histological sample ^{1,2,3}	3	-	22	-	25
Stomach contents, convenient record ^{2,3}	3	-	22	13	38
Volume and weight of stomach content in each compartment ^{2,3}	3	-	22	13	38
Observation of marine debris in stomach ³	3	-	22	13	38
Collection of stomach contents for feeding study ^{2,3}	3	-	20	11	34
Earplug for age determination ^{1,3}	2*	-	22	13	37
Ocular lens for age determination ^{1,3}	3	-	22	13	38
Collection of Baleen plate ^{1,2,3}	3	-	22	13	38
Baleen plate measurements (length and breadth) ^{1,2}	3	-	22	13	38
Photographic record of baleen plate series	3	-	22	13	38
Length of baleen series	3	-	22	13	38
Vertebral epiphyses sample	2	-	8	7	17
Number of ribs	3	-	22	13	38
Skull measurement (length and breadth) ¹	3	-	22	13	38

*Earplug of one animal could not be collected for harpoon damage.

¹: Data or samples to be used for Primary Objective I

²: Data or samples to be used for Ancillary Objective I

³: Data or samples to be used for Ancillary Objective II

Table 2.

Searching days, distances, hours and number of cetacean sightings made during the 2017 NEWREP-NP Pacific coastal component off Hachinohe and Kushiro. The figures probably includes some duplicated sightings.

Off Sanriku (Hachinohe) (7CS)

Period	Days	Distance* (n.miles)	Hours*	Number of sightings			
				Species	Primary (Ind/Sch)	Secondary (Ind/Sch)	Total (Ind/Sch)
18 Jul. - 20 Aug.	34	4,297.1	456.2	Common minke whale	6/6	2/2	8/8
				Like minke whale	1/1	1/1	2/2
				Humpback whale	0/0	1/1	1/1
				Sperm whale	2/1	7/1	9/2

*The distance and hours is the total of two sampling vessels (996.6 n.mile/99.5 hours) and six sighting vessels (3,300.5 n.mile/356.3 ho

Off Kushiro (7CN)

Period	Days	Distance (n.miles)	Hours	Number of sightings*			
				Species	Primary (Ind/Sch)	Secondary (Ind/Sch)	Total (Ind/Sch)
1 Sept. - 31 Oct.	61	7,038.5	724.0	Common minke whale	45/43	2/2	47/45
				Like minke whale	12/12	1/1	13/13
				Fin whale	22/15	3/2	25/17
				Humpback whale	99/69	7/4	106/73
				Sei whale	4/3	0/0	4/3
				Sperm whale	2/2	0/0	2/2

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

Table 3.
Body length (m) of common minke whales collected in the 2017 NEWREP-NP Pacific coastal component off Kushiro.

Period	Male					Female				
	Mean	S.D.	Min.	Max.	n	Mean	S.D.	Min.	Max.	n
1 Sept. - 10 Sept.	5.57	1.06	4.89	6.79	3	7.27	2.21	4.71	8.58	3
11 Sept. - 20 Sept.	6.56	1.00	5.43	7.34	3	7.02	-	-	-	1
21 Sept. - 30 Sept.	5.35	0.90	4.71	7.11	6	6.90	1.66	5.01	8.12	3
1 Oct. - 10 Oct.	6.18	1.14	4.93	7.16	3	4.80	-	-	-	1
11 Oct. - 20 Oct.	5.42	1.19	4.62	7.48	5	6.59	1.74	5.10	8.50	3
21 Oct. - 31 Oct.	5.65	1.29	4.74	6.56	2	4.88	0.01	4.87	4.88	2
Total	5.70	1.03	4.62	7.48	22	6.45	1.63	4.71	8.58	13

Table 4.
Sexual maturity composition of common minke whales collected in the 2017 NEWREP-NP Pacific coastal component off Kushiro.

Period	Male				Female						Sex ratio (%males)
	Im	M	Total	Maturity*	Im	R	P	Total	Pregnancy*	Maturity*	
1 Sept. - 10 Sept.	2	1	3	33.3	1	2	0	3	0.0	66.7	50.0
11 Sept. - 20 Sept.	1	2	3	66.7	1	0	0	1	-	0.0	75.0
21 Sept. - 30 Sept.	5	1	6	16.7	1	0	2	3	100	66.7	66.7
1 Oct. - 10 Oct.	2	1	3	33.3	1	0	0	1	-	0.0	75.0
11 Oct. - 20 Oct.	4	1	5	20.0	2	1	0	3	0.0	33.3	62.5
21 Oct. - 31 Oct.	2	0	2	0.0	2	0	0	2	-	0.0	50.0
Total	16	6	22	27.3	8	3	2	13	40	38.5	62.9

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

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.

Table 5.
Number of common minke whales with major prey species found in forestomach, collected in the 2017 NEWREP-NP Pacific coastal component off Kushiro.

Period	Number of whales (%)			All
	Japanese sardine	Mackerels	Unknown*	
1 Sept. - 10 Sept.	6 (100.0)	0 (0.0)	0 (0.0)	6
11 Sept. - 20 Sept.	4 (100.0)	0 (0.0)	0 (0.0)	4
21 Sept. - 30 Sept.	8 (88.9)	0 (0.0)	1 (11.1)	9
1 Oct. - 10 Oct.	4 (100.0)	0 (0.0)	0 (0.0)	4
11 Oct. - 20 Oct.	7 (87.5)	1 (12.5)	0 (0.0)	8
21 Oct. - 31 Oct.	4 (100.0)	0 (0.0)	0 (0.0)	4
Total	33 (94.3)	1 (2.9)	1 (2.9)	35

*Stomach was broken by harpoon.

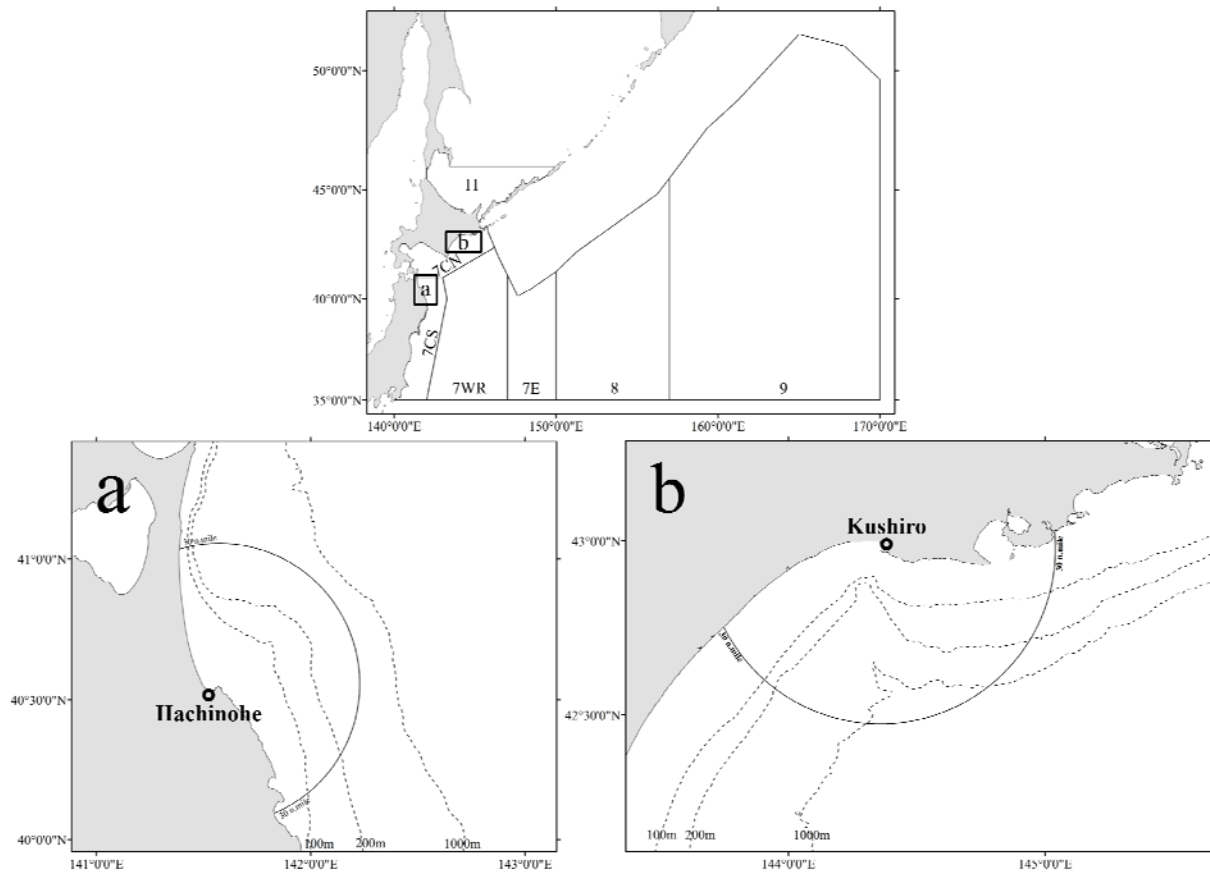


Figure 1. Research area set for the 2017 NEWREP-NP Pacific coastal component (a) off Hachinohe and (b) off Kushiro.

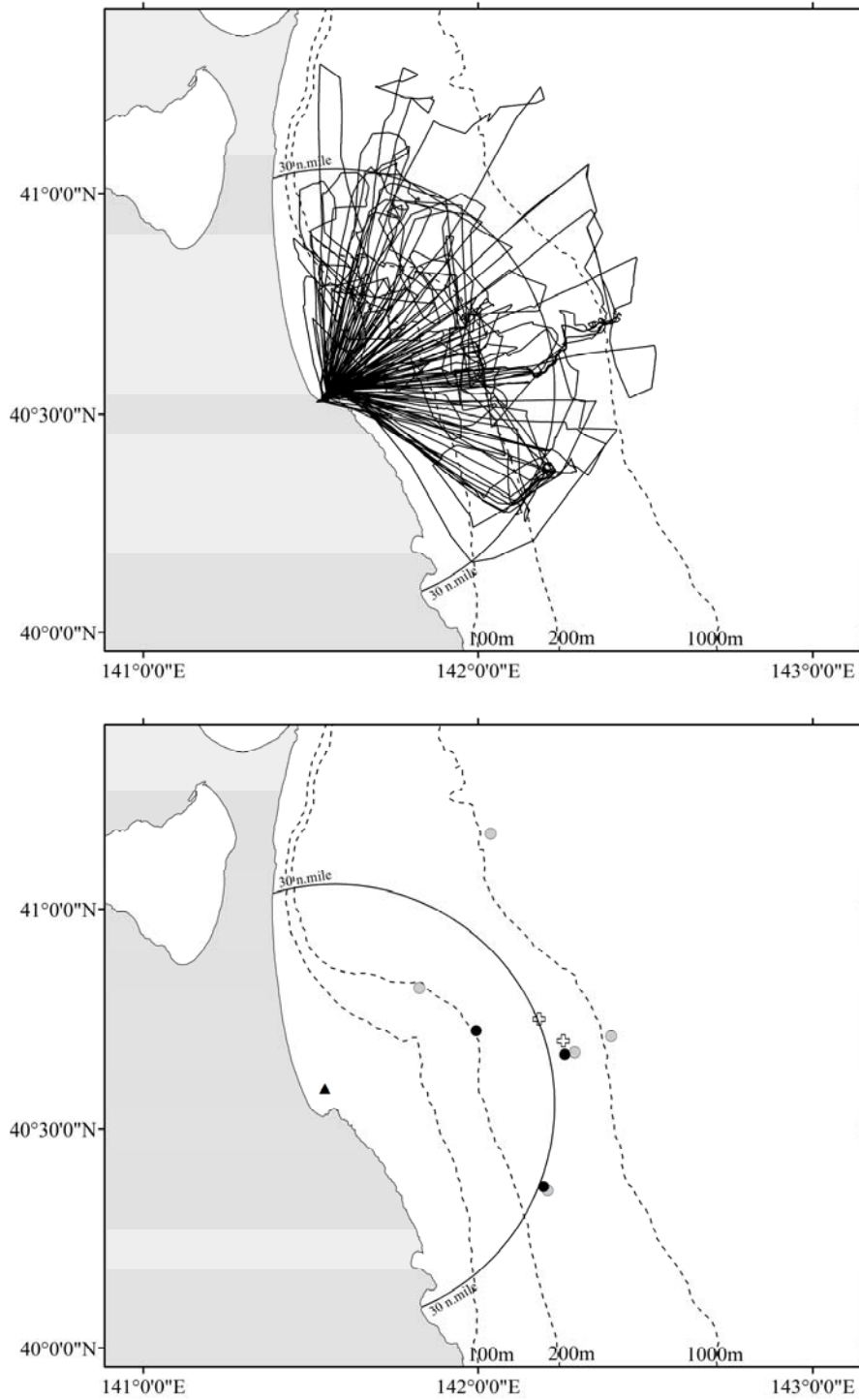


Figure 2. Cruise tracks (upper) and sighting position (lower) of whales made by sighting/sampling vessels during the 2017 NEWREP-NP Pacific coastal component off Hachinohe. Circles: common minke whales (black circles are sighting position of common minke whales sampled), triangle: humpback whale, cross: sperm whales.

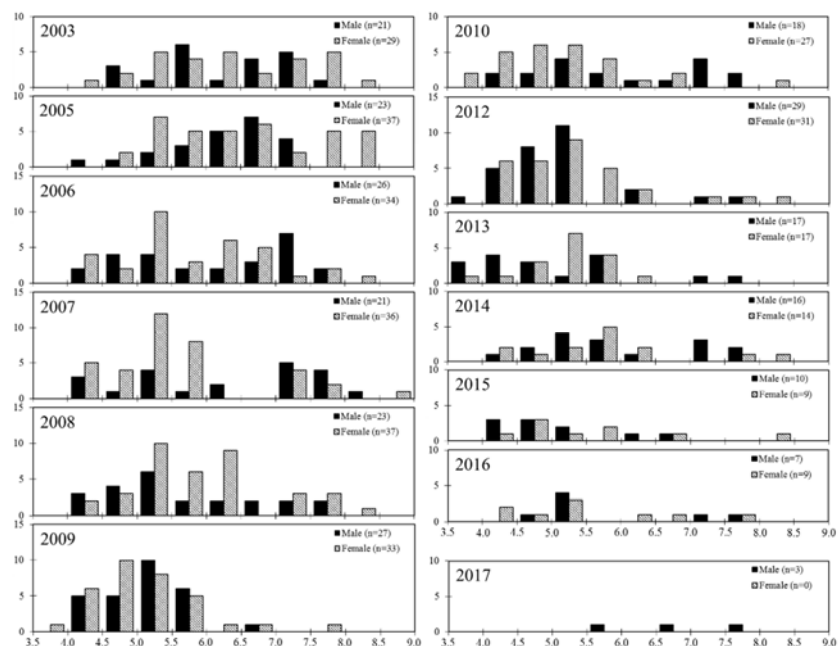


Figure 3. Body length frequency of common minke whales sampled during the 2017 NEWREP-NP Pacific coastal component off Hachinohe, compared with results of the previous 2003-2016 JARPNII surveys in Ayukawa.

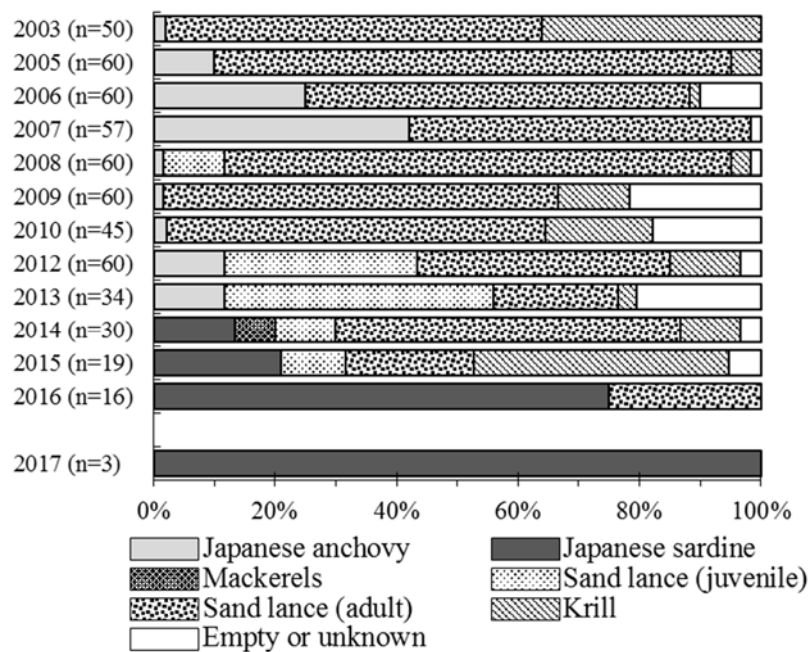


Figure 4. Composition of prey species of common minke whales sampled during the 2017 NEWREP-NP Pacific coastal component off Hachinohe, compared with results of the previous 2003-2016 JARPNII surveys in Ayukawa.

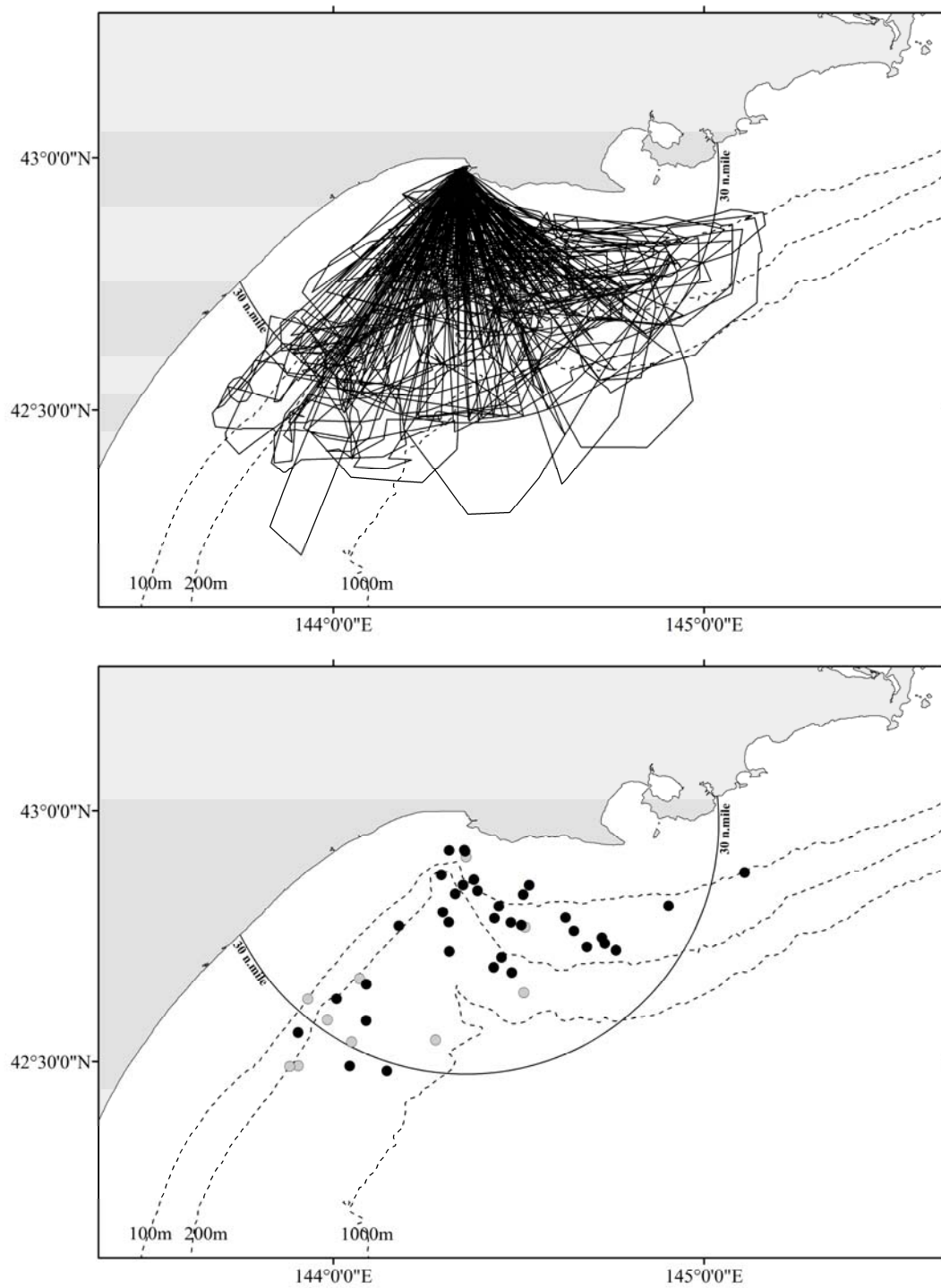


Figure 5. Cruise tracks (upper) and sighting position (lower) of common minke whales made by sighting/sampling vessels during the 2017 NEWREP-NP Pacific coastal component off Kushiro. Black circles are sighting position of common minke whales sampled.

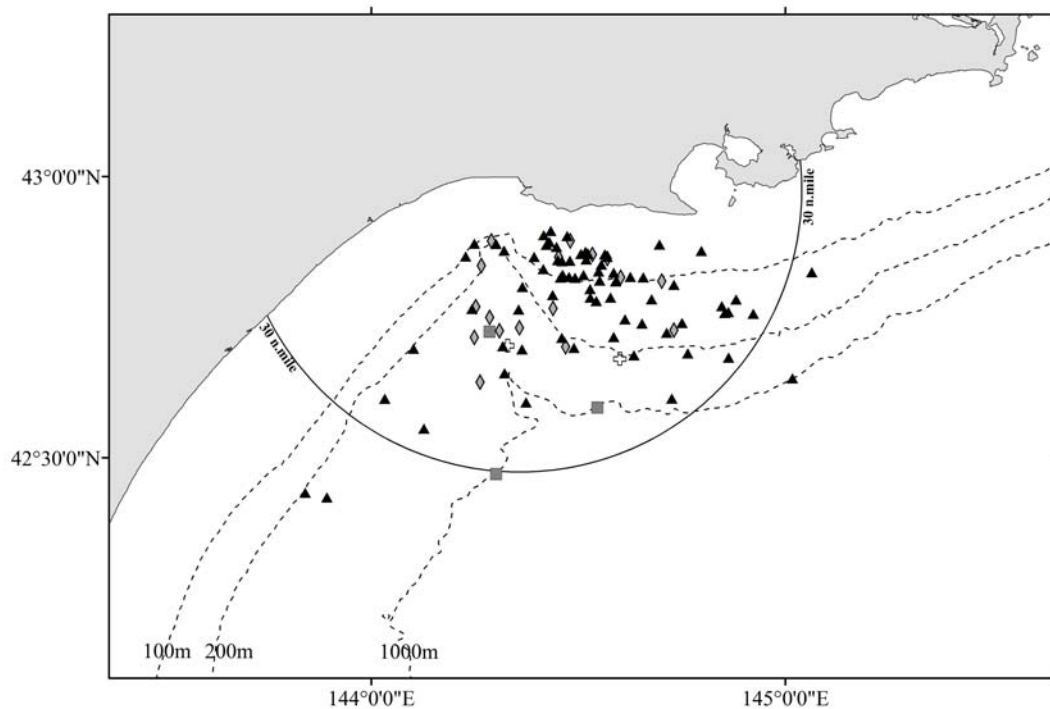


Figure 6. Sighting positions of fin (rhombus), humpback (triangle), sei (square) and sperm whales (cross) whales made by sighting/sampling vessels during the 2017 NEWREP-NP Pacific coastal component off Kushiuro.

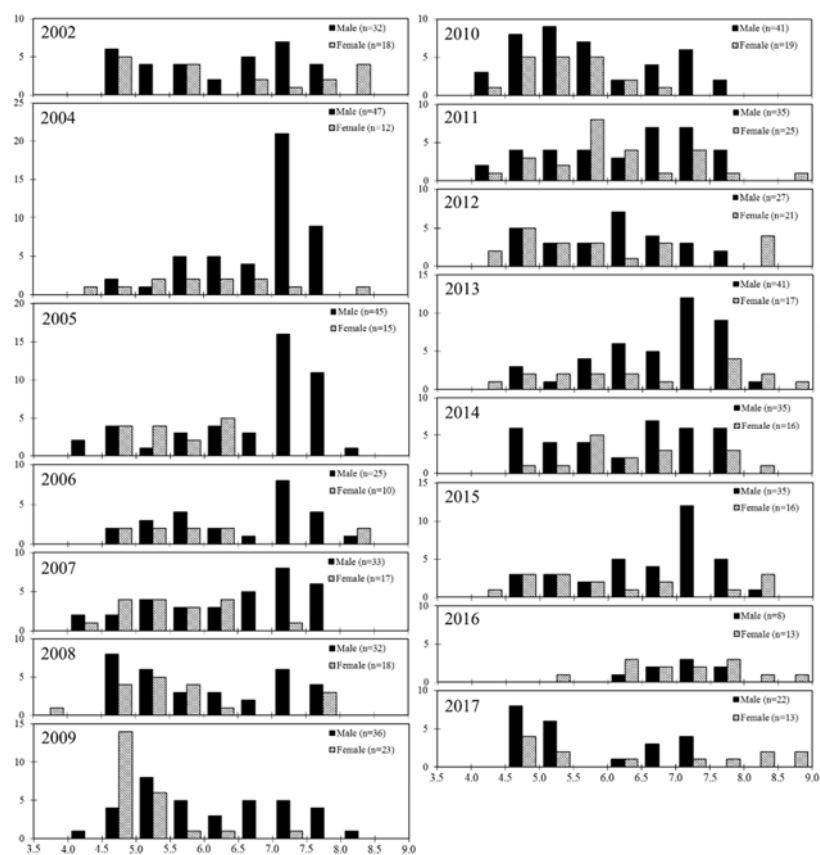


Figure 7. Body length frequency of common minke whales sampled during the 2017 NEWREP-NP Pacific coastal component off Kushiuro, compared with results of the previous 2002-2016 JARPNII surveys.

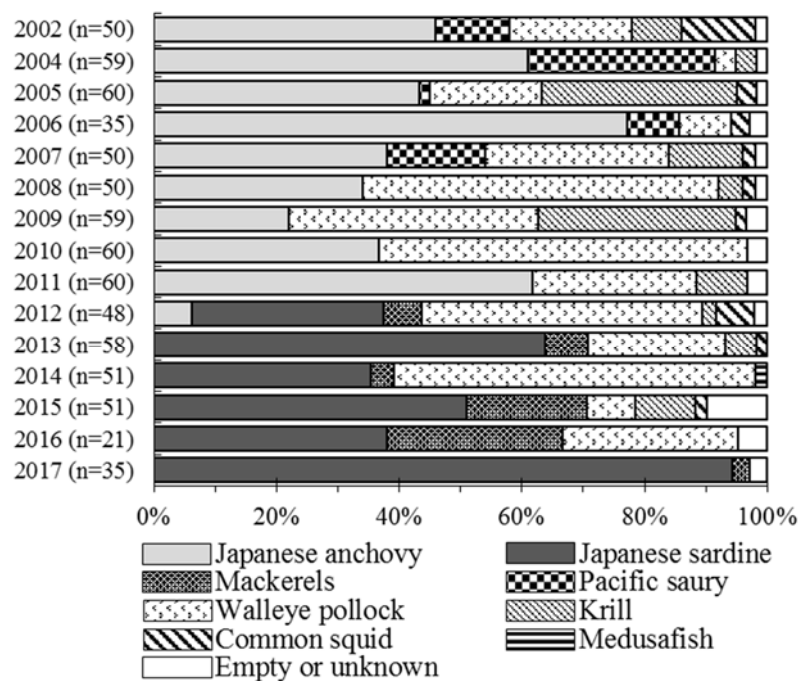


Figure 8. Composition of prey species of common minke whales sampled during the 2017 NEWREP-NP Pacific coastal component off Kushiro, compared with results of the previous 2002-2016 JARPNII surveys.