SC/64/O5

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

TOSHIYA KISHIRO[1], HIDEHIRO KATO[2], NOBUYUKI ITO[3], GENTA YASUNAGA[4], HARA TAKAHIRO[3], GEN NAKAMURA[2], HIKARI MAEDA[2], SATOKO INOUE[2], NAOKO MIYAKAWA[2], KOZUE ISHIDA[2], ICHIRO KADOWAKI[2], HIROYUKI OIKAWA[4], TOMIO MIYASHITA[1], TOSHIHIDE IWASAKI[1], YU KANAJI[1], SHINGO MINAMIKAWA[1], HIKARU WATANABE[1], SAEKO KUMAGAI[3], HITOMI SATO[3], AND KAZUYA KITAYAMA[2]

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

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

[3] *Association for Community-Based Whaling, Hakata-Eki-Higashi, Hakata-ku, Fukuoka 812-0013, Japan*

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

Contact e-mail: kishiro@affrc.go.jp

ABSTRACT

The autumn survey of the JARPN II coastal component off Kushiro, northeast Japan (the sub-area 7CN) was conducted from 9 September to 30 October 2011, using four small-type whaling catcher boats as sampling vessels. The sampling was conducted in the coastal waters within the 50 nautical miles from the Kushiro port, and all whales sampled were landed on the land station in the Kushiro port for biological examination. 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, respectively. 19 of the 35 males (54.3%) and three of the 25 females (12.0%) were sexually mature. The dominant prey species found in the stomach was Japanese anchovy *Engraulis japonicus* (61.7%), followed by walleye pollock *Theragra chalcogramma* (26.7%), and krill *Euphausia pacifica* (8.3%). Pacific saury *Cololabis saira* and Japanese common squid *Todarodes pacificus* were not observed. Frequent sightings of the whales, slightly higher ratio of mature and larger whales in the samples compared with the last year survey, and more whales taking Japanese anchovy suggested that Japanese anchovy might be abundant in the research area in this season, and the distribution of those preys attracted the whales including mature animals to the coastal waters off Kushiro in 2011 autumn season. During the survey, no apparent impact due to the earthquake occurred in March 2011was detected in the distribution, density, and catch composition of common minke whales. This implied that effect of the earthquake for the migration of common minke whales in the coastal waters off Kushiro might be reduced or negligible when the present survey was conducted.

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

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, 2002). The objectives of the surveys are: i) feeding ecology and ecosystem studies, involving prey consumption by cetaceans, prey preferences of cetaceans and ecosystem modelling, ii) monitoring environmental pollutants in cetaceans and marine ecosystem, and iii) stock structure of whales (Government of Japan, 2002).

The full-scale JARPN II involves two survey components; 'offshore' which is covered by the *Nisshin Maru* research vessels and 'coastal' which is covered by small-type whaling catcher boats, and the latter one is necessary to cover the temporal and spatial gaps, which cannot be covered by the *Nisshin maru* research vessels (Government of Japan, 2002).

Based on the results of the two-year feasibility study of the coastal survey component conducted in 2002 off Kushiro and 2003 off Sanriku district (Kishiro, *et al*., 2003, Yoshida, *et al*., 2004, Government of Japan, 2004a), the coastal component has been revised to be conducted twice a year, with 60 common minke whales being sampled in each of spring off Sanriku and autumn off Kushiro (Government of Japan, 2004b). After the first revised survey carried out off Kushiro in autumn 2004 (Kishiro, *et al*., 2005), the coastal survey off Kushiro was conducted annually from 2005 to 2010 (Kishiro, *et al*., 2006, 2008, 2010, Yoshida, *et al*., 2007, 2009, 2011).

In January 2009, the expert workshop was carried out in Japan under the IWC/SC, and reviewed the results of the first six years of the full-scale JARPN II (IWC, 2009). Because there was no critical problem in the survey methodology, the coastal components were continued following the original research plan (Government of Japan 2004b).

However, in March 2011, the great earthquake disaster occurred in the Sanriku region. The serious disaster prevented to carry out the survey in Sanriku region, and the coastal component in spring season in 2011 was modified to conduct in Kushiro region for collecting the information about the seasonal variation in the distribution and feeding habit of common minke whales off Kushiro (Yasunaga, *et al*., 2012). After the spring survey off Kushiro, the coastal component off Kushiro was conducted again in the autumn season following the original research plan.

This paper presents results of the autumn survey conducted off Kushiro, from 9 September to 30 October in 2011. The survey was authorized by the Government of Japan in compliance with Article VIII of the international convention for the Regulation of Whaling. The National Research Institute of Far Seas Fisheries (NRIFSF), Fisheries Research Agency, planned and conducted the survey cooperate with the Institute of Cetacean Research (ICR), Tokyo University of Marine Science and Technology, and the Association for Community-Based Whaling.

MATERIALS AND METHODS

Research area

The research area was same to the previous surveys (Kishiro, *et al*., 2003, 2005, 2006, 2008, 2010, Yoshida, *et al*., 2007, 2009, 11, Yasunaga *et al*., 2012), i.e. the coastal waters off Kushiro, within the 50 nautical miles from the Kushiro port (Fig. 1). This area is included in the middle part of the sub-area 7CN, established by the IWC.

Research vessels and land station

Four small-type whaling catcher boats were used as sampling vessels.

Taisho Maru No. 28 (47.3GT),

Koei Maru No.8 (32.0GT),

Sumitomo Maru No.51 (30.0GT)

Katsu Maru No.7 (32.0GT)

All whales sampled were landed on the land station (the JARPN II research station) in the Kushiro port for biological examination. Research period was from 9 September to 30 October, 2011.

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 was placed in the research station and controlled the sampling vessels during the survey. All catcher boats were engaged as the sampling vessels. To avoid the concentration of sampling location, the research head office arbitrarily determined the searching area and route (direction from the port) for each sampling vessel in every day, based on the information of the whale distribution. Weather conditions and information on fishing grounds of prey species were also considered. In each vessel, a researcher was on board and recorded the cruise tracks, searching time on effort, sea weather conditions and sighting data. Sighting data would be collected for all baleen whales and sperm whales. The vessel principally continued to cruise and search along the predetermined direction until arrived at 15-30 n. miles from the port, and then freely cruised in the waters within the 50 n. miles radius from the port. Searching was carried out during the day and the vessels returned to the port every night. Sighting was conducted from the top barrel and upper bridge by all the crews and researcher with vessel speed at about 11 knots. All common minke whales sighted were targeted for sampling, except for the cow-calf pair. When a sighting consisted of more than one animal, first targeted animal was selected following the random sampling digits. Sampling was made by 50 mm whaling cannon. 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 sighted were also targeted for sampling, if the situation allowed. At the port, the sampled whale was lift up from the vessel using wire nets and a crane and transported to the station by an 11 tons freight trailer. At that time, body weight of the whale was measured with the truck scale.

Biological research on common minke whales collected

All the whales sampled were biologically examined by researchers at the research station. Research items of the biological studies were summarized in Table 2, with the number of data and samples obtained. These items were related to studies on feeding ecology, stock structure, life historical biology and pollutions.

RESULTS

Searching effort made by sampling vessels

The cruise tracks made by the sampling vessels during the survey are shown in Fig.2. The searching areas covered widely coastal waters within 30 nautical miles from the Kushiro port. Searching distance and time are shown in Table 1. Here, we defined the searching distance and time as that with sighting effort, i.e. the periods of the searching conducted from the top barrel. During the research period, total searching distance and time were 5,367.8 n. miles and 515.0 hours, respectively.

Sightings and sampling of common minke whales

Fig.3 shows distribution of common minke whales sighted by the sampling vessels. Sighting positions widely distributed in inshore areas off Kushiro port to the waters in around 30 n. miles from the port, and relatively concentrated on the continental shelf regions in the south western side and the south eastern side of the research area. During the survey, a total of 144 schools/ 150 individuals of common minke whales were sighted, consisting of 122 schools/ 126 individuals of primary sightings and 22 schools/ 24 individuals of secondary sightings (Table 1). These figures probably include some duplicated sightings

because sampling vessels searched almost same areas in every day. Density index of common minke whales was calculated as 2.27 for DI (the number of primary sightings of schools per 100 nautical miles searching) and 0.23 for SPUE (the number of primary sightings of schools per 1 hour searching). Of the 126 common minke whales sighted, 60 common minke whales were sampled. In the sampling process, there were no struck and lost animals. Fig.3 showed sighting positions of sampled whales. Distribution of these whales almost covered all of the areas where the sightings were made during the survey period.

Sightings of other large cetaceans

During the survey, a total of 8 schools/ 9 individuals of humpback whales, and 2 schools/ 2 individuals of sperm whales were sighted (Table 1). Sighting positions of those whales were shown in Fig.4.

Sex ratio, body length and maturity of common minke whales caught

The 60 sampled whales were consisted of 35 males and 25 females (sex ratio of males was 0.58). Average body length of the whales was 6.24m (max=7.76, min=4.07, SD=1.06) for males and 6.05m (max=8.55, min=4.31, SD=1.08) for females, respectively (Table 3). Composition of sex and sexual maturity of the whales is listed in Table 4. Male with a single testis weight of 290g or more, and female had at least one corpus luteum or albicans in their ovaries were determined as sexually mature. In males, 19 of 35 individuals (54.3%) were sexually mature. This figure was higher than that of the last two years autumn surveys, e.g. 33.3% in 2009, and 22.0% in 2010. In females, three of 25 individuals (12.0%) were sexually mature, and all mature females were resting animals, e.g. no lactating and no pregnant. In the last two years autumn surveys, there was no mature females (n=23 in 2009, and n=19 in 2010), and maturity ratio of females in 2011 was higher than those of 2009 and 2010.

Prey species of common minke whale found in the stomach contents

Stomach contents of all collected animals were examined (Table 5). Following the same methods used in the JARPN II feasibility surveys (Fujise, *et al.*, 2002), stomach contents were weighted to the nearest 0.1 Kg by each four chamber in both cases of including and excluding liquid. Then, a sub-sample of stomach contents was collected and frozen for the later laboratory work. Three prey species, walleye pollock *Theragra chalcogramma*, krill *Euphausia pacifica*, and Japanese anchovy *Engraulis japonicus* were found in the forestomach contents. Among them, Japanese anchovy was the most dominant prey species. Ratio of the whales mainly fed on Japanese anchovy was 61.7% or 37 out of 60 whales. Next dominant prey species was walleye pollock (26.7% or 16 whales), followed by krill (8.3% or 5 whales). Pacific saury *Cololabis saira* and Japanese common squid *Todarodes pacificus* were not found. The weights of forestomach contents ranged from 0.88Kg to 116.9Kg, and average weight was 25.6Kg.

DISCUSSION

The present survey was the ninth survey of the JARPN II coastal component in the autumn season off Kushiro. As same as the previous surveys, bad weather conditions such as typhoons, low atmospheric pressures and thick fog often disturbed research activities. Of total 52 day survey period from 9 September to 30 October, sampling vessels could conduct the research for 26 days or 50.0%. This figure was lower than those of the last two years surveys (58.1% in 2009, and 60.0% in 2010). Of these, there was only 9 days (17.3%), on which the vessels conduct the survey throughout the day. Nevertheless, we could collect a planned sample size of 60 animals as well as in the last 2010 survey. One of the reasons was thought to be the migration of common minke whales. The density index of common minke whales recorded by the sampling vessels in autumn 2011 (DI=2.27) was almost same in the last year survey (DI=2.34, Yoshida *et al.*, 2011), and higher than those of the past survey in 2009 (DI=1.89, Kishiro *et al.*, 2010) and 2008

(DI=1.67, Yoshida *et al*., 2009). This suggested that the migration of common minke whales in autumn 2011 was abundant as same as in 2010, and higher than those in 2009 and 2008.

Body length of common minke whales collected in autumn 2011 was ranged from 4.07m to 8.55m, and frequency of large animals was relatively high, when compared with those of 2010 (Fig. 5). Ratio of sexual maturity animals (54.3% for males, and 12.0% for females) in autumn 2011 was also high, when compared with those of 2010 (22.0% for males, and 0% for females: Yoshida, *et al*., 2011). These results indicated that the mature whales were more frequently migrated off Kushiro in the 2011 autumn season, compared with the same season of the last year. The most dominant prey species found from the whale stomach was changed from walleye pollock in 2010 to Japanese anchovy in 2011 (Fig.7). Japanese anchovy was taken by both immature and mature whales, but ratio of mature whales taking Japanese anchovy was high compared with those of walleye pollock (Fig. 8). The whales taking Japanese anchovy were distributed widely on the continental shelf region, while the whales taking walleye pollock were concentrated along the 200-500m isobaths on the continental slop region (Fig. 9). These results suggested that Japanese anchovy might be more abundant than the last year, and the distribution of those preys attracted more whales including mature animals to the coastal area, and as a result, stable and abundant migration of the whales was observed in autumn 2011.

Pacific saury was not observed in the stomach of the whales. This might be due to fewer migration of Pacific saury in the restricted research area (within a 50 nautical miles from the Kushiro port). Fishing grounds for Pacific saury during the present survey period were located in the offshore waters at around 90 to 180 nautical miles from the Kushiro port (Japan Fisheries Information Service Center, 2011).

The present survey was conducted in about six month later the earthquake disaster, which occurred in the Sanriku region in March 2011. However, as shown in Fig.3, 5, and 6, no apparent impact due to the earthquake was detected in the distribution, density, and catch composition of common minke whales. This implied that effect of the earthquake for common minke whales might be reduced or negligible when the present survey was conducted.

In this year, spring survey of the JARPN II coastal component was conducted off Kushiro, instead of Sanriku (Yasunaga, *et al*., 2012). Compared with the results of that survey, apparent difference such as the increase in the density of the whales (0.83 animals/100 n.miles in spring, 2.27 animals/100 n.miles in autumn) and the diversification of the prey species (from 2 species: walleye pollock and krill to 3 species: added Japanese anchovy) were observed (Yasunaga, *et al*., 2012, and Fig.6). This information is valuable in considering the seasonal change of the habit of common minke whales within the same waters in the same year, and will be contribute to the objectives of the JARPN II feeding ecology and ecosystem studies, though the impact of the earthquake in the spring survey might be carefully considered.

There was no serious practical problem in conducting the surveys and the 2011 autumn survey off Kushiro was conducted successfully.

ACKNOWLEDGMENTS

The authors are greatly indebted to Dr. Hiroshi Hatanaka, the Institute of Cetacean Research (ICR), Dr. Seiji Ohsumi (ICR) and Mr. Tatsushi Matsuo, the Fisheries Agency of Japan for their guidance and implementation of the research. We thank to all crew of the research vessels and all staff of the land station and the Japanese small-type whaling association. We also thank to the staff of the Kushiro City and the Kushiro Fisheries Cooperative Union for their kind assistance in the implementation of the research.

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, 2002. 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., Tamura, T., Kato, H. and Kawahara, S. eds.), 2004a. Some considerations of the feasibility components of the JARPN II research plan. Paper SC/56/O2 submitted to the 56th IWC Scientific Committee, 36pp.

Government of Japan, 2004b. 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.

International Whaling Commission, 2009. The Report of the Expert Workshop to review the ongoing JARPN II Programme. Paper SC/61/Rep1 submitted to the 61th IWC Scientific Committee, 57pp.

Japan Fisheries Information Service Center, 2011. Medium-and-long term forecast of fishing conditions for Pacific saury in the western North Pacific. http://www.jafic.or.jp/gyokaikyo/index.html.(in Japanese)

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 component off Kushiro. Paper SC/J09/JR13 submitted to theIWC SC JARPN II review workshop, 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 (Part II) - Coastal component off Kushiro. Paper SC/62/O6 submitted to the 62th IWC Scientific Committee, 13pp.

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, T., 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, T., Okamoto, R., Maeda, H., Matsumoto, A., Ogawa, N., Nagatsuka, S., Inoue, S., Hiruda, H., Gokita, A., Matsunaga, H., and Yamazaki, 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, S., 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.

Table 1. Searching days, hours, distances, and number of sightings made by the whale sampling survey in the 2011JARPN II coastal component off Kushiro, autumn survey.

Period	Days	Hours	Distances (n.miles)	Species	Number of sightings					
					Primary		Secondary		Total	
					Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
9 Sept.-30 Oct.	26	515.0	5,367.8	Common minke whale	122	126	22	24	144	150
				Like minke whale	26	26	1	1	27	27
				Humpback whale	7	8	1	1	8	9
				Sperm whale	1	1	1	1	2	2
				Unidentifed cetaceans	23	23	3	3	26	26

Table 2. Summary of biological data and samples collected during the 2011 JARPN II coastal component off Kushiro, autumn survey.

Samples and data	Number of whales		
	Male	Female	Total
Body length and sex	35	25	60
External body proportion	35	25	60
Photographic record and external character	35	25	60
Diatom film record	35	25	60
Body scar record	35	25	60
Measurements of blubber thickness (five points)	35	25	60
Detailed measurements of blubber thickness (eleven points)	-	2	2
Body weight	35	25	60
Body weight by parts	-	2	2
Skin tissues for DNA study	35	25	60
Muscle, liver, kidney and blubber tissues for heavy metal analysis	35	25	60
Muscle, liver, kidney and blubber tissues for organic chlorine analysis	35	25	60
Muscle and blubber tissues for byproduct analysis	35	25	60
Muscle, liver, spleen, heart and blubber tissues for chemical analysis	35	25	60
Urine for chemical analysis	7	3	10
Mammary grand; lactation status, measurement and histological sample	-	25	25
Uterine horn; measurement and endometrium sample	-	25	25
Collection of ovary	-	25	25
Testis and epididymis; weight and histological sample	35	-	35
Stomach content, conventional record	35	25	60
Volume and weight of stomach content in each compartment	35	25	60
Stomach contents for feeding study	28	22	50
Stomach contents for multipurpose study	1	-	1
Record of external parasites	35	25	60
Earplug for age determination	35	25	60
Tympanic bulla for age determination	34	25	59
Largest baleen plate for morphologic study and age determination	35	25	60
Baleen plate measurements (length and breadth)	34	25	59
Photographic record of baleen plate series	35	25	60
Length of each baleen plate series	35	25	60
Crystalline lens in eyeball for age determination	35	25	60
Blood serum for chemical analysis	34	25	59
Vertebral epiphyses sample	21	11	32
Number of ribs	35	25	60
Brain weight	-	2	2
Skull measurement (length and breadth)	35	25	60

Table 3. Body length (m) of common minke whales sampled by the 2011 JARPN II coastal component off Kushiro, autumn survey.

	Male					Female				
Period	Mean	S.D.	Min.	Max.	n	Mean	S.D.	Min.	Max.	n
9 Sept.- 15 Sept.	6.16	0.91	4.70	7.38	7	5.75	0.95	4.53	7.44	6
16 Sept. - 30 Sept.	6.64	0.87	4.79	7.35	11	5.80	0.95	4.52	7.40	7
1 Oct. -15 Oct.	6.01	1.56	4.07	7.63	6	5.74	1.26	4.31	7.12	5
16 Oct. -30 Oct.	6.03	1.04	4.58	7.76	11	6.79	1.05	5.76	8.55	7
Total	6.24	1.06	4.07	7.76	35	6.05	1.08	4.31	8.55	25

Table 4. Composition of sex and sexual maturity of common minke whales sampled by the 2011 JARPN II coastal component off Kushiro, autumn survey.

	Male				Female							
Period	Imm.	Mat.	Total	Marutity (%)	Imm.	Rest.	Lact.	Preg.	Total	Pregnancy (%)*1	Maturity (%)	Sex ratio (%males)
9 Sept.-15 Sept.	5	2	7	28.6	6	0	0	0	6	-	0.0	53.8
16 Sept.- 30 Sept.	3	8	11	72.7	6	1	0	0	7	-	14.3	61.1
1 Oct.- 15 Oct.	4	2	6	33.3	5	0	0	0	5	-	0.0	54.5
16 Oct.- 30 Oct.	4	7	11	63.6	5	2	0	0	7	-	28.6	61.1
Total	16	19	35	54.3	22	3	0	0	25	-	12.0	58.3

*1: Apparent pregnancy rate

Table 5. Number of common minke whales by major prey species found in their forestomach contents sampled by the 2011 JARPN II coastal component off Kushiro, autumn survey.

	No. of whales (%)							
Period	Walleye pollock	Krill	Japanese anchovy	Pacific saury	Common Squid	Empty	Unknown	Total
9 Sept.-15 Sept.	7 (53.8)	0 (-)	6 (46.2)	0 (-)	0 (-)	0 (-)	0 (-)	13
16 Sept.- 30 Sept.	6 (33.3)	2 (11.1)	10 (55.6)	0 (-)	0 (-)	0 (-)	0 (-)	18
1 Oct.- 15 Oct.	1 (9.1)	0 (-)	9 (81.8)	0 (-)	0 (-)	0 (-)	1 (9.1)	11
16 Oct.- 30 Oct.	2 (11.1)	3 (16.7)	12 (66.7)	0 (-)	0 (-)	1 (5.6)	0 (-)	18
Total	16 (26.7)	5 (8.3)	37 (61.7)	0 (-)	0 (-)	1 (1.7)	1 (1.7)	60

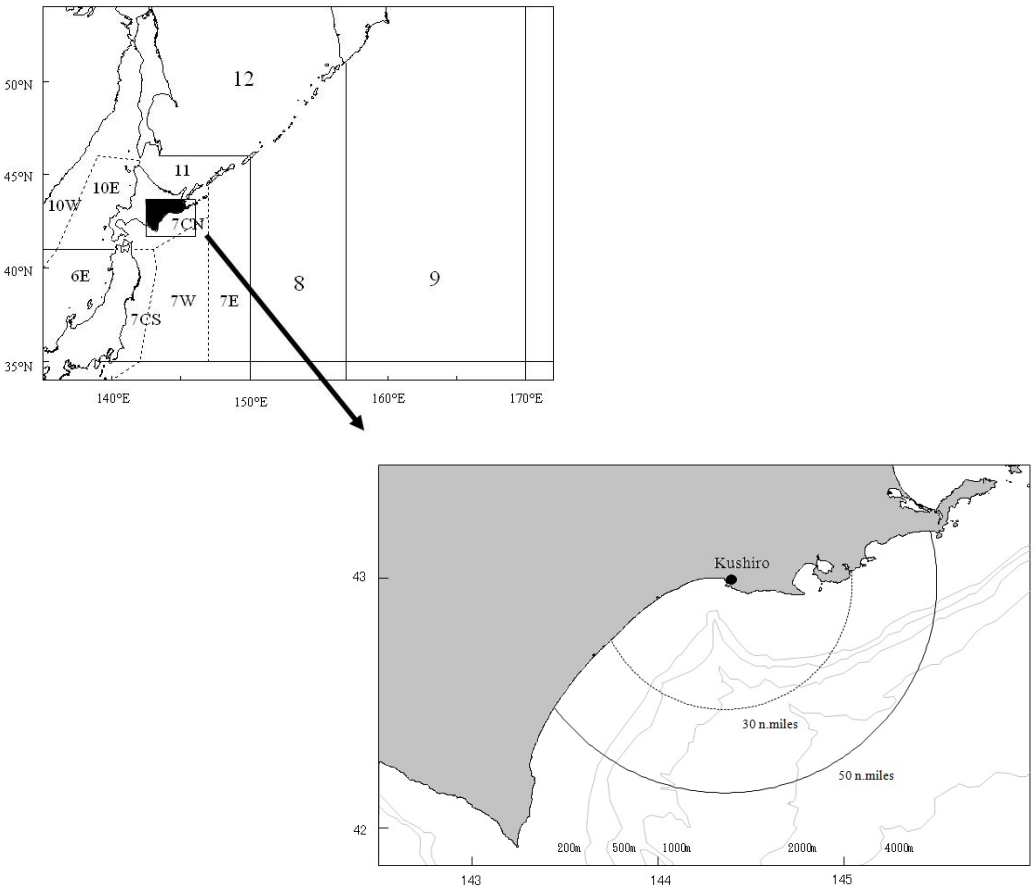

Fig.1. The IWC sub-area for western North Pacific minke whales (upper) and research area for the 2011 JARPN II coastal component off Kushiro (lower).

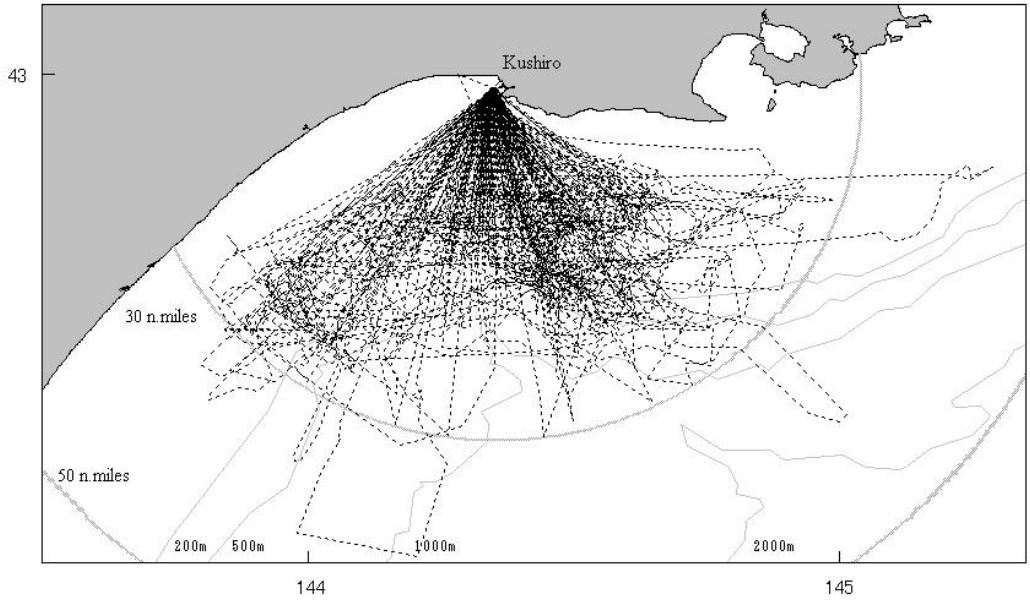

Fig.2. Cruise tracks of the sampling vessels in the 2011 coastal component off Kushiro, autumn survey..

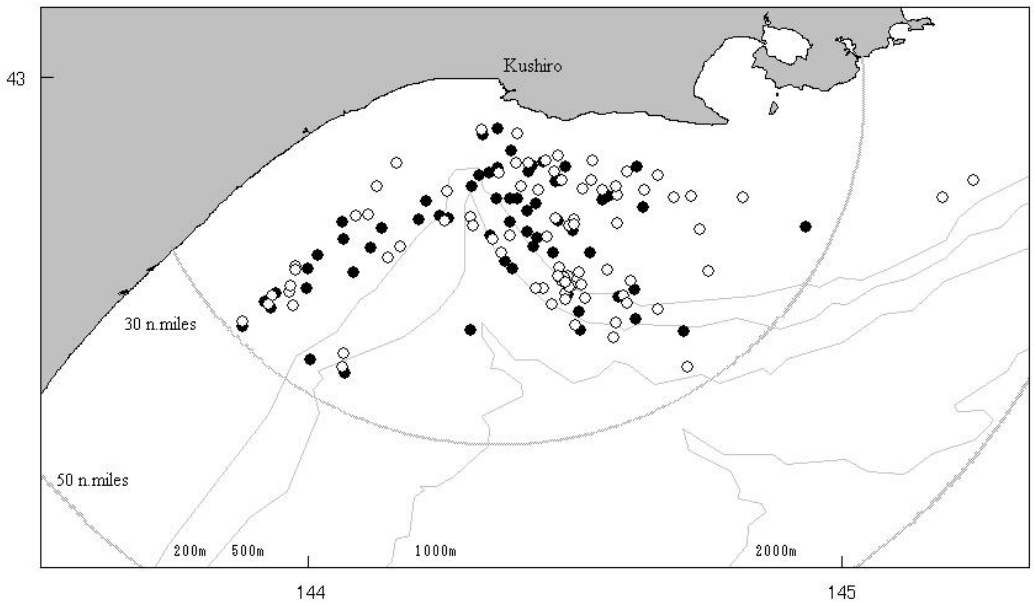

Fig.3. Sighting positions of common minke whales in the 2011 coastal component off Kushiro, autumn survey. Closed circle indicates sighting position of sampled whale.

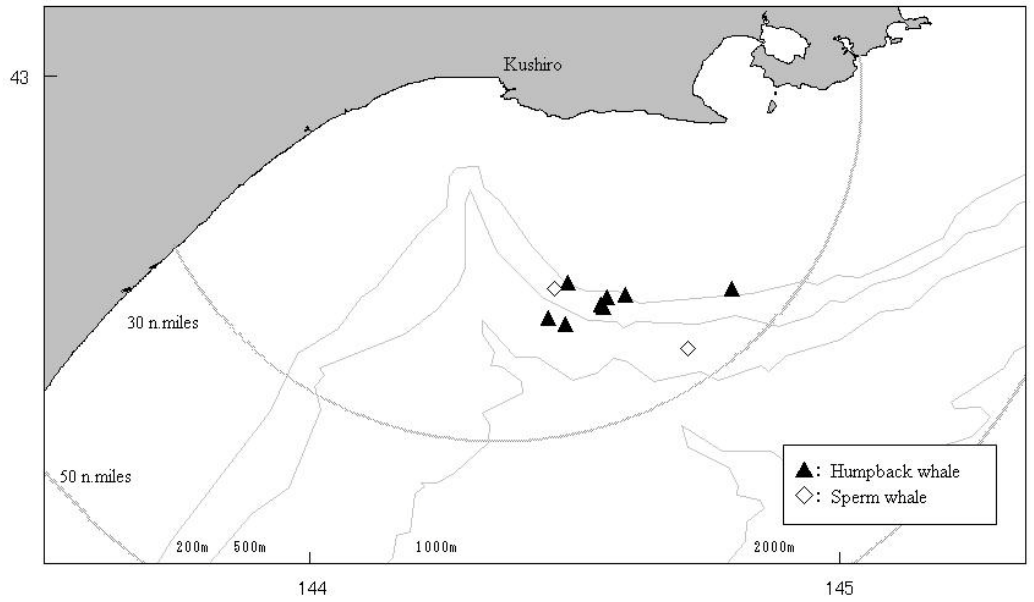

Fig.4. Sighting positions of humpback whales (closed triangle), (grey square), and sperm whales (open square) in the 2011 coastal component off Kushiro, autumn survey.

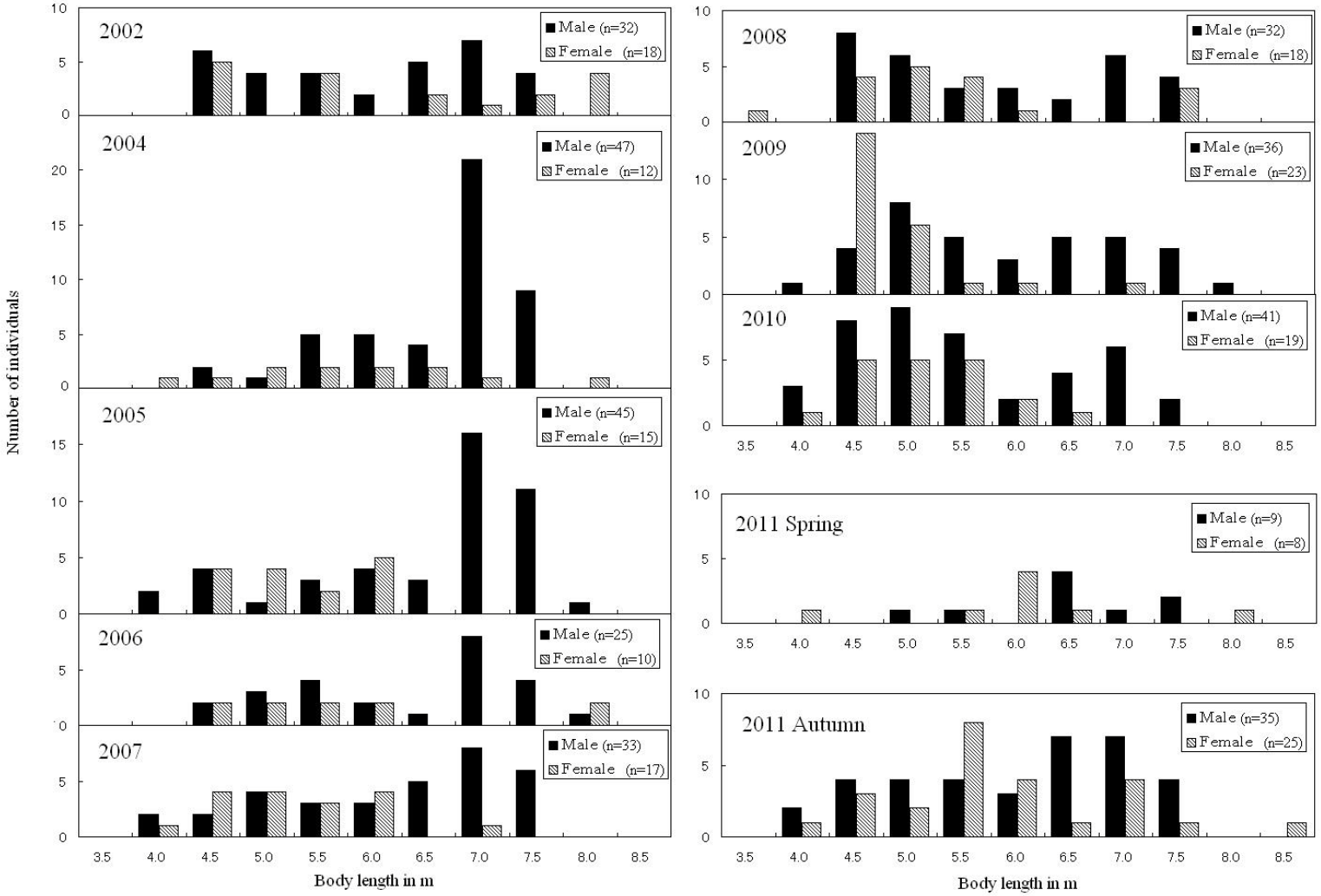

Fig 5. Body length frequency of common minke whales sampled during the 2011 coastal component off Kushiro, autumn survey, with comparison to the results of the previous surveys.

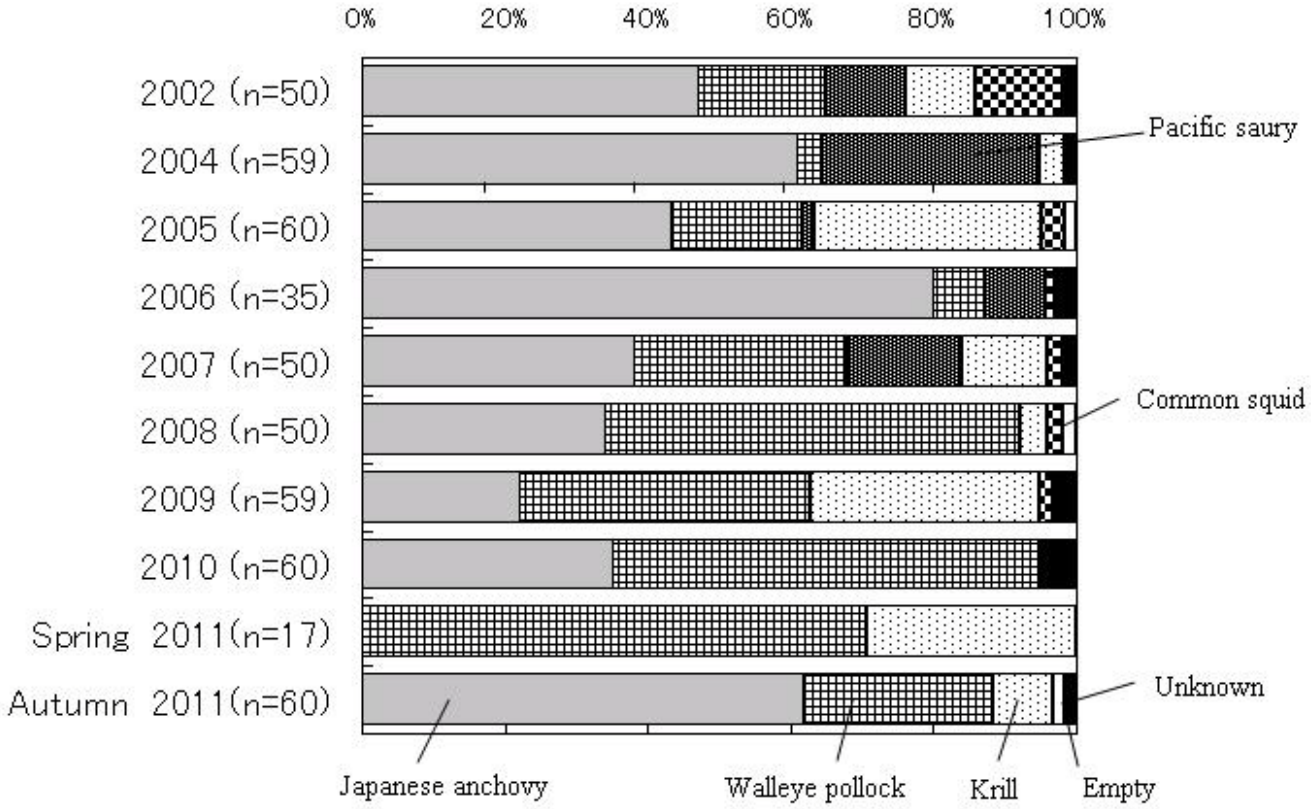

Fig. 6. Composition of prey species of common minke whales sampled during the 2011 coastal component off Kushiro, autumn survey, with comparison to the results of the previous surveys.

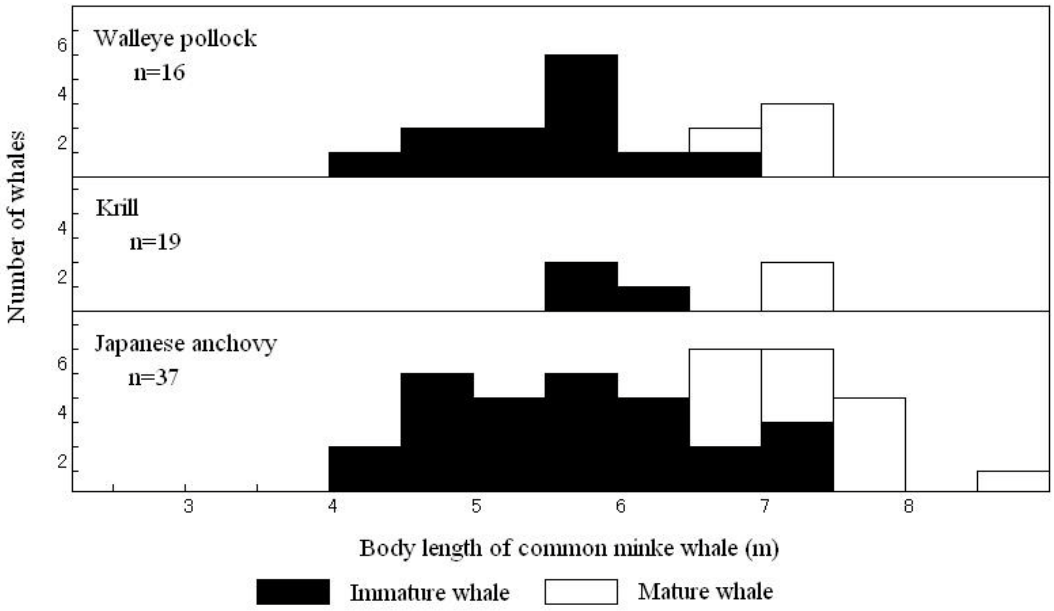

Fig.7. Sexual maturity and body length frequency of common minke whales by their major prey species found in the forestomach in the 2011 coastal component off Kushiro, autumn survey.

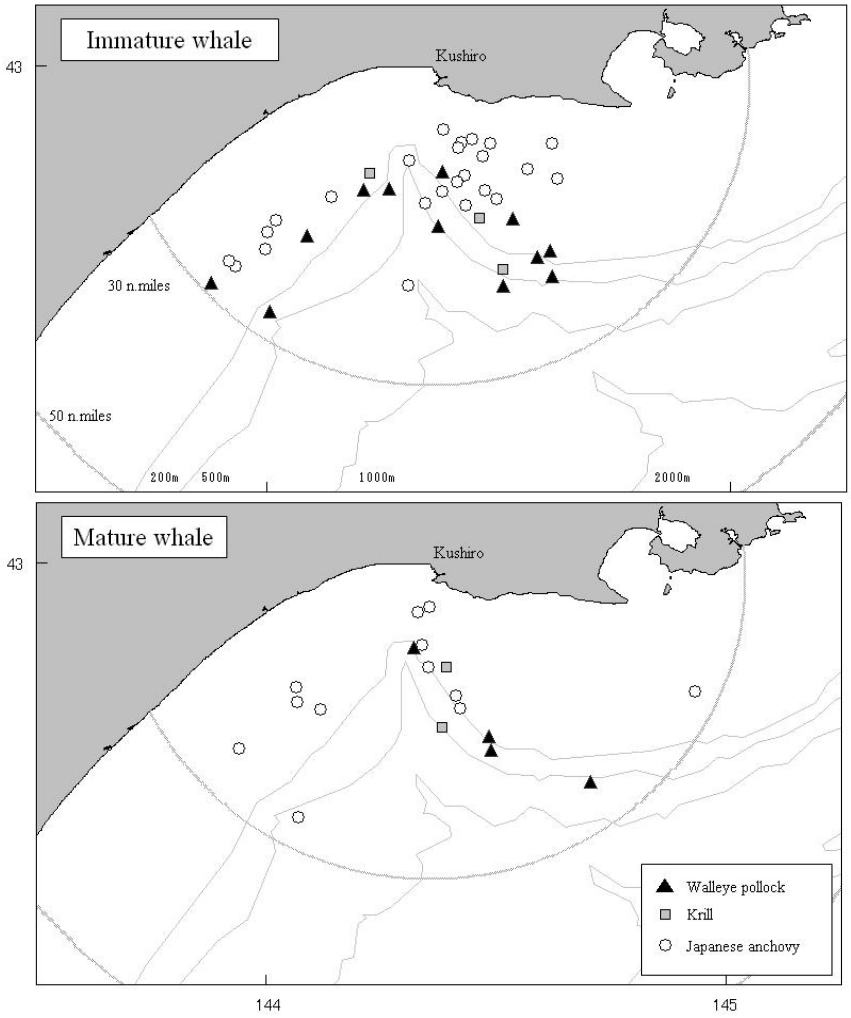

Fig.8. Sighting positions of common minke whales in the 2011 coastal component off Kushiro, autumn survey, by their sexual maturity and major prey species found in the forestomach