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 II) - Coastal component off Sanriku survey

GENTA YASUNAGA[1)], NOBUYUKI ITOH[2)], HIROYUKI OIKAWA[1)], GEN NAKAMURA[3)], HIKARI MAEDA[3)], SATOKO INOUE[3)], KAZUYA KITAYAMA[3)], ICHIRO KADOWAKI[3)], NOZOMI TAMAI[3)], NAOKO MIYAKAWA[3)], YUICHIRO ISHIKAWA[3)], KOZUE ISHIDA[3)], NOBUYUKI SUZUKI[3)], NOZOMI KOBAYASHI[3)], HITOMI SATO[2)], SAEKO KUMAGAI[2)], NAGISA SAKAMOTO[2)], HIDEHIRO KATO[3)]

1) Institute of Cetacean Research, 4-5 Toyomi-cho, Chuo-ku, Tokyo 104-0055, Japan
2) Association for Community-Based Whaling, 2-5-28, 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

Contact e-mail:yasunaga@cetacean.jp

ABSTRACT

The 2012 survey of the JARPN II coastal component off Sanriku (northeastern Japan, corresponding to a part of sub-area 7), was conducted from 12 April to 26 May, using four small-type whaling catcher boats and one echo sounder trawl survey vessel. Sampling of common minke whales was conducted in coastal waters within 50 n. miles from Ayukawa port in the Sanriku district, and all animals collected were landed at the JARPN II research station established for biological examination in Ayukawa. A total of 6,488.1 n.miles (620.1 hours) was surveyed and 95 schools (97 individuals) of common minke whales were sighted. A total of 60 animals were sampled. Average body length of the animals was 5.10 m (SD: 0.82, *n*=29) for males and 5.34 m (SD: 0.97, *n*=31) for females. Dominant prey species found in the forestomach of common minke whales collected in the Sendai Bay were adult and juvenile Japanese sand lances, and those collected outside the Sendai Bay were Japanese anchovies and krill. Information on sighting distribution, biological characteristics of whales sampled and feeding habit obtained during the 2012 survey was similar to that obtained before the 2011 earthquake and tsunami.

KEYWORDS: COMMON MINKE WHALE; NORTH PACIFIC; FEEDING ECOLOGY; SCIENTIFIC PERMITS.

INTRODUCTION

After the two-year feasibility study in 2000-2001, 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 objectives of the program are 1) Feeding ecology and ecosystem studies, involving prey consumption by cetaceans, prey preferences of cetaceans and ecosystem modeling; 2) Monitoring environmental pollutants in cetaceans and the marine ecosystem; and 3) Stock structure of whales (Government of Japan, 2002).

The JARPN II coastal component using small-type whaling catcher boats started in 2002 to complement the temporal and spatial gap of the offshore components using the *Nisshin Maru* research vessel. In the original JARPN II plan, the coastal component was presented as a two-year feasibility study to examine the logistic aspects of the methodology (Government of Japan, 2002). The first feasibility survey was carried out in the coastal waters off Kushiro in autumn 2002 (Kishiro *et al*., 2003) and the second feasibility survey was conducted in the coastal waters off Sanriku district in spring 2003 (Yoshida *et al*., 2004). In each of the surveys, 50 common minke whales were caught.

From detailed examination of the logistic aspects of the surveys, it was concluded that no substantial problem occurred and that the coastal survey could be continued as a component of the JARPN II using same kind of vessels (small-type whaling catcher boats) and methodology (Government of Japan, 2004a, Kato *et al*., 2004). However, re-calculation of required sample size from the survey data suggested that the size should be modified to 60 individuals in each area/season (Tamura *et al*., 2004), and from the possible geographical and/or temporal variations of prey consumption of the whales, the coastal surveys thought to be needed on a yearly basis in each local area (Government of Japan, 2004b). The revised survey off Sanriku was carried out in spring during 2005 and 2010 year (Yoshida *et al*., 2006; Goto *et al*., 2007; Bando *et al*., 2008, 2011; Yasunaga *et al*., 2009, 2010).

On March 11 2011 the Ayukawa town, including all research facilities of JARPN II, was destroyed by a large earthquake and tsunami. In this year the spring coastal survey could not be conducted in Ayukawa. Instead the spring survey in 2011 was conducted in Kushiro. Fortunately the Ayukawa research station was reconstructed and the 2012 survey of the JARPN II coastal component in spring could be conducted in this locality again.

Here we report the survey carried out in coastal waters off Sanriku from 12 April to 26 May in 2012. This survey was authorized by the Government of Japan in compliance with Article VIII of the International Convention for the Regulation of Whaling. The Institute of Cetacean Research (ICR) planned and conducted the survey in cooperation with the National Research Institute of Far Seas Fisheries and Tokyo University of Marine Science and Technology, and the Association for Community-Based Whaling.

MATERIALS AND METHODS

Research area

The research area was set in the same way as in previous surveys off Sanriku (Bando *et. al*, 2011). The research area comprised coastal water within 50 n. miles from northeastern part of the Japanese main island, Honshu, (Figure 1). The area was divided into Areas 1, 2 and 3 centering on the Ayukawa port (Figure 1). The research area corresponds to the northern part of sub-area 7, established by IWC (1994).

Whale sampling

Four small-type whaling catcher boats were used as sampling vessels: *Taisho Maru* No. 28 (hereinafter referred as 28T; 47.3GT), *Koei Maru* No. 8 (8K; 32.0GT), *Katsu Maru* No.7 (7K; 32.0GT), and *Sumitomo Maru* No.51 (51S; 30.0GT). All the animals sampled were landed on the JARPN II research station established at the Ayukawa port for biological examination. All common minke whales collected were examined biologically by researchers at the

research station. A list of biological items to be collected is shown in Table 1.

Prey species of common minke whale

Following the same methods used in the JARPN II feasibility survey conducted in 2001 (Fujise, *et al*., 2002), stomach contents were weighted to the nearest 0.1 kg, in each of the four chambers, for both cases including and excluding liquid contents. In addition a small sample of forestomach contents was collected and frozen for laboratory analysis.

RESULTS

Searching effort

The whale sampling survey was conducted from 12 April to 26 May, 2012. Cruise tracks by the sampling vessels 28T, 8K, 7K and 51S are shown in Figure 2. The tracks covered widely the coastal waters off Sanriku. Searching distance and time are listed in Table 2, by sampling vessel. Searching distance and time are defined as distance and time recorded under searching activity conducted from the top barrel of the vessels. Total searching distance and time made by the three vessels were 6,488.1 n. miles and 620.1 hours, respectively (Table 2).

Sightings

A total of 95 schools (97 individuals) of common minke whales was sighted during the searching (Table 3, Figure 3). One cow-calf pair was observed. Density index (DI, the number of primary sightings of schools per 100 n.miles searching) of common minke whales in Areas 1, 2 and 3 were calculated as 2.43, 0.43 and 0.49, respectively (Table 4). Two schools (two individuals) of fin whales, 43 schools (58 individuals) of humpback whales and 4 schools (11 individuals) of killer whales were sighted during the searching (Table 3, Figure 4).

Sampling of common minke whales

A total of 60 common minke whales was sampled. Two situations of struck and lost occurred. The sighting positions of sampled animals are shown in Figure 3.

Biological examination

Sex ratio, body length and weight

Research items for the biological examination are summarized in Table 1. The sampled animals consisted of 29 males and 31 females. Sex ratio of males was 0.48. Average body length was 5.10 m (max=7.57, min=3.92) for males and 5.34 m (max=8.07, min=4.06) for females (Table 5). The sexual maturity of animals collected is shown in Table 6. For males and females 6.9% and 9.7% of the animals sampled in all areas, were sexually mature, respectively. Among the mature females, one resting, one pregnant and one pregnant & lactating cases were observed.

Prey species of common minke whale

Forestomach contents are listed in Table 7. Adult Japanese sand lance (*Ammodytes personatus*) (46.3%, 19 from 41 animals) and juvenile sand lance (41.5%, 17 from 41 animals) were observed in Area 1, and Japanese anchovy (*Engraulis japonicus*) and krill (*Euphausia pacifica)* were observed in two and five animals in Areas 2 and 3, respectively (Table 8, Figure 5). The maximum net weight of forestomach contents was 27.6 kg, consisting of

juvenile Japanese sand lance.

Observation of marine debris

Observation of marine debris was made in the stomachs of the 60 common minke whales sampled. One plastic piece was found in the stomach of an individual, one fishhook in the stomach of a different individual and three sheets of resins in the stomachs of three different individuals.

DISCUSSION

The spring survey of the coastal component of JARPN II was re-started in Ayukawa in 2012 after one year of no research activities in that locality as effect of the 2011 earthquake and tsunami. There were no practical problems in conducting the survey in Ayukawa in 2012.

In general the weather conditions were good and better that those in previous surveys in Sanriku. This allowed that the research area was searched widely and that the sample size of 60 animals could be attained.

The sighting positions of common minke whales in the present survey were concentrated mainly within the Sendai Bay (Figure 3). Whales outside the Sendai Bay were distributed on the shelf region and along the 100-200m isobaths on the slop. The density index (DI) of common minke whales in Area 1 (DI=2.43) was higher than those in Areas 2 (DI=0.43) and 3 (DI=0.49), suggesting that common minke whales were concentrated in the Sendai Bay. The DI in Area 1 in the present survey was slightly higher than those in 2006 (DI=1.83, Goto *et al.*, 2007), 2007 (DI=1.91, Bando *et al.*, 2008), 2008 (DI=1.57, Yasunaga *et al.*, 2009) and 2009 (DI=2.08, Yasunaga *et al.*, 2010). On the other hand the DI of Areas 2 and 3 in 2012 were similar to DI in 2010 (DI=0.66, Yasunaga *et al.*, 2011). The surveys from 2006 to 2010 were conducted mainly in Area 1.

The sex ratio of males of minke whales collected in the present survey (0.48) was similar to those in 2006 (0.43, Goto *et al.*, 2007), 2007 (0.37, Bando *et al.*, 2008), 2008 (0.38, Yasunaga *et al.*, 2009), 2009 (0.45, Yasunaga *et al.*, 2010) and 2010 (0.48, Yasunaga *et al.*, 2011). Frequency distribution of body length of common minke whales collected in the present survey was similar to those in 2009 and 2010 surveys, and their peaks in 2009, 2010 and 2012 surveys were shorter than those in 2006, 2007 and 2008 surveys (Figure 6).

These results suggest that the pattern of migration of common minke whales into the Sendai Bay in spring 2012 was similar to that before the earthquake and tsunami, although more whales were observed in 2012.

Adult Japanese sand lances were mainly observed in the forestomachs of whales collected from Area 1 while that Japanese anchovy and krill were observed in forestomachs in whales in Areas 2 and 3 (Table 8). This suggests that common minke whales in the Sendai Bay and in the outside slope feed on different preys (Figure 5). The first dominant prey items of the whales collected from Area 1 in the present research (adult sand lance) are in agreement with those during 2006 and 2010 (Goto *et al.*, 2007; Bando *et al.*, 2008; Yasunaga *et al.*, 2009; Yasunaga *et al.*, 2010; Band *et al.*, 2011) (Figure 7). The second dominant prey items of whales collected from Area 1 were juvenile Japanese sand lance. This is the same as those in 2008 (Yasunaga *et al.*, 2009), while those in 2009 (Yasunaga *et al.*, 2010) and 2010 (Bando *et al.*, 2011) were krill and those in 2006 (Goto *et al.*, 2007) and 2007 (Bando *et al.*, 2008)

were Japanese anchovy (Figure 7). The second dominant prey item for common minke whales in Sendai Bay shows some yearly change.

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Table 1. Summary of biological data and samples collected during the 2012 JARPN II coastal survey off Sanriku.

Samples and data	Number of animals		
	Male	Female	Total
Body length and sex	29	31	60
External body proportion	29	31	60
Photographic record and external character	29	31	60
Diatom film record	29	31	60
Body scar record	29	31	60
Measurements of blubber thickness (5 points)	29	31	60
Detailed measurements of blubber thickness (11 points)	1	0	1
Whole body weight	29	31	60
Body weight by parts	1	0	1
Skin tissues for DNA study	29	31	60
Muscle, liver, kidney, spleen, blubber, heart and ventral groove for various analysis	29	31	60
Urine for various analysis	12	3	15
Muscle, liver, kidney, and blubber for heavy metal analysis	29	31	60
Muscle, liver, kidney, and blubber for organochlorine analysis	29	31	60
Collection of blood plasma	19	24	54
Muscle and vertebra for lipid analysis	1	0	1
Mammary grand; lactation status, measurement and histological sample	-	31	31
Uterine horn; measurements and endometrium sample	-	31	31
Collection of Ovary	-	31	31
Photographic record of fetus	0	1	2*
Fetal length and weight	0	1	2*
External measurement of fetus	0	1	2*
Muscle, liver, kidney, heart, blubber and skin tissues of fetus	0	1	2*
Collection of fetus	0	1	2*
Testis and epididymis; weight and histological sample	29	-	29
Stomach contents, convenient record	29	31	60
Volume and weight of stomach content in each compartment	29	31	60
Observation of marine debris in stomach	29	31	60
Collection of stomach contents for feeding study	24	24	48
Record of external parasites	29	31	60
Earplug for age determination	29	31	60
Tympanic bulla for age determination	29	31	60
Eye lens for age determination	29	31	60
Largest baleen plate for morphologic study and age determination	29	31	60
Baleen plate measurements (length and breadth)	29	31	60
Photographic record of baleen plate series	29	31	60
Length of baleen series	29	31	60
Vertebral epiphyses sample	4	5	9
Number of ribs	29	31	60
Skull measurement (length and breadth)	29	31	60

*: including a fetus of sex unidentified.

Table 2. Searching days, hours and distances by four sampling vessels in the 2012 JARPN II coastal surveys off Sanriku

Area		Sampling vessels*				Total
		28T	08K	07K	51S	
Area 1	Days	18	20	19	18	75
	Hours	68.8	65.4	78.4	68.2	280.7
	Distance(n.mile)	763.7	685.2	787.1	731.8	2,967.8
Area 2	Days	13	13	15	13	54
	Hours	43.0	44.2	43.5	50.8	181.5
	Distance(n.mile)	480.8	451.5	418.1	527.2	1,877.6
Area 3	Days	14	15	11	12	52
	Hours	42.8	38.8	36.2	40.0	157.8
	Distance(n.mile)	482.6	400.2	356.9	403.0	1,642.7
Total	Hours	154.6	148.4	158.1	159.0	620.1
	Distance(n.mile)	1,727.1	1,536.9	1,562.1	1,662.0	6,488.1

* 28T: *Taisho Maru* No.28; 08K: *Kouei Maru* No.8; 07K; *Katsu Maru* No.7, 51S: *Sumitomo Maru* No.51.

Table 3. List of cetacean species and number of sightings made by four sampling vessels in the 2012 JARPN II coastal surveys off Sanriku

Area	Species	Primary		Secondary		Total	
		Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Area 1	Common minke whale	72	74	7	7	79	81
	Like minke whale	8	8	2	2	10	10
	Humpback whale	20	26	1	1	21	27
	Killer whale	0	0	0	0	0	0
	Fin whale	0	0	0	0	0	0
Area 2	Common minke whale	8	8	0	0	8	8
	Like minke whale	6	6	0	0	6	6
	Humpback whale	9	11	1	2	10	13
	Killer whale	2	8	0	0	2	8
	Fin whale	1	1	0	0	1	1
Area 3	Common minke whale	8	8	0	0	8	8
	Like minke whale	6	6	0	0	6	6
	Humpback whale	12	18	0	0	12	18
	Killer whale	2	3	0	0	2	3
	Fin whale	1	1	0	0	1	1
Total	Common minke whale	88	90	7	7	95	97
	Like minke whale	20	20	2	2	22	22
	Humpback whale	41	55	2	3	43	58
	Killer whale	4	11	0	0	4	11
	Fin whale	2	2	0	0	2	2

Table 4. Density index of common minke whales in the 2012 JARPN II coastal survey off Sanriku

Area	SPUE[*1]	DI[*2]
Area 1	0.26	2.43
Area 2	0.04	0.43
Area 3	0.05	0.49
Total	0.14	1.46

[*1]: No. of primary school sightings per 1 hour searching.

[*2]: No. of primary school sightings per 100 n. miles searching.

Table 5. Body length (m) of common minke whales collected during the 2012 JARPN II coastal survey off Sanriku

Area	Male					Female				
	mean	S.D.	Min.	Max.	n	mean	S.D.	Min.	Max.	n
Area 1	4.90	0.59	3.92	6.33	24	5.35	1.01	4.13	8.07	27
Area 2	5.85	0.87	5.03	7.05	3	4.90	0.84	4.06	5.73	2
Area 3	6.36	1.22	5.14	7.57	2	5.59	0.33	5.26	5.92	2
Total	5.10	0.82	3.92	7.57	29	5.34	0.97	4.06	8.07	31

Table 6. Sex and sexual maturity status of common minke whales collected by the 2012 JARPN II coastal survey off Sanriku

Area	Male					Female						
	Im	M	Uk	Total	Maturity (%)	Im.	R	P	P&L	Uk	Total	Maturity (%)
Area 1	24	0	0	24	0.0	24	1	1	1	0	27	11.1
Area 2	2	1	0	3	33.3	2	0	0	0	0	2	0.0
Area 3	1	1	0	2	50.0	2	0	0	0	0	2	0.0
Total	27	2	0	29	6.9	28	1	1	1	0	31	9.7

Im: Immature, M: Mature, R: Resting, P: Pregnant, P&L: Pregnant and lactating, Uk: Unknown

Table 7. Prey species found in forestomach of common minke whales collected by the 2012 JARPN II coastal survey off Sanriku (animals with broken stomach were removed)

Area	No. of whales observed		Prey species			
			Sand lance (adult)	Sand lance (juvenile)	Japanese anchovy	Krill
Area 1	41	Number	19	17	5	0
		Occurrence (%)	46.3	41.5	12.2	0.0
Area 2	5	Number	0	0	1	4
		Occurrence (%)	0	0	20	80
Area 3	2	Number	0	0	1	1
		Occurrence (%)	0	0	50	50
Total	48	Number	19	17	7	5
		Occurrence (%)	39.6	35.4	14.6	10.4

Table 8. Weight (kg) of forestomach content of common minke whales collected by the 2012 JARPN II coastal survey off Sanriku

Area		Prey species				
		Sandlance (adult)	Sandlance (juvenile)	Japanese anchovy	Krill	Total
Area 1	average	6.41	7.09	4.93	0.00	6.51
	range	0.21-26.52	0.35-27.63	0.55-8.56	0.0	0.21-27.63
Area 2	average	0.00	0.00	15.29	6.02	7.87
	range	0.0	0.0	15.29-15.29	3.47-12.09	3.47-15.29
Area 3	average	0.00	0.00	10.09	11.03	10.56
	range	0.0	0.0	10.09-10.09	11.03-11.03	10.09-11.03
Total	average	6.41	7.09	7.15	7.02	6.82
	range	0.21-26.52	0.35-27.63	0.55-15.29	3.47-12.09	0.21-27.63

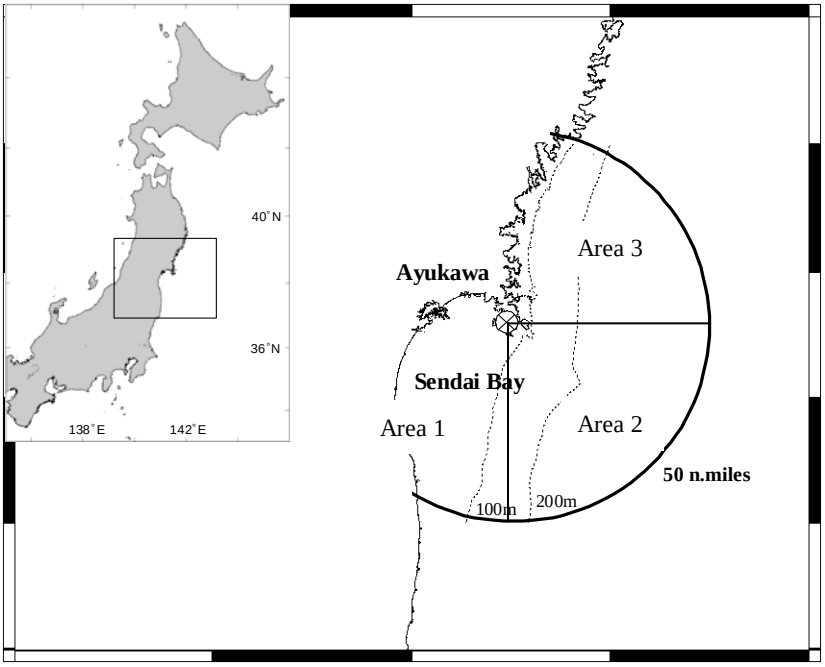

Figure 1. Research area of the 2012 JARPN II coastal survey off Sanriku

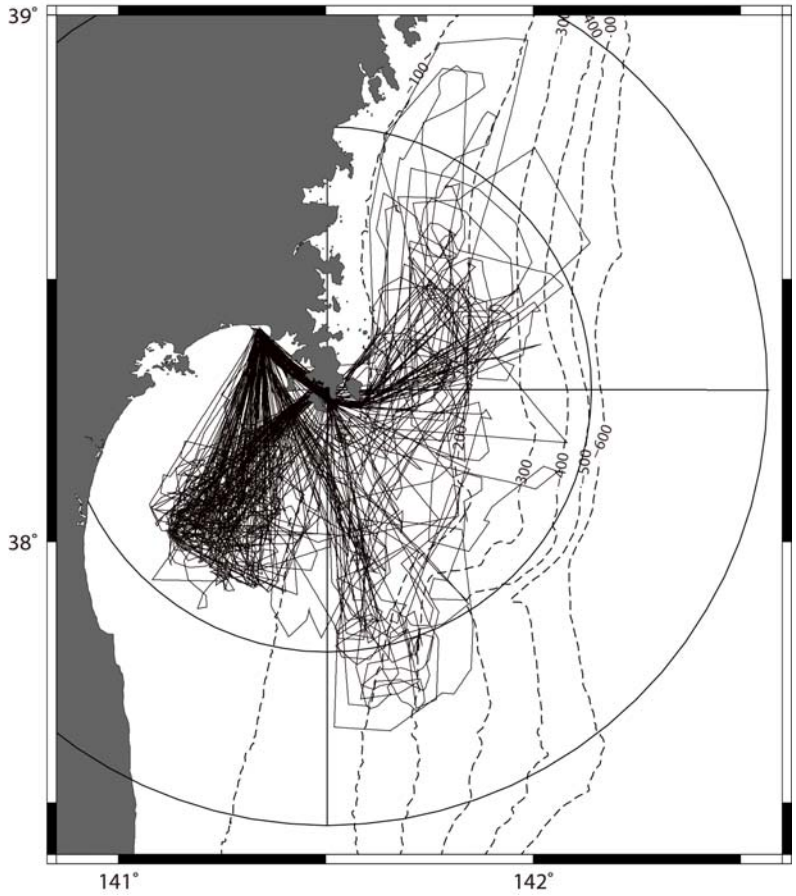

Figure 2. Cruise tracks by four sampling vessels in the 2012 JARPN II coastal survey off Sanriku

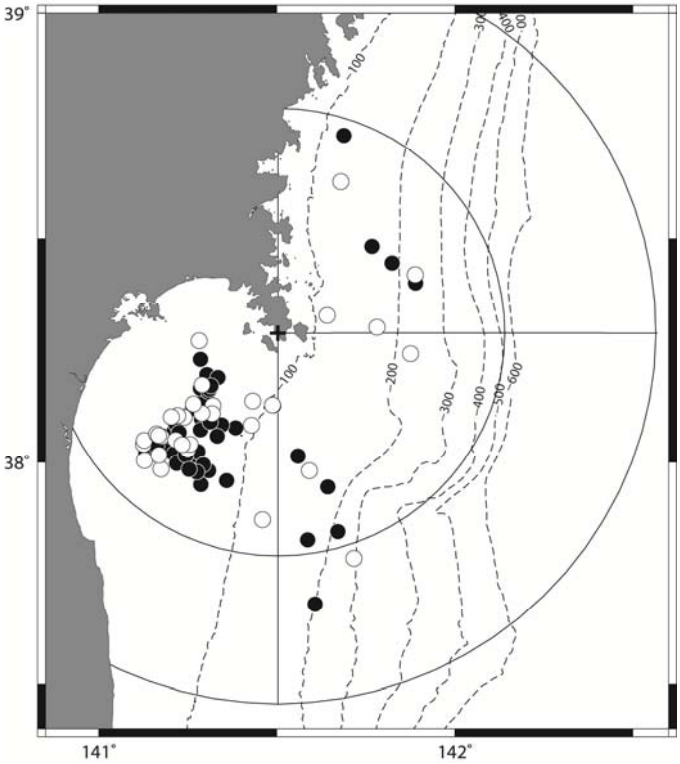

Figure 3. Sighting positions of common minke whales in the 2012 JARPN II coastal survey off Sanriku (●:sighting and sampled; ○: only sighting)

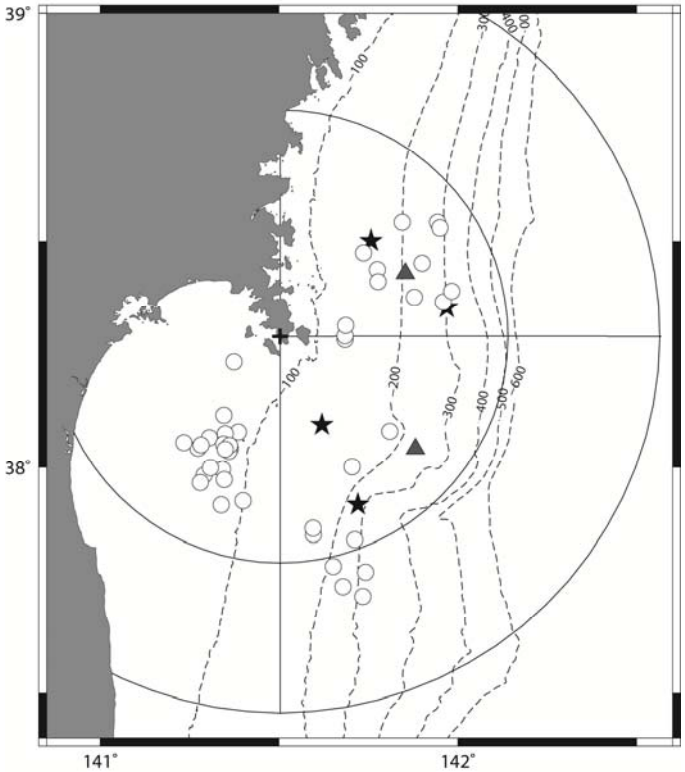

Figure 4. Sighting position of humpback (○), killer (★) and fin (▲) whales sighted in the 2012 JARPN II coastal survey off Sanriku

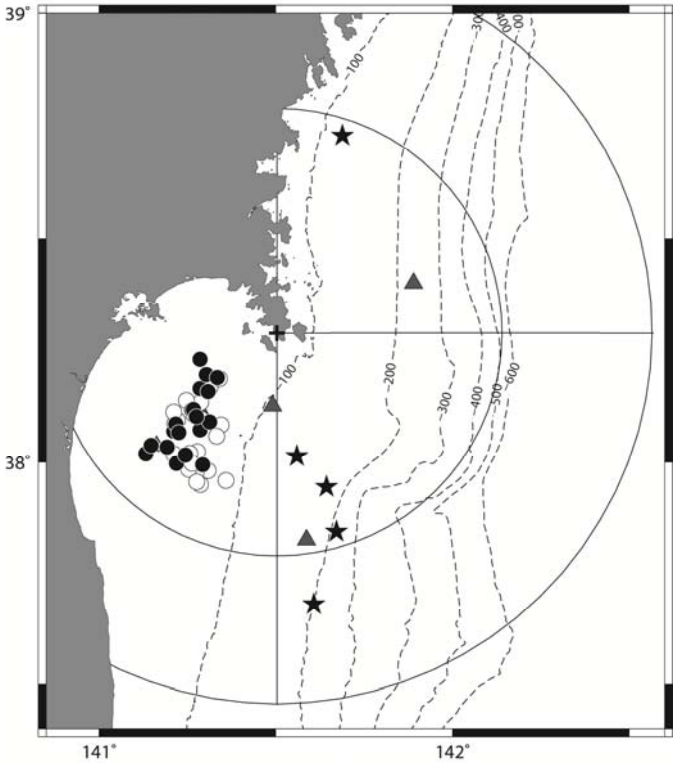

Figure 5. Sighting position of common minke whales sampled in the 2012 JARPN II coastal survey off Sanriku by major prey species. (○: adult of Japanese sand lance; ●: juvenile of Japanese sand lance; ★: krill; ▲: Japanese anchovy)

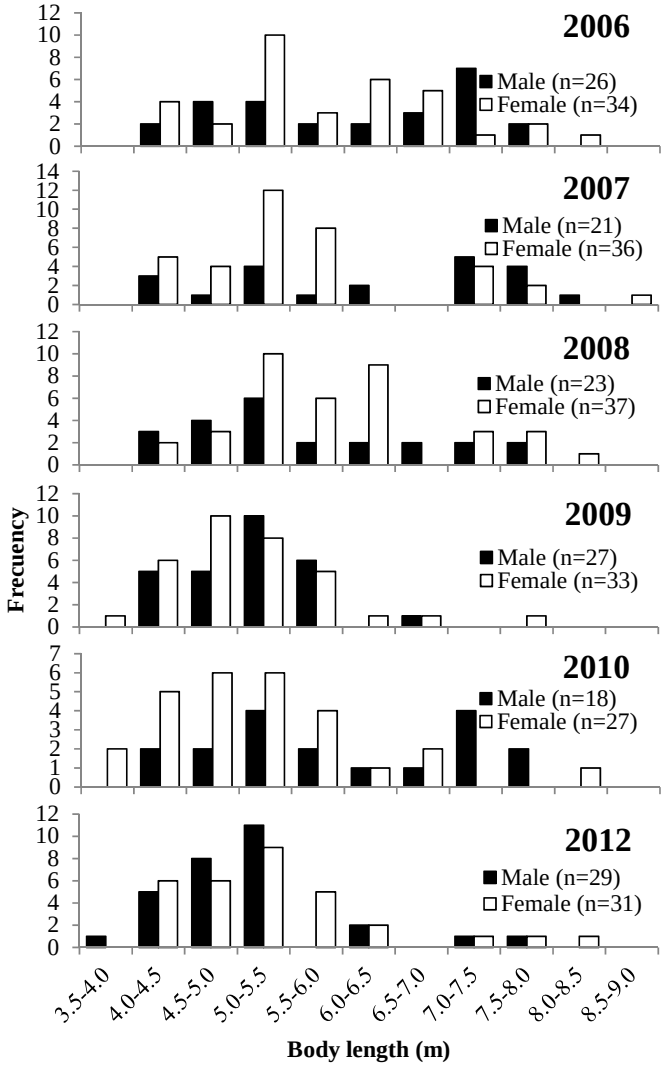

Figure 6. Body length frequency of common minke whales off Sanriku for the period 2006-2012, by sex.

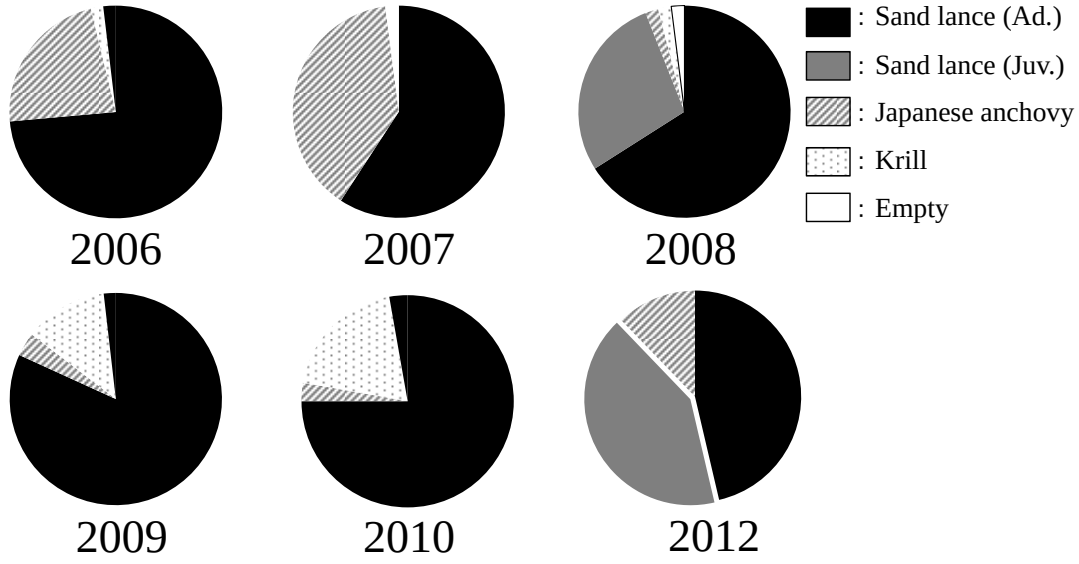

Figure 7. Composition of prey species of common minke whales off Sanriku for the period 2006-2012.

Appendix

Report of the coastal prey species survey off Sanriku in 2012

Mitsuhiro Saeki [1] and Genta Yasunaga[2]

[1] *Miyagi Prefecture Fisheries Technology Institute, 97-6 Sodenohama, Watanoha, Ishinomaki, Miyagi 986-2135, Japan*
[2] *The Institute of Cetacean Research, 4-5 Toyomi-cho, Chuo-ku, Tokyo 104-0055, Japan*

ABSTRACT

A prey species survey was conducted in the coastal region off Sanriku, northeastern Japan in spring 2012 as a part of JARPNII coastal component off Sanriku. The survey was conducted concurrently with a sampling survey of common minke whales. The survey was conducted in April (16 - 21April) and May (14 - 18 May). Four stratified blocks were surveyed in April (A, B, C and D) and two blocks (B and C) were surveyed in May. Zigzag tracklines were set in the blocks. A trawler type RV, *Takuyo-maru*, was used for the survey. Acoustic data were recorded continuously along the tracklines by a quantitative echosounder. Samplings using a midwater trawl net were conducted at 12 stations to identify species and body size compositions. Vertical oceanographic conditions were recorded at 35 stations by using a CTD. Subsurface oceanographic conditions were recorded continuously along the tracklines.

INTRODUCTION

JARPN II is designed to contribute to conservation and sustainable use of marine living resources including whales in the western North Pacific, especially within Japan's EEZ (Government of Japan, 2002). One of the major objectives of JARPNII is to study feeding ecology of cetaceans and ecosystem studies, involving studies of prey consumption by cetaceans, prey preference of cetaceans and ecosystem modeling. To accomplish the goal, a sampling survey of common minke whales (*Balaenoptera acutorostrata*) and a survey on biomass estimation of their prey species have been conducted concurrently off Sanriku, Japan as the JARPNII coast component since 2003, except for 2011 when a large earthquake and tsunami affected greatly the region.

In this document the results of the prey species survey off Sanriku in 2012 are presented.

MATERIALS AND METHODS

While the sampling survey of minke whales was conducted in the coastal waters within the 50 n.miles (mainly within 30 n.miles) from Ayukawa, Miyagi prefecture, the prey species survey was conducted in wider area at bottom depths between 20 m and 200 m from 37º 54' N to 38º 40' N off Sanriku, northeastern Japan, to elucidate the distribution and abundance of main prey species. Seven survey blocks (A-G) have been set within the survey block since 2005 for the purpose of biomass estimation of prey species based on a stratified random sampling method using echo-sounder data (Figure 1). Stratification of blocks was based on bottom depth (20, 40, 100, and 200m) and political boundary (boundary between Miyagi and Fukushima prefecture). Because of logistical constraint and Fukushima nuclear accident, only 4 blocks (A, B, C and D) were surveyed in April, and only 2 blocks (B, C,) were

surveyed in May in 2012 (Figure 1). A zigzag track line was set in each block. The waypoints of planned tracklines in each block were shown in Table 1.

The survey was conducted in April (16 - 21 April) and May (14 - 18 May). The same blocks and tracklines were surveyed in April and May to see whether the distribution patterns of prey species differed between the months. The survey was conducted during the daytime from an hour after sunrise to an hour before sunset. Acoustic, trawl and oceanographic surveys were conducted using a trawler-type RV, "*Takuyo maru*" (Miyagi Prefecture, 120 GT). Data on distribution and abundance of the prey species were recorded by a quantitative echosounder, EK500 (Simrad, Norway) with operating frequency at 38, 120 and 200 kHz. The RV steamed at 9-10 knots along the tracklines. Acoustic data were stored with an aid of software, Echoview (Myriax Software Pty. Ltd., Austlaria). A calibration was carried out in the survey area on 15 April and on 14 May using the copper sphere technique described in EK 500 manual. Vertical oceanographic observations were conducted with CTD. Subsurface (approximately 5m water depth) temperature, salinity and *chlorophyll-a* were recorded every minute (in time) along the tracklines.

Trawl sampling was conducted to identify the species and size compositions of targeting echosigns. The trawl net had a mouth opening of 7 m (width) by 3.5 m (height) and a 3 mm liner cod end. The depth and the height of the mouth of the net were monitored with a net recorder. Towing speed of the trawl net was 2-4 knots. Catches of trawl were identified to the species level and weighed aboard the vessel. For the major species, a sample of 100 animals was taken, and lengths and weights were measured. Scale and standard lengths were used for Japanese anchovy (*Engraulis japonicus*) and sand lance (adult and juvenile, *Ammodytes personatus*), respectively. Total length from the tip of the rostrum to the end of the telson was used for krill (*Euphausia pacifica*). Some frozen samples were taken for further analysis in the laboratory.

RESULTS

The planned tracklines were almost surveyed by the quantitative echosounder. Trawl was towed at 12 stations. A summary of the midwater trawl samplings was shown in Table 2. CTD casts were conducted at 35 stations. Occurrences of prey species were different between April and May. In April, backscatterings of juvenile sand lance and krill were observed while these of adult sand lance and Japanese anchovy were rarely observed. In May, number of backscatterings of Japanese anchovy was increased. Backscatterings of juvenile sand lance, adult sand lance and krill were also observed in May. Detailed analysis will be conducted in the laboratory and the results will be presented in the near future.

ACKNOWLEDGEMENT

We would like to thank the captain of RV "*Takuyo-Maru*", Mr. Hiroaki Kimura, and his crews who assisted us to collect a valuable data set. This survey was supported by Fisheries Agency of Japan, Miyagi Prefecture and the Institute of Cetacean Research. We thank these institutions for their support.

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Government of Japan. 2002. Research Plan for Cetacean Studies in the Western North Pacific under Special Permit (JARPN II). IWC/SC/54/O2 submitted to the 54th IWC Scientific Committee Meeting, 115pp.

Table 1. Waypoints and planed lines

Block A

Waypoint	Latitude				Longitude				Course (degree)	Distance (n.mile)
A1	38	-	15.0	N	141	-	50.5	E	295	11.7
A2	38	-	20.0	N	141	-	37.0	E	58	13.0
B3	38	-	27.0	N	141	-	51.0	E	301	13.7
B4	38	-	34.0	N	141	-	36.0	E	237	13.9
B5	38	-	40.0	N	141	-	52.0	E	-	-
									Total	52.3

Block B

Waypoint	Latitude				Longitude				Course (degree)	Distance (n.mile)
B1	37	-	54.0	N	141	-	13.0	E	291	12.7
B2	37	-	58.5	N	140	-	58.0	E	68	14.9
B3	38	-	04.0	N	141	-	15.5	E	294	13.8
B4	38	-	09.5	N	140	-	59.5	E	71	17.0
B5	38	-	15.0	N	141	-	20.0	E	327	6.5
B6	38	-	20.5	N	141	-	15.5	E	76	4.1
B7	38		21.5	N	141	-	20.5	E	-	-
									Total	68.9

Block C

Waypoint	Latitude				Longitude				Course (degree)	Distance (n.mile)
C1	38	-	15.0	N	141	-	37.5	E	257	17.4
C2	38	-	11.0	N	141	-	16.0	E	112	10.6
C3	38	-	07.0	N	141	-	28.5	E	250	11.4
C4	38	-	03.0	N	141	-	15.0	E	115	9.6
C5	37	-	59.0	N	141	-	26.0	E	250	11.4
C6	37	-	55.0	N	141	-	12.5	E	96	9.9
C7	37	-	54.0	N	141	-	25.0	E	-	-
									Total	70.2

Block D

Waypoint	Latitude				Longitude				Course (degree)	Distance (n.mile)
D1	38	-	15.0	N	141	-	50.5	E	262	13.5
D2	38	-	13.0	N	141	-	33.5	E	121	15.6
D3	37	-	05.0	N	141	-	50.5	E	248	21.6
D4	37	-	57.0	N	141	-	25.0	E	103	13.3
D5	37	-	54.0	N	141	-	41.0	E	-	-
									Total	63.7

Table 2. A summary of the trawl sampling

Station		St-1	St-2	St-3	St-4	St-5	St-6
Block		B	B	B	C	C	C
Date		16 Apr.	16 Apr.	17 Apr.	17 Apr.	18 Apr.	18 Apr.
Time		7:58	11:57	13:30	16:42	8:55	10:20
Latitude		38-21N	38-08N	37-59N	37-54N	38-03N	38-06N
Longitude		141-16E	141-06E	141-00E	141-21E	141-16E	141-25E
Temp (°C) by depth	0 m	7.8	7.6	7.9	8.4	7.4	8.2
	10 m	7.0	7.1	6.8	7.7	6.9	6.9
	20 m		6.9		6.9	7.1	6.3
	30 m				6.7	6.5	6.2
	40 m				6.5		6.2
	50 m				6.5		5.8
	75 m						5.7
	100 m						
	Bottom (m)	6.3 (16m)	6.1 (25m)	6.6 (19m)	6.3 (74m)	5.9 (39m)	5.8 (87m)
Trawl sampling depth (m)		10-20	10-20	10-15	40-60	20-40	40-60
Major sampled species		Sand lance (juvenile)	Sand lance (juvenile)	Sand lance (juvenile)	*Maurolicus japonicus*	Sand lance (adult)	Krill

Station		St-7	St-8	St-9	St-10	St-11	St-12
Block		D	D	B	B	B	C
Date		20 Apr.	20 Apr.	14 May	15 May	17 May	18 May
Time		11:18	14:42	13:58	12:51	11:33	9:05
Latitude		38-14N	37-57N	38-19N	38-11N	38-02N	38-09N
Longitude		141-44E	141-26E	141-16E	141-07E	141-10E	141-22E
Temp (°C) by depth	0 m	7.2	8.1	13.5	14.2	13.6	13.6
	10 m	6.7	7.3	8.5	11.2	ND	11.5
	20 m	6.2	6.0	6.9	7.2	ND	10.4
	30 m	5.6	6.3				11.5
	40 m	5.9	6.1				10.6
	50 m	5.9	6.3				8.2
	75 m	5.4	5.6				
	100 m	5.0	5.5				
	Bottom (m)	5.0 (146m)	5.5 (105m)	6.9 (25m)	7.0 (25m)	ND (25m)	7.2 (58m)
Trawl sampling depth (m)		10-20	40-65	20-25	20-30	15-20	20
Major sampled species		Jelly fish	Krill	Sand lance (juvenile)	Sand lance (juvenile)	Japanese anchovy	Japanese anchovy

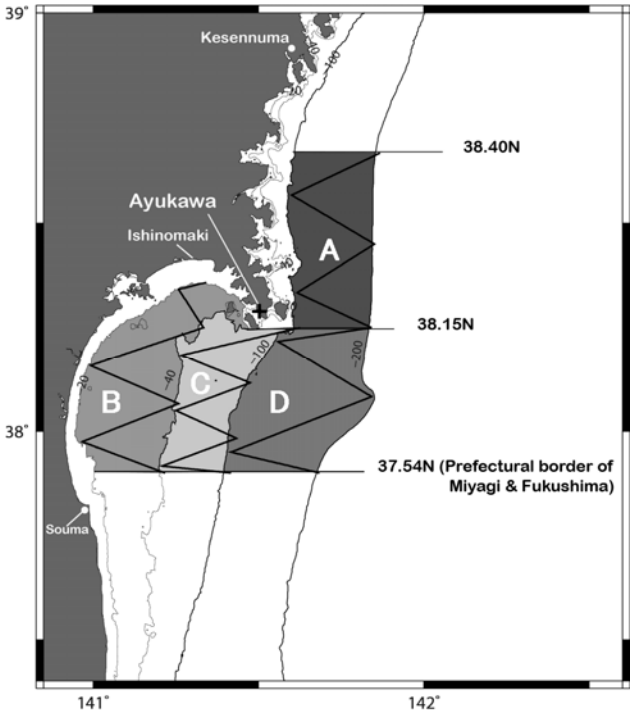

Fig. 1. Survey Blocks and planed tracklines in 2012