SC/55/O8

Report of the 2002 JARPN II survey in the western North Pacific. Part II: Coastal component – Coastal Survey off Kushiro, northeast Japan.

TOSHIYA KISHIRO[1], HIDEHIRO KATO[1], HIROSHI OHIZUMI[1], HIDEYOSHI YOSHIDA[1], TERUO SAITO[2], TATSUYA ISODA[2], SHIGEO TABATA[2], MIZUKI SAKAKIBARA[3], SHIGEO SAINO[2], TAKAHIRO HARA[2], TAKENOBU HAYASHI[2], TOMIO MIYASHITA[1], KAZUKI FUKUDOME[2], HIROSHI KIWADA[2] AND SHIGEYUKI KAWAHARA[1]

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

[1] *National Research Institute of Far Seas Fisheries, 5-7-1, Shimizu-orido, Shizuoka, 424-8633, Japan*

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

[3] *Hokkaido University, 3-1-1, Minato-cho, Hakodate, 041-8611, Japan*

ABSTRACT

The full-scale surveys of the Japanese Whale Research Program under Special Permit in the western North Pacific (JARPN II) started in 2002, with the aim to study the feeding ecology and ecosystem of common minke whale *Baraenoptera acutorostrata*, Bryde's whale *B. edeni*, sei whale *B. borealis* and sperm whale *Physeter macrocephalus*. Under this program, the sampling of 50 minke whales in the coastal areas by small-type whaling catcher boats was planned to cover the temporal and spatial gap of the research, and to check the logistic feasibility in the first two years (2002 and 2003). The first survey was conducted from 10 September to 12 October 2002 in the coastal waters off Kushiro, northeast Japan (northern part of the sub-area 7), using three small-type whaling catcher boats, one echo sounder-trawl survey vessel and one dedicated sighting survey vessel. The whale sampling was conducted in the coastal waters within the 50 nautical miles form the Kushiro port, and all whales sampled were landed on the newly established land station in the Kushiro port for biological research. During the period, a total of 3,522.8 n. miles (330.4 hours) was surveyed for whale sampling, 171 schools/ 177 individuals of minke whales were sighted and 50 minke whales were sampled. Average body length of sampled whales was 6.28m (SD=1.13, n=32) for males and 6.39m (SD=1.39, n=18) for females, respectively. Major prey species found in the forestomach contents were Japanese anchovy *Engraulis japonicus*, walleye pollock *Theragra chalcogramma*, Pacific saury *Cololabis saira*, Japanese common squid *Todarodes pacificus* and Krill. The concurrent prey survey using echo sounder and trawling could reveal the distribution of those prey species in the research area, and the dedicated sighting survey sighted 52 schools/ 56 individuals of minke whales with 681.5 n. miles searched. These results suggested that minke whales could use various prey species, and the coastal area off Kushiro was one of the major feeding grounds for the whales in the autumn season. There was no serious practical problem and the 2002 coastal whale survey off Kushiro was conducted successfully.

KEYWORDS: COMMON MINKE WHALE; PACIFIC OCEAN; FOOD/PREY; ECOSYSTEM; SCIENTIFIC PERMITS

INTRODUCTION

After the two-year feasibility study in 2000-2001, the full-scale surveys of the Japanese Whale Research Program under Special Permit in the western North Pacific (JARPN II) started in 2002. The main purpose of the program was to study the competition between whales and fisheries, and to elucidate the role of the cetaceans in the marine ecosystem of the western North Pacific Ocean (Government of Japan, 2002a). The target cetacean species in the full-scale JARPN II were common minke whale *Baraenoptera acutorostrata*, Bryde's whale *B. edeni*, sei whale *B. borealis* and sperm whale *Physeter macrocephalus*, and the sampling and research for these whales in the offshore areas were conducted by the *Nisshin-Maru* research fleet (an outline and result of this survey were presented in SC/55/O7 as the report of the offshore survey: JARPN II-part I).

The JARPN (1994-1999) and the JARPN II feasibility study (2000-2001) showed that common minke whales were widely distributed from the offshore to the coastal waters and fed on various prey species such as Japanese anchovy, Pacific saury and walleye pollock (Government of Japan, 2002b; Tamura and Fujise, 2000). Especially, the coastal area of Japan was an important fishing ground and the competition between the whales and fisheries was likely to be severe. However, the *Nisshin-Maru* research fleet could not survey in the near shore areas and in the seasons from late autumn to early spring because of the practical availability of the vessels. Under this situation, the sampling of minke whales in the coastal areas by small-type whaling catcher boats was planned to cover the temporal and spatial gap of the research. The coastal survey was planned as the feasibility study in the first two years (2002 and 2003) to check the logistic feasibility, and consisted of the three components as follows; 1) coastal whale sampling survey by three small-type whaling vessels, 2) coastal prey species survey by one echo sounder-trawl survey vessel, and 3) dedicated sighting survey by one research sighting vessel.

The coastal 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 this survey entrusted by the Institute of Cetacean Research (ICR).

In this paper, we presented an outline of the first feasibility survey using the small-type whaling vessels, which was conducted in the coastal waters off Kushiro, northeast Japan, from 10 September to 12 October 2002.

MATERIALS AND METHODS

Research area

In the past, the coastal waters off Kushiro (eastern part of the Pacific coast of Hokkaido, northeast Japan) was one of the major whaling grounds for the coastal whaling of minke whales in autumn

season (Miyashita and Hatanaka, 1997) and the possible competition between the whales and the fisheries in this area was suggested by the JARPN and JARPN II feasibility study (Tamura and Fujise, 2000). Thus, the research area in this study was set in the coastal waters off Kushiro, within the 30 nautical miles (maximum 50 n. miles) form the Kushiro port (Fig. 1). This area coincided with the northern part of the sub-area 7 determined by the IWC.

Research vessels and land station

Whale sampling survey

Three small-type whaling catcher boats (*Taisho Maru* No. 28 (T28: 47.31GT), *Sumitomo Maru* No.31 (31S: 32.00GT) and *Katsu Maru* No.7 (7K: 32.00GT) were used as sampling vessels. The sampling survey was conducted from 10 September to 12 October. All whales sampled were landed on the newly established land station (the JARPN II research station) in the Kushiro port for biological examination of the whales and the by-products.

Prey species survey

The *Kaiyo Maru* No.3 (KY3: 473.65GT) was engaged as an echo sounder-trawling survey vessel. This survey was conducted from 10 September to 6 October. Detail of the survey was shown in Appendix 1.

Dedicated sighting survey

The *Kyoshin Maru* No.2 (KS2: 368GT) was engaged as a dedicated sighting survey vessel. This survey was conducted from 10 to 24 September, following the predetermined zigzag-shaped track line. This vessel was also conducted the oceanographic observations using CTD and EPCS (Electric particle counting and sizing system). Detail of the survey was shown in Appendix 2.

Sighting and sampling methods

The research head office established in the JARPN II research station, commanded the research activity of the sampling vessels. Searching area and route of the sampling vessels were determined every days based on the weather conditions, the whale distribution, and the information of the fishing grounds of the prey species such as Pacific saury. In each sampling vessel, researcher on board recorded the cruise tracks, searching time on effort, sea weather conditions and sighting data for cetacean species (minke whales and other baleen whales, sperm whales and baird's beaked whales). Sighting was conducted from the top barrel and upper bridge, and all minke whales sighted were targeted for sampling. When the sighting school was consisted of more than one animal, first targeted animal was selected following the random sampling digits. Cow and calf pair was not targeted for sampling. The sampling was made by 50 mm whaling cannon. Once the vessel sampled the whale, she returned to the Kushiro port as soon as possible. In the port, the sampled whale was lift up from the vessel using wire nets and a crane and transported to the land station (the JARPN II

research station) by an 11 tons freight trailer.

Biological research for minke whales sampled

All sampled whales were biologically examined by researchers on the land station (the JARPN II research station). Research items of the biological studies were summarized in Table 4, with the number of data and samples obtained. These items were related to the studies on feeding ecology, stock structure, life historical biology and pollution studies.

RESULTS

Searching distance by the sampling vessels

The cruise tracks of the three sampling vessels (28T, 31S and 7K) during the 2002 coastal survey were shown in Fig.2. The searching areas made by the sampling vessels almost covered the coastal waters within 30 nautical mails form the Kushiro port. The searching distance and searching times were shown in Table 1. Here, we defined the searching distance and times as that with sighting effort, i.e. the periods of the searching conducted from the top barrel. During the research period, the total searching distance of the three sampling vessels was 3,522.8 n. miles and the total searching times was 330.4 hours.

Sightings of minke whales by the sampling vessels

Fig.2 showed the distribution of minke whales sighted by the sampling vessels. The sighting positions widely distributed form the inshore areas off Kushiro port to the waters in around 30 n. miles from the port which was almost coincided with the waters at the depth shallower than 200m. The sighting positions partly concentrated on the continental shelf and slope in the southeast region from the port. During the survey, a total of 171schools/ 177 individuals of minke whales were sighted, consisting of 142 schools/ 146 individuals of primary sightings and 29 schools/ 31 individuals of secondary sightings (Table 2). These figures included possible duplicated sightings because the sampling vessels surveyed almost same areas in day after day. Table 3 showed the temporal change of the density index (SPUE: number of schools primary sighted per one hour searched, and DI: number of schools primary sighted per 100 n. miles searched) of minke whales obtained from the sampling vessels. Both SPUE and DI decreased from the middle of September to late of September, but increased in the early of October. During the total research periods, 0.43 schools was primary sighted per one hour searched, and 4.03 schools was primary sighted per 100 n. miles searched.

Sightings of other large cetacean species

Table 2 also showed the sightings for other cetacean species made by the sampling vessels. Baird's beaked whales (28schools/ 205 individuals), fin whales (2 schools/ 2 individuals) and Humpback whales (1 school/ 2 individuals) were sighted during the coastal whale sampling survey.

Sampling of minke whales

A total of 50 minke whales were sampled. In the sampling process, there was no whale harpooned and missed by the technical reason (struck and lost). 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 research period.

Prey species survey and Dedicated sighting survey

The concurrent prey species survey using echo sounder-trawling vessel (KY3) and the dedicated sighting survey using sighting vessel (KS2) were conducted to estimate the prey preference of cetaceans in the wider areas from Cape Erimo (143°15'E) to Cape Nosappu (about 146°00'E)) and north of 41°00'N. Results of these surveys were described in appendix 1 for the prey species survey and appendix 2 for the dedicated sighting survey, respectively.

Sex ratio, body length and weight of sampled whales

The 50 sampled whales were consisted of 32 males and 18 females (sex ratio of males was 0.64). The body length distribution of sampled whales was shown in Fig.4 and Table 5. Average body length of sampled whales was 6.28m (max=7.98, min=4.51, SD=1.13) for males and 6.39m (max=8.27, min=4.53, SD=1.39) for females, respectively. The distribution of body weight was shown in Fig.5 and Table 6. Average body weight was 3.19 tons (max=5.76, min=0.86, SD=1.60) for males and 3.63 tons (max=8.23, min=1.02, SD=2.38) for females, respectively. In males, both the average body length and the average body weight increased during the seasons from the middle of September to the early of October (Table 5 and 6). Both in males and females, the frequency distribution of body length showed bimodal distribution with peaks in 4.5m and 7m up (Fig.4).The left mode was smaller than mean body length at sexual maturity (Kato, 1992), and represented the immature animals. Analysis of age and maturity status for each animal is on going and will be presented after the completion of the two-year feasibility studies.

Pray species of minke whale found in the stomach contents

Except for 1 stomach destroyed by the harpoon, we could examine 49 stomach contents of minke whales. Following the same methods conducted 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 forestomach contents was sampled and frozen for the later laboratory works. Major prey species found in the forestomach contents were Japanese anchovy *Engraulis japonicus* (46.9%, 23 out of 49 whales), walleye pollock *Theragra chalcogramma* (20.4%, 10 whales), Pacific saury *Cololabis saira* (12.2%, 6 whales), Japanese

common squid *Todarodes pacificus* (12.2%, 6 whales) and Krill (8.2%, 4 whales). The range of forestomach contents weights was form 1.4Kg to 104.8Kg, and the maximum of % body weight was 1.9 % (This whale fed on Pacific saury). Detailed analysis of the stomach contents is on going and will be presented after the completion of the two-year feasibility studies.

By-products of the whales

After biological examination, all whales sampled were processed according to the International Convention for regulation of whaling, Article VIII. Total production of the 50 minke whales was 103 tons (40 tons for red meat and 63 tons for blubber, respectively).

DISCUSSION

The present survey was the first attempt to use the small-type whaling catcher boats as the sampling research vessels, and to conduct the sampling survey in the inshore areas in autumn season. Although several accidents such as the engine trouble of the vessel, the slump of the communication equipment and the shortage of the research staff arose during the survey, these problems were solved with the efforts of the staff and researchers engaged. In the research area, there were many fishing boats engaged in the coastal fisheries such as the jigging, set netting and the purse seines fisheries but no trouble or accidents arose between these fisheries and our research vessel's activities. The sampling vessels could enter the inshore areas and take samples beside the fishing boats. The concurrent prey species survey and dedicated sighting survey also conducted successfully as previously scheduled.

The major prey species (Japanese anchovy, walleye pollock, Pacific saury and, Japanese common squid) found in the stomach contents of the sampled whales coincided with the main target species of the coastal fisheries in this areas (Fisheries Agency of Japan, 2002), and suggested the existence of the competition between the whales and the fisheries. The results of surveys also suggested that minke whales could use various prey species and the coastal area off Kushiro was one of the major feeding grounds in the autumn season. The local concentrated and abundant distribution of minke whales revealed by the sighting surveys and full stomach contents of the whales showed by the sampling surveys indicated that these areas might be consisted with the suitable local hot places for the feeding of minke whales during its northward and/or southward migration. The analyses of the samples and data obtained through the surveys are on going in the NRIFSF and ICR with respect to the various aspects such as the feeding ecology, genetics, stock structure, life historical biology, pollution studies, and the prey preference studies for constructing the ecosystem models. The present survey is the first step in the two-year program and the details of the results will be presented after the completion of the two-year feasibility studies.

From the viewpoint of the logistic feasibility, there was no serious practical problem and we

concluded that the 2002 coastal survey off Kushiro was conducted successfully.

ACKNOWLEDGMENTS

The authors are greatly indebted to Dr. Hiroshi Hatanaka, the project leader of the full-scale JARPN II surveys, the Fisheries Research Agency, Dr. Seiji Ohsumi, the Institute of Cetacean Research (ICR) and Mr. Joji Morishita, 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 Japan 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

Fisheries Agency of Japan, 2002. Assessments for the coastal fisheries stocks in the waters off Japan (Assessments by species and stocks). The coastal division of the Fisheries Agency of Japan and the Fisheries Research Agency, September 2002, 927pp. (in Japanese).

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, 2000. Research plan for cetacean studies in the western North Pacific under special permit (JARPN II) Feasibility study plan for 2000 and 2001). Paper SC/52/O1 submitted to the 52th IWC Scientific Committee, 68pp.

Government of Japan, 2002a. Research plan for cetacean studies in the western North Pacific under special permit (JARPN II). Paper SC/54/O2 submitted to the 54th IWC Scientific Committee.

Government of Japan (Fujise, Y., Kawahara, S., Pastene, L.A. and Hatanaka, H. eds.), 2002b. Report of 2000 and 2001 feasibility study of the Japanese Whale Research Program under Special Permit in the western North Pacific-Phase II (JARPN II). Paper SC/54/O17 submitted to the 54th IWC Scientific Committee, 202pp.

Hatanaka, H. and Miyashita, T. 1997. On the feeding migration of the Okhotsk Sea-West Pacific Stock of minke whales, estimates based on length composition data. *Rep.int. Whal. Commn* 47:557-564.

Kato, H. 1992. Body length, reproduction and stock separation of minke whales off northern Japan. *Rep.int. Whal. Commn* 42:443-453.

Miyashita, T. and Hatanaka, H. 1997. A note on whaling grounds for the western North Pacific minke whale. *Rep.int. Whal. Commn* 47:539-542.

Tamura, T. and Fujise, Y. 2002. Geographical and seasonal changes of the prey species on minke whale in the Northwestern Pacific. ICES Journal of Marine Science, 59:516-528.

Table 1. Searching days, hours and distances made by the three small-type whaling catcher boats in the 2002 coastal whale survey off Kushiro, in the JARPN II.

Period		Sampling vessels*1			Total
		28T	31S	7K	
First period	Days	8	8	8	24
(10 Sept.-18 Sept.)	hours	16.9	22.5	27.7	67.1
	distances (n.miles)	178.1	239.5	274.6	692.2
Second period	Days	9	9	9	27
(19 Sept.- 30 Sept.)	hours	47.8	49.7	54.7	152.2
	distances (n.miles)	518.7	527.2	596.3	1642.2
Third period	Days	7	7	7	21
(1 Oct.-12 Oct.)	hours	38.5	32.1	40.5	111.1
	distances (n.miles)	403.7	347.0	437.7	1188.4
Total	Days	24	24	24	72
	hours	103.2	104.3	122.9	330.4
	distances (n.miles)	1100.5	1113.7	1308.6	3522.8

*1: 28T: *Taisyo Maru* No.28; 31S: *Sumitomo Maru* No.31; 7K: *Katsu Maru* No.7

Table 2. Cetacean species and number of sightings made by the three small-type whaling catcher boats in the 2002 coastal whale survey off Kushiro, in the JARPN II.

		Primary		Secondary		Total	
Period	species	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
First period (10 Sept.-18 Sept.)	Common minke whale	45	45	5	5	50	50
	Like minke whale	1	1	-	-	1	1
	Unidentified cetacean	4	4	-	-	4	4
Second period (19 Sept.- 30 Sept.)	Common minke whale	59	62	16	18	75	80
	Like minke whale	1	1	-	-	1	1
	Baird's beaked whale	15	126	2	23	17	149
	Unidentified cetacean	12	12	-	-	12	12
Third period (1 Oct.-12 Oct.)	Common minke whale	38	39	8	8	46	47
	Like minke whale	3	3	-	-	3	3
	Fin whale	2	2	-	-	2	2
	Humpback whale	1	2	-	-	1	2
	Baird's beaked whale	10	53	1	3	11	56
	Unidentified cetacean	1	1	2	2	3	3
Total	Common minke whale	142	146	29	31	171	177
	Like minke whale	5	5	-	-	5	5
	Fin whale	2	2	-	-	2	2
	Humpback whale	1	2	-	-	1	2
	Baird's beaked whale	25	179	3	26	28	205
	Unidentified cetacean	17	17	2	2	19	19

Table 3. Density index of minke whales in the 2002 coastal whale survey off Kushiro, in the JARPN II.

	Primary sightings		Searching	Distances		
Period	Sch.	Ind.	Hours	(n.miles)	SPUE*1	DI*2
10 Sept.-14 Sept.	23	23	40.3	443.1	0.57	5.19
15 Sept.-19 Sept.	32	33	49.3	480.3	0.65	6.87
20 Sept.-24 Sept.	21	23	51.5	569.4	0.41	4.04
25 Sept.-29 Sept.	18	18	60.6	657.9	0.30	2.74
30 Sept.- 4 Oct.	10	10	38.6	374.5	0.26	2.67
5 Oct.- 9 Oct.	14	14	42.4	475.9	0.33	2.94
10 Oct.-12 Oct.	24	25	47.7	521.7	0.50	4.79
Total	142	146	330.4	3522.8	0.43	4.03

*1: No. of schools sighted per 1 hour searched.

*2: No. of schools sighted per 100 n. miles searched.

Table 4. Summary of biological data and samples collected during the 2002 coastal whale survey in the JARPN II.

Samples and data	Number of whales		
	Male	Female	Total
Body length and sex	32	18	50
External body proportion	32	18	50
Photographic record and external character	32	18	50
Diatom film record and sampling	32	18	50
Body scar record	32	18	50
Measurements of blubber thickness (eleven points)	32	18	50
Body weight	32	18	50
Body weight by parts	1	-	1
Skin tissues for DNA study	32	18	50
Muscle, liver and heart tissues for isozyme analysis	32	18	50
Muscle, liver, kidney and blubber tissues for chemical analysis	32	18	50
Muscle, liver, blubber, vertebrae and stomach contents for lipid analysis	1	-	1
Mammary grand; lactation status, measurement and histological sample	-	18	18
Uterine horn; measurement and endometrium sample	-	18	18
Collection of ovary	-	18	18
Photographic record of foetus	1	2	3
Foetal sex (identified by visual observation)	1	2	3
Foetal length and weight	1	2	3
External measurements of foetus	1	2	3
Collection of foetus	1	-	1
Testis and epididymis; weight and histological sample	32	-	32
Stomach content, conventional record	32	18	50
Volume and weight of stomach content in each compartment	32	18	50
Stomach contents for feeding study	31	17	48
Record of external parasites	32	18	50
Earplug for age determination	32	18	50
Tympanic bulla for age determination	32	17	49
Largest baleen plate for morphologic study and age determination	32	18	50
Baleen plate measurements (length and breadth)	32	18	50
Photographic record of baleen plate series	32	18	50
Length of each baleen plate series	32	18	50
Vertebral epiphyses sample	32	17	49
Number of vertebrae	32	16	48
Number of ribs	32	18	50
Skull measurement (length and breadth)	32	18	50
Collection of skull	1	-	1
Collection of whole skeleton	-	1	1

Table 5. Body length (m) of minke whales sampled by the 2002 coastal whale survey in the JARPN II.

		Male					Female				
Period		Mean	S.D.	Min	Max	n	Mean	S.D.	Min	Max	n
First period	(10 Sept.-18 Sept.)	5.93	1.14	4.69	7.98	10	6.42	1.33	4.53	8.04	7
Second period	(19 Sept.- 30 Sept.)	6.24	1.24	4.51	7.85	15	6.20	1.33	4.77	8.27	5
Third period	(1 Oct.-12 Oct.)	6.83	0.69	5.56	7.60	7	6.50	1.72	4.57	8.15	6
Total		6.28	1.13	4.51	7.98	32	6.39	1.39	4.53	8.27	18

Table 6. Body weight (t) of minke whales sampled by the 2002 coastal whale survey in the JARPN II.

		Male					Female				
Period		Mean	S.D.	Min	Max	n	Mean	S.D.	Min	Max	n
First period	(10 Sept.-18 Sept.)	2.59	1.52	1.10	5.24	10	3.53	2.16	1.02	6.90	7
Second period	(19 Sept.- 30 Sept.)	3.21	1.71	0.86	5.57	15	3.43	2.78	1.22	8.23	5
Third period	(1 Oct.-12 Oct.)	3.97	1.27	2.34	5.76	7	3.93	2.71	1.20	7.38	6
Total		3.19	1.60	0.86	5.76	32	3.63	2.38	1.02	8.23	18

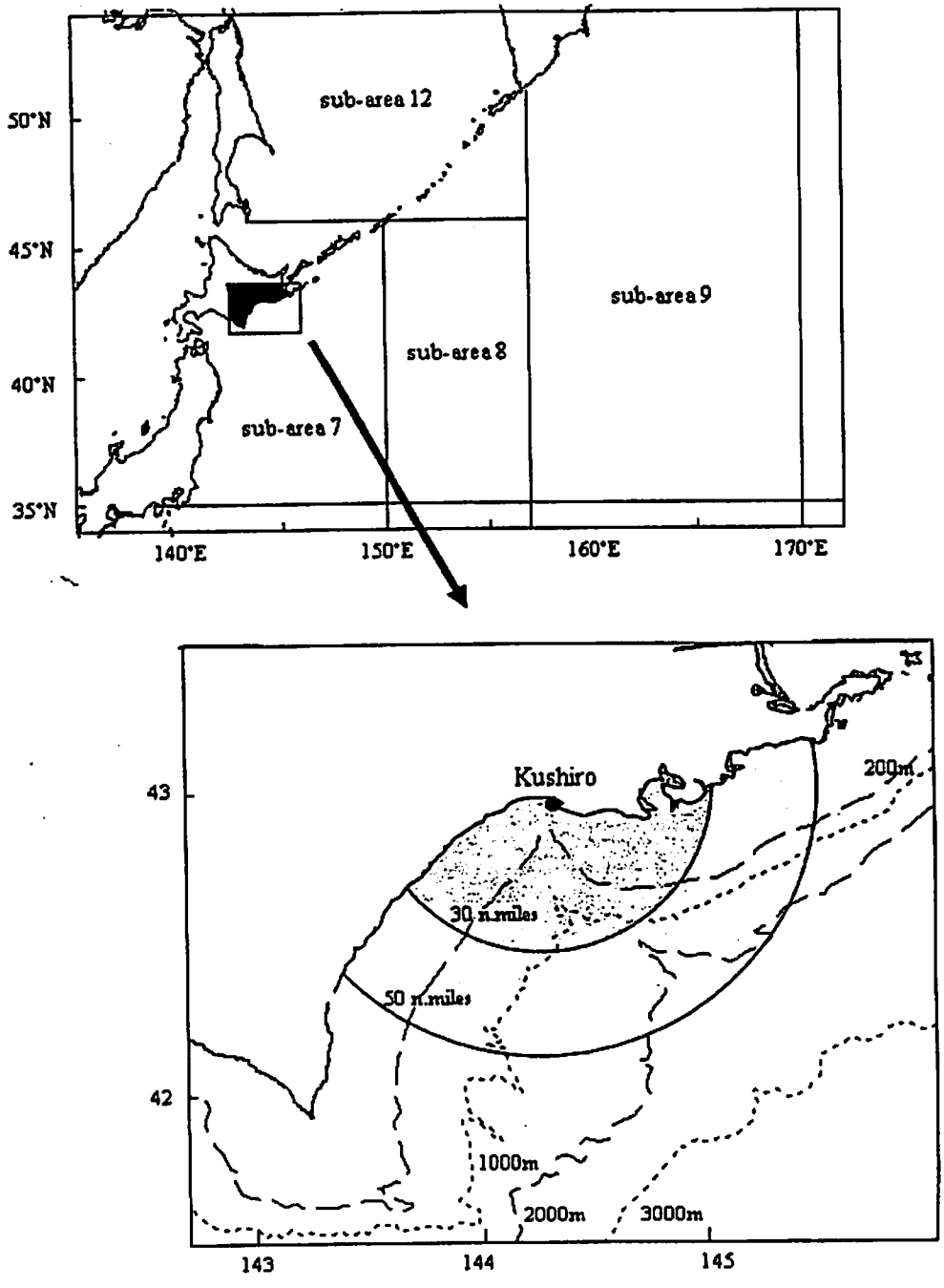

Fig. 1. The IWC sub-areas for western North Pacific minke whales (upper) and research area of the 2002 coastal whale survey in the JARPN II (lower).

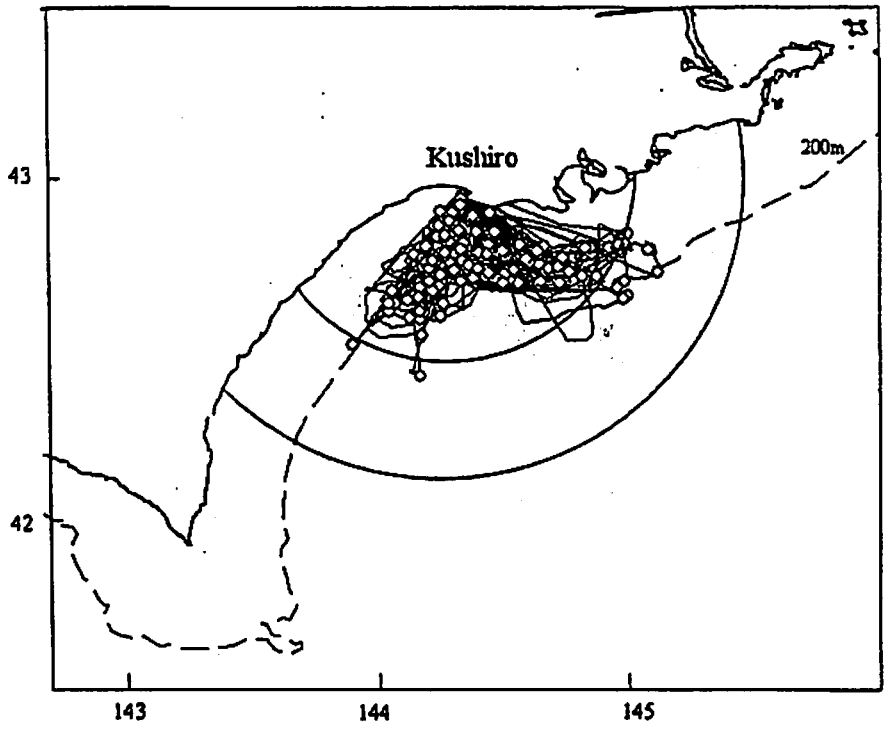

Fig. 2. Cruise tracks and sighting positions of minke whales (○) made by the 2002 coastal whale survey in the JARPN II.

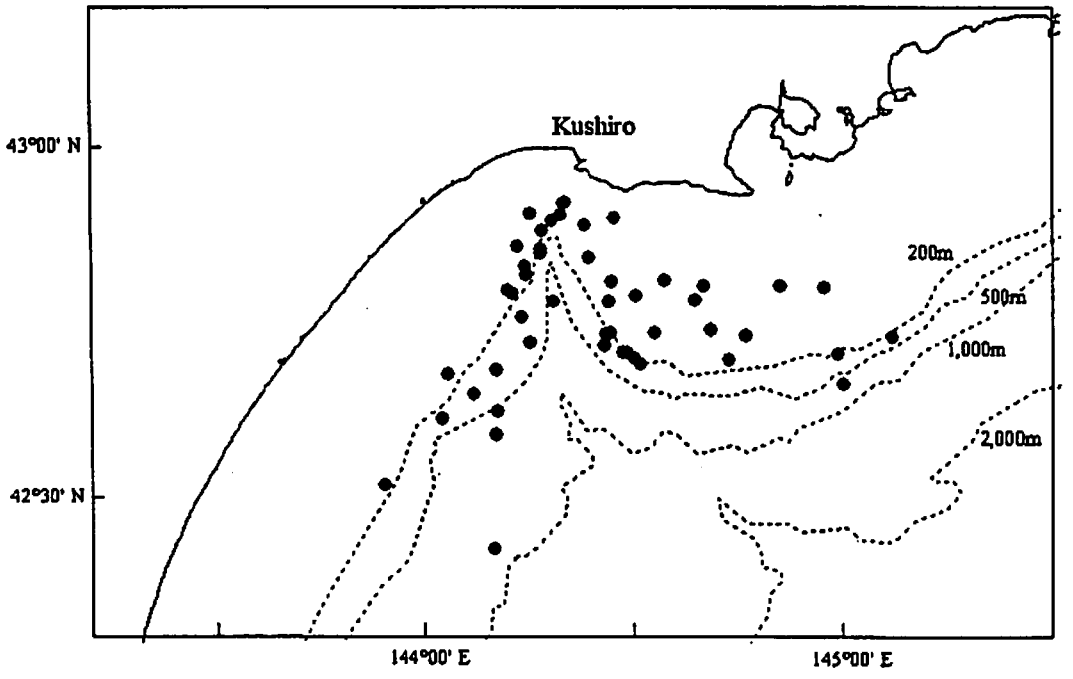

Fig. 3. Distribution of the sighting positions of sampled minke whales taken by the 2002 coastal whale survey in the JARPN II.

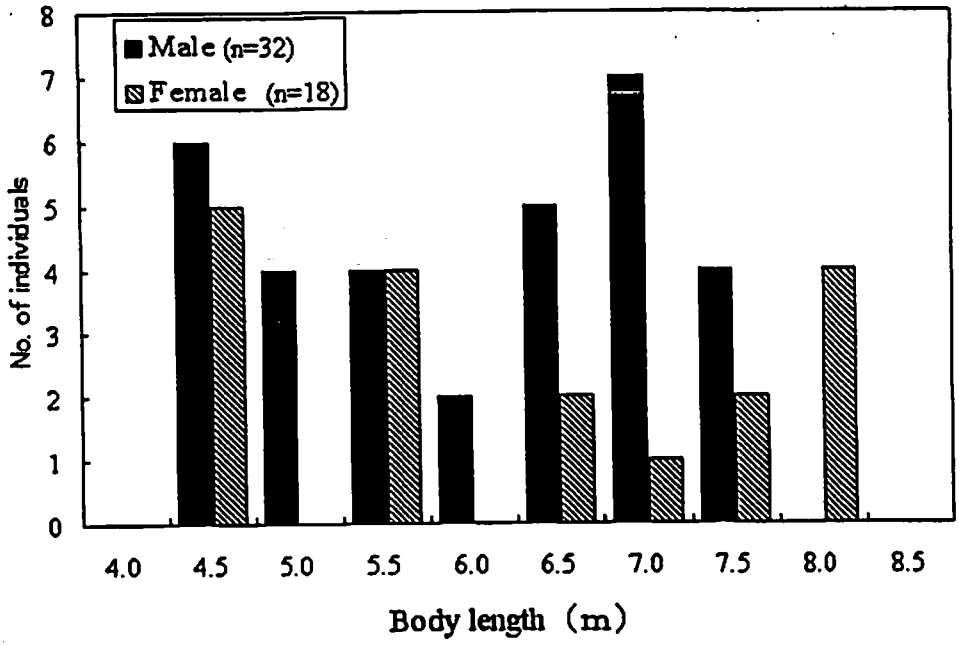

Fig. 4. Body length frequency of minke whales sampled by the 2002 coastal whale survey in the JARPN II.

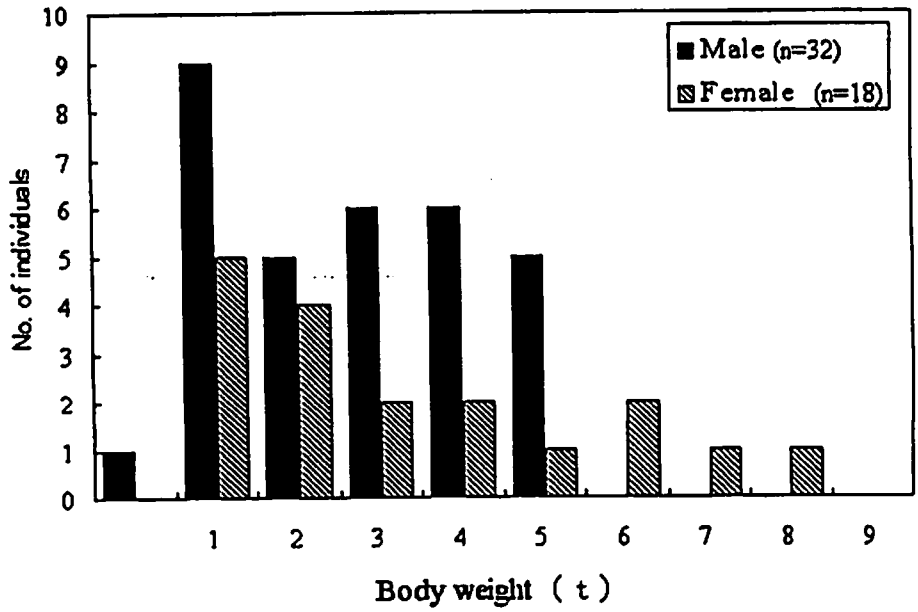

Fig. 5. Body weight frequency of minke whales sampled by the 2002 coastal whale survey in the JARPN II.

Appendix 1

2002 prey species survey (coastal component) of JARPN II

SHIGEYUKI KAWAHARA[1], HIROSHI KIWADA[2], YO SUENAGA[3] AND MAKI KATAOKA[3]

[1] *National Research Institute of Far Seas Fisheries, 5-7-1, Shimizu-orido, Shizuoka, 424-8633, Japan*

[2] *The Institute of Cetacean Research, 4-18 Toyomi-cho, Chuo-ku Tokyo, 104-0055, Japan*

[3] *Nippon Kaiyo Co., Ltd., Tokyo Branch Office, 9-2 Sakae-cho, Kita-ku Tokyo, 101-0041, Japan*

ABSTRACT

A prey species survey was conducted concurrently with the sampling survey for minke whale by small-type whaling catcher boats in September and October 2002 as a part of coastal component of 2002 JARPN II. The primary objective of cooperative study was to estimate the prey preference of minke whale. While the whale sampling survey was conducted in the coastal waters within the 30 nautical miles (max 50 nautical miles) from Kushiro, the prey species survey was conducted in wider area off the eastern Hokkaido to cover the distribution of main prey species. Zigzag track lines were set to cover the whole survey area. The distribution and abundance of the prey species were investigated with the quantitative echosounder (EK500) on board a stern trawler-type research vessel, *Kaiyo maru* No. 3 (473.65 GT) steaming at about 10 knots along the track lines during daytime. Acoustic data were acquired with operating frequency at 38 and 120 kHz. Species compositions of acoustical backscatterings were identified using midwater trawl and IKMT. In addition, trawl operations were made at predetermined stations. In the acoustic survey Japanese anchovy and walleye pollock were found in shoals on the continental shelf and upper slope, respectively. Krills were mainly distributed at depths from 150 to 200m in the open sea. Pacific saury was confined to the northeastern part of the survey area, which is consistent with the situations in 2002 fishing season. Japanese common squid were caught from the edge of continental shelf to the open sea.

INTRODUCTION

The full-scale Japanese Whale Research Program under Special Permit (JARPN II) started in 2002 after the success of the two-year feasibility study (Government of Japan, 2002a and 2002b). The overall goal of JARPN II is to contribute to the conservation and sustainable use of marine living resources including whales in the western North Pacific, especially within Japan's EEZ. The priority is put on feeding ecology and ecosystem studies, involving studies of prey consumption by cetaceans, prey preferences of cetaceans and ecosystem modeling. Prey preference of cetaceans is one of the important parameters in the most ecosystem models and estimated with the cooperative whale sampling and prey species surveys (Haug et al., 1995). As it is difficult to cover the coastal area, especially in spring and autumn, by the Nisshin Maru fleet, the full-scale JARPN II has a new coastal component, that is, the sampling survey for minke whale by small-type whaling catcher boats.

A prey species survey was conducted concurrently with the coastal sampling survey during autumn in 2002 as in the case of the offshore surveys. In this document, the results of the 2002 prey species survey of the coastal component are presented.

MATERIALS AND METHODS

While the sampling survey of minke whale was conducted in the coastal waters within the 30 nautical miles (max 50 nautical miles) from Kushiro, the prey species survey was conducted in wider area off the eastern Hokkaido, east of Cape Erimo and north of 41°N, to cover the distribution of main prey species (Fig. 1). As many gears were set near the shore, the waters shallower than 50m were excluded in principle. The survey area was divided into two parts; coastal side and offshore side. A zigzag track line was set to cover each part. The prey species survey was conducted from September 10 to October 6 2002 consisting of three terms; the first from September 10 to 20, the second from September 20 to 30 and the third from September 30 to October 6. The whole survey area was covered once in the first and second terms. In the third term the area off Kushiro, where the sampling survey for minke whale was conducted, was covered again. The distribution and abundance of the prey species were investigated with the quantitative echosounder (EK500), midwater trawl and Isaacs-kidd Midwater Trawl (IKMT) on board a stern trawler-type research vessel, *Kaiyo maru* No. 3 (473.65 GT) steaming at about 10 knots along the track lines. The survey was conducted during the daytime from an hour after sunrise to an hour before sunset (generally from 6:00 to 16:30 JST). Sighting survey and oceanographic observations with CTD were conducted on board *Kyoshin Maru* No. 2.

Acoustic data were acquired with EchoView version 2.10.48 (Sonar Data Co., Ltd.) with operating frequency at 38 and 120 kHz of the hull-mounted transducers. Calibrations were carried out off Akkeshi, Hokkaido (September 10 2002) using the copper sphere technique. The mid-water trawl net used had a mouth opening of 30x30m and a 17.5mm liner cod end. The depth and the height of the mouth of the net were recorded with the small-type depth recorders. Towing speed of the trawl net was 3-5 knots. Two types of mid-water trawlings were made. Targeting trawlings for less than about 0.5 hours were to identify the species and size compositions of biological backscatterings detected by the echosounder. Samples were identified to the species level and weighed aboard the ship. For the major species, a sample of about 100 animals was taken and the lengths were measured to cm below. Some frozen samples were taken for further analysis in the laboratory. Also, IKMT was used to the biological backscatterings expected as micronekton and/or zooplankton such as krills on the echosounder. Samples were preserved in 10 % formalin for species identification at the laboratory.

Another type of trawlings was made at predetermined stations to estimate the abundance and distribution of cephalopods and neustnic organisms such as Japanese common squid and Pacific

saury that are difficult to detect with the echosounder. More efforts were allocated to the trawlings at predetermined stations than targeting trawlings in the survey. At predetermined stations the midwater trawl net was towed in a stairs-like fashion at three depth layer; 0-30m (surface) 30-60m and 60-90m. Towing duration was 60 minutes in total, 20 minutes for each layer. Sometimes surface trawlings were conducted with the special floats attached the bridle. Samples taken were processed as in the targeting trawlings.

Acoustic data are being analysed at the laboratory. The analysed depth range was from the surface to 200m. Data collected at 38 kHz and 120 kHz were used mainly for fishes and krills, respectively. In principle, backscatterings on the echosounder were identified based mainly on the results of trawl and IKMT samplings. The school shape and backscattering intensity were also used for species identification. Backscatterings were identified as krills if ΔSv (the difference of Sv between 38 and 120 kHz) falls between 10 and 15 dB (Miyashita et al. 1997). The integration was made at an interval of one nautical mile by 50 m depth zone.

RESULTS

The planned track lines were almost covered in the acoustic survey. A summary of the midwater trawl and IKMT operations was shown on Table 1. The positions of midwater trawl and IKMT operations were shown in Fig. 2. Targeting trawlings and IKMT were made eight and two times, respectively. The midwater trawl operations were made at 34 predetermined stations, 21 of them from the layer between 0-100m and 13 from the surface layer. In the acoustic survey Japanese anchovy were found in shoals on the continental shelf (Fig. 3), as well as in the upper layer of the open sea. Walleye pollock were confined to on the upper continental slope (Fig. 3). Krills were mainly distributed in shoals at depths from 150 to 200m in the open sea (Fig. 4). Based on the catches at predetermined stations, Pacific saury were distributed in the northeastern part of the survey area (Fig. 5). This was consistent with the situations of the fisheries in 2002 when Pacific saury were recruited in the late fishing season. Japanese common squid were caught from the edge of continental shelf to the open sea (Fig. 6). The prey preference of minke whale will be analyzed comprehensively with the distribution of minke whale from the sighting survey, the diet composition from the whale sampling survey, the distribution and abundance of prey from the prey species survey and the oceanographic conditions from the CTD observations.

REFERENCES

Government of Japan. 2002a. Report of 2000 and 2001 feasibility study of the Japanese Whale Research Program under Special Permit in the Western North Pacific-Phase II (JARPN II). IWC/SC/54/O17: 202pp.

Government of Japan. 2002b. Research Plan for Cetacean Studies in the Western North Pacific under Special Permit (JARPN II). IWC/SC/54/O2: 115pp.

Haug, T., H. Gjosater, U. Lindstrom, K. T. Nilssen and I. Rottingen. 1995. Spatial and temporal variations in northeast Atlantic minke whale Balaenoptera acutorostrata feeding habits. Whales, seals, fish and man. Elservier Science B.V: 225-239.

Miyashita, K., Aoki, I., Seno, K., Taki, K. and Ogishima. 1997. Acoustic identification of isada krill, Euphausia pacifica Hansen, off the Sanriku coast, north-eastern Japan. Fish. Oceanogr. 6. 266-271.

Murase, H., Tamura, T., Kiwada, H.; Fujise, Y., Watanabe, H., Ohizumi, H. and Kawahara, S. 2002. Preliminary estimation of prey preference of minke and Bryde's whales based on JARPN II. Appendix 5, pp 97-117. In: Fujise, Y., Kawahara, S., Pastene, L. A. and Hatanaka, H. 2002. Report of 2000 and 2001 feasibility study of the Japanese whale research program under special permit in the western North Pacific – phase II. Paper SC/54/O17 submitted to the 54th IWC Scientific Committee Meeting, 202 pp.

Table 1. Midwater trawl and IKMT operations

St	Date			Gear	Target/ Prede.	Dura. (min.)	Depth (m)	Casting Time	Latitude		Longitude		SST (°C)
1	2002	9	10	Trawl	Prede.	30	0- 30	16:05	42	28.6	144	46.7	14.2
2	2002	9	11	Trawl	Prede.	60	0-100	07:18	42	22.2	144	56.1	15.8
3	2002	9	11	Trawl	Prede.	60	0-100	11:54	42	43.1	144	59.2	14.4
4	2002	9	12	Trawl	(failed)	-	-	07:40	42	06.2	144	56.1	16.2
5	2002	9	14	Trawl	Prede.	60	0-100	06:38	42	47.4	144	45.6	14.5
6	2002	9	14	Trawl	Prede.	60	0-100	10:22	42	30.9	144	39.0	13.1
7	2002	9	14	Trawl	Prede.	60	0-100	13:59	42	05.3	144	39.0	16.5
8	2002	9	15	IKMT	Target	20	175, 200	07:10	42	20.2	144	28.2	14.8
9	2002	9	15	Trawl	Target	20	0- 30	10:10	42	36.8	144	17.7	14.9
10	2002	9	15	Trawl	Target	7	100-150	13:00	42	48.0	144	13.1	16.2
11	2002	9	15	Trawl	Prede.	60	0-100	14:48	42	47.2	144	10.7	15.6
12	2002	9	16	Trawl	Target	7	0- 30	07:25	42	55.3	144	17.2	15.2
13	2002	9	16	Trawl	Target	5	130-160	10:23	42	45.8	144	26.3	14.6
14	2002	9	16	Trawl	Prede.	60	0-100	14:20	42	25.1	144	15.5	15.4
15	2002	9	17	Trawl	Prede.	60	0-100	07:05	42	01.5	144	20.3	13.9
16	2002	9	17	Trawl	Prede.	20	0- 30	10:19	42	11.1	144	12.8	14.6
17	2002	9	17	Trawl	Target	5	10- 40	15:03	42	39.9	143	52.0	14.1
18	2002	9	18	Trawl	Target	6	70-100	12:20	42	33.1	143	52.9	14.5
19	2002	9	18	Trawl	Prede.	60	0-100	14:49	42	15.8	144	00.3	14.2
20	2002	9	19	Trawl	Prede.	60	0-100	08:48	41	47.7	144	12.0	15.0
21	2002	9	19	Trawl	Prede.	20	0- 30	11:22	41	50.9	143	50.3	13.6
22	2002	9	21	Trawl	Prede.	30	0- 30	07:59	42	35.6	145	15.2	10.6
23	2002	9	21	Trawl	Prede.	60	0-100	10:34	42	22.2	145	31.5	14.0
24	2002	9	21	Trawl	Target	30	0- 30	13:00	42	27.2	145	35.2	11.2
25	2002	9	21	Trawl	Prede.	30	0- 30	15:30	42	47.2	145	38.3	12.6
26	2002	9	22	Trawl	Prede.	60	0-100	07:07	42	58.1	145	40.1	13.6
27	2002	9	22	IKMT	Target	25	60- 70	09:25	42	53.1	145	39.1	13.6
28	2002	9	22	Trawl	Prede.	60	0-100	13:10	42	31.0	145	59.9	12.9
29	2002	9	23	Trawl	Prede.	30	0- 30	07:56	42	01.1	145	51.4	15.1
30	2002	9	23	Trawl	Prede.	60	0-100	11:37	41	31.9	145	42.7	16.4
31	2002	9	24	Trawl	Prede.	60	0-100	07:52	41	00.0	145	35.9	15.8
32	2002	9	24	Trawl	Prede.	30	0- 30	13:17	41	34.3	145	21.3	15.5
33	2002	9	25	Trawl	Prede.	60	0-100	06:14	41	56.1	145	12.4	15.8
34	2002	9	25	Trawl	Prede.	30	0- 30	08:41	42	07.9	145	08.5	15.5
35	2002	9	26	Trawl	Prede.	60	0-100	08:38	41	47.0	144	59.3	15.2
36	2002	9	26	Trawl	Prede.	30	0- 30	11:49	41	24.1	144	50.3	15.3
37	2002	9	26	Trawl	Prede.	60	0-100	14:50	40	59.9	144	42.1	19.7
38	2002	9	27	Trawl	Prede.	60	0-100	08:39	41	22.3	144	29.4	19.0
39	2002	9	27	Trawl	Prede.	30	0- 30	12:40	41	47.4	144	15.9	14.0
40	2002	9	27	Trawl	Target	35	0- 30	15:40	41	26.5	144	27.2	15.1
41	2002	9	28	Trawl	Prede.	30	0- 30	08:47	41	24.4	144	03.7	15.9
42	2002	9	28	Trawl	Prede.	60	0-100	12:14	41	00.3	143	50.5	21.5
43	2002	9	28	Trawl	Prede.	30	0- 30	14:49	40	59.2	143	31.7	21.0
44	2002	9	29	Trawl	Prede.	60	0-100	07:10	41	28.7	143	28.9	15.8
45	2002	9	29	Trawl	Prede.	30	0- 30	12:40	41	54.7	143	27.9	14.0

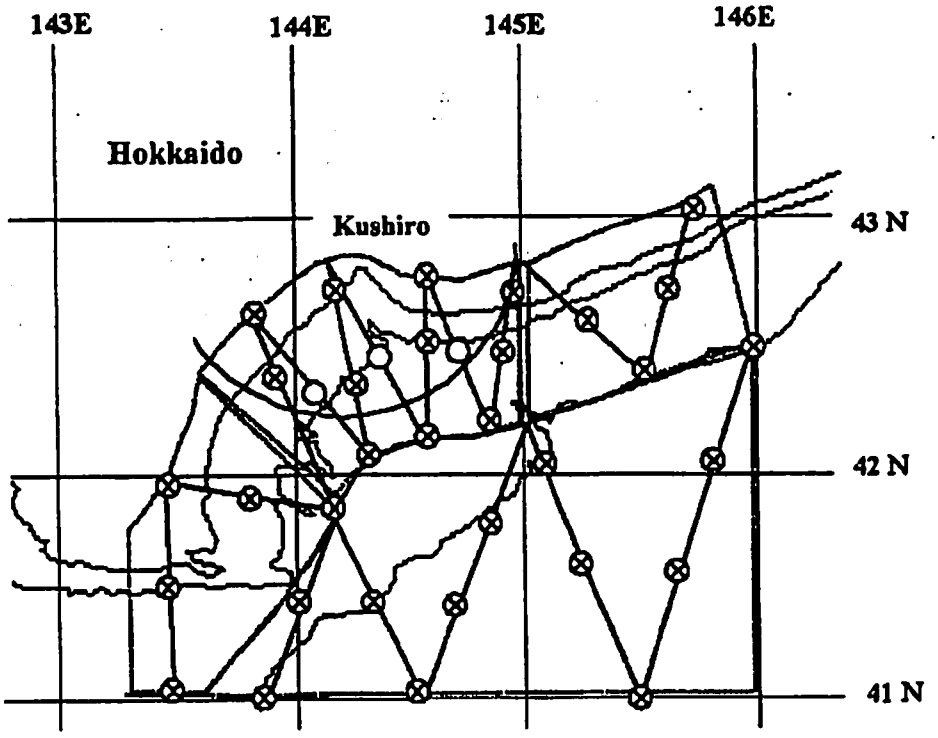

Fig. 1. The area and track lines for 2002 prey species survey (coastal component).

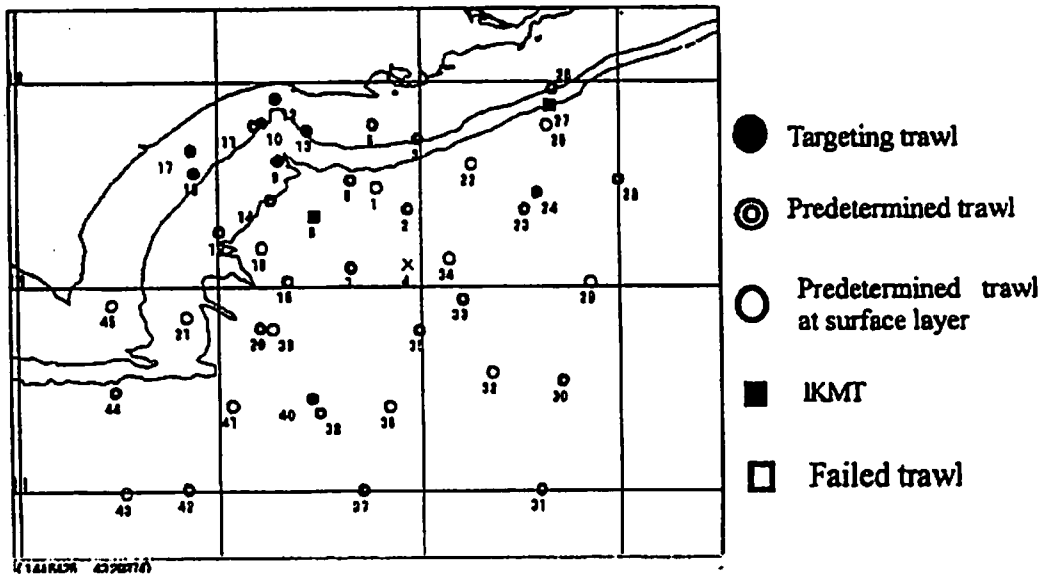

Fig. 2. Positions of midwater trawl and IKMT operations.

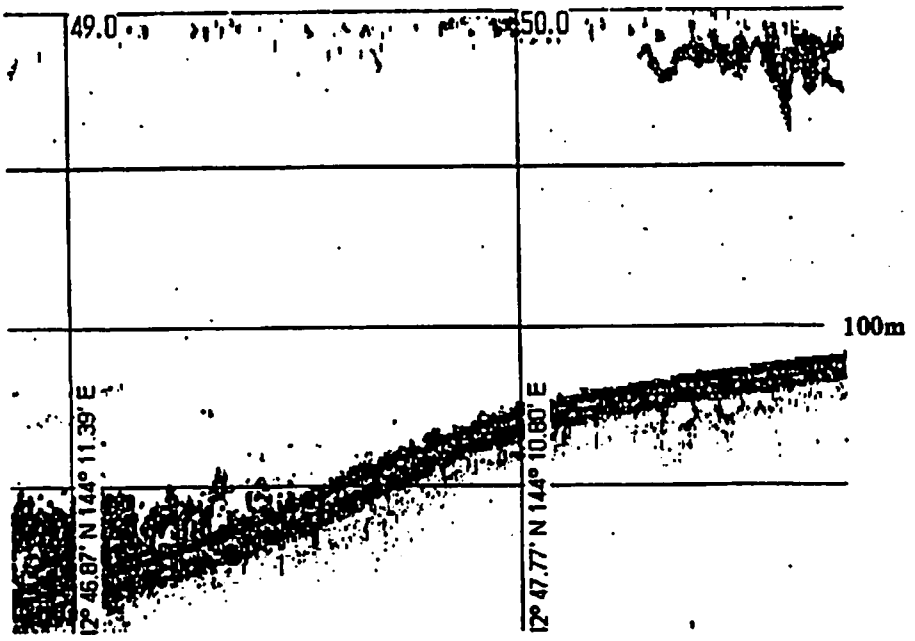

Fig. 3. Japanese anchovy (above) and walleye pollock (below) on the echo diagram at the edge of continental shelf off Kushiro.

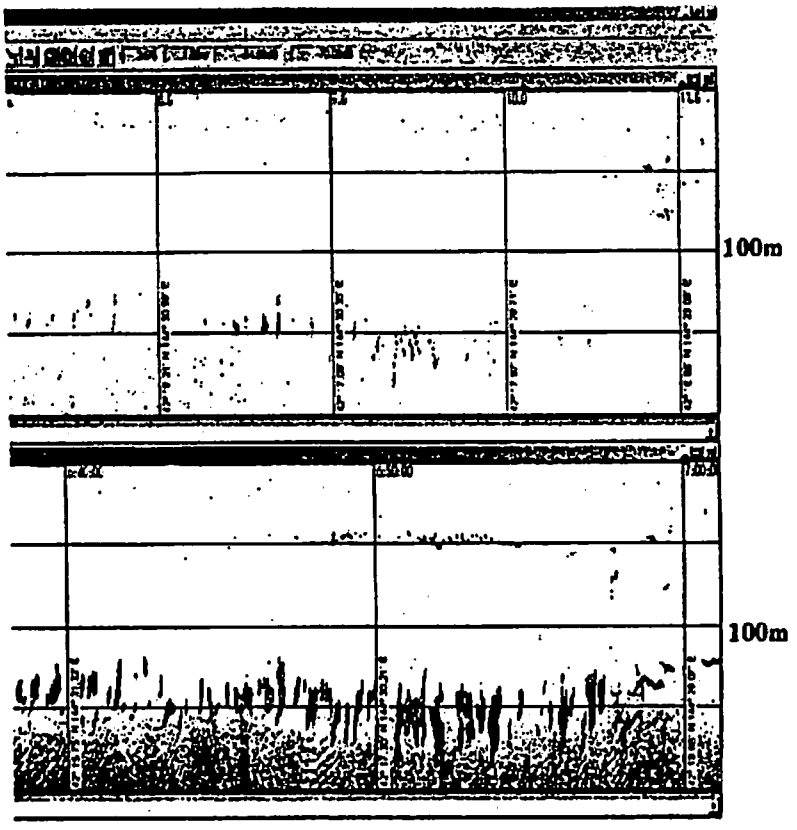

Fig. 4. Krills in the open sea on the echo diagram at 38 kHz (above) and 120 kHz (below).

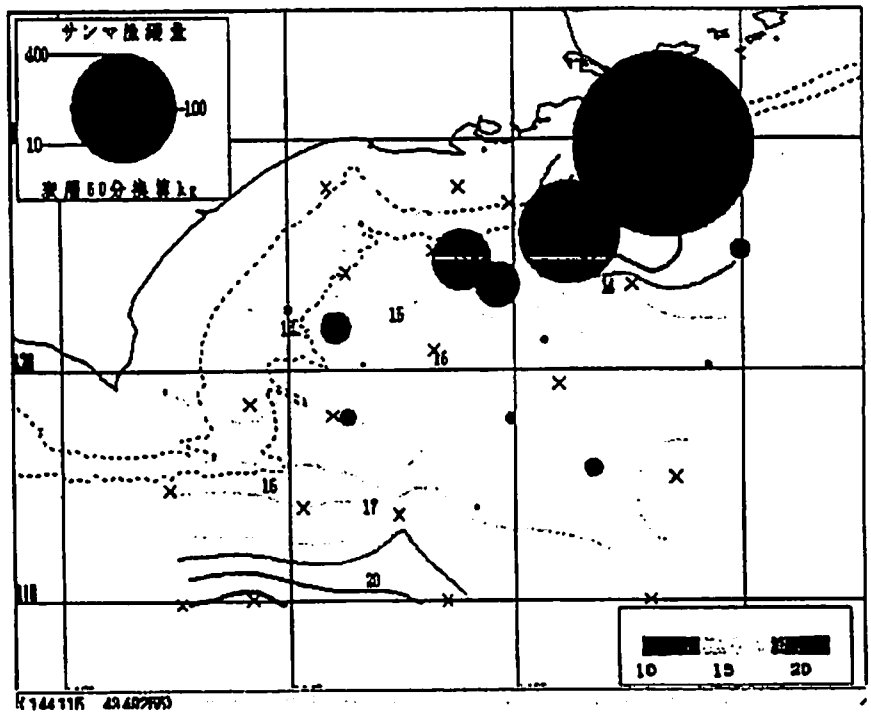

Fig. 5. Distribution of catches per 60 minute towing of Pacific saury.

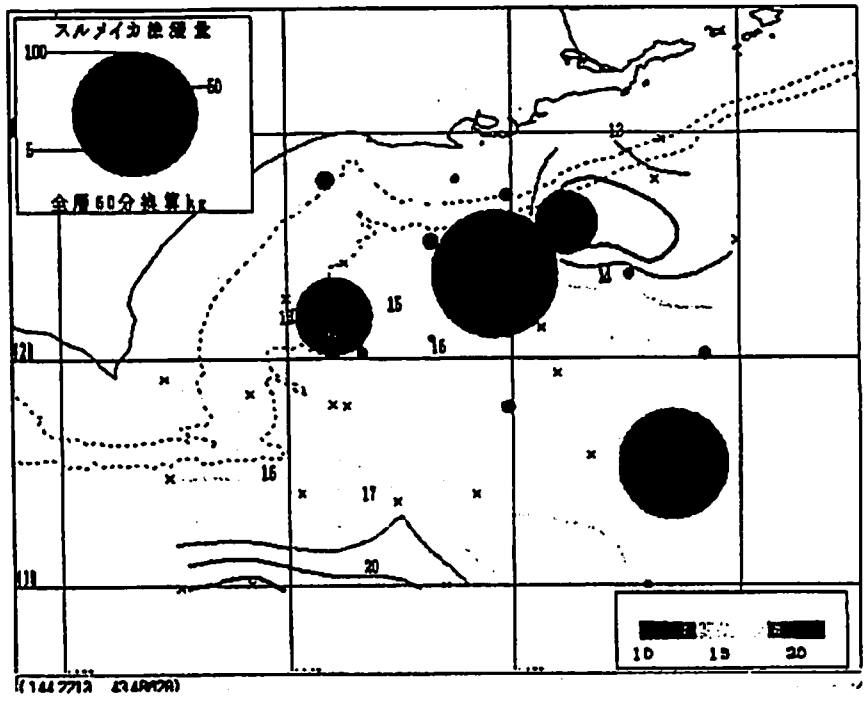

Fig. 6. Distribution of catches per 60 minute towing of Japanese common squid.

Appendix 2

Cruise report of the dedicated sighting survey in 2002 JARPNII coastal survey off Kushiro, northeast Japan.

SHIGETOSHI NISHIWAKI, KAZUKI FUKUDOME, HIROSHI KIWADA, KOJI MATSUOKA

The Institute of Cetacean Research, 4-5 Toyomi-cho, Chuo-ku Tokyo, 104-0055, Japan
Corresponding E-mail address: nisiwaki@cetacean.jpl

ABSTRACT

A cetacean sighting survey using the line transect method was conducted concurrently with the whale sampling and the whale prey surveys off the coast of Kushiro, Hokkaido, Japan in September 2002 as a part of coastal component of 2002 JARPN II full scale study. The primary objective of the sighting survey was abundance estimation of baleen whale in the survey area. *Kyoshin-maru* No.2 was dedicated to the sighitng survey. Total searching distances were 681.5 n.miles. A total of 394 individuals of 176 schools primary sightings were made. Common minke and sperm whales were dominant in the survey area. Oceanographic observations were made with CTD at 33 stations down to 1000m. Sea surface environmental data such as SST were collected using EPCS for 17 days..

INTRODUCITON

A cetacean sighting survey using the line transect method was conducted concurrently with the whale sampling and the whale prey surveys off the coast of Kushiro, Hokkaido, Japan in September 2002 as a part of coastal component of 2002 JARPN II full scale study (Government of Japan, 2002a and 2002b). The primary objective of this survey was to estimate baleen whale abundance in the coastal component survey area. Preliminary results of the cetacean sighting survey are presented in this paper.

MATERIALS AND METHODS

The cetacean sighting survey was conducted in small survey block, 7MO, which were set within Sub-area 7 (Fig. 1). West of Erimo Peninsula was not surveyed considering both oceanographic conditions and available survey days. Near shore area of the survey block where the water depth is less than 50m was not surveyed because many fisheries gears were set in there. The survey block was further divided into the coastal and offshore area. The boundary between coastal and offshore area was set on the line parallel to the coastline and the distance between the boundary and coastline was 60 n.miles. Coastal area was divided into three at the two boundary lines, 135°E and 145°E. The survey was conducted from 10 to 24 September, 2002. Details of itinerary were shown in Table 1. *Kyoshin-maru* No.2 (KS2, 368GT) engaged in the cetacean sighting survey and oceanographic observations. Sighting survey procedures were same as offshore component of 2002 JARPN II but

the survey mode was only restricted to closing mode. Biopsy sampling experiments were attempted at right (*Eubalaena japonica*), blue(*Balaenoptera musculus*), fin (*B. physalus*), sei (*B. borealis*), Bryde's (*B. edeni*), humpback (*Megaptera novaeangliae*), grey (*Eschrichtius robustus*) and sperm (*Physeter macrocephalus*) whales as well as cetacean carcases. Natural marking record experiment was attempted at grey, blue, humpback and right whales. Biopsy sampling and natural marking experiments were attempted at the opportunistic basis. Large baleen whale feeding behavior visual observation was attempted. If the behavior was observed, it was recorded on video tape. CTD casts were made once per day in principal. In addition, the casts were made at the positions where the prey vessel requested to KS2. Maximum CTD deployment depth was set at 1000m. Sea surface environmental data were recorded once per minute using EPCS (Electric particle counting and sizing system when KS2 steamed on the tracklines.

RESULTS AND DISCUSSION

Surveyed tracklines and sighting positions of sei, sperm and common mike whales (*Balaenoptera acutorotrata*) were shown on Fig. 2. Total searching distances were 681.5 n.miles. A total of 394 individuals of 176 schools primary sightings and 27 individuals of 22 schools secondary sightings were made. Details of sightings were listed on Table 2. Right, sei, common minke and sperm whale were sighted in the survey area. Common mike whales were mainly distributed in the coastal zone of the survey area. In contrast, sperm whales were mainly distributed in the offshore zone of the survey area. Distribution patterns of minke and sperm whales could be attributed to bottom topography. Biopsy sampling experiment was attempted on 1 individual of 1 school of right whale (*Eubalaena japonica*) but no sample was collected. No natural marking record experiment was conducted. No large baleen whale feeding behavior was observed. CTD casts were made at 33 stations. EPCS was operated a total of 17 days.

ACKNOWLEDGEMENT

Special thanks is given to the crews and researchers for their dedication in collecting data. The authors would like to thank Dr. Hiroshi Hatanaka (National Institute of Fisheries Science, Japan). We also express the gratitude to Hiroto Murase (The Institute of Cetacean Research) for the preparation of English manuscript of this paper.

REFERENCES

Government of Japan. 2002a. Report of 2000 and 2001 feasibility study of the Japanese Whale Research Program under Special Permit in the Western North Pacific-Phase II (JARPN II). IWC/SC/54/O17: 202pp.

Government of Japan. 2002b. Research Plan for Cetacean Studies in the Western North Pacific under Special Permit (JARPN II). IWC/SC/54/O2: 115pp.

Table 1. Details of survey itinerary.

Date	Event
9/10	Depart Kushiro, Japan
9/11	Start sighting survey
9/24	End sighting survey
9/27	Arrive and depart Tsurumi, Japan. Disload survey equipments.
9/29	Arrive Setoda, Japan.

Table 2. Summary of cetacean sightings.

	Primary		Secondary	
Species	Sch.	Ind.	Sch.	Ind.
Sei whale	1	1	0	0
Common mine whale	38	40	14	16
Like minke	4	4	5	5
Right whale	0	0	1	1
Sperm whale	61	105	1	1
Unidentified large whale	1	1	0	0
Unidentified cetaceans	4	4	0	0

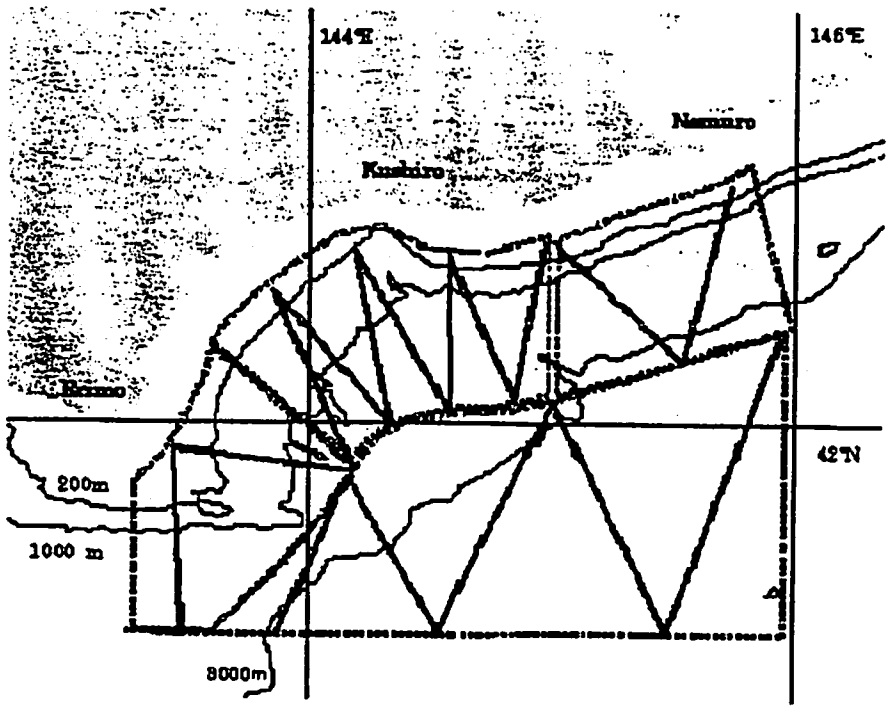

Fig. 1. Research area and planed tracklines by dedicated sighting survey vessel "*Kyoshin-Maru No.2*" in the 2002 JARPNII coastal survey.

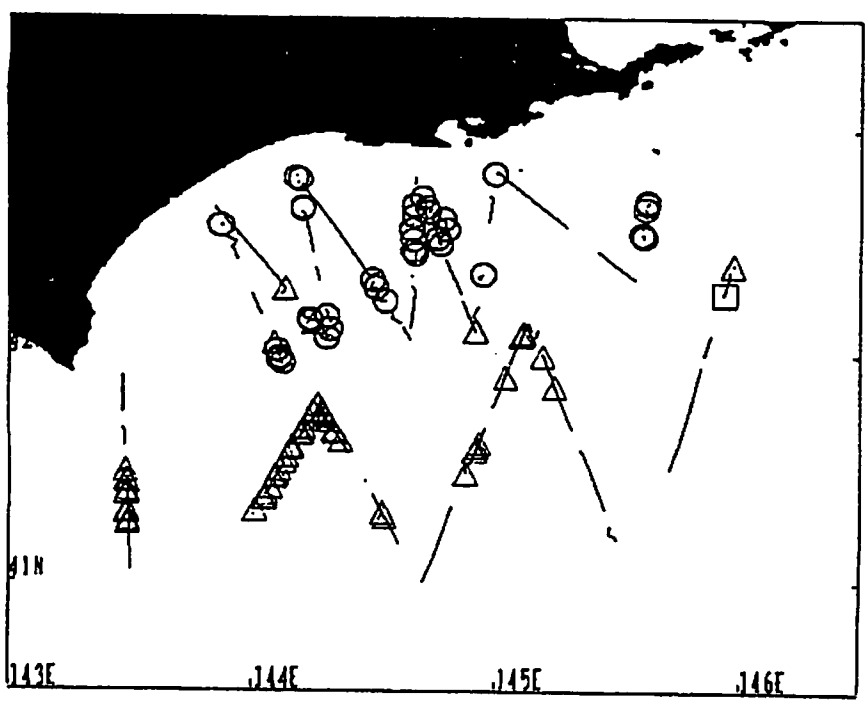

Fig 2. Searching effort and sighting positions of sei (□), common mike (○) and sperm whales (△)by dedicated sighting survey vessel "*Kyoshin-Maru No.2*" in the 2002 JARPNII coastal survey.