

# 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

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## ABSTRACT

On March 11 2011 the Ayukawa town, including all research facilities of JARPN II there, was destroyed by a large earthquake and tsunami. For this reason the spring coastal survey in 2011 could not be conducted in Ayukawa. Instead the spring survey was conducted in Kushiro. While the main reason for this change was logistic, we expected that the survey in a different season in this locality (Kushiro/spring) would provide new information on the feeding ecology of the common minke whales. The survey was conducted from 25 April to 10 June, using three small-type whaling catcher boats. Sampling of common minke whales was conducted in coastal waters within 50 n. miles from Kushiro port, and all animals collected were landed on the JARPN II research station established for biological examination. A total of 3,867.4 n.miles (375.2 hours) was surveyed and 36 schools (43 individuals) of common minke whales were sighted. A total of 17 animals was sampled. Average body length of the animals was 6.70 m (SD: 0.84,  $n=9$ ) for males and 6.29 m (SD: 1.02,  $n=8$ ) for females. Dominant prey species found in the forestomach were walleye pollock (*Theragra chalcogramma*) throughout all survey period, and krill (*Euphausia pacifica*), which was observed less frequently. This spring survey revealed that walleye pollock is one of the most important food items for common minke whales in Kushiro in both spring and autumn seasons. Distribution of the common minke whales appear to differ between spring and autumn surveys in Kushiro, at least for some of the years surveyed.

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 to complement the temporal and spatial gap of the offshore components using the *Nisshin Maru* research vessels since 2002. In the original JARPN II plan, the coastal component was presented as the two-year feasibility study to examine the logistic aspects of the methodology (Government of Japan, 2002). First feasibility survey was carried out in the coastal waters off Kushiro in

autumn 2002 (Kishiro *et al.*, 2003) and then 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 logistic aspects in 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 bases 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. For this reason the spring coastal survey could not be conducted in Ayukawa in 2011. Instead the spring survey was conducted in Kushiro. While the main reason for this change was logistic, we expected that the survey in a different season in Kushiro will provide new information on the feeding ecology of the common minke whales. There is no data of feeding ecology of common minke whales off Kushiro in spring through JARPN, JARPN II and past commercial whaling.

Here we report the survey carried out in coastal waters off Kushiro from 25 April to 10 June in 2011. 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 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 in Kushiro (Yoshida *et. al*, 2011). The area was in coastal water within 50 n. miles from Kushiro port, south eastern Hokkaido (Figure 1). The research area corresponds to the northern part of sub-area 7CN, established by the IWC (1994).

### Whale sampling

Three small-type whaling catcher boats were used as sampling vessels: *Seiwa Maru* (here in after referred as SW; 15.2GT), *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 in the Kushiro port for biological examination.

## BIOLOGICAL RESEARCH

All common minke whales collected were examined biologically by researchers at the research station. Research items are summarized in Table 1. These items are related to studies on feeding ecology, stock structure, life history and pollutions.

## RESULTS

### Searching effort

The whale sampling survey was conducted in the period from 25 April to 10 June, 2011. Cruise tracks by the sampling vessels SW, 7K and 51S are shown in Figure 2. The tracks covered widely the coastal waters of Kushiro. 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 3,867.4 n. miles and 375.2 hours, respectively (Table 2).

### Sightings

The cruise tracks covered widely distributed the coastal waters of Kushiro (Figure 2). A total of 36 schools (43 individuals) of common minke whales was sighted during searching (Table 3, Figure 3). No cow-calf pair was observed. Density index (DI, the number of primary sightings of schools per 100 n.miles searching) of common minke whales was calculated as 0.83 (Table 4). Three schools (four individuals) of fin whales were sighted during the searching.

### Sampling of common minke whales

A total of 17 common minke whales was sampled. No situation 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 9 males and 8 females. Sex ratio of males was 0.53. Average body length was 6.70 m (max=7.86, min=5.28, SD: 0.84) for males and 6.29 m (max=8.11, min=4.39, SD=1.02) for females (Table 5). The sexual maturity of animals collected is listed in Table 6. For males and females 67% and 13% of the animals sampled, were sexually mature, respectively. The mature female was pregnant.

### 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. Forestomach contents are listed in Table 7. Dominant prey species were walleye pollock (*Theragra chalcogramma*) (71.4%, 10 from 14 stomachs examined). Krill (*Euphausia pacifica*) was observed in four animals. The maximum net weight of forestomach contents was 105.3 kg, consisting of walleye pollock (Table 8).

## DISCUSSION

The present survey was the first coastal survey carried out in coastal waters off Kushiro in spring. A total of 17 animals were sampled of 60 planned for this survey. Limited sampling can be explained by the migration pattern of minke whale. Less minke whales migrate to Kushiro coastal area in spring than they do in fall. In addition low atmospheric pressure often disturbed the research activities during the 2011 survey and changeable weather condition and big waves obstructed sampling activities in offshore waters.

The sighting positions of the common minke whales in this survey were concentrated along the Kushiro canyon of north-south orientation (Figure 4). In contrast whales were distributed widely on the shelf region and along the 200-500m isobaths on the continental slope in the autumn surveys of 2010 and 2011 (Yoshida *et al.*, 2011; Kishiro *et al.*, 2012).

Figure 5 shows the histogram of body length of whales sampled in the 2011 spring survey and those in autumn surveys in the years 2011-2012 (Yoshida *et al.*, 2011; Kishiro *et al.*, 2012). Average body lengths in the spring 2011 survey (male=6.70m; female=6.29m) were higher than those in the 2010 autumn survey (male=5.80; female=5.44, Yoshida *et al.*, 2011) and similar to those in the 2011 autumn survey (male=6.24; female=6.05, Kishiro *et al.*, 2012).

Sexual maturities of whales sampled in Kushiro in the 2011 spring survey (male=67%; female=13%) were higher than those in the 2010 autumn survey (male=22% female=0%, Yoshida *et al.*, 2011) and similar to those in the 2011 autumn survey (male=54% female=12%, Kishiro *et al.*, 2012). These results reflect the migratory nature of minke whales by sex and reproductive classes.

Walleye pollock and krill were observed in the forestomach of common minke whales in this research, whereas walleye pollock, anchovy and Japanese saury had been observed in previous autumn surveys (Yoshida *et al.*, 2011; Kishiro *et al.*, 2010). The results in the spring survey suggest that walleye pollock is one of the most important food

items for common minke whales in Kushiro in both the spring and autumn seasons. Common minke whales feeding on walleye pollock in the 2011 spring survey were concentrated along the Kushiro canyon of north-south orientation, while those in 2010 autumn survey were concentrated along the 200-500m isobaths on the continental slope region.

In summary during the present survey, which involved a new area/season combination, new valuable information on feeding ecology of common minke whales was obtained.

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Table 1. Summary of biological data and samples collected during the 2011 JARPN II coastal survey off Kushiro in spring

Samples and data	Number of animals		
	Male	Female	Total
Body length and sex	9	8	17
External body proportion	9	8	17
Photographic record and external character	9	8	17
Diatom film record	9	8	17
Body scar record	9	8	17
Measurements of blubber thickness (5 points)	9	8	17
Whole body weight	9	8	17
Skin tissues for DNA study	9	8	17
Muscle, liver, kidney, spleen, blubber, heart and ventral groove for various analysis	9	8	17
Urine for various analysis	6	2	8
Muscle, liver, kidney, and blubber for heavy metal analysis	9	8	17
Muscle, liver, kidney, and blubber for organochlorine analysis	9	8	17
Collection of blood plasma	8	7	15
Mammary gland; lactation status, measurement and histological sample	-	8	8
Uterine horn; measurements and endometrium sample	-	8	8
Collection of ovary	-	8	8
Photographic record of fetus	-	1	1
Fetal length and weight	-	1	1
External measurement of fetus	0	0	0
Muscle, liver, kidney, heart, blubber and skin tissues of fetus	0	0	0
Collection of fetus	-	-	1
Testis and epididymis; weight and histological sample	9	-	9
Stomach contents, convenient record	9	8	17
Volume and weight of stomach content in each compartment	9	8	17
Observation of marine debris in stomach	9	8	17
Collection of stomach contents for feeding study	9	8	17
Record of external parasites	9	8	17
Earplug for age determination	9	8	17
Tympanic bulla for age determination	9	8	17
Eye lens for age determination	9	8	17
Largest baleen plate for morphologic study and age determination	9	8	17
Baleen plate measurements (length and breadth)	9	8	17
Photographic record of baleen plate series	9	8	17
Length of baleen series	9	8	17
Vertebral epiphyses sample	9	8	17
Number of ribs	9	8	17
Skull measurement (length and breadth)	9	8	17
Skull measurement (43 points)	7	6	13
Collection and measurement of pelvic bone	9	8	17

Table 2. Searching days, hours and distances by three sampling vessels in the 2011 JARPN II coastal surveys off Kushiro in spring

Period		Sampling vessels*			Total
		SW	07K	51S	
Early period (25 April-17 May)	Days	12	12	9	33
	Hours	70.6	67.3	55.0	192.9
	Distance(n.mile)	708.8	688.0	582.6	1,979.4
Late period (18 May-10 June)	Days	3	12	12	27
	Hours	22.8	79.0	80.5	182.3
	Distance(n.mile)	224.8	783.5	879.7	1,888.0
Total	Days	15	24	21	60
	Hours	93.4	146.3	135.5	375.2
	Distance(n.mile)	933.6	1,471.5	1,462.3	3,867.4

\*: SW: *Seiwa Maru*, 07K; *Katsu Maru* No.7, 51S; *Sumitomo Maru* No.51.

Table 3. List of cetacean species and number of sightings made by three sampling vessels in the 2011 JARPN II coastal surveys off Kushiro in spring

Period	Species	Primary		Secondary		Total	
		Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Early period (25 April- 17 May)	Common minke whale	12	12	1	1	13	13
	Like minke whale	3	3	0	0	3	3
Late period (18 May- 10 June)	Common minke whale	20	27	3	3	23	30
	Like minke whale	2	2	0	0	2	2
Total	Common minke whale	32	39	4	4	36	43
	Like minke whale	5	5	0	0	5	5

Table 4. Density index of common minke whales by sampling vessels in the 2011 JARPN II coastal survey off Kushiro in spring

Period	SPUE <sup>*1</sup>	DI <sup>*2</sup>
Early period (25 April-17 May)	0.062	0.61
Late period (18 May- 10 June)	0.11	1.06
Total	0.085	0.83

\*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 2011 JARPN II coastal survey off Kushiro in spring

Period	Male					Female				
	mean	S.D.	Min.	Max.	n	mean	S.D.	Min.	Max.	n
Early period (25 April-17 May)	6.68				1	6.22	1.19	4.39	8.11	6
Late period (18 May-10 June)	6.70	0.90	5.28	7.86	8	6.51		6.23	6.79	2
Total	6.70	0.84	5.28	7.86	9	6.29	1.02	4.39	8.11	8

Table 6. Sex and sexual maturity status of common minke whales collected by the 2011 JARPN II coastal survey off Kushiro in spring

Period	Male					Female						
	Im	M	Uk	Total	Maturity (%)	Im.	R	P	P&L	Uk	Total	Maturity (%)
Early period (25 April-17 May)	0	1	0	1	1.00	5	0	1	0	0	6	0.17
Late period (18 May-10 June)	3	5	0	8	0.63	2	0	0	0	0	2	0.00
Total	3	6	0	9	0.67	7	0	1	0	0	8	0.13

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 2011 JARPN II coastal survey off Kushiro in spring (removing animals with broken stomach by harpoon.)

Period	No. of whales observed	Prey species	
		Walleye pollack	Krill
Early period (25 April-17 May)	6	Number	3
		Occurrence (%)	50.0
Late period (18 May-10 June)	8	Number	7
		Occurrence (%)	87.5
Total	14	Number	10
		Occurrence (%)	71.4



Table 8. Weight (kg) of forestomach content of common minke whales collected by the 2011 JARPN II coastal survey off Kushiro in spring

		Walleye pollack	Krill
Early period (25 April-17 May)	average	10.0	9.6
	range	(2.6-22.1)	(1.2-18.0)
Late period (18 May-10 June)	average	52.4	4.7
	range	(3.7-105.3)	-
Total	average	36.5	7.98
	range	(2.6-105.3)	(1.2-18.0)

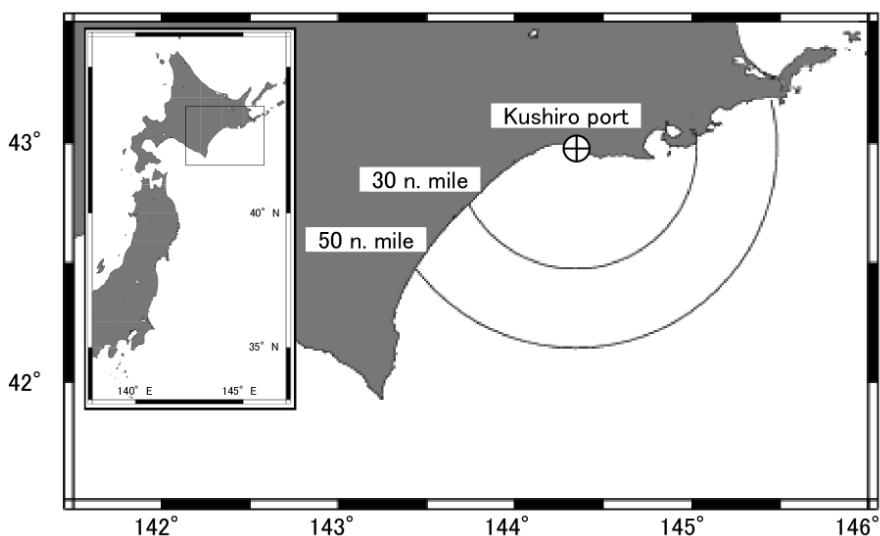


Figure 1. Research area of the 2011 JARPNII coastal survey off the Kushiro in spring.

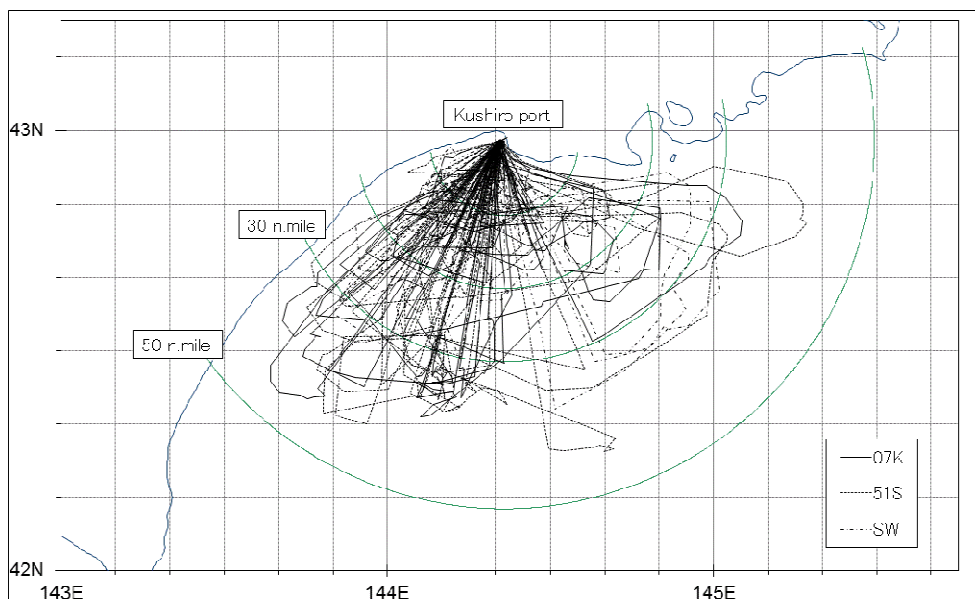


Figure 2. Cruise tracks by three sampling vessels in the 2011 JARPNII coastal survey off Kushiro in spring

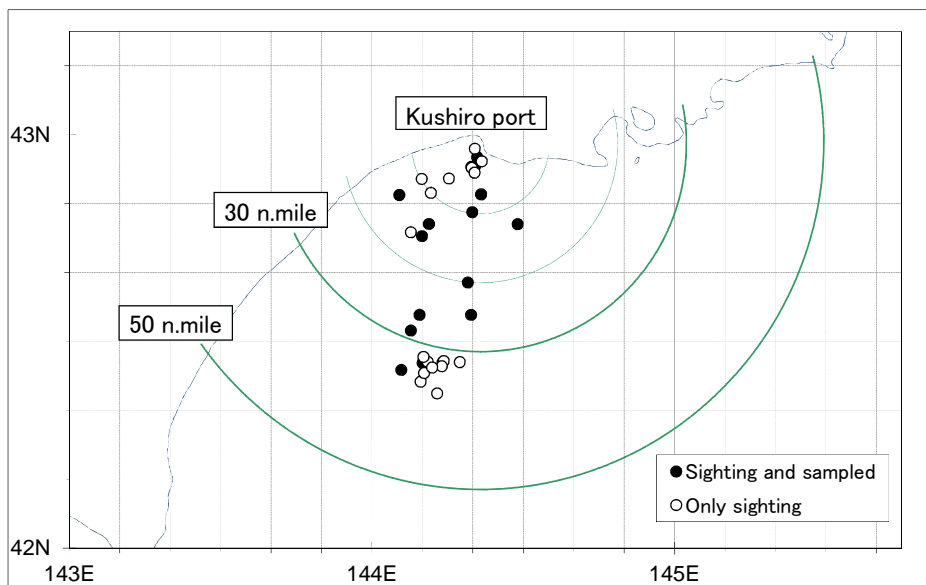


Figure 3. Sighting positions of common minke whales made by sampling vessels in the 2011 JARPN II coastal survey off Kuroshio in spring (●:sighting and sampled; ○: only sighting)

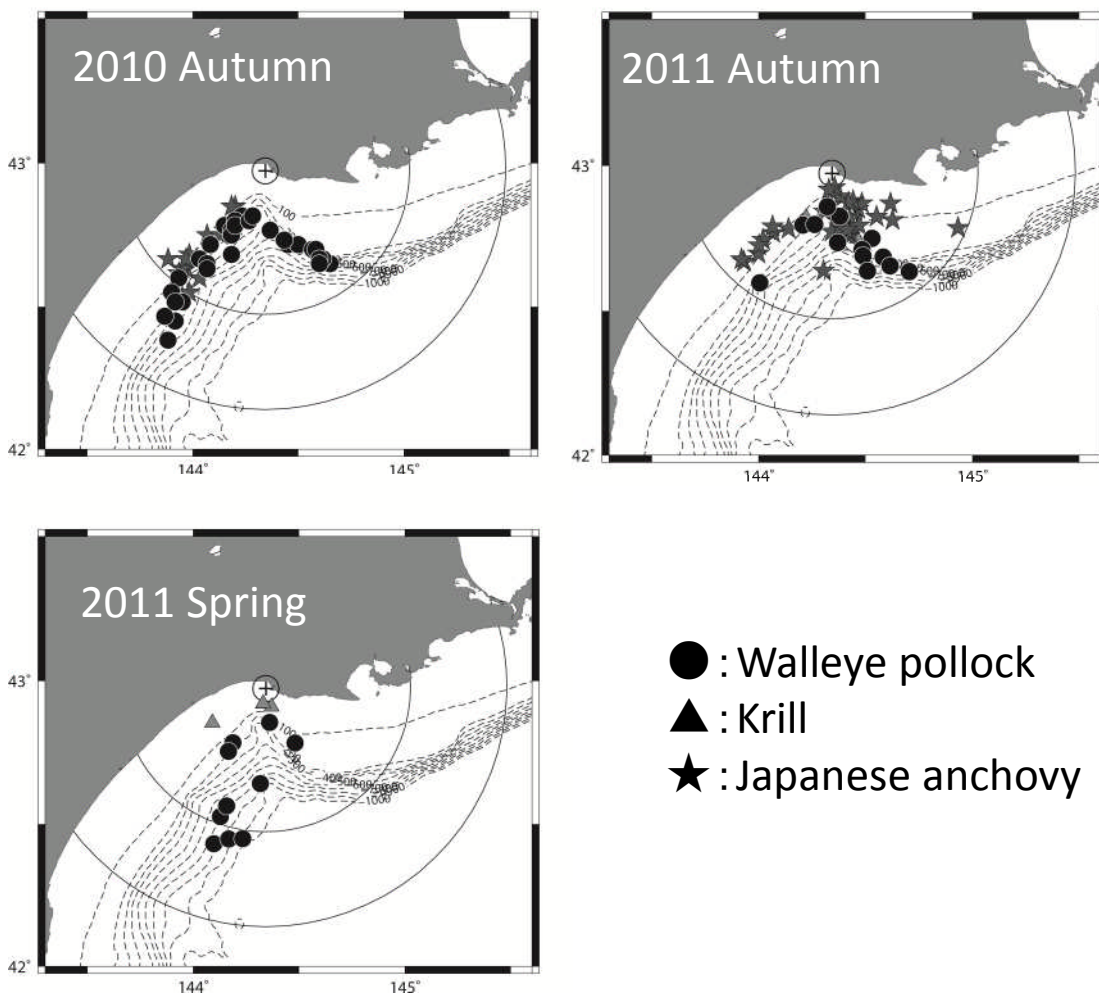


Figure 4. Sighting position of common minke whales sampled in Kuroshio during spring 2011 and autumn 2010, 2011, by major prey species.

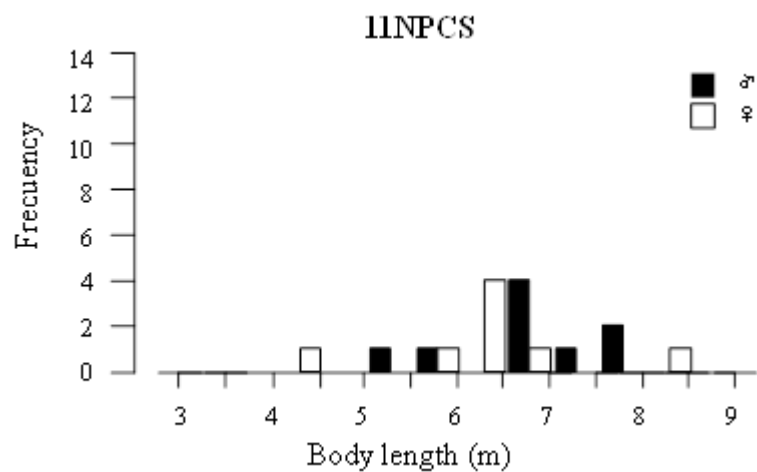


Figure. 5. Frequency of body length of common minke whales sampled in Kushiro in spring 2011, by sex