Cruise Report of the Second Phase of the Japanese Whale Research Program under Special Permit in the Antarctic (JARPAII) in 2013/2014

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ABSTRACT

The results of the 2013/14 survey of the Second Phase of the Japanese Whale Research Program under the Special Permit in the Antarctic (JARPA II) are reported here. Two dedicated sighting vessels (SV), one sighting and sampling vessels (SSV) and one research base vessel engaged in the research for 70 days, from 3 January to 13 March 2014 in Areas V (130°E - 170°W) and VI West (VIW: 170°W - 145°W). Unfortunately the research activities were interrupted several times by an anti-whaling group which directed violent sabotage activities against Japanese research vessels in previous seasons. As a result the planned dedicated sighting survey was cancelled in the whole research area because the two SV had to dedicate to security tasks. The research activity of the SSV was also interrupted several times. The total searching distance was 3,182.0 n.miles by the SSV, which was approximately one-third of the searching distance in 'normal' years. Seven species including five baleen (blue, fin, sei, Antarctic minke and humpback) and two toothed (sperm and southern bottlenose) whales were sighted during the research period. A total of 531 schools (313 individuals) of Antarctic minke whales was sighted. It was the dominant species in the research area followed by the humpback whales (82 schools/ 133 individuals) and fin whales (45/99). The number of sightings of the Antarctic minke whales was about 4.0 times higher than that of humpback whales. A total of 251 Antarctic minke whales was sampled which were examined on board the research base vessel except one whale was lost during the transfer to the research base. Photo-id experiments were conducted and a total of two blue whales were photographed. Oceanographic surveys to investigate vertical sea temperature profiles were also implemented using XCTD.

KEYWORDS: ANTARCTIC MINKE WHALES, BLUE WHALES, FIN WHALES, HUMPBACK WHALES, ROSS SEA, SCIENTIFIC PERMITS

INTRODUCTION

The Second Phase of the Japanese Whale Research Program under Special Permit in the Antarctic (JARPA II), which combine lethal and non-lethal methods, started from the 2005/2006 austral summer season (Government of Japan, 2005, Pastene *et al.*, 2006, Nishiwaki *et al.*, 2006, Nishiwaki *et al.*, 2007, Ishikawa *et al*., 2008, Nishiwaki *et al*., 2009, Nishiwaki *et al*., 2010, Ishikawa *et al*., 2011, Matsuoka *et al*., 2012, Tamura *et al*., 2013). The full-scale JARPAII started from the 2007/08 season. JARPA II is a long-term research program with the following objectives: 1) Monitoring of the Antarctic ecosystem, 2) Modeling interaction among whale species and developing future management objectives, 3) Elucidation of temporal and spatial changes in stock structure and 4) Improving the management procedure for the Antarctic minke whale stocks. JARPA II focuses on Antarctic minke whale, humpback whale (*Megaptera novaeangliae*), fin whale (*B. physalus*) and possibly other species in the Antarctic ecosystem that are major predators of Antarctic krill.

A violent anti-whaling group (Sea Shepherd, SS) has been continuing violent sabotage activities against the research vessels of JARPA II. The IWC has condemned SS's tactics against Japan's whale research vessels. The International Maritime Organization (IMO) also adopted a resolution that seriously concerned safety and security of vessels, human life and marine environment caused by unlawful protests or confrontations on the high seas (IMO, 2010). In 2011, the IWC adopted the Consensus Resolution 2011-2 on Safety at Sea which condemns any actions that are a risk to human life and property in relation to the activities of vessels at sea.

Despite international criticisms above, the research activities of the JARPA II survey in 2013/14 was again interrupted by the SS first during the transit survey from Japan to the research area and throughout the research period. In order to secure safety for the research vessels and their crew members, the planned sighting vessels had to dedicate many of its planned research time to security tasks. It was very regrettable and disappointing to report that this large investment - dedicated sighting survey in the Antarctic - had to be cancelled in the 2013/14 season. These dedicated sighting surveys were planned according to the IWC survey guideline (IWC, 2005) and were endorsed by the IWC SC in 2011 (IWC, 2011).

The research objectives and research progress of JARPA II in the period 2005/06-2010/2011 seasons were summarized (Pastene *et al*., 2014a). In February 2014, "The expert workshop to review the Japanese JARPA II Special Permit Research Programme" was carried out to review data and results for the period 2005/06 to 2010/11 data (IWC, 2014).

This paper reports the ninth survey of the JARPA II conducted during the austral summer season 2013/14.

RESEARCH METHODS

Research vessels

Three research vessels, *Yushin-Maru* (YS1), *Yushin-Maru No. 2* (YS2), and *Yushin-Maru No. 3* (YS3) were engaged in sighting and sampling (SSV) (Table 1). Two SVs dedicated were planned to conduct independent sighting survey based on the IWC survey guideline (IWC, 2005), oceanographic survey and some non-lethal experiments. A research base vessel (NM: *Nisshin-Maru*) served as a research base on which all biological examinations of sampled whales were conducted.

Research area

Figure 1 shows the geographic location of the research area for the 2013/14 JARPAII survey. The research area for the 2013/14 survey was the eastern side of the whole JARPA II research area, i.e. Area V (130°E - 170°W) and Area VIW (170°W - 145°W). Area V (130°E - 170°W) was divided into western part (Area VW: 130°E - 165°E) and eastern part (Area VE: 165°E - 170°W). The Area VE was further divided into East-North stratum and Ross Sea (East-South stratum). The Ross Sea was defined as south of 69°S. The southern stratum of the Area VIW was defined as south of 68°15'S.

Survey track line design

In North and South stratum Area VIW, North and South stratum of Area VE and Area VW, the survey track line consisted of a zigzag course changing direction at 1°40' longitudinal degree intervals. In the Ross Sea and the southern stratum of the Area VIW, the survey track lines were randomly consisted of a mesh designed zigzag course changing direction at 1° latitudinal and 30° longitudinal degree intervals, respectively.

Two parallel track lines were set at 7 n. miles apart. Two legs of track line for the northern stratum were set every six legs for southern stratum, in principle. The interval of legs and number of legs for the northern stratum could be changed by sub-area according to progress of the survey. In these areas, the southern stratum was defined from ice edge to 45 n. miles north in principle. For this survey, as same as IWC-SOWER (Southern Ocean Whale and Ecosystem Research), our best estimate of the position of the ice edge was based on our visual and radar observations of the ice edge using the DMSP SSM/I daily polar griddled sea ice concentration data set available from the National Snow and Ice Data Center (NSIDC) (Matsuoka *et al*., 2003, Cavalieri *et al*, 1999).

Sighting method

Sighting procedures followed the previous JARPA surveys (*e.g*. Nishiwaki *et al*. 2007) in principle. The sighting survey using SSVs was conducted under closing mode (when a sighting of target species was made on the predetermined track line, the vessel approached the whales and species and school size were confirmed). Three SSVs advanced along parallel track lines at a standard speed of 11.5 knots.

The survey by SSVs was operated under optimal research conditions (when the wind speed was below 25 knots in the south strata or 20 knots in the north strata and visibility was over 2 n. miles). In addition to the sightings of Antarctic minke whales, the SSVs approached blue whale (*Balaenoptera musculus*), southern right whale (*Eubalaena australis*) and humpback whale (*Megaptera novaeangliae*) for conducting experiments.

Sampling methods and biological survey for whales

Sampling of 850 Antarctic minke whales (with 10 % of allowance) and 50 fin whales was planned in the research area south of 62°S. Although the original plan included 50 humpback whales (Government of Japan, 2005), Government of Japan decided to suspend the sampling of humpback whales. One to two Antarctic minke whales were sampled randomly from each primary sighted school within 3n.miles of the track line. Dwarf minke whales were not a target for sampling. Sampling of fin whales was restricted to those animals with an estimated body length in principal 19m or less due to logistic limitations at the NM. Only one fin whale was planed to be sampled from each primary sighted school within 3n.miles of the track line. If two or more animals (less than 18m in body length) were found in a school, only one of them was randomly selected and sampled. Biological research on all sampled whales was conducted on the NM.

Experiments

Sighting distance and angle experiment
This experiment was conducted in order to evaluate the accuracy of sighting distance and angle given by observers on the SSVs. Observers on each vessel were required to assess eight sets of angles and distance from two platforms (top barrel and upper bridge). All trials were conducted under good sighting condition.

Photo-identification
The following species were targeted for photographic record of natural markings: blue, humpback and southern right whales.

Biopsy sampling
In addition to the species targeted for the photo-identification experiment, pygmy right whale (*Caperea marginata*), fin whale, sei whale (*B.borealis*), Antarctic minke whale, sperm whale (*Physeter macrocehpalus*), and southern bottlenose whale (*Hyperoodon planifrons*) were targeted for biopsy skin sampling using a compound-crossbow.

Vomiting and fecal observation
The SSVs was engaged in observations of vomits and feaces of sighted whales which closed within 0.2 n.miles from the vessel. Target species of these observations were Antarctic minke, fin and humpback whales.

Oceanographic survey
The SSVs planned the following oceanographic survey; 1) consecutive measuring of vertical water temperature profile by expendable XCTD system, 2) marine debris recording in the research area, 3) all marine debris found in the stomach of whales taken was also recorded on the NM.

RESULTS AND DISCUSSIONS

Outline of the research activities
Table 2 shows an outline of the research activities. Research vessels were frequently attacked by the anti-whaling group and the survey was interrupted in several opportunities. As a consequence vessels YS3 and YS2 had to dedicate to search and monitor the anti-whaling group vessels most of the research period. Total research period was 70 days from 3 January to 13 March 2014. Unfortunately the research activity was interrupted for over 18 days by directed violent sabotage activities of the SS. Therefore the research of most part of East-North in Area V and Western part of Area V had to be cancelled (Figure 1).

Sighting
Low and middle latitudinal sighting survey
During transit, sighting surveys were conducted from 26 December 2013 in the area between 30°S and 60°S outside of national EEZs. However, in order to secure safety of the research vessels and their crew members, the planned sighting surveys to and from the research area were cancelled completely. Sei whale (1 school / 1 individual) and sperm whales (2 sch. / 3 ind.) were sighted as secondary sightings (Table 3).

Antarctic research area
In the research area the sighting survey by the SV was planned to operate independently. However the survey by the SV was cancelled because of obstruction from the anti-whaling group. There was no searching effort of the SV. The total searching distance was 3,182.0 n.miles by the SSV, which was approximately one-third of the searching distance in a normal year (Table 4).

Seven species including five baleen whales and three toothed whales were identified during the research period. The following five species of baleen whales were identified: blue, fin, sei, Antarctic minke and humpback whales. Three toothed whale species were identified; sperm and southern bottlenose whales. Table 5 shows the number of sightings by each sub-area and Figures 2, 3 and 4 show sighting position of Antarctic minke, other baleen (blue, fin, sei and humpback) whales and toothed (sperm and southern bottlenose) whales, respectively. Antarctic minke whale was the most abundant species in the research area, followed by humpback whale (in number of schools).

The number of sightings of Antarctic minke whales (313 schools and 531 individuals in total) was about 4.0 times higher (individuals) than that of humpback whales (82 schools and 133 individuals) and was considerably higher than those of other species. Both Antarctic minke and humpback whales were widely distributed in the entire research area, but density was different among strata. No mother and calf pair of Antarctic minke whale was observed in the research area. Humpback whales were widely distributed in Area V even at ice edge north of the Ross Sea. Most of them were found in Area VIW (Figure 3). These distribution patterns were almost same as in previous surveys (e.g.Matsuoka *et al*., 2011).

Fin whales (45 schools and 99 individuals) were also found in the Areas VE and VIW. There were sightings of fin whales in the Ross Sea (Figure 3). Although sightings of blue whales were small (15 schools and 20 individuals), they were found in all of the research area even in the Ross Sea (Figure 3). These observations were almost the same as in past JARPA/JARPAII surveys (Nishiwaki *et al.* 2009 and 2010). Further, blue whales (3 schools and 3 individuals) were found in most southern part of Area VIW between 72ºS and 74ºS in particular compare with the previous JARPA and JARPAII surveys (Matsuoka and Hakamada, 2014). Sei whales were only distributed in the northern part of Area VE (Figure 3). Solitary large male sperm whales were found between near ice edge and the northern strata (7 schools and 7 individuals). Southern bottlenose whales were found in Area VIW (Figure 4).

These information are contributing significantly to the objectives of the JARPAII programme. It was noted in the report of the JARPAII review meeting that the survey work represents a considerable expenditure of research time and a large dataset for long-term monitoring. It complements the work of the IDCR/SOWER programme that has now finished. The importance of monitoring trends in abundance in cetacean species is of general conservation and management importance especially in the context of documenting the recovery of species/populations that had been extensively depleted by commercial whaling, as well as investigating variation in species mix compared to the period prior to exploitation (IWC, 2014).

Experiments

Sighting distance and angle experiment

This experiment was performed on 6 February and 11 February by YS1 and on 11 February 2014 by YS2. The results of this experiment will be used for the calculation of abundance estimates.

Photo-ID

Natural markings of two individuals of blue were photographed in this season (Table 6a). Although number of photographs is small, the scientific knowledge has been accumulated putting several seasons' data together to make up for some non-surveyed areas due to interrupt by violent sabotage activity. A total of 10 individuals of blue whale, 5 of southern right whale and 13 of humpback whale were photographed between 2011/12 and 2013/14 JARPAII surveys (Table 6b). These data will be registered to the ICR catalogue and submission of photographs to relevant international catalogues (e.g. Matsuoka and Pastene, 2014).

Biopsy sampling

No biopsy samples were obtained in this season. Although number of biopsy samples is small in recent seasons, the scientific knowledge has been accumulated putting several seasons' data together to make up for some non-surveyed areas due to interrupt by violent sabotage activity. A total of 4 biopsy samples of southern right whale, 5 of humpback whale were collected between 2011/12 and 2013/14 JARPAII surveys (Table 6c). These data will be registered to the ICR database and analyzed for genetic research (e.g. Pastene *et al*., 2014b, Kanda *et al*, 2014b).

Vomiting and feaces observation

A total 284 (454 individuals) of Antarctic minke whale, 20 (31 individuals) of fin whale and 26 (36 individuals) of humpback whale schools were observed during school confirmations within 0.2 n.miles. There was no observation of vomiting and feacal behavior in this season. There was no vomiting observations during 2011/12 to 2013/14 surveys. There was only one case of fecal observation of fin whale in 2011/12 survey. It was spread the surface and it was not impossible to collect from the vessel (Table 6d).

Oceanographic survey

Oceanographic survey using XCTD was conducted only at 43 stations due to external interruptions in this season. A total of 107 XCTD oceanographic observations were conducted in recent 3 seasons (Table 6d). These data will be accumulated into the oceanographic database and analyzed later to investigate such as relationship between whale distributions and oceanographic structures (e.g. Watanabe *et al*., 2014, Naganobu *et al*., 2014).

Three marine debris (all single fishing floats) were observed from the research vessels in the research area in this season. No marine debris was found in the stomach of Antarctic minke whales (Table 6d). These data are useful for monitoring different type debris on which little information is available for the Antarctic Ocean (Isoda *et al*., 2014, IWC, 2014).

Sampling of Antarctic minke whales

Out of 416 schools (259 individuals) in the primary sightings of Antarctic minke whales, 313 schools (531 individuals) were targeted for sampling. A total of 251 individuals were sampled. Sampling efficiency (the rate of successful sampling for targeted individuals) was 89.7 % for solitary schools, 94.0 % for the first targeted individual from schools with more than one animal. A total of 17 individuals were sampled as the second targeted individual from the schools

with more than one animal. No struck and lost case occurred. And one sample lost in the transfer from sampling vessel to research base vessel.

The scientific knowledge has been accumulated putting several seasons' data together to make up for some non-surveyed areas due to interrupt by violent sabotage activity. A total of 620 Antarctic minke whale was sampled between 2011/12 and 2013/14 JARPAII surveys. Sampling of Antarctic minke whales in each IWC Areas are conducted successfully and almost equally in the research area including the mixing area of Antarctic minke whale stocks (Area VW), and the Ross sea (Area VE) (Tables 10a and 10b).

These data will be examined for genetic analysis and estimation of biological parameters for Antarctic minke whales (e.g. Kanda *et al*., 2014a, Bando *et al*., 2014, Kitakado *et al*., 2014, Yasunaga *et al*., 2014, Konishi and Walloe, 2014, Konishi *et al*., 2014, Tamura and Konishi, 2014).

Biological research

Biological research was conducted on the research base vessel for all whales sampled except for one whale lost during the transfer from sampling vessel to research base vessel. Of 250 Antarctic minke whales, 125 were male (50.0 %) and 125 were female (50.0 %) in this season (Tables 7 and 8).

Biological information of sampled whales

Figure 5 shows the distribution of sighting position of sampled Antarctic minke whales by sex and sexually mature status. Mature males and females were dominant in the southern strata of Area VE and VIW.

Table 7 shows the summary of biological data and samples collected from Antarctic minke whales. Table 8 shows the sex and reproductive status of sampled Antarctic minke whales by stratum. Immature rate of both females and males was high in the northern strata of Area VE and Area VIW (Figure 5). The mature rate of females was high in the southern stratum of Area VE and Area VIW (Figure 5). The ratio of pregnant mature females was high in the southern stratum of Area VIW. One of sampled Antarctic minke whale was lactating.

Figure 6 shows the body length distribution of Antarctic minke whales sampled in this survey. Maximum length was 9.16 m for male and 9.46 m for female. Minimum length was 4.97 m and 4.80 m for male and female, respectively. Maximum body length of immature animals was 8.01 m and 8.23 m for male and female, whereas minimum body length of mature animals was 7.17 m and 7.72 m for male and female, respectively.

Table 9 shows prey species found in the stomach of Antarctic minke whales sampled by in this survey. The Antarctic krill (*Euphausia superba*) was the dominant prey species, in the Areas V and VIW. However, *Thysanoessa* spp. was found as main prey species from 6 whales and 8 whales in northern and southern stratum of Area VIW, respectively.

Results of past JARPA/JARPAII surveys strongly suggested that Antarctic minke whales, especially mature females tend to concentrate in the ice free area beyond the ice edge where research vessels could not enter (Ishikawa *et al*, 1998, 2008, Ishikawa, 2003). It was also suggested that recent drastic expansion of humpback whale distribution in the Areas IV and V may force Antarctic minke whales to move in the pack ice (Ishikawa *et al*., 2004, Fujise *et al*., 2006, Matsuoka *et al*., 2011, Kitakado *et al*., 2012, Hakamada *et al*., 2014, Murase *et al*., 2014).

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Table1. Specifications of the research vessels.

	Yushin-Maru	*Yushin-Maru No.2*	*Yushin-Maru No.3*
Call sign	JLZS	JPPV	7JCH
Length overall [m]	69.61	69.61	69.61
Gross tonnage (GT)	724	747	742
Barrel height [m]	19.5	19.5	19.5
IO platform height [m]	13.5	13.5	13.5
Upper bridge height [m]	11.5	11.5	11.5
Bow height [m]	6.5	6.5	6.5
Engine power [PS / kW]	5280 / 3900	5280 / 3900	5280 / 3900

Table2. Outline of the research activities.

Event	Date						
Depature from Japan (YS3)	5/	Dec./	2013				
Depature from Japan (NM, YS1, YS2)	7/	Dec./	2013				
Low and middle latitudinal sighting survey	26/	Dec./	2013	-	2/	Jan./	2014
Survey in Antarctic research area	3/	Jan./	2014	-	13/	Mar./	2014
Low and middle latitudinal sighting survey	14/	Mar./	2014	-	20/	Mar./	2014
Arrival at Japan (NM, YS1, YS2, YS3)	5/	Apr./	2014				

Table 3. Summary of low and middle latitudinal whale sightings during transit to and from the research area.

Species	Transit to research area		Transit from research area		Total	
	sch.	ind.	sch.	Ind.	sch.	ind.
Sei whale	1	1	0	0	1	1
Sperm whale	2	3	0	0	2	3

Table 4. Summary of the searching distances (n. miles) of the 2013/14 JARPAII survey, research stratum. ASP mode represents sighting survey and NSC mode represents sighting and sampling survey.

Area	Stratum		ASP	NSC	Total
V	East	North	---	132.6	132.6
		Ross Sea	---	990.3	990.3
VI	West	North	2.5	675.2	677.7
		South	---	1,381.5	1,381.5
	Total		2.5	3,179.5	3,182.0

Table 5. Summary of sightings by species and research stratum in the 2013/14 JARPAII survey.

Area	V								VI								Total			
Stratum	East-South (Ross Sea)				East-North				West-South				West-North							
	Primary		Secondary		Primary		Secondary		Primary		Secondary		Primary		Secondary		Primary		Secondary	
Species	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.	sch.	ind.

Blue whale	1	2	0	0	0	0	0	0	6	6	1	2	4	4	3	6	11	12	4	8
Fin whale	12	33	4	8	0	0	1	1	13	32	0	0	9	14	6	11	34	79	11	20
Sei whale	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0	3	3	0	0
Antarctic minke whale	89	170	21	66	4	7	0	0	120	178	1	1	46	61	32	48	259	416	54	115
Like minke whale	4	4	0	0	0	0	0	0	2	2	0	0	0	0	1	1	6	6	1	1
Humpback whale	35	57	6	11	2	2	0	0	13	23	0	0	15	18	11	22	65	100	17	33
Sperm whale	1	1	0	0	0	0	1	1	3	3	0	0	2	2	0	0	6	6	1	1
Southern bottlenose whale	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	4	1	1	1	4

Table 6a. Details of the photo-ID during the 2013/14 JARPAII survey. LD: Left dorsal; LL: Left lateral; RD: Right dorsal; RL: Right lateral; HD: Head; OT: Other.

Vessel	Date	Sighting No.	Species	School size	Number of individuals photographed	Photo-ID result
YS2	20140220	004	Killer	16	13	LD
YS2	20140226	004	Killer	13	7	LD, LL
NM	20140305	-	Blue	4	2	RD, OT

Table 6b. Summary of photo-ID photos collected between 2011/12 and 2013/14 JARPAII surveys after JARPAII review meeting.

Season	Blue	S. right	Humpback
2011/12	5	4	6
2012/13	3	1	7
2013/14	2	0	0
Total	10	5	13

Table 6c. Summary of biopsy samples collected between 2011/12 and 2013/14 JARPAII surveys.

Season	Blue	S. right	Humpback
2011/12	0	4	2
2012/13	0	0	3
2013/14	0	0	0
Total	0	4	5

Table 6d. Summary of vomiting, fecal, XCTD, marine debris observations between 2011/12 and 2013/14 JARPAII surveys.

Season	Vomiting observation	Fecal observation	XCTD	Marine debris recording in the research area.	Marine debris found in the stomach of whales
2011/12	0	1*	9	0	0
2012/13	0	0	55	0	0
2013/14	0	0	43	3	0
Total	0	1	107	3	0

*Fin whale

Table 7. Summary of biological data and samples collected from Antarctic minke whales and fin whales in the 2013/14 JARPAII survey.

Samples and data	Antarctic minke whale		
	Male	Female	Total
Photographic record of external character	125	125	250
Diatom film observation	125	125	250
Record of external parasites	125	125	250
Body length and sex identification	125	125	250
Measurement of external body proportion	125	125	250
Body weight	125	125	250
Standard measurement of blubber thickness (two points)	125	125	250
Lactation status	-	124	124
Measurement of mammary gland	-	124	124
Record of ovary	-	125	125
Photographic record of fetus	-	53	53
Fetal length and weight	-	50	50
Testis weight	125	-	125
Record of stomach contents	125	125	250
Weight of stomach content	125	125	250
Record of marine debris	125	125	250
Record of internal parasites	125	125	250
Macro pathological observation (thyroid, lung and liver)	125	125	250
Skull measurement (length and breadth)	123	120	243
Body weight by total weight of parts	1	1	2
Blood plasma for physiological study	107	100	207
Ovary sample	-	125	125
Fetal skin for genetic study	-	53	53
Small fetus sample	-	3	3*
Histological sample of testis	125	-	125
Skin for genetic study	125	125	250
Blubber, muscle and liver tissues for environmental monitoring	125	125	250
Lung and liver tissue for air monitoring	20	-	20
Muscle and blubber tissues for various analysis	3	3	6
Tissues for histopathological study	4	1	5
Stomach contents for feeding study	21	18	39
Stomach contents for environmental monitoring	14	21	35
Earplug for age determination	125	125	250
Ocular lens for age determination	125	125	250
Largest baleen plate for various analysis	38	48	86
Vertebral epiphyses sample	87	77	164
External parasites sample	0	0	0
Tissues for functional food study	3	3	6

Table 8. Reproductive status of Antarctic minke whales sampled in the 2013/14 JARPAII survey. Maturity of males was tentatively defined by testis weight according to Kato (1986). "Resting" represents non-pregnant mature female without corpus luteum.

Area	Stratum	Male			Female					All
					Immature	Mature				
		Immature	Mature	Total		Maturing	Resting	Pregnant	Total	combined
V	East-North	3 50.0%	0 0.0%	3 50.0%	3 50.0%	0 0.0%	0 0.0%	0 0.0%	3 50.0%	6 100.0%
	East-South (Ross sea)	16 18.6%	30 34.9%	46 53.5%	23 26.7%	1 1.2%	1 1.2%	15 17.4%	40 46.5%	86 100.0%
VI	West-North	14 32.6%	16 37.2%	30 69.8%	11 25.6%	1 2.3%	0 0.0%	1 2.3%	13 30.2%	43 100.0%
	West-South	17 14.8%	29 25.2%	46 40.0%	29 25.2%	1 0.9%	1 0.9%	37 32.2%	69* 60.0%	115 100.0%
Total		50 20.0%	75 30.0%	125 50.0%	66 26.4%	3 1.2%	2 0.8%	53 21.2%	125* 50.0%	250 100.0%

*including one female of reproductive status unknown.

Table 9. Main prey species found in the stomach of Antarctic minke whales sampled in the 2013/14 JARPAII survey.

Area	Stratum	*Euphausia superba*	*Thysanoessa* spp.	Empty
V	East-North	4 80.0%	0 0.0%	1 20.0%
	East-South (Ross sea)	56 73.7%	0 0.0%	20 26.3%
VI	West-North	19 45.2%	6 14.3%	17 40.5%
	West-South	64 59.8%	8 7.5%	35 32.7%
Total		143 62.2%	14 6.1%	73 31.7%

Table 10a. Summary of the number of Antarctic minke whales, fin and humpback whales sampled between 2011/12 and 2013/14 surveys.

Season	Antarctic minke			Fin			Humpback		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
2011/12	99	167	266	0	1	1	-	-	-
2012/13	50	53	103	0	0	0	-	-	-
2013/14*	125	125	251	0	0	0	-	-	-
Total	274	345	620	0	1	1	-	-	-

*: One sample lost in the delivery from sampling vessel to research base vessel.

Table 10b. Summary of the number of Antarctic minke whales sampled between 2011/12 and 2013/14 surveys.

Areas	IIIE 35E-70E	IV 70E-130E	V 130E-170W	VIW 170W-145W	Total
2011/12	-	-	136	130	266
2012/13	3	99	1	-	103
2013/14	-	-	92	159	251
Total	3	99	229	289	620

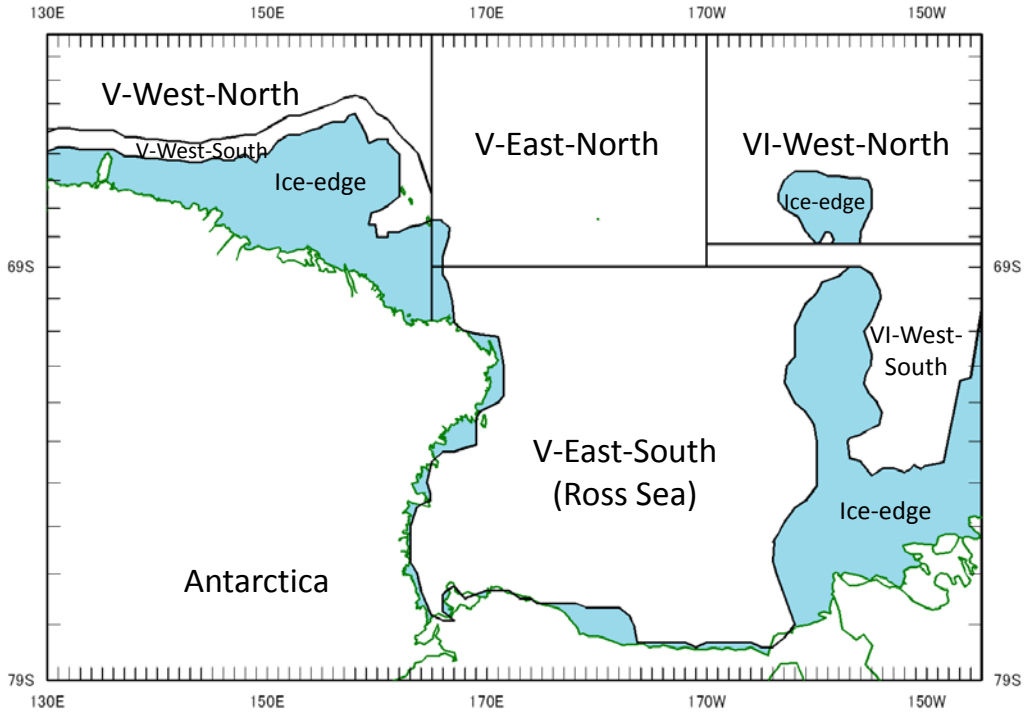

Figure 1. Research area and each stratum of the 2013/14 JARPAII survey.

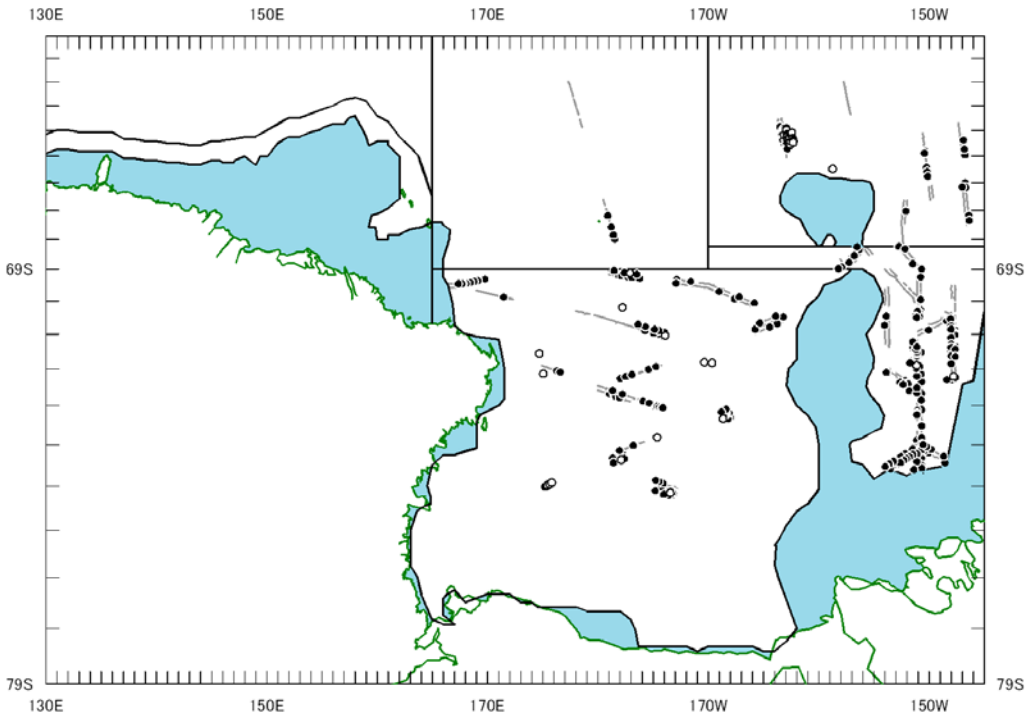

Figure 2. Distribution of sightings of Antarctic minke whales in the 2013/14 JARPAII survey.
●: Primary sightings, ○: Secondary sightings, Gray line: Searching effort.

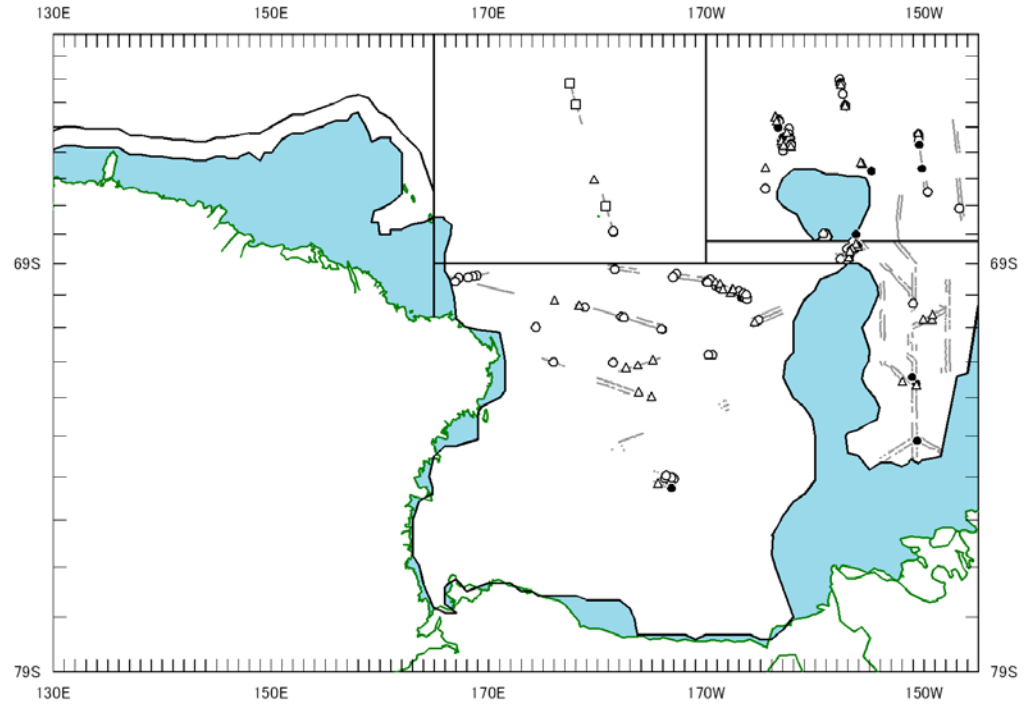

Figure 3. Distribution of sightings of blue, fin, sei and humpback whales in 2013/14 JARPAII.
●: Blue whale, ○: Fin whale, □: Sei whale, △: Humpback whale, Gray line: Searching effort.

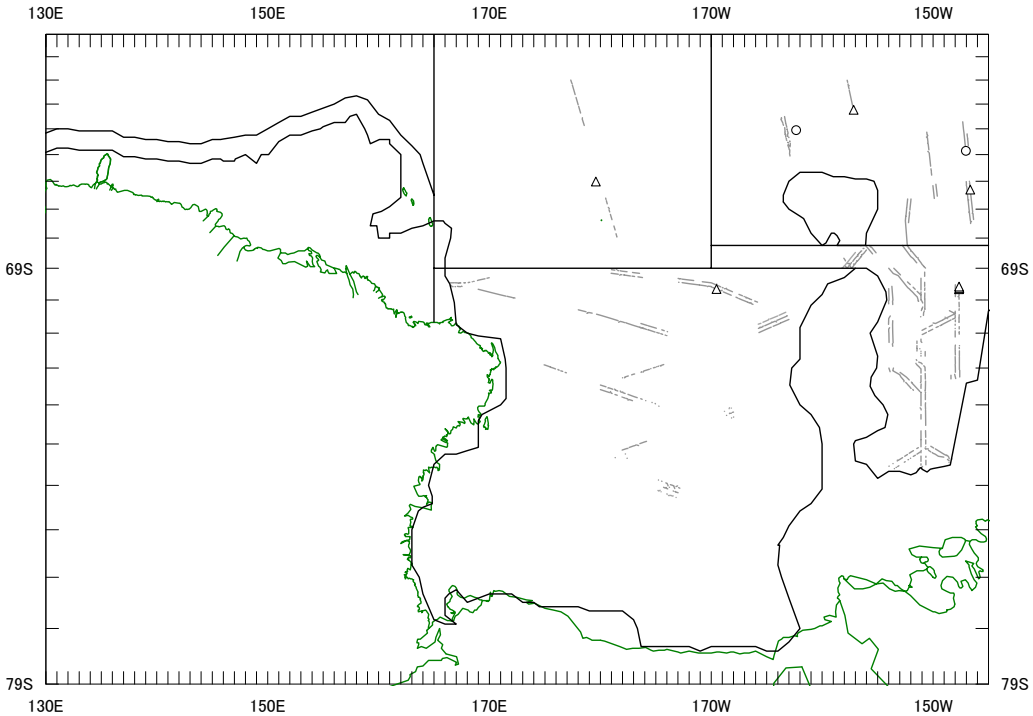

Figure 4. Distribution of sightings of sperm, southern bottlenosed and killer whales in the 2013/14 JARPAII survey.
△: Sperm whale, ○: Southern bottlenose whale, Gray line: Searching effort.

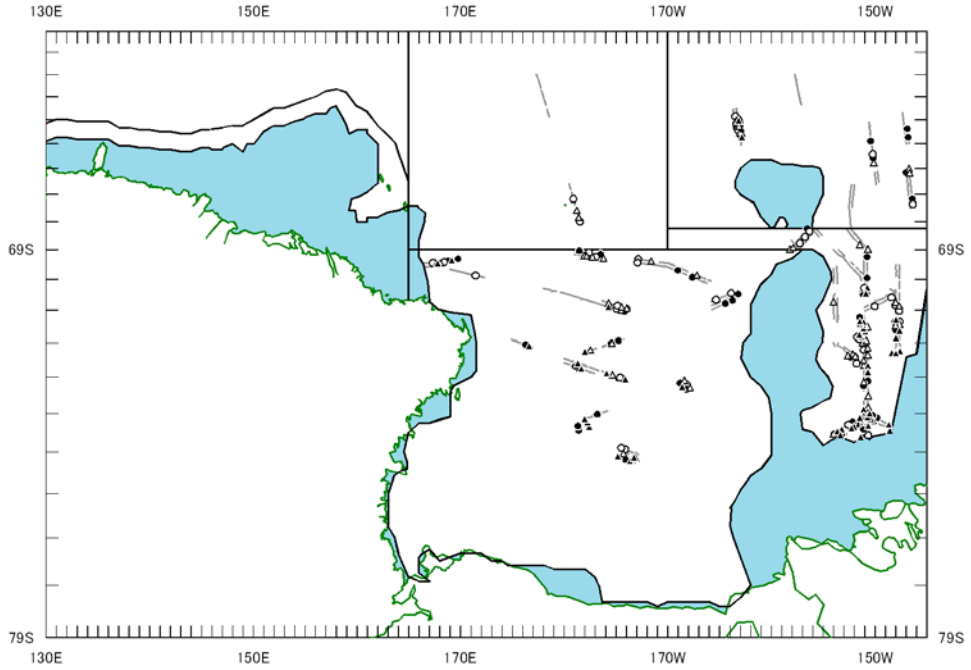

Figure 5. Distribution of immature Antarctic minke whale sampled in the 2013/14 JARPAII survey, by sex and maturity. ○: immature male, ●: mature male, △: immature female, ▲: mature female, Gray line: Searching effort.

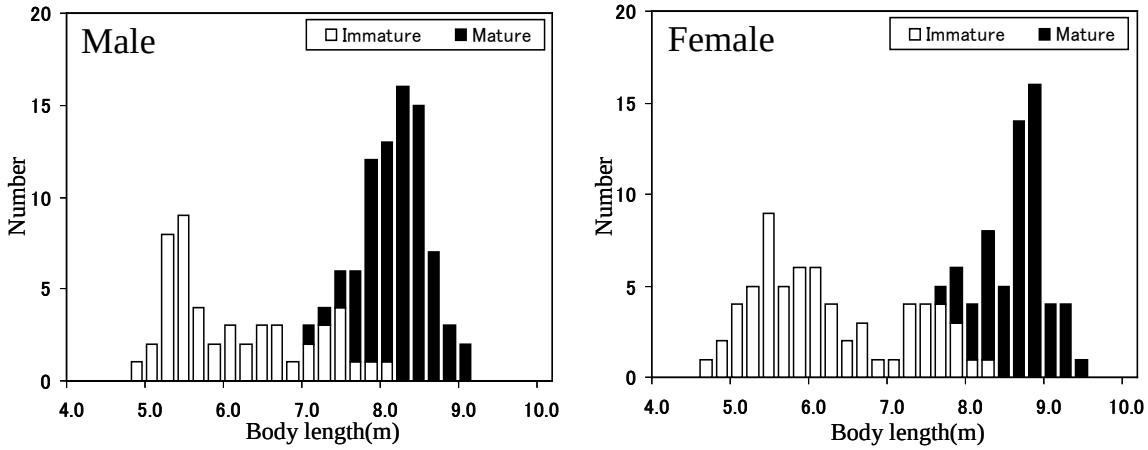

Figure 6. Body length distribution of Antarctic minke whales sampled during the 2013/14 JARPAII survey, by sex.