Cruise Report of the Second Phase of the Japanese Whale Research Program under Special Permit in the Antarctic (JARPA Ⅱ) in 2005/2006 -Feasibility study-

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ABSTRACT

The research plan for the Second Phase of the Japanese Whale Research Program under Special Permit in the Antarctic (JARPA II) was presented to the 2005 meeting of the International Whaling Commission's Scientific Committee (IWC/SC). The research program involves both non-lethal and lethal research techniques. The first two JARPA II surveys, to be conducted in the 2005/06 and 2006/07 austral summer seasons, were planned as feasibility studies with the following objectives: 1) to examine the practicability and appropriateness of sighting methods considering the enlarged research area, 2) to examine the practicability and appropriateness of sampling procedure considering the increased sample size for Antarctic minke whale and 3) to examine the practicability of methods of hunting, hauling, flensing and biological sampling of large-sized whales. For the feasibility surveys a total of 850+/-10% Antarctic minke whales and 10 fin whales were planned for sampling. The first feasibility survey of the JARPA II was carried out between 3 December 2005 and 20 March 2006 (108 days) in Areas IIIE, IV and part of Area V. The total searching distance was 16,372.7n.miles (8,836.2n.miles covered by the two dedicated Sighting Vessels (SVs) and 7,536.5n.miles covered by the three Sighting and Sampling Vessels (SSVs). The following species managed by the IWC were sighted: Antarctic minke, blue, fin, sei, humpback, southern right, sperm and southern bottlenose whales. The Antarctic minke and humpback whales were the dominant species. Out of 821 schools (1,959 individuals) in the primary sightings of Antarctic minke whales by SSVs, 779 schools (1,879 individuals) were targeted for sampling. A total of 853 individuals were sampled. Out of 37 schools (245 individuals) in the primary sightings of fin whales by SSVs, 11 schools (112 individuals) were targeted for sampling. A total of 10 animals were sampled. The maximum body length for the sampled fin whales was 20.22m (female, 61.52tons). Photo-id experiments were conducted on blue, humpback and southern right whales and a total of 85 animals were photographed. A total of 46 skin biopsy samples were collected from seven species. CTD, XCTD and XBT castings were conducted at 86, 123 and 22 locations, respectively. EPCS (Electric Particle Counting and Sizing System) survey was conducted for 94 and 99 days by each SV, respectively. One of SV conducted the quantitative echo sounder survey for 94 days in the whole research area. The main results of this feasibility survey were as follows: 1) Antarctic minke and the humpback whales were the dominant species observed in similar numbers in the research area, 2) fin whales were widely distributed in the south strata from 80°E to 135°E, 3) large baleen whales intermingled in the south strata throughout the whole research area. Regarding the objectives of the feasibility survey, the following results were obtained: 1) the sighting methods used were practical and appropriate for the enlarged research area, 2) sampling procedures were appropriate for covering the increased sample size of the Antarctic minke whales of 850+/- 10%, 3) method of hunting, hauling, flensing and biological sampling of large-sized whales was checked and found to be adequately done. Therefore it can be concluded that the first feasibility survey of JARPA II was conducted satisfactorily and that the objectives of the survey had been covered adequately.

KEYWORDS: ANTARCTIC MINKE WHALES; FIN WHALES;HUMPBACK WHALES; BALEEN WHALES; ANTARCTIC; SOUTHERN HEMISPHERE; SCIENTIFIC PERMITS

INTRODUCTION

The Japanese Whale Research Program under Special Permit in the Antarctic (JARPA) was conducted between 1987/88 and 2004/05 austral summer seasons, under Article VIII of the International Convention for the Regulation of Whaling. The IWC Scientific Committee conducted an interim review of JARPA results in 1997. In January 2005, a JARPA review meeting called by the Government of Japan was held.

JARPA provided a wide variety of information on biological parameters of Antarctic minke whale such as the natural mortality coefficient and changes over time in the age at maturity as well as narrowing down the parameters of relevance for stock management. JARPA also elucidated that there were two stocks in the research area but their geographical boundaries were different from those used by the IWC (Pastene *et al*.2005). Further, JARPA found that pollutant concentration in whale's tissues, such as heavy metals and PCBs, was extremely low (Yasunaga *et al*, 2005). JARPA has thus successfully obtained data related to the initially proposed objectives. The review meeting conducted in January 2005 agreed that results from JARPA were consistent with the behavior to be expected of baleen whale populations competing for a dominant single food resource, krill. The meeting also agreed that the results obtained provide clear support for the need to take species-interaction (ecosystem) effects into account in understanding the dynamics of the baleen whale species in the Antarctic ecosystem, and predicting future trends in their abundance and population structure (Government of Japan. 2005).

Based on these considerations, the Government of Japan launched a new comprehensive study, the Second Phase of the Japanese Whale Research Program under Special Permit in the Antarctic (JARPA II), combining lethal and non-lethal methods, starting from the 2005/06 austral summer season. The first two seasons (2005/06 and 2006/07) are dedicated to feasibility studies.

The full-scale JARPA II will start from the 2007/08 season. It will be a long-term research program with the following objectives 1) Monitoring of the Antarctic ecosystem, 2) Modeling competition 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 will focus on Antarctic minke, humpback and fin whales and possibly other species in the Antarctic ecosystem that are major predators of Antarctic krill. Annual sample sizes for the full-scale research (lethal sampling) are 850 (with 10% of allowance) Antarctic minke whales (Eastern Indian Ocean and Western South Pacific Stocks), 50 humpback whales (D and E-Stocks) and 50 fin whales (Indian Ocean and the Western South Pacific Stocks). During the feasibility study, a maximum annual sample size of 850+-10% Antarctic minke whales will be sampled. A maximum of ten fin whales will be sampled in each season. Humpback whales will not be taken during the feasibility study.

The research methods for the JARPA II are basically the same as the previous JARPA with some modifications. The program involves both non-lethal research techniques such as sighting surveys, biopsy sampling, acoustic surveys for prey species and the collection of oceanographic data and lethal sampling since collection of certain information, of vital importance to the overall study, requires examination of internal organs such as ovaries, earplugs and stomachs. A comprehensive review will be conducted following completion of the first 6 years of the research (Government of Japan. 2005).

This is the first cruise report in JARPA II. This season was dedicated to feasibility studies. The practicability and appropriateness of sighting methods in the enlarged area and sampling procedures for the increased sample size were examined. Methods for catching, flensing and taking biological measurements of large body-sized fin whales were also tested.

RESEARCH METHODS

Research vessels

The whale research unit was composed of two dedicated sighting vessels (*Kyoshin Maru No.2*: KS2 and *Kaikoh Maru No.1*:KK1), three sighting and sampling vessels (*Yushin Maru No.2*: YS2, *Yushin Maru*: YS1, and *Kyo Maru No.1*: KO1) and one research base vessel (*Nisshin Maru*: NM).

Two sighting vessels (SVs) were dedicated to sighting survey and most of the experiments were conducted by these vessels. Three sighting and sampling vessels（SSVs）vessels were engaged in sighting and sampling surveys. NM served as a research base on which all biological examinations of collected samples were conducted.

Research area

JARPA began with surveys in Areas IV (70°-130°E) and V (130°E-170°W). From the austral summer season 1995/96. the research area was extended to include the eastern part of Area III (35°-70°E) and the western part of Area VI (170°-145°W). The stock structure of Antarctic minke whales was therefore investigated in an area spanning 180 degrees in longitude.

With regard to the Antarctic minke whales, it was found that there were two independent stocks in the research area and a soft boundary at 165°E (middle of Area V) was proposed for management purposes (Pastene *et al.*, 2005a). To the west of this boundary line, but especially in Area IV, humpback whales have shown a rapid increase in recent years, and have surpassed the Antarctic minke whales in biomass. Fin whales have also shown a rapid increase with an abundance estimate of about 9,000 animals in Area IV+IIIE. On the other hand, there has been significant decrease in blubber thickness of the

minke whales and a reversal in the trend of age at maturity toward younger ages (Bando *et al.*, 2005; Konishi and Tamura, 2005; Zenitani and Kato, 2005), which strongly indicates competition among the whale species in the area. Comparative studies of both areas will be useful to understand the pattern of competition among whale species.

The area to be covered by JARPA II is basically same as JARPA: the eastern part of Area III, Areas IV and V, and the western part of Area VI (35°E - 145°W). In the first year, JARPA II surveyed the East Indian Ocean Stock of Antarctic minke whales in a longitudinal span of 140° on the western side of the research area (35°E - 175°E). Fig.1 shows geographic location of the research area for the 2005/2006 JARPAII surveys

Survey track line design

The minimum unit of the longitudinal width is 10 degrees in principle. The number of units was allocated to correspond with the longitudinal width of each stratum. However, the width of the units was changed based on the planed research days within the stratum. Track lines were constructed for SVs and SSVs, separately. Vessels made sightings alternately in the north and south strata. In the case of SV, two vessels crossed each other. Three SSVs conducted sighting and samplings simultaneously in the interval of 7 n.miles. The schematic figures are shown in Fig. 2 for SVs and Fig. 3 for SSVs, respectively.

The survey track line is systematically designed in the 10 degree longitudinal width interval in principle from the survey starting point. The survey starting point was randomly selected on the longitudinal border of the research area. Details are shown under the heading "The longitudinal interval and number of the survey track line in the sub-research area" on pages 4 and 5.

Sighting method

Sighting procedures were the same as in the previous JARPA surveys (Nishiwaki *et al*. 1999, Ishikawa *et al*. 2000). The sighting survey using SSVs was conducted under limited closing mode (when a sighting of Antarctic minke whales was made on the predetermined track line, the vessel approached the whales and species and school size confirmed). Three SSVs advanced along parallel track lines 7 n.miles apart, at a standard speed of 11.5 knots. The sighting survey by SV was conducted under limited closing mode and passing mode (even if sighting was made on the predetermined track line, the vessel did not approach the whales directly and searching from the barrel was uninterrupted).

The survey was operated under optimal research conditions (when the wind speed was below 25 knots in the south strata and 20 knots in the north strata and visibility was more than two n.miles). In addition to the sighting of Antarctic minke and fin whales or whales suspected to be those species, the SV approached blue (*B. musculus*), humpback (*Megaptera novaeangliae*), southern right (*Eubalaena australis*), pigmy right (*Caperea marginata*), sei (*B.borealis*), sperm (*Physeter macrocehpalus*) and southern bottlenose *(Hyperoodon planifrons*) whales for conducting some experiments. The SSVs also approached the same whale species as experiments in SV while they engaged in the sighting survey.

Sampling method

Three sampling/sighting vessels were engaged in the sampling survey. 850 Antarctic minke whales (with 10 % Allowance) and ten fin whales were planned to be taken in the research area south of 62°S.

One or two Antarctic minke whale was sampled randomly from each primary sighted school within 3n.miles of the track line. The dwarf form minke whales were not a target for sampling. Sampling of fin whales was restricted to an estimated body length less than 20m, because of limitation of the research base ship (NM) facility for dissection.

Low and middle latitudinal sighting survey

During transit cruises, sighting surveys were conducted in the area between 30°S and 60°S except for Areas within national EEZs. The results of these surveys are not shown in this report.

Biological research

Non-lethal means are not satisfactory to address all objectives of the planned in JARPA II. For example, age of whale, nutrition condition of the whale, food consumption, and heavy metal load can not be obtained by the current non-lethal methods. As well as the former JARPA, JARPA II will be conducted as a comprehensive research plan using lethal and non-lethal methods allocated properly for each research objective. Most of the research methods used in JARPA II were established through a research period of 18 years in JARPA.

Biological research on all sampled whales were conducted on the NM

Experiments

Sighting distance and angle experiment

This experiment was conducted in order to evaluate the accuracy of the information on sighting distance and sighting angle given by observers of the SV and SSVs.

Photo-identification experiment

The following species were targeted for photographic record of natural markings by SV and SSVs: blue, humpback and

southern right whales.

Biopsy sampling
In addition to the species targeted for the photo-identification experiment, pygmy right, fin, sei, sperm, southern bottlenose whales were targeted for biopsy skin sampling by the SV and SSVs using compound-crossbow. All collected sample were preserved at –80°C.

Oceanographic and acoustic survey
SVs conducted the following oceanographic survey.

1) Consecutive measuring of water surface temperature, conductivity, surface chlorophyll, dissolved oxygen, surface particle and surface flow by Electric Particle Counting and Sizing System (EPCS)
2) XCTD and CTD survey
3) Marine debris recording in the research area by KK1 and KS2. All marine debris found in the stomach of Antarctic minke whales was recorded and collected on NM.
4) Hydro-acoustic survey using a scientific echo sounder (EK500 with operating frequencies at 38kHz, 120kHz, 200kHz, SIMRAD, Norway) to elucidate distribution and abundance of prey species of baleen whales. Hydro-acoustic survey was conducted by KS2.This survey was conducted with sighting survey throughout the whole research area.

In addition to these surveys mentioned above, SVs deployed Argo profiling floats (profiling devices), which collected high quality oceanographic data of upper and middle layers of the world ocean almost simultaneously with very high space-time resolution, during this cruise in cooperation with Japan Marine Science and Technology Center (JAMSTEC) (See http://w3.jamstec.go.jp/ARGO/J_ARGOe.html).

During the 57th SC, three concerns were raised (IWC/57/Rep1, P58-59),

1) The level of details in proposed survey and sampling designs is insufficient to adequately review the proposal.
2) As noted in the proposal, krill plays a central role in the Antarctic ecosystem. However, the proposal appears to recognize this but contains no commitment or specific survey plans for such work.
3) Substantial numbers of Antarctic minke whales appear to occur within the pack ice and the pack ice is a potentially important habitat for this species. JARPA II contains no plans to surveys within the pack ice.

For sighting and sampling design, we considered the discussions and established a new design of track line in Figs. 2 and 3. These designs could assure the randomness and representativeness of sighting and sampling of whales.

With respect to krill survey, acoustic krill abundance survey using a scientific echo sounder (EK500) was planed. KS2 conducted this survey in the whole research area.

The survey of whales within the pack ice is very important. However, it is difficult and dangerous for the research unit NM. We conducted a survey using the Shirase (Ice-breaker vessel) in 2004/05 season and will make efforts to continue such surveys within pack ice.

RESULTS

Outline of the research activities
Table 1 shows an outline of the research activities. The research period in the 2005/06 JARPAII was 108 days from 3 December 2005 to 20 March 2006. The whale research unit (WRU) encountered a Greenpeace (GP) vessel during the research activity on 21 December 2005 and, the Sea Shepherd (SS) vessel together with GP on 25 December 2005. The WRU interrupted research activities from 25 December 2005 to 2 January 2006 to ensure safe refueling. The attempted obstruction and violent activities of GP occurred from 21 December 2005 to19 January 2006.

The longitudinal interval and number of the survey track lines in the sub-research area
The track lines by the SVs and the SSVs are shown in figures 4 and 5. The longitudinal interval and number in the unit of survey track line in each sub research area were as follows:

1) The eastern part of Area V
The research area in the eastern part of Area V is a range from 60°S to 69°S and from 175°E to 165°E. The research starting point of SVs and SSVs were provided on the 175°E longitudinal line. The survey track line was set zigzag in north and south to westward. The longitudinal interval of each tooth of the survey track line was 1° 15' for SSVs in both north and south strata, and 2°30' in north stratum and 1° 15'of south stratum for SVs. Allocated survey track line of the research area is one tooth in the north stratum and 3 teeth in the south stratum for SSVs. SVs surveyed two teeth in the north stratum and four teeth in the south stratum. The pack ice line was estimated based on the latest ice-edge information from near real time DMSP SSM/I daily polar griddled sea ice concentration data set available from the National Snow and Ice Data Center (NSIDC, Cavalieri *et al.*1999). However, the actual pack ice line projected remarkably to the north because of the developed low atmospheric pressure. Therefore, the northern boundary of south

stratum in the research area ranged from 175°E to 165°E was fixed at the 62°S and SSVs only surveyed the south stratum.

2) The western part of Area V

The research area in the western part of Area V was south of 60°S and from 165°E to 130°E. The research starting points of SVs and SSVs were the 165°E. The survey track line was set zigzag in north and south to westward. The survey track line was continued from that of the eastern part of Area V. SSVs surveyed 3 teeth in the north stratum and 9 teeth in the south stratum. SVs surveyed six teeth in the north stratum and twelve teeth in the south stratum. The research activity was planned from 9 to 28 December for the convenience of refueling. The entire research activities were interrupted on 23 December to evade interference by the GP and SS. The range surveyed in this period was from 165°E to 139°E.

Un-surveyed range in the research area from 130°E to 139°E was covered later (in March). The research starting point of SVs and SSVs were set on the 130°E. The survey track line was set zigzag in north and south to eastward. The same design of survey track line was continued from that of the eastern part of Area IV again. For the longitudinal interval of one tooth of the survey track line, the SSVs made 3° 20'in the north and south strata, the SVs adopted 5° in the north stratum and 2.5° in the south stratum. Because of limitation of research period due to the harassment by GP and SS, survey effort of SSVs was concentrated in the south stratum and the north stratum in this area was not surveyed.

3) The eastern part of Area IV

The range of the eastern part of Area IV is south of 60°S and from 100°E to 130°E. The same design of survey track line was continued from the western part of Area IV. The research starting point of SVs and SSVs was on the 100°E latitudinal line. The track line of the SSVs was set zigzag in north and south to eastward. In the case of SVs, the research area was divided into two areas at 117° 38'. The survey was implemented zigzag in north and south to westward in western half and to eastward on eastern half from this longitude. For the longitudinal interval of one tooth of the survey track line, the SSVs had 3° 20' in both north and south strata, the SVs adopted 5° in the north stratum and 2°30' in the south stratum. The teeth in the survey track line of this area were composed of four and a half teeth in the south stratum in SSVs and three teeth in the north stratum and six teeth in the south stratum in SVs. Because of limitation of research period due to the harassment by GP and SS, survey effort of SSVs was concentrated the south stratum and the north stratum in this area was not surveyed.

4) The western part of Area IV

The range of the western part of Area IV is south of 60°S and from 70°E to 100°E. The research starting point of SVs and SSVs was on the 70°E longitude line. The track line was surveyed zigzag in north and south to eastward except to westward from west of 75 ° east longitude. For the longitudinal interval of one tooth of survey track line, the SSVs had 1°40' in both north and south strata, the SVs adopted 5° of the north stratum and 2 °30' in the south stratum. The survey track line in this area for the SSVs was composed of two and half teeth in the north stratum and eight and half units in the south stratum. SV track lines were composed of three teeth in the north stratum and five and half teeth in the south stratum. In east of 95E, because of limitation of research period due to the harassment by GP and SS, survey effort of SSVs was concentrated the south stratum and the north stratum in this area was not surveyed.

5) The Prydz Bay (the western part of Area IV)

The range of the Prydz Bay is from south of 66°S from 70°E to 80°E. A tongue-shape ice field projected to the west side from 66°S to 67°S and from 80°E to 73°E. The entrance to the bay was blockaded in the neighborhood of 73°E and 67°S. The research area was divided into north and south at the 67°S. The research starting point of SVs and SSVs was on the 80°E. For the longitudinal interval of one tooth of survey track line, the SSVs had 3°20'and the 2°30' for the SVs. The survey track line of the research area was composed one and half teeth for the SSVs and two teeth for the SVs.

6) The eastern part of Area III

The research area in the eastern part of Area III is a range from south of 60° and from 55°E to 70°E. The research starting point of SVs and SSVs provided on the 55°E. The survey track line was set zigzag in north and south to eastward. For the longitudinal interval of one tooth of the track line, the SSVs had 1°40' in both north and south strata. The SVs had 5° of the north stratum and 2°30' of the south stratum. The survey track line of the research area was composed of one and a half teeth in the north stratum and three and a half teeth in the south stratum for SSVs and one and a half teeth for the north stratum and three teeth in the south stratum for the SVs.

Searching distance

The searching distances of the SVs and the SSVs were shown in table 2. The research period was 108 days but 9days were not surveyed because of harassment of GP and SS. The total searching distance was 16,372.7 n.miles consist of 8,836.2 n.miles in the two SVs and 7,536.5 n.miles in the three SSVs.

Whale species sighted

Fourteen species were identified during the research period. Table 3 shows eight whale species number of sightings by SV and SSVs. The following six species of baleen whales were confirmed; Antarctic minke, blue, fin, sei, humpback and southern right whales, and two toothed whales were confirmed; sperm and southern bottlenose whales.

The number of the primary sightings was; humpback whales (1702 schools and 3200 individuals), Antarctic minke whales (1658 schools and 4383 individuals) and fin whales (188 schools and 748 individuals). These account for 76.2% in the sighting composition with 36.6% for the humpback, 35.6% for the Antarctic minke and 4.0% for the fin whales in schools. The Antarctic minke and the humpback whales were equally dominant species. When considering biomass, it is suggested that the humpback whales exceeds that of fin whales which were the same as Antarctic minke whales.

Distributions of confirmed whale species in the research areas

1) Antarctic minke whales

The distribution of sightings of the Antarctic minke whales by SVs is shown in figure 6 and SSVs in figure 7. The Antarctic minke whales were widely distributed throughout the research areas. The density and distribution of sightings seemed to be different between east and west of 115 degrees of east longitude. In the east of this line, high density area was found only near the ice-edge, and density was low in the north strata and offshore in the south strata. In the west side of the line, high density and concentrated areas were observed from east of 55°E to the Prydz Bay and around the Drygarsky Island in the south strata of the Area IVW. Antarctic minke whales were low density in the north stratum but were widely distributed.

2) Humpback whales

The distribution of sightings of the humpback whales by SVs is shown in figure 8 and SSVs in figure 9.The humpback whales were widely distributed throughout the research areas. The density and distribution of sightings seemed to be different between east and west of 130 °E. In the east of this latitudinal line, humpback whales were concentrated near the ice-edge. In the west of 130°E latitudinal line, high concentrated areas were conformed in the south strata of Area IV except the Prydz Bay and around the Drygarsky Island where Antarctic minke whales were dominant. They were medium density in the north strata and offshore in the south strata.

3) Fin whales

The distribution of sightings of the fin whales by SVs is shown in figure 10 and SSVs in figure 11. Fin whales were widely distributed in the research areas throughout the research periods. High concentrated areas were confirmed in the south strata of Area IV, while they were rare in the Prydz Bay and around the Drygarsky Island. Sightings of fin whales in Areas IIIE and IV in the north strata were low.

3) Blue, sei and southern right whales

The distribution of sightings of blue, sei and southern right whales by SVs is shown in figure 12 and SSVs in figure 13. Sightings of blue whales were widely spread in the entire research area. Southern right whales were concentrated in the limited area in the south strata of the Area IV. Sei whales were sighted in the north stratum in the eastern part of Area IV.

Density index and mean school size

1) Antarctic minke whales

Table 4 shows density indices (DI; number of schools sighted/100 n.miles searching distance) and mean school size (MSS) of primary sightings of Antarctic minke whales by vessels and stratum. For the whole research area the DI was 12.7 schools and the MSS was 2.8 individuals for the SVs. For the SSVs, DI was 10.9 schools and MSS was 2.4 individuals.

In the case of the SVs, there is no difference in the DI within south and the north strata of the Areas VW (18.1 on north and 18.4 on south strata) and IIIE (15.0 on north and 11.7 on south strata). MSS was also nearly same (2.8 in the north and 2.3 in the south strata in Area VW and 2.3 in the north and 2.1 in the south strata in the Area IIIE). There is no difference in the DI and MSS within the south stratum of Area IIIE (DI 11.7 and MSS 2.1) and the Prydz Bay (DI 12.3 and MSS 1.9). However, there was a large difference of DI between north and south strata in the Area IV. These were 1.4 in eastern to 7.1 in western in the north stratum and 10.7 in eastern to 29.0 in western in the south stratum. The MSS also showed a similar tendency. These were 1.5 in eastern to 3.8 in western in the north stratum and 2.4 in eastern to 4.4 in western in the south stratum. The MSS for the south and north strata in the Area IVW was a maximum through the whole research area.

2) Humpback whales

Table 5 shows DI and MSS of primary sightings of humpback whales by vessels and stratum. In the whole research area, DO was 17.8 schools and the MSS was 1.9 individuals for the SVs. For the SSVs DI was 8.2 schools and MSS was 1.9 individuals. The MSS was the same level through the whole research areas.

In the case of the SVs, the DI was remarkably high in the south stratum of eastern and western part of Area IV. The south

stratum of Area IVE (50.0) was a maximum through the whole research area and was remarkable high density compared with other strata. There is not a difference in the DI within south and the north strata in the western part of Area VW (22.2 on north and 22.6 on south strata).

3) Fin whales

Table 6 shows DI and MSS of primary sightings of fin whales by vessels and stratum. In the whole research area DI was 2.7 schools and MSS was 3.1 individuals for the SVs. For the SSVs DI was 0.5 schools and MSS was 6.6 individuals.

In the case of the SVs, the DI in the north was remarkably lower than in the south stratum in the Area VE (0.5 in the north and 8.4 in the south strata) and in the Area IV (1.2 in the north and 8.9 in the south strata of eastern part, 1.8 in the north and 4.2 in the south strata of western part) except for the Prydz Bay. The range of the MSS was from 2.3 to 4.8 and there was no remarkable fluctuation by the research strata.

Sampling of Antarctic minke whales and fin whales

1) Antarctic minke whales

Out of 821 schools (1959 individuals) in the primary sightings of Antarctic minke whales by SSVs, 779 schools (1,879 individuals) were targeted for sampling. A total of 853 individuals were sampled (2 from Area VE, 148 from Area VW, 74 from Area IVE, 499 from Area IVW and 130 from Area IIIE).Sampling efficiency (the rate of successful sampling for targeted individuals) was 95.6%. This value was the highest level during the previous JARPA surveys. Struck and lost occurred in only three cases.

2) Fin whales

Out of 37 schools (245 individuals) in the primary sightings of fin whales by SSVs, 11 schools and 112 individuals (6 schools and 90 individuals in the south stratum of Area IVW, 5 schools and 22 individuals in the south stratum of Area IVE) were targeted for sampling. A total of 10 individuals were sampled (6 from Area IVW-S and 4 from Area IVE-S). Sampling efficiency was 90.16%. No struck and lost occurred.

Biological research

Biological research was conducted on the research base ship for all whales sampled. Table 6 summarizes biological data and samples collected from the Antarctic minke whales. Table 7 summarizes biological data and samples collected from the fin whales.

Preliminary analyses of biological information

1) Antarctic minke whales

Table8 shows the reproductive status of samples by stratum in Antarctic minke whales. Mature females were dominant in Prydz Bay, whereas mature males were dominant in most of other strata. In the south stratum of Area IVE, both immature males and females were dominant. Pregnancy rate in mature females was 93.8% (227 individuals) in the whole research areas and two twins were observed.

Table 10 shows mean body length of Antarctic minke whales collected in each stratum. Maximum length of the sample was 9.58m for males and 10.47m for females. Minimum length was 4.85m and 4.73m, respectively.

2) Fin whales

The biological data of the collected fin whales is shown in Table 9. The maximum body length was 20.22 m with body weight of a 61.52t for a female. The minimum body length of the mature female was 19.47 m with weight of 51.80 t.

Experiments

1) Sighting distance and angle experiment

A sighting distance and angle experiment was preformed on 30 December 2005 by SSVs, 3 and 4 January 2006 by the KS2 and 6 January 2006 by KK1. The results of this experiment will be used in calculation of abundance estimates.

2) The results of photo-ID

Table 10 summarizes the results of photo-ID. The photo-ID experiment was conducted within the entire research area. A total of 85 targeted individuals were photographed (13 blue, 34 humpback and 38 southern right whales).

3) The results of biopsy sampling

Table 11 summarizes the results of biopsy sampling. A total of 46 skin biopsy samples were collected from blue whales (n=5), fin whales (n=9), sei whales (n=1), humpback whales (n=13), southern right whales (n=15), carcass of sperm whale (n=1), carcass of southern bottlenose whale (n=1) and long-finned pilot whale (n=1).

4) The attachment of the satellite tags

YS1 tried to attach satellite tags to two individuals of one school of Antarctic minke whales on 14 February 2006. The body lengths were estimated at 8.2 m and 8.5 m. Both tags hit but one was omitted from the body because of trouble with the discharge. The other was attached to the body in the position behind the dorsal fin. However, the transmission antenna was ineffective and did not operate.

5) The Oceanographic and acoustic surveys
Table 12 shows the summary of oceanographic and acoustic surveys. CTD, XCTD and XBT castings which were conducted at 86, 123 and 22 locations, respectively. EPCS survey was conducted for 94 days by KS2 and 99 days by YS2 in total. KS2 conducted the quantitative echo sounder survey which ranged over 94 days in the whole research area.

6) The marine debris
The marine debris survey was carried out concomitant with the sighting survey of the SVs in all research areas. A total of fifteen debris (thirteen buoys, one wad of fishing net and one lump of styrol were confirmed. Eight sheets feathers as alien substances from the stomach content were confirmed in eight of the collected Antarctic minke whales.

Products
All the whales collected were processed on NM after biological sampling was completed, according to the provisions of Article VIII of the Convention. A total of 3441.4 tons (268.9 tons of fin and 3171.5 tons of Antarctic minke whales) of meat, blubber, viscera, etc. was produced.

DISCUSSION
This paper describes research methods and reports results from the first feasibility survey of the JARPA II. The objectives of this feasibility survey were the following: 1) to examine the practicability and appropriateness of sighting methods considering the enlarged research area, 2) to examine the practicability and appropriateness of sampling procedure considering the increased sample size for Antarctic minke whale and 3) to examine the practicability of methods of hunting, hauling, flensing and biological sampling of large-sized whales. For the feasibility surveys a total of 850+/-10% Antarctic minke whales and 10 fin whales were planned for sampling, and this target was met in this first feasibility survey.

The main results of the first feasibility survey can be summarized as follows:

1) Antarctic minke and humpback whales were the dominant species observed in similar numbers in the research area.
Both species were highly concentrated in the south strata. However, some segregation was observed as high density for one species did not coincide with the high density of the other species in a same stratum. Antarctic minke whale was dominant in the western part of Area IVW while the humpback whale was dominant in the eastern part of Area IVE. In terms of biomass it can be suggested that the humpback whale is the dominant species in the research area.

2) Fin whales were widely distributed in the south strata from 80°E to 135°E. In the past it was suggested that fin whales do not distribute in large number in the south strata compared with Antarctic minke and humpback whales. However, it was observed during this survey that fin whales distributed in the south strata presenting large mean school sizes (MSS) compared with that of other baleen whale species. It is clear that the biomass of fin whales is similar to that of Antarctic minke whales.

3) Large baleen whales intermingled in the south strata through whole research area.
Blue whales were widely observed in the entire research area. Southern right whales were concentrated in the south strata of Area IV. Sightings of both species were few compared with those of Antarctic minke, humpback and fin whales. However increasing in sighting composition of large baleen whales is important for studies of inter-species relationships of whales.

Regarding the objectives of the first feasibility survey, the following results were obtained:

1) The practicability and appropriateness of sighting methods in the enlarged area
This cruise was planned to cover a longitudinal span of 140° from 35°E to 175°E through early December to late March. It was planned that the search effort would be distributed mainly in Area IV, in the peak feeding season of baleen whales. The only un-surveyed areas were those from 35°E to 55°E and 135°E to 139°E, due to external disturbances. Despite these disturbances, sighting was conducted in the peak season from early January to early March in the main research area from 55°E to 130°E which included Area IV. The practicability and appropriateness of the planned sighting methods were confirmed.

2) Sampling procedures given the increased sample size and additional species.
A total of 779 schools (1,879) individuals of Antarctic minke whales were targeted for sampling. A total of 853 individuals were sampled from 4 December to 20 March. Sampling efficiency was 95.6%. A total of 11 schools (112 individuals) of the fin whales were targeted for sampling. A total of 10 individuals were sampled from 3 February to 13 March. Sampling efficiency was 90.16%. These results showed that sampling procedure were appropriate for the increased sample size of Antarctic minke whale and for additional species.

3) Methods for catching, flensing and taking biological measurements of large body-sized fin whales
Although it took more time to catch, transport, measure and dissect the fin whales than is the case for the Antarctic minke whales, the process from catching to biological sampling of fin whales was successfully conducted. Therefore the method of hunting, hauling, flensing and biological sampling of large-sized whales was checked and confirmed as adequate for whales of body length of at least 20.22m.

Therefore it can be concluded that the first feasibility survey of JARPA II was conducted satisfactorily and that the objectives of the feasibility survey were covered adequately.

ACKNOWLEDEGMENTS
We are indebted to Dr. Hiroshi Hatanaka, director-general of the ICR and Mr. Hideki Moronuki, the Government of Japan for implementation of the research. We thank research technicians, Messrs. Yasuhiro Murai, Chinori Asahina, Akio Kuji and Fukuo Oyama, Kyodo Senpaku Kaisya Ltd., for their contribution. Mr. Takashi Takaoka from the Government of Japan, served as onboard inspector. We are also indebted to all the crew, colleagues of the ICR and other related institutions who participated in the research for their contributions. We would like to express our appreciation to the Government of Japan for providing financial support for this research.

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Table1. Outline of the research activities

Event	Date	RBV	SSVs	SV	
				KK1	KS2
Depature from Shimonoseki-city in Yamaguchi prefecture Japan	8/ Nov./ 2005	○	○	○	○
Low and middle latitudinal sighting survey in trasit area	24/ Nov./ 2005 ～ 2/ Dec./ 2005		○	○	○
Starting of the sighting and sampling survey in the Antarctic Ocean	3/ Dec./ 2005			○	○
	4/ Dec./ 2005	○	○		
Sighting and sampling survey in the eastern part of Area V from 175E to 165E	3/ Dec./ 2005 ～ 8/ Dec./ 2005	○	○	○	○
Sighting and sampling survey in the Western part of Area V from 165E to 155E	9/ Dec./ 2005 ～ 11/ Dec./ 2005	○	○	○	○
Sighting and sampling survey in the Western part of Area V from 155E to 145E	12/ Dec./ 2005 ～ 22/ Dec./ 2005	○	○	○	○
Sighting and sampling survey in the Western part of Area V on west of 139E	24/ Dec./ 2005	○	○		○
Sighting and sampling survey in the Western part of Area IV from 75E to 70E	3/ Jan./ 2006 ～ 6/ Jan./ 2006			○	○
Sighting and sampling survey in the Western part of Area IV from 75E to 70E	3/ Jan./ 2006 ～ 7/ Jan./ 2006	○	○		
Sighting and sampling survey in the Eastern part of Area III from 70E to 55E	7/ Jan./ 2006			○	○
Sighting and sampling survey in the Eastern part of Area III from 70E to 55E	10/ Jan./ 2006 ～ 20/ Jan./ 2006	○	○		
Sighting and sampling survey in the Eastern part of Area III from 70E to 55E	10/ Jan./ 2006 ～ 13/ Jan./ 2006			○	○
Sighting and sampling survey in the Eastern part of Area III from 70E to 55E	14/ Jan./ 2006 ～ 19/ Jan./ 2006				○
Sighting and sampling survey in the Western part of Area IV from 75E to 80E	14/ Jan./ 2006 ～ 20/ Jan./ 2006			○	
Sighting and sampling survey on the Prydz Bay in the Western part of Area IV	20/ Jan./ 2006 ～ 31/ Jan./ 2006				○
Sighting and sampling survey on the Prydz Bay in the Western part of Area IV	21/ Jan./ 2006 ～ 3/ Feb./ 2006	○	○		
Sighting and sampling survey on the Prydz Bay in the Western part of Area IV	21/ Jan./ 2006 ～ 30/ Jan./ 2006			○	
Sighting and sampling survey in the Western part of Area IV from 75E to 100E	1/ Feb./ 2006 ～ 14/ Feb./ 2006				○
Sighting and sampling survey in the Western part of Area IV from 80E to 100E	1/ Feb./ 2006 ～ 15/ Feb./ 2006			○	
Sighting and sampling survey in the Western part of Area IV from 75E to 80E	3/ Feb./ 2006 ～ 4/ Feb./ 2006	○	○		
Sighting and sampling survey on the Prydz Bay in the Western part of Area IV	5/ Feb./ 2006 ～ 6/ Feb./ 2006	○	○		
Sighting and sampling survey in the Western part of Area IV from 80E to 100E	7/ Feb./ 2006 ～ 4/ Mar./ 2006	○	○		
Sighting and sampling survey in the Eastern part of Area IV from 117-38E to 100E	17/ Feb./ 2006 ～ 24/ Feb./ 2006				○
Sighting and sampling survey in the Eastern part of Area IV from 117-38E to 100E	18/ Feb./ 2006 ～ 24/ Feb./ 2006			○	
Sighting and sampling survey in the Eastern part of Area IV from 100E to 130E	4/ Mar./ 2006 ～ 16/ Mar./ 2006	○	○		
Sighting and sampling survey in the Eastern part of Area IV from 117-38E to 130E	5/ Mar./ 2006 ～ 11/ Mar./ 2006				○
Sighting and sampling survey in the Eastern part of Area IV from 117-38E to 130E	5/ Mar./ 2006 ～ 12/ Mar./ 2006			○	
Sighting and sampling survey in the Western part of Area V from 130E to 135E	17/ Mar./ 2006 ～ 20/ Mar./ 2006	○	○		
Sighting and sampling survey in the Western part of Area V from 130E to 132-38E	11/ Mar./ 2006 ～ 13/ Mar./ 2006				○
Sighting and sampling survey in the Western part of Area V on east of 130E	12/ Mar./ 2006			○	
Sighting and sampling survey in the Western part of Area V from 131E to 135E	17/ Mar./ 2006 ～ 20/ Mar./ 2006			○	○
Ending of the sighting and sampling survey in the Antarctic Ocean	20/ Mar./ 2006	○	○	○	○
Low and middle latitudinal sighting survey in trasit area	23/ Mar./ 2006 ～ 29/ Mar./ 2006		○	○	○
Arrive on Shimonoseki-city in Yamaguchi prefecture Japan	13/ Apr./ 2006		○		
Arrive on Kanazawa-city in Ishikawa prefecture Japan	14/ Apr./ 2006	○			
Arrive on Ohi in Tokyo Japan	15/ Apr./ 2006				○
Arrive on Shiogama-city in Miyagi prefecture Japan	16/ Apr./ 2006			○	

RBV:Resarch Base Vessel(Nisshin Maru) . SSVs:Sighting and Sampling Vessels.Sighting Vessel(KK1;Kaikoh Maru. KS2;Kyoushin Maru No.2)

Table2. Searching distances (n.miles) of two sighting vessel (SVs) and three sighting / sampling vessels (SSVs) in each stratum.

Area	Stratum	Block	SVs			SSVs			Grand total
			Closing	Passing	**Sub total**	Closing	Passing	**Sub total**	
V	East	North-North	21.8	75.1	**96.9**	0.0	0.0	**0.0**	**96.9**
		North-South	50.3	103.5	**153.8**	803.8	0.0	**803.8**	**957.7**
	West	North	202.5	411.3	**613.8**	808.9	0.0	**808.9**	**1422.7**
		South	156.5	496.2	**652.7**	1195.6	0.0	**1195.6**	**1848.3**
		Sub-total	**431.1**	**1086.2**	**1517.2**	**2808.4**	**0.0**	2808.4	**4325.6**
IV	East	North	462.7	987.6	**1450.3**	0.0	0.0	**0.0**	**1450.3**
		North (Transit-KS2)	0.0	134.6	**134.6**	0.0	0.0	**0.0**	**134.6**
		South	189.6	675.9	**865.5**	1707.2	0.0	**1707.2**	**2572.7**
		South (Special-KS2)	0.0	80.3	**80.3**	0.0	0.0	**0.0**	**80.3**
		South (Ice edge-KK1)	0.0	407.1	**407.1**	0.0	0.0	**0.0**	**407.1**
	West	North	297.5	827.8	**1125.3**	706.9	0.0	**706.9**	**1832.2**
		North (Transit-KS2)	0.0	143.3	**143.3**	0.0	0.0	**0.0**	**143.3**
		South	227.8	637.8	**865.6**	608.4	0.0	608.4	**1474.0**
	Prydz Bay		95.1	285.9	**381.1**	672.2	0.0	**672.2**	**1053.3**
		Transit-KS2	0.0	53.5	**53.5**	0.0	0.0	**0.0**	**53.5**
		Special-KS2	0.0	31.9	**31.9**	0.0	0.0	**0.0**	**31.9**
		Ice-edge-KK1	0.0	431.5	**431.5**	0.0	0.0	**0.0**	**431.5**
		Sub-total	**1272.7**	**4697.2**	**5969.8**	**3694.8**	**0.0**	**3694.8**	**9664.6**
III	East	North	149.8	524.5	**674.2**	322.6	0.0	**322.6**	**996.8**
		South	238.7	436.3	**675.0**	664.0	46.8	**710.8**	**1385.8**
		Sub-total	**388.4**	**960.8**	**1349.2**	**986.5**	**46.8**	**1033.4**	**2382.6**
		Grand total	**2092.2**	**6744.1**	**8836.2**	**7489.7**	**46.8**	**7536.5**	**16372.7**

Table 3. Summary of whale sightings conducted by SV and SSVs in whole research areas.

Vessls	Sighting vessls				Sighting and sampling vessels				Total			
Type of the sightings	Primary		Secondly		Primary		Secondly		Primary		Secondly	
Species	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Antarctic minke whales	837	2,424	170	470	821	1,959	20	64	1,658	4,383	190	534
Liked minkewhales	85	138	8	14	12	13	0	0	97	151	8	14
Blue whales	18	29	2	3	6	9	5	7	24	38	7	10
Fin whales	151	503	12	40	37	245	24	148	188	748	36	188
Sei whales	2	3	0	0	0	0	0	0	2	3	0	0
Humpback whales	1,085	2,024	99	161	617	1,176	47	93	1,702	3,200	146	254
Southern right whales	33	44	4	4	20	29	4	5	53	73	8	9
Baleen whales	226	456	25	71	8	8	11	72	234	464	36	143
Sperm whales	138	139	12	12	43	43	6	6	181	182	18	18
Southern bottlenose whales	71	150	3	6	17	29	0	0	88	179	3	6

Table 4. Density indices (DI, number of schools per 100 n.miles) and mean school size (MSS) of Antarctic minke whale primary sightings by SV and SSVs.

Area	Part	Stratum	SVs					SSVs				
			Searching distance (n.mile)	Antarctic minke whale (primary sighting)				Searching distance (n.mile)	Antarctic minke whale (primary sighting)			
				Sch.	Ind.	DI	MSS		Sch.	Ind.	DI	MSS
V	East	North-North	96.9	0	0	0.0	0.0	-	-	-	-	-
		North-South	153.8	0	0	0.0	0.0	803.8	2	2	0.2	1.0
	West	North	613.8	111	311	18.1	2.8	808.9	41	78	5.1	1.9
		South	652.7	120	280	18.4	2.3	1195.6	85	165	7.1	1.9
		Sub-total	**1517.2**	**231**	**591**	**15.2**	**2.6**	**2808.4**	**128**	**245**	**4.6**	**1.9**
IV	East	North	1450.3	20	30	1.4	1.5	-	-	-	-	-
		North (Transit-KS2)	134.6	11	12	8.2	1.1	-	-	-	-	-
		South	865.5	93	224	10.7	2.4	1707.2	70	126	4.1	1.8
		South (Special-KS2)	80.3	1	1	1.2	1.0	-	-	-	-	-
		South (Ice edge-KK1)	407.1	28	52	6.9	1.9	-	-	-	-	-
	West	North	1125.3	80	307	7.1	3.8	706.9	112	238	15.8	2.1
		North (Transit-KS2)	143.3	3	3	2.1	1.0	-	-	-	-	-
		South	865.6	251	1096	29.0	4.4	608.4	214	752	35.2	3.5
	Prydz Bay		381.1	47	89	12.3	1.9	672.2	155	344	23.1	2.2
		Transit-KS2	53.5	20	33	37.4	1.7	-	-	-	-	-
		Special-KS2	31.9	2	3	6.3	1.5	-	-	-	-	-
		Ice-edge-KK1	431.5	156	280	36.2	1.8	-	-	-	-	-
		Sub-total	**5969.8**	**712**	**2130**	**11.9**	**3.0**	**3694.8**	**551**	**1460**	**14.9**	**2.6**
III	East	North	674.2	101	236	15.0	2.3	322.6	20	34	6.2	1.7
		South	675.0	79	169	11.7	2.1	710.8	122	220	17.2	1.8
		Sub-total	**1349.2**	**180**	**405**	**13.3**	**2.3**	**1033.4**	**142**	**254**	**13.7**	**1.8**
		Grand Total	**8836.2**	**1123**	**3126**	**12.7**	**2.8**	**7536.5**	**821**	**1959**	**10.9**	**2.4**

Table5 . Density indices (DI, number of schools per 100 n.miles) and mean school size (MSS) of humpback whale primary sightings by SV and SSVs.

Area	Part	Stratum	SVs					SSVs				
			Searching distance (n.mile)	Humpback whale (primary sighting)				Searching distance (n.mile)	Humpback whale (primary sighting)			
				Sch.	Ind.	DI	MSS		Sch.	Ind.	DI	MSS
V	East	North-North	96.9	2	3	2.1	1.5	-	-	-	-	-
		North-South	153.8	3	3	2.0	1.0	803.8	18	28	2.2	1.6
	West	North	613.8	31	58	5.1	1.9	808.9	42	68	5.2	1.6
		South	652.7	87	154	13.3	1.8	1195.6	45	67	3.8	1.5
		Sub-total	**1517.2**	**123**	**218**	**8.1**	**1.8**	**2808.4**	**105**	**163**	**3.7**	**1.6**
IV	East	North	1450.3	118	234	8.1	2.0	-	-	-	-	-
		North (Transit-KS2)	134.6	96	189	71.3	0.0	-	-	-	-	-
		South	865.5	433	791	50.0	1.8	1707.2	293	569	17.2	1.9
		South (Special-KS2)	80.3	0	0	0.0	0.0	-	-	-	-	-
		South (Ice edge-KK1)	407.1	182	298	44.7	1.6	-	-	-	-	-
	West	North	1125.3	250	460	22.2	1.8	706.9	72	155	10.2	2.2
		North (Transit-KS2)	143.3	88	171	61.4	1.9	-	-	-	-	-
		South	865.6	196	381	22.6	1.9	608.4	129	255	21.2	2.0
	Prydz Bay		381.1	0	0	0.0	0.0	672.2	5	8	0.7	1.6
		Transit-KS2	53.5	0	0	0.0	0.0	-	-	-	-	-
		Special-KS2	31.9	0	0	0.0	0.0	-	-	-	-	-
		Ice-edge-KK1	431.5	2	4	0.5	2.0	-	-	-	-	-
		Sub-total	**5969.8**	**1365**	**2528**	**22.9**	**1.9**	**3694.8**	**499**	**987**	**13.5**	**2.0**
III	East	North	674.2	77	159	11.4	2.1	322.6	6	9	1.9	1.5
		South	675.0	6	12	0.9	2.0	710.8	7	17	1.0	2.4
		Sub-total	**1349.2**	**83**	**171**	**6.2**	**2.1**	**1033.4**	**13**	**26**	**1.3**	**2.0**
		Grand Total	**8836.2**	**1571**	**2917**	**17.8**	**1.9**	**7536.5**	**617**	**1176**	**8.2**	**1.9**

Table6 . Density indices (DI, number of schools per 100 n.miles) and mean school size (MSS) of fin whale primary sightings by SV and SSVs.

Area	Part	Stratum	SVs					SSVs				
			Searching distance (n.mile)	Fin whale (primary sighting)				Searching distance (n.mile)	Fin whale (primary sighting)			
				Sch.	Ind.	DI	MSS		Sch.	Ind.	DI	MSS
V	East	North-North	96.9	0	0	0.0	0.0	-	-	-	-	-
		North-South	153.8	0	0	0.0	0.0	803.8	0	0	0.0	0.0
	West	North	613.8	3	14	0.5	4.7	808.9	3	7	0.4	2.3
		South	652.7	55	154	8.4	2.8	1195.6	1	3	0.1	3.0
		Sub-total	**1517.2**	**58**	**168**	**3.8**	**2.9**	**2808.4**	**4**	**10**	**0.1**	**2.5**
IV	East	North	1450.3	18	35	1.2	1.9	-	-	-	-	-
		North (Transit-KS2)	134.6	0	0	0.0	0.0	-	-	-	-	-
		South	865.5	77	177	8.9	2.3	1707.2	17	108	1.0	6.4
		South (Special-KS2)	80.3	1	25	1.2	25.0	-	-	-	-	-
		South (Ice edge-KK1)	407.1	10	30	2.5	3.0	-	-	-	-	-
	West	North	1125.3	20	56	1.8	2.8	706.9	0	0	0.0	0.0
		North (Transit-KS2)	143.3	1	1	0.7	1.0	-	-	-	-	-
		South	865.6	36	172	4.2	4.8	608.4	10	116	1.6	11.6
	Prydz Bay		381.1	0	0	0.0	0.0	672.2	1	2	0.1	2.0
		Transit-KS2	53.5	0	0	0.0	0.0	-	-	-	-	-
		Special-KS2	31.9	0	0	0.0	0.0	-	-	-	-	-
		Ice-edge-KK1	431.5	0	0	0.0	0.0	-	-	-	-	-
		Sub-total	**5969.8**	**163**	**496**	**2.7**	**3.0**	**3694.8**	**28**	**226**	**0.8**	**8.1**
III	East	North	674.2	16	75	2.4	4.7	322.6	2	4	0.6	2.0
		South	675.0	0	0	0.0	0.0	710.8	3	5	0.4	1.7
		Sub-total	**1349.2**	**16**	**75**	**1.2**	**4.7**	**1033.4**	**5**	**9**	**0.5**	**1.8**
		Grand Total	**8836.2**	**237**	**739**	**2.7**	**3.1**	**7536.5**	**37**	**245**	**0.5**	**6.6**

Table 7. Summary of biological data and samples collected from Antarctic minke whales.

Samples and data	Number of whales		
	Male	Female	Total
Photographic record of external character	461	389	850
Body length and sex identification	462	391	853
Measurement of external body proportion	462	391	853
Body weight	12	11	23
Body weight by total weight of parts	5	6	11
Skull measurement (length and breadth)	437	360	797
Standard measurement of blubber thickness (two points)	462	391	853
Lactation status	-	391	391
Measurement of mammary gland	-	391	391
Testis weight	462	-	462
Weight of stomach content	440	378	818
Diatom film observation	462	391	853
Blood plasma for physiological study	459	389	848
Earplug for age determination	462	391	853
Ocular lens for age determination	107	107	214
Tympanic bone for chemical analysis	48	27	75
Largest baleen plate for chemical analysis	462	390	852
Vertebral epiphyses sample	401	308	709
Ovary	-	391	391
Histological sample of endometrium	-	15	15
Histological sample of mammary gland	-	391	391
Milk sample for chemical analysis	-	2	2
Histological sample of testis	462	-	462
Skin and liver tissues for genetic study	462	391	853
Blubber, muscle and liver tissues for environmental monitoring	462	391	853
Lung tissue for air monitoring	21	16	37
Macro pathological observation (thyroid, lung, stomach, liver and gonad)	462	391	853
Tissues for histopathological study	110	98	208
Stomach contents for food and feeding study	38	24	62
Stomach contents for environmental monitoring	15	10	25
External parasites	9	9	18
Internal parasites	1	5	6
Photographic record of fetus	126	93	227*
Fetal length and weight	126	93	227*
Collection of small fetus	0	0	8*
Fetal ocular lens for age determination	16	11	27
Fetal skin for genetic study	126	93	227*
Oocyte for *in-vitro* fertilization (IVF)	-	132	132
Oviductal fluids for *in-vitro* culture (IVC)	-	5	5
Spermatogenic cell for round spermatid injection (ROSI)	1	-	1
Fetal ovary for *in-vitro* fertilization (IVF)	-	16	16
Uterus and placenta tissues for histomorphological study	-	40	40
Blubber for sphingolipid analysis	10	10	20
Tissues for organogenic study of bone	5	0	5
Fetal tissues for organogenic study of bone	4	1	5
Fetal tissues for organogenic study of olfactory system	9	3	12
Fetal head for organogenic study	1	2	3
Various organ tissues for histological study	17	20	37
Baleen plates for educational exhibition	0	1	1

*** : including a fetus of sex unidentified.**

Table 8. Summary of biological data and samples collected from fin whales.

Samples and data	Number of whales		
	Male	Female	Total
Photographic record of external character	4	6	10
Body length and sex identification	4	6	10
Measurement of external body proportion	4	6	10
Body weight by total weight of parts	3	6	9
Skull measurement (length and breadth)	4	4	8
Detailed measurement of blubber thickness (fourteen points)	4	6	10
Lactation status	-	6	6
Measurement of mammary gland	-	6	6
Breadth measurement of uterine horn	-	6	6
Testis weight	4	-	4
Epididymis weight	4	-	4
Weight of stomach content	4	6	10
Number of ribs	4	6	10
Diatom film observation	4	6	10
Diatom film sample	4	6	10
Blood plasma for physiological study	4	6	10
Earplug for age determination	4	6	10
Ocular lens for age determination	4	6	10
Tympanic bone for chemical analysis	4	6	10
Largest baleen plate for chemical analysis	3	6	9
Vertebral epiphyses sample	4	6	10
Ovary	-	6	6
Histological sample of endometrium	-	6	6
Histological sample of mammary gland	-	6	6
Milk sample for chemical analysis	-	0	0
Histological sample of testis	4	-	4
Histological sample of epididymis	3	-	3
Skin and liver tissues for genetic study	4	6	10
Blubber, muscle and liver tissues for environmental monitoring	4	6	10
Lung tissue for air monitoring	4	6	10
Macro pathological observation (thyroid, lung, stomach, liver and gonad)	4	6	10
Tissues for histopathological study	4	3	7
Muscle, liver, kidney, lumbar and blubber tissues for lipid analysis	4	6	10
Muscle, liver and blubber tissues for chemical analysis	4	6	10
Muscle and blubber tissues for nutritional analysis	4	6	10
Stomach contents for food and feeding study	4	5	9
Stomach contents for environmental monitoring	2	3	5
Stomach contents for lipid analysis	2	4	6
External parasites	3	2	5
Internal parasites	1	0	1
Photographic record of fetus	1	1	2
Fetal length and weight	1	1	2
External measurements of fetus	1	1	2
Collection of whole fetus	0	0	0
Fetal ocular lens for age determination	1	1	2
Fetal skin for genetic study	1	1	2
Baleen plates for educational exhibition	1	0	1

Table 9. Reproductive status of Antarctic minke whales sampled in 2005/2006 JARPAII. Numbers in parenthesis represent ratio of samples in each stratum (%). Maturity of males was tentatively defined by testis weight according to Kato (1986). "Resting" represents non-pregnant mature female without corpus luteum and "Ovulating" represents female that had corpus luteum but fetus was not observed.

Stratum	Male			Female						Combined
					Mature					
	Immature	Mature	Total	Immature	No-pregnant		Pregnant		Total	
					Ovulating	Resting	Pregnant	Lactating		
AreaV East-North (Northern part)	0 0.0%	0 0.0%	0 0.0%	1 50.0%	0 0.0%	0 0.0%	1 50.0%	0 0.0%	2 100.0%	2
AreaV West-North	2 3.9%	36 70.6%	38 74.5%	7 13.7%	0 0.0%	0 0.0%	6 11.8%	0 0.0%	13 25.5%	51
AreaIV East-North	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0
AreaIV West-North	18 14.5%	53 42.7%	71 57.3%	29 23.4%	1 0.8%	1 0.8%	22 17.7%	0 0.0%	53 42.7%	124
AreaIII East-North	1 4.5%	11 50.0%	12 54.5%	6 27.3%	0 0.0%	0 0.0%	3 13.6%	1 4.5%	10 45.5%	22
Northern Strata (Total)	21 10.6%	100 50.3%	121 60.8%	43 21.6%	1 0.5%	1 0.5%	32 16.1%	1 0.5%	78 39.2%	199
AreaV East-North (Southern part)	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0
AreaV West-South (First period)	7 8.9%	30 38.0%	37 46.8%	13 16.5%	0 0.0%	1 1.3%	28 35.4%	0 0.0%	42 53.2%	79
AreaV West-South (Second period)	7 38.9%	7 38.9%	14 77.8%	1 5.6%	0 0.0%	0 0.0%	3 16.7%	0 0.0%	4 22.2%	18
AreaV West-South (Total)	14 14.4%	37 38.1%	51 52.6%	14 14.4%	0 0.0%	1 1.0%	31 32.0%	0 0.0%	46 47.4%	97
AreaIV East-South	12 16.2%	27 36.5%	39 52.7%	22 29.7%	0 0.0%	3 4.1%	10 13.5%	0 0.0%	35 47.3%	74
AreaIV West-South	28 12.3%	108 47.4%	136 59.6%	33 14.5%	1 0.4%	4 1.8%	54 23.7%	0 0.0%	92 40.4%	228
AreaIV Prydz Bay	8 5.4%	55 37.4%	63 42.9%	14 9.5%	2 1.4%	1 0.7%	66 44.9%	1 0.7%	84 57.1%	147
AreaIV West-South + Prydz Bay	36 9.6%	163 43.5%	199 53.1%	47 12.5%	3 0.8%	5 1.3%	120 32.0%	1 0.3%	176 46.9%	375
AreaIII East-South	15 13.9%	37 34.3%	52 48.1%	23 21.3%	0 0.0%	1 0.9%	31 28.7%	1 0.9%	56 51.9%	108
Southern Strata (Total)	77 11.8%	264 40.4%	341 52.1%	106 16.2%	3 0.5%	10 1.5%	192 29.4%	2 0.3%	313 47.9%	654
Combined	98 11.5%	364 42.7%	462 54.2%	149 17.5%	4 0.5%	11 1.3%	224 26.3%	3 0.4%	391 45.8%	853

Table 10. Some biological information on fin whales sampled in 2005/2006 JARPAII.

No.	Date of capture	Body length	Body weight*	Sex	Weight of testis (L/R)	Reproductive information	Remarks
F-001	060203	19.17m	–	M	1.84/2.19kg		
F-002	060208	20.05m	53.48t	F	–	Pregnant	Fetal length 127.5cm
F-003	060209	19.47m	52.05t	F	–	Pregnant	Fetal length 280.7cm
F-004	060210	18.73m	41.87t	M	5.36/5.54kg		
F-005	060213	19.14m	47.28t	M	10.10/10.60kg		Spondylosis deformans
F-006	060214	19.15m	47.04t	F	–	Immature	
F-007	060307	20.22m	61.52t	F	–	Mature/Resting	
F-008	060309	18.22m	41.06t	F	–	Immature	
F-009	060310	18.30m	42.27t	M	1.65/1.91kg		
F-010	060313	19.35m	47.24t	F	–	Immature	

* Body weight was represented by total weight of body parts.

Table 11. Average body length (m) with standard deviation (S.D.) and body length range of Antarctic minke whales sampled in each stratum. Maturity of males was defined as Table 8.

Stratum	Average S.D.	Max Min	N	Average S.D.	Max Min	N	Average S.D.	Max Min	N	Average S.D.	Max Min	N
AreaV East-North (Northern part)	—	—	—	—	—	—	8.98 —	8.98 8.98	1	6.77 —	6.77 6.77	1
AreaV West-North	8.32 0.42	9.37 7.58	36	7.52 0.46	7.84 7.19	2	8.75 0.48	9.41 8.18	6	6.22 1.11	8.12 4.95	7
AreaIV East-North	—	—	—	—	—	—	—	—	—	—	—	—
AreaIV West-North	8.40 0.36	9.12 7.76	53	6.40 0.85	7.88 5.13	18	9.01 0.35	9.75 8.38	24	6.60 0.86	8.00 4.99	29
AreaIII East-North	8.36 0.39	9.13 7.72	11	6.68	6.68 6.68	1	8.98 0.43	9.53 8.49	4	7.23 0.94	8.77 6.31	6
AreaV East-North (Southern part)	—	—	—	—	—	—	—	—	—	—	—	—
AreaV West-South (First period)	8.29 0.32	9.00 7.75	30	6.92 0.52	7.61 6.17	7	8.79 0.38	9.41 8.19	29	6.91 1.01	8.30 5.16	13
AreaV West-South (Second period)	8.40 0.38	9.06 8.00	7	6.86 1.04	7.72 4.85	7	8.92 0.33	9.14 8.54	3	5.55	5.55 5.55	1
AreaIV East-South	8.55 0.32	9.03 7.92	27	6.04 0.75	7.47 5.02	12	8.92 0.39	9.70 8.28	13	6.39 0.91	8.22 4.73	22
AreaIV West-South	8.44 0.38	9.58 7.54	108	6.67 0.97	8.43 5.02	28	8.90 0.34	9.54 8.08	59	7.14 0.82	8.58 5.31	33
AreaIV Prydz Bay	8.37 0.39	9.35 7.36	55	7.04 0.71	7.79 5.60	8	8.94 0.42	10.47 8.15	70	7.67 0.77	8.80 5.82	14
AreaIII East-South	8.39 0.30	8.98 7.70	37	6.49 0.88	7.81 5.16	15	8.92 0.40	9.71 7.96	33	7.43 0.83	8.32 5.40	23

Table12.Summary of photo-ID

	Stratum									Total
	Area III		Area IV					Area V		
	East		East		West		Prydz Bay	West		
Species	North	South	North	South	North	South		North	South	
Blue whale		3	1	6	1	2				13
Humpback whale			3		11	20				34
Southern right whale			9	22		7				38
Total	0	3	13	28	12	29	0	0	0	**85**

Table13.Summary of biopsy sampling

	Stratum									Total
	Area III		Area IV					Area V		
	East		East		West		Prydz Bay	West		
Species	North	South	North	South	North	South		North	South	
Blue whale			1	1	1	2				5
Fin whale				1		7	1			9
Sei whale			1							1
Humpback whale		1	2		4	6				13
Southern right whale			2	10		3				15
Sperm whale (Carcass)			1							1
Southern bottlenose whale (Carcass)							1			1
Long-finned pilot whale					1					1
Total	0	1	7	12	5	18	2	0	0	**46**

Table14 . Summary of oceanographic and acoustic survey.

Vessel					CTD (stations)		XCTD (stations)		XBT (stations)		EPCS (days)		Quantitive echo sounder (days)
					KS2	KK1	KS2	KK1	KS2	KK1	KS2	YS2	KS2
Stratum	Area III	East	North		7	1	5		2		7	3	7
			South		5	2	2	1			7	8	7
	Area IV	East	North		10	2	13	10	4	4	14		14
			South		3	4	6	7	2	1	8	13	8
		West	North		5	5	9	14	3	1	7	11	7
			South		8	4	5	1			11	24	11
	Prydz Bay				3	4	18				9	14	9
	Area V	East	North	North	1	1	1	2			3		3
				South		2		2			4	6	4
			South										0
		West	North		5	5	11	7	2	1	12	6	12
			South		7	2	5	4	1	1	12	14	12
Total					54	32	75	48	14	8	94	99	94

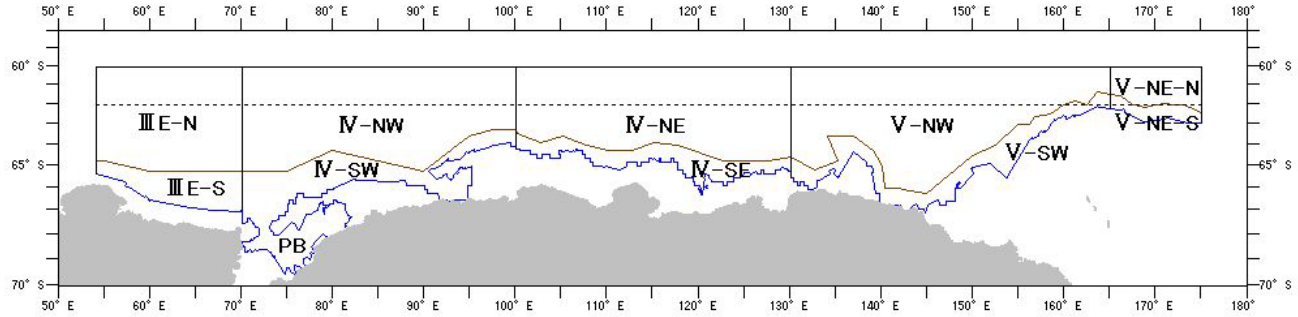

Fig. 1. Geographic location of research area of the 2005/2006 JARPAII surveys.

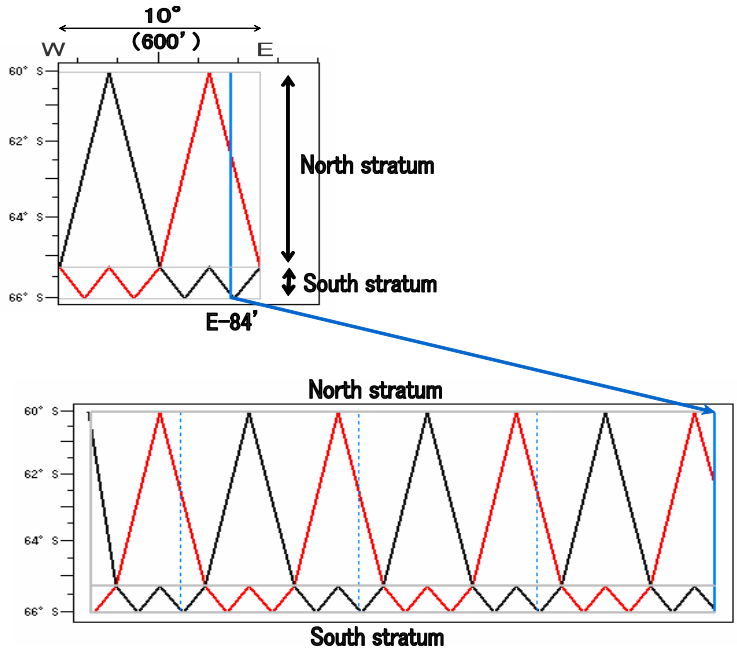

Fig2. The design of survey track line of SVs based on the minimum unit.

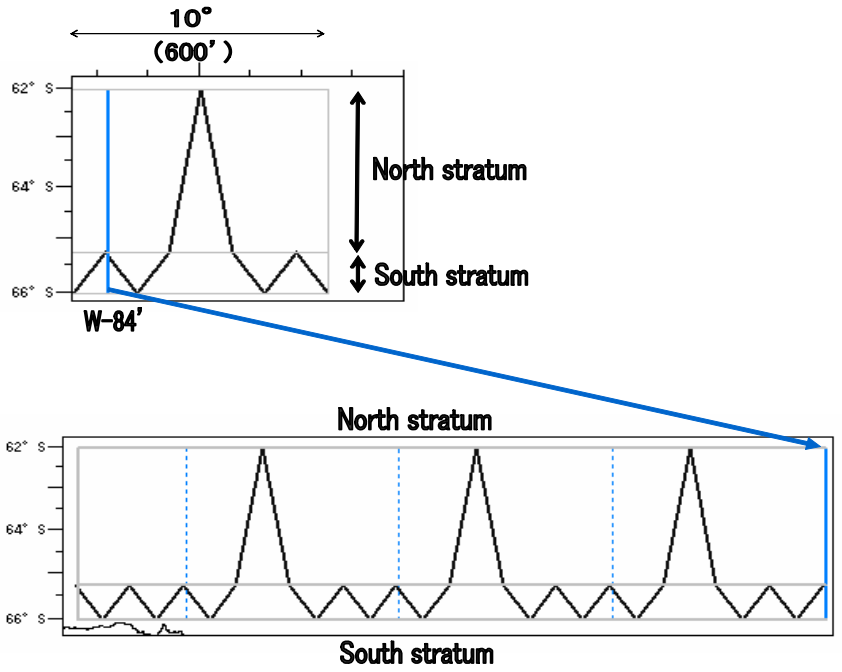

Fig3. The design of survey track line of SSVs from the minimum unit.

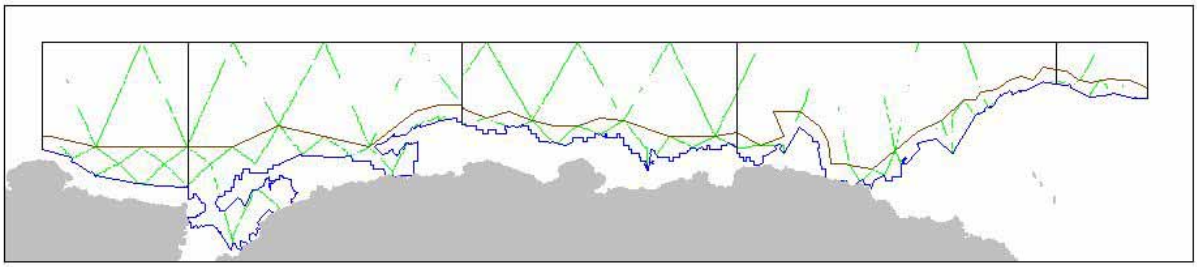

Fig. 4. Survey track line of SVs in 2005/2006 JARPAII. Pack ice lines are estimated by observation of research vessels and the information from Near real time DMSP SSM / I daily polar griddled sea ice concentration data set available from the National Snow and Center (NSIDC, Cavalieri et al. 1999), US.

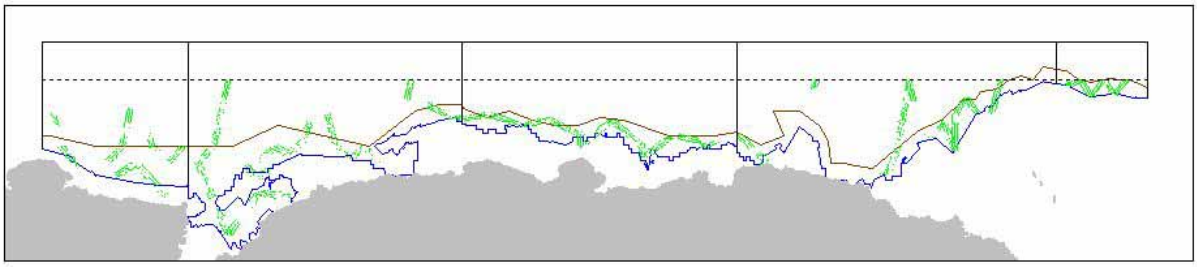

Fig. 5. Survey track line of SSVs in 2005/2006 JARPAII. Pack ice lines are estimated by observation of research vessels and the information from Near real time DMSP SSM / I daily polar griddled sea ice concentration data set available from the National Snow and Center (NSIDC, Cavalieri et al. 1999), US. Because of limitation of research period due to the harassment by GP and SS, survey effort of SSVs was concentrated the south stratum and un-surveyed the north stratum from 95°E to 135°E.

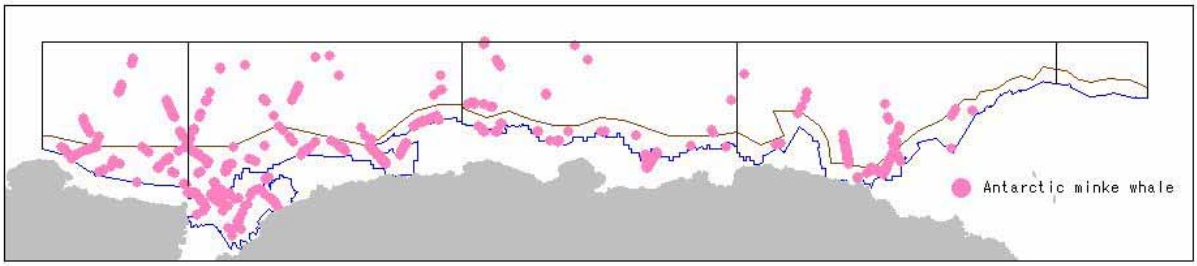

Fig. 6. Distribution of all sightings of Antarctic minke whales sighted by SVs in 2005/2006 JARPAII

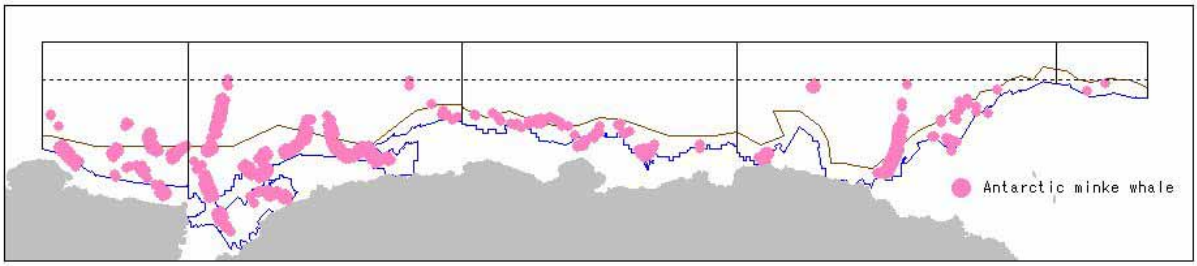

Fig. 7. Distribution of all sightings of Antarctic minke whales sighted by SSVs in 2005/2006 JARPAII

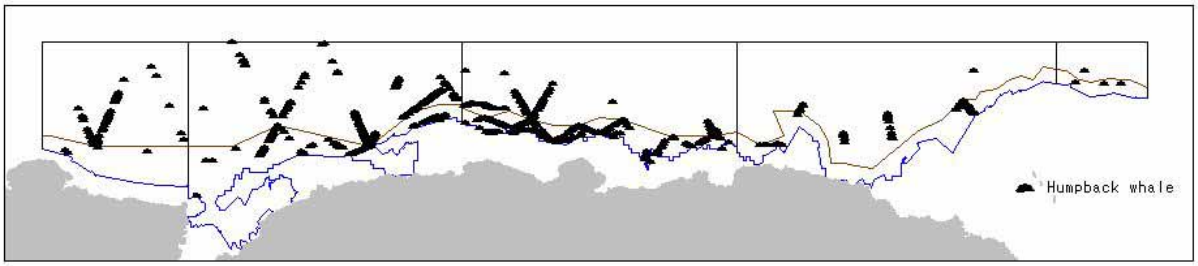

Fig.8. Distribution of all sightings of humpback whales sighted by SVs in 2005/2006 JARPAII.

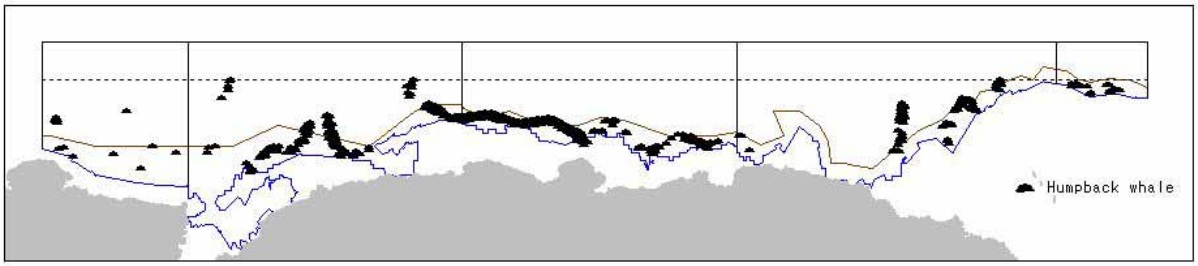

Fig. 9. Distribution of all sightings of humpback whales sighted by SSVs in 2005/2006 JARPAII

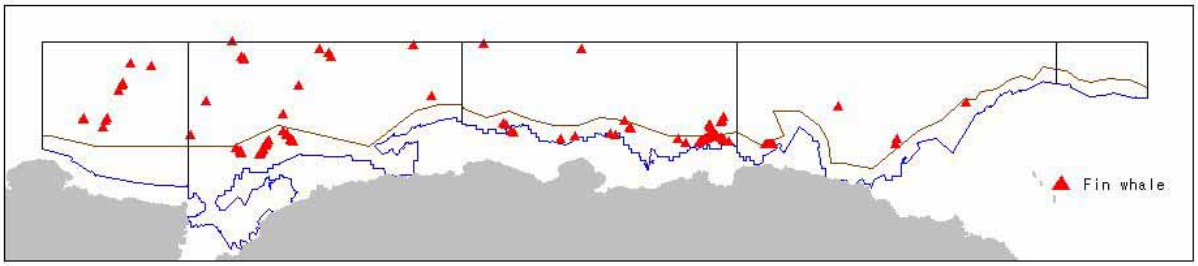

Fig.10. Distribution of all sightings of fin whales sighted by SVs in 2005/2006 JARPAII

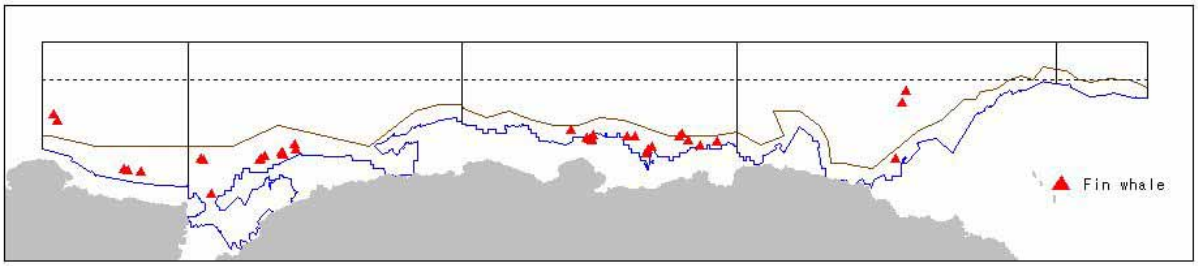

Fig.11. Distribution of all sightings of fin whales sighted by SSVs in 2005/2006 JARPAII

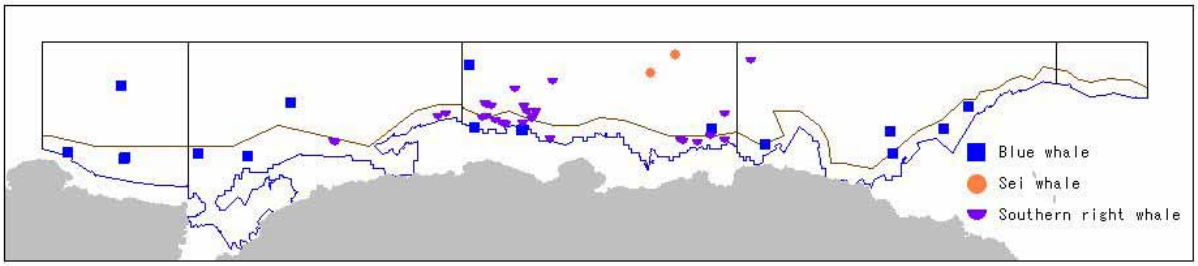

Fig.12. Distribution of all sightings of blue, sei and southern right whales sighted by SVs in 2005/2006 JARPAII

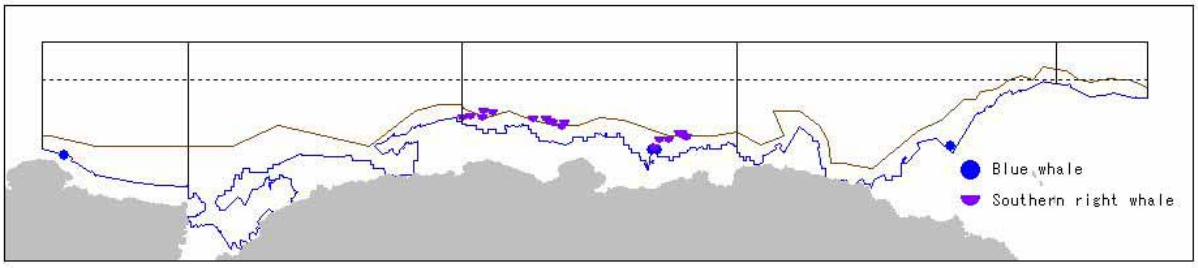

Fig.13. Distribution of all sightings of blue and southern right whales sighted by SSVs in 2005/2006 JARPAII