

2010 IWC/Japan Joint Cetacean Sighting Survey Cruise in the North Pacific

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ABSTRACT

The 1st annual IWC/Japan Joint Cetacean Sighting Survey Cruise in the North Pacific (as a successor to the IWC/IDCR-SOWER cruises since 1978/79 in the Antarctic) was conducted from 2 July to 31 August, 2010 in the central North Pacific (north of 40°N, south of the Aleutian Islands, between 170°E and 170°W) using the Japanese Research Vessel *Kaiko-Maru*. The cruise plan was endorsed at the 62nd IWC/SC meeting. The cruise had five main objectives: (a) provide information for the proposed future in-depth assessment of sei whales in terms of both abundance and stock structure; (b) provide information relevant to Implementation Reviews of whales (e.g. common minke whales) in terms of both abundance and stock structure; (c) provide baseline information on distribution and abundance for a poorly known area for several large whale species/populations, including those that were known to have been depleted in the past, but whose status is unclear; (d) provide biopsy samples and photo-identification photos to contribute to discussions of stock structure for several large whale species/populations, including those that were known to have been depleted in the past but whose status is unclear; (e) provide essential information for the intersessional workshop to plan for a medium-long term international programme in the North Pacific. The sighting survey was conducted under the methods based on the guidelines of the IWC/SC and the predetermined transect lines were completed. On the whole, there were poor weather conditions (heavy winds or poor visibility) in the research area due to a strong low pressure system moving eastwards, especially in the western side of the northern stratum. Survey coverage was 34% in the northern stratum and 70% in the southern stratum. A total of 1,986.3 n.miles were surveyed in the research area in two modes: NSC Mode (1,098.5 n.miles) and IO Mode (887.8 n.miles). A total of 375 schools (4,242 individuals) of 12 whale species were recorded. Sightings of blue (5 schools / 5 individuals), fin (28/55), sei (62/118), common minke (8/8), humpback (5/8), sperm (75/92), Baird's beaked (1/20), killer (10/102), common dolphin (17/1,196), Pacific white sided dolphin (20/1,341), northern right whale dolphin (6/750), Dall's porpoise (73/398), *Mesoplodon* spp. (3/6), *Ziphiidae* (4/9), and unidentified large whales (42/68) were made. Sei and sperm whales were the most frequently sighted species. Blue whales were distributed in both northern and southern strata. Fin whales were mainly distributed in the northern stratum in concentrated areas. Sei whales were mainly distributed in the southern stratum with some concentrated areas. Common minke whales were sighted most often in the coastal area of the Aleutian Islands. Because of the difficulty in seeing their blows and small bodies, observations of common minke whales were more difficult than in Antarctic waters. Most sperm whales were solitary large males and were mainly distributed in the southern stratum in some concentrated areas. Killer whales were distributed both in the northern and southern strata. Photo-ID images of 5 blue, 5 humpback, and 45 killer whales were obtained. A total of 18 biopsy samples from fast swimming whale species were successfully collected from 1 blue, 2 fin, 13 sei and 2 killer whales using the Larsen-gun system. Marine debris of 33 materials were recorded. The Estimated Angle and Distance Training Exercise and Experiment were completed as in previous years. The 1st cruise of this program was completed and provided information that various baleen whale species and other cetacean species were widely distributed in the research area where they were depleted in the past. These results will contribute to the above objectives for the IWC/SC.

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INTRODUCTION

During the 2009 IWC SC meeting Japan presented a proposal and preliminary plan for a mid- to long-term research program involving sighting surveys to provide information for cetacean stock management in the North Pacific. The IWC SC welcomed the initiative, agreed to the value of a large-scale, middle-long term integrated research program in the North Pacific and strongly encouraged this in the context of international collaboration under IWC auspices. The IWC SC recommended that the planning process should start with a review of the current discussions on North Pacific issues within the Committee and a careful examination of available information and an identification of gaps in knowledge (IWC, 2009).

The IWC SC has been conducting the international whale sighting survey programme in the Southern Hemispheres every year since the 1978/79 Antarctic season as the International Decade of Cetacean Research Program (IWC/IDCR: 1978/79-1995/96 seasons) and as the Southern Ocean Whale and Ecosystem Research (IWC/SOWER: 1996/97-2009/10 seasons) (IWC, 2009).

To start the organization of this research program the IWC SC established an intersessional group with the following terms of references (TORs) (IWC, 2009):

- (1) Review the Committee's issues in the North Pacific and circulate a paper before the next Annual Meeting.
- (2) Review the past and ongoing survey activities and available data in range states from completed pro forma.
- (3) Consider possible line transect survey plan and additional data collection (e.g. photo ID and biopsy) for 2010 season.
- (4) Prepare proposal for intersessional workshop (between SC62 and SC63) on future surveys beyond 2010.

To initiate and review progress of the work related to those TORs, an informal intersessional meeting (IM) was held in Tokyo on 27 September 2009. The IM reviewed progress for each of the TORs listed above. In particular, the IM initiated discussions about medium-long-term objectives of the research program. Specific groups were identified to complete the works related to TORs 1 and 2 above. Another group was identified to make a proposal for an intersessional workshop to plan for a mid-to long-term program within the North Pacific (TOR 4 above). The proposal for such a workshop should be developed for presentation at IWC62 (IWC, 2010a).

Regarding TOR 3 above, the IM discussed and agreed on a cruise plan for 2010. For several reasons given in the IM report (IWC, 2010a) the IM agreed that the 2010 survey could be considered to be a joint IWC/Japan collaborative venture, although almost entirely funded by Japan as a succession of the IWC/IDCR-SOWER cruises since 1978/79 season in the Antarctic.

The Government of Japan provided the research ship, the *Kaiko-Maru*. This ship has been used for the 2009/10 IWC-SOWER cruise. Specifications and member of the ship are given in Appendix A.

Initial planning for the cruise was undertaken at the 2010 Meeting of the IWC Scientific Committee (IWC in Press). The cruise was planned to operate from and to Kushiro, in the northern part of Japan. Logistical aspects for the cruise, operations of the ship and the data records etc. were also finalized at 2010 SC meeting and the pre-cruise meeting held in Kushiro on 1 July 2010 (Anon. 2010a and 2010b).

The cruise was conducted in summer 2010 in the area between 170°E and 170°W (Figure 1) for the following reasons:

- (1) This area has been poorly covered by previous surveys and not at all in recent decades thus representing an important information gap for several large whale species;
- (2) For at least some species it spans proposed stock boundaries.

Personnel

For the cruise, four researchers were selected by the steering group of this cruise, Koji Matsuoka (Cruise leader, Institute of Cetacean Research, ICR, Japan), Siri Hakala (photo-ID/biopsy, Southwest Fisheries Science Center, SWFSC, NOAA, USA), Hyun Woo Kim (biopsy/photo-ID, Cetacean Research Institute, NFRDI, Republic of Korea) and Motonori Aki (line transect, Kaiko Senpaku Co., Ltd, Japan).

Schedule

The 2010 cruise itinerary.

Date	Event
6/29	<i>Kaiko-Maru</i> (KK1) depart Shiogama
6/30	Researchers assembled in Kushiro
7/1	KK1 arrive Kushiro 08:00 (refuel), pre-cruise meeting (13:00-15:00 at KK1)
7/2	KK1 depart Kushiro (13:00), researchers on board, start transit survey (from 7/4 to 7/6)
7/7	KK1 arrive research area and start survey in the US EEZ
7/16	KK1 completed the US EEZ area and moved to the high seas area.
8/25	End survey in the research area, start transit survey (from 8/26 to 8/29)
8/30	Post-cruise meeting at KK1
8/31	Arrive Kushiro (researchers leave KK1), Depart Kushiro
9/2	Arrive Shiogama

OBJECTIVES and METHODS

The objectives for the 2010 cruise (Anon. 2010a and 2010b):

The cruise was focused on the collection of line transect data to estimate abundance and biopsy/photo-identification data to make a valuable contribution to the work of the Scientific Committee on the management and conservation of populations of large whales in the North Pacific in a number of ways, including:

- 1) providing information for the proposed future in-depth assessment of sei whales in terms of both abundance and stock structure;
- 2) providing information relevant to Implementation Reviews of whales (e.g. common minke whales) in terms of both abundance and stock structure;
- 3) providing baseline information on distribution and abundance for a poorly known area for several large whale species/populations, including those that were known to have been depleted in the past but whose status is unclear;
- 4) providing biopsy samples and photo-identification photos to contribute to discussions of stock structure for several large whale species/populations, including those that were known to have been depleted in the past but whose status is unclear;
- 5) providing essential information for the intersessional workshop to plan for a medium-long term international program in the North Pacific.

Research area

The research area was set north of 40°N, south of the Aleutian Islands, between 170°E and 170°W. As planned, the research area was divided into two strata (northern and southern) by 47°N. Surveys in both strata were conducted in alternating NSC and IO modes. Each survey leg was divided approximately in half by survey mode. The cruise track was constructed in relation to the Aleutian Islands boundary in the northern strata (Figure 1a, 1b, 1c).

Priority of research items

Priority was given to the sightings survey of the research area. Research was conducted in alternating Normal Closing mode and IO (Independent Observer) mode and the associated distance and angle experiments.

Survey Modes

Activities aboard the ship were classified into two principal groups: On-effort and Off-effort. In the sightings survey portion of the research, On-effort activities were times when full search effort was being executed and conditions (such as weather and sea conditions) were within acceptable parameters to conduct research. Off-effort activities were all activities that were not On-effort. All sightings recorded while the ship was On-effort were classified as Primary sightings. All other sightings were Secondary sightings.

Sighting effort was conducted by the bosun and topmen from the barrel (crow's nest) and the upper bridge where the helmsman, captain or officer-on-watch, researchers, and the chief engineer or deputy were also present. Search effort also took place from the independent observer platform (IOP) during IO mode.

Primary search effort was only conducted in acceptable weather conditions. These conditions were defined as visibility better than 2.0 n.miles, wind speed less than 21 knots and Beaufort sea state less than 5. These conditions were used as guidelines; in some circumstances, less severe conditions were still inappropriate for searching effort.

The following sections describe each of the survey modes.

Normal Closing Mode (NSC)

Two topmen observed from the barrel at all times; there was no observer in the IOP. There were open communications between the barrel and the upper bridge. When a sighting was made, the topman (or upper bridge observer) gave an estimate of the distance and angle to the sighting and the ship turned immediately, regardless of the angle to the sighting. The whales were approached and the species and number of animals determined. All subsequent sightings were regarded as secondary until normal search effort was resumed. If the initial sighting distance was more than 3 n.miles (perpendicular distance) from the vessel's trackline and the sighting was thought to be of minke whales, the sighting was passed; if, however, the species was thought to be a large baleen whale, closure to the sighting was attempted. In order to save valuable research time, closure to the sighting position of whales that can be positively identified as long-diving species (such as sperm whales or beaked whales) was abandoned if it was considered that the animals had dived.

When a sighting was made, the person who made the sighting provided the sighting information. The ship then changed course to the appropriate heading to approach the whale, and vessel speed was increased to 15 knots to hasten the closure. Ship speed was decreased when the group was neared, usually at a distance of 0.2-0.4 n.miles from the initial sighting position.

After the whale group was approached, the species, number of animals in the group, estimated lengths, number of calves present, and behaviours were determined and recorded. After as much data as possible had been collected, other activities sometimes took place, such as natural marking (Photo ID) or biopsy experiments. Until the ship resumed the transect with full search effort, any whale sightings made after the initial sighting were classified as secondary sightings.

Closing while returning to the trackline

This was the same as the standard Closing Mode except that the ship was not on the designed trackline due to closing with a previous sighting while on effort. Sightings that had a perpendicular distance greater than 3 n.miles from the planned trackline (not the return trackline) were not closed with.

Closing in high density areas

This mode would have been initiated when the frequency of whale sightings was so high that effective survey could not be conducted. It is the same as the standard Closing Mode except that closure is restricted to every nth primary sighting, where n is decided in situ by the CL (n is usually 3). The value of n must be determined before starting the mode. If the survey still cannot be accomplished, n can be increased. If n becomes so great that closures do not occur, then the mode should be changed to passing in high density areas. There was no opportunity for utilizing this mode during the 2010 survey.

Independent Observer Mode (IO)

Two topmen observed from the barrel at all times and two topmen were stationed in the independent observer platform (IOP). Communications were essentially one-directional, with the topmen reporting information to the upper bridge observers, but no information being exchanged between the barrel and IOP. The observers on the upper bridge communicated with the topmen only to clarify information and did not direct the topmen to disrupt their normal search procedure unless directed to do so by the Senior Scientist.

Immediately after a sighting was made from the barrel or IOP, the topman informs the bridge of his estimate of the distance and angle to the sighting (and also, if possible, the species and number of animals present), but did not change his normal searching pattern in order to keep contact with the sighting. The observers on the upper bridge attempted to locate the sighting made by the topman and decide whether it was possible for them to confirm the species and number before the sighting passes abeam of the vessel. The topman gave no further information to the upper bridge unless the whale group happened to surface again within the normal searching pattern of the topman. A designated researcher on the upper bridge determined which of the sightings made from the barrel, IOP, and upper bridge were duplicates, in consultation with other researchers.

Resighting

The resighting record was used to record resighting data during IO modes. The resighting data were to provide an additional source of information for the estimation of $g(0)$ and for the assessment of duplicate status.

Angles, distances, cue type and times (etc.) to successive cues for a sighting which the personnel on the upper bridge were tracking were recorded directly on the resighting form.

It was not intended that the upper bridge observers do any tracking over and above that normally done for the purposes of identification of duplicate sightings status. Similarly, recording of the resighting data did not involve additional tracking of the sightings by either the IOP or the topmen in the standard barrel. (The topmen relayed resighting information to the upper bridge only when the group happened to surface again within their normal searching pattern.).

The resighting times, angles, distances and cue types of all resighting were recorded only up to and including the time at which the cetacean(s) are judged to have been seen by both the topmen in the standard barrel and the IO or until the cetacean(s) pass abeam of the vessel if the topmen in the standard barrel or the IO do not sight them.

Recording of data would have been abandoned if the sighting rate was so high that collection of these data was compromising normal data recording and search effort.

Angle and distance experiments

An Estimated Angle and Distance Training Exercise and Estimated Angle and Distance Experiment was performed using the same protocol as during recent cruises (Anon. 2010b).

Determination of group size

The following guidelines were used in determining group size: Schools where the number of animals, or an accurate estimated range of the number of animals, is determined are classified as confirmed schools. The data from the confirmed schools are used in the analysis to determine a mean school size. Therefore it is critical that the schools that are confirmed are representative in size of the schools that are in the survey area. Normally, schools believed to be confirmed for school size are approached to within 1 n.mile for large whales and to within 0.3 n.miles for minke whales. Obviously, there are differences in the environmental conditions and behaviour of the animals for every sighting; however, (with particular reference to minke whale sightings) every effort should be made to be as consistent as possible in regard to the maximum time spent on identification of species and confirmation of numbers. Normally, if the sighting is thought to be minke whales, no more than 20 minutes (after closure has been completed) should be spent trying to complete these tasks. (Otherwise there is the potential for confusion with other sightings in the vicinity).

Identification of species

The following guidelines were used for classification of identification:

Positive identification of species was based on multiple clues and usually required the clear observation of the whale's body. Occasionally, repeated observations of the shape of the blow, surfacing and other behavioural patterns were also sufficient; this judgement was made only by the Senior Scientist or other designated researcher.

Probable identification of species was based on multiple clues, which are nevertheless insufficient to be absolutely confident in identification. This usually occurs when blows are seen, the surfacing pattern is correct, but the whale's body cannot be seen or clearly seen.

Other research items

At the discretion of the Cruise Leader, time was allocated, on an opportunistic basis, to the research items discussed below.

Photo-identification: Target species were blue, right and humpback whales. Photos of killer whales were also obtained opportunistically. Photographs for identifying individual whales were obtained using digital cameras (Canon EOS 50D and 30D) each equipped with a 100-400 mm image-stabilized zoom lens. Additionally, researchers used their personal digital cameras and contributed images.

Biopsy sampling: Biopsy sampling from the US EEZ was not conducted for this cruise. Two types of biopsy equipment were available on board: Larsen guns and compound crossbows. As appropriate and when decided by the Cruise Leader, research time was given for biopsy sampling of North Pacific sei, common minke, right, blue, humpback, and fin whales (Bryde's whales were unlikely to be seen north of 40°N). Biopsy of killer and sperm whales was attempted on an opportunistic basis. Biopsy tissue samples were split, with one half for Japan and the other half for IWC. All samples were frozen. When samples had a "significant" amount of blubber attached, the blubber was removed from the skin, and frozen.

Video taping: Blue whales were approached to within 1 n.mile and for at least a 30-minute duration, dive times were recorded if feasible. The whales were then approached for biopsy, photo-identification, and videotaping. The surfacing behaviour of blue whales was recorded from the Top Barrel on high-resolution digital video (Panasonic digital video camera NV-GS50).

Acoustics Research: No acoustic research was planned or conducted during this cruise.

Oceanographic research: No oceanographic sampling was planned, as on the last two year's cruises. There were plans to deploy two ARGO floats under the international ARGO Oceanographic programme, however, this plan was canceled due to logistical reasons just before the departure of this cruise.

Weather/fog Information: Weather and fog information was critical for planning the cruise track line. This information was received from the ICR via e-mail.

NARRATIVE, RESULTS AND DISCUSSION

The following section is a descriptive account of the major aspects of the cruise. Details of the survey area, and cruise tracks are presented in Figures 1a-c.

Pre-cruise meeting and transit to the research area

On 1 July, the pre-cruise meeting was held at the R/V Kaiko Maru (KK1) under Miyashita who was nominated by Convenor (Kato) of the steering group of this cruise. In the meeting, we discussed and confirmed the priorities and strategies of the cruise based on the planning report (SC/62/IA10), as well as the SC62 report (Annex G).

The KK1 had the necessary Japanese research permits to operate on the high seas, and had a Japanese CITES Introduction from the Sea permit. The US Department of State provided clearance for the KK1 to operate within US waters from 8 July- 18 August. The KK1 conducted research under SWFSC's MMPA/ESA (Marine Mammal Protection Act/ Endangered Species Act) permit 14097 while in the US EEZ; however, the KK1 did not conduct biopsy sampling in the US EEZ. Because of this, the tracklines in the US EEZ were completed first, followed by the tracklines on the high seas. Biopsy sampling only began after the KK1 left the US EEZ.

Meeting participants were: Miyashita (NRIFS, Chair), Uoya (MAFF), Matsuoka (ICR), Hakala (US, SWFSC, researcher), Kim (Republic of Korea, CRI, researcher), Aki (Japan, researcher), Shinyashiki (Captain), Nakamura (Chief Engineer), Shigetomo (Chief Operator), Yamauchi (First Officer), Ohmura (Bosun), Shigemune (Kyodo-Senpaku), Yoshizaki (Kaiko-Senpaku), Ikeshima (Kaiko-Senpaku) and Sakamoto (Kaiko-Senpaku). A report of this meeting will be distributed to the steering group after review by the Chair (Anon, 2010c).

On 2 July, all researchers and equipment were on board the KK1. IWC Larsen gun systems were imported to ICR from Indonesia on the day before departure. One compound crossbow was provided by SWFSC and

brought to Japan by the US researcher. The KK1 started to transit toward the research area in the North Pacific, on schedule, at 13:00 from Kushiro.

The KK1 entered the Russian EEZ at 20:09 on 2 July (43°02'N 145°50'E), and exited the Russian EEZ at 19:04 on 4 July (45°26'N 156°56'E). During transit, we sorted and prepared all equipment. The emergency drills were held in the afternoon on 3 July.

On 5 July, the R/V Kaiko Maru (KK1) started the transit survey at 06:00 (45°58'N 159°29'E), under TD off effort steaming because of bad visibility conditions due to heavy fog until the end of 7 July.

The ship arrived at the starting point for the research area in the morning of 8 July.

Northern stratum (including the US EEZ)

On the whole, there were poor weather conditions (heavy strong winds or poor visibility) in the research area due to strong low pressure systems crossing eastwards, especially in the western side of the northern strata.

The northern stratum survey of the research area commenced from the western border of the US EEZ of the research area (49°02'N 174°25'E) at the waypoint on 8 July. On 9 July, the KK1 arrived at the most northern Way Point (WP) 109 (51°45'N 177°20'E), approximately 5 miles from Kiska Island in the Aleutian Islands. On 14 July, the KK1 reached the most northern WP (52°05'N 172°40'W) near Amlia Island and Seguam Island under good visibility and sea state. On 16 July, the KK1 moved under TD off effort survey on the way to the eastern boundary of the research area WP under strong, oncoming wind (over 21kt). The KK1 arrived at WP (49°26'N 170°00'W) at 16:39 and completed the US EEZ survey (49°12'N 170°00'W) at 18:32. The KK1 started to transit to the starting point of the southern research area on the 170°00'W longitudinal line to the high seas survey area overnight to arrive on the morning of 18 July (approximately 330 n.miles transit).

During the northern stratum survey, a total of 48.08 hours of searching was conducted and 490.5 n.miles (34%) were covered on primary effort: NSC mode - 258.0 n.miles (25.18 hours) and IO mode - 232.4 n.miles (22.9 hours) in Table 1. Sections of the trackline covered on primary effort are shown in Figure 2a.

Survey coverage was 21% of the western part of the northern stratum and 48% of the eastern part of the northern stratum. A breakdown of research time, in minutes, by effort mode within the stratum of the research area is shown in Figure 3a. Visibility within the stratum of the research area is shown in Figure 3b. Wind speed experience within the stratum of the research area is shown in Figure 3c.

Estimated Angle and Distance Training Exercise

The Estimated Angle and Distance Training Exercise was conducted in the afternoon of 11 July for 1.95 hours. During the exercise the observers familiarized themselves with distance estimates from the TOP, IOP and Upper Bridge.

Estimated Angle and Distance Experiment

The Estimated Angle and Distance Experiment was conducted on 12 July for 4.08 hours.

Southern stratum

Weather conditions were proportionally better in the southern stratum than in the northern stratum, but this portion of the survey still suffered from strong low pressure systems crossing eastwards. The remaining storm from Typhoon #4 also crossed paths with the KK1 during the Southern stratum survey. Several days were lost to high winds and heavy swell. The southern stratum survey of the research area commenced from the eastern border of the research area (43°50'N 170°00'W) at the waypoint on 18 July.

On 25 July, an exercise for safety, handling and shooting the Larsen guns was held under good sea conditions before searching began. An exercise using the compound crossbows (SWFSC and ICR) was also conducted. On 26 July, the KK1 arrived at the most southern WP at 08:35 (40°00'N 172°31'W) and turned northward. On 27 July, the KK1 continued the survey northward under intervals of heavy fog (wind speed 15-17 knots). The sea temperature sharply changed from 18.6°C to 14.1°C. On 28 July, the KK1 continued the survey under intervals of thick fog (wind speed 14-16 knots). On 29 July, there was heavy fog (wind speed 17-22 knots). The KK1 conducted off effort TD steaming for approximately 30 n.miles and drifted to wait for an improvement in visibility. On July 30, the KK1 conducted the survey under good visibility and weather conditions. On 2 August, the KK1 conducted TD off effort steaming to the south in the northern strata, under windy sea conditions and intervals of fog. The KK1 arrived at the WP at 15:34 (47°00'N 177°40'W) and drifted to wait for an

improvement in weather conditions. On 3 August, the KK1 continued the survey northward under intervals of heavy fog (wind speed 7-10 knots). The sea temperature sharply changed from 9.9°C to 11.8°C. On 9 August, the KK1 conducted the survey under windy sea conditions and intervals of fog. The KK1 arrived at the southern WP at 07:06 (40°00'N 177°25'E) and turned northward.

On 13 August, the KK1 continued drifting due to heavy fog in the morning and started searching under good visibility in the afternoon. On 14, 15 and 16 August, the KK1 entered the storm zone (formally the typhoon No.4) and shifted against the wind to wait for an improvement in weather conditions during the day (wind speed 31-35 knots). On 17 August, the KK1 continued the survey northward under good weather conditions (wind speed 8-12 knots). On 19 August, the KK1 continued to wait for an improvement in weather conditions during the day (wind speed 21-28 knots).

On 20 August, the KK1 restarted the survey northward under acceptable windy conditions and arrived at the northern boundary of the southern stratum (47°00'N, 172°20'E). The KK1 started the northern stratum survey. However, we did not have enough time to cover the northern stratum completely (remaining 337 n.miles) due to poor weather conditions in recent weeks (coverage of the searching distance; approximately 70 n.miles was 21 % of the remaining northern stratum) and restarted the survey southwards in the southern stratum. On 21 and 22 August, the KK1 continued the survey southwards under poor visibility with off effort TD steaming.

On 23 and 24 August, the KK1 entered a low pressure zone (visibility 0.0-0.5 n.miles) and waited for an improvement in weather conditions during the day. On 25 August, the KK1 restarted the survey southward under good visibility weather conditions (wind speed 8-12 knots) and arrived at the final WP (43°55'N, 170°00'E) at 11:34 and completed the research area survey. The KK1 started the transit survey to Kushiro.

During the southern stratum survey, a total of 127.37 hours of searching was conducted and 1,325.7 n.miles (70%) were covered on primary effort: NSC mode - 670.4 n.miles (64.62 hours) and IO mode - 655.4 n.miles (62.74 hours) (Table 1). Sections of the trackline covered on primary effort are shown in Figure 2a.

Breakdown of research time, in minutes, by effort mode within the stratum of the research area are shown in Figure 3a. Visibility within the stratum of the research area is shown in Figure 3b. Wind speed experience within the stratum of the research area is shown in Figure 3c.

Sightings

Lists of all the sightings recorded in the northern and southern strata, by species and by effort mode are presented in Tables 2 and 3, respectively. List of all the sightings recorded in the research area, by species and by effort mode are presented in Table 4. Figures 2a-f illustrates the location of the sightings.

Table 5 shows the duplicate status of sightings observed during survey in IO mode. Tables 6-7 lists the sightings observed during transits to and from the research area. Table 8 summarizes all the sightings observed during the entire cruise.

An additional summary of observations of cetaceans within the 200 n.mile EEZ of United States is presented in Appendix B.

Highlights from the northern stratum included sightings of 8 humpback whales (3 good fluke photo ids were obtained and 2 individual fluke id's taken from an angle), two large concentrations of fin whales, several pods of killer whales, Baird's beaked whales and one blue whale. Much of the northern stratum survey lines (66%) were covered under TD (off-effort) steaming due to poor weather conditions. The two concentrations of fin whales occurred; the first was off the eastern side of the Atka Seamount and the second was on the northern side of the Aleutian Trench. Baird's beaked whales, common minke whales, killer whales and Dall's porpoise were all sighted close to the Aleutian Islands. Humpback whale sightings were dispersed throughout the northern strata, as were sei whale sightings.

Highlights from the southern stratum included sightings of large groups of killer whales, two more blue whales, a mixed school of fin and sei whales (one fin, two sei whales), numerous sei whales, sperm whales, and common, Pacific white-sided and northern right whale dolphins. The dolphin sightings were sharply segregated by latitude (or sea temperature).

Detailed sightings by each species as follows:

Blue Whale

A total of 3 groups (3 individuals) of blue whales were observed in the northern and southern stratum (Figure 2a). A total of 2 groups (2 individuals) of blue whales were observed during transit survey from the research area to Kushiro (Table 7).

A solitary blue whale was sighted on 13 July (sighting no.005) at position 50°12'N 174°36' within a high concentration of fin whales on the eastern side of the Atka Seamount between 50°00'N and 50°45'N. We were concerned that the whale would move into the fog and thus be inaccessible for photo-ID, so no dive time experiment could be conducted. There was no biopsy sampling attempted because we were in the US EEZ. The whale was approached for photo-ID, and video taping was conducted during and after approach. Because the whale moved quickly there was no opportunity to take photographs of both sides of the animal. Some photo-ID images of the left side of the animal were obtained (Table 10). Video of the animal was recorded for 5 min. 34 sec. Estimated body length of the whale was 21.8 meters. Sea temperature of the sighting position was 6.9°C.

A solitary blue whale was sighted on 8 August (sighting no.001) at position 41°50'N 178°38'E under good visibility, but windy conditions (wind speed 14-17 knots). Sea temperature of the sighting position was 17.8°C. We were concerned that the weather was deteriorating and thus the sighting would be inaccessible for photo-ID and biopsy, so no dive time experiment was conducted. The whale was approached for photo-ID, video taping and biopsy. Due to difficulties in approaching the whale (8-9 minutes for the long diving intervals), there was no opportunity to take photographs of both sides of the animal or to attempt biopsy sampling. Some photo-ID images of left side of animal were obtained (Table 10). Video of the animal was recorded for 4 min. 55 sec. Estimated body length of whale was 18.7 meters.

On the same day after the above sighting, another solitary blue whale was sighted (sighting no.002) at position 41°35'N 178°28'E under good visibility but windy conditions (wind speed 14-17 knots). Sea temperature of the sighting position was 18.2°C. We were still concerned that the weather was deteriorating, so no dive time experiment could be conducted. The whale was approached for photo-ID, video taping and biopsy (5-7 minutes for the long diving intervals); there were opportunities to take photographs of both sides of the animal and for biopsy sampling. Two biopsy shots were attempted but there were no hits. Good photo-ID images of both sides of the animal were obtained (Table 10). Video of the animal was recorded for 6 min. 19 sec. Estimated body length of the whale was 20.4 meters.

A solitary blue whale was sighted on 27 August (sighting no.012) at position 43°26'N 159°22'E during the transit survey under good visibility, but windy conditions (wind speed 12-14 knots). Sea temperature of the sighting position was 18.5°C. Because of the priority of the transit survey progress, no dive time experiment was conducted. The whale was approached for photo-ID, video taping and biopsy. Due to difficulties in approaching the whale (6-11 minutes for the long diving intervals), there was no opportunity to attempt biopsy sampling. Some photo-ID images of both side of animal were obtained (Table 10). Video of the animals was recorded for 9 min. 52 sec. Estimated body length of the whale was 21.6 meters.

On the same day, a solitary blue whale was sighted (sighting no.022) at position 43°28'N 158°56'E. Sea temperature of the sighting position was 18.7°C. Because of the priority of the transit survey progress, no dive time experiment was conducted. The whale was approached for photo-ID, video taping and biopsy. There were opportunities to take photographs of both sides of the animal and for biopsy sampling. Two biopsy shoots were attempted by the compound crossbows and one sample was collected (one hit and one miss). Good photo-ID images of both sides of the animal were obtained. Video of the animal was recorded for 4 min. 31 sec. Estimated body length of the whale was 20.4 meters.

Fin Whale

Fin whales were the second most frequently encountered baleen whale species in the research area. The fin whales were mainly distributed in the northern stratum in concentrated areas but they were also distributed in the southern stratum. In the southern stratum, they were mainly observed at the edges of the research area. A total of 23 schools (48 individuals including 5 calves) of fin whales were observed in the research area (Figure 2b). Mean school size was 2.4.

A concentration of fin whales was observed on 13 July (7 schools 16 individuals, 2 calves) on the eastern side of the Atka Seamount (between 50°00'N and 50°45'N, 172°00'W and 173°00'W) and on 15 July (8 schools 21 individuals) between 50°55'N and 51°30'N, 171°30'W and 170°30'W on the northern side of the Aleutian Trench.

Sei Whale

Sei whales were the most frequently encountered baleen whale species in the research area. A total of 53 schools (102 individuals, including 4 calves) of sei whales were observed (Figure 2b). Mean school size was 1.9. Sei whales were mainly distributed in the southern stratum with some concentration areas but they were also distributed in the northern stratum (sea temperatures ranged from 6.7°C to 20.7°C).

A concentration of sei whales was observed on 30 July (13 schools 43 individuals) between 44°30'N and 45°15'N, 175°00'W and 177°00'W where the sea temperature ranged from 10.4°C to 11.2°C. Red colored faeces of sei whales were observed which indicated this area was a feeding area for this species. Another concentration of sei whales was observed on 4 and 5 August (12 schools 19 individuals) between 43°50'N and 44°30'N, 179°00'E and 179°00'W where the sea temperatures ranged from 11.6°C to 13.8°C. Sei whales were also distributed in the western side of the southern stratum. Their main distribution range of the latitude were between 43°50'N and 46°15'N through the southern stratum.

Common minke Whale

A total of 8 schools (8 individuals) of common minke whales were observed in the northern stratum (sea temperature were from 4.3°C to 10.1°C) (Figure 2a). Solitary common minke whales were sighted in the coastal area near Amlia and Segum Islands of the Aleutian Islands under calm weather conditions on 14 July. The sea temperature was between 4.4°C and 7.6°C. Because of difficulty in seeing their blow and small body, observations of this species were more difficult than in Antarctic waters. Common minke whales are hard to find within harsh sea surface conditions because their blows are not visible. In this survey, the Beaufort Sea states were 4-5 in general. It is assumed that the sea condition was inadequate for common minke whale sightings.

Humpback Whale

Humpback whales were only distributed in the northern stratum. A total of 5 schools (8 individuals) of humpback whales were observed (Figure 2a). Mean school size was 1.6. No biopsy sampling was attempted because all sightings of humpback whales were made in the US EEZ.

A solitary humpback whale was sighted on 8 July (sighting no.001) at position 49°21'N 174°45'E. The whale was approached for photo-id. Some photo-id images of the dorsal fin and fluke of the animal were obtained (Table 10). Estimated body length of the whale was 13.8 meters. Sea temperature of the sighting position was 6.3°C.

A solitary humpback whale was sighted on 11 July (sighting no.007) at position 48°52'N 179°35'W. The whale was approached for photo-id. Some photo-id images of the dorsal fin and fluke of the animal were obtained. Estimated body length of the whale was 14.0 meters. Sea temperature of the sighting position was 6.9°C.

A solitary humpback whale was sighted on 15 July (sighting no.007) at position 51°28'N 172°01'W. The whale was approached for photo-id. Some photo-id images of the dorsal fin and fluke of the animal were obtained. Estimated body length of the whale was 13.5 meters. Sea temperature of the sighting position was 7.6°C.

Three humpback whales were sighted on 15 July (sighting no.012) at position 51°20'N 172°03'W. The whales were approached for photo-id. Due to difficulty in approach for all individuals, photo-id images of the dorsal fin and fluke of only one animal were obtained. Estimated body length of one of the whales was 12.8 meters. Sea temperature was 7.3°C.

Two humpback whales were sighted on 15 July (sighting no.013) at position 51°22'N 171°55'W. The whales were approached for photo-id. Due to difficulty in approach for both individuals, photo-id images of the dorsal fins and only one fluke photo was obtained. Estimated body length of the whale was 12.8 meters. Sea temperature was 7.3°C.

Sperm Whale

Sperm whales were the most frequently encountered toothed whale species in the research area. A total of 67 schools (84 individuals) of sperm whales were observed in the research area (sea temperature were from 5.1°C to 18.6°C) (Figure 2c). Most sperm whales were solitary large males (97% of the schools) and were mainly distributed in the southern stratum in some concentrated areas. The concentration of sperm whales were observed on 12 August (10 schools 10 individuals) between 44°00'N and 45°07'N, 173°45'E and 175°00'E where the sea temperature ranged from 12.2°C to 14.6°C.

Twelve sperm whales were sighted on 5 August (sighting no.007) at position 43°59'N 179°53'W in the southern stratum. One sperm whale surfaced and rested near the vessel. Biopsy sampling was attempted for this animal

but there was no sample due to a miss (estimated body length of whale was 10.4 meters). Sea temperature of the sighting position was 13.4°C.

Killer Whale

A total of 10 schools (102 individuals) of killer whales were observed in the research area (sea temperatures ranged from 5.6°C to 17.8°C) (Figure 2c). Mean school size was 10.2. The killer whales were distributed in the northern stratum and the southern stratum. In the northern stratum, the offshore killer whales were more careful than the inshore killer whales; they didn't allow the approach. Main sightings were follows:

Five killer whales were sighted on 25 July (sighting no.009) at position 40°31'N 172°15'W in the southern stratum. One large male was observed (estimated body length of the whale was 8.3 meters). All killer whales were photographed and one biopsy sample collected from either a female or immature male. Sea temperature of the sighting position was 11.1°C.

Seven killer whales were sighted on 31 July (sighting no.016) at position 45°35'N 176°35'W in the southern stratum. Two large males and 1 calf were observed. Sea temperature of the sighting position was 10.7°C. There was no chance to sample the killer whales due to difficulties in approaching the group. Four of the seven killer whales were photographed from a distance.

Five killer whales were sighted on 1 August (sighting no.012) at position 47°34'N 178°15'W in the northern stratum. At least one large male was observed. Sea temperature of the sighting position was 10.1°C. After the initial sighting, they were never seen again.

Twenty-four killer whales were sighted on 17 August (sighting no.009) at position 45°22'N 173°35'E in the southern stratum. Eight large males and 3 calves were observed. Biopsy was attempted and one sample was collected from a large male (estimated body length of whale was 9.2 meters). Grey colored liquid feces of killer whale were observed during the biopsy experiment. Sea temperature of the sighting position was 11.1°C.

Thirteen killer whales were sighted on 18 August (sighting no.001) at position 46°03'N 173°03'E in the southern stratum. Five large males and 2 calves were observed. Some sea surface oil indicated that these killer whales were possibly feeding. There were no remainders of prey on the sea surface. Sea temperature of the sighting position was 10.8°C. No biopsy was attempted due to the windy conditions. Seven of 13 killer whales were photographed (right side saddle patch). This group of killer whales was sighted 46 n.miles from the sighting on 17 August.

Ziphiidae and Mesoplodon spp.

A total of 4 schools (9 individuals) of *Ziphiidae* were observed in the research area (sea temperature ranged from 7.6°C to 15.9°C). A total of 3 schools (6 individuals) of *Mesoplodon* species were observed in the research area (sea temperature were from 6.5°C to 16.8°C). They were widely distributed throughout the research area (Figure 2e).

Other species

A total of one school of 20 Baird's beaked whales was observed on 14 July (sighting no.006) at position 51°50'N 172°54'W near the Amlia and Seguam Islands of the Aleutian Islands. Sea temperature of the sighting position was 6.9°C.

Sightings of dolphin species such as short-beaked common dolphin (17 schools 1,196 individuals, mean school size was 70.3), Pacific white-sided dolphin (20 schools 1,341 individuals, mean school size was 67.1), Northern right whale dolphin (6 schools 750 individuals, mean school size was 125.0), Dall's porpoise (71 schools 391 individuals, including Unidentified type, mean school size was 5.5) were made. Dall's porpoise were the most frequently encountered dolphin species. This species was sighted throughout the research area. Pacific white-sided dolphins and Northern right whale dolphins were often observed in mixed schools.

A dolphin species spatial segregation was clearly observed (Figure 2e). Only short-beaked common dolphins were observed in the southern part of the survey area dominated by warm water. Conversely, Northern right whale dolphins, Pacific white sided dolphins and Dall's porpoise were observed in the northern part. Anomalous color patterns of Pacific white sided dolphins were occasionally observed during the survey. A very pale common dolphin and a dark color morph common dolphin were observed on 8 August (sighting no.004) at position 41°30'N 178°24'E in the southern stratum.

Biopsy experiments

All of the biopsy attempts were made using the Larsen system and compound crossbow system. Limited supplies of ammunition were available for the Larsen guns due to difficulty in arranging airfreight of replacement ammunition in a timely manner. (Only 50 rounds of ammunition were available; all rounds were used). Allocation of research time to biopsy attempts was initially restricted with the aim of maximizing the searching effort to cover the research area. A total of 18 biopsy samples were collected from 18 individuals of blue, fin, sei and killer whales during the 40 biopsy attempts (Table 9).

Blue whale

Biopsy sampling was attempted from a total of 2 blue whales in the research area during 1.83 hours of research time. No sample was taken from these animals because of the difficulty in approach. However, 1 blue whale was biopsied from 2 schools (2 individuals) of blue whales during the transit survey from the research area to Kushiro during 3.31 hours of research time. Photo-ID images of the biopsied animal were taken.

Fin whale

During the cruise a total of 2 fin whales were biopsied during 5.71 hours of research time. Photo-ID images of the three whales were obtained.

Sei whale

A total of 34 sei whales were approached for biopsy and photo-id during 19.48 hours of research time. Biopsy samples and photo-ID images were obtained for 13 animals.

Sperm whale

Opportunistic biopsy sampling was attempted from a pod of sperm whale during 0.33 hours of research time. However, no biopsy sample was obtained.

Killer whale

A total of 3 killer whales were approached for biopsy during 3.90 hours of research time. Biopsy samples were obtained for 2 animals; one with Photo-ID.

Photo-ID experiments

A total of 17 sightings of 3 species were photographed for the Photo-ID experiments (Table 10). Individual photo IDs were obtained for 5 blue whales, 5 humpbacks and 45 killer whales. The blue whales were photographed in the northern, southern strata and during transit survey from the research area to Kushiro. The humpback whales were photographed in the northern strata, and the killer whales were photographed in both the southern and northern strata. The total effort expended in approaching sightings for photo-ID was 26 hours and 18 minutes.

A total of 5 sightings of blue whales were approached for photo id and biopsy. There was 1 animal in each sighting. One biopsy sample was obtained, but photographs of each animal's dorsal fin and left flank were taken. Photos of the right lateral side were obtained for the final three sightings.

Five groups of humpback whales were approached for photo id. Three of the groups contained only one individual while the fourth and fifth groups contained three and two individuals respectively. Dorsal fin and fluke identification photographs were obtained for five individuals, though the fluke photos from the first two groups are quite angled.

Eight groups of killer whales were approached for photo id and one group was photographed from a distance. A total of 6 hours and 13 minutes was spent during photo id experiments for killer whales. Five of the sightings occurred in the northern strata; one near the Aleutian island of Kiska and two close to the islands of Amlia and Segum. A total of 19 saddle patch photos were obtained from these coastal groups. The saddles patches from these groups were open, indicating they are possibly from a resident population of killer whales. Four more sightings of killer whales were made in the southern strata. The first of these groups (25 July) contained 5 individuals. Photos were obtained for all five individuals and one biopsy sample was obtained. The second group (31 July) contained 7 individuals. These animals were cryptic in their surfacing behavior and close approach for biopsy or better photos proved too difficult. Four dorsal fin and saddle patch photo ids were obtained. The third group (17 Aug) contained 24 individuals including at least 8 large males. One biopsy sample was obtained from a large male and individual saddle patch and dorsal fin photos were obtained for 9

individuals. The final group of whales (18 Aug) contained 13 individuals. They were sighted by a large slick in the water which could have been caused by prey. The weather conditions inhibited any biopsy attempts on this group, but 7 individual photo ids of the left side dorsal and saddle patches were obtained.

Additional species id photographs were taken for fin whales, sei whales, common minke whales, sperm whales, Baird's beaked whales, Pacific white-sided dolphins, northern right whale dolphins, common dolphins and Dall's porpoise (Table 11).

Whale feces – visual observations

During whale observations after closing and during experiments, we paid attention to observe whale feces. Opportunistically a total of 2 visual observations of feces (sei and killer whales) were recorded during the cruise. Red colored feces of sei whale (30 July, sighting no.011) and grey colored feces of killer whales (17 August, sighting no. 009). These feces dispersed quickly and looked difficult to pick up with the available plankton net.

Northern fur seals observations

A total of 16 schools (18 individuals) of northern fur seal were recorded on the independent sighting sheets on an opportunistic basis throughout the research area. Primary sightings of 9 schools (9 individuals) were recorded. All primary sightings were made in the southern strata. Encounter rate was 0.68 (number of individuals / 100 n.miles). We had no conflict with whale sighting observations during the cruise.

Marine debris observations

Marine debris is an element of concern in all marine environments and could have an impact on the total ecosystem. During this cruise, we collected data on floating marine debris (mainly artificial materials which listed in the research manual, Anon, 2010b) to observe the type and extent of the marine debris in the North Pacific. Marine debris of 33 materials were recorded which encountered during the research area are shown in Table 12.

Oceanographic observations

There were plans to deploy two ARGO floats under the international ARGO Oceanographic programme; however, this plan was cancelled due to logistical reasons.

Transit to Kushiro and post-cruise meeting

The *Kaiko-Maru* commenced transit to Kushiro, Japan from position 43°55'N 170°00'E at 11:34 of 25 August. This was one day earlier than scheduled; however, weather conditions were already poor and based on the forecast much worse weather was expected the following day.

During the 3-day transit between research area and the intercept with a 200 n.mile EEZ of Russia, good conditions were experienced and a total of 170.1 n.miles was covered during 16.55 hours of research in NSC mode. Sightings of blue, fin and sei whales were made. On 27 August, blue whales sightings were made (2 schools / 2 individuals). Photo-ID, video taping and biopsy experiments were conducted for two schools of blue whales. For one animal, there was no chance to shoot due to difficulty in approach. For the second animal, one sample was collected. Both whales' dorsal fins and left and right sides were photographed.

The transit survey was completed on 28 August at 43°09'N 153°04'E at 15:03 hours. No research was conducted in the Russian EEZ.

The report of the cruise was finalized during a Post-cruise Meeting held aboard the vessel on the morning of 30 August.

The ship entered Kushiro Port, at 08:00 hours on 31 August. The vessel departed Kushiro on 31 August at 13:00 hours.

RECOMMENDATIONS

The researchers and captain make the following recommendations based on their experience of this cruise (note that recommendations do not appear in any order of priority).

Sighting surveys:

1. It is strongly recommended that IO mode be reconsidered for future surveys in the North Pacific. The IO mode was developed in the Antarctic waters and suitable for the Antarctic minke whales for their g (0) estimation. In this cruise, we introduced the IO mode in the North Pacific based on the previous performance in the Antarctic. However, it was not a realistic survey mode for the following reasons: 1) It was difficult to track common minke whales during passing mode because their blow was not seen in the North Pacific as well as in the Antarctic; 2) In recent experiment cruises in the Antarctic, one researcher has been engaged on the IO platform as a primary observer. However, for such full scale line transect surveys for abundance estimation, it is not realistic to keep uniform searching ability during the cruise for the researcher who is engaged on the IO platform. It is recommended that the normal passing mode (with abeam closing (SS-II) mode) would be introduced in 2011 and future surveys.
2. It is recommended that the ICR data entry system should be improved for the IWC cruise (data format, effort code etc). This system has been developed for the exclusive use of the Japanese Whale Research Programme, but it has no mapping system for the report.
3. Provided that ship logistics and the cruise plan allow, it is recommended to explore the possibility of using a towed hydrophone array for future cruises. Surveys conducted by SWFSC/NOAA have indicated that use of a towed hydrophone array could result in an increase in the number of cetaceans detected. We would suggest replacing one of the visual survey researchers with an acoustics researcher.
4. During this cruise we tried to record northern fur seal observations. We had no trouble with this recording and recommend that the steering group consider this recording for future surveys as a formal research item in the North Pacific.
5. We recommend that the steering group consider adding seabird observations for future surveys as a formal research item in the North Pacific. We suggest having one (or more) researcher(s) dedicated to seabird surveys so as not to conflict with whale sightings. This could be an additional researcher, or replace an existing visual sighting researcher.
6. We recommend that the steering group consider adding CTD castings for collecting real-time sea temperature, salinity and depth data in the survey area.

Biopsy/photo-Identification

- 1 The maintenance and repair of the Larsen guns were canceled before this cruise due to time limitations. Maintenance and repairs must be completed before the next cruise in Japan. The ammunition for the Larsen gun was completely consumed in this cruise. New ammunition must be purchased before the next cruise.
- 2 This year, we successfully imported the Larsen guns to Japan and to the research vessel. However, much of the ammunition for the Larsen gun (800 rounds) is still in Bali, Indonesia Customs. It is recommended to arrange for this import to Japan for future surveys.
- 3 The IWC cameras should be repaired, provided with maintenance, and transported from Indonesian Customs to Japan before the next cruise. Camera batteries and an external hard drive should be purchased.

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2010 IWC / Japan Joint Cetacean Sighting Survey Cruise in the North Pacific

Table 1. Summary of search effort (time and distance) and experimental time (hours) conducted during the 2010 IWC / Japan Joint Cetacean Sighting Survey Cruise in the North Pacific in each survey mode.

Area	Start	End	NSC		IO		TOTAL		Photo-ID, Biopsy	Estimated angle and distance training	Estimated angle and distance experiment
	Date	Date	Time	Dist.	Time	Dist.	Time	Dist.	Time	Time	Time
	Time	Time	(hours)	(n.m.)	(hours)	(n.m.)	(hours)	(n.m.)	(hours)	(hours)	(hours)
Kushiro to research area	2-Jul 13:00	8-Jul 6:00	0	0	0	0	0	0	-	-	-
Northern stratum	8-Jul 6:00	20-Aug. 12:25	25.18	258	22.9	232.4	48.08	490.5	0.72	1.95	4.08
Southern stratum	18-Jul 6:00	25-Aug. 11:14	64.62	670.4	62.74	655.4	127.37	1,325.70	43.94	-	-
Research area to Kushiro	25-Aug. 11:14	28-Aug. 15:03	16.55	170.1	0	0	16.55	170.1	6.98	-	-
Total	2-Jul 13:00	28-Aug. 15:03	106.4	1,098.5	85.6	887.8	192.00	1,986.3	51.64	1.95	4.08

Table 2. Number of sightings for all species observed during **the northern stratum** in each effort mode (including US EEZ). Parentheses indicated the number of calves observed.

Species	NSC		IO		OE		Total	
	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Blue whale	0	0	1	1	0	0	1	1
Fin whale	1	1	15	37	0	0	16	38 (3)
Sei whale	2	2	2	2	0	0	4	4
Common minke whale	6	6	1	1	1	1	8	8
Like minke whale	1	1	0	0	0	0	1	1
Humpback whale	1	1	3	6	1	1	5	8
Sperm whale	10	10	9	9	3	3	22	22
Baird's beaked whale	1	20	0	0	0	0	1	20 (1)
Ziphiidae	0	0	1	3	0	0	1	3
Mesoplodon spp.	0	0	1	1	0	0	1	1
Killer whale	1	5	4	42	1	6	6	53 (6)
Dalli type Dall's porpoise	7	33	5	23	1	4	13	60 (1)
Unid type Dall's porpoise	0	0	5	15	2	5	7	20
Unid. Large cetacean	1	1	5	7	1	1	7	9
Unid. dolphin	1	4	1	2	1	3	3	9
Unid. Cetacean	1	1	0	0	0	0	1	1
Total	33	85	53	149	11	24	97	258 (11)

Table 3. Number of sightings for all species observed during **the southern stratum** in each effort mode. Parentheses indicated the number of calves observed.

Species	NSC		IO		OE		Total	
	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Blue whale	0	0	2	2	0	0	2	2
Fin whale	3	5	4	5	0	0	7	10 (2)
Sei whale	34	75	13	18	2	4	49	97 (4)
Sperm whale	30	47	14	14	1	1	45	62
Ziphiidae	1	1	2	5	0	0	3	6
Mesoplodon spp.	1	2	1	3	0	0	2	5 (1)
Killer whale	3	36	1	13	0	0	4	49 (6)
Common dolphin (short-beaked)	7	489	10	707	0	0	17	1,196 (59)
Pacific white-sided dolphin	7	876	5	250	8	215	20	1,341
Northern right whale dolphin	3	630	1	30	2	90	6	750
Dalli type Dall's porpoise	21	135	10	50	7	55	38	240 (1)
Unid type Dall's porpoise	5	21	6	40	2	10	13	71
Unid. Large cetacean	14	23	4	8	2	3	20	34
Unid. small cetacean	0	0	1	1	0	0	1	1
Unid. dolphin	2	4	3	35	0	0	5	39
Unid. Cetacean	3	13	2	2	0	0	5	15
Total	134	2,357	79	1,183	24	378	237	3,918 (73)

Table 4. Number of sightings for all species observed during **the entire research area** in each effort mode. Parentheses indicated the number of calves observed.

Species	NSC		IO		OE		Total	
	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Blue whale	0	0	3	3	0	0	3	3
Fin whale	4	6	19	42	0	0	23	48 (5)
Sei whale	36	77	15	20	2	4	53	101(4)
Common minke whale	6	6	1	1	1	1	8	8
Like minke whale	1	1	0	0	0	0	1	1
Humpback whale	1	1	3	6	1	1	5	8
Sperm whale	40	57	23	23	4	4	67	84
Baird's beaked whale	1	20	0	0	0	0	1	20 (1)
Ziphiidae	1	1	3	8	0	0	4	9
Mesoplodon spp.	1	2	2	4	0	0	3	6(1)
Killer whale	4	41	5	55	1	6	10	102 (12)
Common dolphin (short-beaked)	7	489	10	707	0	0	17	1,196(59)
Pacific white-sided dolphin	7	876	5	250	8	215	20	1,341
Northern right whale dolphin	3	630	1	30	2	90	6	750
Dall type Dall's porpoise	28	168	15	73	8	59	51	300 (2)
Unid type Dall's porpoise	5	21	11	55	4	15	20	91
Unid. Large cetacean	15	24	9	15	3	4	27	43
Unid. small cetacean	0	0	1	1	0	0	1	1
Unid. dolphin	3	8	4	37	1	3	8	48
Unid. Cetacean	4	14	2	2	0	0	6	16
Total	167	2,442	132	1,332	35	402	334	4,176 (84)

Table 5. Identification of duplicate sightings observed during survey in Independent Observer (IO) mode excluded dolphins. Duplicate status was based on the number of sightings made by the Independent Observer Platform (IOP) that were observed also by the Topmen in the Standard Barrel. Status codes: **D** - Definite duplicate, **P** - Possible duplicate, **R** - Remote duplicate, **N** - Not duplicate.

Species	Number of sightings made by IOP	Duplicate Status			
		D	P	R	N
Fin whale	7	6	-	-	1
Sei whale	6	5	-	-	1
Sperm whale	7	6	-	-	1
Ziphiidae	1	-	-	-	1
Killer whale	2	2	-	-	-

Table 6. Number of sightings for all species observed during the transit from Kushiro to the Research Area.

Species	NSC		IO		OE		TOTAL	
	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Unid type Dall's porpoise	0	0	0	0	1	4	1	4
Total	0	0	0	0	1	4	1	4

Table 7. Number of sightings for all species observed during the transit from the Research Area to Kushiro.

Species	NSC		IO		OE		TOTAL	
	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Blue whale	2	2	0	0	0	0	2	2
Fin whale	5	7	0	0	0	0	5	7
Sei whale	9	17	0	0	0	0	9	17 (1)
Sperm whale	8	8	0	0	0	0	8	8
Dalli type Dall's porpoise	1	3	0	0	0	0	1	3
Unid. Large cetacean	15	25	0	0	0	0	15	25
Total	40	62	0	0	0	0	40	62 (1)

Table 8. Summary of all sightings observed during the 2010 IWC / Japan Joint Cetacean Sighting Survey Cruise in the North Pacific. Parentheses indicated the number of calves observed.

Species	Total	
	Sch.	Ind.
Blue whale	5	5
Fin whale	28	55 (5)
Sei whale	62	118 (5)
Common minke whale	8	8
Like minke whale	1	1
Humpback whale	5	8
Sperm whale	75	92
Baird's beaked whale	1	20 (1)
Ziphiidae	4	9
Mesoplodon spp.	3	6 (1)
Killer whale	10	102 (12)
Common dolphin (short-beaked)	17	1,196 (59)
Pacific white-sided dolphin	20	1,341
Northern right whale dolphin	6	750
Dalli type Dall's porpoise	52	303 (2)
Unid type Dall's porpoise	21	95
Unid. Large cetacean	42	68
Unid. small cetacean	1	1
Unid. dolphin	8	48
Unid. Cetacean	6	16
Total	375	4,242 (85)

Table 9. Results of biopsy sampling during 2010 Joint Cetacean Sighting Survey Cruise in the North Pacific.

Species & Date	Sight No.	Group size	No. of whales sampled	Sample no.	Blubber	Photo	Comments
Blue whale							
8 Aug.	1	1	0	-	-	Yes	No chance to shoot.
8 Aug.	2	1	0	-	-	Yes	2 misses.
27 Aug.	12	1	0	-	-	Yes	No chance to shoot.
27 Aug.	22	1	1	1006018	Yes	Yes	1 miss. During transit.
Total			1				
Fin whale							
11 Aug.	3	2	1	10053014	No	Yes	Only skin, Mother/Calf pair, Sampled from mother.
22 Aug.	15	2	1	10053017	No	Yes	Only skin, Mother/Calf pair, Sampled from calf.
27 Aug.	14	1	0	-	-	Yes	3 misses.
Total			2				
Sei whale							
25-Jul	5	1	0	-	-	Yes	1 miss.
25-Jul	10	2	1	10043002	Yes	Yes	1 miss, 2 samples from 1 animal.
27-Jul	6	1	0	-	-	No	No chance to shoot.
27-Jul	8	2	0	-	-	Yes	No chance to shoot.
28-Jul	2	3	2	10043003	Yes	Yes	2 attempt.
				10043004	Yes		
30-Jul	7	3	2	10043005	Yes	Yes	1 miss.
				10043006	Yes		
30-Jul	11	8	0	-	-	Yes	2 misses.
31-Jul	2	5	0	-	-	Yes	5 misses.
31-Jul	3	2	1	10043007	Yes	Yes	1 attempt.
31-Jul	4	4	1	10043008	Yes	Yes	1 attempt.
31-Jul	6	5	0	-	-	No	No chance to shoot.
31-Jul	8	3	1	10043009	Yes	Yes	1 attempt.
31-Jul	11	3	0	-	-	Yes	2 misses.
31-Jul	16	7	0	-	-	No	No chance to shoot.
4 Aug.	9	2	1	10043010	Yes	Yes	1 attempt.
4 Aug.	13	3	1	10043011	Yes	Yes	1 miss.
4 Aug.	19	1	0	-	-	Yes	1 miss.
5 Aug.	14	2	1	10043012	No	Yes	Only skin.
9 Aug.	2	2	1	10043013	Yes	Yes	1 miss.

2010 IWC / Japan Joint Cetacean Sighting Survey Cruise in the North Pacific

Species & Date	Sight No.	Group size	No. of whales sampled	Sample no.	Blubber	Photo	Comments
Sei whale (continued)							
10 Aug.	1	1	0	-	-	No	1 miss.
11 Aug.	1	2	0	-	-	Yes	5 misses.
11 Aug.	4	1	0	-	-	Yes	No chance to shoot.
13 Aug.	3	1	0	-	-	Yes	No chance to shoot.
13 Aug.	13	1	1	10043015	Yes	Yes	2 misses.
17 Aug.	4	2	0	-	-	Yes	1 miss, Mother/Calf pair.
17 Aug.	12	1	0	-	-	No	No chance to shoot.
17 Aug.	14	2	0	-	-	Yes	No chance to shoot.
22 Aug.	16	1	0	-	-	Yes	No chance to shoot.
22 Aug.	19	1	0	-	-	No	No chance to shoot.
25 Aug.	3	2	0	-	-	Yes	No chance to shoot.
Total			13				
Sperm whale							
5 Aug.	7	12	0	-	-	Yes	1 miss.
Total			0				
Killer whale							
25-Jul	9	5	1	10273001	Yes	Yes	2 misses, sampled from female or immature male.
31-Jul	9	5	0	-	-	Yes	No chance to shoot.
17 Aug.	9	24	1	10273016	Yes	Yes	4 misses. (Sample from large male).
Total			2				

Table 10. Summary of the photo-ID images collected during the 2010 Joint Cetacean Sighting Survey Cruise in the North Pacific.

Species & Date	Sight no.	Group size	No. of individuals photo-ID's	Biopsy sample no.	Comments
Blue whale					
13-Jul	5	1	1	-	Dorsal fin (left side).
8 Aug	1	1	1	-	Dorsal fin and flank (left side).
8 Aug	2	1	1	-	Dorsal fin and flank (both sides).
27 Aug	12	1	1	-	Dorsal fin and flank (both sides).
27 Aug	22	1	1	1006018	Dorsal fin and flank (both sides).
Total			5	-	
Humpback whale					
8-Jul	1	1	1	-	Dorsal fin and fluke (angled fluke photo)
11-Jul	7	1	1	-	Dorsal fin and fluke (angled fluke photo)
15-Jul	7	1	1	-	Dorsal fin and fluke.
15-Jul	12	3	1	-	Dorsal fin and fluke.
15-Jul	13	1	1	-	Dorsal fin and fluke.
Total			5		
Killer whale					
9-Jul	2	6	0	-	Dorsal fin (from a distance).
14-Jul	16	5	5	-	Dorsal fin and right side saddle patch.
14-Jul	17	9	*	-	*Sightings No. 17 & 18 grouped together.
14-Jul	18	24	14	-	Dorsal fin, right side saddle patch, and 1 fluke.
15-Jul	1	4	1	-	Dorsal fin.
25-Jul	9	5	5	10273001	Dorsal fin and right side saddle patch, biopsy attempt.
31-Jul	16	7	4	-	Dorsal fin and right side saddle patch. No biopsy possible due to whale behavior.
17 Aug.	9	24	9	10273016	Dorsal fin and right side saddle patch. No photo of successful biopsy attempt.
18 Aug.	1	13	7	-	Dorsal fin and left side saddle patch. No opportunity for biopsy experiment due to weather conditions.
Total			45		

Table 11. Summary of the additional photographs for species identity in the entire cruise.

Species & Date	Sight No.	Group size	No. of whales photographed	Sample no.	Comments
Fin whale					
12 July	3	1	1	-	-
13 July	1	3	2	-	-
13 July	7	3	3	-	-
13 July	9	1	1	-	-
13 July	12	3	1	-	-
13 July	14	2	1	-	-
13 July	15	2	2	-	-
15 July	8	5	2	-	-
15 July	10	1	1	-	-
15 July	14	2	1	-	-
15 July	17	3	1	-	-
15 July	19	4	2	-	-
15 July	22	1	1	-	-
11 Aug.	3	2	2	10053014	Biopsy attempted. Mother/Calf pair.
17 Aug	13	1	1	-	Mixed school of sei (2) and fin (1).
22 Aug.	15	2	2	10053017	Biopsy attempted. Mother/Calf pair.
27 Aug.	14	1	1	-	Biopsy attempted
Total			25		
Sei whale					
11 Jul	1	1	1	-	-
13 Jul	3	1	1	-	-
25 Jul	5	1	1	-	Biopsy attempted.
25 Jul	10	2	1	10043002	Biopsy attempted.
27 Jul	8	2	2	-	Biopsy attempted.
28 Jul	2	3	1	10043003	Biopsy attempted.
				10043004	
30 Jul	7	3	3	10043005	Biopsy attempted.
				10043006	
30 Jul	10	3	3	-	-
30 Jul	11	8	3	-	Biopsy attempted.
31 Jul	2	5	5	-	Biopsy attempted.
31 Jul	3	2	2	10043007	Biopsy attempted.
31 Jul	4	4	4	10043008	Biopsy attempted.
31 Jul	8	3	1	10043009	Biopsy attempted.
31 Jul	11	3	3	-	Biopsy attempted.
4 Aug	9	2	2	10043010	Biopsy attempted.
4 Aug	13	3	2	10043011	Biopsy attempted.
4 Aug	19	1	1	-	Biopsy attempted.
5 Aug	14	2	2	10043012	-
9 Aug	2	2	2	10043013	Biopsy attempted.
10 Aug	3	1	1	-	Biopsy attempted.
11 Aug	1	2	2	-	Biopsy attempted.
11 Aug	4	1	1	-	Biopsy attempted
13 Aug	3	1	1	-	Biopsy attempted
13 Aug	13	1	1	10043015	Biopsy attempted
17 Aug	4	2	2	-	Biopsy attempted , Mother/Calf pair.
17 Aug	14	2	2	-	Mixed school of sei and fin.
22 Aug	17	1	1	-	-
25 Aug	3	2	1	-	-

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Species & Date	Sight No.	Group size	No. of whales photographed	Sample no.	Comments
Sei whale (continued)					
27 Aug	15	2	1	-	Calf photographed
Total			53		
Common minke whale					
14 Jul	8	1	1	-	-
14 Jul	9	1	1	-	-
Total			2		
Sperm whale					
10 Jul	1	1	1	-	-
5 Aug	7	12	4	-	Biopsy attempted.
Total			4		
Baird's beaked whale					
14 Jul	6	20	2	-	-
Total			2		
Common dolphin					
25 Jul	2	3	3	-	-
25 Jul	8	90	2	-	-
26 Jul	2	60	5	-	-
8 Aug	3	30	15	-	-
8 Aug	4	350	20	-	Pale animal (YY20100808-004-001,2,3); dark color morph (HK20100808-004-007)
Total			45		
Northern right whale dolphin					
20 Jul	3	60	3	-	-
Total			3		
Pacific white-sided dolphin					
20 Jul	2	80	3	-	Anomalous color pattern
4 Aug	11	140	3	-	-
5 Aug	9	120	5	-	-
Total			11		
Dall's type Dall's porpoise					
12 Jul	4	8	3	-	-
Total			3		

Table 12. Observations of marine debris in the research area.

Date	Latitude	Longitude	Objects
13 July	50°23'N	174°25'W	Two clustered fishing floats.
21 July	43°18'N	170°22'W	Plastic, approximately 3 square meters.
25 July	40°40'N	172°08'W	Small Styrofoam piece.
25 July	40°30'N	172°15'W	Styrofoam box six sides.
26 July	40°21'N	172°20'W	Fishing float.
26 July	40°05'N	172°38'W	Fishing float.
26 July	40°05'N	172°38'W	Plastic packing band with rope.
27 July	41°16'N	173°28'W	Wood log.
28 July	42°09'N	174°05'W	Clustered fishing floats.
31 July	45°25'N	176°29'W	Fishing float.
1 Aug.	46°02'N	176°56'W	Wood log.
1 Aug.	47°17'N	177°58'W	Fishing float.
3 Aug.	46°05'N	178°22'W	Fishing float.
4 Aug.	45°11'N	179°01'W	Metal drum can (150-250litres).
5 Aug.	43°51'N	179°59'W	Styrofoam pieces.
5 Aug.	43°42'N	179°54'E	Styrofoam box.
7 Aug.	43°25'N	179°42'E	Wood log (12 meters).
7 Aug.	43°19'N	179°38'E	Wood log (15meters).
10 Aug.	41°49'N	176°09'E	Plastic bottle (about 2 liter)
10 Aug.	41°58'N	176°02'E	Styrofoam piece.
10 Aug.	42°02'N	176°00'E	Natural wood log (3 m).
11 Aug.	43°38'N	174°51'E	Single fishing float.
12 Aug.	44°33'N	174°11'E	Styrofoam piece.
17 Aug.	45°07'N	173°45'E	Styrofoam piece.
17 Aug.	45°49'N	173°14'E	Styrofoam board.
20 Aug.	47°06'N	172°14'E	Styrofoam piece.
20 Aug.	47°05'N	172°20'E	Natural wood log (15m).
20 Aug.	47°02'N	172°22'E	Natural wood log (1.5m).
20 Aug.	46°57'N	172°18'E	Wood piece.
21 Aug.	46°01'N	171°35'E	Wood created material.
21 Aug.	45°40'N	171°19'E	Styrofoam float.
22 Aug.	44°51'N	170°42'E	Styrofoam piece.
22 Aug.	44°40'N	170°34'E	Styrofoam piece.

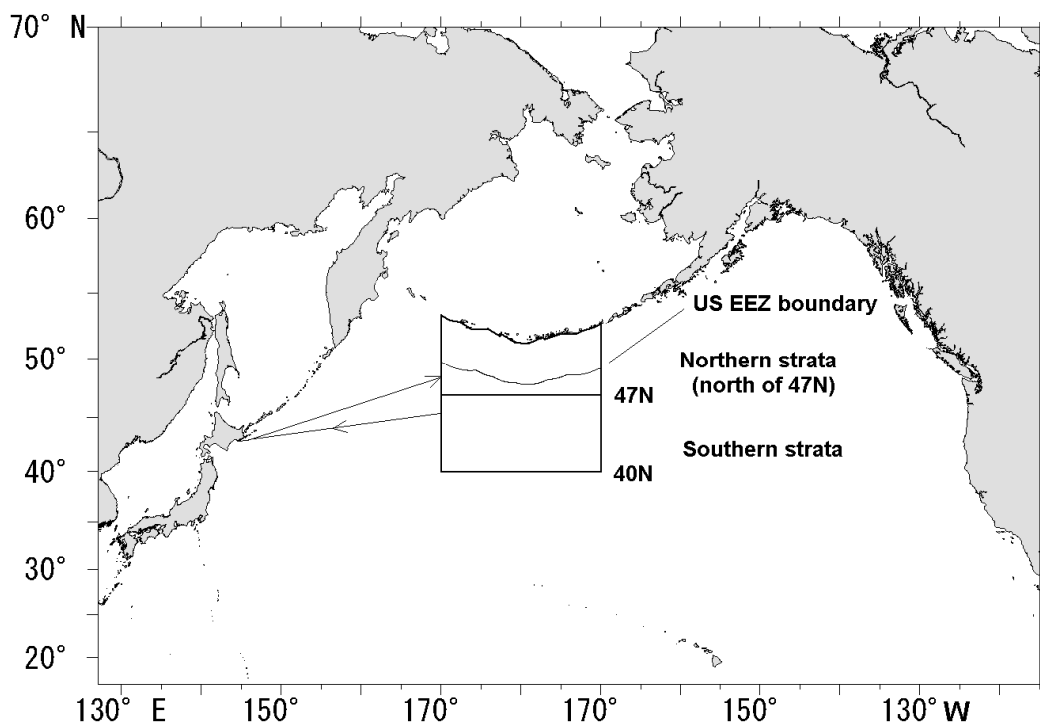


Figure 1. Research area of the 2010 IWC/Japan Joint Cetacean Sighting Survey Cruise in the North Pacific. The survey area is divided into northern and southern stratum at 47°N. Black line in the northern strata represents the boundaries for the US EEZ. Outer limit of US EEZ is provided by NOAA Office of Coast Survey and the data are available from http://www.nauticalcharts.noaa.gov/csdl/docs/GIS_EEZ_Alaska.zip.

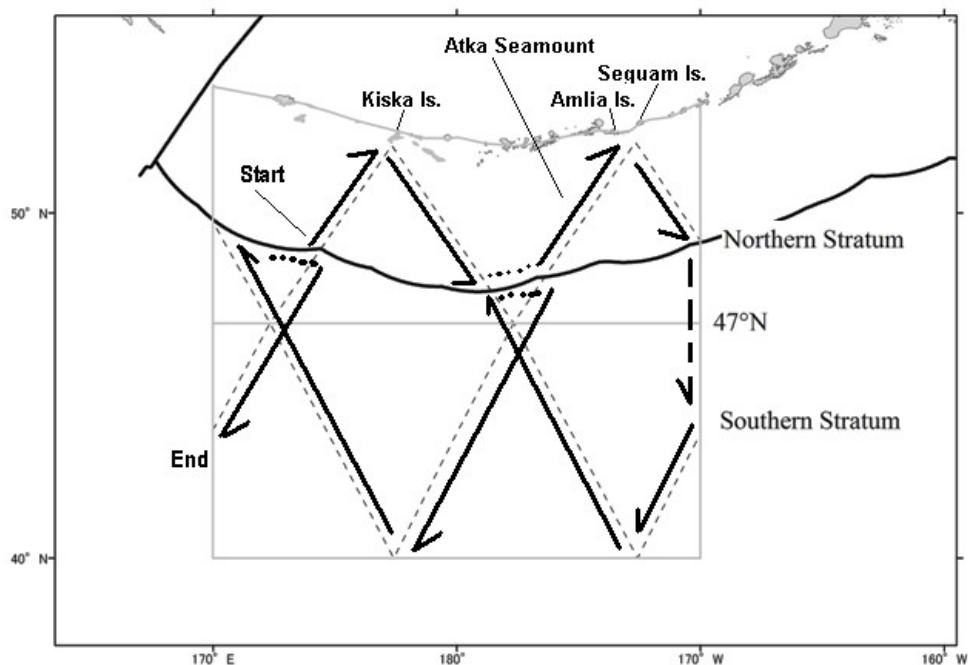


Figure 1b. The trackline design for this cruise (dotted line). The survey area is divided into northern and southern stratum at 47°N. Black line represents the boundaries for the US EEZs. The starting points of transect lines within the study area were randomized following IWC/SC guidelines (Hammond and Donovan, 2004).

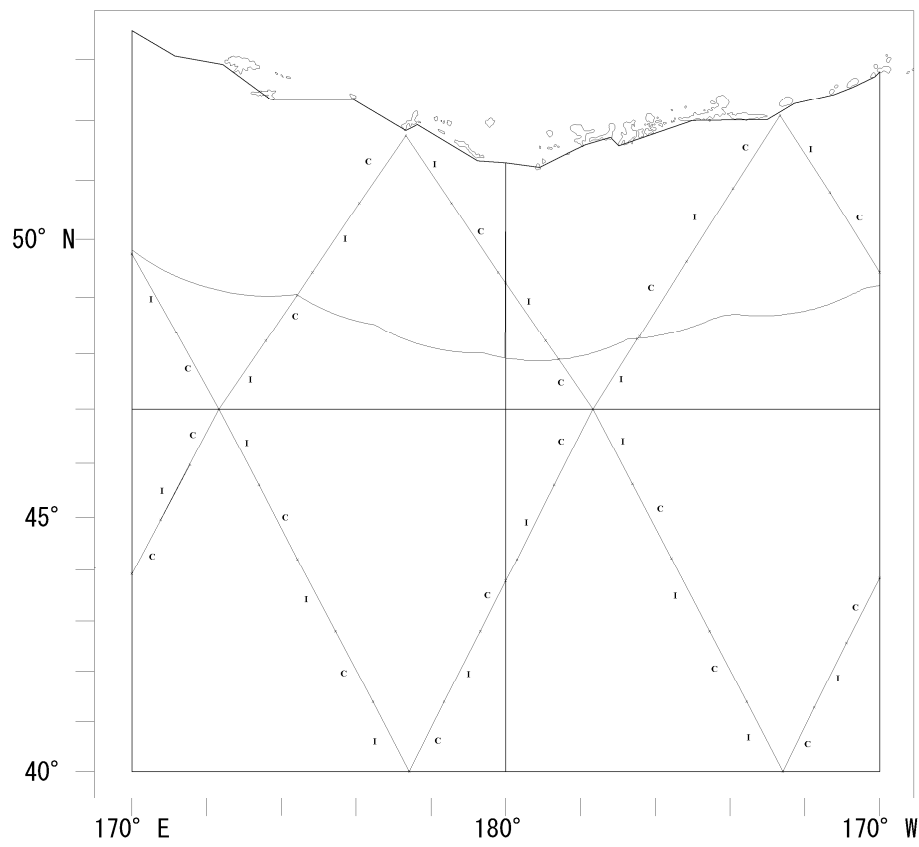


Figure 1c. Sections of the cruise track of the research area covered on two survey modes, NSC (C) and IO (I) in each transect.

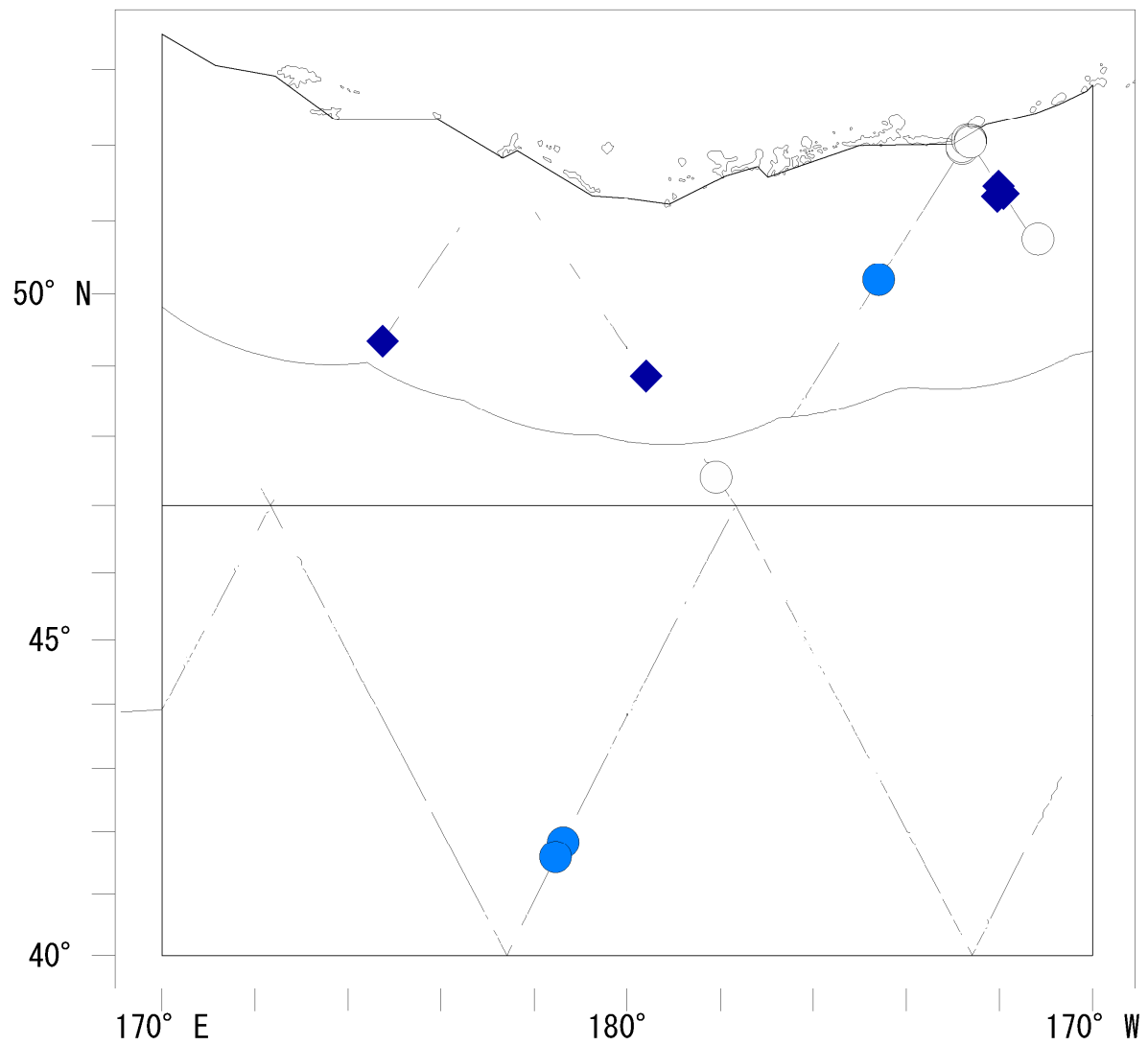


Figure 2a. Positions of blue (colored circle), common minke (white circle) and humpback (diamond) whales observed in the research area.

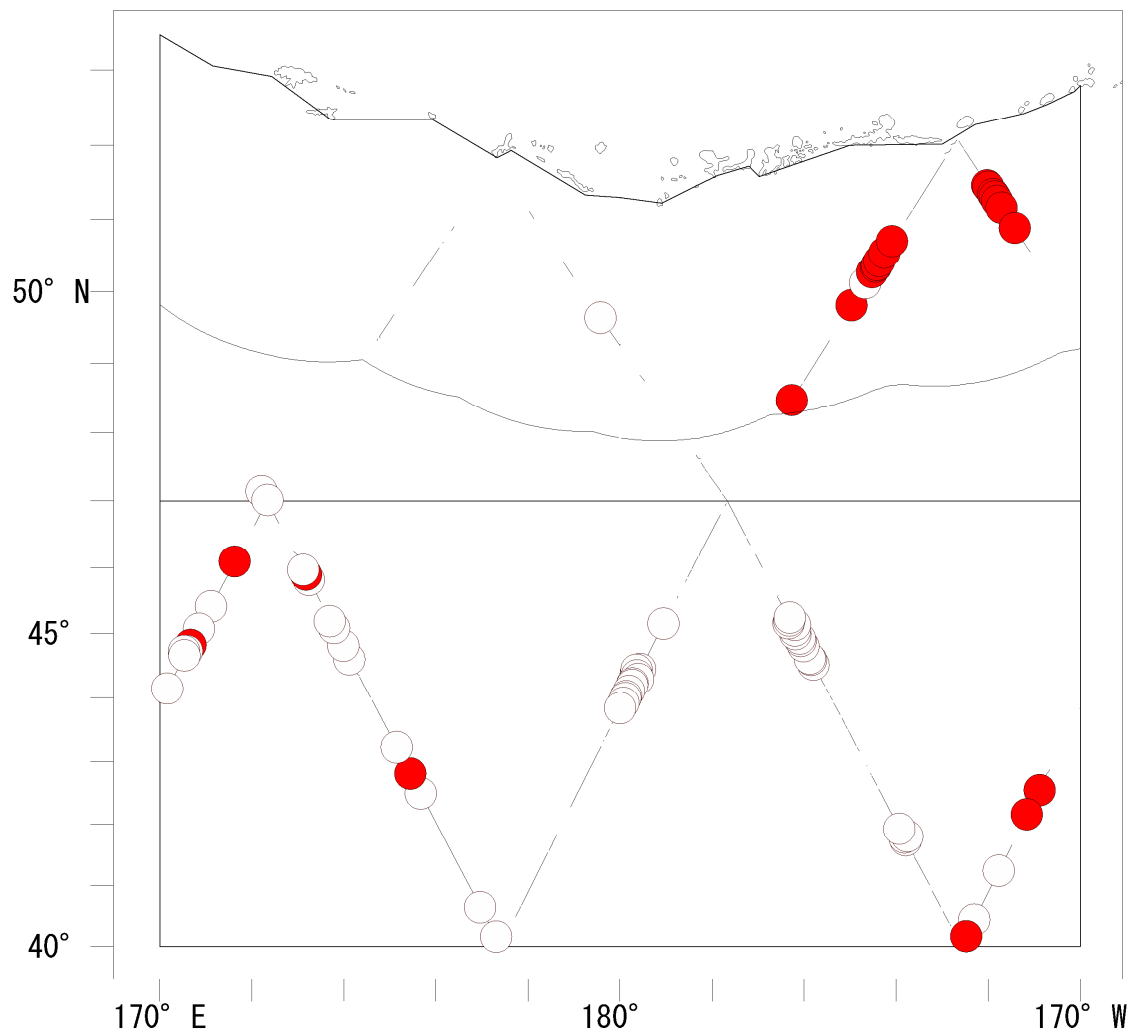


Figure 2b. Positions of fin (colored circle) and sei (white circle) whales observed in the research area.

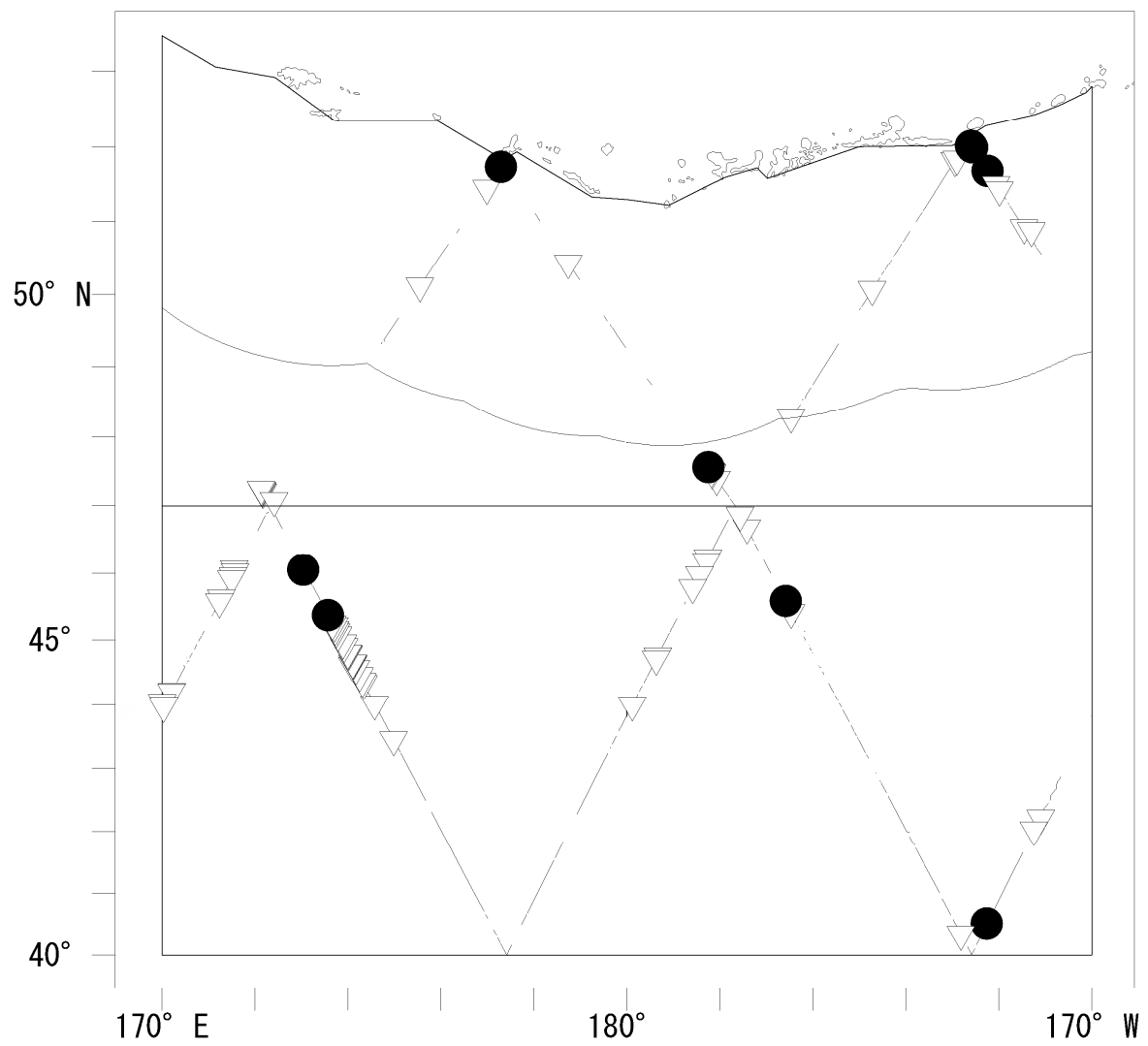


Figure 2c. Positions of sperm (opposite white triangle) and killer (black circle) whales observed in the research area.

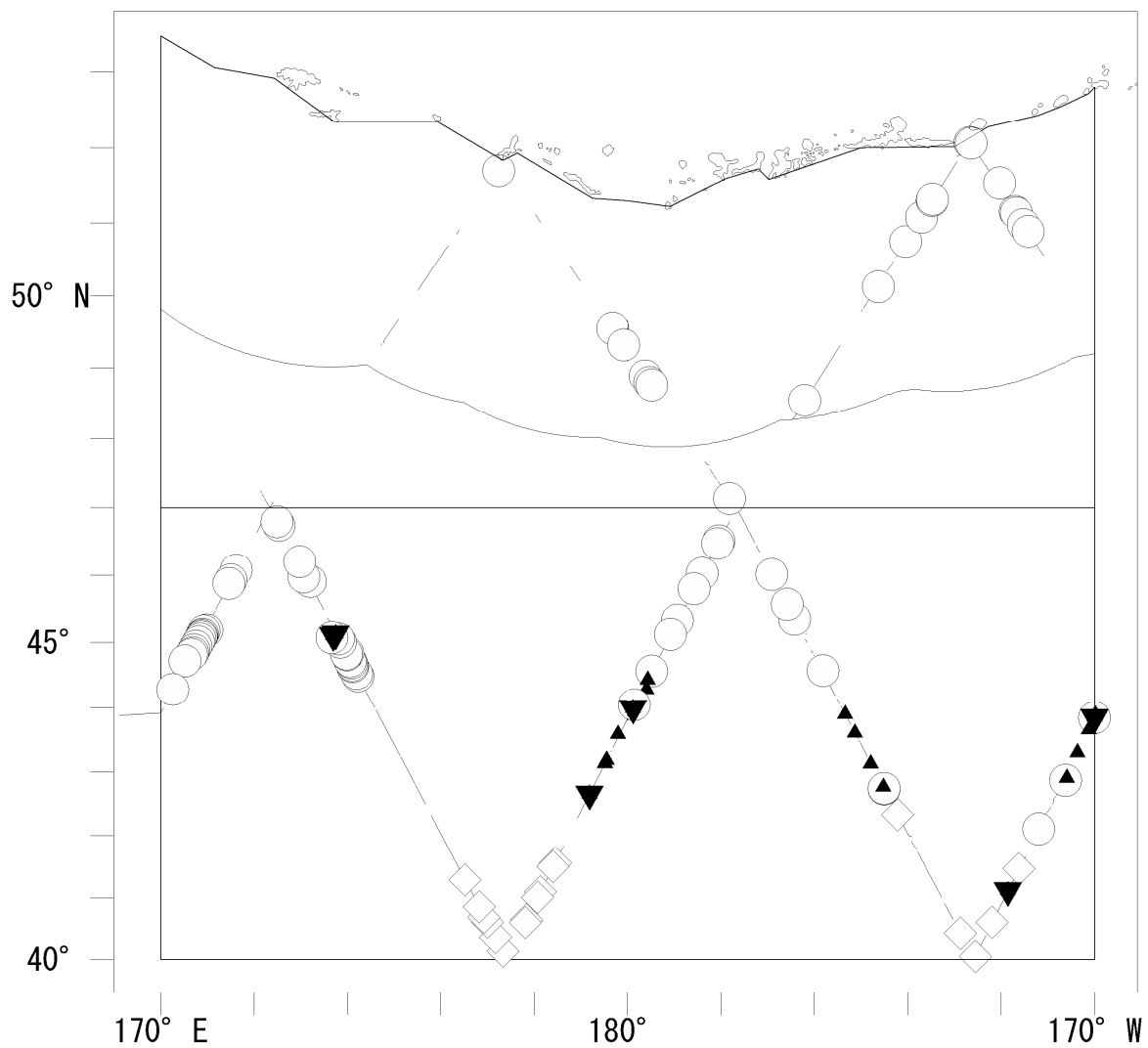


Figure 2d. Positions of short beaked common dolphin (white diamond), Pacific white-sided (black triangle), northern right whale dolphins (opposite black triangle) and Dall's porpoise (white circle) observed in the research area.

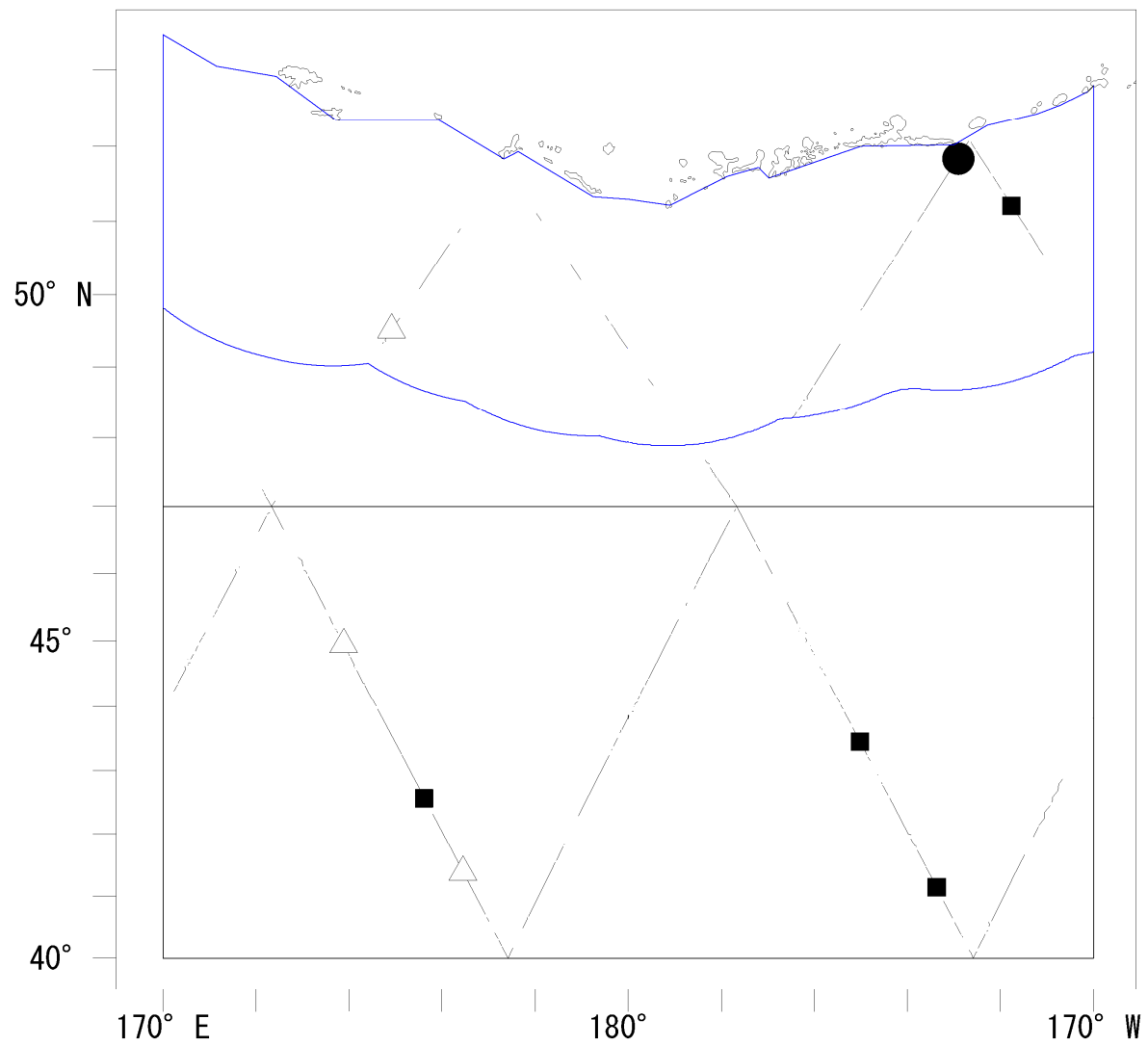


Figure 2e. Positions of Baird's beaked whale (black circle), *Ziphiidae* (white square) and *Mesoplodon* spp. (white triangle) observed in the research area.

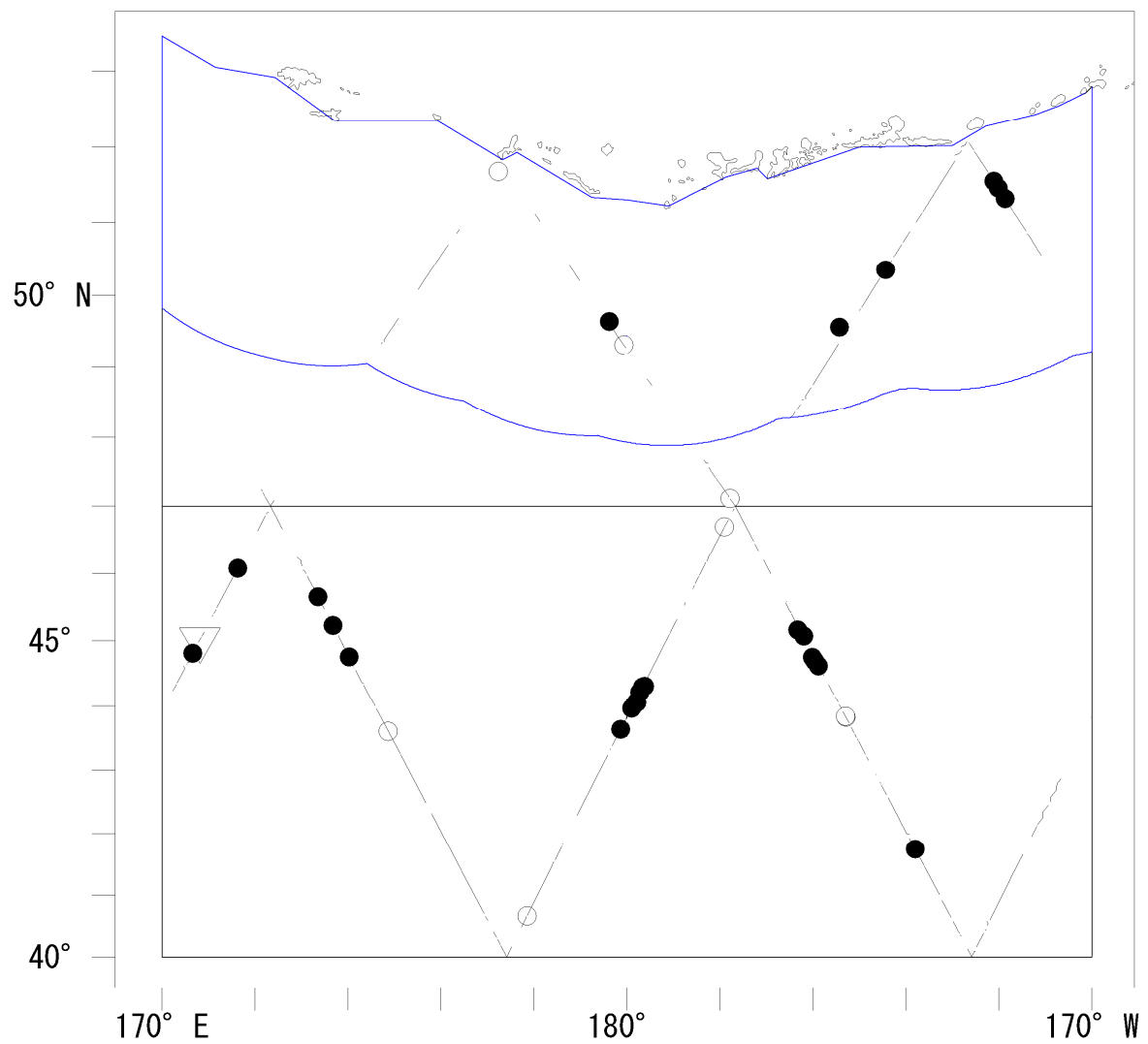


Figure 2f. Positions of unidentified large whales (black circle), unidentified small cetacean (opposite triangle) and unidentified dolphin (white circle) observed in the research area.

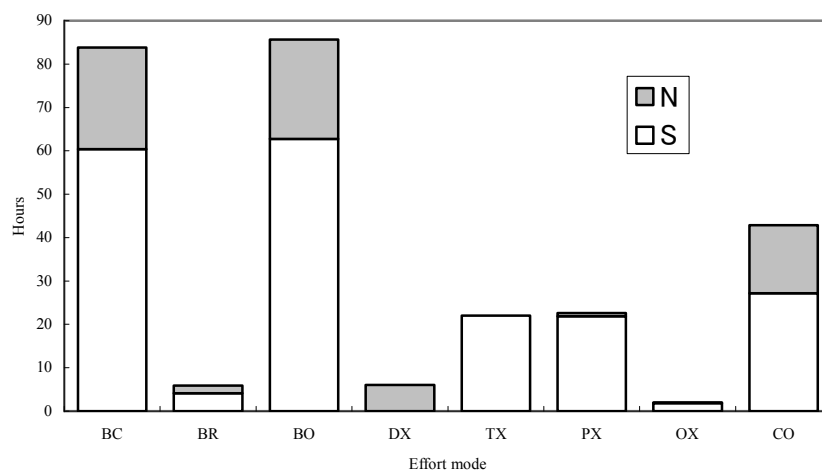


Figure 3a. Breakdown of research time, in minutes, by on-effort mode within the strata of the research area

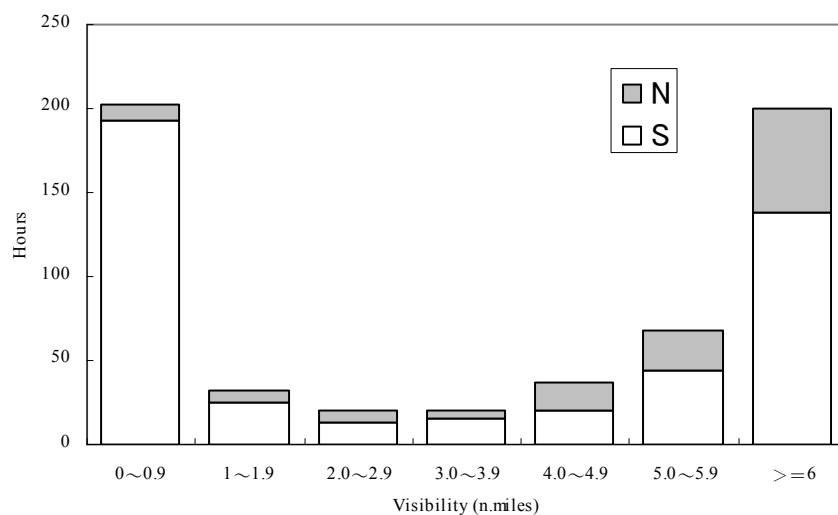


Figure 3b. Visibility (in nmiles) within the strata of the research area.

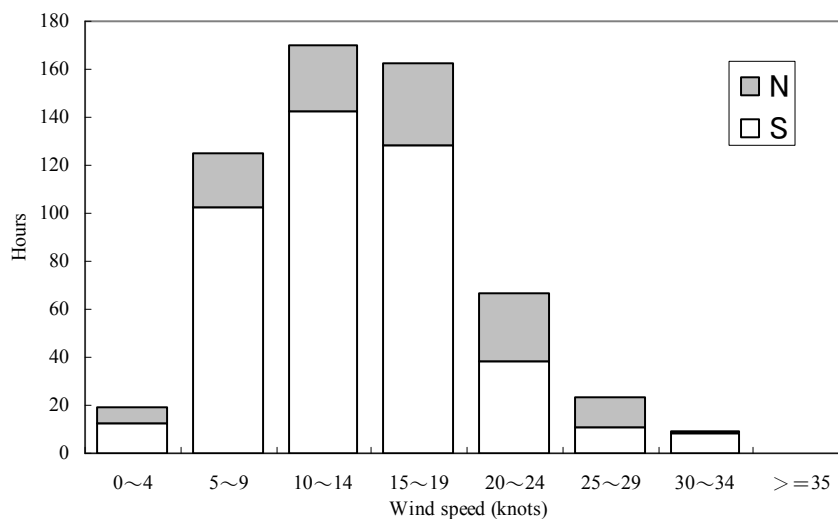


Figure 3c. Wind speed experienced within the strata of the research area.

Appendix A

Ship specifications and crew list.

Ship specifications:

	<i>Kaiko Maru</i>
Call sign	JGDW
Length	61.90 m
Breadth	11.0 m
International Gross tonnage	1010 t
Japan Gross tonnage	860.25t
Barrel height	19.5 m
IOP height	14.5 m
Upper Bridge height	9.0 m
Bow height	6.5 m
Engine power (main)	1471kW
Crew	19

Crew list:

	<i>Kaiko Maru</i>
Captain	Y. Shinyashiki
Chief Officer	Y. Yamauchi
Second Officer	T. Takamatsu
Chief Engineer	K. Nakamura
First Engineer	H. Yasunaga
Second Engineer	K. Satou
Third Engineer	H. Oikawa
Chief Operator	K. Shigetomo
Boatswain	H. Ohmura
Jr. Boatswain	M. Kaseda
Quartermaster	T. Suzuki
Quartermaster	K. Hasebe
Quartermaster	K. Kurisu
Sailor	A. Tsuji
Sailor	H. Nawa
No. 1 Oiler	H. Yanagiuchi
Oiler	M. Abe
Chief Steward	S. Murakami
Steward	I. Kaga

Appendix B

Observations of cetaceans while in the 200 n.mile Exclusive Economic Zone of the United States.

Introduction

The 2010 IWC/Japan Joint Cetacean Sighting Survey Cruise in the North Pacific was conducted by the Japanese R/V Kaiko Maru (KK1) in July and August 2010. The research area was set north of 40°N, south of Aleutian Islands, 170°E-170°W (including US EEZ). The cruise will be focused on the collection of line transect data to estimate abundance and biopsy/photo-identification data, would make a valuable contribution to the work of the International Whaling Commission (IWC) Scientific Committee (SC) on the management and conservation of populations of large whales in the North Pacific in a number of ways, including: (1) providing information for the proposed future in-depth assessment of sei whales in terms of both abundance and stock structure; (2) providing information relevant to Implementation Reviews of whales (e.g. common minke whales) in terms of both abundance and stock structure; (3) providing baseline information on distribution and abundance for a poorly known area for several large whale species/populations, including those that were known to have been depleted in the past but whose status is unclear; (4) providing biopsy samples and photo-identification photos to contribute to discussions of stock structure for several large whale species/populations, including those that were known to have been depleted in the past but whose status is unclear; (5) providing essential information for the intersessional workshop to plan for a medium-long term international programme in the North Pacific.

The KK1 has the necessary Japanese research permits to operate on the high seas, and has a Japanese CITES Introduction from the Sea permit. The US Department of State provided clearance for the KK1 to operate within US waters from 8 July- 18 August. The research activities within the US EEZ were conducted under the SWFSC's MMPA/ESA (Marine Mammal Protection Act/ Endangered Species Act) permits 14097 and 774-1714 while in the US EEZ; no additional permit was required. The US researcher on board, Siri Hakala is listed as a Co-Investigator on the SWFSC permit. The KK1 did not conduct biopsy sampling in the US EEZ, and the tracklines in the US EEZ were completed first, followed by the tracklines on the high seas. Biopsy sampling only began after the KK1 left the US EEZ.

Narrative

On 8 July, the KK1 started the research area survey (US EEZ) on schedule at 06:00 (49°02'N 174°25'E), under TD steaming due to strong wind. During the day, after acceptable conditions arrived, we started the survey in both NSC and IO modes. One humpback whale was sighted and photographed. Two sperm whales and an unidentified Mesoplodon species were sighted.

On 9 July, the KK1 arrived at the most northern Way Point (WP) 109 (51°45'N 177°20'E) and drifted approximately 5 miles from Kiska Island in the Aleutian Islands. North wind increased to approximately 27 knots. Secondary sightings of sperm and killer whales were made.

On 10 and 11 July, the KK1 conducted the survey under poor visibility conditions with TD and DR. The exercise "experiment of distance and angle estimation" was conducted on 11 July. Photo-id of one humpback whale was taken during TD steaming. The KK1 almost arrived southern WP 114 (47°54'N 178°35'E) (effort halted due to fog) and moved to the next northward starting point in the US EEZ.

On 12 July, the KK1 continued the research area survey (US EEZ) at the southern WP116 (48°16'N 176°29'W), under acceptable searching conditions. Fin and sperm whales were sighted. During the day, the experiment of distance and angle estimation was conducted under good visibility and sea state.

On 13 July, the KK1 met a concentrated area of fin whales (7 schools 16 individuals) on the eastern side of the Atka Seamount between 50°00'N and 50°45'N, under fog intervals between searching effort and TD off effort steaming. A total of 7 schools and 16 individual (2 calves) sightings of fin whales were made. A solitary blue whale was sighted and photographed.

On 14 July, the KK1 reached the most northern WP (52°05'N 172°40'W) near the Amlia Island and Seguam Island under good visibility and sea state. Around this WP, sightings of Baird's beaked, common minke and killer whales were made. Some of those killer whales were photographed.

On 15 July, the KK1 continued the survey on the way to the eastern boundary of the research area WP122 (49°26'N 170°00'W) under good weather conditions. She met a concentration of fin whales (8 schools, 21

individuals) again between 50°55'N and 51°30'N on northern side of the Aleutian Trench. Sightings of fin, humpback, sperm and killer whales were made. Some of the humpback and killer whales were photographed.

On 16 July, the KK1 moved to TD off effort survey on the way to the eastern boundary of the research area WP122 (49°26'N 170°00'W) against strong wind (over 21kt). She arrived at WP122 at 16:39 and started to transit to the starting point of the southern research area on the 170°00'W longitudinal line. She left the US EEZ at 18:32 (49°12'N 170°00'W).

Results

A total of 937.8 n.miles of the cruise track line was set in the US EEZ research area (Table 1). Over all, weather conditions of the research area were poor (heavy winds or poor visibility/fog) due to the strong low pressure system moving eastward through the research area, especially in the western side of the research area. The KK1 started the research area survey at 06:00 (49°02'N 174°25'E) on 8 July from the most western side of the research area, and completed the US EEZ survey on 16 July at 18:32 (49°12'N 170°00'W). The total number of the research days was 9 (Table 2). Range of the air temperature in the US EEZ was 6.0°C to 8.1°C, and range of the sea temperature was 4.4°C to 8.0°C.

Total searching distances in the US EEZ were 199.7 n.miles in NSC mode (coverage of the searching distance was 35 %) and 226.6 n.miles in IO mode (coverage of the searching distance was 62 %). The research area was divided into a western and eastern area by the 180-degree longitude line. Due to weather conditions, 27 % of the planned western trackline was covered while on effort, and 65 % of the planned eastern trackline was covered on effort. In the western area, 48.8 n.miles were covered in NSC mode (coverage of the searching distance was 16 %) and 77.9 n.miles in IO mode (coverage of the searching distance was 43 %). In the eastern area 150.9 n.miles were covered in NSC mode (coverage of the searching distance was 55 %) and 148.7 n.miles in IO mode (coverage of the searching distance was 80 %) (Table 3).

A total of 9 species including blue, fin, sei, humpback, common minke, sperm, Baird's beaked, killer whales and Dall's porpoise were observed (Table 4). Photo-ID experiments were conducted for blue, humpback and killer whales. The experiment of distance and angle estimation was conducted on 12 July.

Table 1. Way point in the US EEZ.

WP	Latitude	Longitude
106	49°02'N	174°25'E
107	49°26'N	174°50'E
108	50°37'N	176°05'E
109	51°45'N	177°20'E
110	50°37'N	178°33'E
111	49°26'N	179°48'E
112	49°15'N	180°00'E
113	48°14'N	178°56'W
114	47°54'N	178°35'W
116	48°16'N	176°29'W
117	48°19'N	176°25'W
118	49°37'N	175°10'W
119	50°52'N	173°55'W
120	52°05'N	172°40'W
121	50°48'N	171°20'W
122	49°26'N	170°00'W

Table 2. Noon position of the KK1.

Date	Latitude	Longitude
8-Jul	49°51'N	175°17'E
9-Jul	51°34'N	177°07'E
10-Jul	50°56'N	178°13'E
11-Jul	49°02'N	179°46'E
12-Jul	48°42'N	176°00'W
13-Jul	50°18'N	174°29'W
14-Jul	51°51'N	172°54'W
15-Jul	51°21'N	171°54'W
16-Jul	51°21'N	171°54'W

Table 3. The planed cruise track length, searching effort and coverage in each survey mode.

US EEZ	West (170E-180)			East (180-170W)		
	NSC	IO	Total	NSC	IO	Total
Planed (n.miles)	296.1	181.3	477.4	275.6	184.8	460.4
Effort (n.miles)	48.8	77.9	126.7	150.9	148.7	299.6
Coverage (%)	16%	43%	27%	55%	80%	65%

Sightings

The following sightings were made.

Table 4. Summary of the sightings in the US EEZ.

Species	NSC		IO		OE		Total	
	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.	Sch.	Ind.
Blue whale	0	0	1	1	0	0	1	1
Fin whale	1	1	15	37	0	0	16	38
Sei whale	1	1	1	1	0	0	2	2
Humpback whale	1	1	3	6	1	1	5	8
Common minke whale	5	5	1	1	1	1	7	7
Like minke whale	1	1	0	0	0	0	1	1
Sperm whale	2	2	8	8	3	3	13	13
Baird's beaked whale	1	20	0	0	0	0	1	20
Ziphiidae	0	0	1	3	0	0	1	3
Mesoplodon spp.	0	0	1	1	0	0	1	1
Killer whale	0	0	4	42	1	6	5	48
Dall's porpoise	6	31	5	23	1	4	12	58
Unid. type Dall's porpoise	0	0	5	15	2	5	7	20
Unid. large whale	1	1	5	7	1	1	7	9
Unid. dolphin	0	0	1	2	1	3	2	5
Unid. cetacean	1	1	0	0	0	0	1	1
Northern fur seal	0	0	0	0	1	1	1	1
Total	20	64	51	147	12	25	83	236

Table 5. Cetacean sightings made while in the US EEZ.

Date	Time	Mode	Species	Number	Position	
					Latitude	Longitude
8July2010	8:13	NSC	Humpback whale	1	49°20.88'N	174°44.60'E
8July2010	9:39	NSP	Mesoplodon spp.	1	49°30.86'N	174°54.96'E
8July2010	13:49	NSP	Sperm whale	1	50°07.19'N	175°33.39'E
8July2010	13:49	NSP	Sperm whale	1	50°07.25'N	175°33.45'E
9July2010	10:55	OE	Sperm whale	1	51°26.65'N	176°59.27'E
9July2010	13:49	OE	Killer whale	6	51°43.86'N	177°17.83'E
9July2010	15:39	OE	Unid. type Dall's porpoise	2	51°41.56'N	177°14.83'E
9July2010	16:23	OE	Unid. dolphin	3	51°40.75'N	177°14.00'E
10July2010	15:34	OE	Sperm whale	1	50°26.01'N	178°44.43'E
11July2010	7:16	NSC	Sei whale	1	49°38.24'N	179°34.99'E
11July2010	7:25	NSC	Unid. Large cetacean	1	49°37.99'N	179°37.28'E
11July2010	8:18	NSC	Dalli type Dall's porpoise	4	49°33.10'N	179°40.89'E
11July2010	9:59	NSP	Dalli type Dall's porpoise	4	49°19.29'N	179°55.40'E
11July2010	10:06	NSP	Unid. dolphin	2	49°18.33'N	179°56.42'E
11July2010	12:13	OE	Nothorn fur seal	1	40°00.23'N	179°44.20'W
11July2010	14:56	OE	Unid. type Dall's porpoise	3	48°53.38'N	179°37.36'W
11July2010	15:09	OE	Humpback whale	1	48°51.58'N	179°35.46'W
11July2010	15:36	NSP	Unid. type Dall's porpoise	2	48°47.81'N	179°31.30'W
11July2010	15:52	NSP	Unid. type Dall's porpoise	1	48°45.82'N	179°28.98'W
12July2010	6:05	NSP	Sperm whale	1	48°17.13'N	176°27.75'W

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12July2010	6:38	NSC	Unid. cetacean	1	48°21.58'N	176°22.43'W
12July2010	7:26	NSC	Blue Whale	1	48°28.17'N	176°16.06'W
12July2010	8:02	NSC	Dalli type Dall's porpoise	8	48°32.59'N	176°12.23'W
12July2010	19:22	OE	Unid. Large cetacean	1	49°33.33'N	175°25.80'W
13July2010	6:11	NSP	Fin whale	3	49°48.75'N	174°58.14'W
13July2010	9:01	NSP	Sperm whale	1	50°04.00'N	174°43.31'W
13July2010	9:23	NSP	Sei whale	1	50°07.23'N	174°39.98'W
13July2010	9:35	NSP	Dalli type Dall's porpoise	6	50°07.60'N	174°37.62'W
13July2010	10:20	NSP	Blue whale	1	50°11.51'N	174°35.63'W
13July2010	11:47	NSP	Fin whale	3	50°16.19'N	174°31.11'W
13July2010	12:46	NSP	Fin whale	1	50°20.92'N	174°26.28'W
13July2010	12:46	NSP	Unid. Large cetacean	1	50°20.92'N	174°26.28'W
13July2010	12:47	NSP	Unid. Large cetacean	1	50°21.04'N	174°26.16'W
13July2010	13:03	NSP	Fin whale	3	50°22.11'N	174°25.03'W
13July2010	13:25	NSP	Fin whale	2	50°25.32'N	174°21.78'W
13July2010	14:28	NSP	Fin whale	2	50°32.40'N	174°15.02'W
13July2010	16:02	NSP	Fin whale	2	50°41.98'N	174°05.12'W
13July2010	17:04	NSP	Dalli type Dall's porpoise	4	50°44.65'N	174°02.39'W
14July2010	6:30	NSC	Dalli type Dall's porpoise	5	51°04.53'N	173°42.23'W
14July2010	8:03	NSC	Dalli type Dall's porpoise	6	51°18.08'N	173°28.67'W
14July2010	8:08	NSC	Dalli type Dall's porpoise	2	51°18.89'N	173°27.84'W
14July2010	11:45	NSC	Sperm whale	1	51°49.05'N	172°56.65'W
14July2010	11:55	NSC	Sperm whale	1	51°49.97'N	172°53.91'W
14July2010	11:56	NSC	Baird's beaked whale	20	51°50.03'N	172°53.93'W
14July2010	13:50	NSC	Common Minke Whale	1	51°57.43'N	172°47.97'W
14July2010	13:59	NSC	Common Minke Whale	1	51°59.20'N	172°48.31'W
14July2010	14:52	NSC	Common Minke Whale	1	52°04.15'N	172°40.99'W
14July2010	14:57	NSC	Dalli type Dall's porpoise	6	52°04.35'N	172°39.81'W
14July2010	15:10	NSC	Common Minke Whale	1	52°04.09'N	172°36.80'W
14July2010	15:11	NSC	Like minke whale	1	52°04.15'N	172°36.55'W
14July2010	15:20	NSC	Common Minke Whale	1	52°04.05'N	172°37.07'W
14July2010	15:42	OE	Dalli type Dall's porpoise	4	52°03.72'N	172°38.32'W
14July2010	15:51	NSP	Common Minke Whale	1	52°02.65'N	172°37.41'W
14July2010	16:27	NSP	Killer whale	5	52°00.62'N	172°35.53'W
14July2010	16:30	NSP	Killer whale	9	52°00.33'N	172°35.23'W
14July2010	16:39	NSP	Killer whale	24	51°59.43'N	172°34.32'W
15July2010	7:28	NSP	Killer whale	4	51°40.70'N	172°14.48'W
15July2010	8:35	NSP	Unid. Large cetacean	2	51°32.94'N	172°06.34'W
15July2010	8:55	NSP	Dalli type Dall's porpoise	6	51°31.94'N	172°01.98'W
15July2010	9:13	NSP	Sperm whale	1	51°30.10'N	172°03.51'W
15July2010	9:15	NSP	Sperm whale	1	51°29.87'N	172°03.31'W
15July2010	9:28	NSP	Humpback whale	1	51°27.88'N	172°01.19'W
15July2010	9:28	NSP	Fin whale	5	51°27.79'N	172°01.09'W
15July2010	9:30	NSP	Unid. Large cetacean	1	51°27.47'N	172°00.76'W
15July2010	9:37	NSP	Fin whale	1	51°26.38'N	171°59.52'W
15July2010	9:44	NSP	Sperm whale	1	51°25.35'N	171°58.91'W
15July2010	10:36	NSP	Humpback whale	3	51°19.48'N	172°02.88'W
15July2010	11:35	NSP	Humpback whale	2	51°21.71'N	171°54.72'W
15July2010	12:02	NSP	Fin whale	2	51°20.42'N	171°53.38'W
15July2010	12:11	NSP	Unid. Large cetacean	2	51°19.06'N	171°51.83'W
15July2010	12:16	NSP	Fin whale	3	51°18.44'N	171°51.15'W

15July2010	12:38	NSP	Fin whale	3	51°15.11'N	171°47.98'W
15July2010	12:39	NSP	Fin whale	4	51°15.06'N	171°47.92'W
15July2010	13:15	NSP	Unid. Ziphiidae	3	51°12.50'N	171°45.33'W
15July2010	13:37	NSP	Fin whale	1	51°09.40'N	171°42.20'W
15July2010	13:38	NSP	Unid. type Dall's porpoise	7	51°09.23'N	171°42.02'W
15July2010	14:03	NSP	Dalli type Dall's porpoise	3	51°08.09'N	171°40.54'W
15July2010	15:13	NSP	Unid. type Dall's porpoise	1	50°58.62'N	171°31.14'W
15July2010	15:40	NSP	Sperm whale	1	50°55.10'N	171°27.20'W
15July2010	15:56	NSP	Unid. type Dall's porpoise	4	50°53.11'N	171°25.09'W
15July2010	15:57	NSP	Fin whale	2	50°52.92'N	171°24.89'W
15July2010	16:30	OE	Sperm whale	1	50°52.80'N	171°17.58'W
16July2010	2:36	OE	Common Minke Whale	1	50°44.96'N	171°09.76'W

Experiments

The following experiments were conducted in the US EEZ.

1. Distance and angle estimation experiment

Total 36 times calibrations were conducted for 8 primary observers on 12 July.

2. Photo-ID*

Species & Date	Sight No.	Group size	No. of individuals photo-ID's	Comments
Blue whale 13 July	5	1	1	Dorsal fin, left side
Humpback whale 8 July	1	1	1	Fluke
11 July	7	1	1	Fluke
15 July	7	1	1	Dorsal fin and fluke
15 July	12	3	1	Dorsal fin and fluke
15 July	13	2	1	Dorsal fin and fluke
Killer whale 9 July	2	6	0	Dorsal fin
14 July	16	5	5	Dorsal fin and saddle patch
14 July	17	9	~	Sightings No. 17 & 18 grouped together
14 July	18	24	14	Dorsal fin, saddle patch, and 1 fluke
15 July	1	4	1	Dorsal fin

* Additional photos were taken to confirm species identity for the following individuals:

2 minke, 2 sei, 19 fin, 2 Baird's beaked whales, and 3 Dall's porpoise.

3. Biopsy

No biopsy was conducted in the US EEZ.

4. Marine debris observation in the US EEZ.

Date	Latitude	Longitude	Comments
13 July	50°23'N	174°25'W	Two clustered fishing floats.