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Satellite tracking of a common minke whale
in the coastal waters off Hokkaido,
Northern Japan in 2010

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SATELLITE TRACKING OF A COMMON MINKE WHALE IN THE COASTAL WATERS OFF HOKKAIDO, NORTHERN JAPAN IN 2010

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ABSTRACT

Using a research vessel, *Shonan-maru No.2*, the sighting and satellite tagging survey for common minke whales was conducted in the coastal waters off Kushiro, southeastern coast of Hokkaido, northern Japan in 2010 autumn season. The period of survey was from 6 September to 4 October. During the survey, a total of 878.2 n. miles was searched with the restricted closing mode, and 28 schools/ 30 individuals of common minke whales were sighted (primary sightings: 20/21, secondly sightings: 8/9). Using a handy air gun, a satellite tag (Argos transmitter) was attached on one common minke whale in the 15 n. miles offing of Kiritappu on 13 September. The estimated body length of the whale was 7.8m. The electric wave reception by the satellite was started on 15 September, and the movement of the whale was tracked for a period of 27 days. Estimated position of the tagged whale was located in the west coast off the cape of Erimo, and moved to east –west courses along the coastline. These results suggested that the tagged whale stayed in the coastal waters off Kushiro, for at least four weeks in autumn season. The tracking results were not contradicted with the expected migration routes of the whales. The increasing of the tagging success rate and the extension of the tracking period could bring further information on migratory route and the southern breeding area of common minke whales.

KEYWORDS: COMMON MINKE WHALE, NORTH PACIFIC, COASTAL, SATELLITE TRACKING, SIGHTING SURVEY, MIGRATION

INTRODUCTION

Common minke whale, *Balaenoptera acutorostrata*, is a main target species for the past Japanese coastal small-type whaling, and the second phase of the Japanese whale research program under special permit in the western North Pacific (JARPN II) coastal component. Coastal waters off Kushiro, southeastern part of the Pacific coast of Hokkaido, northern Japan is one of the major grounds of common minke whales in autumn season (Miyashita and Hatanaka, 1997), and the JARPN II coastal component off Kushiro had been conducted annually since 2005 (Kishiro *et. al.*, 2009). During those surveys, the independent dedicated sighting surveys were often conducted for collecting data related to the distribution and abundance of the common minke whales (Kiwada *et. al.*, 2009). However, individual migration manner such as the residence time of the whales in those waters, and wintering routes and grounds is almost unknown. The former aspect is important in the ecosystem modeling work in the JARPN II through the estimation of the prey consumption, and the later aspect is important in considering the stock structure.

The satellite telemetry is an efficient way to investigate the migratory routes and wintering grounds of

marine mammals, and recent development of the tagging techniques have given the opportunity to investigate them (Mate *et.al.*, 2007; Heide-Jorgensen *et al.*, 2001). In Japan, some satellite tags had been successfully attached using air guns for the coastal Bryde's whales (Kishiro and Minamikawa, 2006) and the offshore Bryde's whales (Nishiwaki *et.al.* 2009), but common minke whales had not been attached, because of the difficulties in approaching them in the western North Pacific, and tagging activity had been a low or medium priority in the existent sighting survey programs.

In autumn 2010, a dedicated sighting and satellite tagging survey for common minke whales was conducted in the coastal waters off Kushiro. In this program, tagging activity was allocated to even priority with the sighting survey, and one Argos transmitter could be attached on a common minke whale. The present report summarizes this cruise and result of the tracking by the Argos satellite-based data collection and location system.

MATERIAL AND METHODS

Sighting survey

The research area was set in the coastal waters off southeastern Hokkaido from Cape Erimo (143°15'E) to Cape Nosappu (about 146°00'E) and north of 41°00'N. In the area, three survey blocks (CW, CE, OF blocks) were established and systematically designed track line were settled in the respective blocks (Fig.1). The research vessel, *Shonan-maru No.2* (712GT, 4,045KW) with a top barrel elevated 20 m above the sea surface was used. The period of survey was from 6 September to 4 October in 2010. The restricted closing mode survey was carried out, in which closing was made only for common minke whales, though opportunistic closing was sometimes carried out. Two observers on the top barrel of the vessel conducted searching by naked eyes. Species identification was conducted using binocular. Two observers on the upper-bridge also searched for cetaceans and recorded sighting information. The survey was conducted from 6:00 a.m. to 6:00 p.m. basically when the weather conditions were suitable for observations: visibility better than 1.5 nautical miles and the wind speed less than 7.5m/s. The vessel speed was 11.5 knots with slight adjustment to avoid vibration of the vessel.

Satellite tagging

Basically, all common minke whales encountered were targeted for tagging except for the whales sighted in the survey area of the JARPN II coastal component off Kushiro (area within about 30 nautical miles radius from the Kushiro port). The time for chasing was usually limited to a maximum of 120 minutes against one animal. The Wildlife Computers Spot-5 implantable tags were used as the Argos transmitter. The tagging dart system and methods of attachment were followed to the methods developed for the coastal Bryde's whales by the NRIFSF (Kishiro and Minamikawa, 2006). A handy air gun with a 40mm-caliber (Miroku Machinery Co. Ltd) was used for attachment (Fig.2). The filling pressure was set to 110kgf/cm², and firings were made from the forecastle deck when the vessel could adequately approach the whale during the chasing. The tagging dart consists of a dart with 3-bladed tip, an Argos transmitter, and retrievable float (Fig.3). The float was connected with dart by aqueous rope. When the whale is hit, the dart becomes embedded in the blubber and muscle, the float is come off, and antenna of the transmitter is exposed on the body surface. When the whale is missing, the dart with float can be retrieved. The dart was coated with povidone iodine to mitigate

physical damage and potential infection caused by tagging.

RESULTS

Scientists on board

Two scientists were onboard during the survey:

Shigeru Noji (Chief scientist, NRIFSF), Noriko Funasaka (Scientist, NRIFSF)

Cruise itinerary

6 September: The vessel left the Shiogama port, Miyagi Prefecture.

7 September: The vessel arrived at the research area, started the survey.

19 September: The vessel arrived at the Kushiro port, Hokkaido.

21 September: The vessel left the Kushiro port, resumed the survey.

2 October: The vessel ended the survey, left the research area.

4 October: The vessel arrived at the Shiogama port.

Sighting results

During the survey, a total of 878.2 nautical miles was searched with the restricted closing mode. Cruise tracks and sighting positions of common minke whales are shown in Figure 4. Although some track lines were not searched in southern part of the offshore block (OF block) due to the bad weather condition, the rest of all predetermined track lines was searched. Sighting positions of Common minke whales were concentrated in the coastal blocks (CW and CE blocks) and no sightings were made in the OF blocks. Numbers of sightings are given in Table 1. A total of 28 schools/ 30 individuals of common minke whales were sighted (primary sightings: 20/21, secondary sightings: 8/9). In addition, two schools/ two individuals of sei whales, six schools/ ten individuals of fin whales, eight schools/ ten individuals of humpback whales, and two schools/ six individuals of sperm whales were sighted. Although some humpback whales were sighted in the coastal blocks, almost all of sightings of large whale species were made in the offshore OF block (Fig. 5).

Tagging activity

Among 30 individuals of common minke whales sighted, only three schools/ three individuals of the whales (10% of all 30 sightings) could be approached within the maximum firing range of the equipment (30m or less). Results of the firings for each individual are shown in Table 2. Among three shots made for these whales, one animal was missed with the firing distance of 25m, one animal was ricocheted with the firing distance of 22m, and one animal was hit with the firing distance of 15m. The time for chasing was ranged from 47 minutes to 1 hour 18 minutes. One tag was successfully attached on the left side of the dorsal body surface anterior to the dorsal fin with near the mid-line of the animals (Fig. 6). The estimated body length of the tagged whale was 7.8m. The candidate whale swam fast during the chasing, and no behavioral change was observed during and after the tagging operation.

Signal reception and movements of the tagged whale

The tag was attached on the whale in around 15 nautical miles offing of Kiritappu, southeastern coast of Hokkaido (42°48.9'N, 145°17.9' E) on 13 September. The electric wave reception by the Argos satellite was started on 15 September, and a total of 61 signals were received during the periods from 15 September

to 31 October (Fig. 7). Among them, a total of nine locations were obtained by the Argos satellite-based data collection and location system with the accuracy location class of A or B (A; two times, B; seven times). The movement of the whale was tracked for a period of 27 days until 9 October. At first, estimated position of the whale was located in the west coast off the cape of Erimo on 3 October (42°05.40'N, 142°14.7' E; about 262.7km west of the tagging site, and the average daily movement was 13.1km). Then, the whale moved to the east coast off the cape of Erimo on 6 October, and moved to the coastal waters off Kushiro. After that, it turned to west to the cape of Erimo, and turned to east to the coastal waters off Kushiro again (Fig. 8). The total distance travelled was 667.1km, and the average daily movement for the whole period was 25.7km.

DISCUSSION

The present study indicated a first result of the satellite tracking of a common minke whale in the western North Pacific. Results of the tracking suggested that the whale does not move for long distances, and possibly stayed in the coastal waters off Kushiro, for at least four weeks in autumn season, though sample size was too small. These results were not contradicted with the expected migration routes of the whales. The coastal waters off Japan is thought to be located in the migration corridor of north-south migration of mature common minke whales, and in general, mature females off Kushiro in autumn is thought to be on the way to the southward migration from the northern feeding areas to the southern unknown breeding areas. Sex of tagged whale was unknown, but estimated body length (7.8m) suggested the whale was mature. In the waters off Kushiro, common minke whales frequently take a lot of prey such as walleye pollock, Japanese anchovy, krill, Pacific saury, and common squid, and distribution of those prey species may attract the whales in this waters (Kishiro *et. al.*, 2010). The concentrated distribution of the sightings of common minke whales in the coastal regions observed in this study (Fig. 4) also implies these aspects, and it is thought that an abundant prey supply possibly contribute the short residence of the whales in this waters.

During the tracking period, there were only 61 signals received by the satellite, and reception was sporadic. Low uplink frequency may be caused by low surfacing time of the whale or some mechanical problems of the tag at firing or hitting on the whale body. After 1 November or a periods of 49 days from the attachment, no signal has been received by the satellite, and the tag was thought to be fallen out.

In this study, we revealed that a large vessel such as *Shonan-maru No.2* could be used as a tagging vessel for common minke whales, but the success rate was low. The increasing of the tagging success rate and the extension of the tracking period could bring further information on migratory route and the southern breeding area of common minke whales. In addition, simultaneous biopsy sampling will be also valuable in considering the migratory route and stock structure of the whales.

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Table 1. Number of sightings made by the *Shonan-maru No.2* sighting and tagging survey off Kushiro in 2010.

Species	Primary		Secondly		Total	
	sch.	ind.	sch.	ind.	sch.	ind.
Common minke whale	20	21	8	9	28	30
sei whale	2	2	0	0	2	2
fin whale	5	7	1	3	6	10
humpback whale	6	8	2	2	8	10
sperm whale	2	6	0	0	2	6

Table 2. Results of the firing of the satellite tags for common minke whales off Kushiro in 2010.

Argos ID no.	Date	School size	Estimated BL (m)	Time for chasing (h:m)	Firing distance (m)	Verdicts	Transmitter attached
64638	9 Sep.	1	4.9	0:47	25	Miss	Retrieve
64638	10 Sep.	1	5.7	1:18	22	Ricochet	Lost
64640	13 Sep.	1	7.8	1:02	15	Hit	Fix

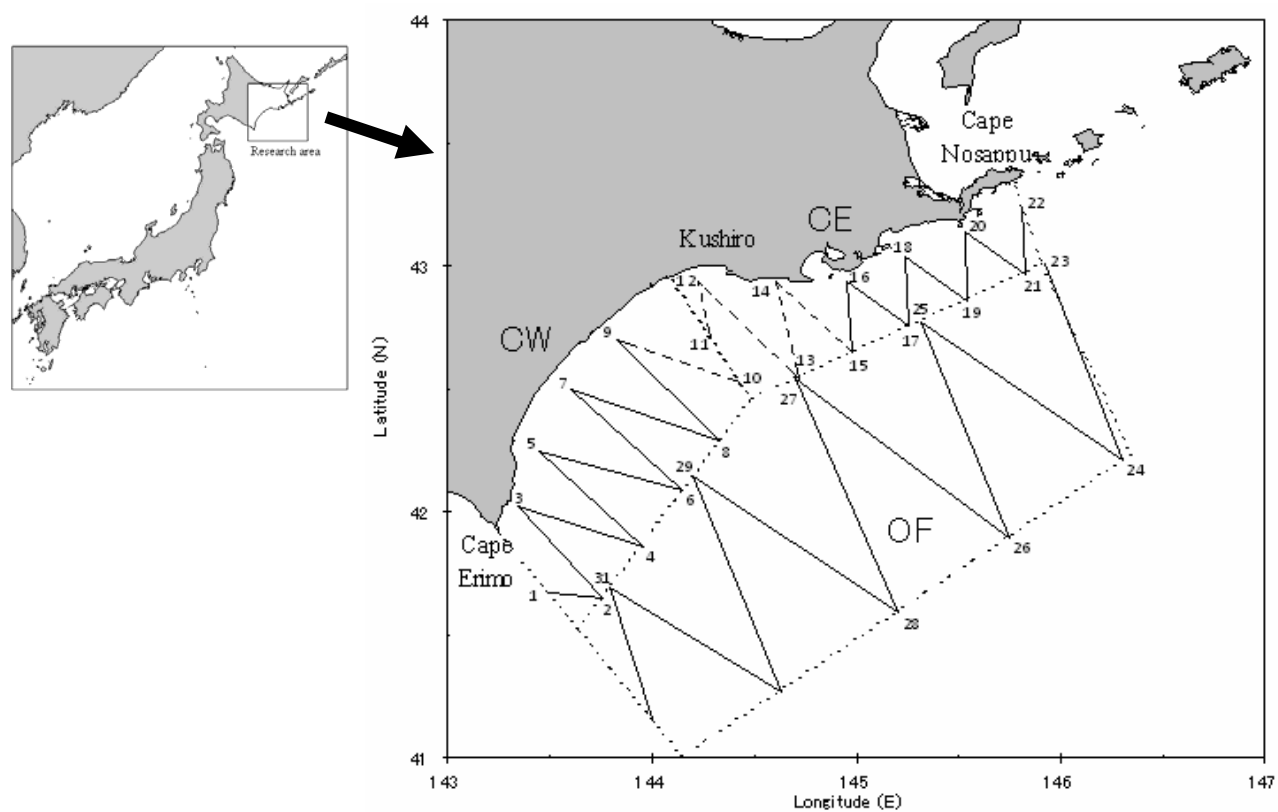


Fig. 1. Research area and pre-determined track line for *Shonan-maru No.2* sighting and tagging survey off Kushiro in 2010. The satellite tagging was not tried on the dotted track lines (way points 9-15) because of the overlap with the survey area of the whale sampling survey of the coastal component JARPN II survey off Kushiro.



Fig. 2. Air gun used for attachment of the satellite tags.



Fig. 3. The satellite tag used in this study. Upper photograph indicates the tag with a retrievable float at firing. Lower photograph indicates the tag without the float.

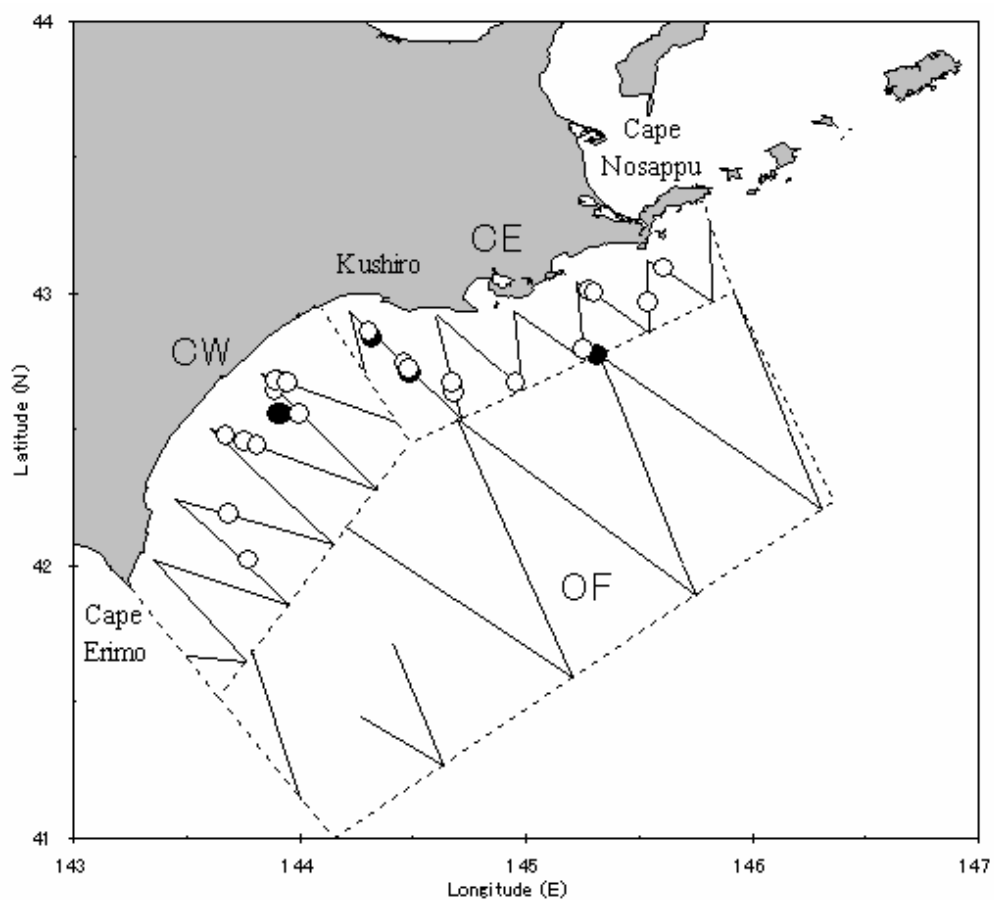


Fig. 4. Cruise tracks and sighting positions of commom minke whales by the *Shonan-maru No.2* sighting and tagging survey off Kushiro in 2010. Open circles: primary sightings; closed circles: secondly sightings.

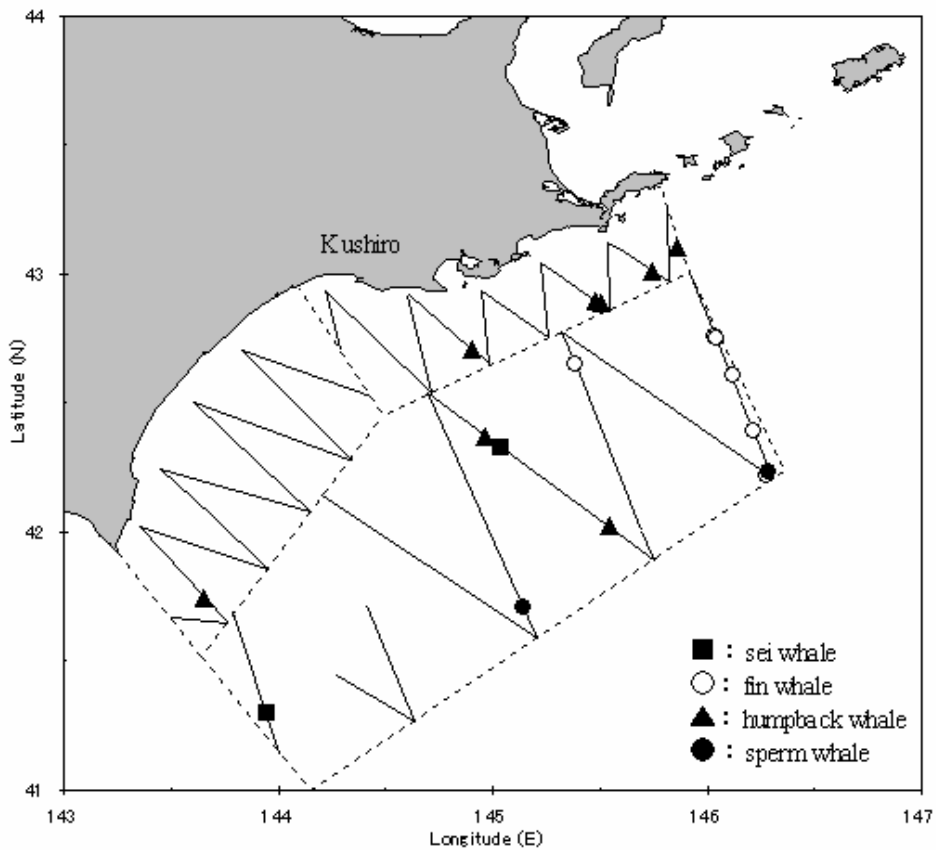


Fig.5. Sighting positions of sei, fin, humpback, and sperm whales by the *Shonan-maru No.2* sighting and tagging survey off Kushiro in 2010.

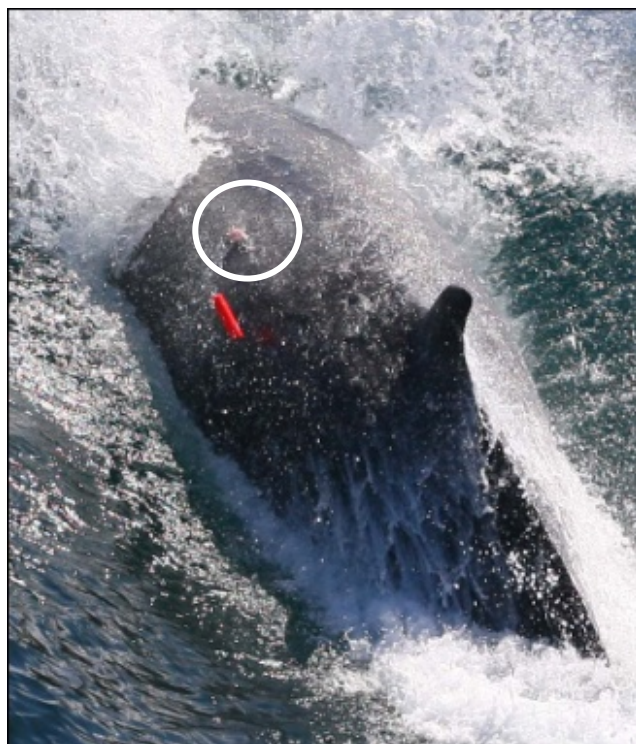


Fig. 6. Common minke whale with the satellite tag attached (White circle) on 13 September

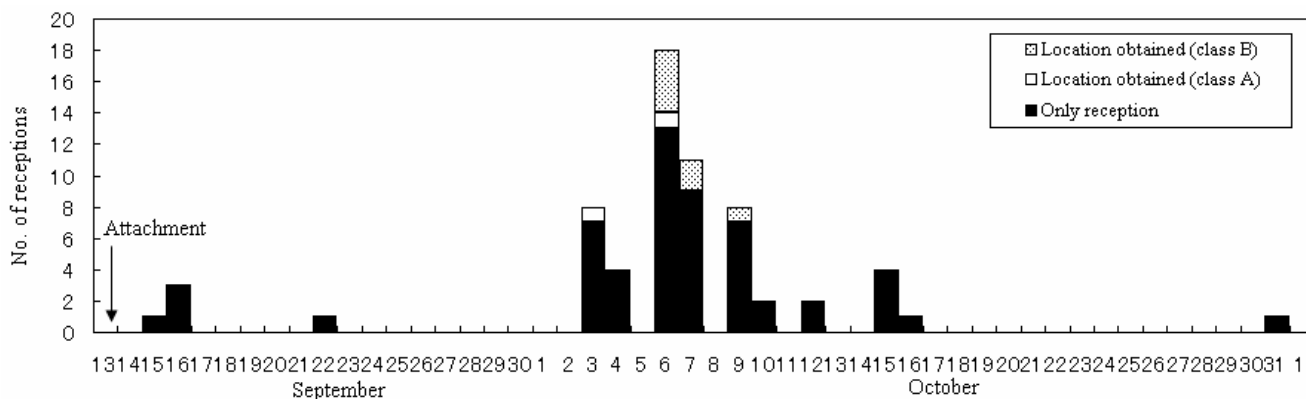


Fig.7. The electric wave receptions by the Argos satellite

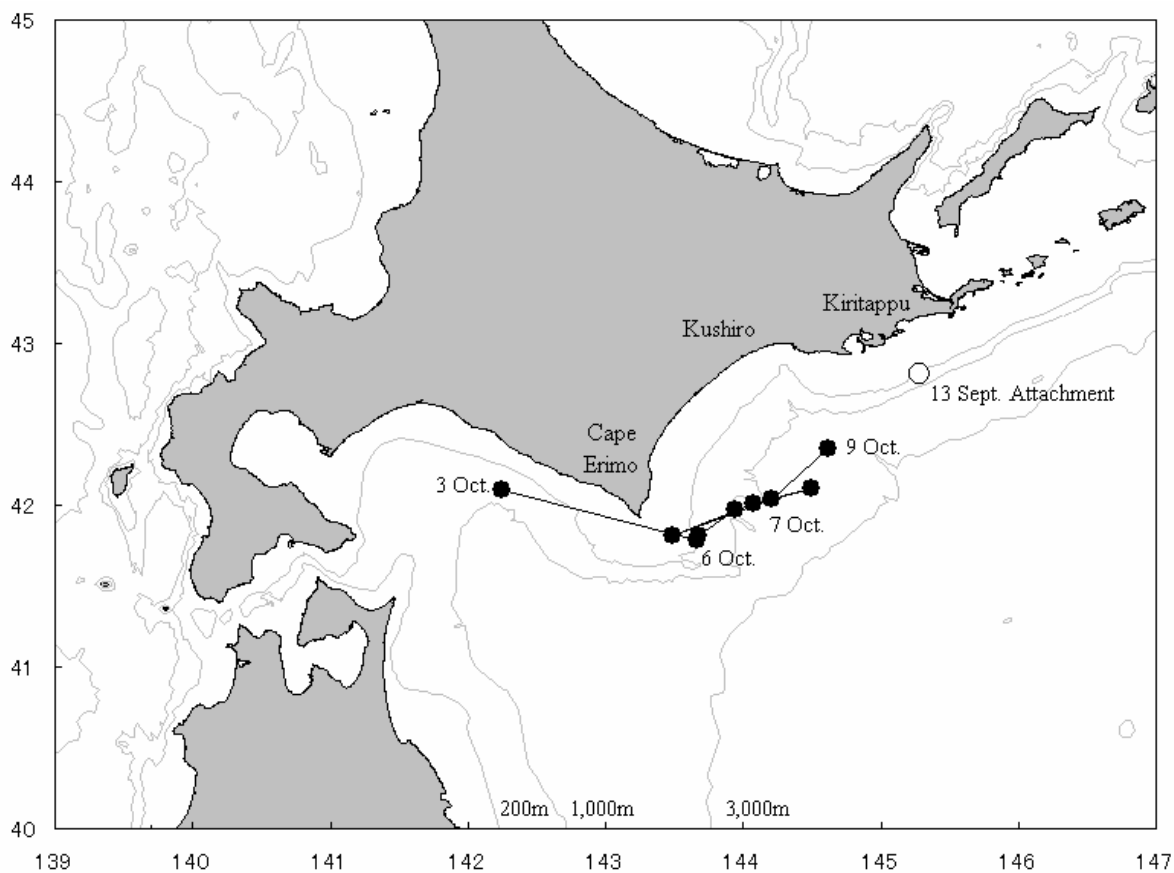


Fig.8. Movements of a common minke whale tagged on 13 September 2010 and tracked until 9 October (27 days).