Methodology and procedures of surveys of prey of common minke whales

JARPN II - Coastal component of Sanriku -

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ABSTRACT

Methodology and procedures of survey of prey of common minke whales in the coastal component of JARPN II in the Sanriku region during 2003 – 2007 (except 2004) are described. The main objective of the prey species surveys was the estimation of prey preference of common minke whales. Prey preference was one of the most important parameters of ecosystem models. This could only be studied by comparing species compositions of prey in stomachs of common minke whales with species compositions of prey in area. Both the whale sampling and prey surveys were conducted in the same season though the prey survey period was shorter than that of the whale sampling survey. While the whale sampling surveys were conducted in the coastal waters within a maximum of 50 nautical miles from Ayukawa, Miyagi prefecture, the prey species surveys were conducted in the wider area of the Sanriku region. In each year, two to nine small blocks were established within in the Sanriku region of coastal component of JARPN II. Trawler type fisheries survey vessels conducted prey surveys including net sampling and acoustic data recording by quantitative echosounders. Four types of nets (IKMT, Bongo, Sabiki, and midwater trawl) were used to sample various prey species from zooplankton to fishes. Quantitative echo sounders, EK 500 and EK 60 (Simrad, Norway) commonly used for fisheries research worldwide, were used in the prey surveys. Oceanographic observations using CTD and EPCS were also conducted as part of the prey surveys.

INTRODUCTION

The first phase of the Japanese Whale Research Program under Special Permit in the western North Pacific (JARPN) was to obtain data necessary to address questions related to stock identity, and this implied that a sampling regime was not optimal for the ecological studies. The workshop of IWC recommended that future surveys should consider a sampling design specifically for the research objective on feeding ecology. In particular, there was a need to design surveys in coastal areas to evaluate the interactions between common minke whale (*Balaenoptera acutorostrata*) and some fisheries (IWC, 2001).

The full-scale surveys of the second phase of the Japanese Whale Research Program under Special Permit in the western North Pacific (JARPN II) started in 2002 (Government of Japan, 2002). The main focus of the JARPN II was the study of the possible competition between whales and fisheries, and to elucidate the role of the cetaceans in the western North Pacific marine ecosystem. The relation between whales and fisheries will be examined by developing ecosystem simulation models. Information important for the construction of these models is obtained through quantitative research on the cetacean prey species, prey consumption and prey preferences of each whale species. Although prey preference of cetacean is not easy to know, it will be estimated based on stomach contents of cetaceans and prey species biomass in their habitat. The purpose of this prey species surveys is to estimate the prey abundance for investigating prey preference of common minke whales that is an important parameter for ecosystem modelings in the Sanriku region. Details of analysis of prey preference of common minke

whales were described in Murase *et al*. (2009).

The outlines of the investigation in the each year were shown by IWC / SC documents (Kawahara *et al*., 2004; Yonezaki *et al*., 2006, 2007, 2008).

SURVEY AREA

In the full-scale survey, JARPN II has three components namely off Sanriku, off Kushiro, and offshore. The Sanriku region is northeastern part of the Japanese Main Island that was known to be major grounds of the past commercial whaling of common minke whales in spring season (Hatanaka and Miyashita, 1997). This region is one of the most productive waters in the world ocean due to the mixing of Kuroshio and Oyashio currents. Generally, the Oyashio water dominates in the survey area in the investigation period (Hanawa and Mitsudera, 1987). Therefore, this region was an important fishing ground for commercial species such as Japanese sand lance (*Ammodytes personatus*) (Nagashima, 2000), Japanese anchovy (*Engraulis japonicus*) (Nagashima, 2007), and Pacific krill (*Euphausia pacifica*) (Taki *et al.*, 1993; Taki, 2002). The possible competition between the whales and the fisheries in this area was suggested by the JARPN and the JARPN II feasibility study (Tamura and Fujise, 2000).

Prey species surveys were conducted in the coastal region off Sanriku, independently from the coastal sampling surveys for common minke whale during 2003 – 2007 (except 2004) as a part of JARPN II. The sampling surveys of common minke whale were conducted in the coastal waters within the 30 nautical miles (maximum of 50 nautical miles) from Ayukawa, Miyagi prefecture. The survey area of the prey species surveys was wider than that of whale survey and embraced it. In 2003, the survey was conducted in a wider area off the Pacific coast of the northern Japanese Main Island, to cover the distribution of main prey species (Fig. 1). To avoid the conflict with nets in the coastal waters, the waters within 10 miles from the coast were excluded in principle. The survey area divided into two parts (Block I and II). A zigzag track lines were set to cover two blocks.

The surveys during 2005 – 2007 were conducted in a wider area at depths between 20 m and 200 m from 37° – 00′ N to 38° – 40′ N off Sanriku (Fig. 2). To avoid the conflict with set nets in the coastal waters, the waters within 10 miles from the coast were excluded in principle. The survey area was divided into nine blocks (A, B, C, D, E, F, G, HI, and J) at depths of 40 m / 100 m and 37° – 40′ N / 37° – 54′ N / 38° – 15′ N. A zigzag track lines were set to cover each block. The survey of Block HI and J was carried out in 2006 only.

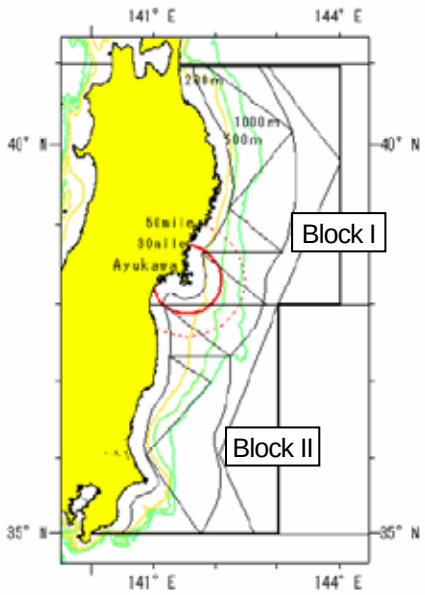

Figure 1. The survey area and two blocks of prey species surveys of Sanriku region in 2003.

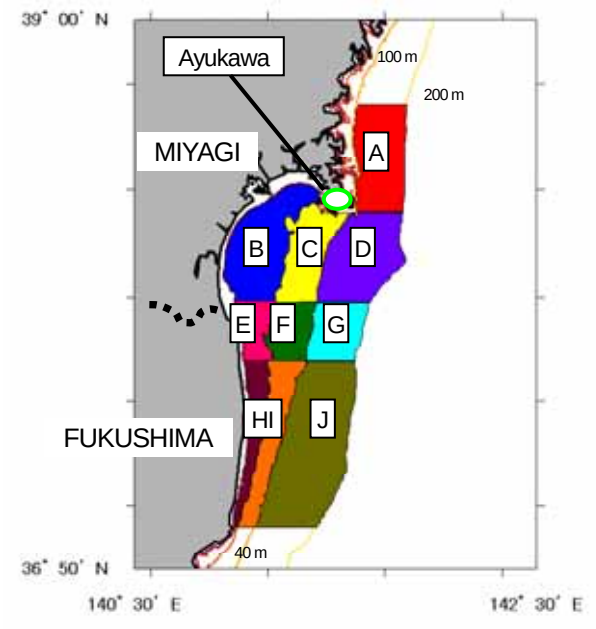

Figure 2. The survey area and nine blocks of prey species surveys of Sanriku region from 2005 to 2007. Block HI and J were investigated in 2006 only.

TIMING OF SURVEYS AND RESEARCH VESSEL

Timing of whale sampling and prey surveys from 2003 to 2007 was summarized in Table 1. Both whale sampling and prey surveys were conducted in the same season though the prey surveys period was shorter than that of whale sampling surveys. The surveys were conducted during daytime from an hour after sunrise to an hour before sunset. Zigzag track lines were constructed for prey surveys in all survey blocks (Fig. 1 and 2). The surveys vessels steamed on planned zigzag track lines.

The research vessels (RVs) used were *Kaiyo-maru No.7* (Nippon Kaiyo Co., Ltd, 499 GT, KY7), *Takuyo-maru* (Miyagi Prefecture Fisheries Technology Institute, 120 GT, TKY), and *Shunyo-maru* (National Research Institute of Far Seas Fisheries, 887 GT, SYO) that were trawler type fisheries research vessels (Fig. 3). Net sampling, acoustic data recording using quantitative echosounders and oceanographic observations were conducted by RVs. Details of whale sampling surveys were described in Kishiro *et al*. (2009).

Table 1. Timing of whale samplings, prey surveys, survey blocks, and research vessels from 2003 to 2007.

Year	Prey Survey		Survey Block	Research Vessel	Whale Sampling Survey	
	Start	End			Start	End
2003	9 – April	28 – April	I, II	KY7	8 – April	2 – May
2005	11 – April	27 – April	A, B, C, D, E, F, G	TKY	11 – April	21 – May
2006	11 – April	27 – April	A, B, C, D, E, F, G, HI, J	TKY, SYO	12 – April	24 – May
2007	9 – April	27 – April	A, B, C, D, E, F, G	TKY	16 – April	31 – May

Figure 3. Prey surveys vessels. (a) Kaiyo-maru No.7 (KY7), (b) Takuyo-maru (TKY), (c) Shunyo-maru (SYO)

NET SAMPLING

Three types of nets (IKMT, Bongo, and midwater trawl) and Sabiki fishing gear were used to sample various prey species from zooplankton to fishes.

The trawl nets of KY7 and SYO were both mouth opening of 30 m width / 30 m height and a 17.5 mm liner cod end. The trawl net of TKY was a mouth opening of 7 m width / 3.5 m height and a 3 mm liner cod end. The sampling depths and height of the net mouth were monitored by Scanmar net monitoring system (Scanmar, Norway). Towing speed of the trawl nets was 2 – 5 knots.

IKMT (Isaacs-Kidd Midwater Trawl) and Bongo net were mainly used to sample Pacific krill and juvenile Japanese sand lance. These nets were used in 2003 and 2006. The mouth opening of IKMT was about 3.7 m width / 3.1 m height. Sabiki fishing was the sampling using the fishing rod with artificial bait, and it was mainly used for the fishes.

All samples were identified to the species as much as possible and weighted aboard the vessels. For the major species (ex. Japanese anchovy, Japanese sand lance, Pacific krill), a sample of 100 animals was taken, and lengths and weights were measured. Scaled and standard lengths were used to Japanese anchovy and adult / juvenile Japanese sand lances, respectively. Total length from the tip of the rostrum to the end of the teleson was used for Pacific krill. Trawl frozen samples were taken for further laboratory analysis. IKMT and Bongo net samples were preserved in 10 % formalin for further investigation at the laboratory. These data were used to identify the species and size compositions of biological backscattering detected by the quantitative echosounder.

Number of net hauls was summarized in Table2.

Table 2. Number of net sampling from 2003 to 2007.

Year	Midwater trawl	Bongo net	Sabiki	IKMT
2003	22	4	–	17
2005	14	–	–	–
2006	11	1	2	–
2007	10	–	–	–

QUANTITATIVE ECHOSOUNDER

Quantitative echosounders were used in prey surveys to collect distribution pattern and biomass data of prey species. EK 60 and EK 500 (Simrad, Norway) were used onboard KY7 and TKY, respectively. These are commonly used for surveys on fisheries resources worldwide. Acoustic data collected by 38 and 120 kHz transceivers steaming at about 9 – 10 knots along the track lines. Those raw data were analyzed using software Echoview (Myriax, Australia). Calibration was carried out at a depth around 30 m in the survey area using the copper sphere technique described in EK 500 manual.

OCEANOGRAPHIC OBSERVATION

Water temperature and salinity profiles were recorded using Conductivity Temperature Depth profiler (CTD, Seabird, USA). CTD casts were made most net stations. Details of oceanographic observations were described in Okazaki *et al* (2009).

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