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Studies of the Relation between the Whaling Grounds
and the Hydrographical Conditions (I).

By
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Introduction

By the request of the Whaling Vessel-equipments Improving Committee and by the courtesy of the Whaling Companies in Japan (Taiyō, Nippon Suisan, Kyokuyō, Nittō, Kinkai Hogeï Fisheries Co.) together with Whales Research Institute, the data of the whaling grounds in the waters adjacent to Japan during 1910-1951, the daily whaling reports of all catcher boats and the monthly whaling reports were given to the author at his disposal in order to study them. He plotted the maps of yearly whaling grounds for each ten days and of the annual fisheries grounds.¹⁾²⁾³⁾

In the opportunity the author wishes to state his sincere thanks to the fishing companies above mentioned and the director of the Whales Research Institute Dr. Tsutomu Maruyama and the director Dr. Hideo Ōmura for their encouragement, and also to all captains of the catcher boats who have prepared the correct data by their zealously continued observations. Also he wishes to state his heartfelt thanks to the aids and cares given during his researches by the Whaling Vessel-equipment Improving Committee (President Mr. Iwao Fujita and its Charge in Press, Mr. Takao Ban and the Chief of Research Section in the Fisheries Agency, Dr H. Ōmura.

Basing on the 10 days reports of whaling grounds, the charts prepared by us have shown clearly the location of fishing-grounds for each species of whales, the date of catch, the abundance of catch, its body length, stomach-contents, the data of whales seen, isotherms and currents with the general description of the sea conditions. The annual report of whaling ground charts have shown the iso-lines of the catch of sperm-whales, sei-whales and fin-whales on the basis of the summarized number for each rectangle of 1 degree of longitude and latitude and as its consequence the location of the most concentrated abundance of whales. Also the amount of catch for each sea-districts for each decade and the body-length were shown in additional tables.

Hitherto, with respect to the whaling fishing grounds there appeared the researches carried out by Mr. Yoshio Matsuura⁴⁾, H. Ōmura⁵⁾⁶⁾

K. Kasahara,⁷⁾ K. Midunoe,⁸⁾ K. Otsuru,⁹⁾ the Japan Whaling Association¹⁰⁾, the Central Meteorological Observatory,¹¹⁾ the Tōkai Regional Fisheries Research Laboratory¹²⁾ and Mr. Z. Nakai,³⁾ however there lacks the detailed study of the relation between the yearly whaling grounds and the hydrographical conditions.

Basing on the above charts (for annual and each decade), the whaling grounds in the waters adjacent to Japan; the Northern Kurile, the Middle Kurile, the Southern Kurile, the Northern Coast of Hokkaidō (off Akkeshi, Kushiro), the North-eastern Sea-region of Japan (off Sanriku, off Kinkazan and off Fukushima and Ibaragi Prefectures), off Kishū (Kumano-nada), Ogasawara, Kyūshū (SE-sea region, Gotō-nada, Tsushima Strait), South Western Islands (Amami Ōshima and Ryūkyū etc.), the South Sea to Formosa, the Yellow Sea, off the Southern Korea, the Eastern Korea, the Japan Proper-side faced to the Japan Sea.

We can inspect the yearly variation of those whaling grounds easily, and referring to the oceanographical charts we can at once point out the following features:

1. *The General Trends of the Whaling Grounds.*

(1) During 1910-1926 (Meiji, Taishō eras) the whaling grounds were remarkably coastal one in general and among them the conspicuous whaling grounds off Kinkazan, Sanriku and Kii were also limited in the very coastal area by the capacities of the whaling navigation and the whale processing at that time.

(2) The whaling grounds in the period after the year 1926 extended its circle to the offing of Kinkazan and especially developed in South Kurile region and the regions north and south off Hokkaidō.

(3) Entering in Syōwa era, during the years from 1932 to 1941 the whaling grounds have been extended to the North Kurile region and marked with its prosperous fishing. Also in that period the Ogasawara Whaling grounds and the grounds adjacent to Korea developed remarkably.

(4) After the last World War II, we have lost the whaling grounds in the waters adjacent to Kurile and in the Yellow Sea, but we can now continuing the fishing in the grounds mainly from the offing of Kinkazan to the offing of Akkeshi (Hokkaidō), partly off the north coast of Abashiri (Hokkaidō), Ogasawara and Kii (Shiono-misaki).

2. *Relation between the Variation of Whaling Grounds in Each Year and the Corresponding Hydrographical Fluctuation.*

(1) In the years of the prosperous cold current such as 1934 the

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whaling grounds distribute relatively to the south with its center of grounds and extend conspicuously to the east offing. The catches in the central and southern districts of the North-eastern Sea-district of Japan are more abundant than that in the Hokkaidō ground.

(2) In the cold years two centres of the whaling grounds, the offing one and the coastal one, can be observed. Those correspond to the two frontal regions of warm and cold currents at their heads of the coastal and offshore cold current respectively. The ratio of the areas of fishing grounds varies in correspondence to the relative fluctuation of the two cold currents above mentioned.

(3) In the year 1948 the state of the sea was normal, showing remarkably rich catch on the whaling ground off Kinkazan. During the years from 1944 to 1949 in accompany with the gradual decay of the cold current tending to warmer, the whaling ground extended its circle to north than before and accordingly translated its centre of gravity to north in the fishing ground off Akkeshi (Hokkaidō).

In short, in the former period of years during 1933-1941 (the prosperous period of warm current), the prosperity of the northern fishing ground off Kurile Islands was shown. After then corresponding to the decay of warm current and the development of cold current the whaling ground temporarily tended to translate to south than before. However after the elapse of ten years in accompany with the rise of warm current again the grounds have shown the tendency to come back to the north.

(4) The fishing grounds of sei-whale show somewhat later appearance seasonally in the northern district than those of sperm-whale relatively in southern (warmer) region, more approaching to the coast compared to those of sperm-whale.

(5) We are now in the course of researches on the optimum temperature for each species of whales. However, roughly speaking, the range of the water temperature at the time of catch is prettily broad and lies in the range 5°-28°C, centering at about 12°-23°C. Probably the optimum temperature may be separated in two parts of 12°-16°C and 17°-23°C as those due to the optimum temperature of the feeders or due to the two fronts (Oyashio- and Kuroshio-Fronts).

3. *The Oceanographic Structure Determining the Whaling Grounds are as in the following.*

(1) Each boundaries of water-masses (fronts) determine the favourable fishing grounds. Or in other words, they have intimate relations to the distributions of the vertical and the horizontal gradients of water temperature. Particularly the massive centre of the whaling

grounds locates in the zone where the cold and warm current collide each other (i.e. where the cold current creeps beneath the warm current, accordingly the vertical gradient of water temperature shows its maximum of the super-saturation of dissolved oxygen).

(2) The boundaries between the cold upwelling water-mass of a cyclonic eddy and the warm water-mass, forming a cyclonic revolving pattern of the tongues of cold and warm currents corresponds to the centres of the most favourable whaling grounds. (Fig. 1, 2.) It may

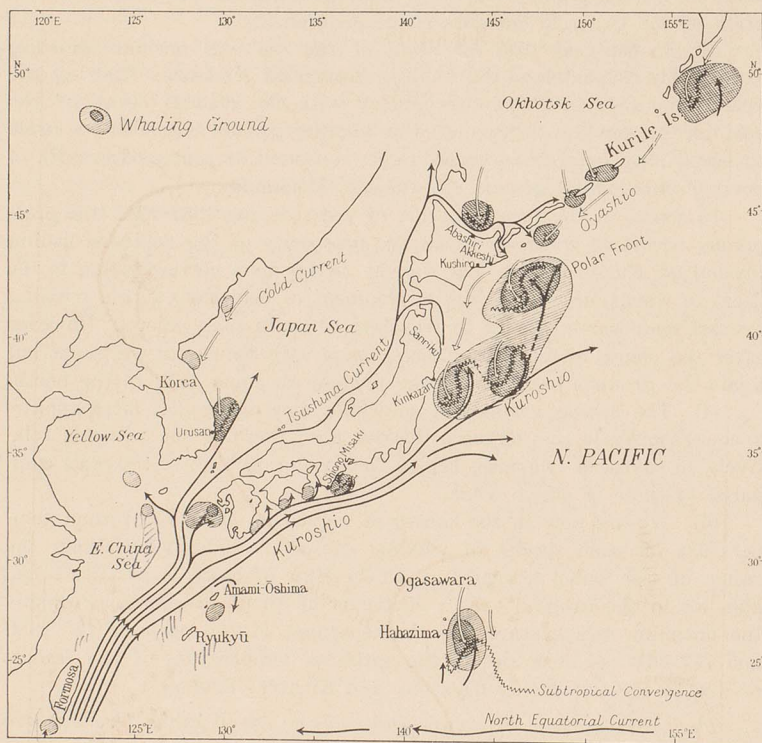


Fig. 1. Distribution of whaling grounds in relation to the boundaries of water masses (fronts) and currents.

be due to the rich zone of the foods of whales involving, euphausiid, copepods, squids and sardine, anchovy etc. which were assembled to

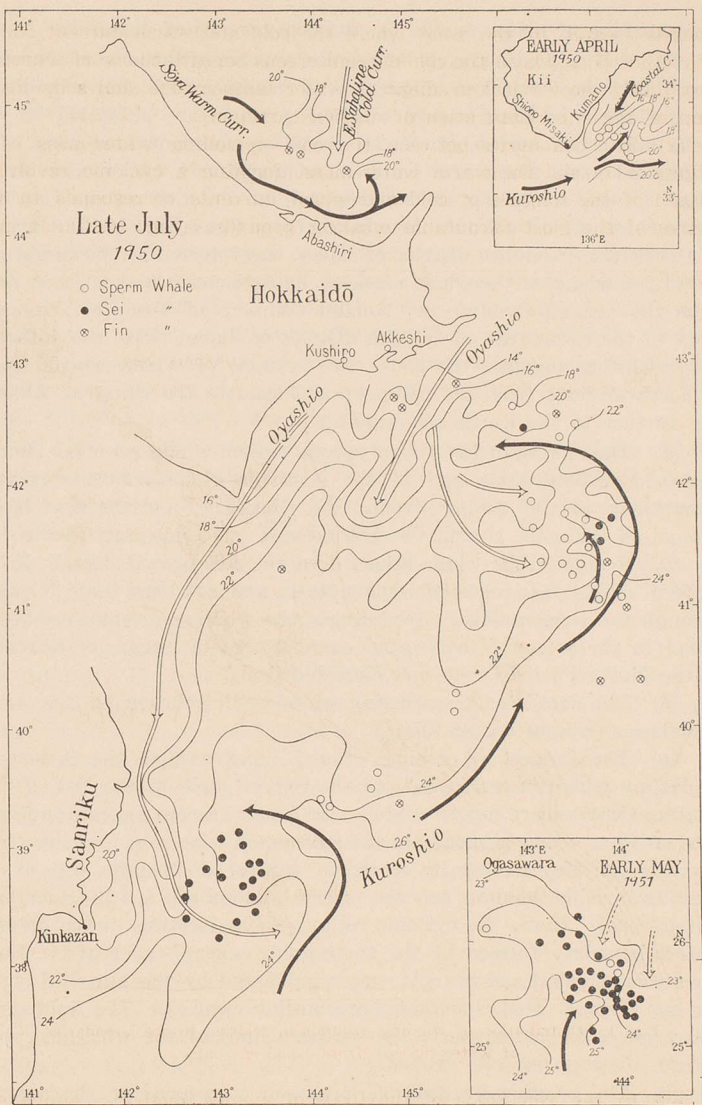


Fig. 2. Typical examples of the distribution of the whaling grounds, surface water temperature and currents.

the boundary of water masses by the convergence of currents.

(3) The migrating route of whales appears in the zone of abundant food. It seems that the migration of whale schools and accordingly the movement of their central whaling grounds are subjected by the north and south movement of the front of abundant food zone. One migration route along the band of comparatively cold water on the Japan Trench stretching in the longitudinal direction to the east side of the ridge of Fuji volcanic mountains, from Ogasawara fishing ground to the Southern NE-Sea district of Japan, was inferred by the recaptured report (sei-whale) of the whale marking experiment,¹⁰ and another route from the east off Ryūkyū and Amami Oshima, off Tosa, Kii Kumano-nada to the south part of NE-Sea district of Japan were also inferred. After jointing together the above two systems of whale schools going to north migrate from the offing of Kinkazan to the offing of Akkeshi and further to the Kurile sea-region.

(4) The mixing of the several species (sperm-whale, sei-whale, hump-back-whale, blue-whale and in the north fin-whale) can be seen most remarkably in the fishing ground off Kinkazan, and the next in the ground off Akkeshi, also in the ground east off Ogasawara (Bonin Is.)

(5) Generally the whale school does not concentrate densely in the easterly rapid flowing zone of warm current and not long there it passes through the zone rapidly. Accordingly the whaling grounds are poorly found in the westerly drift wind current area (a branch of Kuroshio) in the North Pacific Ocean and Kuroshio itself.

(6) The details of the whaling grounds in relation to the water boundaries (fronts) are as follows.

(a) The Ogasawara fishing ground lying east to the Ogasawara Hahazima where it corresponds to the region north of the line of Sub-tropical Convergence nearly crossing the Japan Trench, indicates a highly productive zone and especially in the seasons of winter and spring (from Dec. Jan. to May having its centre in spring) it exhibits one of the most favourable whaling fisheries (sperm-, humpback and bluefin-whales mixed zone). Here, the cyclonic rolling eddies locating in the cores of waters boundary formed by the north-going warm branch of the North Equatorial Current and the cold water influenced by the upwelled south-coming Oyashio Under-current (intermediate water). The subtropical Convergence indicates nearly the southern limit of the whaling ground and of albacore fisheries ground.

(b) The whaling grounds off Kinkazan correspond to the cores of the water boundary between the Oyashio Cold Current and the northern

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branch of the Kuroshio Warm Current, forming the cyclonic rolling eddies in the zone limited by the Oyashio Front (Polar Front) and the Kuroshio Front (the northern marginal line of the Kuroshio main current). The fishing season extends over the whole year, but its prosperous period lying in May—Nov. (spring, summer, autumn) of this well-known great whaling grounds of the longest season corresponds to the long stay of whales (sperm-, sei-, fin-, blue- and humpback-whales mingled).

(c) The whaling grounds off Akkeshi and Kushiro (in the southern sea off Hokkaidō correspond to the cores of water-boundary forming cyclonic eddies in summer and autumn by the Oyashio Cold Current flowing to southwest along the south coast of Hokkaidō and the north-going warm branch of Kuroshio Current (NE warm branch current). In its fishing season from May to Dec. (prosperous in summer and autumn) the whale shoals (mainly sperm-, sei-, fin-whale and sometimes bluefin-whale mingling in them) are observed.

(d) The whaling grounds in the waters adjacent to Kurile Islands appears in summer in the frontal zone of cold watermasses of Oyashio flowing out from the Okhotsk Sea through the Straits of Kurile in warmer watermass of the North Pacific Ocean.

In particular the Northern Kurile whaling ground is formed in the water boundary between the north-going warm branch current towards Kamtchatska Peninsula and the North Kurile sea-region. It is noted as whaling ground (mainly of sperm-whale) in the season from June to late August. The middle Kurile whaling ground located in the area between Shinshiru and Uruppu Islands, showing the whales (mainly sperm-whale mixed with sei- and fin-whales) in the fishing season from middle May to middle Sept. The Southern Kurile whaling ground lies off the Etorofu Is. and Shikotan Is. in the season from May to late Sept, showing mainly sei-whale mixed with sperm- and fin-whales. The Southern Aleutian whaling grounds (sperm- and fin-whales) appears in the water boundary formed between the warm branch current flowing strongly towards north during June and July and the cold current in the North-western part in the Bering Sea.

(e) The whaling grounds (mainly of fin-whale) north off Kitami (Abashiri) of Hokkaidō are formed in the cyclonic eddies by the front between the south-coming East Saghaline Cold Current and the coastal Sōya Warm Current strengthened by the geomorphological conditions of the Okhotsk Yamato Bank and Cape Shiretoko. The fishing season begins in late June, prosperous in July (the maximum) and ends in early Sept.

(f) The whaling grounds in Kumano-nada are narrow and near the

coast, forming cyclonic eddy located at the water boundary (front) between Kuroshio Main Current and the Coastal Cold Current in the fishing season from January to July (in April, May, sperm-whale and in June, July sei-whale dominantly).

(g) In some years the humpback-whaling ground was observed in the waters to Okinawa coast during January—April.

(h) The humpback-whaling ground off Goarampii south of Formosa was seen in the winter (Jan.-March).

(i) In the whaling grounds west to Kyūshū, fin-whale (Jan.—April), sei-whale and sperm-whale (May—Nov.) and again fin-whale (June—Dec.) were caught. The fishing grounds are divided in three parts (Gotō Is., Yobuko-Iki Is. and adjacent to Koshiki-zima).

(j) The fin-whale ground in the Yellow Sea have the fishing seasons during Jan.—April (May) and in Oct.—Dec.

(k) The Urusan whaling grounds of fin-whale were seen in the fishing season during August—November.

(l) The fin-whale whaling grounds off Genzan and Seishin along the east coast of Korea were seen during March—April, Dec.—Nov.

(m) The fin-whale grounds in March and April in the waters adjacent to Sado and Noto were also observed in past years.

7 Remarks on the Antarctic Whaling Grounds.

There are greatest whaling grounds in the world located around the water-boundaries circumscribing near the Antarctic Continent, which correspond to the most abundant area of the food of whales (euphausia) and they can be found by the oceanographic surveys or aerial surveys by helicopter. The principles of the formation of whaling grounds may be the same throughout the waters adjacent to Japan in the North Pacific and in the Antarctic Ocean.

Concluding Remarks.

Now we can foretell the variation and location of whaling grounds by investigating the oceanographic conditions and whaling conditions continuously year by year as stated in above and by availing the maps of whaling grounds, and also we can supply some important data to the scientific control of the whaling.

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Postscript.

- (1) We can distinguish the following 4 types of the whaling grounds in the above charts;
the warm front type at the head of the north-going warm current (Apr.—Aug.),
the cold front type at the head of the south-going cold current (Sept.—Dec.),
the stationary front type (summer, winter) and the occluded front type (most favourable fishing grounds, however not persistent, feasible to change and disappear).
- (2) The central localities of the main whaling grounds in the NE-sea district are at about (40°-43°N., 144°-147°E.) off Akkeshi, (37°-39°N., 142°-144°E.) and (38°-48°N., 144°-146°E.) off Kinkazan.