

CATCH OF MARINE MAMMALS, MAINLY OF SMALL CETACEANS, BY LOCAL FISHERIES ALONG THE COAST OF JAPAN*

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INTRODUCTION

Japanese coastal fisheries for marine mammals are for the convenience of administration divided into three categories : large type whaling, small type whaling, and local fisheries. The first two are the fisheries catching whales with powered vessel with mounted harpoon gun, and licensed by the Minister of Agriculture and Forestry, Japanese Government. They are further divided into two categories according to their objective species : one is for larger species such as the baleen whales (excluding the minke whale) and the sperm whale, and the other for middle sized whales such as the minke, beaked, killer and pilot whales. Catch results of these whalings should be reported by whalers to the Government on each whale individual caught.

On the other hands, local fisheries or hunting for marine mammals are partially licensed by the Governor in respective Prefectures or in part unlicensed. Sometimes marine mammals are caught incidentally with other fisheries which aim to take other animals. The catch data of the local fisheries are collected through the net-work of branches of the Statistics and Survey Division, Ministry of Agriculture and Forestry, from fish markets or fisheries co-operative associations on the coast of Japan. The marine mammals taken by the local fisheries include whales, dolphins, porpoises and seals excluding the northern fur seals, but the catch are mostly small cetaceans.

In the 24th Annual Meeting of the International Whaling Commission in 1972, the Scientific Committee recommends that members from countries engaged in killing small cetaceans provide information on their controls on these operations and also information on the catch and incidental kills to be included in future progress reports. And it also recommends the establishment of a sub-committee on small cetaceans to improve data collection of the world catches of these animals, and to review species, stock identification and other problems.

Japanese local fisheries for the small cetaceans have a long history. There are some descriptions on the local fisheries for marine mammals in Japan by Fisheries Agency (1912), Matsuura (1943a, b), Noguchi (1946), Hirashima and Ohno (1944) and Uchida (1954). However, the recent situation has not been well reviewed yet. The following review is made for future establishment of Japanese research system on the population study of the small cetaceans in the coastal waters.

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MATERIALS

The Statistics and Survey Division of the Ministry of Agriculture and Forestry, Japan, has published on a year basis an "Annual Report of Catch Statistics on Fisheries and Aquaculture" on all catches by the Japanese fisheries.

The amount of catch of marine mammals by local fisheries has been relatively small (less than 0.1% in terms of weight) among all the fisheries production in the Japanese coastal waters, hence the catch statistics of the local marine mammals has been included into an item of "Other Marine Animals" in the above Annual Reports. However, since 1957, an item of "Marine Mammals" was established independently, with separating from the "Other Animals".

The catch statistics of the marine mammals used in this paper are from the Annual Reports from 1957 to 1970. Tabulation of the statistics has changed gradually. Therefore, the same kinds of statistics have not always been available throughout these years.

The items of marine mammal catch statistics in the Annual Reports are as follows :

- Item 1. Amount of catch (weight) by type of fisheries and by regions, 1957—1962.
- Item 2. Amount of catch (weight) by type of fisheries in the whole regions, 1963—1970.
- Item 3. Amount of catch (weight) by month in all regions, 1957—1963.
- Item 4. Amount of catch (weight) by prefecture, 1957—1970.
- Item 5. Amount of catch (number) by species and by prefecture, 1957—1970.
- Item 6. Price of catch in whole regions, 1959—1970.

Regions are divided into eight as shown in Fig. 3, excluding Okinawa.

They are :

- Region A : Hokkaido.....Around Hokkaido.
- Region B : Pacific, North.....From Pacific coast of Aomori to Ibaragi Prefs.
- Region C : Pacific, MiddleFrom Chiba to Mie Prefs.
- Region D : Pacific, South.....Wakayama to Miyazaki Prefs.
- Region E : Sea of Japan, NorthFrom Japan Sea coast of Aomori to Ishikawa Prefs.
- Region F : Sea of Japan, WestFrom Fukui to Yamaguchi Prefs.
- Region G : East China SeaFrom Fukuoka to Kagoshima Prefs.
- Region H : Seto Inland Sea.....Seto Inland Sea coast of boarding Prefs.

Species breakdown are available only in Item 5. But they are simply classified into three categories of seals, whales and dolphins. The statistics of other Items combine all species. During the years 1957—1962, whales were classified into fin, sei (including Bryde's whale), humpback, minke, sperm, Baird's beaked, pilot and other whales. They were mostly caught by set-nets except for the pilot whales which are caught by drive fishery method. There are much doubts in the identification of whale species by fishermen. Seals and dolphins are not separated into further classification in the Annual Reports.

The catch statistics of the local fisheries are incomplete, especially in the case of seals. The pelts are often sent from hunters directly to the fur dressers, so that it is difficult to

obtain accurate catch data in that case. The number of dolphins caught is sometimes estimated on the basis of total weights and average weight per head. Body weights of dolphins are usually measured after removing internal organs.

Offices of the Statistics and Survey Division of the Ministry of Agriculture and Forestry in each prefecture also publish the Annual Reports of the Statistics on Agriculture, Forestry and Fishery in their areas. Some of them are used in this paper to investigate fishing season in several prefectures.

MARINE MAMMALS AROUND JAPAN

List of the marine mammal species and their relative abundance which are considered to be distributed in the coastal waters of Japan are shown in Table 1. This table is made on the basis of my personal communication with Drs. Masaharu Nishiwaki, Toshio Kasuya and Yasuhiko Naito and from papers by Ogawa (1936—1937), Inukai (1942), Matsuura (1943 b) and Nishiwaki (1957, 1965, 1967).

It is considered that about 44 species of marine mammals are distributed in the coastal waters of Japan. Seven species of them are very rare, 10 are rare, 17 are common and 10 are very common. Excluding large and middle sized whales which are objects of the large and small type whaling operations and the northern fur seal which is banned to catch commercially, the common and very common species are only about 17 species. They consist of 12 species of Odontoceti and 5 species of Pinnipedia.

As noted in the previous chapter, the kinds of marine mammals caught by the local fisheries are classified only into seals, whales and dolphins. According to Inukai (1942), Matsuura (1943a), Nishiwaki (1965) and Naito (1971), the objects of sealing in Hokkaido are two kinds of harbor seals (*Phoca vitulina largha* and *P. kurilensis*), ribbon seal, ringed seal and beared seal. Among them, the harbor seals and ribbon seal are most numerous. Although Steller sea lions are common and give damages to some fisheries, this species is not caught commercially because of less economic value.

Whales so-called are not caught actively by local fisheries, except for the pilot whales and the false killer whales which are one of the objects of the drive fishery in Shizuoka, Wakayama, Nagasaki and Yamaguchi Prefectures. Other whales are incidentally caught by some kinds of set nets. Whale species which are caught in the local fisheries are reported in the Annual Reports of Catch Statistics during six years 1957—1962. They are amounted to one fin, two humpback, 180 sei or Bryde's, 59 minke, 10 sperm, eight Baird's beaked, 1,603 pilot and 99 unidentified whales. Although there are some doubts in the identification of these whale species, it is accounted that the pilot whales (probably including false killer whales) occupy the substantial part of the whales caught by the local fisheries.

Most of marine mammals caught along the coast of Japan are dolphins and porpoises, as shown in later chapter. Species of small cetaceans which are caught by the local fisheries are somewhat different by regions, by types of fishing gears and by seasons. In Region B, Dall's and True's porpoises are mainly caught by the harpoon fishery. The right whale

Table 1. Species and relative abundances of marine mammals which are distributed in the waters around Japan.

Japanese name	Scientific name	Regions								
		General	A	B	C	D	H	G	F	E
ホッキョククジラ	<i>Balaena mysticetus</i>	±	±	±	±		±		±	±
セミクジラ	<i>Eubalaena glacialis</i>	+	+	+	±	±			±	±
コククジラ	<i>Eschrichtius robustus</i>	±	±	±	±	±	?	±	+	±
シロナガスクジラ	<i>Balaenoptera musculus</i>	+	+	+	±	±			±	±
ナガスクジラ	<i>B. physalus</i>	++	++	++	+	+		+	+	++
イワシクジラ	<i>B. borealis</i>	++	++	++	+	+			+	+
ニタリクジラ	<i>B. edeni</i>	++	+	++	++	++		+		
コイワシクジラ	<i>B. acutorostrata</i>	++	++	++	+	+		++	++	++
ザトウクジラ	<i>Megaptera novaeangliae</i>	+	+	+	+	+		±	±	±
マッコウクジラ	<i>Physeter catodon</i>	+++	+++	+++	+++	++		+	+	+
コマッコウ	<i>Kogia breviceps</i>	+		±	+	+		+	?	
オガワコマッコウ	<i>K. simus</i>	+			+	+		+	?	
アカボウクジラ	<i>Ziphius cavirostris</i>	++	+	++	++	++		+	+	+
ツチクジラ	<i>Berardius bairdi</i>	++	++	++	++	+		±	+	+
イチョウハクジラ	<i>Mesoplodon ginkgodens</i>	+		±	±	+		±	+	?
ハツブスオオギハクジラ	<i>M. carlhubbsi</i>	±		±	±	?		?	?	?
オオギハクジラ	<i>M. stejnegeri</i>	+		+	+	±		?	?	±
マイルカ	<i>Delphinus delphis</i>	++	+	+	++	+		++	+	?
ハセイイルカ	<i>D. capensis</i>	++				++		++		
スジイルカ	<i>Stenella caeruleoalba</i>	+++		++	+++	+++		++	±	?
ハシナガイルカ	<i>S. longirostris</i>	+				+		++		
アラリイルカ	<i>S. attenuata</i>	++		+	++	++		++		
カマイルカ	<i>Lagenorhynchus obliquidens</i>	+++	+++	+++	+++	++		++	++	+
セミイルカ (シロハラセミイルカ)	<i>Lissodelphis borealis</i>	+++	+	+++	++	+				
シワハイイルカ	<i>Steno bredanensis</i>	+			+	+		+		
バンドウイルカ	<i>Tursiops gilli</i>	++	+	+	++	++	+	++	+	+
ネズミイルカ	<i>Phocaena phocaena</i>	++	++	++	+			?	+	+
スナメリ	<i>Neophocaena phocaenoides</i>	++		+	+	+	++	++		
リクゼンイルカ (イシイルカ)	<i>Phocoenoides dalli</i>	+++	+++	+++	+				++	++
コビレゴンドウ	<i>Globicephala macrorhyncha</i>	+++	+	+++	+++	++		+	+	+
オキゴンドウ	<i>Pseudorca crassidens</i>	+++	+	++	++	++		+++	++	+
ユメゴンドウ	<i>Feresa attenuata</i>	±			±	±				
カズハゴンドウ	<i>Peponocephala electra</i>	±			±	±		?		
サカマタ	<i>Orcinus orca</i>	++	++	++	+	+	±	+	+	+
ハナゴンドウ	<i>Grampus griseus</i>	+++		+	+++	+++		+++	+	+
トド	<i>Eumetopias jubata</i>	++	++	+						+
オットセイ	<i>Callorhinus ursinus</i>	+++	+++	+++	+				+	+
ゴマフアザラシ	<i>Phoca vitulina largha</i>	+++	+++	+	±				±	±
ワモンアザラシ	<i>Pusa hispida</i>	++	++	+	±				±	±
クラカケアザラシ	<i>Histriophoca fasciata</i>	++	++							
アゴヒゲアザラシ	<i>Erignathus barbatus</i>	++	++	±						
ゼニガタアザラシ	<i>Phoca kurilensis</i>	++	++							
ラッコ	<i>Enhydra lutris</i>	±	±							
ジュゴン	<i>Dugong dugon</i>	±						±		

Remarks : ± : Very rare, + : Rare, ++ : Common, +++ : Very common, ? : Doubtful.

dolphin and the white dotted dolphin or the Pacific white sided dolphin are sometimes caught incidentally by the purse seine fishery in the same region. Mr. N. Miyazaki (personal communication) collected catch statistics of cetaceans by drive fishery in Izu Peninsula in Region C. Most of them are blue white dolphins, and sometimes white dotted dolphins, pilot whales and Gill's bottle-nosed dolphins are caught. The false killer whale, Risso's dolphin, common dolphin, rough toothed porpoise, *etc.* are seldom caught. The Pacific white sided dolphin is relatively abundant in this region, but is difficult to catch with this method. The blue white dolphin is also often caught by the harpoon fishery in Wakayama and perhaps in Chiba Prefectures. Several rare cetacean species (pygmy sperm whale, slender blackfish, *etc.*) are rarely caught in this region (Yamada, 1954 a, b). Mizue *et al.* (1960, 1961 a, 1961 b, 1962 a, 1962 b, 1964, 1965, 1967) and Fishery Agency (1968, 1969) reported the cetaceans which were caught in Region G. The main species in this region are Pacific bottle-nosed dolphin, false killer whale, Risso's dolphin, Pacific white sided dolphin, finless black porpoise, some kinds of *Stenella* and common dolphin. We have very scarce reports on the species caught in Regions E and F. Noguchi (1946) reported the Dall's porpoise and the Pacific white sided dolphin caught on the coast of Hyogo Prefecture of Japan Sea side. Tsutsumi *et al.* (1961) noted the Pacific bottle-nosed dolphin and the false killer whale from Yamaguchi Prefecture. According to Hiroshima and Ohno (1944), Dall's porpoise is exclusively caught in the north-east coastal waters of Hokkaido by harpoon fishery.

AMOUNT OF CATCH AND ITS YEARLY CHANGE

Table 2 and Fig. 1 show the annual total catch of marine mammals by local fisheries off the coast of Japan during 14 years from 1957 to 1970. Annual yield shows large fluctuation, varying between 1,026 and 2,789 tons. The average is 1,821.7 tons during these years. Decreasing tendency is seen in the yield throughout the years. This seems that the decreasing of the catch may be caused by the decrease of fishing efforts due to the decrease of the population of coastal fishermen and their increase in the average age in recent years. For example, a fishing village in the west coast of Izu Peninsula ceased its traditional drive fishery for dolphins in 1962, because many of fishermen changed their job from coastal fishery to pelagic fisheries such as tuna long line fishery, or they left the village to have better jobs to cities. Two villages which engage in the drive fishery along the east coast of the Peninsula have started to catch dolphins co-operatively, and decreased the catch effort for maintaining the price of dolphins since 1967. Until then the price often went down remarkably, when two villages took large schools at the same time independently.

Although we presently have no reliable data on the fishing efforts of the coastal fisheries for marine mammals, the phenomenon of decreasing amount of catch does not mean the decrease of their abundance in the waters around Japan. Kasuya (1971) assessed the abundance of small cetaceans off the Pacific coast of Japan by means of aerial sighting, and found that the density was rather stable in recent years, although There are some yearly fluctuations.

Table 2. Yearly change in yield of marine mammals
(weight, unit : ton) by regions in the coast of Japan.

Year	Regions								Total
	A	B	C	D	H	G	F	E	
1957	11	506	660	4	—	4	23	11	1,234
1958	31	739	745	24	—	501	11	20	2,074
1959	19	476	1,829	10	—	22	28	46	2,434
1960	29	859	771	12	—	337	98	33	2,141
1961	178	642	1,678	10	3	237	13	24	2,789
1962	19	579	921	23	—	173	4	12	1,734
1963	35	955	789	44	—	44	20	19	1,909
1964	—	900	500	—	—	—	—	—	1,679
1965	120	636	1,393	68	—	40	10	11	2,277
1966	85	664	1,332	34	—	246	3	10	2,374
1967	82	382	455	80	3	3	9	22	1,033
1968	125	450	627	52	—	1	18	15	1,288
1969	139	450	293	103	—	3	32	6	1,026
1970	126	621	559	125	—	72	1	8	1,512
Total	999	8,859	12,552	589	6	1,683	270	237	25,504
%	3.92	34.73	49.20	2.31	0.02	6.60	1.06	0.93	100.00

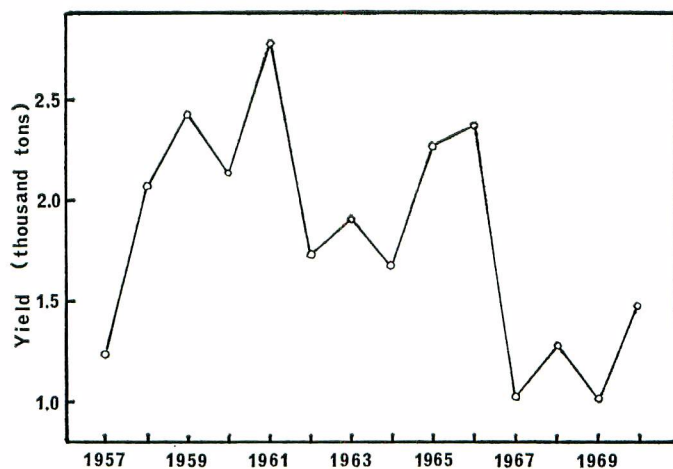


Fig. 1. Yearly change in amount of catch of marine mammals by local fisheries around the coast of Japan.

Table 3. Number of marine mammals caught by local fisheries in the coast of Japan during years 1957—1970.

Year	Seals	Whales	Dolphins	Total
1957	1,235	85	15,213	16,533
1958	5	275	21,160	21,440
1959	17	209	30,744	30,970
1960	52	789	24,826	25,667
1961	1,118	521	30,138	31,777
1962	219	83	20,577	20,879
1963	412	69	26,240	26,721
1964	397	148	23,427	23,972
1965	931	59	25,446	26,436
1966	707	169	27,774	28,650
1967	618	59	12,586	13,263
1968	782	33	13,741	14,556
1969	1,143	27	11,448	12,618
1970	1,265	81	16,255	17,601
Total	8,901	2,607	299,575	311,083
%	2.86	0.84	96.28	100.00
Average	635.8	186.2	21,398.2	22,220.2

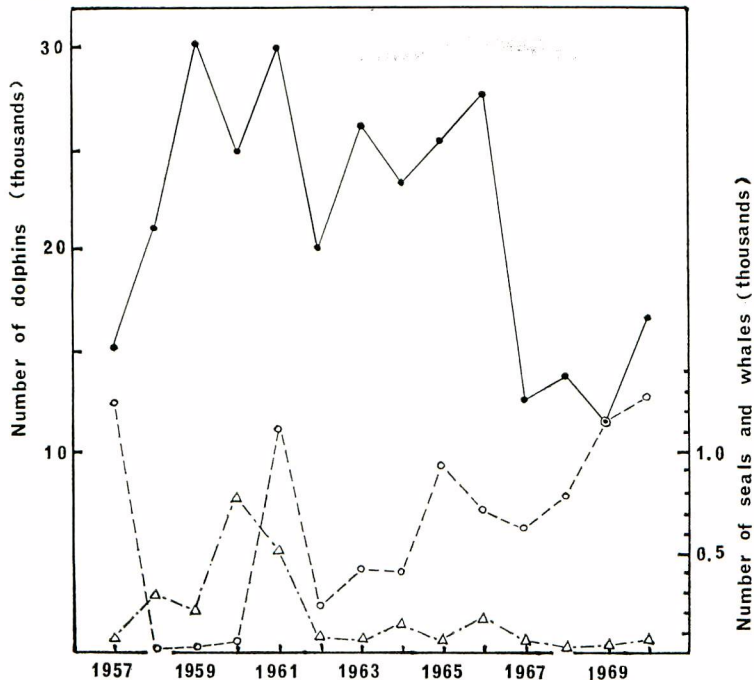


Fig. 2. Yearly change in catch number of marine mammals by local fisheries around the coast of Japan.
 Open circle and broken line : Seals, Triangle and chain line : Whales, Closed circle and solid line : Dolphins and porpoises.

Table 3 and Fig. 2 show the number of catches of seals, whales and dolphins during 14 years until 1970. Generally speaking, almost all (96.3%) of the marine mammals caught are dolphins. Seals and whales occupy only 2.9 and 0.8%, respectively. Therefore, the marine mammals which are caught by local fisheries in Japan can be generally regarded mostly to be small cetaceans.

The average catch of seals is 635.8 in number. According to Naito (1971) who investigated the seals in Hokkaido, the recent catch of seals is estimated to be 2,500-2,800. This means that the catch statistics described in the Annual Reports are incomplete, and that the actual catch may be amounted about three times that reported. There seems that the catch of seals have been increasing in recent years from the Annual Reports, but Naito (1971) estimates that catch was almost stable in recent years, 1968-1970.

Annual catch of whales in which most of them are pilot whales and false killer whales, averages only 186.2 during the 14 years. The catches in 1960 and 1961 were more than usual, and those in the last four years (1967-1970) were less than 100.

The maximum catch in number of dolphins was 30,744 in 1959, and the minimum was 11,448 in 1969, with the average of 21,398.2 for the recent 14 years. There is a decreasing tendency in the catch of dolphins. Especially since 1967, the number of catches has decreased to about half of those in the previous years. The control of catch by the co-operation in Izu Peninsula seems to affect to this phenomenon. Dolphin fisheries has a long history, but they were very local and of small scale in the past time. According to Yoshida (1939), the catch of dolphins was estimated to be 3,235 in 1923. However, after the beginning of the World War II, the demand for dolphins as food, leather and oil increased the catch remarkably, and it accelerated the development of dolphin fisheries rapidly.

Matsuura (1943a) noted that about 45 thousand dolphins were caught from the coastal waters off Japan in 1941. After the War, however, the efforts of dolphin fishery have been fallen due to less interests to this fishery and change in consumer's taste in food.

LOCALITY OF CATCH

Catch of marine mammals differs largely by locality. Table 4 shows the number of marine mammals caught by regions. Seals are exclusively caught in Hokkaido, especially in its east and north-east coasts (Naito, 1971). Whales and dolphins are caught in every region, but the catch is larger in Regions B and C. Marine mammals are seldom caught in Region H. Sea of Japan coast (Regions E and F) is poor in catch compared with Pacific coast. However, there is a record that about two thousand dolphins were caught at one time in Noto Peninsula in 1883, and according to Noguchi (1946), 211-1,622 (average 813.5) dolphins (mainly *Phocaenoides* and *Lagenorhynchus*) in Japan Sea coast of Hyogo Prefecture during years 1941-1944. Hirashima and Ohno (1944) reported on a dolphin fishery in north-east coast of Hokkaido. According to them, over one thousand Dall's porpoises were caught in this area annually during the War.

Appendices I, II and III show the catch in number of seals, whales and dolphins by

Table 4. Total numbers of marine mammals caught by regions in the coast of Japan during years 1957—1970.

Region	Numbers caught				Per cent of catch			
	Seals	Whales	Dolphins	Total	Seals	Whales	Dolphins	Total
A	8,883	231	4,784	13,898	99.80	8.86	1.60	4.47
B	15	765	127,805	128,585	0.17	29.34	42.66	41.33
C	—	1,097	148,783	149,880	0.00	42.08	49.66	48.18
D	1	115	7,060	7,175	0.01	4.41	2.36	2.31
H	—	3	49	52	0.00	0.12	0.02	0.02
G	—	48	3,815	3,863	0.00	1.84	1.27	1.24
F	—	209	1,205	1,414	0.00	8.02	0.40	0.45
E	1	139	1,039	1,178	0.01	5.33	0.35	0.38
Total	8,901	2,607	299,575	311,083	100.00	100.00	100.00	100.00

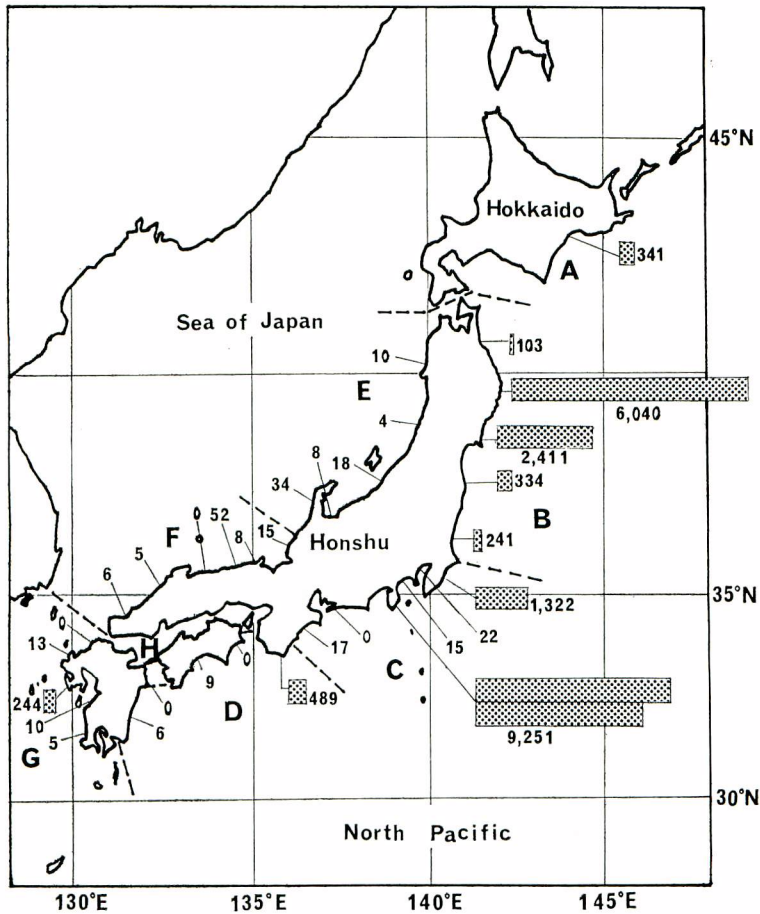


Fig. 3. Average number of dolphins and porpoises caught by local fisheries in each prefecture annually during years 1957—1970.

prefecture and by years. There are great differences even in the same Region. For example, Shizuoka Prefecture is the largest in the catch of dolphins. However, Aichi Prefecture which is a neighbour of Shizuoka Prefecture has no record of catch of marine mammals. Even in Shizuoka Prefecture, the drive fishery is operated only off Izu Peninsula.

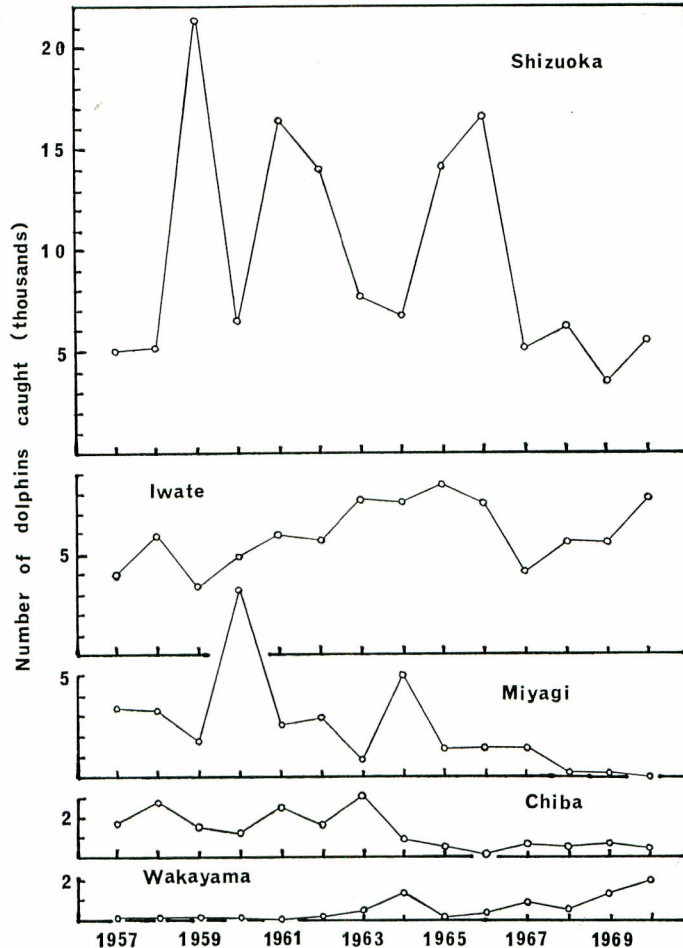


Fig. 4. Yearly change in annual catch number of dolphins and porpoises by local fisheries in five main Prefectures.

The local concentration in catch of marine mammals is of course due to their abundance and availability in the waters near coast. The topography of the coast is also an important condition especially in the case of drive fishery. Local fisheries for the marine mammals are not regular, so that the catch are more or less related to the fishing season and activity of other fisheries.

Fig. 3 shows the average number of dolphins caught in each prefecture during recent 14 years from 1957 to 1970. Shizuoka Prefecture occupies 43.2% of the total catch, and the largest five Prefectures (Shizuoka, Iwate, Miyagi, Chiba and Wakayama) occupy 91.2% of

the total. Nearly the same result was recorded during the War (Noguchi, 1946).

Fig. 4 indicates change in annual catch of dolphins in five main Prefectures. Decreasing tendency is obtained in Shizuoka, Miyagi and Chiba Prefectures. On the contrary, there is increasing tendency in Iwate and Wakayama Prefectures. According to Noguchi (1946), about 2,800 dolphins were caught in the west coast of Izu Peninsula, but this fishery ceased in 1962 as noted in previous chapter.

FISHING SEASON

The fishing season can only be estimated from the amount of catch in weight of over-all Japanese landings by month, then we cannot obtain the detailed information on each region or each type of fishery from the Annual Reports.

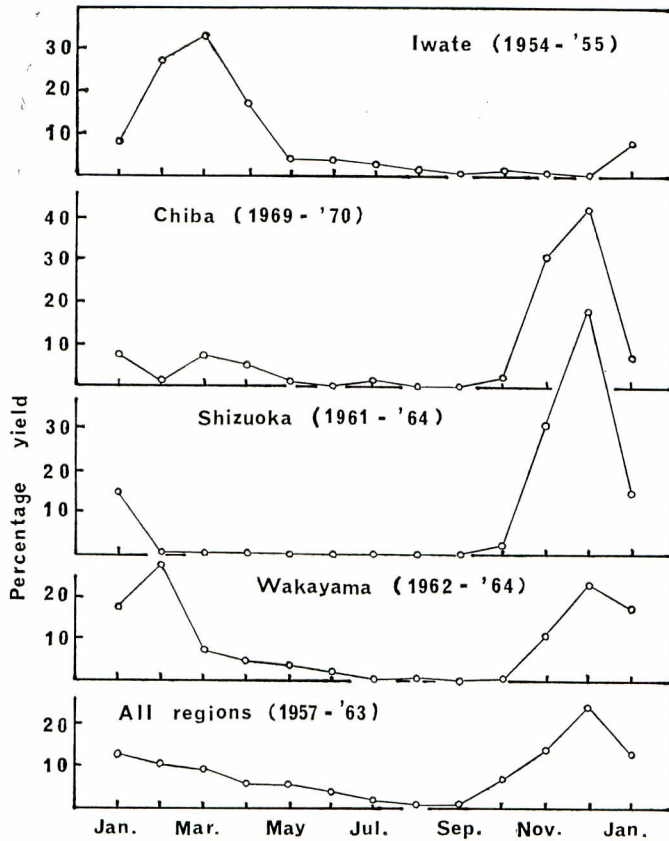


Fig. 5. Seasonal cycle of catch in weight of the mammals by local fisheries landed in main Prefectures.

There is one cycle of fishing season in a years as is shown in Fig. 5. The main season lasts from October to May, having a peak in December. In this month is obtained about one fourth of annual catch. During summer season from June to September, the amount of catch is only 7.9% of the total.

Some of detailed statistics on the catch of dolphins are available from the Annual Reports published by the Branch Offices of the Statistics and Survey Division, the Ministry of Agriculture and Forestry, which are distributed in each prefecture. Fig. 5 also show the percentage frequency of monthly catch of marine mammals in Iwate, Chiba, Shizuoka and Wakayama Prefectures. The main fishing season in Iwate Prefecture is from January to April. Kasuya (1971) shows the almost same result in the number of *Phocaenoides spp.* landed to Kamaishi Fish Market in Iwate Prefecture in 1969 and 1970. Fishing season in Chiba Prefecture lasts from November to April, and the peak is in December. Shizuoka Prefecture has a very limited fishing season from October to January on the east coast of Izu Peninsula. In the past time when the dolphin drive fishery was operated on the west coast of the same Peninsula, the main season was from May to July (Nishiwaki and Yagi, 1954). According to Noguchi (1946), peak of fishing season was April and May in Izu Peninsula. This means that the west coast was more favourable at least until that time. Wakayama Prefecture has a relatively long fishing season, and the main season is from November to April with a peak in February. According to Fisheries Agency (1912), the favourable season was from May to the middle of June in Noto Peninsula of Ishikawa Prefecture at that time. Noguchi (1946) reported that the fishing season for the dolphin was from early March to middle of June, with a peak in early April in Hyogo Prefecture of Region F. According to Hirashima and Ohno (1944), the fishing season in the north-east coast of Hokkaido is from July to September.

Sealing season in Hokkaido lasts from the late winter to spring. As described by Uchida (1954) and Maito (1971), seal hunting in Okhotsk Sea coast is carried out from the late decade of March to the early decade of May when the drift ice breaks and moves as the ice disc. The sealing season in Nemuro Pass is from the middle of February to the late April, and in the Pacific coast of the east Hokkaido, the season lasts from the middle of May to the middle June.

Fishing season is mainly reflected with the seasonal change in the abundance and the availability of the animals. As the fishermen do not engage in exclusively for the marine mammal fisheries, the fishing season is also affected by the other fisheries. The blue white dolphin is the main object of marine mammal fishery both in Shizuoka and Wakayama Prefectures. They are caught in the course of southward migration in winter in both areas. The delay of fishing season in Wakayama is due to the topographic reason that Wakayama is situated south of Shizuoka. Fig. 6 shows an estimated routes of the blue white dolphin in the northward and the southward migrations off Izu Peninsula. This Peninsula juts out to the south. A part of the southbound migration group moves toward Sagami Bay, so that the fishing season off the east coast of Izu Peninsula occurs around December. On the contrary, a group of the northward migrates enters into Suruga Bay. Then, the fishing season is in spring off the west coast of the Peninsula.

As is described by Matsuura (1943b), Noguchi (1946) and Kasuya (1971), *Phocaenoides* is a species living in cold waters, and appears in Sanriku District in winter. The fishing

season in this district is from late winter to early spring. According to Uchida (1954), this genus is abundant in the waters off Hidaka of Hokkaido in May, and from a good fishing ground in that time. This means that it migrates northward in spring. Noguchi (1946) reported that Dall's porpoise appears off the Sea of Japan coast of Hyogo Prefecture earlier than the Pacific white sided dolphin.

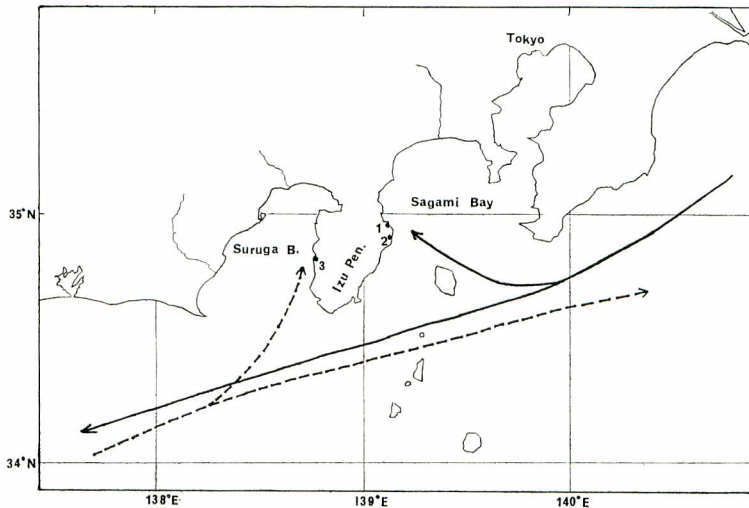


Fig. 6. Estimated migratory routes of the blue white dolphin in the waters off Izu Peninsula.

1 : Kawana, 2 : Futo, 3 : Arari, Broken line : Northward migration, Solid line : Southward migration.

Fishing season is also affected with the seasonal change in price of dolphins. Dr. T. Kasuya (personal communication) observed this phenomenon in Iwate Prefecture.

TYPES OF FISHERIES

Marine mammals are caught by many types of fisheries in the waters off Japanese coast as shown in Table 5. Drive fishery and sealing are included into "other types of fisheries" in the Annual Reports. However, at least in the case of marine mammals it means mostly drive fishery and seal hunting. Therefore, I regard "other fisheries" as drive fishery or seal hunting in the present paper. Harpoon fishery has also been included in "other fisheries" in the Annual Reports since 1968.

Out of marine mammals landed, 54.5% are caught by means of drive fishery or seal hunting, and 29.3% by harpoon fishery. Marine mammals are also caught incidentally by other types of fisheries. However, the amount of catch is only 16.2%. About half of them (8.0%) are taken by purse seine, and 2.2% of them are took by yellow-tail and tuna set net. Sometimes a school of cetaceans strands ashore, and some of them may be landed to fish market. Amount of catch by purse seine fishery is not so large as in the western coastal waters of America (Perrin, 1968).

Seals are exclusively caught by hunting, and are rarely caught incidentally by salmon gill nets. Naito (1971) also reported that they are also incidentally caught by salmon set-net, crab trap-net, cod gill-net and "teguri"-net.

Whales enter sometimes into set net, and pilot whales and false killer whales are occasionally caught by drive fishery.

The active fisheries for marine mammals are only by drive, harpoon and hunting methods. Other fisheries take them merely incidentally during operation for fishes. Hunting by means of shot gun is now only permitted to take seals excluding the northern fur seal, though this method was used for taking dolphins in combination with harpoon until 1957. Details of seal hunting method in the Japanese coastal waters are thoroughly described by Matsuura (1943b) and Uchida (1954).

Table 5. Types of local fisheries and catch of marins mammals in the coast of Japan during years 1957—1968.

Types of fisheries	Catch (tons)	%
Drive and hunting	11,809	54.45
Harpoon	6,359	29.32
Purse seine of two boat operation	1,744	8.04
Yellow tail and tuna set net	477	2.20
One-boat medium trawl east of 130°E	359	1.66
Long lines excluding for tuna and cod	192	0.89
Gill nets excluding for sardine, herring and salmons	137	0.63
Tuna long line	131	0.60
Large set not excluding for herring, yellowtail, tuna and salmons	109	0.50
Others	370	1.71
Total	21,687	100.00

Drive method has a long history in some districts on Japan, such as Noto Peninsula, Goto Islands and Izu Peninsula (Fishery Agency, 1912). There is a record that it operated in Goto Islands since at latest 250 years ago (Fishery Agency, 1912). This method was also called as "net method", because net are used after a school of dolphins are driven into a bay. This method depends on the behavior of dolphins that they are very sensitive with under-water sounds and are gregarious. A school of dolphins are driven into a bay by moise under-released from many fishing boats. As soon as the school is driven into a bay, fishermen set net at the mouth of the bay. Some of them are taken up by net and some driven ashore. This method of catching is carried out only in a bay suitable for driving. The method and gears used are somewhat different by regions (Fishery Agency, 1912).

In Izu Peninsula the drive fishery is now carried out by two fishery co-operative associations of Kawana and Futo, and all the fishermen of the associations work co-operatively for taking dolphins. When fishing season comes, several scouting boats search for dolphin school every day. The range of the scouting boats often covers 30—40 miles off their villages,

though it was not that in the old time. When a scouting boat finds a school of suitable dolphins, report is made to the office ashore (Fig. 7 A). Ten to twenty driving boats surround the school and drive them by making noise by means of several methods into the bay of their village (Fig. 7 B). After the school is located in a suitable position in the bay, the mouth of bay is closed with a long net (Fig. 7 C). Then, The fishermen pick up the dolphins after spueezing the nets, on board of vessels (Fig. 7 D). All dolphins in a school are driven in this way. Sometimes a few thousands of blue white dolphins are caught at the same time (Tobayama, 1969). Plate I shows some spaps of this fishery.

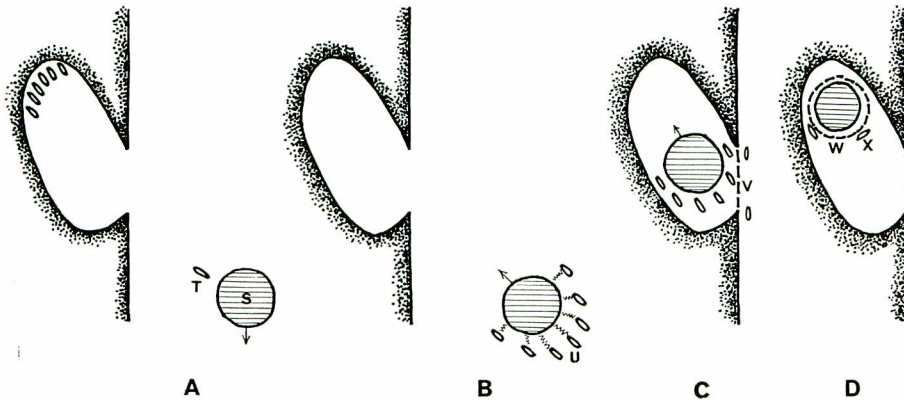


Fig. 7. Schematic figures of the catching process of dolphins in drive fishery.

A : Finding of a school of dolphins by a scouting boat, B : Driving of the school to a bay by driving boats, C : Closing of the mouth of bay after the driving of the school to the bay, D : Picking up the dolphins on board of vessels after squeezing them with net, S : School of dolphins, T : Scouting boat, U : Driving boats, V : Set net, W : Surrounding net, X : Picking up vessel.

Harpoon fishery has also a long history in Japan. It is estimated that it started at latest several hundred years ago (Matsuura, 1943a). The proper object of this fishery is to take billfish and tuna. Dolphins and porpoises are caught if found during operation or for season when the main objective animals are scarce. In Tohoku District even the squid angling boats are built for harpooning dolphins. The harpoon fishing boats are 5—50 tons with engine. In 1962 3,973 harpoon fishing boats were operated in the coastal waters of Japan. Plate II A shows a typical harpoon fishing boat. A long scaffold stretches at bow of the boat on which three or four men can stand in operation (Plate II B). The boat has a "crow's nest" at fore-mast as whaling catcher has, for watching. Harpoon is consisted of five parts, that is, harpoon (Fig. 8 B), 70m long line, 4.5m long pole (Fig. 8 A), top iron (Fig. 8 C and D) and floating keg. When a fisherman finds a school of dolphins, the boat approaches to the distance of 15—20 m, and harpoon-men throw harpoon to the dolphins. As soon as the harpoon hits the dolphin, fishermen picked up the pole and harpoon, and throw

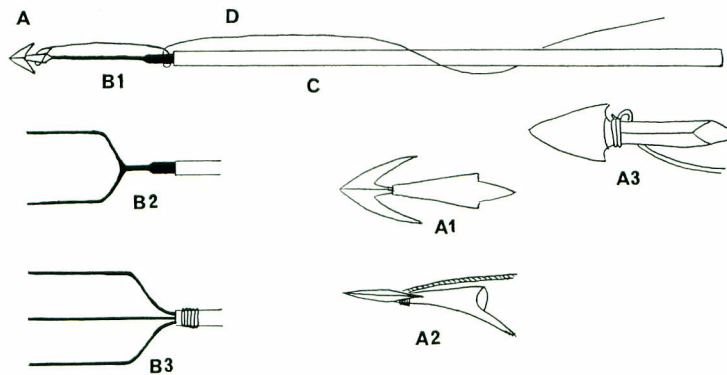


Fig. 8. Harpoon for catch of dolphins in the harpoon fishery.

A : Top iron, B : Harpoon, C : Pole, D : Line, A1 : Ventral view of a top iron, A2 : Side view of A1 iron, A3 : Another type of top iron, B1 : Single top harpoon, B2 : Double top harpoon, B3 : Triple top harpoon.

Table 6. Amount of catch (weight in tons) of marine mammals by means of different types of fisheries by Regions in the coastal waters of Japan, 1957—1962.

Types of local fisheries	Regions								
	A	B	C	D	H	G	F	E	Total
Otter trawl west of 130°E	—	—	—	—	—	1	—	—	1
One-boat medium trawl east of 130°E	0	254	—	—	—	—	1	0	255
Two-boat medium trawl east of 130°E	—	—	—	—	—	—	—	—	—
Small trawl "Teguri" type 1	—	2	—	—	—	—	0	0	2
Purse seine of one-boat operation	—	1	0	—	—	0	0	0	1
Purse seine of two-boat operation	—	737	5	0	—	0	—	0	742
Saury stick-held dip net	0	44	1	—	—	—	—	—	45
Lift net	—	0	—	—	—	—	—	0	0
Salmon drift gill net	50	3	—	—	—	—	—	27	80
Sardine drift gill net	—	—	—	—	—	0	—	—	0
Other gill net	2	25	0	0	3	0	0	—	30
Skipjack pole and line	—	12	2	0	—	—	—	—	14
Mackerel pole and line	—	—	1	—	—	—	—	0	1
Other kinds of mackerel angling	—	9	1	—	—	—	—	—	10
Squid angling	—	1	1	—	—	—	—	—	2
Other angling	0	6	—	0	—	1	0	0	7
Tuna long line	0	87	6	4	—	0	—	11	108
Other long line	6	51	8	—	—	0	0	3	68
Herring set net	9	—	—	—	—	—	—	—	9
Yellow tail and tuna set net	5	37	64	53	—	19	34	67	279
Salmon set net	0	—	—	—	—	—	—	2	2
Other kinds of large set net	21	3	2	—	—	5	0	17	48
Small set net	1	2	1	—	—	—	—	—	4
Sea weed collecting	—	—	—	—	—	—	1	—	1
Harpoon	95	2,417	777	21	—	4	43	4	3,361
Other fisheries (Drive and hunting)	74	27	5,714	1	—	1,230	80	—	7,126
Total	287	3,801	6,604	94	3	1,274	176	146	12,335

line and floating keg into the waters, and then chase the next dolphin. *Phocaenoides* and *Lissodelphis* are easy to be caught, because they have behavior to move along with boat.

During the World War II and for a while thereafter, shotgun was used in harpoon fishery. The animal is shot before harpooned. This method is more efficient than the harpoon only. However, the Japanese Government prohibited the use of shotgun in harpooning fishery to ensure the complete ban of fur seal hunting in 1957.

The type of local fisheries for marine mammals vary by regions. Table 6 shows the amount of catch by types of fisheries and by Regions. Seal hunting is operated only in Region A. Drive fishery is mostly conducted in Resions C and G. Although dolphins are taken by harpoon fishery in many Regions, the main fishing ground is north of Chiba Prefecture on the Pacific side. However, this fishery was also conducted at least during the War in Tazima, Hyogo Prefecture (Noguchi, 1946). Purse seine operated by two boats catches dolphins only in Region B. Catch of whales and dolphins by yellow-tail and tuna set nets is seen in most Regions, but the amount of catch is larger in the western than northern part of Japanese coast.

PRICE AND UTILIZATION

Price statistics of total marine mammals have been given in the Annual Reports since 1959. Table 7 shows the yearly change in the total amounts and amounts per head during years 1959–1970. Average amount of total yield in a year through these 12 years is 87.5 million yen, with large fluctuations from 48 to 117 million yen. As shown in Fig. 9, total amount had decreased gradually from 1959 until 1967, but increased remarkably since then. The average price per ton of yield is 48.4 thousand yen, with gradual decreasing until 1965, but rapidly increased since 1967. It reached to the highest (77.4 thousand yen) in 1970. Most of the marine mammals caught by local fisheries consists of small cetaceans

Table 7. Price of marine mammals caught by local fisheries.

Year	Price (million yen)	Price per ton (thousand yen)	Price per head (yen)
1959	109	44.8	3,520
1960	102	47.6	3,974
1961	109	39.1	3,430
1962	57	32.9	2,730
1963	74	38.8	2,769
1964	61	36.3	2,545
1965	67	29.4	2,534
1966	73	30.7	2,548
1967	48	46.5	3,619
1968	78	60.6	5,359
1969	73	71.2	5,785
1970	117	77.4	6,647
Total	1,074	48.4	3,452

as shown in the previous chapters, so that figures given above can be regarded as those of dolphins. The tendency in the change in price per head of marine mammals is almost as the same manner as that of price per ton of yield. The average price per head is 3,452 yen during recent 12 years, and reached to 6,647 yen in 1970. Matsui and Uchihashi (1943) noted that the price of a dolphin had been only about 3.5 yen before the World War II, but it increased during the War and it became 8–9 yen in 1940, 35 yen in 1941 and 70–80 yen in 1942 in Hyogo Prefecture. This result was driven by the increase of demand for meat and leather from dolphins. According to Hirashima and Ohno (1944), the price of a Dall's porpoise was about 100 yen during the War in Hokkaido.

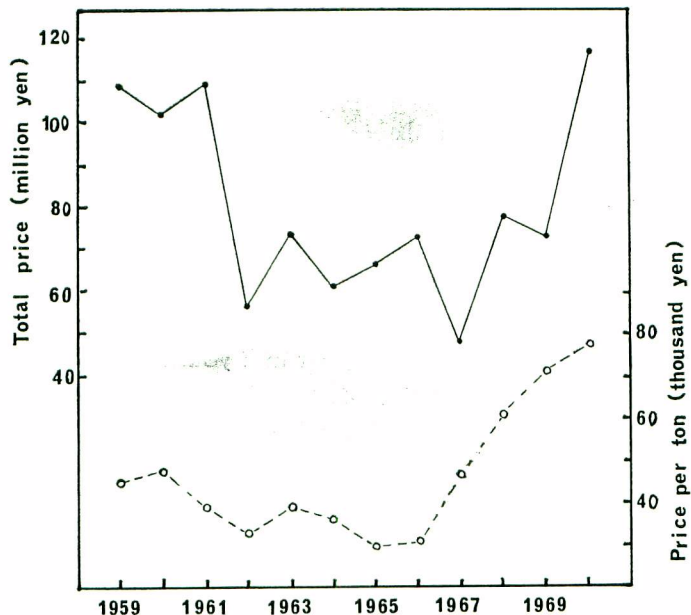


Fig. 9. Yearly change in total price and price per tons of weight produced from the marine mammals caught by local fisheries around the coast of Japan. Solid line : Total price, Broken line : price per ton.

Most small cetaceans are sent and sold at fish markets after removing internal organs and blood. Fish dealers buy dolphins as a whole, and they flense them at their shop.

The consumption of dolphins is more or less limited to certain localities, but their meat and blubber are well consumed in some regions where dolphin fishery has a long history. People in the regions have tasted dolphin meat. They are Iwate, Shizuoka, Yamanashi, Wakayama and Nagasaki Prefectures, for example. A block of meat with blubber are consumed for cooking at home with miso-paste and some vegetables. Bones are mostly used as manure for fruit trees. Noguchi (1946) and Fishery Agency (1969) review on the utilization of small cetaceans.

DISCUSSION

Catch statistics of marine mammals by local fisheries are not yet completely arranged in Japan. There are many difficulty in improving catch statistics which are useful for the population assessment of small cetaceans. As mentioned in the previous chapters, there is no specialized local fisheries for the marine mammals even in the active fisheries like as harpoon and drive fisheries, and total amount of catch and price occupy very small part in the Japanese domestic fisheries. Furthermore, the small cetaceans are caught on almost every region and by many types of local fisheries. It will be, of course, the best method to get enough catch data from all the coast of Japan, and, if possible, it may be considered as the second policy to sample from fishing ports or fishing co-operative associations at which the dolphin fisheries are flourish, and get thorough data.

The marine mammals are only classified into three categories of seals, whales and dolphins in the Annual Reports of Catch Statistics on Fishery and Aquaculture. It is very difficult to get catch statistics by species. Since the commercial values of small cetaceans are also less, fishermen do not need to identify them exactly. Local vernacular name is often different from the standard species name, and a name sometimes means different species by locality. For example, "Ma-iruka" in Japanese="Common dolphin" in English often means the dolphin which is caught most commonly in each locality, as pointed out by Ogawa (1949), and the same name means blue white dolphin in Shizuoka Prefecture. On the case when we get new catch data of cetacea from local fisheries, we should make a list of species of scientific name and local vernacular name. Field book or photographs of cetacea is also useful for fishermen to make accurate identification of species caught.

The fishing efforts for the marine mammals in the local fisheries are not yet available, As the effort of harpoon fishery, boat's day's work spent in endeavouring to catch dolphins is considered to be effective. However, there are many harpoon fishing boats all over Japanese coast, and they do not always engage in dolphin fishery, for their main objects are billfish, tuna and other animals. The selection of sampling boats will be useful in this case. The fishing efforts in drive fishery may be difficult to be measured. There are large variation in the school size of dolphins. I have no idea whether the effort is different in driving different school size or not. Therefore, it is necessary to collect data on the number of drive times, number of dolphins in each school caught, number of boats used in drive them, distance and time spent to drive each school, *etc.* Several scouting boats operate to search for the dolphin school in Izu Peninsula during fishing season. Records of these boat's day's works, number of schools and the school size found will be also useful as an index of abundance of dolphins.

In the present report, I did not review on the exploitation of marine mammals in Okinawa Prefecture which was returned to Japan in 1972. The catch statistics there will be included in the Annual Report in near future, and it is worth while to review the exploitation of marine mammals in Okinawa very soon.

Drive fishery is a unique method to catch marine mammals. Cetaceans are caught alive by means of this method, so that most of cetaceans kept alive in Japanese aquaria have been obtained through this method of fishery. In this connection, I think that the aquaria would use also the purse seine or set net fisheries in case of catching for the exhibition of animals, for cetaceans are caught alive by means of these fisheries. Different kinds of cetaceans can be supplied by these fisheries, especially large whales are only caught by set net fishery. Since whole individuals forming a school are caught by drive fishery, very useful information can be provided for the study of cetacean school structure which is one of the most interesting field of cetacean ecology.

Fishing grounds of the local fisheries are not so far from the coast, while the habitats of cetaceans are very wide in the open sea. This means that local fisheries exploit only a small part of the cetacean population. Therefore, it is required for the stock assessment to investigate the distribution, abundance and migration of these animals in the open sea.

In the old time, fishermen in some regions considered that the dolphins was a kind of gods, and would incur some curse, if it was killed. They also thought that the schools of sardines or other fishes would not migrate to the shores, if they caught dolphins, because dolphins must drive these shoals to the shores. Nowadays, fishermen believe that many kinds of damages are made by cetaceans to their fisheries. These damages will be classified into the following items :

1. Decrease of abundance of the commercial fish by predation.
2. Disturbance in approaching of commercial fishes to the fishing grounds.
3. Dispersion of commercial fishes from and within the fishing grounds.
4. Disturbance of fishing operation.
5. Stealing of commercial fishes which are captured in fishing gears.
6. Damage to fishing gears.

Tuna long line fishery is damaged by medium cetaceans, chiefly false killer whales by the stealing of the tunas hooked. It is estimated that about one tenth of tunas hooked are stolen by cetaceans and sharks (Yamaguchi, 1964). The amount of damage is considered to be several billion yen a year. The cetaceans are so clever that they leave only head of tunas, but they are seldom hooked with the long lines. Sometimes salmon drift gill nets are sunk by the marine mammals which are entangled with the nets in the northern part of the North Pacific. Mizue and Yoshida (1965) reported that about 10 thousand Dall's porpoises were entangled with salmon drift gill nets. The salmon entangled with the gill nets are also stolen by Steller sea lions, northern fur seals or salmon sharks (Sano, 1959). Fishermen of the west coast of Japan complained of the damage affected on their fisheries by the toothed whales to the Diet, and so the Japanese Government investigated on this problem (Fishery Agency, 1968, 1969). As the decreasing of the abundance of commercial fishes, fishermen may feel strongly the damage to their fisheries by cetaceans. Small cetaceans should be studied not only for their protection from the exploitation, but also on their position in the food chain of ecosystem in the sea.

Anyway, the population study of small cetaceans still remains undeveloped. There are too many problems to be solved in this field. As catch statistics are the basic material for the population assessment, we should improve the statistical system for collecting catch data from the coastal fisheries.

SUMMARY

Recent catch of marine mammals by local fisheries around the coast of Japan is reviewed mostly depending upon the Annual Reports of Catch Statistics on Fishery and Aquaculture, 1957—1970. The results obtained are summarized as follows :

1. It is considered that about 44 species of marine mammals are distributed in the waters around Japan (Table 1), but the common species which are the objective species for the local fisheries are limited to about 17. *Stenella* and *Phocaenoides* occupy the overwhelming part of the exploitation.
2. About 1,800 tons and 21,700 individuals of marine mammals are caught annually in average during the years, 1957—1970 (Tables 2 and 3). The amount of catch has been decreasing gradually in recent years (Figs. 1 and 2).
3. In average 21,400 dolphins, 640 seals and 190 whales are caught in a year during 1957—1970. These figures are not complete, especially of seals.
4. Distributions of catch of marine mammals are limited to certain localities (Appendices I, II and III). Shizuoka, Iwate, Miyagi, Chiba and Wakayama Prefectures occupy 91% of dolphin catches. Seals are exclusively caught in Hokkaido.
5. The main fishing season lasts from October to May, with a peak in December (Fig. 5). In details, the season differs by regions and by species, due to seasonal movement of animals and in price of dolphins.
6. Although there are many types in local fisheries for marine mammals, the active types of fisheries are drive, harpoon and hunting methods. Incidental catch by other fisheries is only 16% of the total. Types of fisheries differ among regions (Table 6).
7. The amount of yield in monetary unit from marine mammals is 87.5 million yen per year during recent 12 years, 1959—1970. Price of a dolphin is 3,500 yen in average, but it went up to 6,600 yen in 1970 (Fig. 9).
8. We should improve the statistical system for collecting catch data of the marine mammals from the local fisheries.

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日本沿岸の地方的漁業による海獣類，とくにいるか類の漁獲

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日本沿岸では、大型、小型の各捕鯨の他に、種々の地方的漁業により、古くから海獣類の漁獲がなされている。

本報告は、1972年の第24回国際捕鯨委員会科学小委員会の勧告にしたがい、わが国における小型鯨類の資源調査研究の組織を整備強化するための基礎資料として、最近における日本沿岸の地方的漁業による海獣類の漁獲統計を取りまとめた。利用した漁獲統計は主として、「漁業養殖業生産統計年報 1957—1970」によった。

統計年報には、海獣類は1957年から、「他の動物」と独立した項目として分離して統計されるようになっていたが、多くの統計はすべての海獣類がまとめられており、細分されても、あざらし類、鯨類、いるか類のような大分類に止まり、種別の統計はなされていない。また、漁獲努力量に関する統計も得られていないので、資源調査研究のための漁獲統計としては不充分である。

1957年から1970年の14年間の年間平均漁獲量は総計1,800トン、あざらし類640頭、鯨類190頭、いるか類21,400頭であり、漁獲された海獣類の大部分はいるか類である。あざらし類の漁獲統計は不正確であることが他の資料から推測される。全体として海獣類の漁獲には減少の傾向がみられるが、これは資源の減少を意味するものではなく、地方漁業の衰退による漁獲努力量の減少によってもたらされているとみなされる。

いるか類はすべての地方で漁獲されているものの、その漁獲量は地方によりいちじるしい差があり、静岡、岩手、宮城、千葉、和歌山の各県の漁獲が全国の91%を占める。あざらし類の漁獲は北海道に限定される。

漁期は全体として10月から5月にかけて盛んであり、また、地方や種により漁期を異にする。

海獣類は種々の漁業により漁獲されているが、これを目的として積極的に行なう漁業は、いるか追い込み漁業、いるか突棒漁業およびあざらし猟であり、これらの漁業により、全体の84%が漁獲される。他は他の魚類を目的とした操業の際に附随して漁獲されるにすぎない。

海獣類の生産金額の平均は1959—1970年間で8,750万円、トン当り48,400円であり、いるか類1頭当り3,500円であった。しかし、1967年からそれらの単価は増大しつつあり、1970年には総計11,700万円、1頭当り6,600円となっている。

APPENDIX I. Annual catch number of seals by Prefecture.

Prefecture	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1968	1970	Total	Average
Total	1,235	5	17	52	1,118	219	412	397	931	707	618	782	1,143	1,265	8,901	635.8
Hokkaido	1,232	5	17	52	1,118	219	412	397	931	707	614	782	1,132	1,265	8,883	634.5
Aomori	—	—	—	—	—	—	—	—	—	—	4	—	11	—	15	1.1
Ibaragi	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	0.1
Kochi	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	0.1
Toyama	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	0.1

APPENDIX II. Annual catch number of whales caught by local fisheries by Prefectures.

Prefecture	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	Total	Average
Total	85	275	209	789	521	83	69	148	59	169	59	33	27	81	2,607	186.2
Hokkaido	3	2	18	27	2	—	3	124	1	46	2	3	—	—	231	16.5
Aomori	—	—	—	—	—	1	—	—	1	—	3	5	2	3	15	1.1
Iwate	1	1	4	4	3	2	8	21	1	2	1	1	—	—	49	3.5
Miyagi	—	179	1	—	404	—	3	—	—	—	—	—	—	—	587	41.9
Akita	1	—	—	1	—	1	2	2	1	—	2	—	—	—	10	0.7
Yamagata	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1	0.1
Fukushima	—	—	—	—	—	—	—	—	38	—	—	—	—	—	38	2.7
Ibaragi	40	1	2	3	24	—	1	—	—	3	—	1	1	—	76	5.4
Chiba	18	6	4	10	30	4	1	—	—	100	—	—	1	—	174	12.4
Tokyo	2	2	—	2	—	—	1	—	—	—	—	—	—	—	7	0.5
Kanagawa	—	2	1	1	3	1	—	—	—	—	—	—	—	—	8	0.6
Niigata	—	1	3	4	2	2	—	—	—	1	14	2	1	—	28	2.0
Toyama	1	2	5	10	2	4	1	—	—	1	—	—	—	1	27	1.9
Ishikawa	5	4	6	11	8	2	1	—	4	2	4	11	11	4	73	5.2
Fukui	3	1	—	4	1	2	—	—	1	—	—	—	1	—	13	0.9
Shizuoka	1	54	153	501	25	51	41	—	1	—	20	—	2	41	890	63.6
Aichi	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mie	—	2	1	—	1	2	—	—	—	3	4	3	—	2	18	1.3
Kyoto	1	—	1	—	—	—	—	—	3	—	—	—	—	—	6	0.4
Osaka	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hyogo	—	—	—	2	—	—	—	—	1	1	—	—	—	—	4	0.3
Wakayama	—	3	2	1	1	—	1	—	—	2	6	2	1	30	49	3.5
Tottori	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Shimane	1	—	1	1	—	—	—	—	—	1	—	1	—	—	5	0.4
Okayama	—	—	—	—	1	—	—	—	—	—	—	—	—	—	1	0.1
Hiroshima	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yamaguchi	—	—	1	178	—	—	—	—	—	1	—	—	1	—	181	12.9
Tokushima	—	—	—	—	1	—	—	—	—	1	—	3	1	—	6	0.4
Kagawa	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	0.1
Ehime	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Kochi	1	4	1	8	3	3	4	—	4	3	3	2	—	—	36	2.6
Fukuoka	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Saga	—	1	—	—	—	—	—	—	—	—	—	—	—	—	1	0.1
Nagasaki	3	—	—	18	5	—	—	—	—	1	1	1	1	2	32	2.3
Kumamoto	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ohita	—	1	—	—	—	—	—	—	—	—	—	—	—	—	1	0.1
Miyazaki	—	6	1	—	4	10	2	—	—	—	—	—	—	—	24	1.7
Kagoshima	4	3	4	3	1	—	—	—	—	—	—	—	—	—	15	1.1

APPENDIX III. Annual catch number of dolphins by Prefecture.

Prefecture	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	Total	Average
Total	15,213	21,160	30,744	24,826	30,138	20,577	26,240	23,427	25,446	27,774	12,586	13,741	11,448	16,255	299,575	21,398.2
Hokkaido	303	440	375	505	1,841	184	194	114	416	258	61	56	22	15	4,784	341.7
Aomori	4	—	—	2	4	1	—	441	2	644	—	259	—	84	1,441	102.9
Iwate	4,020	5,891	3,398	4,918	6,064	5,695	7,766	7,600	8,465	7,576	4,105	5,619	5,632	7,813	84,562	6,040.1
Miyagi	3,365	3,270	1,905	9,292	2,491	3,022	862	5,094	1,328	1,440	1,400	121	112	51	33,753	2,410.9
Akita	2	—	—	24	—	10	18	12	30	24	2	19	—	—	141	10.1
Yamagata	—	—	—	9	3	—	27	3	3	1	1	—	2	—	49	3.5
Fukushima	239	1,463	1,203	1,057	21	182	504	—	—	—	—	—	—	1	4,670	333.6
Ibaragi	108	342	227	121	111	499	158	877	67	100	137	259	116	257	3,379	241.4
Chiba	1,711	2,717	1,528	1,251	2,533	1,644	3,110	944	539	208	697	519	660	453	18,514	1,322.4
Tokyo	3	2	7	—	4	13	2	271	—	—	—	—	—	—	302	21.6
Kanagawa	15	94	33	11	21	—	5	2	18	10	—	—	6	1	216	15.4
Niigata	87	5	46	39	17	3	17	6	3	7	8	18	—	—	256	18.3
Toyama	32	9	35	16	22	—	—	—	—	—	—	—	—	—	114	8.1
Ishikawa	95	72	49	75	30	25	17	44	41	18	7	—	4	2	479	34.2
Fukui	65	17	21	27	22	13	10	—	13	—	—	—	20	1	209	14.9
Shizuoka	5,011	5,231	21,342	6,497	16,407	8,968	7,690	6,838	14,105	16,668	5,250	6,303	3,601	5,601	129,512	9,250.9
Aichi	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mie	—	18	2	1	—	12	19	31	67	5	10	35	17	22	239	17.1
Kyoto	—	—	—	15	97	—	—	—	—	—	—	—	—	—	112	8.0
Osaka	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hyogo	65	92	349	36	32	21	46	10	61	2	17	—	—	—	731	52.2
Wakayama	—	90	73	44	34	94	434	1,286	78	276	837	496	1,229	1,879	6,850	489.3
Tottori	—	—	—	—	—	—	—	5	—	—	—	—	—	—	5	0.4
Shimane	27	17	3	1	5	—	12	—	—	—	—	—	—	—	65	4.6
Okayama	7	—	—	—	—	—	—	—	—	—	—	—	—	—	7	0.5
Hiroshima	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Yamaguchi	7	3	—	6	1	—	29	—	—	—	27	10	—	—	83	5.9
Tokushima	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—
Kagawa	7	—	20	—	15	—	—	—	—	—	—	—	—	—	42	3.0
Ehime	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Kochi	24	2	1	8	5	—	—	9	4	57	6	2	14	—	132	9.4
Fukuoka	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Saga	—	30	15	46	93	—	—	—	—	—	—	—	—	—	184	13.1
Nagasaki	10	1,337	91	755	191	164	294	—	—	470	15	9	10	74	3,420	244.3
Kumamoto	—	—	—	62	17	—	20	39	—	—	3	—	—	—	141	10.1
Ohita	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Miyazaki	11	9	9	—	27	—	1	—	—	—	—	17	3	—	77	5.5
Kagoshima	2	9	12	8	30	—	5	—	—	—	3	—	—	1	70	5.0

Catch of marine mammals along Japanese coast

EXPLANATION OF PLATES**PLATE I**

Dolphin drive fishery in Izu Peninsula (Photo by Mr. Nobuyuki Miyazaki).

A : After a school of *Stenella attenuata* was driven into a bay, some net throw around the school.

B : Fishermen pick up the dolphin after squeezing the net.

C : A school of *Stenella attenuata* landed ashore.

PLATE II

Porpoise harpoon fishery in Sanriku District (Photo. by Dr. Kazumoto Yoshida).

A : A harpoon fishing boat in Ozuchi Harbour.

B : Bow of a harpoon fishing boat. Four fishermen stand on scaffold handling harpoon.

C : A True's porpoise picked up the side of boat.

OHSUMI

PLATE I

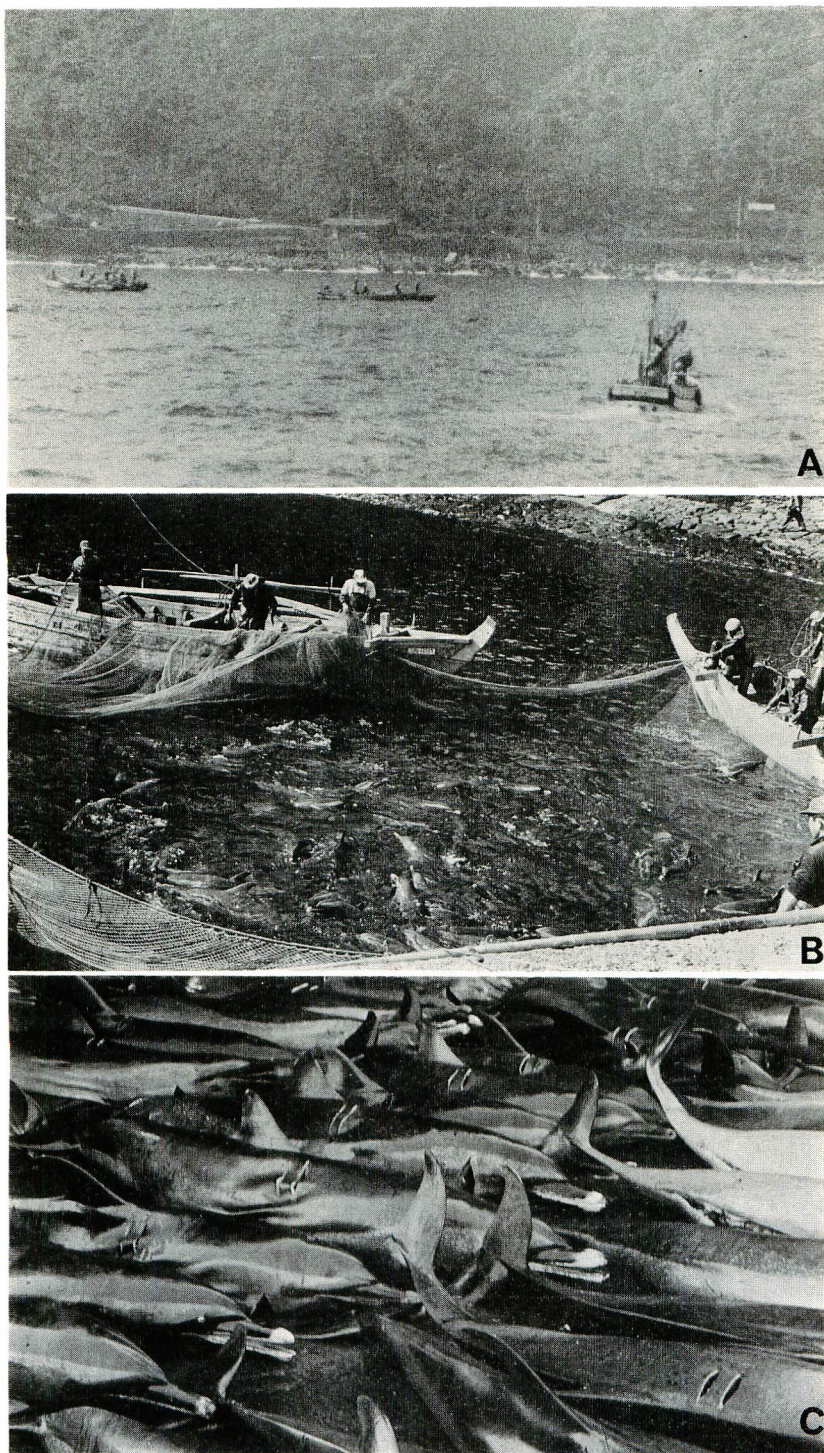


PLATE II

OHSUMI

