

POSSIBLE MIGRATION ROUTE OF THE GRAY WHALE ON THE COAST OF JAPAN

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ABSTRACT

The gray whale occurred on the south coast of Wakayama and Kochi prior to the turn of the century. The calving ground of this stock was possibly in the Seto Inland Sea. It migrated to and from the feeding ground in the Okhotsk Sea, along the east coast of Japan. With the increasing industrial development and boat and ship traffic this stock of the gray whale was driven from the Inland Sea and probably joined to the Korean stock or even to the California stock. A case of stranding of the blue whale is also reported.

INTRODUCTION

Occurrence of the gray whale on the coast of Japan is described by many authors of old Japanese books and picture scrolls of whales. In *Geishi* (The treatise of the whale), written by Jiemon Kandoriya of the castellany of Wakayama in 1758 and printed in 1760, which is the earliest printed monograph of the cetacea in Japan, is shown a drawing of Kokujira with a brief description (Fig. 1). This whale is drawn rather slender, but it has a series of knobs instead of a dorsal fin and bears many circular and semicircular scars on the surface of the body and tail flukes. It has bristles spreading over the entire head. He also describes that this species is the smallest among whales. He has a reason because the minke whale was not taken in these days (see Table 1).

Kiyonori Otsuki (1773–1850), a famous scholar in the Tokugawa era, left an undated manuscript on whales and whaling, entitled *Geishiko* (A draft of a history of the whale). It remained unpublished till 1925, when it was printed in a series of various collections in Sendai. It is by far the most systematic survey of whales and whaling that was written in the Tokugawa period (Hawley, 1958). In this book he notes that Kokujira has baleen plates of white in color. Other descriptions agree in general with those in *Geishi*, but he mentions the body form of Kokujira is more fat than the drawing in *Geishi* and gives two figures of Kokujira which resemble more to the gray whale (Fig. 2).

From the above it may safely be concluded that Kokujira is identical with the gray whale (*Eschrichtius robustus*) and it had occurred in the past at least on the coast of Wakayama. Further there remains some statistical data which show Kokujira or the gray whales were taken on the coast of Kochi, southern part of Shikoku, by the so-called net whaling prior to this century.

Modern whaling was introduced to Japan in 1897. Operation of this type

of whaling was firstly conducted on the east coast of Korea under the permission of the said government. After several years it was introduced to the coast of Kyushu, Kochi and Wakayama, gradually replacing the net whaling, and then to the northeast coast of Japan and off Hokkaido. But there is no record of the gray whale taken by modern whaling on the coast of Kochi and Wakayama, except one reported by Andrews (1914), referred from records of whaling company. This whale, a male of 40 feet long, was taken at Oshima, Wakayama, on 9 February 1910.

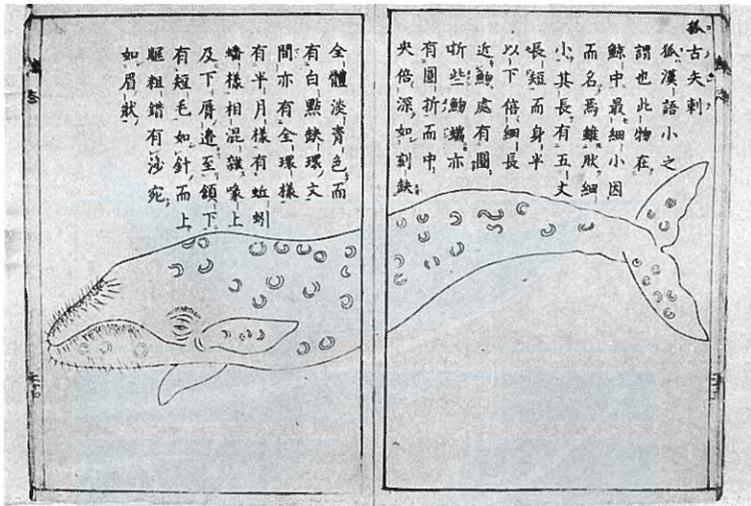


Fig. 1. Kokujiira in Geishi, 1760. Cited from Hawley, 1958.

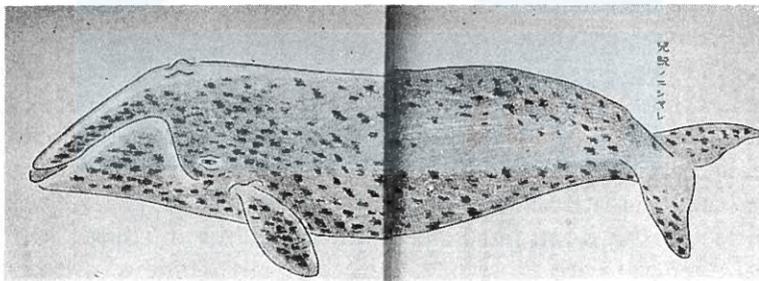


Fig. 2. Kokujiira in Geishiko (Share).

In April of the year he stayed at Oshima, but no gray whale was observed at this landstation by him (Andrews, 1916). On the other coast of Japan the gray whale was taken rarely, as reported by Mizue (1951). What happened with the gray whale on the coast of Japan? This problem is discussed in this paper in relation to the supposed calving ground of this species.

CATCH OF THE GRAY WHALE IN THE DAYS OF NET WHALING

The method of taking whales by net was invented by Kakuemon Taiji in 1677 at Taiji of the castellany of Wakayama (now Wakayama-ken), and then it spread to fishing villages on the south and west coast of Japan, including Shikoku and Kyushu, where whales came in shore in winter.

This method is a combined method of driving, netting and harpooning. When a whale was sighted by Yamami (watch on the hill), they make a signal informing species, position and swimming direction of the whale with flags or rockets. Various kinds of boats waited and went into action in orderly fashion as soon as the commander gave the order. The basic organization of whaling fleet was as follow.

Sekobune (for driving and killing whales). One group of about ten boats or more, 13 m long and 2.2 m wide with 8 oars, occasionally with sail. Crew consists of 15 men.

Amibune (netting boats). One group of about 6 boats, 13 m long and 3.5 m wide with 8 oars. Crew of 10 men.

Mossobune (tug boats). A group of 4 boats, nearly same as Sekobune but with a little broader beam. Crew of 13 men.

Sekobunes drive the whale to the place called Amiba (netting place) near the shore, producing underwater sounds with wooden hammer, where Amibunes are waiting to set the nets. Net is set sometimes two or three-fold in order to prevent the whale's escape and to check its action by entanglement.

Various kinds of harpoons, made of iron, were used. Their weights are not heavy and usually 1.0–2.0 kg in weight. Attached with harpoon a slender wooden pole and a rope with float at its end. Harpoons are thrown high up in the air so that they drop on the back of the whale from the air. When the whale has been sufficiently weakened by a number of harpoons, and later by the help of heavy swords thrown to the thorax, a sailor swims and climbs up on it and makes a hole at the blowholes with his knife in order to pass a rope through it. Then the whale is wound by several strands of rope around the body in order to tie the whale body between two Mossobunes before the whale was finally killed. Then it is stabbed at the heart with long swords.

In this way not only the right whale but also the balaenopterid whales were taken by the net whaling. This type of whaling was conducted by villagers forming groups. In these days two groups were in operation on the coast of Kochi and four groups in Wakayama. Shibusawa (1930) gives catch statistics of Ukitsugumi, one of these groups in Kochi, during 22 years from 1875 to 1896, by species of whales (Table 1). As seen in this table 64 whales or 17 percent among the total of 370 whales taken during this period were gray whales. From this table it is clear that the gray whale was hunted regularly at least until 1896 in these regions, as stated briefly by Nishiwaki and Kasuya (1970).

Further Hattori (1888) presents some data on details of operation and sighting of whales by the same whaling group in three years of 1880, 1882, and 1883 (Table

2). A total of 43 gray whales were sighted in these years, in which 12 were taken, 24 escaped from taking and 7 were not pursued due to unfavorable weather.

In general the rate of the catch against total whales sighted is very low and this is thought to be the main reason why the net whaling could survive more than 200 years. Among whale species other than the gray in Table 1 were also taken later by the modern whaling on the coast of Kochi and Wakayama.

TABLE 1. CATCH OF WHALES BY UKITSU WHALING GROUP, 1875-1896.
(Cited from Shibusawa, 1939)

Year	Blue	Fin	Bryde's	Humpback	Right	Gray	Total
1875	3	—	4	2	1	1	11
1876	2	2	5	6	—	2	17
1877	—	—	3	19	—	11	33
1878	3	—	4	4	6	1	18
1879	1	—	2	9	3	7	22
1880	5	1	8	2	1	6	23
1881	1	—	5	10	2	5	23
1882	3	—	2	4	—	3	12
1883	—	—	3	7	1	3	14
1884	5	1	2	1	2	1	12
1885	4	1	4	5	2	3	19
1886	1	9	3	6	—	1	20
1887	5	—	4	13	—	4	26
1888	1	3	4	6	—	1	15
1889	2	—	7	4	—	2	15
1890	—	3	4	—	—	1	8
1891	5	—	—	9	—	1	15
1892	2	—	3	1	1	1	8
1893	4	—	1	3	1	4	13
1894	1	—	4	3	1	1	10
1895	2	1	5	6	—	3	17
1896	5	2	4	6	—	2	19
Total	55	23	81	126	21	64	370

Note: Japanese name of the above whale species in these days are:

Blue whale—Nagasukujira, Fin—Nosokujira, Bryde's—Iwashi or Katsuokujira,
Humpback—Zatokujira, Right—Semikujira, Gray—Kokujira.

But now the blue whale is called Shironagasukujira, and the fin Nagasukujira. Iwashikujira means usually the sei whale, but Iwashikujira in these districts is possibly the Bryde's whale.

SUPPOSED CALVING GROUND IN THE SETO INLAND SEA

Shindo (1970) proposes the "east Kyushu migration route" of whales. He is a clinical doctor, but concurrently a historian and has much interest on whales and whaling, especially on whales in the Seto Inland Sea. His conclusion is based upon his study of tombs and memorials of whales and old documents concerning these whales. He also visited villages and made interviews with people concerned.

In old days it was a general custom to erect a tomb or a memorial when a whale stranded on the beach or occasionally killed by fishermen, like human being following after buddhism. These tombs or memorials are most abundantly remaining on the northeast coast of Kyushu and west coast of Shikoku (Fig. 10). Among 34 tombs or memorials, he investigated all over Japan, 15 are situated in these districts. They were erected within a period of about 100 years from 1809 to 1907. It is suggested from these facts that whales have passed frequently this strait and some of them were killed occasionally or stranded.

TABLE 2. SIGHTING AND WHALING OPERATION BY UKITSU WHALING GROUP, 1880, 1882, AND 1883.

(Cited from Hattori, 1888)

Year		Blue	Fin	Bryde's	Humpback	Right	Gray	Total
1880:	Catch	5	1	7*	2	1	6	22*
	Escaped, A	1	2	5	—	—	4	12
	„ B	9	3	15	4	2	8	41
	„ C	—	—	—	—	—	—	—
	Not operated, D	5	6	4	4	4	3	26
	„ E	14	—	3	5	—	—	22
	Total, sighted	34	12	34	15	7	21	123
1882:	Catch	3	—	2	4	—	3	12
	Escaped, A	3	—	6	2	—	4	15
	„ B	4	2	11	1	4	1	23
	„ C	—	—	—	—	1	—	1
	Not operated, D	3	1	4	3	4	1	16
	„ E	2	—	1	6	—	—	9
	Total, sighted	15	3	24	16	9	9	76
1883:	Catch	—	—	3	7	1	3	14
	Escaped, A	1	—	6	5	—	2	14
	„ B	9	—	22	16	—	5	52
	„ C	—	—	5	—	—	—	5
	Not operated, D	3	—	2	26	—	3	34
	„ E	5	1	6	46	—	—	58
	Total, sighted	18	1	44	100	1	13	177

* One whale difference from Table 1.

Escaped, A—breaking net, B—beneath net, C—round net.

Not operated, D—due to rough weather, E—offshore.

He (1968) also ascertained that Beppu-wan, a small bay on the northeast coast of Kyushu, was a calving ground of whales. Fishermen applied in vain several times for permission of whaling to the local government. These documents are remaining, but the reason of the rejection has not been made clear. Coming of whales to this bay has lasted until about 1887. With regard to the whale species he notes as Nagasukujira, mainly based on old papers left in Usuki, a city facing to a small bay next to Beppu-wan, and where a memorial of a stranded whale remaining. The story of this stranding is described later in this report.

Waters around Iwajima, Yamaguchi-ken, was also a calving ground of whales.

This is supported by Higashi (1944), who writes "Nearby waters of Iwajjima was a calving ground of Nagasukujira and 60-70 whales have gathered yearly in these waters. Sometimes dead calves were washed ashore". In Onoda, a city located westward of Iwajjima in Yamaguchi-ken, whaling was conducted in small scale in winter with hand harpoons and without using net. The whaling group was consisted of 15-20 fishing vessels. The whale species is not known, but most of them were accompanied by calves. The whaling group was dissolved in some years around 1877.

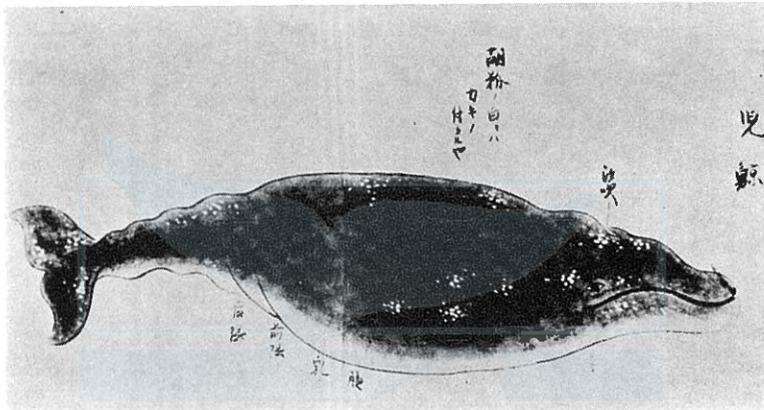


Fig. 3. Kokuujira in Yakuyoki, Kawanoe. First whale.

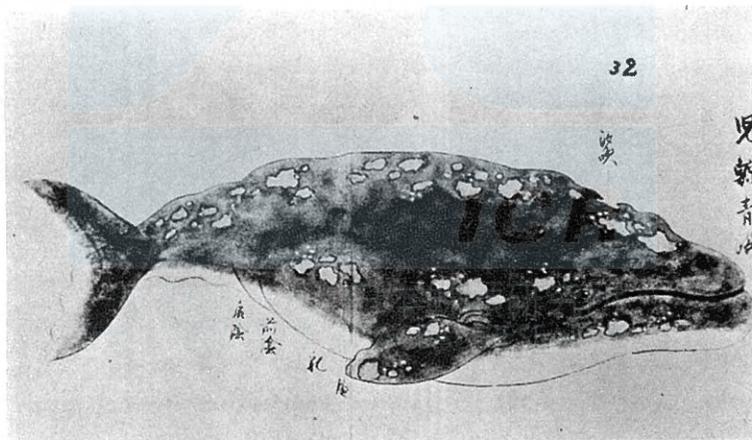


Fig. 4. Kokuujira in Yakuyoki, Kawanoe. Second whale (Aosagi).

Above are the basis why Shindo (1970) proposes the "east Kyushu migration route" of whales. He concludes that there are good evidences of whales coming into Beppu-wan and came in shore of the south coast of Yamaguchi-ken and the purpose of this migration was for calving. For the whale species he notes the pos-

sibility of the balaenopterid whales, but this is hardly be thought. No baleen whales other than the gray whale give birth to a calf in such shallow coastal waters. It is highly possible, therefore, that the Shindo's proposal of migration route is only applied for the gray whale. There is a possibility of other species entering into the Seto Inland Sea through this passage, but it is not for calving. In fact a skull of a balaenopterid whale was dug out from sea bottom off Onoda in 1926. This skull was identified as a minke whale by Dr. T. Ogawa (Shindo, 1968).

Shindo (1968) reports two gray whales were taken at Kawanoe, Ehime-ken, in 1864. The official records or diary of the local government (Yakuyoki) in these days are still being kept at the city library. The first whale was taken on 20 February 1864 by nets and harpoons. This whale came in shore of the city several days before the hunting was done, during which period villagers prepared catching equipment. Shortly after the catch of the first whale the second whale came and this whale was taken on 26 February of the same year.

Attached with the official records there remains sketches of two whales (Figs. 3 and 4). Both are without doubt the gray whale, having several knobs instead of a dorsal fin and the head is small and not arched, unlikely to the right whale. The first whale was marked with white color on the dark gray of the body the infection of barnacles, but lacking the pale patches. The second whale bears pale patches all over the body, in addition to the barnacles. The body length of the first and the second whales were recorded as having 4 Hiro (1 Hiro approximately 1 Fathom) and 6 Hiro respectively. This length does not mean the total length, because it was a custom in Wakayama and Kochi to measure the length of the whale body from the blowholes to the insertion of the tail flukes. In any case the first whale was smaller and younger than the second whale. The first whale is noted as Kokujira, but the second whale as Kokujira or Aosagi. Two types of Kokujira were noted in these days. One is Aosagi and another is Share, but the difference between two types is not clearly described in most of the old books. Should the first whale grouped as Share, then the difference is based on the color pattern of the whale body caused by the infection of barnacles, or it can be said that Share is younger than Aosagi. Both whales are thought to be females, because teats are noted in addition to navel, genital grooves, anus and blow holes in their right positions.

One scapula from one of these whales has been preserved. It has been kept at Hachiman shrine in the city (Fig. 5). There is a custom in Japan to donate Ema to a shrine in memory of big event or from some other reasons. Usually Ema is a painting on a wooden plate. In this case a scapula was used instead of wooden plate. At the center of the scapula a big Japanese (or Chinese) character which means a whale is written with powdered gold. On both sides and below this character a brief descriptions of this whale is also written with paint by small characters. This Ema has been hanged more than a hundred years on the wall of the shrine with other wooden Emas.

These two whales were the only whales taken at Kawanoe in the history, but at Takuma, a small town east of Kawanoe, whaling had been conducted with nets

and harpoons annually, taking about three whales in average, at least in a period from 1889 to 1897. The species of whale are not known, but the size of whales is said to be 5-7 Hiro, which are the comparable size with the Kawanoe whales.



Fig. 5. Left scapula of the Kawanoe whale.

OBSERVATION OF SCAPULAE AND OTHER BONES

Shindo (1970) reports a scapula, a tympanic bulla and one of ribs of the stranded whale at Usuki also have been preserved in the city. These are private possession of persons living there. I had a short trip in April 1974 to Usuki and Kawanoe in order to examine these bones. It may be of some interest to note here the story of the stranded whale briefly. The village of Odomari, now included in Usuki city, constructed fishing harbor (Fig. 6) in 1868, but the cost has remained as a big burden of debt. On 1 February 1870 a big whale came into the harbor and finally stranded. This whale was sold, after being dismembered by all hands of the villagers, and the amount of money earned could cover all of the cost needed for the construction of the harbor. The villagers constructed a memorial (Fig. 7) and on 1 February of the following year they held a buddhistic ceremony for the whale. Since then the ceremony is being held on 1 February every year, including 1974.

On arrival at Odomari, Usuki city, I knew that another scapula has also been preserved at a family. They also said some of the baleen plates of the whale were remained until about five years ago, when they were finally burned, not knowing the value of such precious sample. In Table 3 measurements of the scapulae of the Usuki and Kawanoe whales are shown, together with measurements of other

authors. The scapula of the Kawanoe whale (Fig. 5) agrees in general with the descriptions by Andrews (1914), being intermediate between the wide, low blade of *Balaenoptera* and the high, narrower and more symmetrically fan-shaped scapula of *Eubalaena*. The superior margin is quite evenly convex and the glenoid border is almost straight except for a short concavity where it rises from the glenoid fossa. The acromion is wide, but it is not expanding towards its distal end, contrarily to the description of Andrews and the photograph shown by Nishiwaki and Kasuya



Fig. 6. Odomari fishing harbor, Usuki city. A big whale entered into this harbor and finally stranded in 1870.

(1970). But this is thought to be caused by abrasion of the extreme end. The coracoid is thick and massive and directed somewhat upward from the margin of the glenoid fossa. The external face of the scapula is quite strongly concave. This scapula is smaller than that reported by Andrews (1914), but larger than those reported by Nishiwaki and Kasuya (1970). The former whale is an old male of 1250 cm long, and the latter is a young female of 900 cm in length. This scapula is thought to be taken from the second whale, and the size of this whale is possibly between the two lengths. 日本鯨類研究所

The scapulae of the Usuki whale (Fig. 8) differ from that of the Kawanoe whale, being more broader and less massive, as shown in the table expressed by thickness of the superior margin of the fan. The acromion and the coracoid are shorter than in the Kawanoe whale. The external face is quite different from the Kawanoe whale, having no concavity, a characteristic feature of the gray whale. On the rear surface it has several shallow grooves radiating from the center of the fan. Without doubt these scapulae came from one of the balaenopterid whales. The tympanic bone, 129 mm in length, is broken at its margin, but this also suggest this and the outline of this bone resembles to that of the blue whale from the North Pacific (Fig. 9). The remaining rib is thought to be one of the latter half

ribs. Its head is rounded and it measures 147 cm in straight line, but its distal end was cut off by knife. This bone has lesser value for the identification of the species.

After returning to Tokyo I sent three baleen plates, each one from the blue, fin and Bryde's whales, to Usuki for their identification, not informing them the species. They told me the color of the baleen plates was black, but the scapulae



Fig. 7. Memorial of the big whale at Odomari.

are without doubt not from a right nor a humpback whale, and there is less possibility of the sei whale in these regions. The reply was that the whale was a blue whale. Tomilin (1957) describes the ratio of breadth of the scapula against the height is 1.5–1.6 in the blue, 1.65 in the fin, and 2.0 in the sei whale. This value of the Usuki whale is around 1.6 and very close to the value for both blue and fin whales.

In conclusion above the Usuki whale was possibly a blue whale and this was a rare case of the stranding of this species. The size of the scapulae are relatively small. The body length of this whale was recorded as having 15 Hiro which means roughly 75 feet (2250 cm.). This is clearly too big, even if this means the total length. Possibly the size of this whale was smaller than 20 m and probably around 17 m. The sex of this whale was male, because there remains a record that both

eyes, penis, and bones in the loin (pelvic bones?) were buried beneath the memorial, sealed in a pot.

TABLE 3. MEASUREMENTS OF SCAPULAE OF THE USUKI AND KAWANOE WHALES.
(in mm)

Measurements	Usuki whale		Kawanoe whale	Gray A		Gray B
	Right	Left	Left	Right	Left	
Greatest breadth	980	970	990	757	761	1125
Greatest height	615	600	740	495	514	856
Length of acromion, inferior	260	220	290	193	190	335
Breadth of acromion, distal end	121*	120*	139	132	145	180
Length of coracoid	40	55	100	58	62	146
Length of glenoid fossa	235	220	210	253	245	268
Thickness of superior margin						
at anterior end	29	29	27			
at middle	9	8	15			
at posterior end	42	44	52			
Ratio of breadth against height	1.59	1.62	1.34	1.53	1.48	1.31

* Greatest.

Gray A. Cited from Nishiwaki and Kasuya, 1970.

Gray B. Cited from Andrews, 1914.



Fig. 8. Right scapula of the Usuki whale.

DISCUSSION

Although practically nothing was described by Andrews (1914), Mizue (1951) and Rice and Wolman (1971), the gray whale occurred on the coast of Wakayama and Kochi in the days of the net whaling as already stated. It is possible that they

entered into the Seto Inland Sea for calving, along the west coast of Shikoku. Their calving grounds were at least in the Beppu-wan and on the south coast of Yamaguchi. Possibly some of them then turned to east and reached as far as Kawanoe and Takuma. There is less possibility that the whale entered into the Seto Inland Sea along the west coast of Wakayama. One reason for this is the



Fig. 9. Tympanic bulla of the Usuki whale.

fact that no tomb or memorial is remaining on the west coast of Wakayama and east coast of Shikoku. Fishermen who engaged in the net whaling believed that whales come straight from off Shionomisaki, the southmost point of Wakayama, to the coast of Shikoku. Supposed migration route is shown in Fig. 10.

With the increasing of industrial development along the coast of the Seto Inland Sea and boat and ship traffic the species has been driven from there since some time prior to this century. This might be the most possible explanation why practically no gray whale has been taken by modern whaling on the coast of Japan. Mizue (1951) reports, after investigating available catch records of whaling companies in seven years from 1911 to 1932, three were taken at Ayukawa and one at Nemuro, Hokkaido. Nishiwaki and Kasuya (1970) describe two recent occurrences off Wakayama.

The feeding ground of the Japanese stock of the gray whale was probably in the Okhotsk Sea as in the case of the Korean stock (Rice and Wolman, 1971). The migration route to and from the feeding ground was possibly on the east coast of Japan, as already stated by Nishiwaki and Kasuya (1970). After driven from the calving ground in the Seto Inland Sea it probably has joined to the Korean stock. Further a possibility of joining to the California stock in the Bering Sea can not be denied. The original size of this stock is thought to be small and less than a thousand at the largest.

At Omijima, a small island on the north coast of Yamaguchi, or in the Sea of Japan, the gray whale was also taken in the days of the net whaling (Kimura, 1956). There remains catch records during a period from 1802 to 1850, by species. Annual catch, inclusive of all species, was fluctuated from one to fifteen whales.

The total catch during this period was consisted of the fin (38%), the humpback (34%), the right (19%), and the gray whale (9%). The catch of the gray whale has decreased since 1812. A question remains whether these gray whales belong to the Korean stock or they are stragglers from the Japanese stock.



Fig. 10. Possible migration route of the gray whale on the coast of Japan.
Hatched area: Supposed calving ground.

Black dots: Positions where whale tombs or memorials located.

Names of the places referred to in the text are following.

- | | | | |
|------------|-----------|-------------|-----------|
| 1. Taiji | 2. Ukitsu | 3. Usuki | 4. Beppu |
| 5. Omijima | 6. Onoda | 7. Iwaijima | 8. Kawano |
| 9. Takuma | | | |

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POSTSCRIPT

After completion of the manuscript I read a paper on the Korean stock of the gray whale by Bowen (1974). The author states that the 1968 specimen (Nishiwaki and Kasuya, 1970) resembled members of the California stock in morphological features, without mentioning the character in question. As seen in Table 3 the ratios of breadth against height of scapulae in three specimens of the gray whale are: the Kawanoe whale 1.34, Gray A (Nishiwaki and Kasuya, 1970) 1.48-1.53, and Gray B (Andrews, 1914, Korean stock) 1.31. Thus in this respect the Kawanoe whale resembles more to the member of the Korean stock than the whale reported from the coast of Japan. But the latter whale is a young female and this is thought to be a difference due to the growth.

As regards the distribution of the Korean stock Dr. K. Uchida (1964) describes a gray whale sighted by him towards the end of May 1930 on the west coast of Korea, in the Yellow Sea, at a position close to 38°N.

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