Beaked Whale *Berardius bairdi* of Japan, with Notes on *Ziphius cavirostris*.

By

HIDEO OMURA, KAZUO FUJINO,
and
SEIJI KIMURA

I. Introduction

Beaked whales have been taken from the very old days in Japan. We can find the names Tsuchi-kujira and Akabo-kujira often in old documents. Especially in Chiba prefecture the Tsuchi-kujira (*Berardius bairdi*) were taken commercially from old times and according to Fukuyama (1943) a ducument, which describes that whales were taken in the 17th year of Keicho (1612), is kept at the Daigo family. The Daigo family had been operating with small boats using hand harpoon from a base at Katsuyama, Chiba prefecture, until the beginning of the Meiji era. Tsuchi-kujira (*Berardius bairdi*) was the main object of such whaling, but also Akabo-kujira (*Ziphius cavirostris*) was caught sometimes. Average catch per year in these days was only four or five whales.

Of course, such old type of whaling went out of existence in the early days of Meiji, and later the Norwegian method was introduced. Mutsuura (1943) states that a harpoon gun was imported from Norway and the Tsuchi-kujira-whaling was resumed in Chiba prefecture in 1908, using that harpoun gun with wooden small boat. In no place other than Chiba prefecture, the whaling on Tsuchi-kujira had been carried out before the World War II, however, Omura, Maeda and Miyazaki (1953) note that in the post-war period the situation of being pressed for increase of food stuff gave impetus to this type of whaling, resulting in a sudden increase of catchers of operating. According to the Fisheries Agency (1952) the license for such small type whaling amounted to 76 in 1952. Tsuchi-kujira is also taken beside minke whales or other small toothed whales by such whalers not only in Chiba prefecture, but also in other ground now.

Four genera of *Mesoplodon*, *Berardius*, *Ziphius* and *Hyperoodon* belong to the family *Ziphiidae*, in which, however, two are taken commercially in Japan. One is Tsuchi-kujira (*Berardius bairdi* Stejneger) and the other Akabo-kujira (*Ziphius cavirostris* Cuvier). Ogawa (1936)

reports a sample of *Mesoplodon densirostris* (Blainville) from Japan, but it seems to us that this whale is only taken in very rare occasion. The fourth, *Hyperoodon* (Bottlenose or Bottlenosed whale) has never been reported from Japan in scientific paper. Though there are some publications in Japan which describe that the bottlenose whale is taken in Japanese waters, but this is a mistake. Tanaka and others (1933) note the scientific name of Tsuchi-kujira as *Hyperoodon rostratus* Müller, however this is clearly a mistake of *Berardius bairdi* Stejneger. Tsuchi in Tsuchi-kujira means wooden hammer used in the old days in Japan, of which shape is very resemble to a bottle. Kujira means a whale. Accordingly most people thought that the bottlenose whale is the English name of Tsuchi-kujira, without any evidence of identification.

Also in USSR, Arseniyev and others (1937) and Tomilin (1935) describe that bottlenose whale, *Hyperoodon rostratus*, migrate to the coast of Kamchatka and there are also some records of bottlenose in the catch of Kuril Islands and Kamchatka in the past issues of the International Whaling Statistics. These bottlenose are probably *Berardius*, as already pointed out by Slipp and Wilke (1953). Also in USA, the name of bottlenose was used by whalers in the past, but Scheffer and Slipp (1948) describe that it reasonably certain that the bottlenose whale captured were, indeed, *Berardius* after investigating the amount of oil yielded. As Tomilin (1935) states that the bottlenose attains the body length of 11 meters and produces about 2 tons of oil in average, it is thought that the same can be applied to the Russian bottlenose.

Berardius bairdi is one of little known whale, inhabiting in the waters of the North Pacific. As regard those in the eastern side of the North Pacific, True (1910), Scheffer (1949), Pike (1953), and Slipp and Wilke (1953) contributed considerably, and in particular, very valuable informations were presented recently by the above mentioned latter two papers. However in the western side, to our regret, no scientific report in detail on this whale has been published before, as far as we know. In the light of the above, we collected the data as possible as we could in these years, which are now presented in this report.

Our sincere thanks are due to Dr. R. Kellogg of the U.S. National Museum for his kind advise, and to Dr. T. Ogawa of the Tokyo University, who is so kindly permitted us to read some literatures. We are also indebted to Dr. K. Okada of the National Science Museum, who allowed us to investigate the specimens under his care.

Catch Records and its Analysis

Berardius bairdi is called generally Tsuchi-kujira in Japan, however, Tsuchimbo is more popular in Chiba prefecture. Rather a few number of *Berardius* taken in the pre-war days. According to the Japan Association of Whaling (1943), only 24 whales were caught in 1943 and total number of three years 1941–43, both years inclusive, amounted to 45. In the post-war days, however, the numbers of small type whaling vessels have increased considerably, and moreover the grounds expanded to the northeast part of Japan proper or to Hokkaido, resulting the increased catch of *Berardius*. In 1947 the Fisheries Agency of the Japanese Government promulgated whaling regulations for such small type vessels and placed them under it's control. Table 1 shows the number of *Berardius* taken in each area during the years 1948–1952. Each area is as follows (see also Fig. 1).

Table 1. Catch of *Berardius bairdi* in Japan during the years 1948-1952.

Years	Sex	Areas							Sex ratio
		I	II	III	IV	V	VI	Total	
1948	Male	28	0	1	15	3	0	47	64.38
	Female	15	0	1	9	1	0	26	35.62
	Total	43	0	2	24	4	0	73	100.00
1949	Male	26	0	0	21	9	0	56	60.87
	Female	22	0	0	9	5	0	36	39.13
	Total	48	0	0	30	14	0	92	100.00
1950	Male	93	15	0	9	7	3	127	68.28
	Famale	29	3	1	10	13	3	59	31.72
	Total	122	18	1	19	20	6	186	100.00
1951	Male	73	77	10	7	4	5	176	69.84
	Female	35	25	1	11	2	2	76	30.16
	Total	108	102	11	18	6	7	252	100.00
1952	Male	45	149	19	6	3	3	225	70.09
	Female	27	53	7	5	4	0	96	29.91
	Total	72	202	26	11	7	3	321	100.00
Total	Male	265	241	30	58	26	11	631	
	Female	128	81	10	44	25	5	293	
	Total	393	322	40	102	51	16	924	
	Sex ratio								
	Male	67.43	74.84	75.00	56.86	50.98	68.75	68.29	
	Female	32.57	25.16	25.00	43.14	49.12	31.25	31.71	

Area I. Coast of Chiba prefecture. One landstation operated before the war. Two landstations are operating from 1949 season.

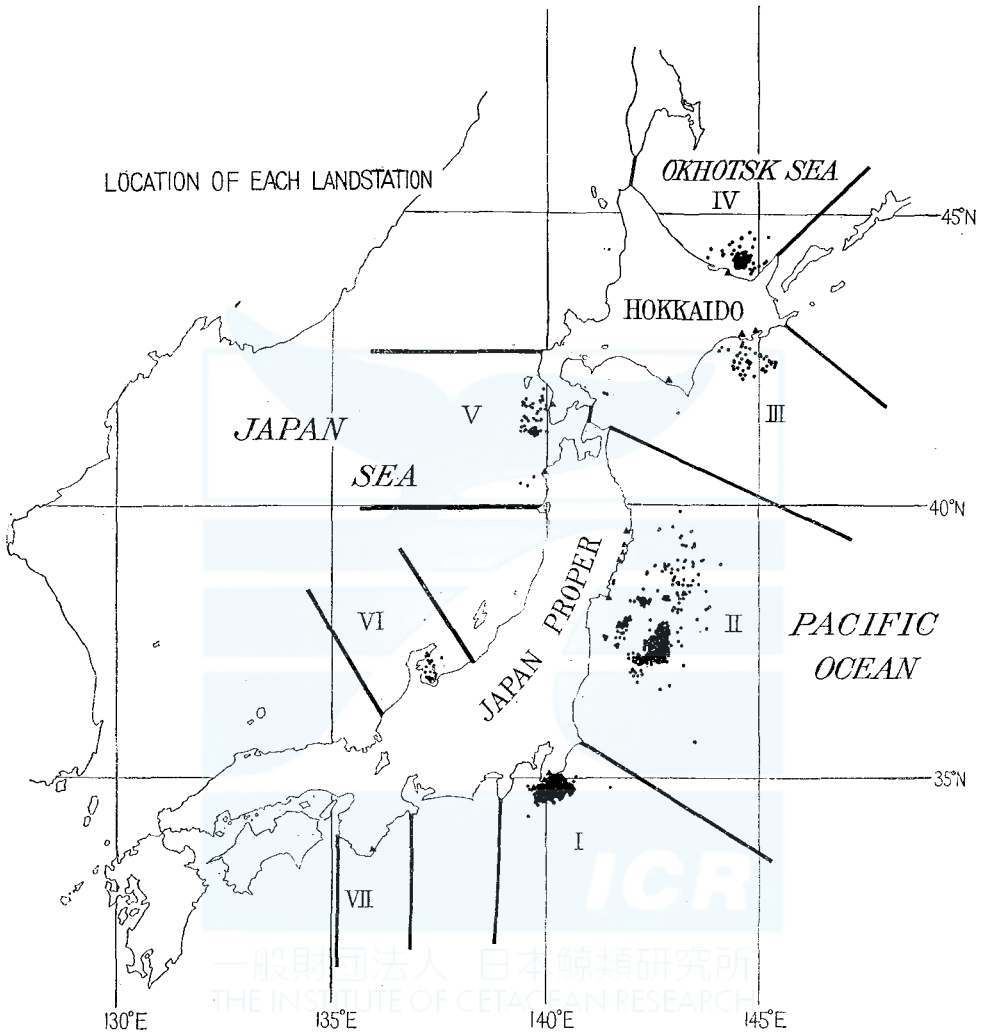

Fig. 1. Position of catch of *Berardius* in Japan, 1948–52. Roman numerals show each area number.

Area II. North-eastern coast of Japan proper. *Berardius* are taken from and inclusive 1950. Fourteen landstations operated in 1952.

Area III. South coast of Hokkaido. Four landstations operated in 1952.

Area IV. East coast of Hokkaido (Okhotsk Sea.). Three landstations are operating.

Area V. West coast of Hokkaido and Aomori prefecture (Japan Sea). Two landstations operated in 1952.

Area VI. Toyama bay. Two landstations operated in 1952.
Area VII. Coast of Wakayama prefecture. No Beaked whale has been taken in this area, except *Ziphius*.

As shown in table 1, the catch of *Berardius* is increasing year by year, reaching over 300 whales in 1952. Jonsgård and Øynes (1952) report that the yearly catch of the bottlenose in Norway is generally below 100 whales in the recent years and even in 1949, in which the catch reached maximum after 1938, 221 bottlenoses were taken. Therefore there might be no other ground in which so many beaked whales are taken than the waters around Japan.

Most *Berardius* are taken in the Areas I and II. In other areas the catch is very small, compared with the former. Sex ratio in the catch is very striking, showing the preponderant number of males. In the total of these five years, about 68 per cent is occupied by males. Female is about 32 per cent of the total, namely only one half of the male. Similar fact can be seen also in each year and in each area, except Area V. We have very scantly records of foetuses. Only 25 foetuses were reported in these five years, in which one is sex unknown. Remainder 24 is 15 males (62.5%) and 9 females (37.5%). In 1953 10 foetuses, 5 males and 5 females, were reported as of end of October. We can not conclude definitely from the above data, however, we could not suppose that there is a difference in ratio of males and females in the North Pacific. There might be, however, some differences in movement between males and females.

Whaling season for *Berardius* commences usually from April and closes in November, having its flourishing period in summer. Fig. 2 shows the monthly catch of *Berardius* in each area in the past five years, separately according to sex. As shown in this figure the peak of catch lies in July in Area I, whereas the peak lying in August in Area II. There is one month difference between both peaks. As whalers say that *Berardius* approach the coast of Chiba prefecture from the south and pass to the north, the main schools in Area I are deemed to reach the ground in Area II one month later. Main season in Area III is in October and November, though only few *Berardius* are caught in this area. Whether the population in this area is a part of that in Areas I and II or a different one, we have no data at present. In Area IV (Okhotsk Sea) there are two peaks, i.e. one in spring and another in autumn. We can not conclude that *Berardius* in the Okhotsk Sea came from Areas I, II or III, because whaling commences in Area IV in April, earlier than in any other areas. Consequently, it is supposed that there is a different population or community in the Okhotsk Sea from others, which approaches to

the coast of east Hokkaido in spring and in autumn and moves north to the northern part of Okhotsk Sea during summer. Areas IV and V are in the Japan sea. *Berardius* in these areas are taken during three months from the beginning of June to the end of August. Comparatively small sized whales migrate into these areas, as stated in the latter part of this report.

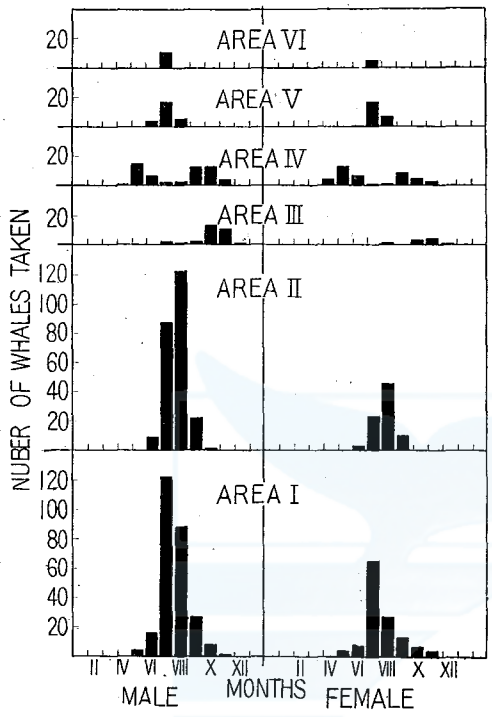

Fig. 2. Monthly catch of *Berardius* in each area. Total of 5 years 1948–52, inclusive.

Size distribution of *Berardius* taken during the five years 1948–1952 are shown in Table 2 and Fig. 3. The biggest male is 38 feet and the biggest female is 40 feet. Further, the peak lies at 35 feet in males, but at 36 feet in females, making a difference of one foot. In *Berardius*, therefore, it is likely that female is bigger than male as such is the case in baleen whale. Also in *Ziphius cavirostris* female is bigger than male by about one foot (see Table 12 and Fig. 30).

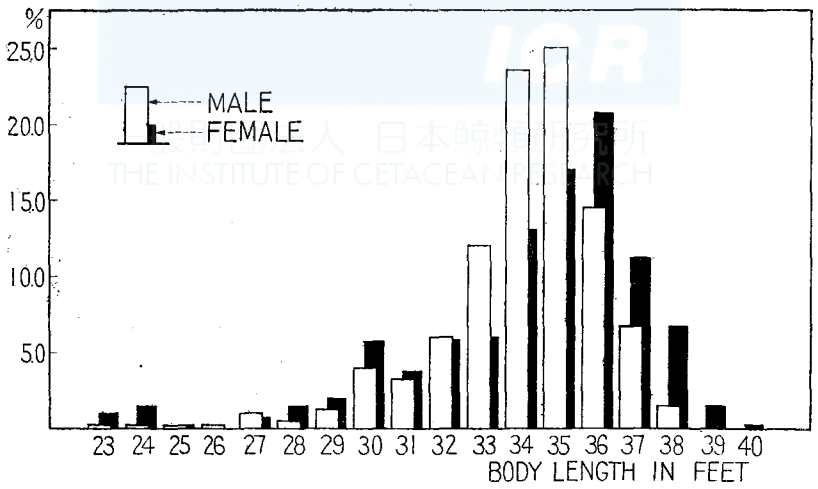

Fig. 3. Size distribution of *Berardius* expressed as Percentages. Total of 5 years 1948–1952, inclusive.

According to Jonsgård and Øynes (1952), male reaches up to 11 meters long and the biggest female is about 9 meters in length in bottlenose. Size distribution of bottlenoses shows also male is bigger than female as in the other species of toothed whales. We have no such data of *Mesoplodon*. We can safely conclude, therefore, that in the Beaked whales at least in the two species, *Berardius bairdi* and *Ziphius cavirostris*, female is bigger than male as in baleen whales. Scheffer and Slipp (1948) state that length of male to about 42 feet, female

Table 2. Size Distribution of *Berardius*. Total of 5 years 1948–1952.

Body length in feet	Actual number			Per cent		
	Male	Female	Total	Male	Female	Total
18	—	1	1	—	0.3	0.1
19	—	1	1	—	0.3	0.1
20	—	1	1	—	0.3	0.1
21	—	—	—	—	—	—
22	—	—	—	—	—	—
23	2	3	5	0.3	1.0	0.5
24	1	4	5	0.2	1.4	0.5
25	1	1	2	0.2	0.3	0.2
26	1	—	1	0.2	—	0.1
27	6	2	8	0.9	0.7	0.9
28	4	4	8	0.6	1.4	0.9
29	8	6	14	1.3	2.1	1.5
30	25	17	42	3.9	5.8	4.5
31	19	11	30	3.2	3.8	3.2
32	38	17	55	6.0	5.8	6.0
33	76	18	94	12.0	6.1	10.3
34	149	38	187	23.6	13.0	20.3
35	158	50	208	25.0	17.1	22.6
36	91	61	152	14.4	20.8	16.4
37	43	33	76	6.8	11.3	8.2
38	9	20	29	1.4	6.8	3.1
39	—	4	4	—	1.4	0.4
40	—	1	1	—	0.3	0.1
Total	631	293	924	100.0	100.0	100.0
Average length	34.06	34.10	34.08			

smaller in *Berardius bairdi*, however, this is not supported by our data. True (1910) reports about the skeletons of *Berardius bairdi*

kept in the United States National Museum, in which the biggest one is 41 feet (Cat. No. 49725). Its sex is noted as male (?). As regards this specimen he cites a letter from Mr. J. H. Ring, of Ferndale, California, dated October 24, 1904. In this letter nothing is wrote about its sex, so it is very doubtful that this whale is certainly a male. Next to that is the Cat. No. 49726, a female of 40 feet 2 inches long. Female may reach up to 40 or 41 feet, judged from the data now available. The biggest male is 38 feet long in our data, however, as there are 9 whales of this body length, the male is supposed to attain a little more, e.g. 39 feet.

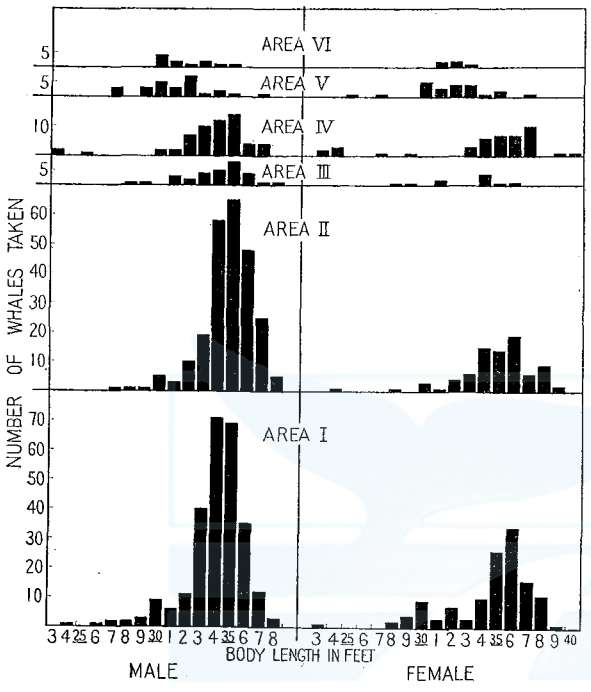

Fig. 4. Size distribution of *Berardius* in each area. Total of 5 years 1948–1952, inclusive.

Size distribution of *Berardius* in each area is histogramed in Fig. 4. Most remarkable point in this figure is the size composition in the Areas V and VI, smaller whales are taken compared with those in the other areas. Though the whales in these areas were not identified yet, but it is not probable that these whales belong to the other species of *Ziphiidae* (e.g. *Hyperoodon*), because most of them are 30 feet or over and too large to be ascribed to other species except *Berardius*. The reason for this may be there that only younger whales approach to the coast of these areas.

External Characters

Color of *Berardius* is described by Pike (1953) as "the body is black on the head, back, flukes and flippers. The undersurface is of a slightly lighter shade, with white and gray markings." According to our observations, however, color of whole body is pure black or somewhat lighter, even on the undersurface of the body. It is not

certain, but most whalers say that there are two groups of *Berardius*, one being black and another slatish. As there are many white scratch marks (Plate I. 1) on the skin of *Berardius*, especially in the old bull, the color looks more lighter than it is in such whale. There are white patches in three regions on the ventral side of the body, i.e. on the throat, between the flippers, and at the umbilicus (Plate I. 2, 3, Plate II. 2). Every *Berardius* seems to have the white patch at the umbilicus, but as for those on the throat or between the flippers, there are considerably individual differences. The whale shown in Plate I. 2 has only a patch on the throat, except that at umbilicus, but in the whale shown in Plate I. 3 this patch extends posteriorly into the region between the flippers.

In most animals the white scratch marks are seen, more numerous on the dorsal side than the ventral. These scratch marks have been attributed to the teeth of rival males as in sperm whales. Pike (1953) notes, however, this explanation seems unlikely to be applicable to this species whose teeth are either buried in the gum or are blunt and protrude only slightly. Pike's opinion seems to us not correct, because teeth are buried in the gum only in the immature whale. After the sexual maturity is reached the teeth protrude above the gum and sharp enough to be attributed to the cause of the scratch marks (Plate III. 1, 3). There are some whales whose teeth were abrade considerably, or in extreme cases, both anterior teeth are removed from the alveori and completely lacking (Plate III. 2). As such cases are observed mostly in old whales, they might be ascribed to the struggle with rivals.

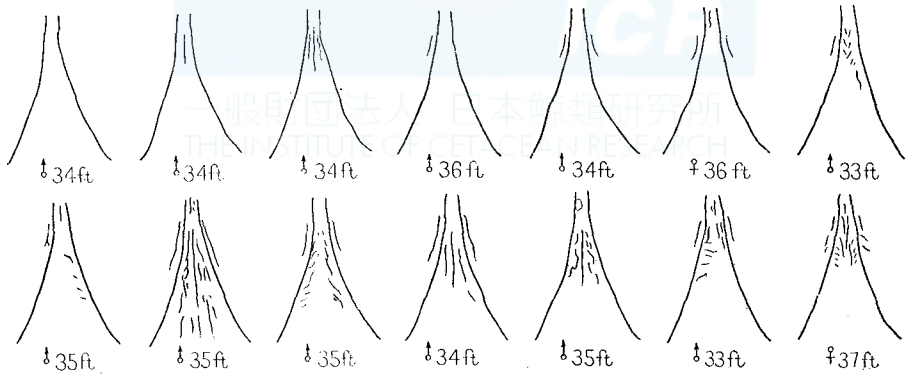

Fig. 5. Examples of the V-shaped grooves in *Berardius bairdi*

The V-shaped grooves extend posteriorly about 70 cm. from nearly the middle part of the lower jaw, with its apex pointing forward.

Two grooves come very near, but never meet at the apex, apart from each other about 4 cm. Besides these two grooves, in some individuals there are short median or very irregular shaped grooves. Fig. 5 shows such example. As shown in this figure, there are many varieties of these grooves, but never lacking the original two. Also in foetus these grooves are well defined (Plate IV. 3).

Notch of flukes is not remarkable, but concaved slightly in middle of hinder margin (Plate II. 3). The flippers are not pointed, as already stated by Pike (1953) (Plate I. 2). However in foetus the flippers are rather pointing, unlike to its parents (Plate IV. 1).

The body proportinons were measured in Chiba prefecture in 4 males and one female, a total of 5 whales in 1952, and at Ayukawa, Miyagi prefecture, in 20 males and 5 females, a total of 25 whales in 1953, making a grand total of 30 whales (24 males and 6 females). Besides above, five foetuses (3 males and 2 females) were measured their proportions.

The measurements were carried on to the following parts.

(1) Total length from tip of snout to notch of flukes.
(2) Projection of lower jaw beyond tip of snout.
(3) Tip of snout to blow-hole.
(4) Tip of snout to angle of gape.
(5) Tip of snout to centre of eye.
(6) Tip of snout to axilla of flipper.
(7) Centre of eye to centre of ear.
(8) Notch of flukes to posterior emargination of dorsal fin.
(9) Width of flukes at insertion.
(10) Notch of fluckes to centre of anus.
(11) Notch of fluckes to umbilicus.
(12) Centre of anus to centre of reproductive aperture.
(13) Vertical height of dorsal fin.
(14) Length of base of dorsal fin.
(15) Tip to anterior end of lower border of flipper.
(16) Axilla to tip of flipper.
(17) Greatest width of flipper.
(18) Length of severed head from condyle to tip.
(19) Length of snout.
(20) Tail flukes, tip to notch.

All these measurements recorded in centimeters and percentages against body length are tabulated in the appended table. Mean values and their standard deviations are shown in Table 3.

Table 3. Body proportions of *Berardius bairedi* from Japan.
(Percent of total length)

Measurements	Male			Female		
	n	$\bar{x}$	σ	n	$\bar{x}$	σ
2. Projection of lower jaw beyond tip of snout	16	0.87	0.18	4	0.80	0.10
3. Tip of snout to blow hole	22	10.89	0.45	6	11.30	0.65
4. Tip of snout to angle of gape	24	6.41	0.54	6	6.46	0.56
5. Tip of snout to centre of eye	24	9.64	0.88	5	9.90	0.97
6. Tip of snout to axilla of flipper	20	21.05	0.87	5	21.20	0.75
7. Centre of eye to centre of ear	8	1.89	0.21	2	1.95	0.15
8. Notch of flukes to posterior emagination of dosal fin	24	26.67	1.52	6	28.00	1.42
9. Width of flukes at insertion	3	7.50	0.24	0	—	—
10. Notch of flukes to centre of anus	20	28.60	1.04	5	29.20	1.94
11. Notch of flukes to umbilicus	24	57.08	1.89	6	58.00	1.29
12. Centre of anus to centre of reproductive aperture	24	7.23	1.15	6	4.05	1.41
13. Vertical height of dorsal fin	21	2.51	0.32	6	2.77	0.22
14. Length of base of dorsal fin	23	6.75	1.15	6	6.30	1.23
15. Tip of anterior end of lower border of flipper	23	12.21	0.61	6	12.05	0.86
16. Axilla to tip of flipper	19	7.96	0.40	5	8.00	0.25
17. Greatest width of flipper	20	4.16	0.16	5	4.18	0.20
18. Length of severed head from condyle to tip	1	12.6	—	0	—	—
19. Length of snout	24	6.17	0.32	6	6.28	0.37
20. Tail flukes, tip to notch	7	13.73	1.05	1	14.00	—

n....Number of measurements
$\bar{x}$....Mean value
σ....Standard deviation.

Furthermore, each measurement is plotted in Figs. 6–25, expressed as percentages against total length, together with the data presented by Pike (1953) for comparison. The latter consisted of two *Berardius*, one being 33 feet 3 inches (10.13 meters) male and the other 29 feet 3 inches (8.92 meters) female, taken in the northwest coast of Vancouber Island, British Columbia. Though in these figures male and female are not classified for the British Columbia sample for the purpose of simplification of the graphs, it is easily identified according to their

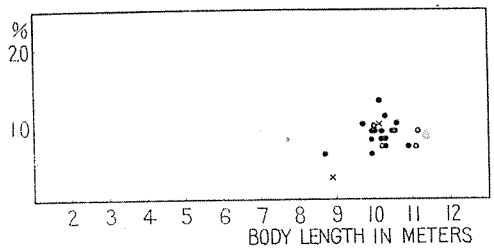

Fig. 6. Projection of lower jaw beyond tip of snout.
● Male ○ Female × British Columbia

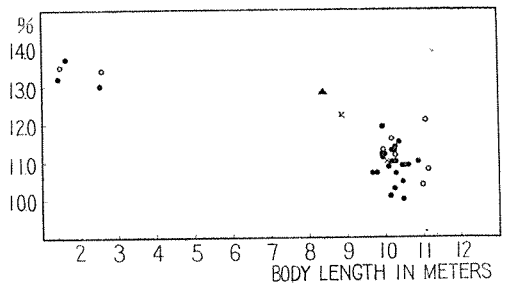

Fig. 7. Tip of snout to blow-hole.
● Male ○ Female × British Columbia
△ *Berardius arnuxi*

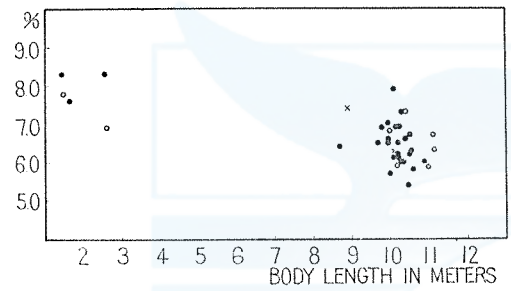

Fig. 8. Tip of snout to angle of gape.
● Male ○ Female × British Columbia

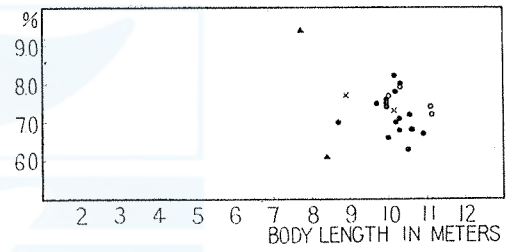

Fig. 9. Tip of mandible to corner of mouth.
● Male ○ Female × British Columbia
△ *Berardius arnuxi*

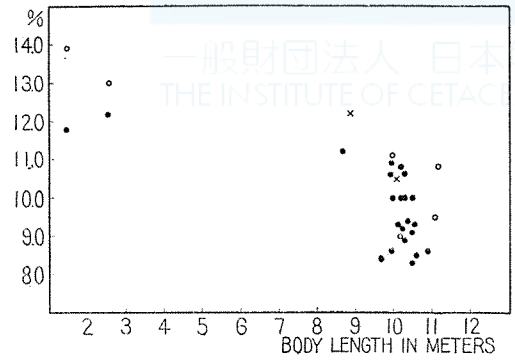

Fig. 10. Tip of snout to centre of eye.
● Male ○ Female × British Columbia

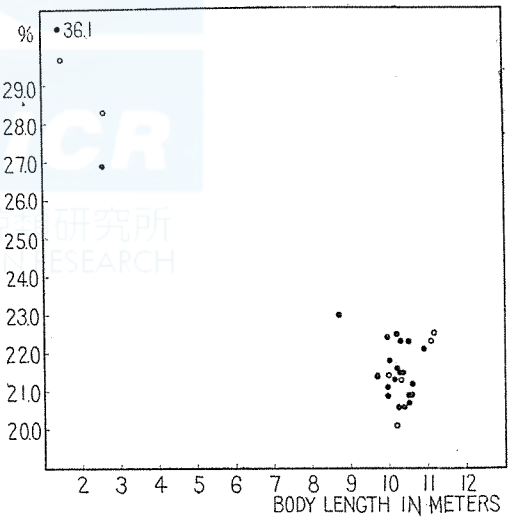

Fig. 11 Tip of snout to axilla of flipper.
● Male ○ Female

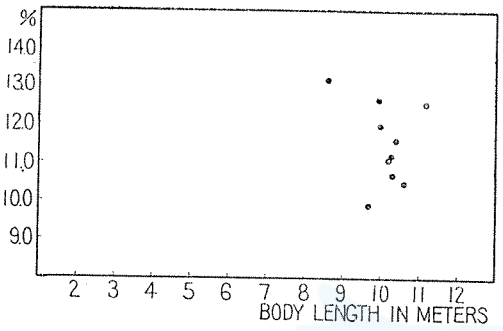

Fig. 12. Tip of snout to centre of ear.
● Male
○ Female

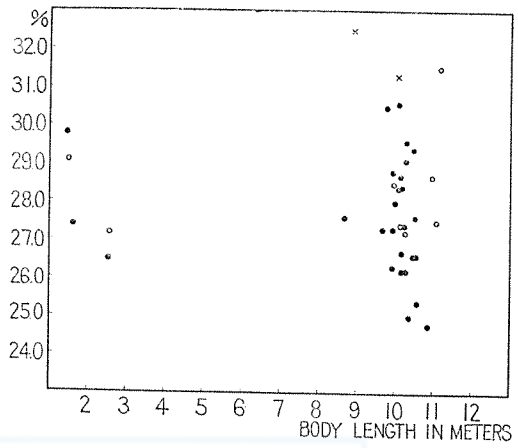

Fig. 13. Notch of flukes to posterior emargination of dorsal fin.
● Male
○ Female
× British Columbia

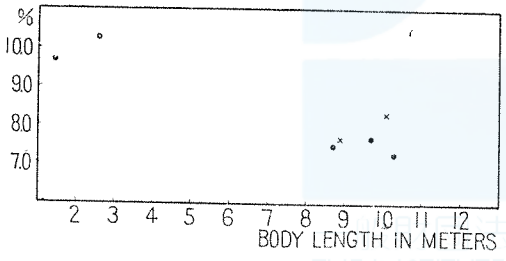

Fig. 14. Width of flukes at insertion.
● Male
○ Female
× British Columbia

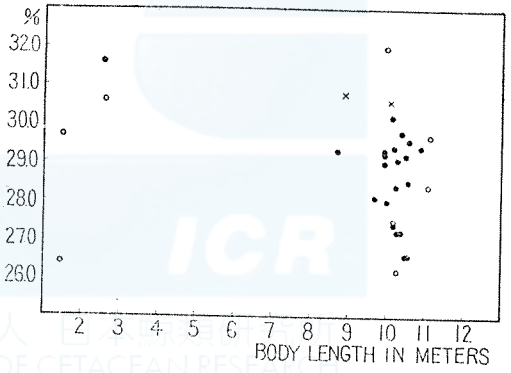

Fig. 15. Notch of flukes to centre of anus.
● Male
○ Female
× British Columbia

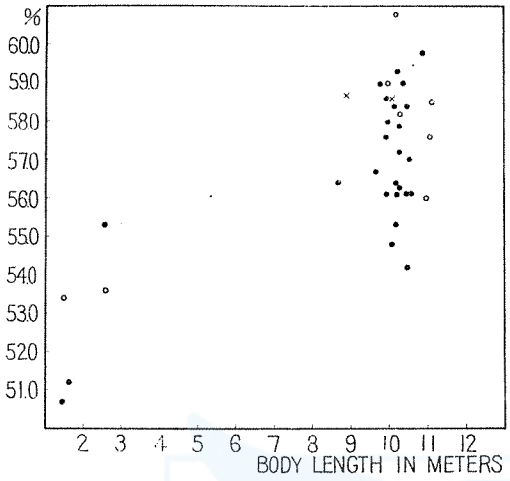

Fig. 16. Notch of flukes to umbilicus.
○ Male
○ Female
× British Columbia

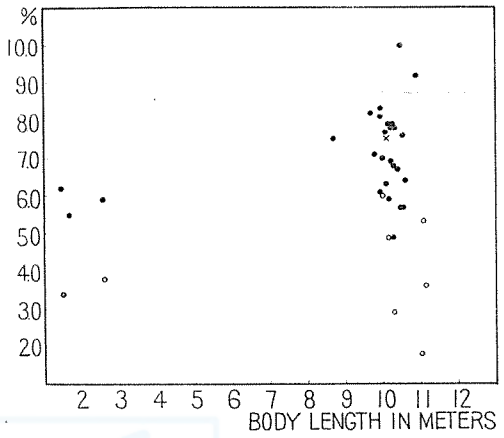

Fig. 17. Centre of anus to centre of reproductive aperture.
● Male
○ Female
× British Columbia.

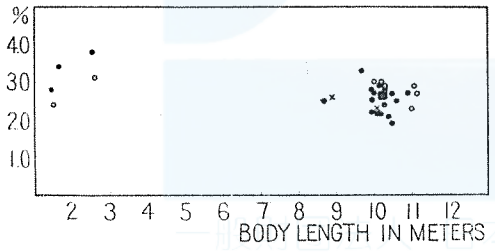

Fig. 18. Vertical height of dorsal fin.
● Male
○ Female
× British Columbia

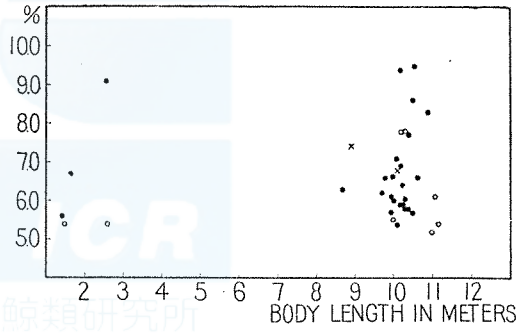

Fig. 19. Length of base of dorsal fin.
● Male
○ Female
× British Columbia

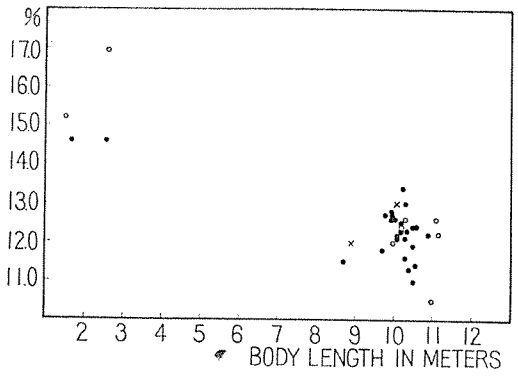

Fig. 20. Tip to anterior end of lower border of flipper.
- ● Male
- ○ Female
- × British Columbia

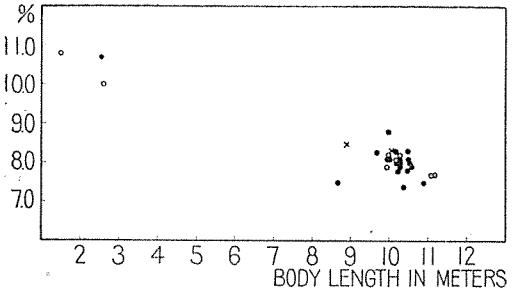

Fig. 21. Axilla to tip of flipper.
- ● Male
- ○ Female
- × British Columbia

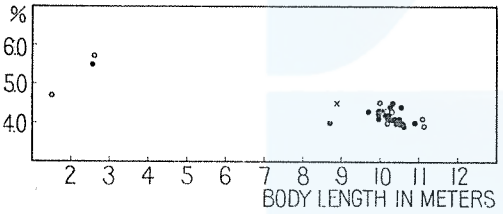

Fig. 22. Greatest width of flipper.
- ● Male
- ○ Female
- × British Columbia

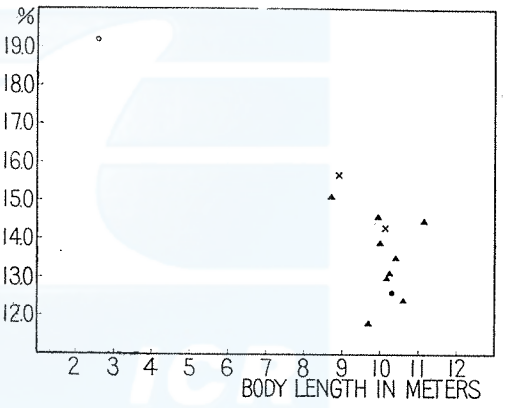

Fig. 23. Length of severed head from condyle to tip.
- ● male
- ○ Female
- × British Columbia
- △ Estimated.

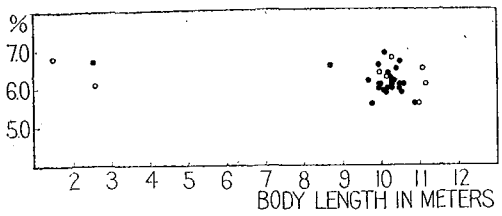

Fig. 24. Length of snout.
● Male
○ Female

body length, i.e. the bigger is male and smaller female. Whales smaller than 3 meters in these graphs are foetuses. Measurement No. 7 (Centre of eye to centre of ear) is expressed as tip of snout to centre of ear in Fig. 12, for the convenience of comparison in head region. Unfortunately we have only one measurement, except one in foetus, for the measurement No. 18 (Length of severed head from condyle to tip) in spite of this measurement is very important for the comparison with *B. arnuxi*, so we estimated this proportion by adding 1.9 per cent to the value from tip of snout to centre of each whale. This 1.9 per cent is the difference between the proportions of the length of the severed head and the length from tip of snout to centre of ear in the whale we measured. These estimated values are shown by another marks from others in Fig. 23.

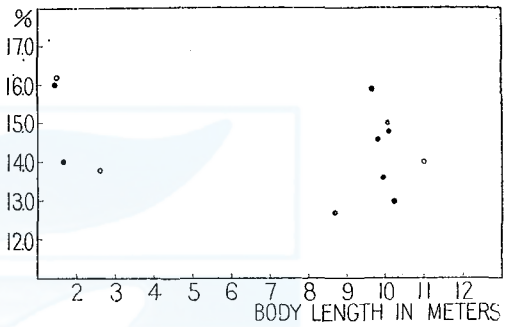

Fig. 25. Tail flukes, tip to notch.
● Male
○ Female

Difference of proportion between male and female is only noticed in measurement No. 12, i.e. centre of anus to centre of reproductive aperture, as is the case in other whales. No remarkable differences are also seen between *Berardius* from Japan and from British Columbia, except following two points.

1. In measurement No. 8 (Notch of flukes to posterior emargination of dorsal fin) a somewhat greater value is seen for the whales from British Columbia than those from Japan (Fig. 13).

2. British Columbia's female has a greater head region than others (Figs. 7, 10, 23).

However, among above stated, point one is probably result of the poorly defined point "posterior emargination of dorsal fin." Point two is perhaps to be ascribed to the fact that body proportions differ in the course of growth, as suggested by those in foetuses. We can safely conclude, therefore, that there is no difference of proportion between *Berardius* from Japan and from British Columbia.

In foetuses body proportions are different from the adult in the

following points.

1. Head proportion is bigger for the foetuses (Figs. 7, 8, 10, 11 and 23).
2. Flippers situated more posteriorly in foetuses (Fig. 11).
3. Larger flippers in foetuses (Figs. 20, 21, and 22).
4. More posteriorly situated umbilicus for the foetuses, though the position of anus is deemed similar (Figs. 15 and 16).
5. A somewhat higher dorsal fin for the foetuses, though no difference is seen in the length of its base (Figs. 18 and 19).
6. More broader flukes at insertion for the foetuses (Figs. 14 and 25.)

Besides above, there are some differences in the external form between the both. A most striking point is the length of the lower jaw. As shown in Plate IV. 1 and 2 the length of lower jaw is nearly the same length of the upper, i.e. no projection of lower jaw beyond tip of snout. In the adult the forehead rises abruptly, making a shape similar to a bottle (Plate II-1), however in foetus, the bulge on the forehead is less prominent (Plate IV-1, and 2). As already stated, the flippers are rather pointing as seen in Plate IV-1. In this foetus, the coloration of the body is pinkish in general and with some gray patches on it.

Though we have no data at present as regards when these differences in proportion or in shape will be reduced to a normal one, however, it is likely that there might occur some changes in proportion with the growth of the body after parturition.

As regards the differences of the external dimensions between *B. bairdi* and *B. arnuxi*, True (1910) notes that the specimen of *arnuxi* appears to have had narrower flukes, shorter pectoral fin, and a rather higher dorsal fin, situated further forward than in *bairdi*. Pike (1953) reports, after comparing two *Berardius* taken from British Columbia to the specimen presented by True, that the comparison bears out True's observation that the flukes are wider and the flippers longer in *bairdi* than in *arnuxi*. However, Slipp and Wilke (1953) describe that the two species may be less well marked than previously supposed, after investigating a *Berardius* stranded at Ocean City, Washington. The body dimensions of *B. arnuxi* (body length 27 ft. 6 in. (8.38 meters)) presented by True for the comparison with *B. bairdi* are the following seven points.

Distance from tip of snout to blow hole	12.8%
Distance from tip of mandible to corner of mouth	6.1
Breadth of flukes from tip to tip	19.1
Length of pectoral fin along outer edge	9.4

Distance from anus to "end of body"	(34.0)%
Height of dorsal fin	3.0
Distance from anterior base of dorsal fin to "end of body"	(34.6)

Among above listed seven measurements, distance from tip of snout to blow hole shows greater value for *B. arnuxi* than ours (Fig. 7). It is likely, however, this may be ascribed to the change of body proportion during the course of the growth, as is deemed for the British Columbia female. As regards head proportion, the similar can be said as shown in Fig. 23. Fig. 9 is made by calculating the length from tip of mandible to corner of mouth from the measurements No. 2 (projection of lower jaw beyond tip of snout) and No. 4 (Tip of snout to angle of gape) for the comparison with *B. arnuxi*. Similar calculation are made for the whales from British Columbia too. Though the smallest value is presented by *arnuxi*, we can not conclude that there is a significant difference between the two species. Unfortunately we does not mesured the breadth of flukes from tip to tip, in which a remarkable difference is seen between *arnuxi* and Pike's measurement for *bairdi*. But, judged from our measurement No. 20 (Tail flukes, tip to notch), it is supposed hardly to occur that our *bairdi* show as small value as 19.1 per cent against the total length, as is the case in *arnuxi*. As regards the length of pectoral fin, *arnuxi* shows very smaller value than ours, when compared with Fig. 20. Anus is seemed to situate more posteriorly in *bairdi* than *arnuxi*, because notch of flukes to centre of anus is below 32 per cent of the total length in *bairdi* and distance from anus to "end of body" is 34 per cent in *arnuxi* (Fig. 15). However, it should not be deemed as established, because we don't know what it meant by "end of body." No differences are seen concerning the height of dorsal fin or its position, judged from the Figs. 18, 13 and 14.

In conclusion above, the Pike's opinion is supported by our data, i.e. the flukes are wider and the flippers longer in *bairdi* than in *arnuxi*.

Teeth

The teeth are concealed beneath the gum before whale reach its sexual maturity, but exposed from the gum in matured whale. (Plate II–1, III–1, 3). *Conchoderma* are attached sometimes on the anterior teeth, like in sperm whale (Plate III–3). Caprellid amphipods are seen often in the region of the teeth. In some whales, especially in older one, teeth are abraded in their apices considerably and in the

extreme case both anterior teeth are lacking (Plate III–2). As already stated, these causes are thought to be ascribed to the struggle with rivals.

The shape of teeth are roughly triangular in side view, anterior teeth being larger, posterior smaller (Plate V, VI). Its shape and size, however, are dependent on individuals or on their age. In foetus of 9 feet long, teeth is consisted only of dentine and thin layer of enamel, convering the outside of the former, inside being hollow. Their apices are acute and with no root rugosities and their shape are rather conical. After paturition, however, the inside cavity is gradually filled with osteo-dentine and finally the root is closed, making a rugose base. Their shape are slightly depressed laterally. Sometimes a narrow canal is left amidst the mass of bony pulp. On the other hand, outside the teeth a layer of cement is formed yearly, making a coating of cement, from which we think, it is possible to determine the age of *Berardius*. The longitudinal section of an anterior tooth is shown in Fig. 26.

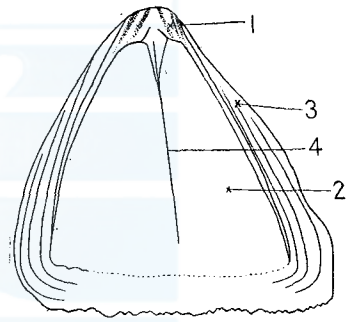

Fig. 26. Longitudinal section of anterior tooth.
1. dentine. 2. Osteo-dentine.
3. Coating of cement. 4. canal

Our data of teeth dimensions are presented in Table 4, together with percentages of greatest height and greatest width at apex against the greatest width of the tooth. Number of corpora lutea in the ovaries are also noted, when observed. The greatest width at apex denotes the degree of abrasion, which is seen mostly in the anterior teeth of the sexually matured whale. It is clear from this table that the lengths of the anterior teeth are not parallel to the body length, while their width increase with age. That is because of comparatively early stop of longitudinal growth and abrasion at apex. Accordingly the greatest height reduced to percentages of the greatest width decreases with age after the sexual maturity is attained. It is noted from this table that the abrasion of anterior tooth occurs also in female. If the cause of such abrasion and scratch marks on the skin are really the struggle with rival, then it should be concluded that also female join such struggle, unlikely to sperm whale. *Berardius* swim in the sea usually consisting a school of about 10 or more individuals. But it is very unlikely that this school is a so-called harem, consisted of leader male and others all females, because male is very preponderant in the catch records, as already stated in former part of this report. The habit of *Berardius*,

Table 4. Dimensions of teeth of *Beradius bairdi* of Japan.

Body length in feet	Sex and side	Anterior teeth				Posterior teeth			Number of corpora lutea
		Greatest height	Greatest width	Greatest width at apex	Root	Greatest height	Greatest width	Greatest width at apex	
			(Length in millimeters)						
9	♀ L	22	18	0	open	12	15	0	foetus
	♀ R	22	18	0	open	12	16	0	
29	♂ R	84	57	0	recently closed	48	33	0	immature
30	♀ L	81	60	0	recently closed	48	35	0	none (immature)
	♀ R	82	54	0	recently closed	47	34	0	
33	♀ L	71	65	20	closed	55	33	0	11
35	♀ L	86	73	11	closed	Ca. 55	45	0	unknown
35	♂ L	Ca. 81	74	16	closed				mature
	♂ R	Ca. 82	76	15	closed				
35	♀ L	83	65	14	closed	53	26	0	7
	♀ R	84	62	17	closed	53	22	0	
36	♀ L	Ca. 75	70	18	closed	Ca. 54	48	0	14
	♀ R	Ca. 73	68	15	closed	Ca. 52	43	0	
36	♀ L	78	89	20	closed				4 in one ovary, another ovary missed
	♀ R	80	87	19	closed				
			(Per cent of width)						
9	♀ L	124	100	0		80	100	0	
	♀ R	124	100	0		75	100	0	
29	♂ R	147	100	0		145	100	0	
30	♀ L	135	100	0		137	100	0	
	♀ R	152	100	0		138	100	0	
33	♀ L	109	100	31		167	100	0	
35	♀ L	118	100	15		122	100	0	
35	♂ L	109	100	22					
	♂ R	108	100	20					
35	♀ L	128	100	22		204	100	0	
	♀ R	135	100	27		241	100	0	
36	♀ L	107	100	26		112	100	0	
	♀ R	107	100	22		121	100	0	
36	♀ L	88	100	22					
	♀ R	92	100	22					

therefore, may be very different from that of sperm whale, though the final explanation should be left in future investigations.

Skeleton

A skull of *Berardius* kept in the National Science Museum was measured and each measurement is presented in Table 5. This *Berardius* is a female of 36 feet in length and is deemed as physically matured, because the epiphyses of the vertebrae are fused to their centra. In Table 5, also percentages of the total skull length and of

Table 5. Skull measurements of *Berardius bairdi* from Japan. (36 ft. ♀)

Measurements	Length in mm.	Per cent of total length	Per cent of breadth
Total (Condylobasal) length	1,421	100.0	196.8
Height from vertex to inferior border of pterygoids	571	40.2	79.1
Breadth across postorbital processes	722	50.8	100.0
Breadth across middle of orbits	686	48.3	95.0
Length of rostrum	921	64.8	127.6
Breadth of rostrum at base	437	30.8	60.5
Breadth of rostrum at middle	201	14.1	27.8
Length of premaxilla	1,330	97.1	191.1
Breadth of premaxilla at middle	113	8.0	15.7
Greatest breadth of premaxillae in front of nares	230	16.2	31.9
Greatest breadth of premaxillae behind nares	194	13.7	26.6
Distance from anterior end of premaxillae to anterior end of pterygoids	1,170	82.3	162.0
Length of nasals (greatest, median)	141	9.9	19.5
Breadth of nasals (greatest)	115	8.1	15.9
Breadth of anterior nares	98	6.9	13.6
Breadth across occipital condyles	238	16.7	33.0
Breadth of right condyle	109	7.7	15.1
Height of right condyle	163	11.5	22.6
Length of mandible (right)	1,300	91.5	180.1
Length of synphysis	276	19.4	38.2
Height at coronoid	234	16.5	32.4
Distance from tip of jaw to centre of 1st tooth	48	3.4	6.6
Distance from tip of jaw to centre of 2nd tooth	168	11.8	23.3

the postorbital width are shown for the convenience of comparison with other specimens.

It is very interesting to compare these measurements to those from British Columbia presented by Pike (1953). Most of our measure-

ments fall between the male and female from British Columbia. When compared with the measurements by Slipp and Pike (1953), some differences are noted, although in some measurements the both agree fairly well.

Table 6. Selected skull dimensions of *Berardius*.

Measurements	Length in mm.				Per cent of Postorbital width			
	J. 36 Ft. ♀	B.C. 33. Ft. ♂	B.C. 29 Ft. ♀	W. 34 Ft. ♀?	J. 36 Ft. ♀	B.C. 33 Ft. ♂	B.C. 29 Ft. ♀	W. 34 Ft. ♀?
Total length	1,421	1,440	1,343	1,438	196.8	187.0	203.8	181.8
Breadth across postorbital processes	722	770	659	791	100.0	100.0	100.0	100.0
Breadth across middle of orbits	686	693	657	757	95.0	90.0	99.7	83.2
Breadth of rostrum at base	437	447	397	445	60.5	58.1	60.2	56.3
Breadth of rostrum at middle	201	208	194	206	27.8	27.0	29.4	26.0
Length of premaxilla	1,380	1,220	1,192	1,286	191.1	158.4	180.9	162.6
Distance from anterior end of premaxillae to anterior end of pterygoids	1,170	1,146	865	1,122	162.0	148.8	131.3	141.8
Length of nasals	141	120	110	135	19.5	15.6	16.7	17.1
Height of right condyle	163	180	173	171	22.6	23.4	26.3	21.6
Distance from tip of jaw to centre of 1st tooth	48	38	30	—	6.6	4.9	4.6	—
Distance from tip of jaw to centre of 2nd tooth	168	189	170	—	23.3	24.5	25.8	—

J....Japan
B.C.....British Columbia (Pike)
W.....Washington (Slipp and Wilke)

The measurements, in which differences are observed among *Berardius* from these three regions, are shown in Table 6, both in millimeters and in percentages of postorbital width. As seen in this table, *Berardius* from Japan has longer premaxillae, longer distance from anterior end of premaxillae to anterior end of pterygoids and a longer nasal. Besides above, anterior teeth located more posteriorly, but posterior teeth are, on the contrary situated more anteriorly, resulting more narrower distance between the both teeth than those from British Columbia. *Berardius* from Washington has shorter breadth across middle of orbits, narrower rostrum, and lower condyle compared with others. We can not conclude for the time being, however, whether there are any significant differences among these four specimens from three different localities.

Table 7. Dimensions of one skeleton of *Berardius bairdi* from Japan

36 Ft. ♀

Measurements	Length in millimeteres			
Length of centra of seven cervicals		309		
Atlas:				
Breadth		326		
Height		304		
Fourth cervical:				
Greatest height		232		
Greatest width		200		
Length of centrum		38		
Seventh cervical:				
Greatest height		240		
Greatest width		188		
Lengtn of centrum		41		
First thoracic:				
Greatest height		330		
Greatest width		284		
Length of centrum		63		
Nineth thoracic:				
Greatest height		462		
Greatest width		262		
Length of centrum		169		
First lumber:				
Greatest height		546		
Greatest width		546		
Length of centrum		205		
Sixth lumber:				
Greatest height		661		
Greatest width		546		
Length of centrum		242		
First caudal:				
Greatest height		727		
Greatest width		515		
Length of centrum		298		
Nineth caudal:				
Greatest height		383		
Greatest width		226		
Length of centrum		218		
Eleventh caudal, length of centrum		152		
Length of scapula	Left	635	Right	637
Height of scapula	〃	478	〃	487
Length of humerus	〃	321	〃	322

Mesaurements	Length in millimeters
Breadth of humerus at distal end	Left 160 Right 158
Length of radius	〃 368 〃 367
Breadth of radius at distal end	〃 128 〃 124
Length of ulna	〃 382 〃 382
Breadth of ulna at distal end	〃 101 〃 99
Length of sternum	1,415
Breadth of first segment of sternum	308
Length of first rib (straight)	Left 490 Right 470
Length of fifth rib (straight)	〃 1,133 〃 1,104
Length of tenth rib (straight)	〃 931 〃 934

Other skeletal dimensions are presented in millimeters in Table 7. When compared these measurements with those of *Berardius bairdi* reported by True (1910), no remarkable differences are recognized. However, there are marked differences in the size of caudal vertebrae, if compared with those of *Berardius arnuxi* and of *Berardius* stranded to Ocean City, Washington, as reported by Slipp and Wilke (1953). The latter two have more smaller nineth and eleventh caudal vertebrae, though no significant difference is noticed in the first caudal vertebra.

Table 8. Centrum lengths as percentages of condylo basal length in *Berardius*

	B. bairdi Japan ♀ Ad.	*Berardius* Ocean City ♀? Ad.	*B. arnuxi* New Zealand (Flower)	*B. bairdi* Pribirof I. ♀ Ad.	*B. bairdi* California ♂? Ad.	*B.bairdi* Pribirof I. ♂ Juv.
1st caudal vertebra	21.0	20.0	19.7	22.2	—	18.8
2nd caudal vertebra	—	—	—	—	19.7	—
9th caudal vertebra	15.3	12.1	12.2	15.8	13.6	15.1
11th caudal vertebra	10.7	7.5	7.6	11.8	11.0	13.4

In Table 8 selected centrum length of caudal vertebrae are shown as percentages of condylobasal length for the various specimens of *Berardius*. In this table, the Japanese specimen shows very similar value to other *bairdi*. And it is suggested from this table that the difference in skeleton between *bairdi* and *arnuxi* lies in smaller caudal vertebrae in posterior region for *arnuxi*. It is suggested also, from this fact, that these smaller caudal vertebrae might be connected with smaller tail flukes of *arnuxi*. It should be left in future, however, that the problem of whether the *Berardius* from Ocean City belongs really to *arnuxi* or to *bairdi*, because it seems also to us that the two species are less well-marked as pointed out by

Slipp and Wilke (1953).

Sexual Maturity and Growth

Testes for 66 males were measured their weight, and in which for 10 whales the testes were examined histologically of their maturity. These measurements were dotted in Fig. 27.

As seen in Fig. 27, the testes of less than 1 kg. are separated clearly from those of above 2 kg. and it is quite certain that the former are immature, and the latter mature. Two males of which testes were examined histologically and weighed less than 1 kg. were immature and others which weighed more than 2 kg. were all proved as mature. Thus in *Berardius* the weight of testis increase abruptly when the sexal maturity is reached. The biggest immature male was 36 feet in length and the smallest matured male was 31 feet long. Judged from this figure, we can safely conclude that the average body length at which sexual maturity is attained is 32 or 33 feet.

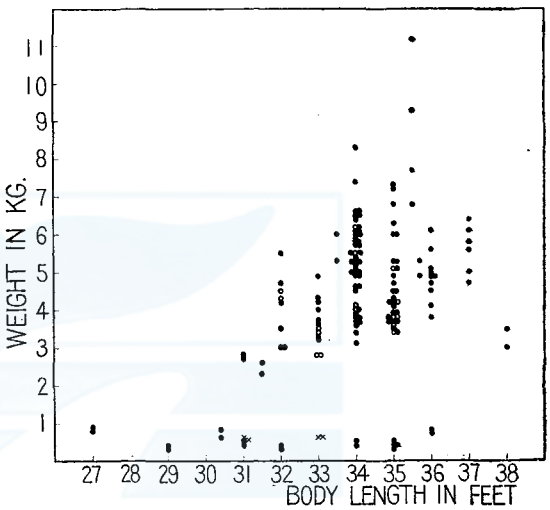

Fig. 27. Weight of testis in *Berardius bairdi* of Japan.
○ Mature ● Not examined histologically
× Immature

Table 9. Number of corpora lutea in *Berardius bairdi* from Japan.

Body length in feet	Immature	Number of corpora lutea														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	Average
30																
31	1															
32																
33												1				11.0
34	1			1		1		1								5.0
35		1			1			1								4.0
36									1					1	1	11.7
37					1	2		1								5.3
38				1												3.0

In females the ovaries for 17 whales were examined of the presence of corpora lutea and their numbers were counted, results of which are presented in Table 9.

As shown in this table, one *Berardius* of 30 feet long is immature. 33 feet one is mature and among four whales of 34 feet only one is immature. All of 35 feet long and above this body length are mature. No data of 31 and 32 feet. Thus we have only scanty data for females at present. So we investigated the record of foetus in the catch record and obtained the following.

Body length of pregnant female	*Occurence*	
	Number	*Per cent*
32 feet	1	2.9
33	0	0
34	8	23.5
35	8	23.5
36	9	26.5
37	4	11.8
38	4	11.8
Total	34	100.0

Judged from the above figures and Table 9, it is likely that the average body length at which sexual maturity is attained is 33 feet or 34 feet for females, being bigger than males by about one foot.

According to our observations, the simple way to know about the maturity of *Berardius* is to examine the teeth, because teeth are all exposed from the gum in sexually matured whales, while in immature whales the teeth are usually concealed beneath the gum. This may be served at least in rough estimation.

Fig. 28 was made by dotting the record of foetuses and *Berardius* of less than 33 feet, according to their body length and also to the date of catch. Estimated growth curve is also drawn very roughly. As seen in this figure, the pairing of *Berardius* takes place in February and the parturition in December in most individuals, length of gestation being about 10 months. The biggest foetus in our record is 14 feet long and according to True (1910), the *Berardius* observed by Dr. Stejneger, which was conjectured it had died immediately after having been born, was 4.81 meters (15 feet 9 inches) long. However, this body length was not measured by straight line, but the length from tip of upper jaw to notch of caudal fin, along the middle of the back, without, however, following the angle between beak and forehead. So we estimated the body length at birth as 15 feet.

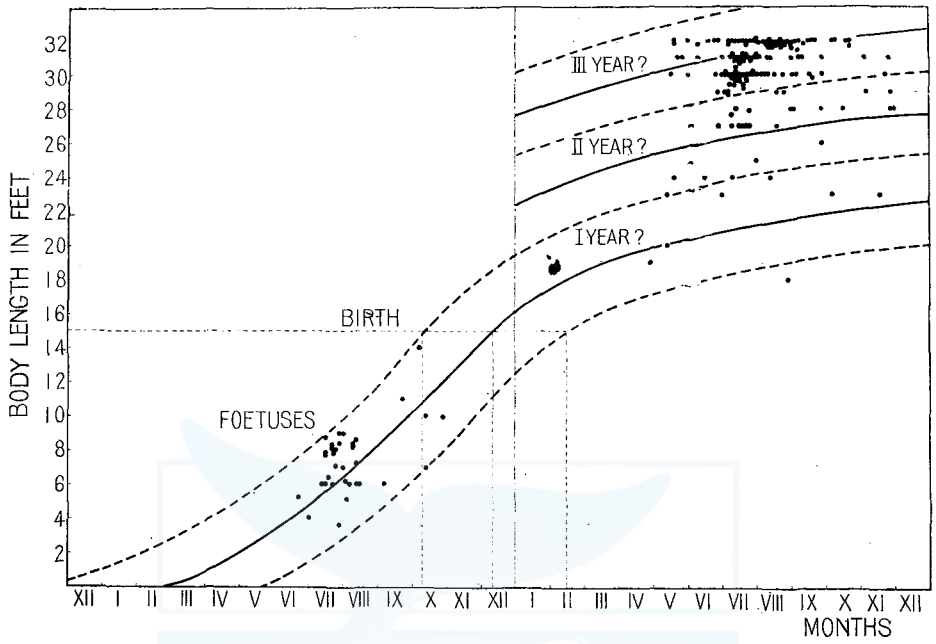

Fig. 28. Growth of *Berardius bairdi*.

The growth curve after birth is very difficult to draw with data available at present. However, it is most unlikely to suppose that *Berardius* reach sexual maturity after one year from birth. It seems also very difficult to us to suppose that they attain their sexual maturity after an interval of two years, judged from the data in hand. Although we drew the growth curve of after the birth very roughly, supposing *Berardius* get matured after three years from birth, we have very little confidence to this growth curve. It may take three or more years in order to be attained the sexual maturity in *Berardius*.

Notes on Ziphius cavirostris

Ziphius cavirostris Cuvier is generally called as Akabo-kujira in Japan, and in Chiba prefecture its local name is Kajippo. Akabo-kujira is also taken by small-typed whaling boats as *Berardius*, however, smaller in number. Yearly catch of *Ziphius* during the five years from 1948 to 1952 is shown in Table 10.

In these five years only 85 *Ziphius* are taken, however, there is also a tendency of increasing number of the catch. The sex ratio of the catch is 60 per cent male and 40 per cent female.

As shown in Table 11, main grounds for *Ziphius* are Area I and Area II, and then Area VII. We have no catch record of *Berardius* in Area VII (coast of Wakayama prefecture), as stated already, but *Ziphius*

Table 10. Catch of *Ziphius cavirostris* in Japan during the years 1948–52, inclusive.

Years	Male	Female	Total
1948	2	1	3
1949	6	4	10
1950	4	6	10
1951	17	10	27
1952	22	13	35
Total	51	34	85
Sex ratio	60.0	40.0	100.0

Table 11. Catch of *Ziphius cavirostris* in each area of Japan. Total of five years 1948–1952.

Areas	Male	Female	Total
I (Chiba pre.)	22	17	39
II (NE-Japan-Proper)	20	9	29
III (S-Hokkaido)	1	0	1
VI (Toyama bay)	0	1	1
VII (Wakayama pre.)	8	7	15
Total	51	34	85

is taken in this area from very old days. Taiji town, Wakayama prefecture, is very famous as a whaling base and many whaling vessels of small type have been operating from old days. The catch is consisted of mainly Gondo-kujira (*Globicephalus melas*), together with other kind of small toothed whales. *Ziphius* is also found in the catch sometimes.

Monthly catch of *Ziphius* is shown in Fig. 29. As seen in this figure, *Ziphius* is caught in all year round, most of catch being from May to October and its peak in August.

Size distribution of the catch is shown in Table 12 and in Fig. 30 in histograms. As shown in these table or figure, the biggest male is 22 feet in length and that of female is 23 feet long, female being

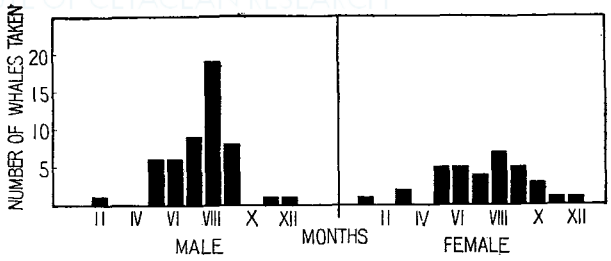

Fig. 29. Monthly catch of *Ziphius cavirostris*. Total of 5 years 1948–52, inclusive.

bigger than male by one foot. The peaks of catch of male and female are lying at 18 and 19 feet respectively, suggesting alse in *Ziphius* female is bigger than male by one foot, as is the case in *Berardius*.

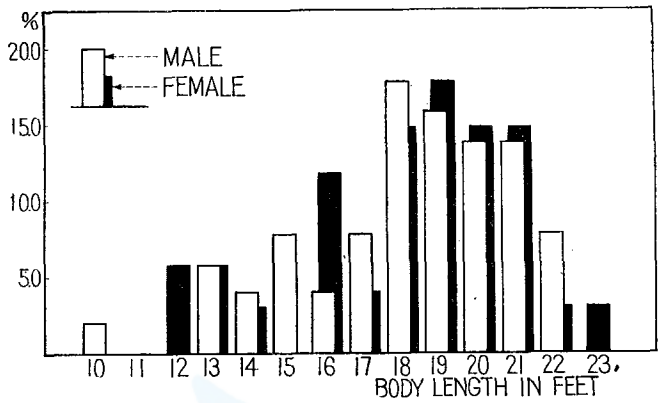

Fig. 30. Size distribution of *Ziphius cavirostris*, reduced in percentages. Total of 5 years 1948–52, inclusive.

As regards to the sexual maturity in *Ziphius*, we have very few data at present. Two *Ziphius* were measured of their testes

Table 12. Size distribution of *Ziphius cavirostris* from Japan.

Body length in feet	Actual number			Per cent		
	Male	Female	Total	Male	Female	Total
10	1	—	1	2.0	—	1.2
11	—	—	—	—	—	—
12	—	2	2	—	5.9	2.4
13	3	2	5	5.9	5.9	5.9
14	2	1	3	3.9	2.9	3.5
15	4	—	4	7.9	—	4.7
16	2	4	6	3.9	11.8	7.0
17	4	2	6	7.9	5.9	7.0
18	9	5	14	17.6	14.7	16.5
19	8	6	14	15.7	17.7	16.5
20	7	5	12	13.7	14.7	14.1
21	7	5	12	13.7	14.7	14.1
22	4	1	5	7.8	2.9	5.9
23	—	1	1	—	2.9	1.2
Total	51	34	85	100.0	100.0	100.0

weight, which were the following.

Body length in feet	*Weight of testis*			
18	one	4,100 gr.	another	4,200 gr.
19.2	,,	3,500 ,,	,,	4,000 ,,

Judged from the data of *Berardius*, it is likely that these males are matured. A *Ziphius* of 590 cm (19 ft. 4 in.) in length, reported by Ogawa (1936) is a matured male. Therefore, it is probable that male *Ziphius* reach their sexual maturity at a body length of 18 feet or smaller. For female we have following five records of foetuses in hand.

Date	*Body length of pregnant female*	*Foetus*	
12 Aug. 1951	20 feet	male	1 feet
12 Aug. 1952	18 ,,	,,	7 ,,
7 Sept. 1952	21.3 ,,	female	5.6 ,,
15 Oct. 1952	22.5 ,,	,,	1.4 ,,
28 Aug. 1953	20 ,,	,,	3.2 ,,

There is one pregnant female of 18 feet, but others are all 20 feet or above that length. Further, we have one example of immature female of 18 feet. This *Ziphius* was taken at the position of 171° East longitude and 37° North latitude by tuna long line and brought to the Tokyo Fish Market on 27 November 1949 (Plate X). Saury Pikes were used as bait of the long line, and according to the crew of the fishing boat that *Ziphius* was still alive when they hauled up the line, and was taken up to the deck of the boat by hooks of many hands. This whale was a female of 18 feet long and neither corpus luteum nor maturing follicles were present in the ovaries.

In conclusion above, also in this repect, female is deemed bigger than male.

Summary

A. *Berardius bairdi* from Japan were studied and the following conclusions were reached:

1. The pairing takes place mostly in February and calves are born in December, length of gestation being about 10 months. Body length at birth is estimated as 15 feet.

2. The average body length at which sexual maturity is attained for females and males are 33–34 feet and 32–33 feet, respectively. They reach these body length after an interval of three or more years from birth. The female attain its body length up to about 40 feet and the biggest male is about 39 feet, female is bigger than male like in baleen whales.

3. No difference is noted between *Berardius bairdi* from British

Columbia and those from Japan.

4. The differences between *Berardius bairdi* and *B. arnuxi* in the external proportions are bigger flippers and broader total spread of tail flukes in the former than the latter. In skeletal measurements, the latter have more smaller sized caudal vertebrae in the posterior region than the former.

5. The males are preponderant over the females in the catch, occupying about two thirds of the total catch in the waters around Japan. It is thought, however, this may be attributed to the difference in movements between both sexes.

6. There is no scientific evidence on occurrence of *Hyperoodon* in the western side of the North Pacific.

B. Also in *Ziphius cavirostris* female is bigger than male.

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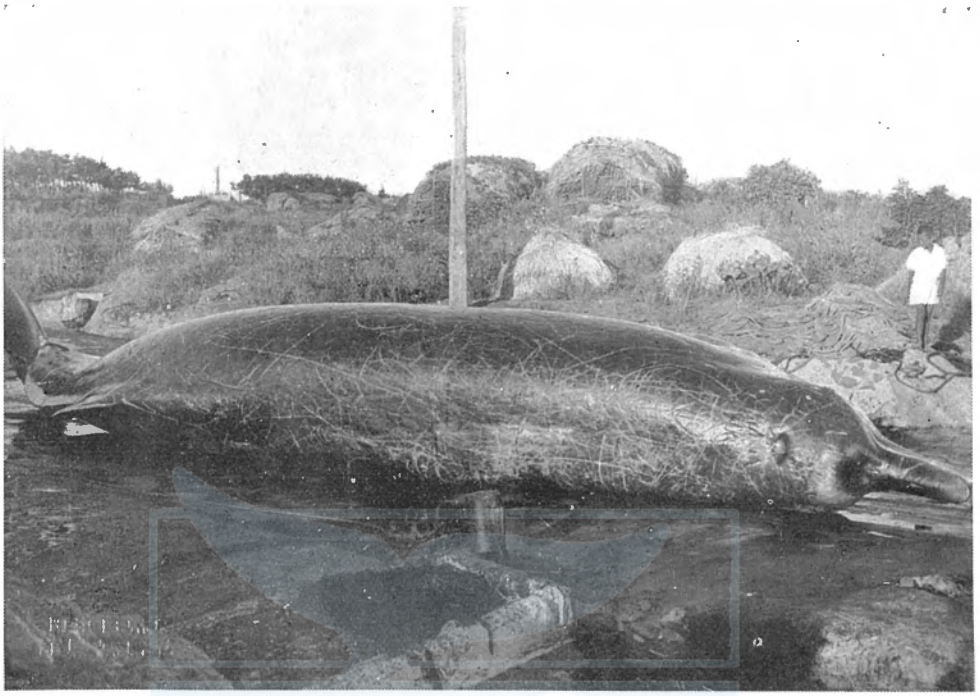
Appendix

Measurements of Body Proportions of *Berardius bairdi* from Japan.
Upper figures: actual measurement in centimeters.
Lower figures: percentages against total length.

Measurement	No. 1	Total length from tip of snout to notch of flukes.
〃	No. 2	Projection of lower jaw beyond tip of snout.
〃	No. 3	Tip of snout to blow-hole.
〃	No. 4	Tip of snout to angle of gape.
〃	No. 5	Tip of snout to centre of eye.
〃	No. 6	Tip of snout to axilla of flipper.
〃	No. 7	Centre of eye to centere of ear.
〃	No. 8	Notch of flukes to posterior emargination of dorsal fin.
〃	No. 9	Width of flukes at insertion.
〃	No. 10	Notch of flukes to centre of anus.
〃	No. 11	Notch of flukes to umbilicus.
〃	No. 12	Centre of anus to reproductive aperture.
〃	No. 13	Vertical height of dorsal fin
〃	No. 14	Length of base of dorsal fin.
〃	No. 15	Tip to anterior end of lower border of flipper.
〃	No. 16	Axilla to tip of flipper.
〃	No. 17	Greatest width of flipper.
〃	No. 18	Length of severed head from condyle to tip.
〃	No. 19	Length of snout.
〃	No. 20	Tail flukes, tip to notch.

Date, Catch	Body length in Feet	Sex	Land-station	Measurement Number																		
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
5 Jul. 1953	4′ 9″ (foetus)	♂	Ayukawa	144	—	19	12	17	52	—	43	14	38	73	9	4	8	—	—	—	—	—	23
					—	13.2	8.3	11.8	36.1	—	29.8	9.7	26.4	50.7	6.2	2.8	5.6	—	—	—	—	—	16.0
15 Jul. 1953	8′ 4″ (foetus)	♂	〃	253	—	33	21	31	68	—	67	—	80	140	15	9.5	23	37	27	14	—	17	
					—	13.0	8.3	12.2	26.9	—	26.5	—	31.6	55.3	5.9	3.8	9.1	14.6	10.7	5.5	—	6.7	—
8 Aug. 1953	28′ 7″	♂	〃	870	5	—	56	97	200	17	240	65	255	490	65	22	55	100	65	35	—	57	110
					0.6	—	6.4	11.2	23.0	2.0	27.6	7.5	29.3	56.4	7.5	2.5	6.3	11.5	7.5	4.0	—	6.6	12.7
6 Aug. 1953	31′ 10″	♂	〃	970	10	104	63	82	208	15	265	75	273	550	80	32	60	115	81	42	—	60	154
					1.0	10.7	6.5	8.4	21.4	1.5	27.3	7.7	28.1	56.7	8.2	3.3	6.2	11.8	8.3	4.3	—	6.2	15.9
13 Jul. 1953	32′ 8″	♂	〃	995	6	110	69	85	210	—	270	—	290	555	60	22	65	126	80	42	—	59	—
					0.6	11.1	7.0	8.6	21.1	—	27.3	—	29.3	56.1	6.1	2.2	6.6	12.7	8.1	4.2	—	6.0	—
24 Jul. 1953	32′ 8″	♂	〃	995	9	118	64	108	207	—	285	—	287	580	82	25	56	127	80	41	—	65	—
					0.9	11.9	6.5	10.9	20.9	—	28.8	—	29.0	58.6	8.3	2.5	5.7	12.8	8.1	4.1	—	6.6	—
5 Aug. 1953	32′ 8″	♂	〃	995	8	111	65	105	222	21	260	—	290	570	80	28	60	125	78	43	—	60	135
					0.8	11.2	6.6	10.6	22.4	2.1	26.3	—	29.3	57.6	8.1	2.8	6.1	12.6	7.9	4.3	—	6.1	13.6
4 Aug. 1953	32′ 10″	♂	〃	1000	9	112	57	100	218	20	280	—	280	580	70	27	60	126	88	43	—	61	—
					0.9	11.2	5.7	10.0	21.8	2.0	28.0	—	28.0	58.0	7.0	2.7	6.0	12.6	8.8	4.3	—	6.1	—
24 Jul. 1953	33′ 4″	♂	〃	1015	13	102	70	94	215	—	290	—	305	590	60	29	60	—	—	42	—	60	—
					1.3	10.1	6.9	9.3	21.3	—	28.7	—	30.2	58.4	5.9	2.9	5.9	—	—	4.2	—	5.9	—
24 Jul. 1953	33′ 6″	♂	〃	1020	8	112	63	110	230	—	272	—	280	564	81	27	96	126	82	42	—	61	—
					0.8	11.0	6.2	10.8	22.5	—	26.7	—	27.4	55.3	7.9	2.6	9.4	12.3	8.0	4.1	—	6.0	—
16 Jul. 1953	33′ 6″	♂	〃	1021	9	115	70	102	220	—	290	—	300	575	70	27	70	128	85	43	—	65	—
					0.9	11.3	6.9	10.0	21.6	—	28.4	—	29.4	56.4	6.9	2.6	6.9	12.5	8.3	4.2	—	6.4	—
25 Jul. 1953	33′ 8″	♂	〃	1025	—	115	62	94	210	20	280	—	290	605	80	27	60	126	80	45	—	64	—
					—	11.3	6.1	9.2	20.6	2.0	27.4	—	28.4	59.3	7.8	2.6	5.9	12.3	7.8	4.4	—	6.3	—
15 Jul. 1953	33′ 10″	♂	〃	1030	7	110	75	103	230	—	270	—	280	580	80	29	60	120	84	42	—	64	—
					0.7	10.7	7.3	10.0	22.3	—	26.2	—	27.2	56.3	7.8	2.8	5.8	11.6	8.1	4.1	—	6.2	—
23 Jul. 1953	33′ 10″	♂	〃	1030	11	118	62	109	222	—	305	—	280	590	50	25	60	125	81	42	—	63	—
					1.1	11.4	6.0	10.6	21.5	—	29.6	—	27.2	57.2	4.9	2.4	5.8	12.1	7.9	4.1	—	6.1	—
26 Jul. 1953	33′ 10″	♂	〃	1032	8	113	62	92	222	19	300	75	300	597	70	28	63	134	82	46	130	64	—
					0.8	11.0	6.0	8.9	21.5	1.8	29.1	7.3	29.1	57.9	6.8	2.7	6.1	13.0	8.0	4.5	12.6	6.2	—
14 Jul. 1953	34′ 1″	♂	〃	1040	—	120	69	98	215	23	260	—	310	615	70	22	80	118	77	42	—	68	—
					—	11.5	6.6	9.4	20.6	2.2	25.0	—	29.8	59.0	6.7	2.1	7.7	11.3	7.4	4.0	—	6.5	—
24 Jul. 1953	34′ 5″	♂	〃	1049	9	105	57	87	235	—	309	—	307	615	101	—	—	130	82	42	—	64	—
					0.9	10.0	5.4	8.3	22.3	—	29.4	—	29.2	58.4	10.0	—	—	12.4	7.8	4.0	—	6.1	—

Date, Catch	Body length in Feet	Sex	Land-station	Measurement Number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
13 Jul. 1953	34′ 5″	♂	Ayukawa	1050	—	110	65	96	220	—	280	—	280	590	60	28	90	116	87	43	—	63	—
					—	10.5	6.2	9.1	20.9	—	26.6	—	26.6	56.1	5.7	2.7	8.6	11.0	8.3	4.1	—	6.0	—
16 Jul. 1953	34′ 6″	♂	〃	1052	—	115	70	105	218	—	280	—	280	570	60	20	60	125	85	42	—	70	—
					—	10.9	6.7	10.0	20.7	—	26.6	—	26.6	54.2	5.7	1.9	5.7	11.9	8.1	4.0	—	6.7	—
13 Jul. 1953	34′ 7″	♂	〃	1055	9	115	66	98	220	—	290	—	300	600	80	—	100	120	84	46	—	62	—
					0.9	10.9	6.3	9.3	20.9	—	27.6	—	28.5	57.0	7.6	—	9.5	11.4	8.0	4.4	—	5.9	—
25 Jul. 1953	34′ 9″	♂	〃	1060	11	116	62	90	225	21	270	—	315	597	68	27	70	132	84	42	—	65	—
					1.0	10.9	5.8	8.5	21.2	2.0	25.4	—	29.6	56.1	6.4	2.5	6.6	12.4	7.9	3.9	—	6.1	—
23 Jul. 1953	35′ 9″	♂	〃	1090	8	120	65	93	240	—	270	—	320	650	100	29	90	133	82	44	—	61	—
					0.7	11.0	6.0	8.6	22.1	—	24.8	—	29.4	59.8	9.2	2.7	8.3	12.2	7.5	4.0	—	5.6	—
19 Jul. 1952	5′ 5″ (foetus)	♂	Chiba prefecture	164	—	22.5	12.5	—	—	—	45	—	—	84	9	5.6	11	24	—	—	—	—	23
					—	13.7	7.6	—	—	—	27.4	—	—	51.2	5.5	3.4	6.7	14.6	—	—	—	—	14.0
20 Jul. 1952	32′ 3″	♂	〃	982	—	105	68	100	—	—	300	—	—	580	70	—	65	125	—	—	—	55	143
					—	10.7	6.9	10.2	—	—	30.5	—	—	59.0	7.1	—	6.6	12.7	—	—	—	5.6	14.6
25 Jul. 1952	33′ 2″	♂	〃	1012	—	110	80	108	—	—	287	—	—	644	64	22	72	122	—	—	—	70	150
					—	10.9	7.9	10.7	—	—	28.4	—	—	63.6	6.3	2.2	7.1	12.1	—	—	—	6.9	14.8
27 Jul. 1952	33′ 2″	♂	〃	1012	—	—	62	95	—	—	310	—	—	555	78	22	55	122	—	—	—	59	152
					—	—	6.1	9.4	—	—	30.6	—	—	54.8	7.7	2.2	5.4	12.1	—	—	—	5.8	15.0
27 Jul. 1952	33′ 7″	♂	〃	1024	—	105	67	95	—	—	268	—	—	574	81	28	65	137	—	—	—	62	133
					—	10.3	6.5	9.3	—	—	26.2	—	—	56.1	7.9	2.7	6.4	13.4	—	—	—	6.1	13.0
28 Jul. 1953	4′ 10″ (foetus)	♀	Ayukawa	148	—	20	11.5	20.5	44	—	43	—	44	79	5	3.5	8	22.5	16	7	—	10	24
					—	13.5	7.8	13.9	29.7	—	29.1	—	29.7	53.4	3.4	2.4	5.4	15.2	10.8	4.7	—	6.8	16.2
3 Aug. 1953	8′ 7″ (foetus)	♀	〃	261	—	35	18	34	74	—	71	27	80	140	10	8	14	44	26	15	50	16	36
					—	13.4	6.9	13.0	28.3	—	27.2	10.3	30.6	53.6	3.8	3.1	5.4	16.9	10.0	5.7	19.2	6.1	13.8
17 Aug. 1953	32′ 10″	♀	〃	1000	9	112	68	111	214	—	285	—	320	590	60	30	55	120	82	45	—	64	—
					0.9	11.2	6.8	11.1	21.4	—	28.5	—	32.0	59.0	6.0	3.0	5.5	12.0	8.2	4.5	—	6.4	—
25 Jul. 1953	33′ 6″	♀	〃	1020	—	118	60	92	205	21	280	—	280	620	50	31	80	125	82	42	—	64	—
					—	11.6	5.9	9.0	20.1	2.1	27.4	—	27.4	60.8	4.9	3.0	7.8	12.3	8.0	4.1	—	6.3	—
15 Jul. 1953	33′ 10″	♀	〃	1030	7	115	75	—	220	—	280	—	270	600	30	30	80	130	85	44	—	70	—
					0.7	11.2	7.3	—	21.3	—	27.2	—	26.2	58.2	2.9	2.9	7.8	12.6	8.2	4.3	—	6.8	—
23 Jul. 1953	36′ 5″	♀	〃	1110	8	134	74	105	248	—	305	—	315	640	60	32	68	140	85	45	—	72	—
					0.7	12.1	6.7	9.5	22.3	—	27.5	—	28.4	57.6	5.4	2.9	6.1	12.6	7.7	4.1	—	6.5	—
17 Aug. 1953	36′ 7″	♀	〃	1115	10	120	70	120	250	20	350	—	330	650	40	30	60	135	85	43	—	68	—
					0.9	10.8	6.3	10.8	22.5	1.8	31.5	—	29.7	58.5	3.6	2.7	5.4	12.2	7.7	3.9	—	6.1	—
2 Aug. 1952	36′ 0″	♀	Chiba prefecture	1098	—	114	65	100	—	—	315	—	—	615	20	25	57	115	—	—	—	62	154
					—	10.4	5.9	9.1	—	—	28.7	—	—	56.0	1.8	2.3	5.2	10.5	—	—	—	5.6	14.0



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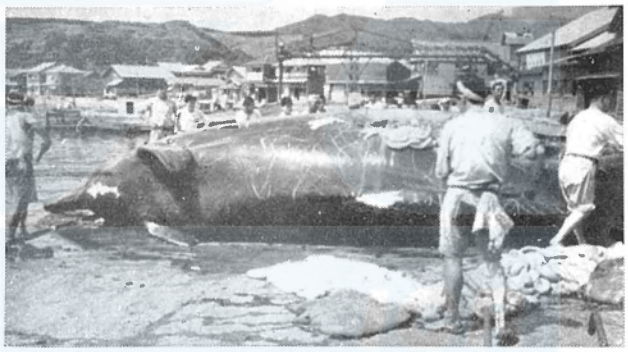

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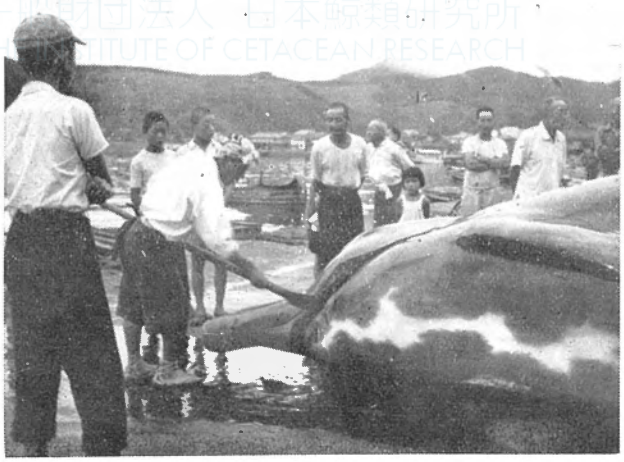

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Plate I. *Berardius bairdi* of Japan.

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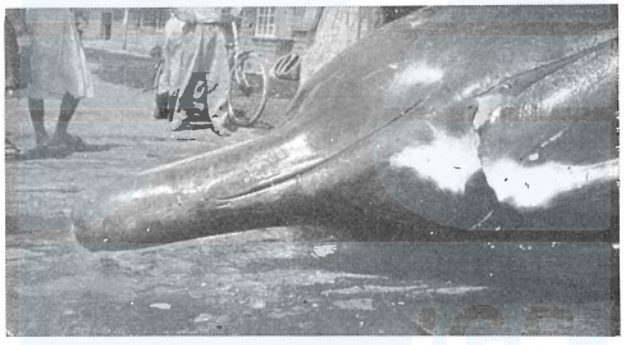

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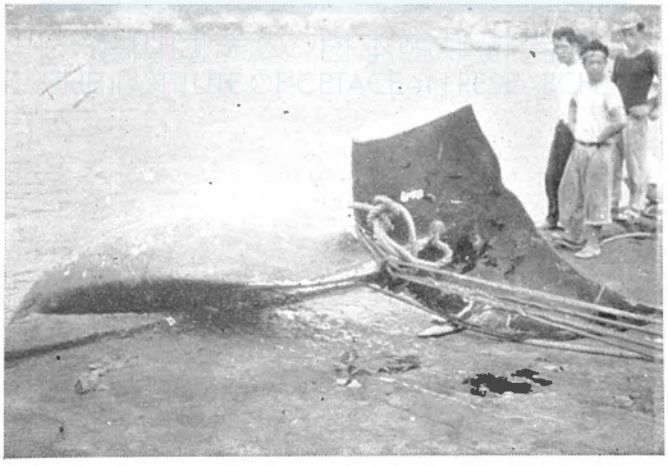

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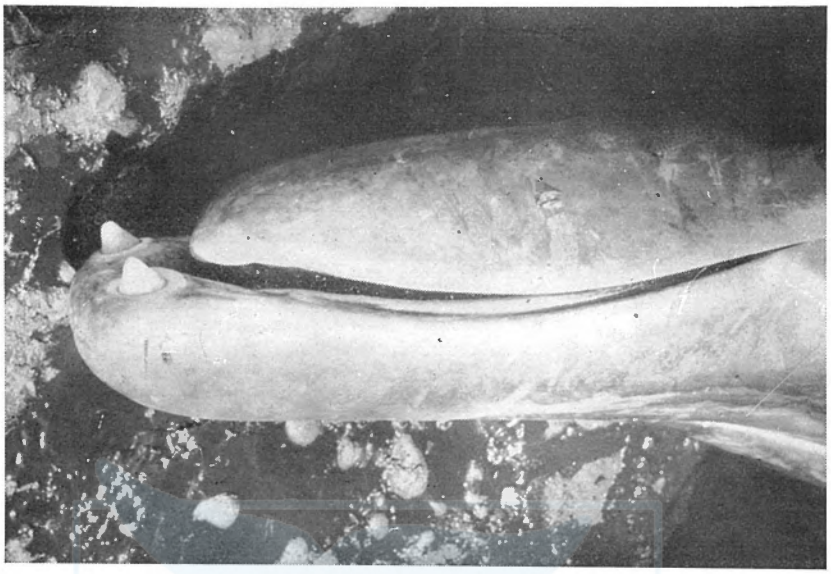
Plate II. *Berardius bairdi* of Japan.



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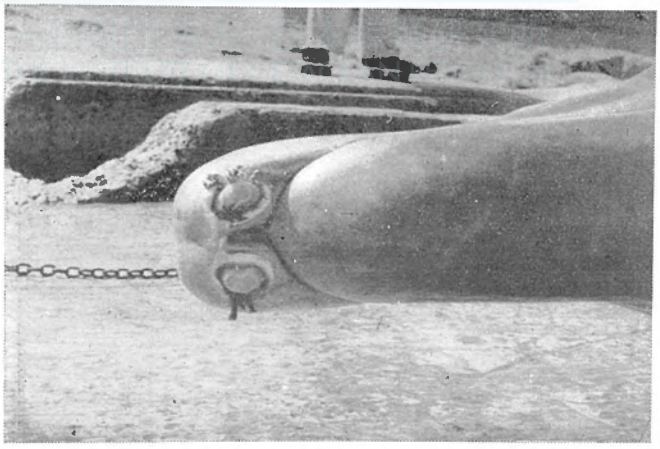

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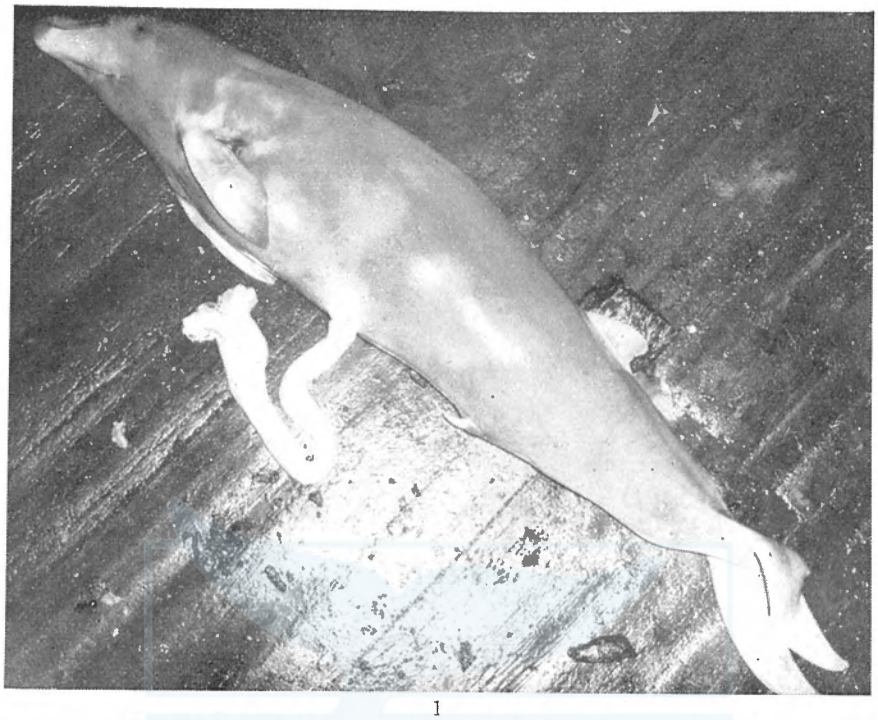
Plate III. Teeth of *Berardius bairdi* of Japan.



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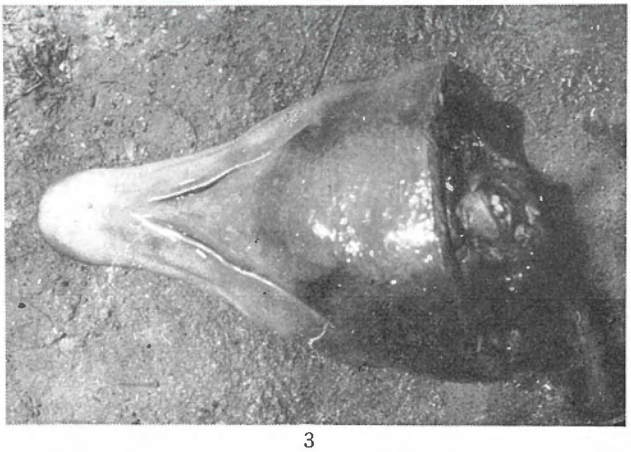

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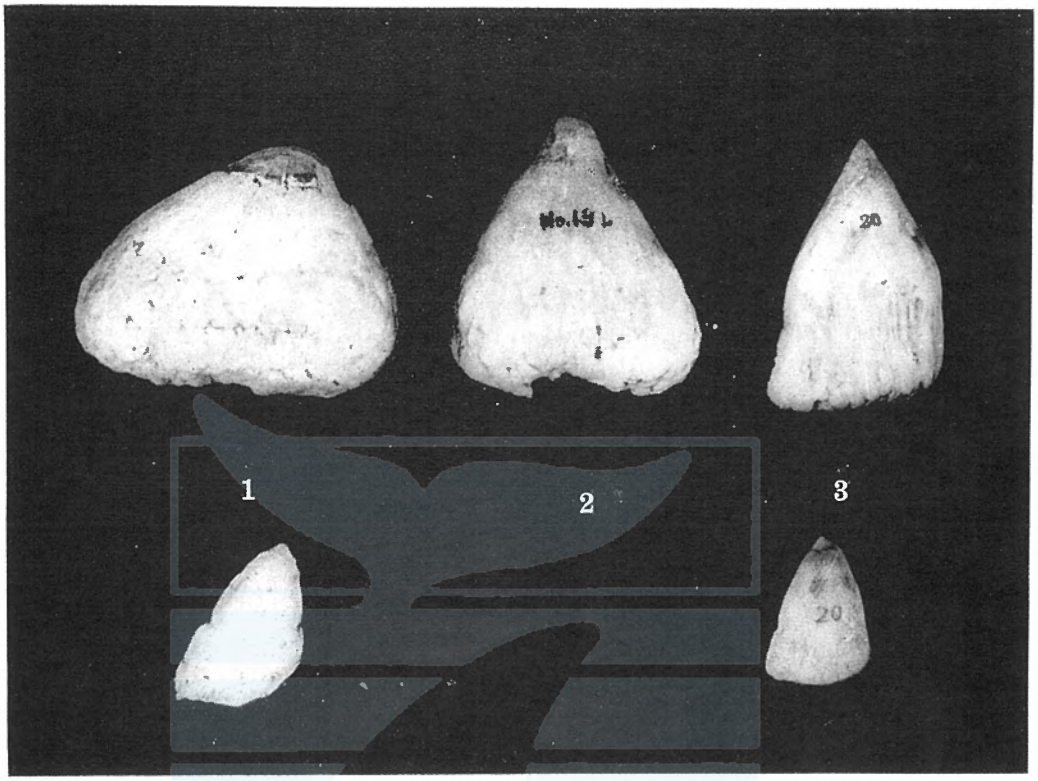
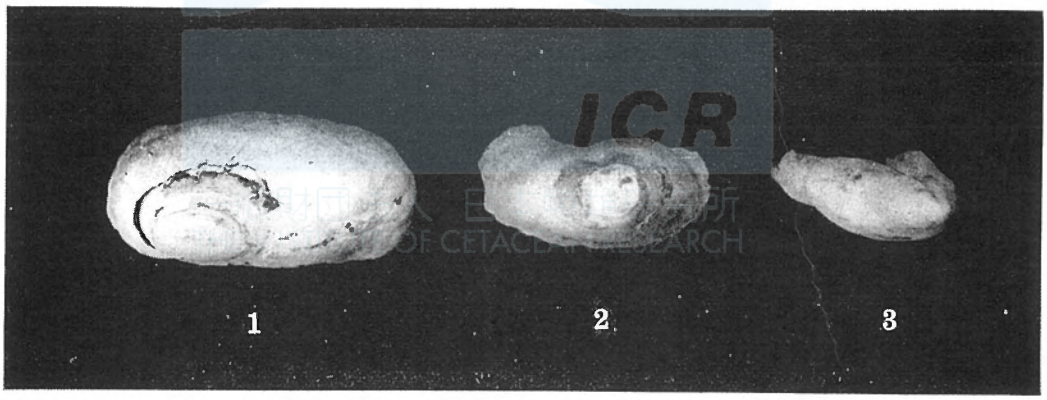
Plate IV. Foetus of a *Berardius bairdi*.



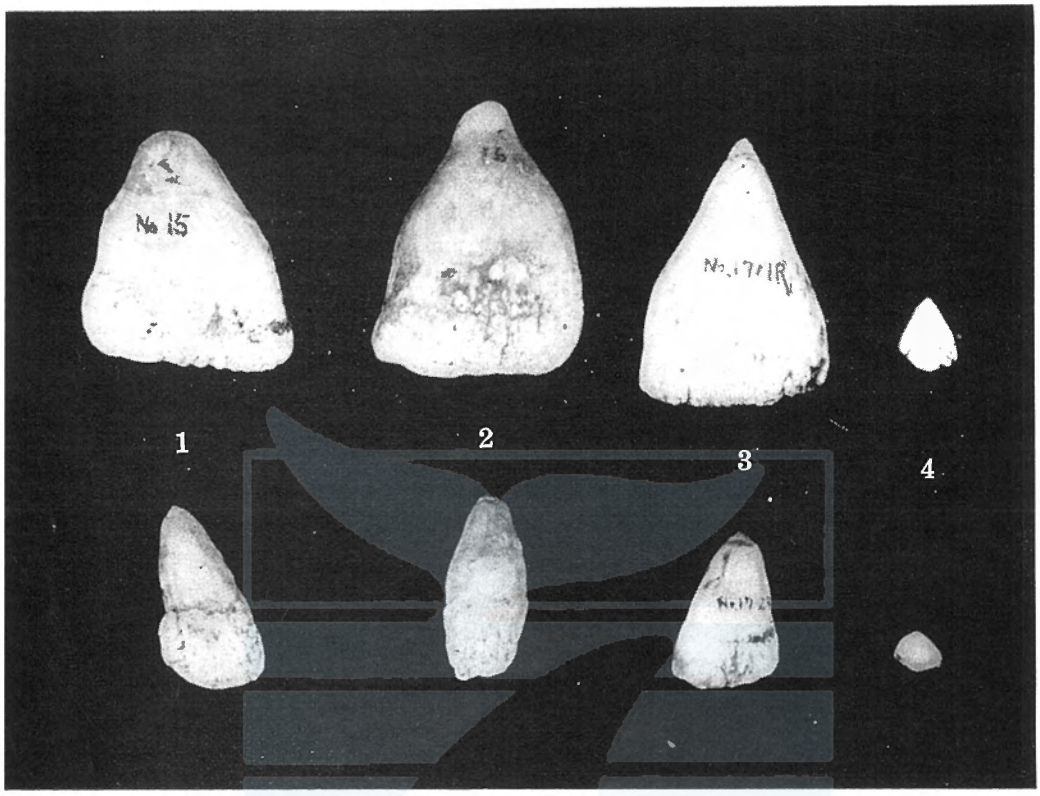
Side View



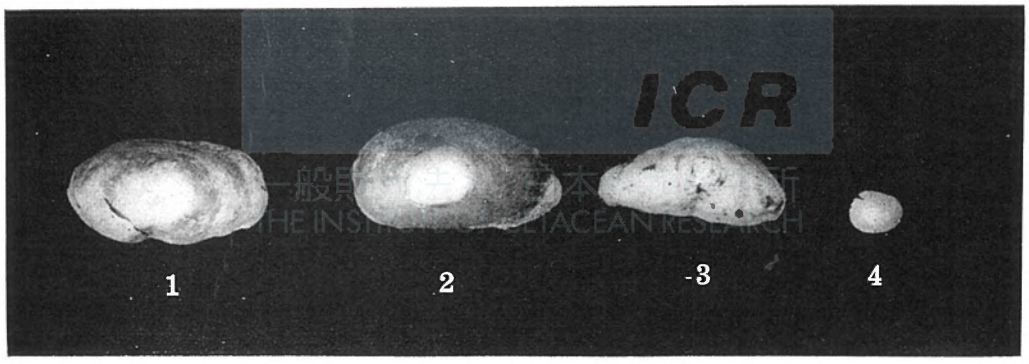
Dorsal View

Plate V. Teeth in Males

1. Right Teeth (Anterior and Porterior) Mature length unknown
2. Left Teeth (Anterior) Mature 35 ft.
3. Right Teeth (Anterior and Posterior) Immature 29 ft.



Side View



Dorsal View

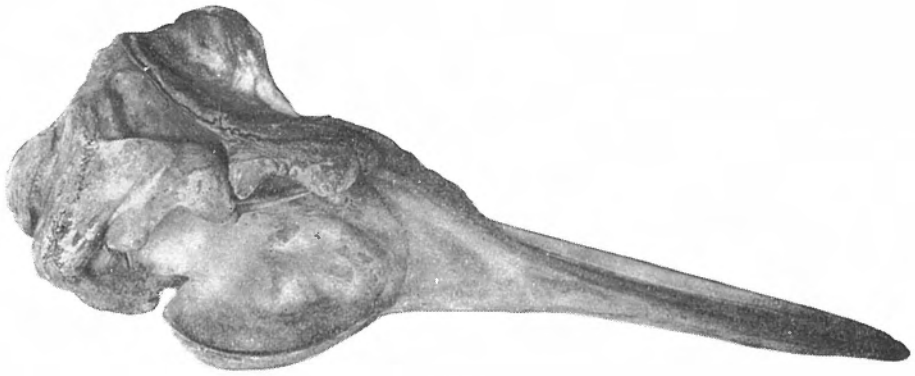
Plate VI. Teeth in Females

1. Left Teeth (Anterior and Posterior) Mature (Number of C.L. 11) 33 ft
2. Right Teeth (Anterior and Posterior) Mature (Nnmber of C.L. 7) 35 ft
3. Right Teeth (Anterior and Posterior) Immature 30 ft
4. Right Teeth (Anterior and Posterior) Foetus 9 ft

1

2

Plate VII. Skull of *Berardius bairdi* from Japan 36 Ft. ♀ adult.
1. Dorsal view 2. Ventral view



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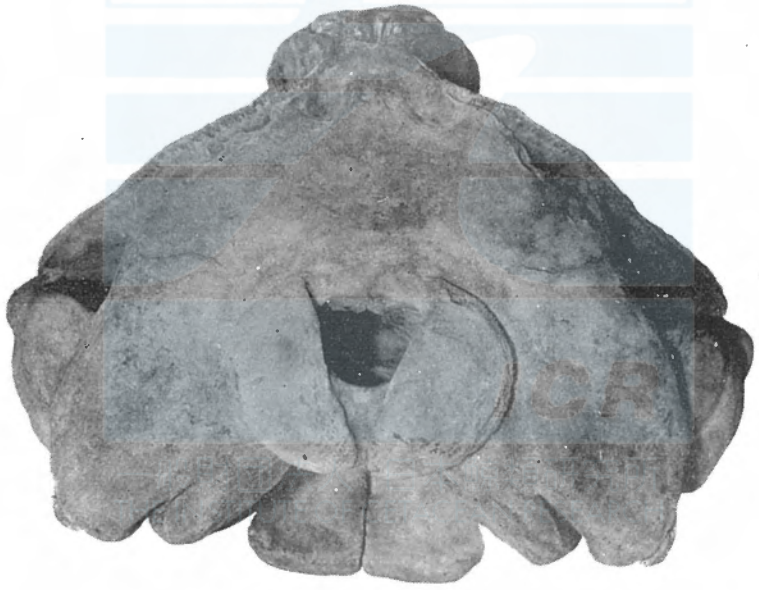

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Plate VIII. Skull of *Berardius bairdi* from Japan.
36 Ft. ♀ Adult.
1. Lateral view.
2. Posterior view.

1

2

Plate IX. Mandibles of *Berardius bairdi* from Japan.
36 Ft. ♀ Adult.
1. Outer view.
2. Inner view.

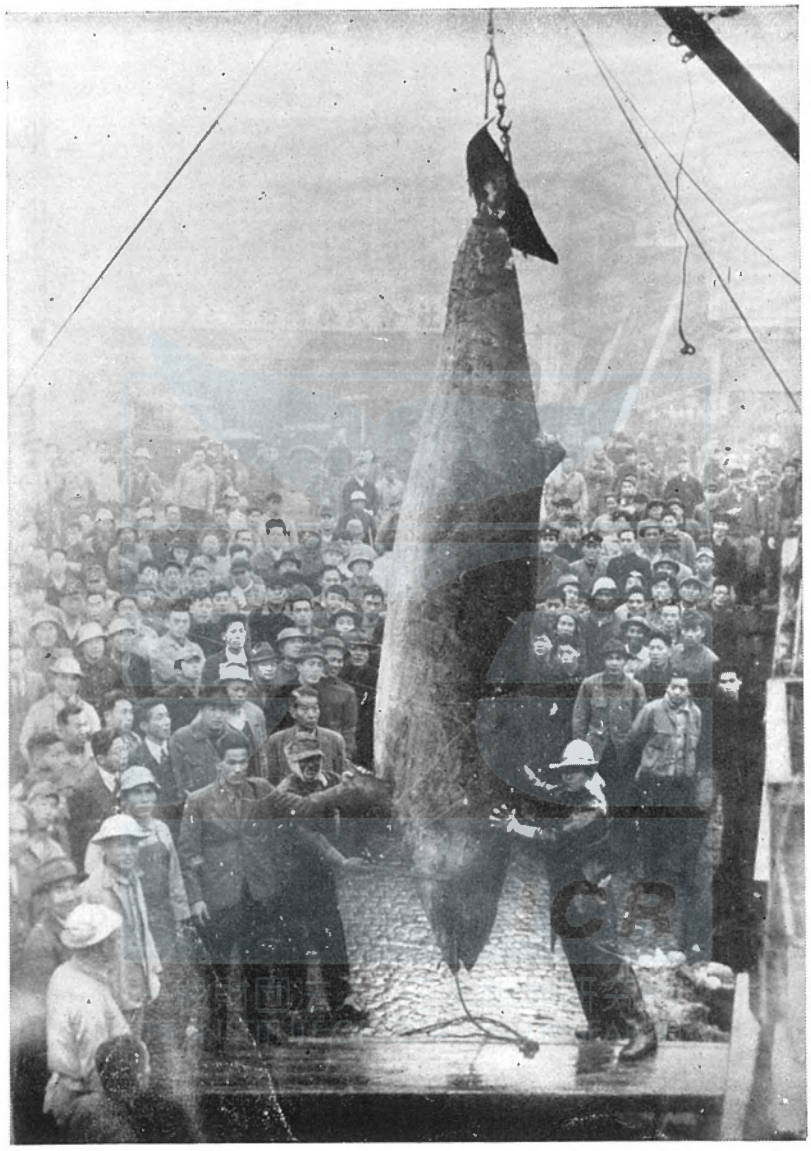

Plate X. *Ziphius cavirostris* taken by tuna long line and was landed at the pier of the Tokyo Fish Market on 27 Nov. 1949. 18 Feet ♀ Immature. (Photograph by kindness of Tokyo Shimbun)