A STRANDING OF *MESOPLODON STEJNEGERI* IN THE MAIZURU BAY, SEA OF JAPAN*

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ABSTRACT

On 13 June 1984 a Stejneger's beaked whale, *Mesoplodon stejnegeri*, was found to have stranded on the beach of Maizuru Bay (35° 31'N,135° 24'E), the Sea of Japan. This whale was probably one of two unidentified whales occasionally sighted in the bay since eight months before the stranding. The animal was a juvenile male having testes of 34 g and measuring 396.5 cm in body length. It had 44 vertebrae, composed of 7 cervical (first three cervical bones were fused into one unit), 9 dorsal, 11 lumbar and 17 caudal vertebrae. Only vertebral epiphyses of the 3rd–7th cervicals and the 16–17th caudals were fused with the centrum. The external, cranial and vertebral measurements, and organ weights were presented. The PCBs and *p,p'*-DDE levels in blubber were 7.0 and 44 μg/g on wet weight basis, respectively. The distribution of the five species of *Mesoplodon* known from the North Pacific Ocean was discussed.

INTRODUCTION

In the Sea of Japan, there have been reported four *Mesoplodon stejnegeri* True, 1885 and one *Mesoplodon ginkgodens* Nishiwaki and Kamiya, 1958. A stranding of *Mesoplodon bowdoini* (Andrews, 1908) reported by Nishiwaki (1962b) was reidentified by Moore (1963) as *M. stejnegeri*. This was the first record of the species in the Sea of Japan. Later, Nishimura and Nishiwaki (1964) reported two additional specimens of *M. stejnegeri* incidentally taken by the salmon drift gill net fishery in the Sea of Japan. They were a 520 cm male taken in 39°32'N, 137°03'E on 23 April 1963 and a 238 cm female taken in 39°08'N, 135°16'E on 10 May 1963. The species was identified based on the external characters, and the skulls were later lost by an earthquake in the Niigata area on 16 June 1964. The fourth specimen was a male (body length: 490 cm) found on the beach of Niigata Prefecture on 10 May 1984 (Ikehara, Shimizu, Hiyama, Ito,

* *This work was partly supported by the Grant-in-Aid for Scientific Research from the Ministry of Education, Japan (grant no. 61560224).*

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Ogawa and Kamiya, 1985). Only record of *M. ginkgodens* is a juvenile female of 344 cm in body length. It was captured in a set net off Hiyoriyama in the Sea of Japan on 16 March 1984 (Hiyoriyama Aquarium, 1984) and was identified to the species by Dr T. Tobayama (T. Tobayama, pers. comm.). These five records (*M. stejnegeri* and *M. ginkgodens*) were obtained during March to June when the oceanographic condition changes from the winter type to the summer.

Present study is to describe the *M. stejnegeri* found on the beach of Maizuru Bay on 13 June 1984, and to describe the ontogenetic change of cranium, the sexual dimorphism and the level of organochlorine pollutant. The distribution of the species is briefly discussed in comparison with other species of *Mesoplodon* in the North Pacific.

MATERIAL AND METHODS

On 13 June 1984, a male beaked whale of 396.5 cm in body length was found on the beach of Taira (35°31′N, 135°24′E), coast of the Maizuru Bay, Sea of Japan. The first observer told to one of the authors (Nakamura) that the animal had been already dead at his first sighting. After identifying the specimen as *Mesoplodon* on 15 June, Nakamura transported it to the Fisheries Research Station of Kyoto University for further examination. In the station, Nakamura recorded the pigmentation, dissected the specimen and weighed the organs with cooperation of Messrs H. Tanaka and Y. Yamamoto of Ehime University. The measurements of external proportion and photographs were also taken. The cranial and vertebral bones were measured by Miyazaki after cleaning and deposited at the Fisheries Research Station, Kyoto University (FAKU M851). Other bones were lost during preparation. As the major portion of the teeth of the specimen were embedded in the alveoli, only right tooth was removed from the alveolus for examination after cutting a part of the right mandible.

PCBs and *p,p'*-DDE were extracted using the alkaline alcohol digestion method of Wakimoto, Tatsukawa and Ogawa (1971). The organochlorines in the final extracts were quantified by a gas chromatograph with electron capture detection (Tanabe, Tatsukawa, Tanaka, Maruyama, Miyazaki and Fujiyama, 1981). Values of *p,p'*-DDE reported here also include those of *p,p'*-DDT, because *p,p'*-DDT is converted to *p,p'*-DDE during alkaline alcohol digestion.

RESULTS

External morphology

The body shape was typical of beaked whales, characterized by a relatively large thorax and small head, flippers and tail (Plate I). The body proportion of the specimen is shown in Table 1. The dorsal fin was placed well posterior

TABLE 1. EXTERNAL MEASUREMENTS OF *MESOPLODON STEJNEGERI* STRANDED ON THE BEACH OF MAIZURU BAY KYOTO, 1984

Measurments*	cm	%
1. Body length	396.5	100
2. Tip of rostrum to apex of melon	13.0	3.3
3. Tip of rostrum to angle of gape	19.5	4.9
4. Tip of rostrum to blowhole	33.0	8.3
5. Tip of rostrum to center of eye	35.0	8.8
6. Tip of rostrm to ear	45.0	11.3
7. Tip of rostrum to anterior insertion of flipper	78.0	19.7
8. Tip of rostrum to anterior insertion of dorsal fin	244.0	61.5
9. Tip of rostrum to umbilicus	188.0	47.4
10. Tip of rostrum to center of genital aperture	249.0	62.8
11. Tip of rostrum to anus	290.0	73.1
12. Width of flipper at the base	18.5	4.7
13. Anterior insertion of flipper to tip	41.0	10.3
14. Posterior insertion of flipper to tip	25.5	6.4
15. Basal length of dorsal fin	37.5	9.5
16. Anterior insertion of dorsal fin to tip	33.0	8.3
17. Posterior insertion of dorsal fin to tip	18.5	4.7
18. Height of dorsal fin	8.8	2.2
19. Width of tail flukes	94.0	23.7
20. Anterior insertion of fluke to tip (left)	54.5	13.7
21. Anterior insertion of fluke to notch (left)	34.0	8.6
22. Center of flukes to tip (left)	48.5	12.2

* Measurements parallel to the body axis.

to the middle of body (tip of rostrum to anterior insertion of dorsal fin : 61.5% of body length) and nearly at the level of genital aperture (tip of rostrum to genital aperture : 62.8%). The length of visceral cavity represented by the proportion of anterior insertion of flipper to anus (55.4%) was longer than the head (tip of snout to ear : 11.3%), the tail (anus to the center of posterior margin of tail flukes : 26.9%) or the remaining portion (ear to anterior insertion of flipper : 8.4%). The height of dorsal fin (2.2%) and the flipper length (anterior insertion of flipper to the tip: 10.3%) were relatively small. Other characteristic features of the specimen were long and narrow snout, forehead smoothly tapering to the rostrum, absence of demarcation between the melon and the rostrum, a pair of prominent throat grooves (left: 24.5 cm in length, right: 26.0 cm), and absence of a median notch on the posterior margin of tail flukes (Plate I).

The color of the animal was black on the dorsal side and lighter on the mandible and the ventral side of the body. The flippers and tail flukes were pigmented black on both sides. In the adult male of *Mesoplodon carlhubbsi*, the rostrum and anterior portion of the mandible back to the posterior edge of the tooth are a brilliant white (Orr, 1953; Mead, Walker and Houck, 1982). This pigmentation was absent on the present specimen of *M. stejnegeri*.

TABLE 2. BODY AND ORGAN WEIGHT OF *MESOPLODON STEJNEGERI* STRANDED ON THE BEACH OF MAIZURU BAY, KYOTO, 1984

Measurments	g	%
Body weight	544,973	100
Brain	783	0.14
Muscle	343,780	63.1
Blubber	112,659	20.7
Bone	50,934	9.35
Viscera	35,258	6.47
Others	1,559	0.29
Internal organs (included in viscera)		
Heart	2,530	0.46
Lungs	6,480	1.19
Liver	5,100	0.94
Diaphragm	2,730	0.50
Pancreas	255	0.05
Kidney (left)	1,200	0.22
(right)	1,480	0.27
Spleen	76	0.01
Testis (left)	15	
(right)	19	

Body and organ weights

Body weight of the animal was calculated at 544.973 kg as the total of the weights of muscle, blubber, bone, viscera, brain and other miscellaneous tissues. This value seemed to be underestimation of the true body weight because some of the blood and body fluid were not included. This will cause some inaccuracy in the proportional weights of organs and tissues in Table 2. Brain weight was 0.14% of the body weight, which was smaller than those of seven delphinid species, ranging from 0.53% in *Stenella coeruleoalba* to 1.48% in *Delphinus delphis* (Bryden, 1972; Miyazaki, Fujise and Fujiyama, 1981). Muscle (63.1% of body weight) was the largest and followed by blubber (20.7%), bone (9.3%) and viscera (6.5%). Among internal organs, lungs (1.2%) were the heaviest organ, and followed by liver (0.94%), diaphragm (0.50%), kidneys (0.49%), heart (0.45%), pancreas (0.05%) and spleen (0.01%). Testis weight was 15 g in the left and 19 g in the right.

Osteology

The cranial and vertebral measurements are shown in Appendix Tables 1 and 2, respectively. It is noted that this specimen had a pair of antorbital notches, but no prominental notches which are characteristics for *M. carlhubbsi* (Plate II).

This specimen had the following characters of *M. stejnegeri* described by Moore (1963): (1) Each antorbital notch opened with an obtuse angle of more

than 90°. (2) The profile of the premaxillary crest above the superior nares showed an abrupt turn forward, forming about 90° turn in dorsoanterior face of each premaxillary. (3) In the anterior view, this 90° turn showed a deep crease across the premaxillary on the portion of its greatest width and descended laterally about 20° below the horizontal. (4) Both the dorsal and ventral profiles of beak were virtually straight. These points are characteristic to *M. stejnegeri* (Moore, 1963). The alveolus of the mandible was entirely posterior to the symphysis. This separates *M. stejnegeri* from *M. carlhubbsi* having alveolus overlapped with the symphysis. The tooth was a triangular shape and was laterally compressed. The ratio of the greatest thickness to the greatest antero-posterior width of the right tooth was 0.15 in the present specimen and was within the range (0.13–0.20) of *M. stejnegeri* (Moore, 1963).

The mesirostral canal was not filled with bone. The anterior margin of the tooth was not of a straight line and the apex of the tooth was not found to lie on that line (Plate III). Apex of the teeth was not worn because the teeth were not erupted. The pulp cavity was widely open. These characters were virtually different from those of adult male of the species described by Moore (1963). The thyrohyals were not fused with the basihyal. Vertebral formula was C:7+D:9+L:11+Ca:17=44. The first to third cervicals were fused on both neural arches and centra, and formed one unit. Only posterior epiphysis of the third cervical and all epiphyses of the 4–7th cervicals were fused with their centrum as well as those of the 16th and 17th caudal vertebrae. These indicate that this animal is juvenile and physically immature.

Organochlorine residues

Concentrations of PCBs and *p, p'*-DDE in some organs and tissues were shown in Table 3. Among the tissues, the concentration was highest in the blubber on wet weight basis. This is because the blubber contains larger quantity of fat and these pollutants have high lipophilicity. The *p, p'*-DDE concentration was higher than that of PCBs in all parts of the body analyzed. *M. stejnegeri* showed higher burdens of both PCBs and *p, p'*-DDE in blubber than other tissues as seen in other marine mammals (dolphin and seal) having higher fat content in the blubber (Tanabe *et al.*, 1981; Hidaka, Tanabe and Tatsukawa, 1983).

DISCUSSION

Since October 1983, several staffs of the Fisheries Research Station of Kyoto University sometimes observed a pair of medium-sized whales during their own investigations in the Maizuru Bay, but they were not able to identify the species because the whales were very shy against the vessel and didn't come within about 100 m of the R/V *Ryouyomaru* (9.8 tons) of the station or didn't jump from the surface. Then in February 1984, a 4–5 m whale was stranded in the Maizuru Bay at the almost same position as that of the present strand-

TABLE 3. CONCENTRATIONS OF PCBS AND *p,p'*-DDE IN THE TISSUES AND ORGANS OF *MESOPLODON STEJNEGERI* STRANDED ON THE BEACH OF MAIZURU BAY, KYOTO, 1984

Tissue and organ	Fat content (%)	Wet weight basis (μg/g)		Fat weight basis (μg/g)		Burden (mg)	
		PCB	*p,p'*-DDE*	PCB	*p,p'*-DDE*	PCB	*p,p'*-DDE*
Blubber	90	7.0	44	7.8	49	790	4900
Muscle	1.2	0.048	0.21	4.0	17	16	72
Liver	8.9	0.29	0.82	3.2	9.1	1.5	4.2
Kidneys	3.6	0.086	0.31	2.4	8.7	0.14	0.52

* *p,p'*-DDE includes *p,p'*-DDT (See text).

ing. This animal was buried under the ground without scientific examination. Since there were no sightings of whales in the Maizuru Bay after these two strandings, there is a high possibility that the present specimen is one of the pair of the medium-sized whales sighted since October 1983.

The detailed cranial measurements of the present specimen are shown in Appendix Table 1, and selected measurements of five available *M. stejnegeri* specimens in Table 4. The proportion of rostrum length (measurement no. 2) to skull length (no. 1) is higher in the larger individuals in both sexes. The same tendency is observed in the following four measurements (measurement nos 3, 5, 6 and 8) related with rostrum length.

The relative and absolute sizes of tooth (nos 56, 57 and 59) and the length of alveolus (no. 53), are obviously larger in adult males than adult females as described by Moore (1963). The ratio of the skull width (nos 17, 18 and 19) to skull length (no. 1) is larger in males than females. The same tendency is observed in the ratio of the premaxillary width at midlength of rostrum (no. 32), the span of premaxillary crests (no. 29) and the nasal breadth on vertex (no. 26) to skull length. The absolute values of both superior nares width (no. 39) and inferior nares width (no. 40) are larger in males than females as well as their proportional values to skull length. The ratios of occipital condyle measurements (nos 21, 22 and 23) to skull length, are larger in males than females as well as that of breadth of foramen magnum (no. 24).

Fig. 1 shows the reported positions of the catches or strandings of the five species of *Mesoplodon* (*M. stejnegeri*, *M. carlhubbsi*, *M. ginkgodens*, *M. densirostris* and *M. hectori*) from the Sea of Japan, the Bering Sea and the North Pacific Ocean (Ogawa, 1938; Jellison, 1953; Nishiwaki and Kamiya, 1958, 1959; Nishiwaki, 1962a, 1962b; Moore, 1963; Galbreath, 1963; Yang, 1964; Nishimura and Nishiwaki, 1964; Fiscus, Rice and Johnson, 1969; Kasuya and Nishiwaki, 1971; Nishiwaki, Kasuya, Kureha and Oguro, 1972; Mead, 1981; Mead, *et al.*, 1982; Loughlin, Fiscus, Johnson and Rugh, 1982; Leatherwood, Reeves, Perrin and Evans, 1982; Nakajima, 1984). Present record extends the range of *M. stejnegeri* in the Sea of Japan to the south by about 1.5 degree in

TABLE 4. COMPARISON OF SKULL MEASUREMENTS (mm) OF 6 SPECIMENS OF *MESOPLODON STEJNEGERI**

Measurements	Present specimen (juv. ♂)	Nushagak** (ad. ♂)	Akita*** (ad. ♂)	Kasilof** (im. ♀)	Tofino** (ad. ♀)	Cedros Is.** (im. no sex)
1. Condylobasal length	612 (100)	686 (100)	682 (100)	708 (100)	782 (100)	631 (100)
2. Rostrum length	327 (53.4)	–	403 (59.1)	405 (57.2)	474 (60.6)	323 (51.2)
3. Rostrum tip to post. margin of pterygoid	446 (72.9)	–	560 (82.1)	540 (76.3)	625 (79.9)	–
4. Rostrum tip to post. ext. of pterygoid wing	270 (44.1)	335 (48.8)	–	313 (44.1)	395 (50.5)	277 (43.9)
6. Rostrum tip to post. ext. of max. on palate	351 (57.4)	426 (62.1)	429 (62.9)	412 (58.2)	500 (63.9)	368 (58.3)
8. Rostrum tip to ant. margin of sup. nares	404 (66.0)	480 (70.0)	502 (73.6)	482 (68.1)	572 (73.1)	422 (66.9)
17. Breadth across frontals	302 (49.8)	–	346 (50.7)	336 (47.5)	355 (45.4)	–
18. Breadth across zygomatic proc.	289 (47.2)	–	333+(48.8+)	323 (45.6)	337 (43.1)	277+(43.9+)
19. Breadth across orbits	289 (47.2)	–	340 (49.9)	323 (45.6)	335 (42.8)	277 (43.9)
21. Span of occipital condyles	95 (15.5)	115 (16.8)	118 (17.3)	108 (15.3)	111 (14.2)	103 (16.3)
22. Width of occipital condyles	36 (5.9)	42 (6.1)	–	39 (5.5)	42 (5.4)	40 (6.3)
23. Length of occipital condyle	63 (10.3)	72 (10.5)	80 (11.7)	63 (8.9)	70 (9.0)	62 (9.8)
26. Breadth across exoccipitals	252 (41.2)	–	–	270 (38.1)	278 (35.5)	247 (39.1)
29. Pmx. crest to right nasal	26 (12.7)	–	–	42 (5.9)	30 (3.8)	36 (5.7)
32. Pmx. width at mid-rostrum	30 (4.9)	–	41 (6.0)	29 (4.1)	26 (3.3)	31 (4.9)
39. Width of sup. nares	49 (8.0)	55 (8.0)	52 (7.6)	53 (7.5)	55 (7.0)	52 (8.2)
40. Width of inf. nares	101 (16.5)	94 (13.7)	116 (17.0)	87 (12.3)	88 (11.3)	85 (13.5)
53. Alveolus length	20 (3.3)	119 (17.3)	121 (17.7)	30 (4.2)	26 (3.3)	–
56. Mandibular tip to alveolus	147 (24.0)	145 (21.1)	149 (21.8)	165 (23.3)	211 (27.0)	–
57. Length of tooth	51 (8.3)	153 (22.3)	164 (24.0)	56 (7.9)	61 (7.8)	–
59. Thickness of tooth	8 (1.3)	18 (2.6)	24 (3.5)	9 (1.3)	9 (1.3)	–

* Figures in parentheses indicate the percentage to the condylobasal length. For details of measurements see Appendix Table 1.

** Measurements from Moore (1963).

*** Measurements from Nishiwaki (1962a).

latitude, but does not require to alter the current knowledge of the distribution that it is distributed in the colder waters of the North Pacific Ocean, the Sea of Japan, and deep waters of the southwest Bering Sea (Tomilin, 1967; Leatherwood and Reeves, 1983; Loughlin and Perez, 1985). Comparison of the sightings among the five species of *Mesoplodon* in the North Pacific indicates that *M. stejnegeri* was found in the coldest waters and *M. densirostris* in the warmest waters. *M. carlhubbsi* was found in the colder waters than *M. ginkgodens* and *M. hectori*.

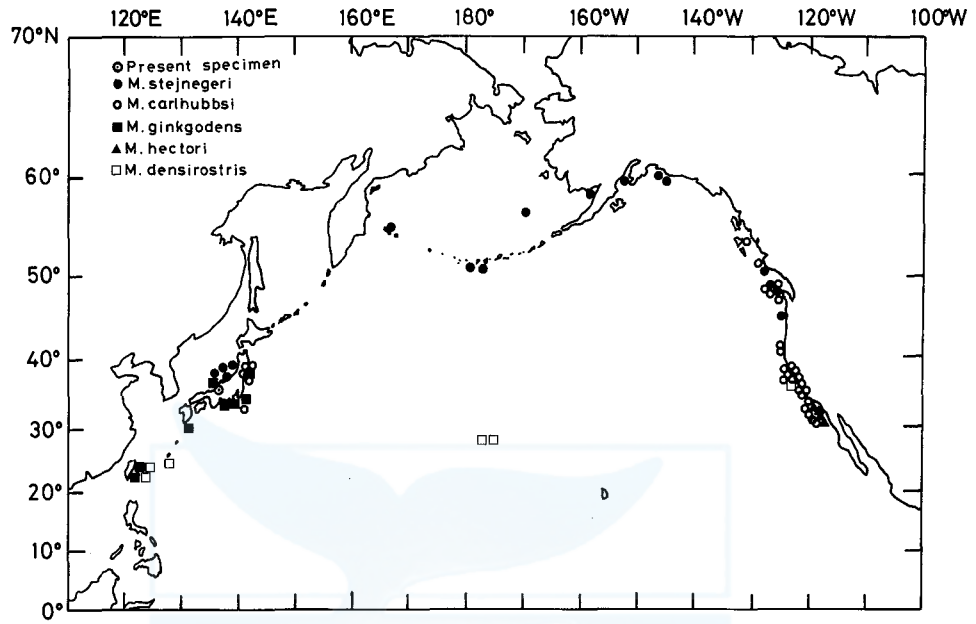

Fig. 1. Locations of the present specimen and the five species of *Mesoplodon* that have been reported from the North Pacific and adjacent seas.

The organochlorine concentrations in the present specimen (7.0 μg/g of PCBs and 44 μg/g of *p, p'*-DDE in wet blubber) are within the range of the concentrations represented by two males *M. densirostris* (PCBs: 14 and 29 μg/g, DDT: 38 and 65 μg/g) from northwestern Atlantic (Taruski, Olney and Winn, 1975), a female *M. densirostris* (PCBs: 4.8 μg/g, DDT: 11 μg/g) from Mediterranian Sea (Aguilar, Jover and Nadal, 1982), and one female and three males of *Ziphius cavirostris* (PCBs: 7.9 to 12 μg/g, DDT: 12 to 45 μg/g) from Bermuda (Knap and Jickells, 1983).

ACKNOWLEDGEMENTS

I wish to thank Mr M. Ueno of Kyoto University, and Messrs H. Tanaka, K. Yamamoto and S. Watanabe of Ehime University for their invaluable assistance in the examination of this study. Mr K. Kameda of the Fishermen's Cooperative Union of Kyoto Prefecture helpfully gave us the stranding information of the present Stejneger's beaked whale. Dr T. Tobayama of the Kamogawa Sea World kindly permitted us to use the stranding record of *M. ginkgodens* as his personal information. Drs Toshio Kasuya of Far Seas Fisheries Research Laboratory, Japan and James Mead of Smithsonian Institution, U.S.A. reviewed the manuscript and made helpful suggestions.

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EXPLANATIONS OF PLATES

PLATE I

External features of the present *Mesoplodon stejnegeri* found on the beach of Maizuru Bay (35°31'N, 135°24'E) on 13 June 1984. The male, 396.5 cm in body length (Photographs by H. Tanaka).

Fig. 1. Lateral view of head.
Fig. 2. Dorsal fin.
Fig. 3. Left flipper.
Fig. 4. Throat region of head.
Fig. 5. Ventral view.
Fig. 6. Dorsal view of tail flukes (dorsal).

PLATE II

Skull of the present specimen, *M. stejnegeri.*

Fig. 1. Dorsal view.
Fig. 2. Ventral view.
Fig. 3. Lateral view.

PLATE III

Skull and skeleton of the present specimen, *M. stejnegeri.*

Fig. 1. Lingual aspect of the right tooth.
Fig. 2. Buccal aspect of the right tooth.
Fig. 3. Mesial aspect of the right mandible.
Fig. 4. Mesial aspect of the mandibles.
Fig. 5. Hyoid bones.
Fig. 6. Dorsal view of the cervical vertebrae.
Fig. 7. Lateral view of the cervical vertebrae.
Fig. 8. Lateral view of the dorsal vertebrae. The eight and 9th dorsal vertebrae have been used for pollutant analysis, and are missing from the figure.
Fig. 9. Lateral view of the lumbar vertebrae.
Fig. 10. Lateral view of the anterior segment of caudal vertebrae.
Fig. 11. Lateral view of the posterior segment of caudal vertebrae.

PLATE I

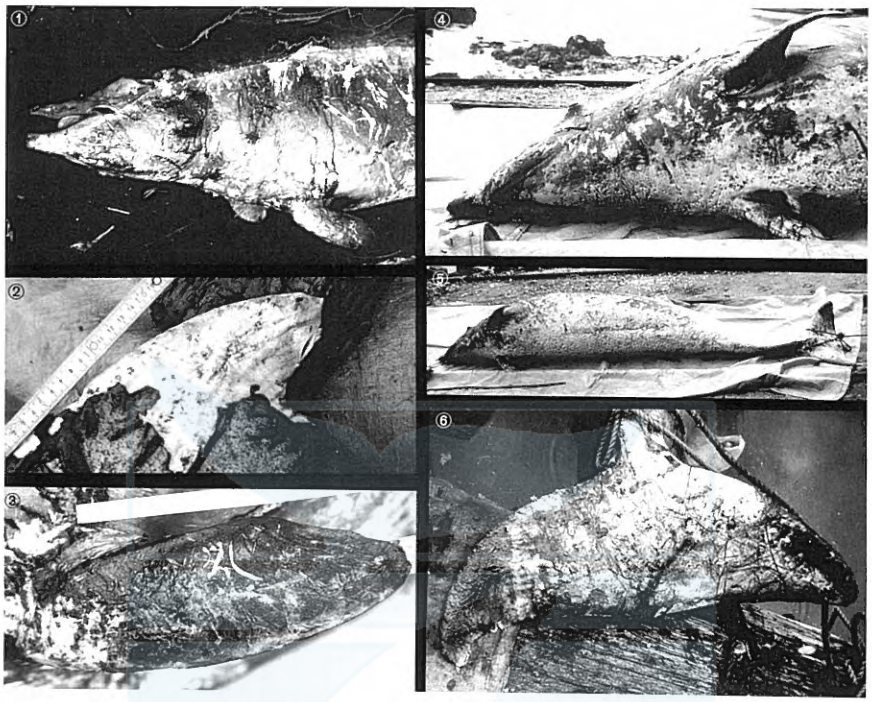


PLATE II

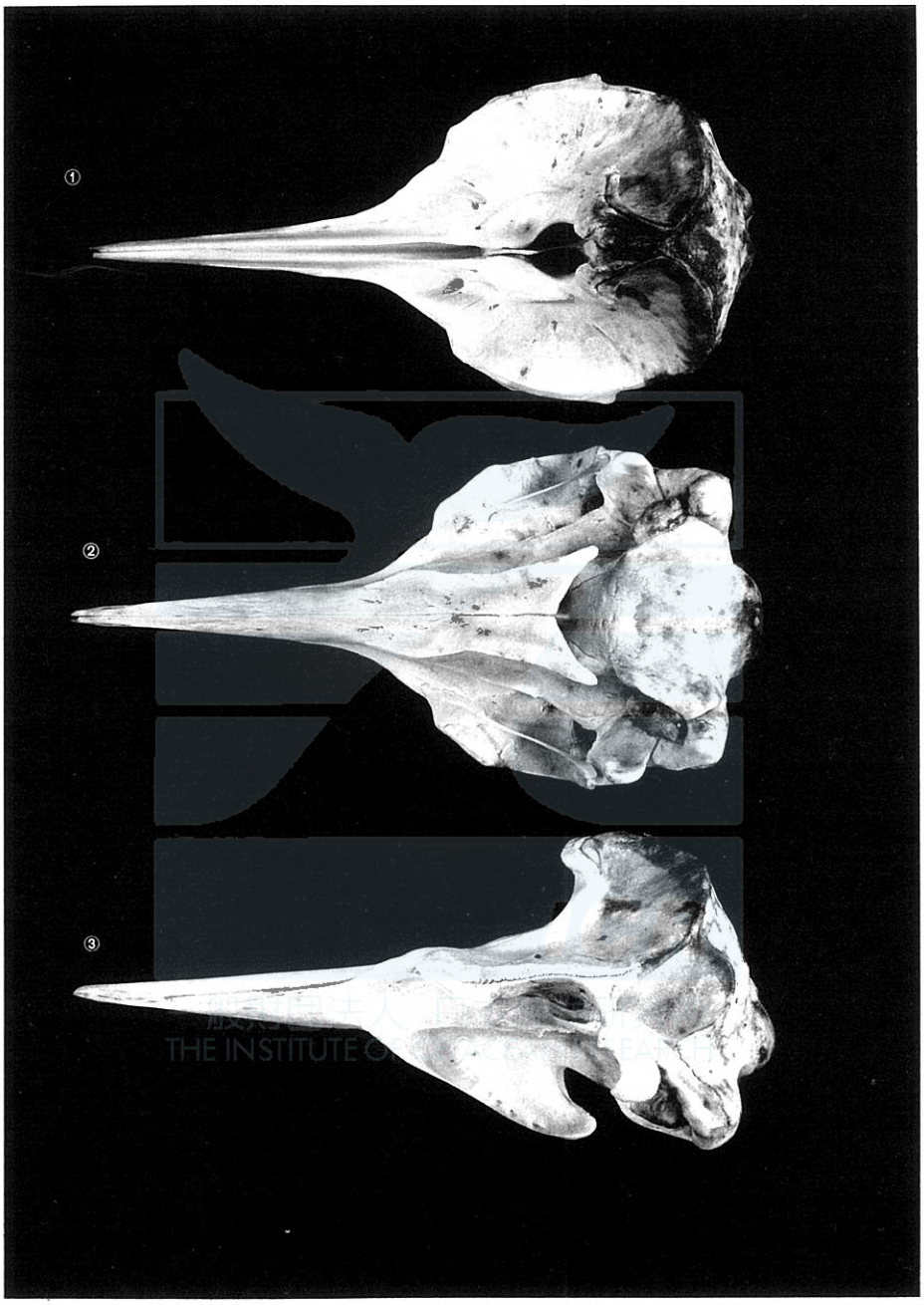
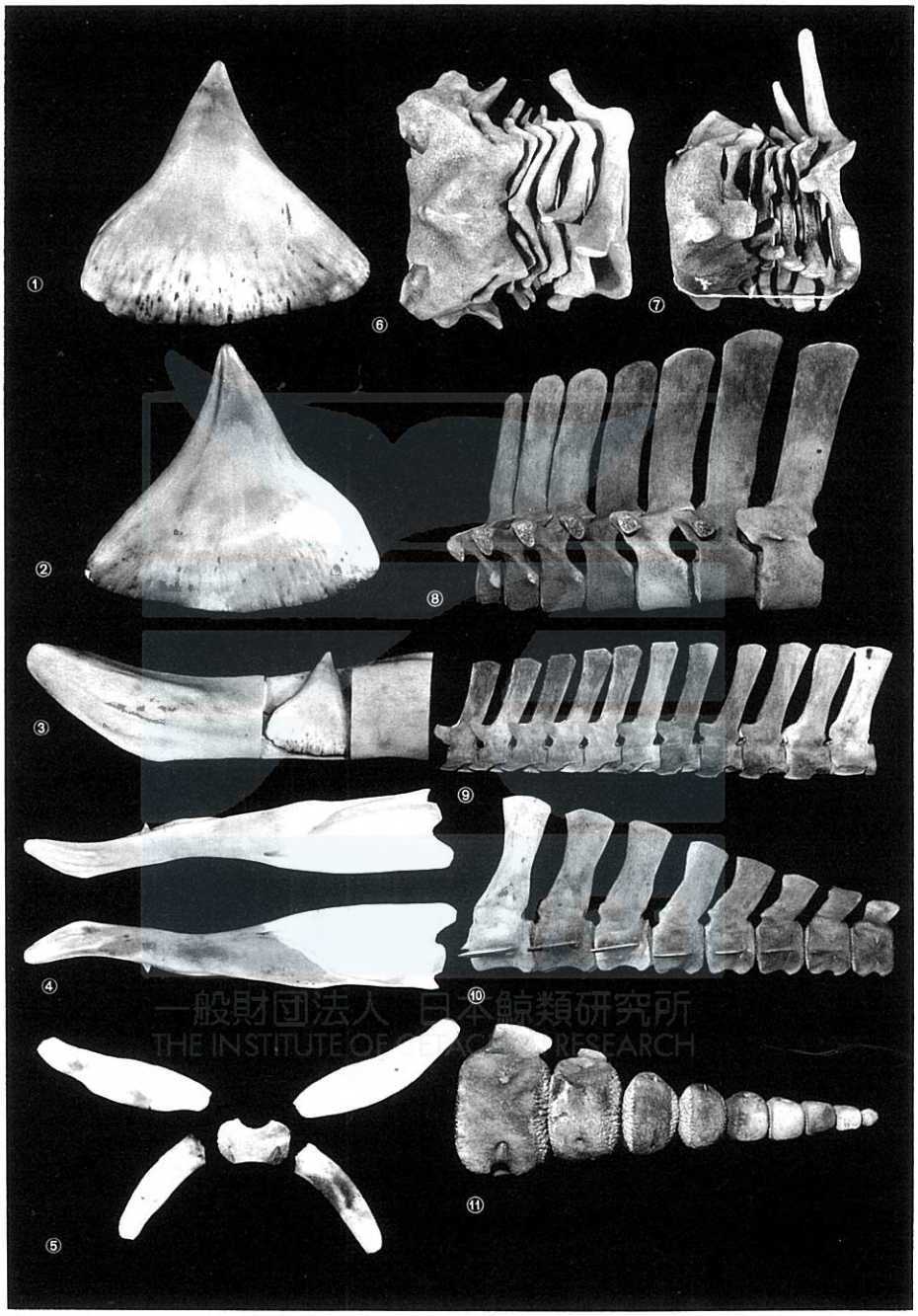


PLATE III



APPENDIX TABLE 1. SKULL MEASUREMENTS OF THE PRESENT SPECIMEN OF *MESOPLODON STEJNEGERI*

Measurements	mm	%
1. Condylobasal length*	612	100
2. Rostrum length*	327	53.4
3. Tip of rostrum to posterior margin of pterygoid nearest mid-sagittal plane*	446	72.9
4. Tip of rostrum to most posterior extension of wing of pterygoid (L)	472	77.1
5. Tip of rostrum to most anterior extension of pterygoid (L)	270	44.1
6. Tip of rostrum to most posterior extension of maxillaries between the pterygoids on the palate*	351	57.4
7. Tip of rostrum to most posterior extension of maxillary plate (L)	557	91.0
8. Tip of rostrum to anterior margin of superior nares*	404	66.0
9. Tip of rostrum to most anterior point of premaxillary crest	436	71.2
10. Tip of rostrum to most posterior extension of temporal fossa (L)	574	93.8
11. Tip of rostrum to most posterior extension of lateral tip of premaxillary crest (L)	469	76.6
12. Tip of rostrum to most anterior extension of pterygoid sinus (L)	311	50.8
13. Greatest length of temporal fossa (L)	101	16.5
14. Greatest length of orbit (L)	89	14.5
15. Greatest length of right nasal on vertex of skull	41	6.7
16. Length of nasal suture	42	6.9
17. Greatest breadth of skull across postorbital process of frontals	302	49.8
18. Greatest breadth of skull across zygomatic processes of squamosals	289	47.2
19. Greatest breadth of skull across centers of orbits	289	47.2
20. Least breadth of skull across posterior margins of temporal fossae	199	32.5
21. Greatest span of occipital condyles	95	15.5
22. Greatest width of occipital condyle (L)	36	5.9
23. Greatest length of occipital condyle (L)	63	10.3
24. Greatest breadth of foramen magnum	40	6.5
25. Greatest height of foramen magnum	42	6.9
26. Greatest breadth of skull across exoccipitals	252	41.2
27. Greatest breadth of nasals on vertex	37	6.0
28. Least distance between premaxillary crests	21	3.4
29. Distance from anterior process of premaxillary crest to posterior to right nasal on vertex	26	12.7
30. Greatest span of premaxillary crests	116	19.0
31. Width of rostrum at midrostral length	39	6.4
32. Width of premaxillae at midlength of rostrum	30	4.9
33. Width of rostrum at 1/4 rostral length from the tip	24	3.9
34. Width of premaxillae at 1/4 rostral length from the tip	24	3.9
35. Width of rostrum at 3/4 rostral length from the tip	48	7.8
36. Width of premaxillae at 3/4 rostral length from the tip	32	5.2
37. Greatest depth of rostrum at midrostral length	38	6.2
38. Width of rostrum in apices of antorbital notches	156	25.5
39. Greatest width of superior nares	49	8.0
40. Greatest width of inferior nares, at apices of pterygoid notches, on the pterygoids	101	16.5
41. Height of skull, distance between vertex of skull and most ventral point on pterygoids	214	35.0
42. Greatest width of temporal fossa approximately at right angles to greatest length (L)	60	9.8
43. Least distance between maxillary foramina	63	10.3
44. Least distance between premaxillary foramina	36	5.9
45. Greatest length of vomer visible on palate	65	10.6
46. Greatest condylar length of mandibular ramus (L)	518	84.6
47. Greatest length of mandibular symphysis	94	15.4
48. Greatest height of mandible at coronoid process (L)	105	17.2
49. Height of mandible at midlength of alveolus (measured from lingual margin of alveolus) (L)	46	7.5
50. Height of mandible at midlength of alveolus (measured from buccal margin of alveolus) (L)	45	7.4
51. Length from most posterior extension of mandibular symphysis to most posterior extention of condyle (L)	426	69.6
52. Length from posterior margin of alveolus to condyle (L)	365	59.6
53. Length of alveolus (L)	20	3.3
54. Width of alveolus (L)	9	1.5
55. Tip of mandible to anterior margin of alveolus (L)	136	22.2
56. Tip of mandible to center of alveolus (L)	147	24.0
57. Greatest length of tooth (R)	51	8.3
58. Greatest antero-posterior width of tooth at approximately right angles to long axis of tooth (R)	55	9.0
59. Greatest thickness of tooth (R)	8	1.3

* These characters were measured parallel to the condylobasal length while the others by distance between points.
L and R indicate left and right, respectively.

APPENDIX TABLE 2. MEASUREMENTS OF VERTEBRAE (mm) OF *MESOPLODON STEJNEGERI* STRANDED ON THE BEACH OF MAIZURU BAY, KYOTO, 1984

Serial no.	Segment no.	Greatest		Centrum			Neural canal		Fusion of epiphyses
		B	H	B	H	L	B	H	
1	C1	14.3	13.0	–	–	–	5.1	3.7	yes
2	2	13.9	13.0	–	–	–	–	–	yes
3	3	11.8	12.1	5.9	4.1	–	4.4	–	yes
4	4	10.1	10.7	5.6	3.8	1.1	4.2	4.0	yes
5	5	9.1	10.5	5.4	4.1	1.0	4.3	4.2	yes
6	6	8.6	14.5	5.4	4.3	1.2	4.6	4.5	yes
7	7	12.8	19.4	6.0	4.3	1.5	5.1	4.8	yes
8	D1	15.2	22.5	5.3	4.3	2.3	5.2	5.0	no
9	2	15.2	24.5	5.4	4.3	3.5	5.0	5.1	no
10	3	15.0	24.9	5.5	4.2	4.4	4.7	5.3	no
11	4	14.8	25.7	5.4	4.1	5.0	4.4	5.5	no
12	5	14.8	26.7	5.7	4.3	5.6	4.2	5.6	no
13	6	14.9	27.4	5.9	4.5	6.3	4.0	5.6	no
14	7	11.6	27.5	6.2	4.7	6.7	3.7	5.5	no
15	8*	–	–	–	–	–	–	–	
16	9*	–	–	–	–	–	–	–	
17	L1	27.1	30.7	7.4	5.5	8.4	3.4	5.4	no
18	2	27.5	31.9	7.7	5.9	8.8	3.1	5.3	no
19	3	27.8	32.8	7.9	6.2	9.3	3.0	5.2	no
20	4	28.2	34.3	8.1	6.3	9.4	3.0	5.1	no
21	5	27.7	35.0	8.3	6.7	9.7	3.0	5.0	no
22	6	27.8	35.3	8.4	6.9	10.1	3.2	5.1	no
23	7	27.7	35.1	8.6	7.4	10.5	2.9	4.6	no
24	8	27.8	34.4	9.0	7.6	11.1	2.9	4.2	no
25	9	27.9	35.2	9.2	7.8	11.2	2.5	3.6	no
26	10	27.2	34.2	9.4	8.0	11.7	2.3	3.2	no
27	11	26.4	33.7	9.4	8.2	11.6	2.2	2.4	no
28	Cal	24.9	33.2	9.7	8.4	11.5	1.8	2.6	no
29	2	22.4	30.8	9.8	8.6	11.0	1.6	2.3	no
30	3	20.1	28.3	9.5	8.6	10.4	1.4	1.9	no
31	4	17.9	24.6	9.4	8.5	9.7	1.4	1.8	no
32	5	15.4	21.6	9.6	8.7	9.2	1.4	1.6	no
33	6	12.5	18.7	9.6	9.1	8.9	1.4	1.2	no
34	7	10.1	16.3	9.9	9.1	8.2	1.3	1.0	no
35	8	8.7	14.2	8.7	9.0	7.4	0.9	1.0	no
36	9	7.7	11.8	7.7	8.8	6.6	0.8	0.7	no
37	10	7.2	9.1	7.2	7.7	5.3	0.6	0.5	no
38	11	6.7	6.5	6.7	6.4	4.0	–	–	no
39	12	5.8	5.1	5.8	5.0	3.6	–	–	no
40	13	5.1	4.0	5.1	3.8	3.3	–	–	no
41	14	4.6	3.5	4.6	3.3	2.9	–	–	no
42	15	4.0	2.8	4.0	2.7	2.6	–	–	no
43	16	3.3	2.0	3.3	2.0	2.0	–	–	yes
44	17	2.1	1.4	2.1	1.4	1.3	–	–	yes

* These two vertebral bones were used for analysis of organochlorine compounds without making measurement.

B: breadth, H: height, L: length.