OSTEOLOGY OF PYGMY BLUE WHALE WITH ADDITIONAL INFORMATION ON EXTERNAL AND OTHER CHARACTERISTICS

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INTRODUCTION

The name " Pygmy blue whale " was first given by Ichihara (1961) to blue whales inhabiting the waters around Kerguelen Island, recognizing differences in the external characteristics from the blue whales elsewhere in the Antarctic. Since then researches on this population have been carried out by various authors (Ichihara, 1963, 1966; Gambell, 1964; Ichihara and Doi, 1964; Zemsky and Boronin, 1964).

The subspecies *Balaenoptera musculus brevicauda* was proposed by Ichihara in a paper read in 1963 at the First International Symposium on Cetacean Research. His paper was not published until 1966 (Ichihara, 1966). Meanwhile, Zemsky and Boronin (1964) published the name *brevicauda* without calling it a new subspecies and without crediting Ichihara (Rice and Scheffer, 1968). The identification of the subspecies is mainly based upon the external characteristics.

In 1966 the Whales Research Institute was granted a special permission to take three pygmy blue whales for scientific researches, and a complete skeleton of this subspecies has been secured. The present paper deals with mainly the osteological study of the skeleton.

OSTEOLOGY

A complete skeleton of the pygmy blue whale was secured in 1966. This whale (66 Pl), a male of 18.6 m in length, was taken on 25 December 1966 at a position of 42°–08′S and 44°–09′E. The skeleton was transported on board factory ship to Japan. It had been burried in sand, at a corner of campus of the College of Marine Science and Technology, Tokai University, in Shimizu city during a period of about one and a half year from April 1967 to September 1968, for extraction of oils contained in bones. In September 1968 the bones were dug out and we made investigation of the bones, after cleaning. The photographs contained in this paper were also taken at this occasion. This skeleton is now mounted and being kept in the exhibition hall of the Marine Science Museum of the University. The body length of this whale is only 18.6 m (61 feet), but it had already attained physical maturity, because all of the vertebral epiphyses are fused completely to their centra, though

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linea epiphysialis is still visible on some vertebrae, especially on those of thoracic region. This is rather surprising, judged from the knowledge of the usual blue whale in the Antarctic, in which the physical maturity is attained at a body length of 24.0 m (79 feet) in male (Nishiwaki and Hayashi, 1950).

Skull (Pls. I and II) The length of the skull is 26.1 % of the body length. Tomilin (1957) gives 21.2–23.9 % for female and 23–27 % for male as the proportional length of the skull of blue whale. The figure of 26.1 % of the pygmy blue

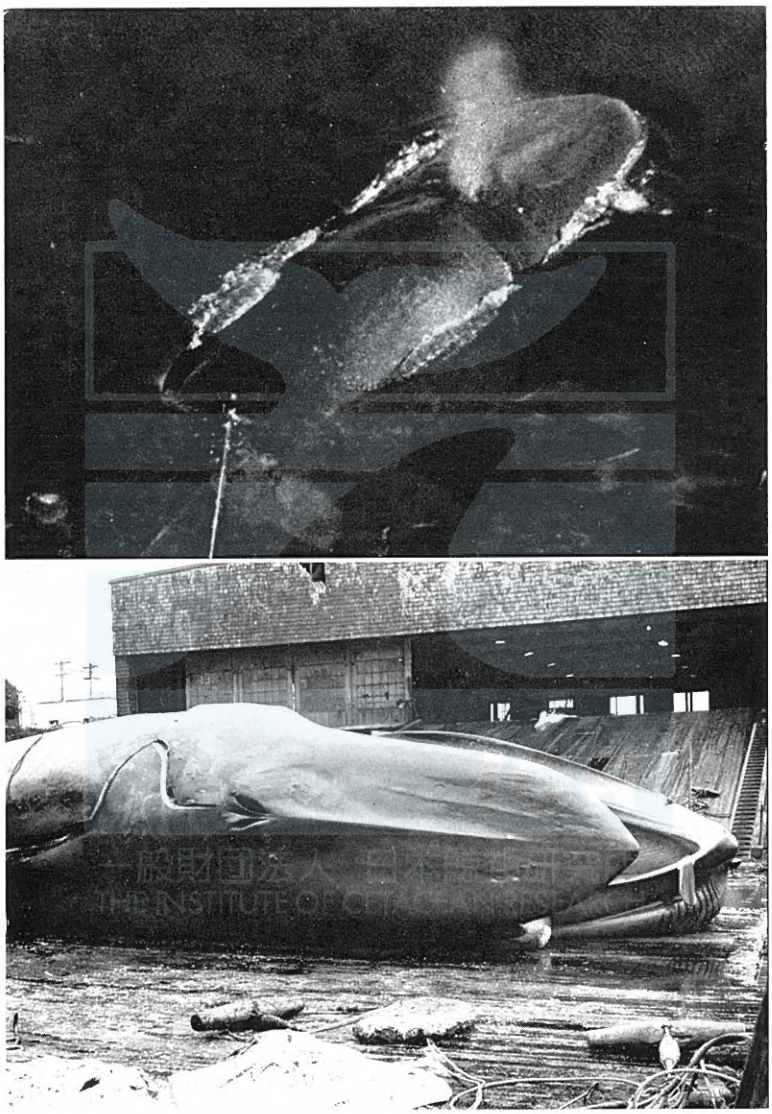


Fig. 1. Dorsal view of rostrum of blue whale.
Above: Blue whale in the Antarctic (photo by M. Yamada, 1947–48 season).
Below: Blue whale in the North Pacific (photo by M. Nishiwaki, Aug. 1963. Coal Harbour, Canada).

TABLE 1. SKULL MEASUREMENTS OF BLUE AND PYGMY BLUE WHALES

	Measurements	Tomilin 1957 ZMAN Ad. F. Ostend Skeleton 25 m		Tomilin 1957 ZMMGU Ad. F (?) Arctic Body 25.62 m		Miller 1924 U.S. Nat. Mus. Subad. M Newfoundland Body 22.87 m		True 1904 Philadelphia Mus. Juv. F. Ocean City Body 20.18 m		Present specimen Tokai Univ. Ad. M Antarctic Body 18.6 m	
		cm	%	cm	%	cm	%	cm	%	cm	%
1.	Condylo-premaxillary length	590.0	100.0	580.0	100.0	579	100.0	445.8	100.0	486.0	100.0
2.	Zygomatic width	310.0	52.5	287.0	49.5	274	47.4	221.0	49.6	236.0	48.6
3.	Orbital width	270.0	45.8	260.0	44.8	—	—	—	—	224.0	46.1
4.	Rostrum length	455.0	77.1	419.0	72.2	399	68.9	315.0	70.7	330.5	68.0
5.	Distance between orbital processes of maxillaries	270.0	45.8	259.0	44.6	—	—	—	—	216.5	44.6
6.	Rostrum width at base	180.0	30.5	168.0	28.9	206*	35.6*	—	—	143.5	29.5
7.	Rostrum width at middle	—	—	169.0	29.1	163*	28.2*	—	28.8**	123.5	25.4
8.	Length of maxillary	510.0	86.1	470.0	81.0	457	78.9	—	—	384.0	79.0
9.	Length of premaxillary	525.0	89.0	—	—	478	82.6	—	—	393.0	80.9
10.	Condyle width	44.0	7.3	43.0	7.4	43	7.4	—	—	36.5	7.5
11.	Occipital condyle height	34.0	5.7	32.0	5.5	—	—	—	—	27.5	5.7
12.	Occipital foramen width	13.5	2.3	12.3	2.1	11	1.9	—	—	9.1	1.9
13.	Occipital foramen height	13.0	2.2	16.0	2.7	—	—	—	—	11.0	2.3
21.	Length of nasal bones	32.0	5.4	—	—	28	5.0	—	—	22.0	4.5
22.	Total anterior width of both nasals	20.0	3.4	—	—	25	4.3	—	—	21.0	4.3
24.	Occipital bone width	186.0	31.5	182.0	31.3	—	—	—	—	141.0	29.0
25.	Occipital length, foramen to vertex	114.0	19.3	119.0	20.9	116	20.0	—	—	90.5	18.6
26.	Lower jaw length (straight)	—	—	600.0	103.4	568	98.0	462.3	103.7	468.0	96.3
27.	Lower jaw length (on curve)	—	—	636.0	109.6	612	105.7	520.7	116.8	487.0	100.2
28.	Lower jaw height at middle	—	—	47.0	8.1	39	6.8	33.0	7.4	37.0	7.6
29.	Lower jaw height, incl. coronoid	74.0	12.5	83.0	14.3	85	14.7	—	—	61.5	12.7

* Curved length.

** Estimated by True. See text.

The same measurements number in Table 13 of Tomilin (1957) is used here.

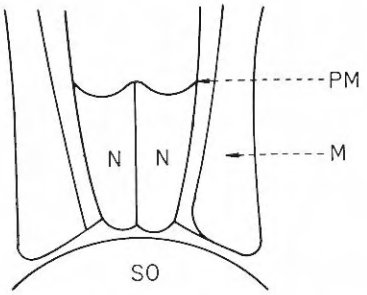
whale is in the range of male blue whale, and this coincides with the conclusion by Ichihara (1966) that no difference is noted in the head region between pygmy and ordinary blue whales, from a study of external body proportions.

In the lateral aspect the skull has a very flat appearance (Pl. I, Fig. 1). The profile resembles very closely to that of the Newfoundland specimen (No. 49757, US National Museum) as reported by Miller (1924).

The most striking point in general view of the skull of pygmy blue whale is in the dorsal aspect. The principal characteristic feature of the ordinary blue whale's cranium is its wide rostrum with convex margins. The width of the rostrum at the middle of its length is as wide, or almost as wide as the width of its base (Tomilin, 1957). This is not applied to the rostrum of the pygmy blue whale. As seen in Pl. I the rostrum is less curved at its outer margin, but tapering from its base. In Table 1 the skull measurements of blue and pygmy blue whales are compared. The width of the rostrum at base does not differ between blue and pygmy blue whales, showing 29–31 % of the skull length. On the contrary, in the width at its middle there is a good difference between the blue and pygmy blue whales. In the former this value is about 29 % whereas in the latter about 25 %. To our regret, however, only few papers on the osteology of blue whale are available. The only reliable measurement of the width at middle of the rostrum is that given by Tomilin (1957, specimen ZMMGU) which shows 29.1 % of the skull length (Table 1).

Miller (1924) presents measurements of the skeleton of the Newfoundland specimen, found among the MS. notes left by Doctor True. But in the Table breadths of rostrum at middle as well as at base were measured on curve. The Ocean City specimen lacks premaxillae, and maxillae were separated from the cranium (True, 1904), but True states " With a suitable allowance for the premaxillae and interspace, the breadth of the rostrum (at middle) is 28.8 % (of the skull length). He states nothing whether this is straight or curved, but probably the latter, judged from the measurements reported by Miller (1924). If so, this value agrees well to that of the Newfoundland specimen. In any case no great difference between measurements in straight and on curve is expected at this position of the rostrum. Accordingly we can safely conclude that the rostrum width of the pygmy blue whale is about 25 % whereas in blue whale 28–29 % at its middle.

The fact that the width of the rostrum at the middle of its length is as wide, or almost as wide as the width of its base in blue whale is well supported by a drawing by van Beneden and Gervais (1880) and also by two photographs (dorsal and ventral aspects of the same skull) presented by Miller (1924). To our knowledge no paper is available on the osteology of blue whale in the Antarctic and in the North Pacific. But from Fig. 1, which shows the rostrum of the blue whale in these oceans, no difference is suggested in this respect among blue whales from different oceans. Tomilin (1957) states that in the blue whale the age-determined variations of the cranium are quite markedly expressed, and they are associated with the relative elongation of the facial region (rostrum, maxillaries, and premaxillaries) and the lateral expansion of the posterior region of the cranium and rostrum. For the



N . . . Nasal
PM . . . Premaxillary
M . . . Maxillary
SO . . . Supraoccipital

Fig. 2. Schematic drawing of nasals in ordinary blue whale, based upon van Beneden and Gervais (1880), and Miller (1924).

Fig. 3. Nasals of pygmy blue whale.

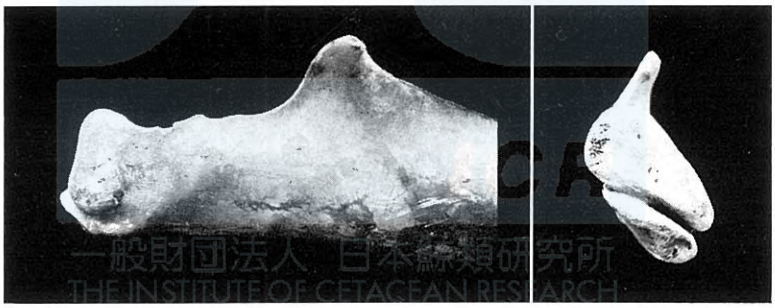


Fig. 4. Mandible of pygmy blue whale (posterior portion).
Left: Lateral view. Right: Posterior view.

pygmy blue whale only one skull is available and no conclusion is drawn at the moment.

Nasal bones are different from those of blue whale. In blue whale they are concave anteriorly, and the inner and outer borders end at nearly the same level (Fig. 2). But as shown in Fig. 3, in nasals of pygmy blue whale their inner borders are extending more anteriorly than outer borders, and they are rather convex

anteriorly in general and only their outer margins concave. The length of nasals is shorter than that of blue whale in proportion to its width (Table 1).

In the dorsal aspect of the skull no other remarkable difference is noted. In the ventral aspect of the skull we find no significant difference from that of the Newfoundland specimen, comparing to the photograph presented by Miller (1924). He also reports the length of inferior margin of palatine which measures 1.22 m (21.1 % of skull length). In our specimen it is 1.06 m (21.8 % of skull length) and the proportional length is quite similar.

From Table 1 it will be noted that mandible of the pygmy blue whale is shorter than in the blue whale in general, and especially in the length on curve. The posterior portion of the mandible is shown in Fig. 4. The groove between angular and articular parts is deep, and the former projects behind the latter. Such relation between the two parts is a characteristic which separates the sei and Bryde's whales and may be of some significance in the taxonomy of baleen whales. But as regards to blue whale we have no material to compare at present.

A detailed measurements of the skull of the pygmy blue whale are shown in Table 2.

Fig. 5. Lacrymal and malar of pygmy blue whale.
Left: Lacrymal. Right: Malar.

Lachrymals are of no special feature, but malars (jugals) are seemed to be congenital bipartite. As seen in Fig. 5 the right malar is a single bone, but towards its posterior portion it is constricted and suggesting that originally it is composed of two ossicles, an anterior major and posterior minor elements. In the left malar this posterior minor element is lacking. Fraser and Cave (1969) report relatively high incidence of congenital jugal bipartism in mysticetes and among four blue whale specimens they investigated three had bipartite jugal. Omura *et al.* (1969) also report a case of bipartite malar in the black right whale in the North Pacific.

Vertebrae (Pls. III and IV) Total number of vertebrae is 63 and the vertebral formula is C 7, D 15, L 14, Ca 27. Tomilin (1957) gives a formula of the blue whale C 7, D 15 (16), L 14 (16), Ca 26 (27); total 64 (65). The same vertebral count has been reported by True (1904) for three female embryos. In comparing above figures we note the only difference of the pygmy blue whale is in the total number. Ichihara (1966) reports the vertebral formula for four fetuses

TABLE 2. SKULL MEASUREMENTS OF PYGMY BLUE WHALE

Measurement		Actual length (mm)	% of skull length	% of skull breadth
Length of skull, straight		4860	100.00	205.93
„ „ beak		3305	68.00	140.04
„ „ premaxillary, straight	R.	3930	80.86	166.53
„ „ „ „	L.	3840	79.01	162.71
„ „ maxillary along upper surface	R.	3920	80.66	166.10
„ „ „ „ „ „	L.	3830	78.81	162.29
Tip of premaxillary to posterior end of maxillary	R.	3970	81.69	168.22
„ „ „ „ „ „ „ „	L.	3900	80.25	165.25
Tip of premaxillary to vertex		3950	81.28	167.37
„ „ „ „ tip of nasals (mesial)		3700	76.13	156.78
Tip of premaxillary to anterior end of palatines (mesial)		3360	68.93	142.37
Tip of premaxillary to posterior end of palatines (mesial)		4420	90.95	187.29
Tip of premaxillary to posterior end of pterygoid		4515	92.90	191.31
„ „ „ „ anterior end of maxillary		205	4.22	8.69
„ „ „ „ „ „ „ vomer		505	10.39	21.40
Length of supraoccipital from foramen magnum		905	18.62	38.35
Greatest breadth of skull, squamosal		2360	48.56	100.00
Breadth of skull, frontal		2240	46.09	94.92
„ „ „ , maxillary		2165	44.55	91.74
„ „ beak at base		1435	29.53	60.81
„ „ „ „ middle		1235	25.41	52.33
„ across premaxillaries, greatest		525	10.80	22.25
„ „ „ at base of beak		505	10.39	21.40
„ „ „ „ middle of beak		455	9.36	19.28
„ „ „ „ posterior ends		260	5.35	11.02
„ „ maxillaries at posterior ends		485	9.98	20.55
Breadth of pterygoids		580	11.93	24.58
„ „ palatines		630	12.96	26.69
„ between tympanic bullae, outer		750	15.43	31.78
Length of nasals mesially		220	4.53	9.32
Breadth of nasals at anterior ends		210	4.32	8.90
„ „ „ posterior ends		180	3.70	7.63
„ „ frontal plane posterior to premaxillary	R.	445	9.16	18.86
„ „ „ „ „ „ „	L.	435	8.95	18.43
Breadth of orbit (frontal wing)	R.	290	5.97	12.29
„ „ „ „ „	L.	290	5.97	12.29
„ „ occiput between squamosal sutures		1410	29.01	59.75
„ across occipital condyle		365	7.51	15.47
Height of occipital condyle	R.	275	5.66	11.65
„ „ „ „	L.	270	5.56	11.44
Breadth of foramen magnum		91	1.87	3.86
Height of foramen magnum		110	2.26	4.66
Breadth across mastoid process, tip to tip		1860	38.27	78.81
„ „ „ „ , greatest				
Length of mandible, straight	R.	4680	96.30	198.31

Continued . . .

TABLE 2. Continued.

Measurement		Actual length (mm)	% of skull length	% of skull breadth
Length of mandible, straight		L. 4660	95.88	197.46
„ „ „ , along outer curve		R. 4870	100.21	206.36
„ „ „ „ „ „		L. 4840	99.59	205.08
Height of mandible at coronoid		R. 615	12.65	26.06
„ „ „ „ „		L. 610	12.55	25.85
„ „ „ „ processus articularis		R. 405	8.33	17.16
„ „ „ „ „ „		L. 400	8.23	16.95
„ „ „ „ middle		R. 370	7.61	15.68
„ „ „ „ „		L. 380	7.82	16.10

of the pygmy blue whale, and in these the total number is 64–66. He also gives vertebral number of three blue whale fetuses in the North Pacific, and in these the number is 63–65. From the above figures the amount of variation in the vertebral number of the pygmy blue whale is considerable, as True (1904) states for blue whale, and no difference between pygmy and ordinary blue whales is noted.

Detailed measurements of each vertebra are shown in Table 3, as well as in Fig. 6. In this Table the most interesting feature is the fact that in the length of the centrum the 12th lumbar shows the largest value. As shown in Fig. 6 (the bottom figure) in the caudal region the length of the centra decrease gradually from the 1st caudal to the 14th, thence very steeply until 17th, and from there again less steep. A similar figure is also presented for the Bryde's whale, comparing with that of the sei whale (Omura 1959, Fig. 3). The curve for the pygmy blue whale is quite similar to that for the Bryde's whale, but it differs from that for the sei whale. In the sei whale the caudal vertebrae are more developed, showing a curve slightly rises from the 1st caudal towards about 5th and then decreases gradually, and then steeply, and lastly again less steep towards the end. In the black right whale this curve is somewhat different from the above (Omura *et al.* 1969, Fig. 23), and the length of the centra decreases gradually from the 1st caudal towards the last, showing no remarkable steep portion, but in this species too the longest centrum is in the lumbar region.

These facts may possibly connected with the manner of swimming. In the species which swim fast or follow long distant migration the caudal vertebrae may develop well and hence longer than those of the slow swimmer. In this connection it is interesting to compare the pygmy blue whale and the ordinary blue whale, but to our regret no material is available for the latter.

Tomilin (1957) states " In adult animals, the cervical region forms 5%, the thoracic 23%, the lumbar 34%, and the caudal 38% of the total length of the vertebral column (E. J. Slijper, 1936)." In our specimen of the pygmy blue whale the total length of the vertebral column is 12,054 mm, and the percentages of the respective regions are: cervical 5.13%, thoracic 24.46%, lumbar 31.11%, and caudal 39.40%. This specimen has attained already of its physical maturity, as

TABLE 3. MEASUREMENTS OF VERTEBRAE OF PYGMY BLUE WHALE
(in mm)

Serial No.	Vertebral No.	Greatest breadth	Greatest height	Centrum			Neural canal	
				Breadth	Height	Length	Breadth	Height
1	C 1	755	414	389	291	112	123	
2	„ 2	1,065	467	373	209	106	139	131
3	„ 3	990	353	345	204	73	152	105
4	„ 4	950	345	342	221	71	175	95
5	„ 5		410	321	240	85	133	85
6	„ 6	914	395	325	230	75	135	83
7	„ 7	958	390	318	245	96	187	83
8	D 1	985	542	318	243	107	134	93
9	„ 2	980	546	328	238	120	177	92
10	„ 3	960	585	312	243	141	190	92
11	„ 4	970	635	313	242	164	179	96
12	„ 5	945	680	327	244	183	155	130
13	„ 6	970	700	317	248	192	141	100
14	„ 7	1,030	725	316	246	199	132	97
15	„ 8	1,120	770	309	251	212	112	107
16	„ 9	1,115	775	317	250	223	102	107
17	„ 10	1,125	780	319	252	227	98	103
18	„ 11	1,130	780	323	251	231	96	105
19	„ 12	1,155	775	327	249	232	92	105
20	„ 13	1,180	790	335	250	237	89	99
21	„ 14	1,205	805	337	251	240	89	111
22	„ 15	1,210	815	342	252	241	85	112
23	L 1	1,205	835	340	260	251	86	117
24	„ 2	1,205	845	336	268	257	85	114
25	„ 3	1,200	860	338	284	260	85	94
26	„ 4	1,215	860	337	274	257	86	107
27	„ 5	1,195	880	339	289	262	85	96
28	„ 6	1,180	900	337	301	266	82	76
29	„ 7	1,155	900	342	305	270	80	80
30	„ 8	1,100	900	346	293	270	81	79
31	„ 9	1,130	905	340	302	370	83	76
32	„ 10	1,070	895	349	297	272	82	77
33	„ 11	1,030	905	355	300	276	74	80
34	„ 12	985	890	355	305	281	71	81
35	„ 13	940	885	359	312	279	80	88
36	„ 14	890	900	356	318	279	78	88
37	Ca 1	825	880	359	321	275	75	77
38	„ 2	770	860	363	325	275	70	78
39	„ 3	730	825	358	324	272	54	77
40	„ 4	680	800	361	327	270	50	76
41	„ 5	655	740	359	327	269	51	67
42	„ 6	625	680	365	333	272	47	55
43	„ 7	550	610	367	341	268	43	43
44	„ 8	515	560	365	333	267	41	41
45	„ 9	463	490	358	328	264	34	22
46	„ 10	416	470	353	322	260	24	13

Continued . . .

TABLE 3. Continued.

Serial No.	Vertebral No.	Greatest breadth	Greatest height	Centrum			Neural canal	
				Breadth	Height	Length	Breadth	Height
47	Ca 11	380	435	338	321	253	18	5
48	„ 12	350	410	327	317	248	17	—
49	„ 13	326	380	306	311	240	16	—
50	„ 14	310	360	291	301	228	15	—
51	„ 15	289	338	276	285	202	12	—
52	„ 16	—	306	261	262	153	11	—
53	„ 17	—	258	228	216	113	4	—
54	„ 18	—	225	226	196	98	3	—
55	„ 19	—	189	189	173	85	—	—
56	„ 20	—	178	172	—	77	—	—
57	„ 21	—	155	147	—	72	—	—
58	„ 22	—	137	125	—	67	—	—
59	„ 23	—	106	102	—	56	—	—
60	„ 24	—	80	92	—	51	—	—
61	„ 25	—	63	71	—	45	—	—
62	„ 26	—	47	49	—	32	—	—
63	„ 27	—	27	43	—	25	—	—

TABLE 4. COMPARISON OF VERTEBRAE. OCEAN CITY AND PRESENT SPECIMENS ARE COMPARED

Measurements	Actual length in mm		% of skull length		% of skull breadth	
	OCS	PB	OCS	PB	OCS	PB
Greatest breadth of axis	914	1,065	20.50	21.91	41.36	45.13
Height of centrum of axis	254	209	5.70	4.30	—	—
Greatest breadth of 1st dorsal	880	985	19.94	20.27	40.23	41.74
Height of centrum of 1st dorsal	267	243	5.99	5.00	—	—
Greatest breadth of 1st lumbar	1,194	1,210	26.78	24.79	54.03	51.27
Height of centrum of 1st lumbar	318	252	7.13	5.19	—	—
Greatest breadth of 1st caudal	914	825	20.50	16.98	41.36	34.96
Height of centrum of 1st caudal	368	321	8.25	6.60	—	—

OCS: Ocean City specimen (True, 1904). Skull length 4,450 mm. Skull breadth 2,210 mm.
PB: Present specimen of pygmy blue whale. Skull length 4,860 mm. Skull breadth 2,360 mm.

stated already. In comparing these figures it is suggested that the pygmy blue whale has a somewhat shorter dorsal and lumbar region, both combined, and a longer caudal region than the blue whale, contrary to our expectation. This is probably due to the different methods of measurements. In our specimen each vertebra is measured and then they are added. Since from studies of the external body proportions the pygmy blue whale is concluded to have a shorter tail region than ordinary blue whale, this problem should be left to future study.

True (1904) presents some vertebral measurements of the Ocean City specimen. In Table 4 these are compared with our specimen. As seen in this Table the

proportional height of the centrum is smaller in the pygmy blue whale than in the Ocean City specimen. Further the greatest breadth of axis and 1st dorsal vertebrae of the pygmy blue whale are greater, but that of 1st lumbar and 1st caudal is smaller than in the Ocean City specimen. It is suggested, therefore, that in the pygmy blue whale the centrum of the vertebral bone is smaller in general than in the ordinary blue whale and it decreases more steeply its breadth in lumbar and caudal regions. This is clearly shown in the percentage figures of greatest breadth against the skull breadth. One problem which is needed for consideration in this matter is the size variation of vertebrae according to growth, as the Ocean City specimen is a juvenile one, but to our regret no material is available for further discussion.

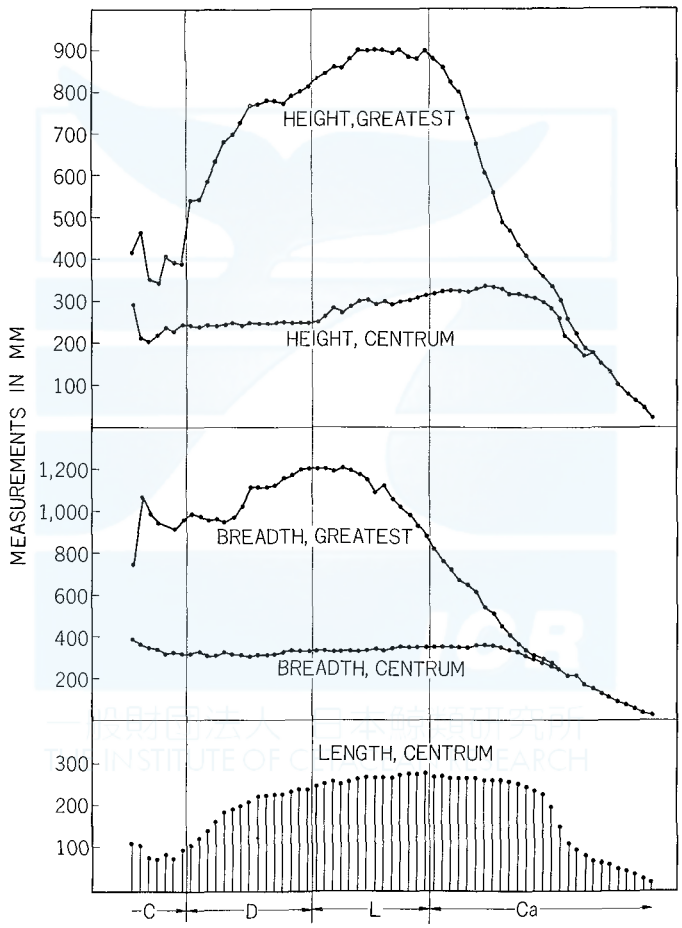


Fig. 6. Vertebral measurements of pygmy blue whale.

In our specimen of pygmy blue whale the first vertebra in which the transverse process is perforated is the 47th (11th caudal) and the neural arch is obsolete on

TABLE 5. MEASUREMENTS OF RIBS (in mm) NEWFOUNDLAND AND PRESENT SPECIMENS ARE COMPARED

Rib No.	PB (right)		PB (left)		NFS	% of skull length	
	Str. l.	Curved l.	Str. l.	Curved l.	Str. l.	PB, right	NFS
1	1,345	1,605	1,315	1,575	1,750	27.67	30.22
2	1,850	2,080	1,825	2,060	1,780	38.07	30.74
3	2,170	2,460	2,145	2,405	2,130	44.65	36.79
4	2,245	2,605	2,245	2,595	2,240	46.19	38.69
5	2,250	2,675	2,220	2,670	2,410	46.30	41.62
6	2,260	2,725	2,310	2,705	2,390	46.50	41.28
7	2,215	2,655	broken	—	2,390	45.58	41.29
8	2,160	2,575	2,200	2,600	2,290	44.44	39.55
9	2,040	2,485	2,030	2,495	2,240	41.98	38.69
10	1,975	2,360	2,010	2,355	2,220	40.64	38.34
11	1,895	2,220	1,895	2,210	2,150	38.99	37.13
12	1,785	2,040	1,795	2,065	2,070	36.73	35.75
13	1,690	1,850	1,580	1,875	1,990	34.77	34.37
14	2,625	1,705	1,630	1,725	1,890	33.44	32.64
15	1,635	1,685	1,645	1,685	1,800	33.64	31.09
16	515	515	—	—	—	—	—

PB: Pygmy blue whale. Skull length 4,860 mm.
NFS: Newfoundland specimen (Miller, 1924). Skull length 5,790 mm.
Str. l.: Straight length.
Curved l.: Curved length.

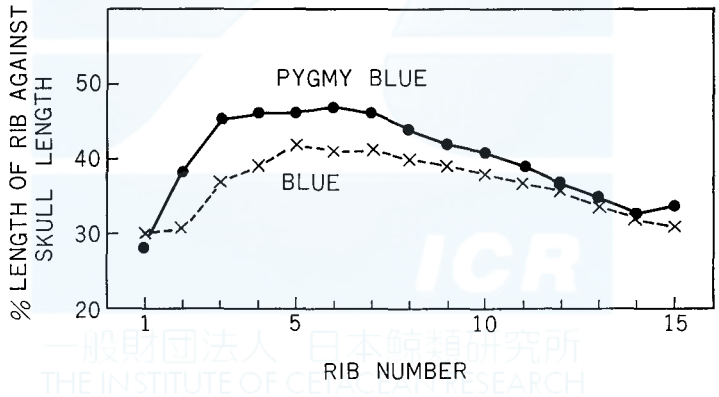


Fig. 7. Length of ribs. Pygmy blue whale and Newfoundland specimen are compared.

the 55th (19th caudal) vertebra. In the Ocean City specimen, as reported by True (1904), they are 46th and 55th respectively and show good agreement in these respects.

Ribs (Pl. IV) Fifteen pairs of ribs are present in our specimen, but in addition one very small rib has been secured. Only the 3rd and 4th ribs are double headed. On the transverse processes of the dorsal vertebrae the articulating facet

for ribs are clearly present on the 11–21st vertebrae, and on the 22nd they are faintly recognizable. But in the 23rd vertebra there is no trace of such facet. The additional small rib is quite different from the foregoing ribs in size. It is less than one third of the 15th and only rudimental. We assigned, therefore, the number of dorsal vertebrae as 15 instead of 16.

Measurements of ribs are shown in Table 5. In this Table the data for the Newfoundland specimen, reported by Miller (1924), are included for comparison. The straight length of ribs are also converted into percentages against their skull lengths for both specimens, and these figures are also shown in Fig. 7. It is clearly shown in Fig. 7 that in the pygmy blue whale the length of ribs in the anterior portion of the thorax is much longer proportionally than in the blue whale. The Newfoundland specimen is an adult male of 75 feet in length and quite comparable to our specimen, because both specimens are thought to be nearly at the same stage of growth, notwithstanding of their sizes. In calculating the proportional lengths of ribs of both specimens against their body length we got similar curves as those shown in Fig. 7, but in this case the greatest difference between the corresponding ribs is 2.2% (3rd rib). The range of variation in the length of ribs is not known yet, but this trend in length of ribs in general is thought to be a difference between subspecies, pending upon future studies.

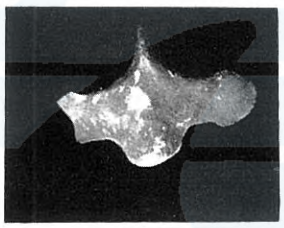


Fig. 8. Sternum of pygmy blue whale.

Sternum (Fig. 8) The sternum in our specimen is roughly crosslike. Its anterior and posterior processes are short, and the former process is broad and the latter pointing. The size and form of the sternum, however, is highly variable and has no taxonomic significance. In our specimen it is 41 cm long and about 60 cm wide (partly broken. Estimated).

Hyoid (Fig. 9) Measurements of hyoid bones are shown in Table 6, comparing with those of the other specimens of pygmy blue whale as reported by Omura (1964). Most of the measurements are within the ranges of the other specimens, but in the combined bone of basihyal and thyrohyals the height at center is slightly higher and the stylohyals are slightly longer and more flat than the other specimens. But in general no specific feature is observed in comparison to other specimens. No material is available for the ordinary blue whale and we are not able to make comparison between subspecies.

Chevron bones (Fig. 10) Eighteen pairs of chevron bones are present in our specimen of the pygmy blue whale. The 1st, 2nd, 17th, and 18th are separated

TABLE 6. MEASUREMENTS OF HYOID BONE OF PYGMY BLUE WHALE

	Actual length (mm)	% of overall length	Other specimens[1]
Combined bone of basihyal and thyrohyals			
Overall length along outer surface	1385	100	
Length, straight	1100	79.4	
Height, greatest	400	28.9	26.5–31.0
Height, center	265	19.1	14.9–18.1
Height, middle of wing, right	219	15.8	13.1–16.6
Height, middle of wing, left	221	16.0	12.8–16.8
Depth, forward notch	135	9.8	8.0–12.7
Thickness at middle of wing, right	139	10.0	8.1–11.2
Thickness at middle of wing, left	139	10.0	8.3–11.6
Stylohyal, right			
Length	586	42.3	36.9–40.8
Breadth	174	29.7[2]	30.5–36.7
Thickness at middle	89	15.2[2]	15.5–22.4
Stylohyal, left			
Length	592	42.7	36.9–40.8
Breadth	171	28.9[2]	30.2–36.1
Thickness at middle	90	15.2[2]	15.5–21.8

1) Cited from Omura (1964).
2) % against their length.

Fig. 9. Hyoid bone of pygmy blue whale.
Left: Stylohyals.
Right: Combined bone of basihyal and thyrohyals.

into two laminae, but in other bones right and left laminae are all united. The size and shape of the chevron bones present no special feature than other species. Miller (1924) reports the height of the 1st and 7th bones of the Newfoundland specimen, and these are 90 and 360 mm respectively. In our specimen the 1st is higher, and the 7th is lower than this specimen. But it is doubtful whether such slight difference in size is of any taxonomic importance. Measurements of the chevron bones are shown in Table 7.

TABLE 7. MEASUREMENTS OF CHEVRON BONE OF PYGMY BLUE WHALE
(in mm)

No.	Height	Breadth, greatest	Distance across two laminae, prox.	Note
1	R. 173	193	—	Left lamina missing
2	R. 231	136	—	Laminae separated
	L. 267	162		
3	341	142	142	
4	341	174	145	
5	341	177	145	
6	326	171	155	
7	323	213	161	
8	332	177	140	
9	347	217	160	
10	230	203	151	
11	243	187	139	
12	221	130	132	
13	194	170	145	
14	151	174	130	
15	142	155	131	
16	108	123	114	
17	R. 63	80	—	Laminae separated
	L. 73	broken		
18	R. 43	55		Laminae separated
	L. 44	55		

Fig. 10. Chevron bone of pygmy blue whale.

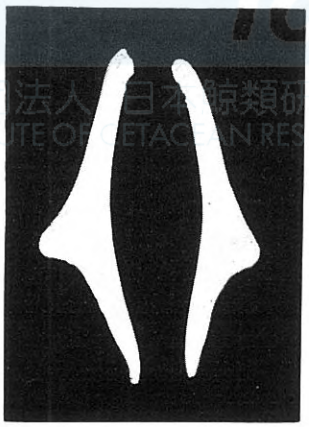


Fig. 11. Pelvic bone of pygmy blue whale.

TABLE 8. MEASUREMENTS OF SCAPULA OF PYGMY BLUE WHALE (in mm)

	Breadth	Height	Acromion		Coracoid		Glenoid fossa	
			Length	Breadth	Length	Breadth	Length	Breadth
Right	1,270	790	365	200	135	95	315	235
Left	1,295	780	365	195	105	95	320	240

TABLE 9. COMPARISON OF SCAPULA, HUMERUS, RADIUS, AND ULNA OF BLUE AND PYGMY BLUE WHALES

Measurements	Actual length in mm			% of skull length		
	OCS	NFS	PB[4]	OCS	NFS	PB
Greatest breadth of scapula	1,257	1,450	1,270	28.20	25.04	26.13
Greatest height of scapula	762	940	790	17.09	16.23	16.26
Length of humerus	—	580	555	—	10.02	11.42
Length of radius	826[1]	1,020[2]	825	18.53	17.62	16.98
Length of ulna, greatest	876[1]	950[3]	890	19.65	16.41	18.31
Breadth of radius at distal end	254	290	255	5.70	5.01	5.25
Breadth of ulna at distal end	203	250	180	4.55	4.32	3.70

OCS: Ocean City specimen (True, 1904). Skull length 4,458 mm.
NFS: Newfoundland specimen (Miller, 1924). Skull length 5,790 mm.
PB: Present specimen of pygmy blue whale. Skull length 4,860 mm.
1) Without epiphyses. 2) Without inferior epiphysis. 3) Length above middle. Without inferior epiphysis. 4) Right side bones.

TABLE 10. MEASUREMENTS OF HUMERUS, RADIUS, AND ULNA OF PYGMY BLUE WHALE (in mm)

	Length, center	Breadth, prox. end	Breadth, dist. end	Breadth, at middle	Thickness, at middle
Humerus					
Right	555	365	315	236	175
Left	555	370	315	245	180
Radius					
Right	825	210	255	159	97
Left	845	220	250	164	99
Ulna					
Right	890	275	180	119	76
Left	890	279	197	129	82

Pelvic bone (Fig. 11) Pelvic bones are different from those of the Newfoundland specimen, judged from a photograph shown by Miller (1924). In our specimen they are more slender and the angle between the cranial and caudal processes is larger, hence less curved than in the Newfoundland specimen, and they resemble more to the pelvic bone of the ordinary blue whale in the Antarctic, as reported by Hosokawa (1951). In our specimen the lengths of right and left bones are 395 and 370 mm respectively and the right bone is somewhat larger than the left.

Scapula (Pl. V, Fig. 1) Scapula is fan-shaped with a convex upper margin, and the acromion is well developed, as in the ordinary blue whale. Measurements

of scapula are shown in Table 8. True (1904) reports measurements of scapulae of blue whales from the North Atlantic Ocean, then known to him, and in these specimens the proportion of height to breadth is 60–64.4%. He describes " The discrepancy in proportions, amounting to about 4 per cent, I am unable to account for. It affects both the American and European specimens and is not, apparently, due to difference in age and sex." Further Tomilin (1957) states " Scapula 1.5–1.6 times as wide as high. In the males, the relative size of the scapula, and particularly its processes, is markedly greater than in the females." In the Newfoundland specimen (Miller, 1924) the corresponding figure is 64.8% (1.54 times as wide as high). In our specimen of pygmy blue whale these figures for the right and left scapulae are 62.2% and 60.2% (1.61 and 1.66 times as wide as high), respectively. In this respect, therefore, we find no difference between the pygmy and ordinary blue whales, but it is probable that even in a single specimen there is a slight difference between right and left scapulae.

In the Miller's specimen the lengths of acromion and coracoid are 480 and 200 mm respectively. These are 33.1% and 13.8% of the breadth of scapula. In our specimen the corresponding figures are 28.7–28.2% and 10.6–8.1% respectively. Both specimens are males, but in our specimen of pygmy blue whale the processes are less developed than in the Newfoundland specimen. We can not conclude, however, whether this difference is of significant, due to limited data available.

In Table 9 measurements of scapula, humerus, radius, and ulna of different

TABLE 11. MEASUREMENTS OF PHALANGES OF PYGMY BLUE WHALE (in mm)

	Right				Left			
	I	II	IV	V	I	II	IV	V
Length								
1st phalanx	203	255	235	161	203	248	233	162
2nd „	207	219	214	175	197	222	216	168
3rd „	167	157	159	117	164	156	156	broken
4th „	127	107	82	—	125	111	77	—
5th „	68	107	70	—	—	112	74	—
6th „	—	59	—	—	—	62	39	—
Breadth at middle								
1st phalanx	81	72	62	60	84	67	65	62
2nd „	39	52	49	31	41	53	48	30
3rd „	28	44	35	22	29	46	34	broken
4th „	18	36	31	—	20	39	30	—
5th „	10	25	20	—	—	26	20	—
6th „	—	23	—	—	—	24	17	—
Thickness at middle								
1st phalanx	58	56	45	32	59	56	43	30
2nd „	44	45	34	18	45	46	33	17
3rd „	30	34	25	11	31	34	24	broken
4th „	11	23	16	—	19	24	15	—
5th „	10	16	9	—	—	15	10	—
6th „	—	11	—	—	—	11	7	—

specimens available are compared. In this Table measurements of each bone are also expressed as percentages of skull length. In this Table too our specimen of pygmy blue whale agrees well to the Newfoundland specimen.

Humerus, Radius and Ulna (Pl. V Fig. 2) Comparison of these bones to those of the other specimens are included in Table 9. No special feature which separate the pygmy blue whale from the ordinary blue whale is observed from this Table as well as from a photograph presented by Miller (1924). Detailed measurements of these bones of our specimen are shown in Table 10.

Carpals and Phalanges (Pl. V Fig. 2) Carpals are of no special feature. The phalangeal formula of our specimen is I_5, II_6, IV_5, V_3. Tomilin (1957) gives a formula of the ordinary blue whale, considering the variation in the number of phalanges in the specimens then available: I_{4-5}, II_{5-8}, IV_{5-7}, V_{3-4}. Our phalanx count is within the ranges of this formula. Measurements of phalanges in our specimen are shown in Table 11.

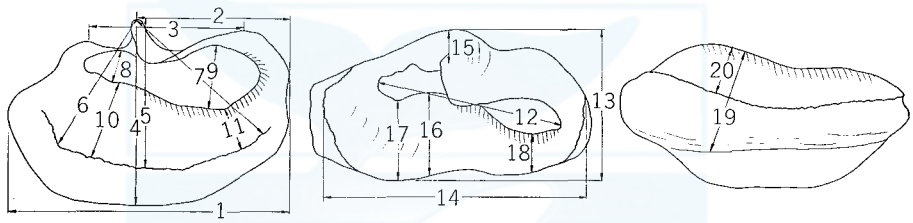


Fig. 12. Measurement portion of tympanic bulla of blue whales.

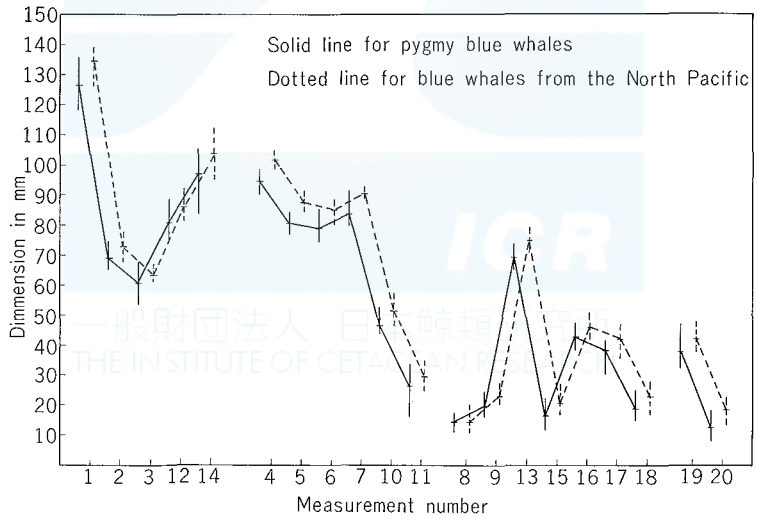


Fig. 13. Comparison of size of tympanic bulla between pygmy blue whales from the Antarctic and blue whales from the North Pacific.

Tympanic bulla. In relation to the rapid development of cetacean auditory sense, the tympanic bulla ceases to grow in the early stage of life, and its size is

TABLE 12. BIOLOGICAL DATA OF BLUE WHALES FROM WHICH TYMPANIC BULLA IS COLLECTED FOR COMPARISON OF SIZE

No.	Sex	Body length	Corpora number in ovaries	Weight of testis
Pygmy blue whales from the Antarctic, season 1963–64				
1	Male	21.3 m	—	1.9, 1.9 kg
2	Male	21.8	—	13.2, 11.7
3	Male	22.4	—	4.6, 4.2
4	Male	23.5	—	17.0, 16.7
5	Female	21.6	3	—
6	Female	21.6	5	—
7	Female	21.9	8	—
8	Female	22.6	2	—
9	Female	23.7	6	—
Blue whales from the North Pacific, season 1965				
1	Male	21.3	—	1.3, 1.2
2	Male	21.5	—	1.0, 1.1
3	Male	22.3	—	20.4, 20.5
4	Female	22.7	0	—
5	Female	23.1	1	—
6	Female	23.6	3	—

TABLE 13. BIOLOGICAL DATA ON THREE PYGMY BLUE WHALES TAKEN UNDER THE SPECIAL PERMISSION.

No.	Date of catch	Position of catch	Sex	Body length	Weight of testis	Laminae number of ear plug
66P1	Dec. 25, 1966	42°–08′S, 44°–09′E	Male	18.6 m	13.4, 13.5 kg	46
66P2	Jan. 13, 1967	41°–56′S, 73°–15′E	Male	16.0	1.7, 1.7	—
66P3	Jan. 17, 1967	42°–02′S, 80°–36′E	Male	20.3	18.8, 19.8	43

maintained throughout the life. Tympanic bullae were collected from 12 pygmy blue whales, of which 9 bullae were taken in the 1963–64 Antarctic season. For comparison, 6 tympanic bullae were collected from 6 blue whales taken by North Pacific expedition in 1965. Table 12 shows the biological data of these whales which are ranging from young to old. It is difficult to express accurately the form of bulla like renal and cowrie-shell. When the bulla is removed from the skull, a small fraction of bulla is usually broken down, however, 20 series as indicated in Fig. 12, can be measured for comparison. Measurement nos. 1, 2, 3, 12 and 14 are dimensions representing portions concerning the length of bulla. Nos. 4, 5, 6, 7, 10 and 11 show portions concerning the width of bulla. Nos. 8, 9, 13, 15, 16, 17 and 18 are related to the height of bulla. Mean value and range for each dimensions are indicated in Fig. 13. In the measurements except for no. 8, the value of the pygmy blue whale is smaller than that of blue whale from the North Pacific. When the mean of each measurement is connected by the line, the shape of bulla is supposed to resemble with each other, indicating a slight difference

TABLE 14. BODY PROPORTIONS OF PYGMY BLUE WHALE (MALE)

Measurements	Actual length (cm)			% of total length		
	66P2	66P1	66P3	66P2	66P1	66P3
Tip of upper jaw to notch of flukes	1600	1860	2030	100.00	100.00	100.00
Tip of upper jaw to blowholes	280	290	390	17.50	15.59	19.21
Tip of upper jaw to eye (center)	315	380	440	19.69	20.43	21.67
Tip of upper jaw to angle of gape	325	390	420	20.31	20.97	20.69
Tip of upper jaw to tip of flipper	670	870	920	41.88	46.77	45.32
Center of eye to ear hole	80	100	105	5.00	5.38	5.17
Notch of flukes to tip of dorsal fin	370	420	430	23.13	22.58	21.18
Notch of flukes to umbilicus	680	790	890	42.50	42.47	43.84
Notch of flukes to end of ventral grooves	670	740	850	41.88	39.78	41.87
Notch of flukes to anus	450	490	520	28.13	26.34	25.62
Notch of flukes to anterior insertion of tail flukes	80	100	100	5.00	5.38	4.93
Reproductive aperture to anus	110	140	160	6.88	7.53	7.88
Dorsal fin, anterior insertion to tip	60	20	50	3.75	1.08	2.46
Dorsal fin, height	30	10	15	1.88	0.54	0.74
Flipper, anterior insertion to tip	205	285	240	12.81	15.32	11.82
Flipper, greatest breadth	55	70	70	3.44	3.76	3.45

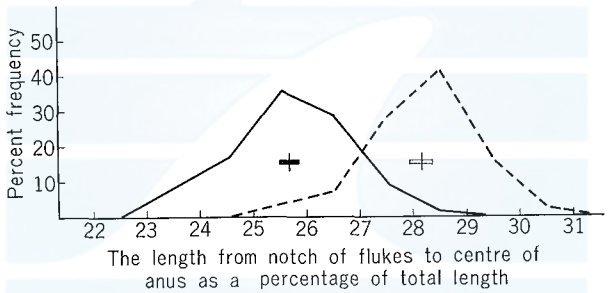


Fig. 14. Comparison of tail length between pygmy blue whales (solid line) and ordinary blue whales (broken line) in the Antarctic.

which the bulla of the pygmy whale is proportionally smaller in measurement nos. 12 and 14, and proportionally larger in measurement no. 8.

Yamada (1953) reports that the size of bulla from the Antarctic ordinary blue whale is 13.7–15.7 cm long and 9.8–11.2 cm wide. The Antarctic ordinary blue whale probably has a slightly larger tympanic bulla than the North Pacific blue whale, but unfortunately we have now no bulla from the former for the purpose of comparison. The mean weight of bulla in dry condition is 575.20 g for the pygmy and 725. 43 g for the North Pacific blue whale.

BODY PROPORTION

Under a special permission three male pygmy blue whales were taken in the Antarctic in the 1966–67 season. Date and position of the catch are listed in Table 13

TABLE 15. BODY WEIGHT OF PYGMY BLUE WHALES TAKEN IN THE 1966–67 ANTARCTIC SEASON

Items	Actual weight (kg)			Percentage of total		
	66P2	66P1	66P3	66P2	66P1	66P3
Blubber						
Body, except ventral grooves	2,200	4,500	5,950	8.89	10.47	10.46
Head	400	1,800	1,450	1.62	4.19	2.55
Lower jaw	700	1,000	3,800	2.83	2.33	6.68
Tail flukes	250	425	350	1.01	0.99	0.62
Ventral grooves	2,700	5,600	6,400	10.91	13.03	11.25
Total	6,300	13,325	17,950	25.47	31.00	31.55
Meat	10,690	15,500	21,355	43.22	36.05	37.53
Internal organs						
Tongue	800	2,600	2,250	3.23	6.05	3.95
Lung	200	150	400	0.81	0.35	0.70
Heart	105	200	250	0.42	0.47	0.44
Liver	300	450	650	1.21	1.05	1.14
Kidneys	90	100	200	0.36	0.23	0.35
Pancreas	7	9	45	0.03	0.02	0.08
Spleen	3	3	30	0.01	0.01	0.05
Stomach	330	400	350	1.33	0.93	0.62
Small intestine	500	650	1,100	2.02	1.51	1.93
Large intestine	200	250	300	0.81	0.58	0.53
Testes	1.7, 1.7 } 4	13.4, 13.5 } 27	18.8, 19.8 } 39	0.02	0.06	0.07
Bladder	3	13	15	0.01	0.03	0.03
Fats	950	1,700	3,000	3.84	3.95	5.27
Others	4	7	45	0.02	0.02	0.08
Total	3,496	6,559	8,674	14.13	15.26	15.25
Bones*						
Skull	1,200	1,710	2,500	4.85	3.98	4.39
Lower jaws	500	1,230	900	2.02	2.86	1.58
Vertebrae	1,500	2,380	2,967	6.06	5.54	5.22
Ribs	231	550	820	0.93	1.29	1.44
Chevron bones	35	40	88	0.14	0.09	0.15
Scapulae	60	100	100	0.24	0.23	0.18
Flippers	200	360	500	0.81	0.84	0.88
Hyoids	25	34	39	0.10	0.08	0.07
Total	3,751	6,404	7,914	15.16	14.90	13.91
Baleen plates	500	1,200	1,000	2.02	2.79	1.76
Total weight	24,737	42,988	56,893	100.00	100.00	100.00

* Weight in dried condition are shown in Appendix Table.

with biological data for each whale. The position of catch indicates that three whales were taken in the Subantarctic area, south of the Indian Ocean. From the histological observation on the tissue of testes, 66 P1 and 66 P3 whales were mature sexually, and 66 P2 immature. Laminae counting of ear plug suggests that 66 P1 and 66 P3 whales are 46 and 43 years old respectively, if we assume one lamina is accumulated per year. No ear plug was collected from young 66 P2

TABLE 16. PERCENT WEIGHT OF EACH ORGAN AGAINST THE TOTAL WEIGHT OF INTERNAL ORGANS FOR PYGMY AND ORDINARY BLUE WHALES FROM THE ANTARCTIC

Item	Pygmy (A)	Ordinary (B)	A/B
Tongue	27.75	24.49	1.13
Lung	4.53	6.25	0.72
Heart	3.77	3.44	1.10
Liver	8.17	8.58	0.95
Kidney	3.07	2.84	1.08
Stomach	5.15	3.23	1.59
Small intestine	12.02*	8.29	1.45
Large intestine	4.01*	2.64	1.52
Others	31.53	40.24	0.78
Total	100.00	100.00	
Individuals examined	8	39	

* from 3 whales

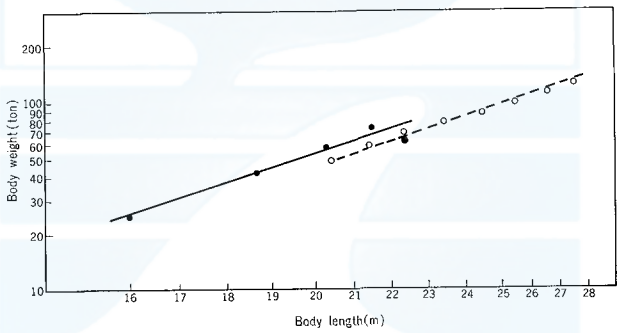


Fig. 15. Length-weight relationship for both pygmy (closed circle) and ordinary (open circle) blue whales in the Antarctic.

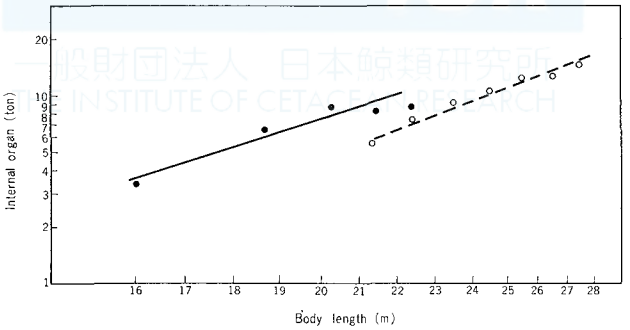


Fig. 16. Length-weight relationship of internal organs for both pygmy (closed circle) and ordinary (open circle) blue whales in the Antarctic.

whale. External measurements of whales were carried out on the deck of the factory ship, and the results are shown in actual length and as the percentages of total body length in Table 14. The length from notch of flukes to center of anus, expressed as a percentage of total length, supports a trend which the tail portion of baleen whale becomes relatively short with the increment of body length. It is clear that 66 P1 whale, 18.6 metre in length, had already attained the physical maturity, as described in the foregoing chapter.

Ichihara (1963, 1966) concludes that the tail length of pygmy blue whale differs remarkably from that of ordinary blue whale in the Antarctic, examining the body proportion from the same length of whale. Since the form of whale body changes with the increment of age, it is desirable to compare the external measurements in full grown whales. As the ordinary male blue whale from the Antarctic attains the physical maturity at 79 feet (24.0 m) in length (Nishiwaki and Hayashi, 1950), we selected the data on the external measurements of larger male than 24 m from the *Appendix* III of Mackintosh and Wheeler (1929). These data were rearranged for the present purpose. Though the body length of physical maturity is not accurately known yet for the pygmy blue whale, we can safely assume that male pygmy of 69 feet (20.9 m) and over are physically matured. On the basis of selected samples, comparison of the tail portion of the pygmy blue with that of the ordinary blue is made in Fig. 14. The size of sample is 109 pygmy and 105 ordinary blue whales. The length from notch of flukes to center of anus as a percentage of total length is 25.68 ± 0.19 (mean and two standard errors) for the pygmy, and 28.15 ± 0.22 for the ordinary blue whale. In the full grown male, the tail region is significantly smaller than that of the ordinary blue whale.

BODY WEIGHT

Body weights of three pygmy blue whales caught in the 1966–67 Antarctic season were measured on the deck of the factory ship. Actual weight and percentages weight are listed in Table 15, for each part of body. As the body weight of five pygmy blue whales was listed in Table 7 of Ichihara's paper (1966), weights of a total of 8 pygmy blue can be compared with those of ordinary blue whales. In the Whales Research Institute are kept data on body weights of 14 male and 24 female ordinary blue whales which were measured in the 1947–48 Antarctic season, most of which were summarized by Nishiwaki (1950). Fig. 15 is obtained, when the mean body weight is plotted against the each meter range of whale length. The logarithmm is used for both body weight and length. As far as pygmy blue whale concerns, the length-weight relationship from the young to the old is not fully drawn for lack of data. The body weight of pygmy blue whale is heavier than that of ordinary blue whale of the same length, however, it is estimated that the rate of weight increment is almost similar between the two subspecies.

In comparison of bones, meats and blubber weight, there is no difference between the two. Fig. 16 suggests that the difference of weight between the two

is derived from the growth rate of the internal organs.

The weight of internal organs in the pygmy blue whale at 21 m in length is about equal to that in the ordinary blue whale at 24 m in length. Table 16 shows the percent weight of each organ against the total weight of internal organs, for pygmy and ordinary blue whales. The item of others in Table 16 includes pancreas, spleen, reproductive organ, bladder, fat and etc. Except for the lung, liver and others, the percent weight of each organ from pygmy blue whales is greater than that for the ordinary blue whale. It is noticeable that the pygmy has heavier digestive organs than in the ordinary blue whale, but it is not known yet whether or not this is derived from the divergence of feeding habit.

SUMMARY AND CONCLUSION

From study of a skeleton of pygmy blue whale, mainly comparing with skeletons of blue whale in the North Atlantic reported by various authors, the followings are noted:

1. The body length of this specimen is 18.6 m, but it had attained physical maturity. The corresponding figure of ordinary blue whale in the Antarctic is 24.0 m.

2. The width of the rostrum at middle of its length is as wide, or almost as wide as the width of its base in ordinary blue whale (29–31 % of skull length), but shorter by about 4 % of skull length in pygmy blue whale, though the width at base does not differ from the former.

3. Nasals are concave anteriorly, and the inner and outer border end at nearly the same level in ordinary blue whale, but rather convex and inner borders project more anteriorly than outer borders in pygmy blue whale. In the latter the length of nasals is shorter than in the former.

4. Mandibles are shorter, especially in curved length, than in ordinary blue whale.

5. The number of vertebrae does not differ from that of ordinary blue whale, but it is suggested that the centrum is smaller in general and it decreases more steeply its breadth in lumbar and caudal regions than in ordinary blue whale.

6. Straight lengths of ribs in the anterior portion of thorax are greater than in ordinary blue whale.

7. Tympanic bulla is smaller than that of blue whale in the North Pacific and slight difference in shape is also noted.

8. Malars of this specimen are congenital bipartite.

From study of external and other characteristics the followings are noted:

9. Body proportions are reexamined with additional data and it is confirmed that in the full grown male the tail region is significantly smaller than that of ordinary blue whale.

10. The body weight of pygmy blue whale is heavier than that of ordinary blue whale of the same length in the Antarctic, and this difference is mainly due to the fact that the former has more heavier digestive organs than the latter.

In conclusion above we think there is a good additional reason to separate pygmy blue whale from the ordinary blue whale as a subspecies, i.e. *Balaenoptera musculus brevicauda.*

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APPENDIX TABLE. WEIGHT OF BONES OF PYGMY BLUE WHALE, IN DRIED CONDITION

Skull	700 kg
Mandibles	420
Vertebrae	927
Cervical	57
Dorsal	273
Lumbar	314
Caudal	283
Ribs	229.4
Scapulae	41.0
Humerus	31.8
Ulnae	12.4
Radii	17.7
Carpals and phalanges	10.1
Hyoid bones	26.2
Sternum	2.2
Chevron bones	20.5
Total weight	2,438.3

Note : The bones were weighed in October 1969 before mounting.

EXPLANATION OF PLATES

PLATE I

Fig. 1. Skull of pygmy blue whale. Lateral view.
Fig. 2. The same. Ventral view.
Fig. 3. The same. Dorsal view.

PLATE II

Fig. 1. Skull of pygmy blue whale. Posterior view.
Fig. 2. Mandibles of pygmy blue whale. Dorsal view.

PLATE III

Fig. 1. Atlas, axis, and 3rd cervical of pygmy blue whale.
Fig. 2. 4th–7th cervicals of the same specimen.
Fig. 3. Dorsal vertebrae of the same specimen.
Fig. 4. Lumbar vertebrae of the same specimen.

PLATE IV

Fig. 1. Caudal vertebrae of pygmy blue whale.
Fig. 2. Ribs of the same specimen.

PLATE V

Fig. 1. Scapulae of pygmy blue whale.
Fig. 2. Bones in flipper of the same specimen.

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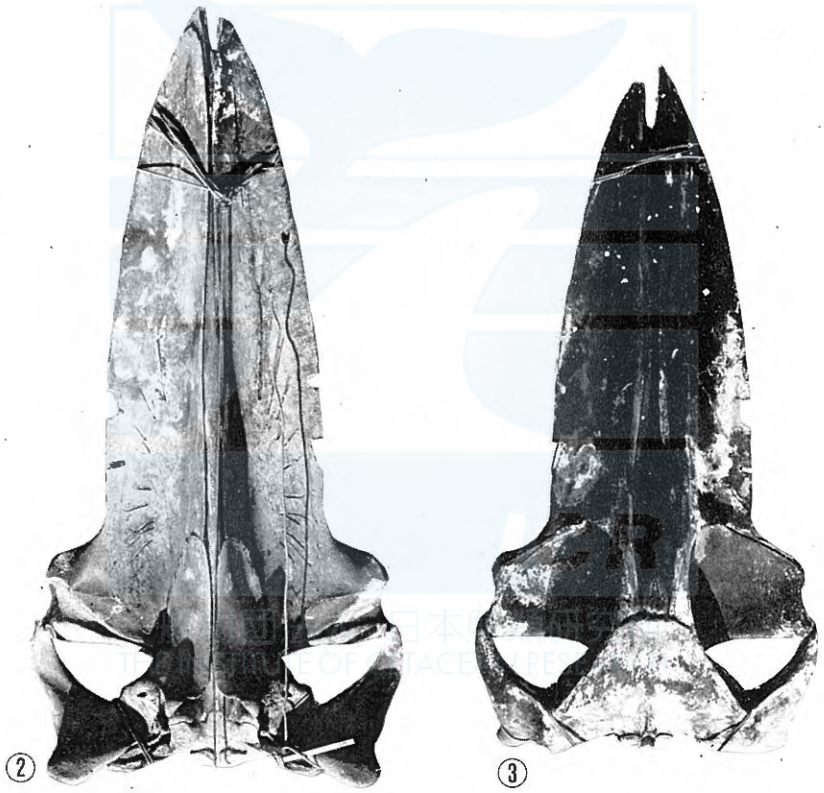

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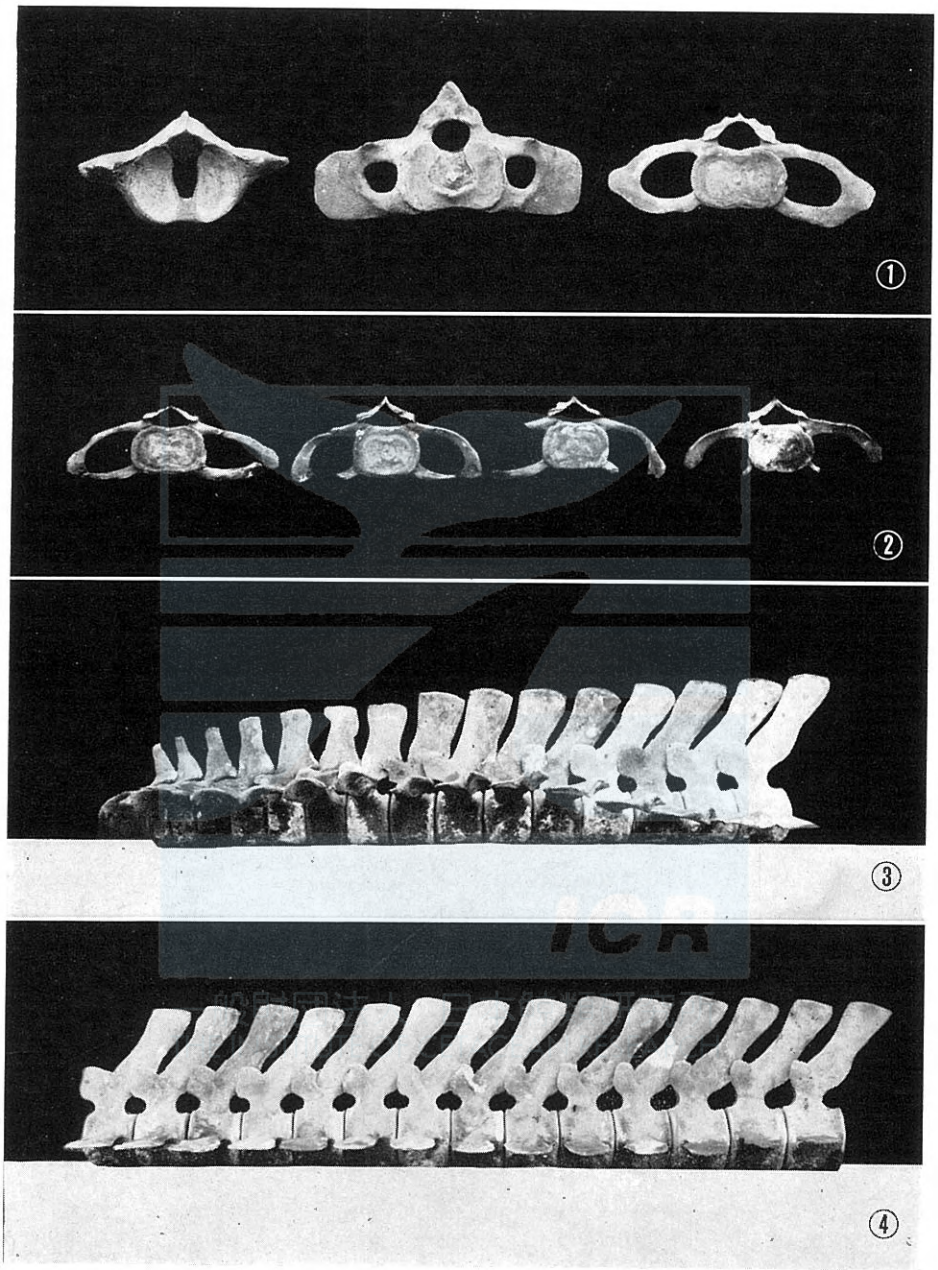
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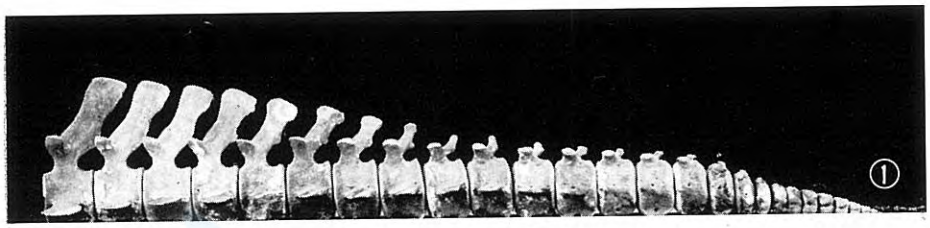

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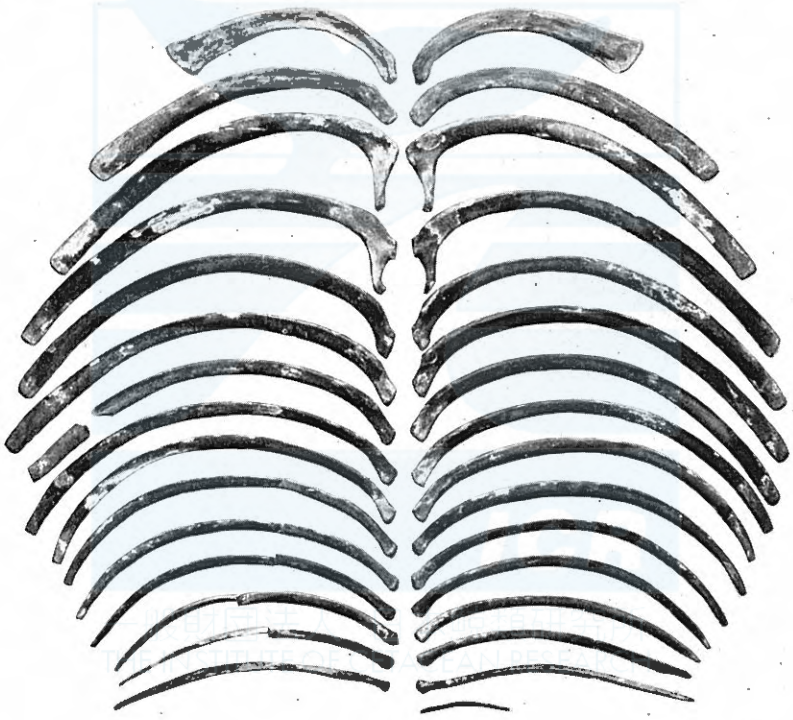

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