On the Body Weight of the Sei Whales located in the Adjacent Waters of Japan (II)

By

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After studying the correlation between body length and weight of various parts of the body, i.e. meat, bones, blubber and internal organs, in sei whales located in the adjacent waters of Japan, Omura (1950) notes the differences in weights between sei whales from Bonin Islands and those from Kamaishi, from which a clue for identifying two types of sei whales was drawn. Further study has been carried out consecutively, mainly on the external characters of both types by Omura, Nishimoto and Fujino (1952) and Omura and Fujino (1954), reaching finally to a conclusion that there present two species in the so-called sei whales in the waters adjacent to Japan, i.e. *Balaenoptera borealis* and *B. brydei*, the latter mostly located in the seas around Bonin Island.

As only scanty data were available as regards sei whales from Bonin waters (*brydei*) at the time when Omura reported previously (1950), further weighing of whales were carried out in 1950. In the year 1950, 20 whales (7 males and 13 females) of Bonin Islands were weighed. These materials are studied in the present paper, comparing with those presented by Omura (1950).

I am much indebted to the crew of the whaling factory ship "Baikal Maru" of Kyokuyo Hogei Company who engaged in the actual weighing of the carcass, and to the whaling inspectors of Japanese Government Messrs. Setsuo Nishimoto and Hirosaku Koda who helped me immensely in the field work. My sincere thanks are also due to Dr. Hideo Omura who directed this investigation.

Nearly the same method as reported by Omura (1950) were followed also in 1950, i.e. the various parts of the body were weighed separately according to blubber, meat, bones, and internal organs, etc., cutted into small pieces and using 50 kg. balance. As regards bones and internal organs, each parts of them were weighed in detail in general, however in some occasions, some parts were weighed together, when it was deemed that more reliable data will be obtained by doing so, not separating into so minor parts. Blood was not weighed. Size distribution of sei whales weighed are shown in Table I, together with those from Kamaishi for comparison.

Table I. Size distribution of sei whales weighed in Bonin waters and Kamaishi.

Area	Bonin Islands			Kamaishi		
Sex	Male	Female	Total	Male	Female	Total
*37	–	–	–	–	1	1
38	1	3	4	–	–	–
39	1	1	2	–	–	–
40	–	–	–	1	2	3
41	2	–	2	4	2	6
42	–	1	1	4	5	9
43	–	1	1	–	3	3
44	–	2	2	1	2	3
45	–	1	1	–	2	2
46	–	–	–	–	–	–
47	–	2	2	–	–	–
48	–	1	1	–	–	–
Total No.	4	12	16	10	17	27
Av. length	39.8	42.8	42.0	41.6	42.1	41.9

* Body length in feet.

1. Meat: In the previous report (Omura, 1950) the weight of "Tongue" is included in the category "Meat," but in 1950 those two parts were recorded separately. Weight of meat in each measurements are plotted in Fig. 1. For the sake of comparison to those from Kamaishi, the weight of tongue is added also in those from Bonin Island. It will be seen from this figure that sei whales from Kamaishi are little heavier than those from Bonin Islands in meat, though the difference is small, as already pointed out by Omura (1950). Regression line of weight of meat obtained from the actual values of each whale is given by the formula I.

$$W = 0.00015 \cdot L^{2.84} \quad \ldots\ldots\ldots(I)$$

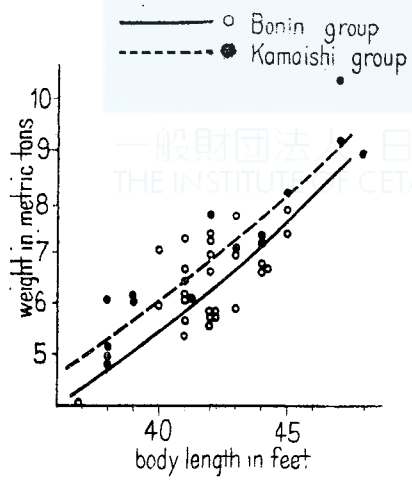

Fig. 1. Weight of meat, sei whales taken from Bonin and Kamaishi areas.

In Table II, the weight of meat from both regions are compared, and from which it will be seen that the whale from Kamaishi is heavier than those from Bonin Island by about 10% in meat. However, this weight of meat includes weight of tongue, therefore, net weight of meat is also shown in this table, calculated by deducting the weight of tongue, which is easily computed from the similar formula for itself.

2. Blubber: In the category "Blubber," the weight of "Ventral grooves" is also included. "Ventral

Table II. Standard weight of meat.

Body length in feet	Weight of meat calculated from formula (I)		Net weight of meat
	Bonin. metric tons	Kamaishi. %against Bonin	Bonin. metric tons
37	4.38	113.9	4.17
40	5.46	111.2	5.23
43	6.71	109.1	6.45
46	8.12	107.0	7.83

grooves'' means the ventral part of the body, consisting of furrowed blubber and attached meat to it. As seen in Fig. 2 difference in weight of blubber between sei whales from Bonin Island and Kamaishi is very remarkable, the former having very heavier blubber than the latter. The ratios of "Ventral grooves" against the total weight of Blubber in Bonin and Kamaishi groups are, in average, 42.64 and 30.97 percent, respectively. This fact endorses that the ventral grooves of the southern type sei whale (*brydei*) extend more posteriorly than those of the northern type sei whale (*borealis*). Regression line of the weight of Blubber against body length is given by the formula II, and standard weight is shown in Table III, calculated from this formula.

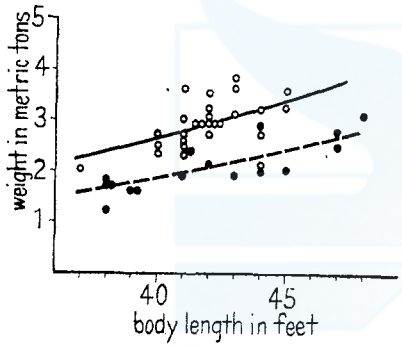

Fig. 2. Weight of blubber, sei whales taken from Bonin and Kamaishi area.

$$W = 0.00076 \cdot L^{2.21} \quad \cdots\cdots\cdots (II)$$

From this table, it is seen that blubber of Kamaishi group weigh only about 72% of those of Bonin Islands group.

Table III. Standard weight of blubber.

Body length in feet	Weight of blubber	
	Bonin. metric tons	Kamaishi. % against Bonin
37	2.21	71.5
40	2.63	71.7
43	3.09	71.9
46	3.58	72.1

3. Bones: As shown in Fig. 3, the bones of Bonin Islands group are heavier than those of Kamaishi group, and this difference increases

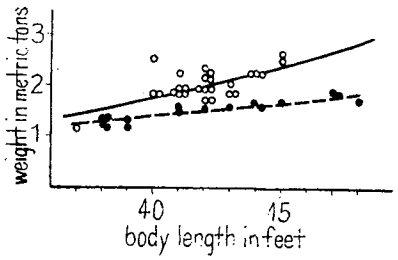

Fig. 3. Weight of bones, sei whales taken from Bonin and Kamaishi areas.

gradually with the growth of body length. Regression line is given by the formula III.

$$W = 0.00005 \cdot L^{2.84} \quad \ldots\ldots (III)$$

Standard weight is shown in Table IV.

Average weight of skull, jaw bones and back bones are shown in Table V. From this table it is shown that Bonin Islands group have heavier bones than those of Kamaishi group.

Table IV. Standard weight ot bones.

Body length in feet	Bonin. metric tons	Kamaishi. % against Bonin
37	1.41	87.9
40	1.76	80.1
43	2.16	73.1
46	2.61	67.4

Table V. Average weight of skull, jaw bone and back bone.

unit: kilogrammes

	skull	jaw bone	back bone	bone total	Remarks
Bonin Is.	524.4 (25.83)	209.2 (10.30)	901.3 (44.38)	2030.9 (100.00) %	Average of 27 whales, average body length of which is 41.9 ft.
Kamaishi	467.1 (30.28)	146.1 (9.47)	655.2 (42.47)	1542.4 (100.00) %	Average of 16 whales, average body length of which is 42.0 ft.

4. Internal organs: In the year 1948 the heart, lung, stomach and kidney of Bonin Islands group were not weighed separately. As it is not clear that whether those are added to "Others" in the item of "Internal organ" or to "Others" in the item of "Miscellaneous," such materials were excluded in comparison according to areas (Fig. 4).

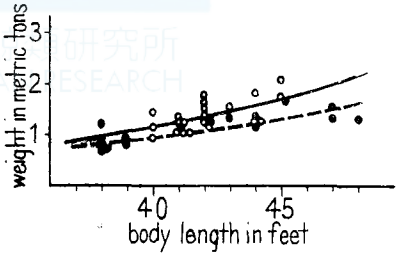

Fig. 4. Weight of internal organs, sei whales taken from Bonin and Kamaishi areas.

From this figure it may be understood that Bonin Islands group have heavier Internal organs than those from Kamaishi. Regression line is given by the formula IV.

$$W=0.000003\cdot L^{3.50} \quad \ldots\ldots\ldots(IV)$$

Standard weight is shown in Table VI.

Table VI. Standard weight of internal organs.

Body length in feet	Bonin. metric tons	Kamaishi. %against Bonin
37	0.88	86.4
40	1.16	83.6
43	1.49	80.5
46	1.89	77.8

5. Total weight: The category "Total weight" is consisting of the above stated four items and of "Miscellaneous" which includes baleen, tongue, jaw ligament and scraps of various parts of the body. As shown in Fig. 5, the Bonin Islands group is heavier than the Kamaishi group in the "Total weight" also. Regression line is expressed as the formula V.

$$W=0.00047\cdot L^{2.74} \quad \ldots\ldots\ldots(V)$$

Standard weight is shown in Table VII. Table III shows the differences of weight of various parts between both areas. It may be seen from this table that the difference in Blubber weight occupies the greatest ratio in the difference of Total weight between both areas. As already stated, "Ventral grooves" in the

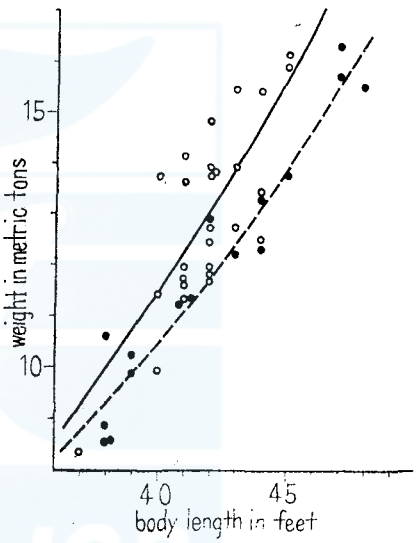

Fig. 5. Total weight, sei whales taken from Bonin and Kamaishi areas.

Table VII. Standard weight of whale body.

Body length in feet	Bonin. metric tons	Kamaishi. % against Bonin
37	9.27	94.2
40	11.47	92.0
43	14.00	89.9
46	16.83	88.1

item of "Blubber" includes the meat just underneath the furrowed blubber in the ventral region. It is quite natural that the sei whales

from Bonin waters have more heavier ventral grooves than those from Kamaishi, because the ventral grooves extend far more posteriorly in the former, this being one of every important character identifying *brydei* from *borealis*.

Table VIII. Differences in weight of various parts of the body between sei whales taken in Bonin area and those from Kamaishi.

	total weight	meat	bone	blubber	internal organs	miscellaneous
Bonin, average of 27 whales	m. tons 13.001	m. tons 6.362	m. tons 2.031	m. tons 2.949	m. tons 1.293	m. tons 0.366
Kamaishi, average of 16 whales	11.981	6.958	1.542	2.124	1.163	0.194
Difference of the above	1.020	-0.596	0.489	0.825	0.130	0.172
Ditto (%)	100.0	-58.4	47.9	80.9	12.7	16.9

Table IX shows the weight of various parts of the body, expressed as percentages of the total weight, for the sei whales from Bonin waters. As already stated these weights are calculated from the formulae I-V, and it is not certain that these formulae can be applied for whales of which body length does not fall within these limits of length, because these formulae were obtained from the measurements of whales ranging from 37 to 45 feet in length.

Table IX. Standard weight of sei whales captured in Bonin area.

Body length in feet	Total weight in metric tons	meat* %	blubber %	bones %	internal organs %	miscellaneous %
37	9.27	45.0	23.8	15.2	9.5	6.5
40	11.47	45.6	23.0	15.3	10.1	6.0
43	14.00	46.1	22.1	15.4	10.6	5.8
46	16.83	46.5	21.3	15.5	11.2	5.5

* not include the tongue.

Summary

Various parts of the whale body were weighed for 20 sei whales caught in the Bonin waters in 1950, and after comparing with those from Kamaishi the following conclusions have been reached.

(1) Total body weight are heavier in whales from Bonin Island than those from Kamaishi, however,

(2) Those from Bonin Islands is lighter than the latter in Meat.

(3) On the contrary Bones, Blubber and Internal organs are heavier than in Kamaishi group.

(4) Correlations between body length and weight of various parts of body are expressed by the following formulae for the sei whales from Bonin Island, which are in reality belong to *B. brydei*.

Total weight	$=0.00047 \cdot L^{2.71}$
Meat	$=0.00015 \cdot L^{2.81}$
Bones	$=0.00005 \cdot L^{2.84}$
Blubber	$=0.00076 \cdot L^{2.21}$
Internal organs	$=0.000003 \cdot L^{3.50}$

Literatures

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Appendix

Weight of various parts of sei whales caught in the waters adjacent to Bonin Island, 1948 and 1950

Male (in kilogrammes)

Body length in ft.	Date, caught	Meat	Blubber			Bones							Internal organs								Miscellaneous						Grand total
			ventral grooves	others	total	skull	back	jaw	rib	shoulder	flipper	others	total	heart	lung	stomach	liver	kidney	intestine	diaphragm	others	total	baleen	jaw ligament	tongue	others	total	
40	June 8 1950	5,573	1,069	1,271	2,340	450	750	214	265	74	83	—	1,836	47	94	92	120	38	203	62	331	987	135	105	413	105	758	11,494
41	May 29 〃	5,570	1,085	1,544	2,629	518	774	196	257	53	69	—	1,867	44	140	102	188	59	248	64	474	1,319	115	74	100	78	367	11,752
41	June 8 〃	5,775	1,005	1,335	2,340	533	840	204	159	45	75	—	1,856	38	90	86	161	51	203	56	403	1,088	133	111	259	79	582	11,641
41	June 9 〃	5,907	1,001	1,549	2,550	396	981	185	155	47	71	—	1,835	47	86	101	171	49	200	77	332	1,063	140	83	206	143	572	11,927
41	June 9 〃	6,390	1,361	1,714	3,075	420	1,084	237	296	49	83	56	2,225	64	102	113	180	53	279	86	387	1,264	157	90	258	152	657	13,611
42	June 1 〃	6,345	1,260	1,643	2,903	605	927	248	301	64	99	—	2,244	68	90	117	203	60	324	71	620	1,553	157	139	258	161	715	13,760
*42	April 13 1948	5,820	—	—	3,100	440	760	180	250	—	—	90	1,720	—	—	—	100	—	190	—	570	860	—	—	—	480	480	11,980
*42	April 15 〃	5,770	—	—	2,930	490	750	170	220	—	—	90	1,720	—	—	—	110	—	190	—	610	910	—	—	—	440	440	11,770
*42	April 15 〃	6,970	—	—	3,510	510	820	200	260	—	—	110	1,900	—	—	—	130	—	220	—	550	900	—	—	—	590	590	13,870
44	May 28 1950	6,540	1,037	1,706	2,743	570	1,060	208	265	66	93	—	2,262	48	100	174	148	59	256	59	446	1,290	149	141	252	83	625	13,460

* Cited from Sci. Rep. Whales Res. Inst., 4: 1–13, 1950.

Appendix (cont.)

Female

Body length in ft.	Date, caught	Meat	Blubber			Bones								Internal organs									Miscellaneous					Grand total
			ventral grooves	others	total	skull	back	jaw	rib	shoulder	flipper	others	total	heart	lung	stomach	liver	kidney	intestine	diaph-ragm	others	total	baleen	jaw liga-ment	tongue	others	total	
*37	Apr. 12 1948	4,040	—	—	2,040	290	580	90	140	—	—	40	1,140	—	—	—	100	—	150	—	290	540	—	—	—	630	630	8,390
40	May 15 1950	6,825	1,230	1,549	2,779	544	1,065	161	281	38	52	375	2,516	45	109	94	184	64	307	64	323	1,191	101	109	263	—	473	13,784
40	May 27 〃	3,725	1,148	1,390	2,538	525	870	186	156	42	55	24	1,858	68	120	101	180	64	314	56	503	1,406	94	139	229	—	462	9,989
41	May 26 〃	5,115	1,125	1,598	2,723	422	804	215	254	49	69	19	1,832	59	96	88	210	68	286	—	414	1,221	49	120	255	—	424	11,315
*41	Apr. 16 1948	7,240	—	—	3,620	520	860	170	280	—	—	90	1,920	—	—	—	150	—	220	—	570	940	—	—	—	400	400	14,120
42	May 23 1950	5,760	1,144	1,568	2,712	536	860	213	214	56	80	—	1,959	51	101	155	204	56	316	56	261	1,200	136	81	—	45	262	11,893
42	June 4 〃	5,266	1,275	1,677	2,952	522	940	243	285	63	95	39	2,187	84	101	131	283	77	443	86	513	1,718	137	125	251	139	652	12,775
42	June 2 〃	6,980	1,290	1,950	3,240	598	1,074	271	279	62	83	—	2,367	93	101	119	251	74	352	88	547	1,625	140	113	236	149	638	14.850
42	May 16 〃	7,068	1,207	1,714	2,921	570	898	233	263	67	73	30	2,134	50	113	90	202	56	247	53	427	1,238	131	146	270	—	547	13,908
42	May 22 〃	5,531	1,590	1,377	2,967	545	882	219	199	41	97	—	1,983	68	86	90	210	60	311	50	540	1,415	165	112	285	—	562	12,458
43	May 24 〃	5,648	1,421	1,710	3,131	522	920	200	254	56	68	—	2,020	54	94	165	210	60	383	83	529	1,588	154	—	251	—	405	12,792
*43	Apr. 14 1948	6,940	—	—	3,670	500	800	190	260	—	—	100	1,850	—	—	—	140	—	240	—	870	1,250	—	—	—	200	200	13,910
*43	Apr. 16 1948	7,700	—	—	3,890	490	820	210	240	—	—	90	1,850	—	—	—	130	—	190	—	1,070	1,390	—	—	—	600	600	15,430
44	June 5 1950	7,353	1,283	1,962	3,245	536	1,061	266	283	62	75	—	2,283	35	108	120	300	78	331	95	698	1,805	187	149	304	145	785	15,471
44	May 16 〃	6,356	937	1,256	2,193	652	986	240	176	48	74	38	2,214	83	98	98	210	58	281	75	363	1,266	120	146	255	—	521	12,550
45	May 30 〃	7,073	1,650	1,951	3,601	745	1,090	267	394	66	131	—	2,693	71	143	150	278	79	413	72	892	2,098	143	130	304	109	686	16,151
45	May 31 〃	7,513	1,327	1,961	3,288	712	1,080	232	367	75	101	—	2,567	83	116	154	225	68	334	86	718	1,784	180	135	319	173	807	15,959

* Cited from Sci. Rep. Whales Res. Inst., 4: 1–13, 1950.