On the Body Weight of Whales

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1. Introduction

As for body weight of whales, hitherto some conceptional figures have been known in relation to the percentage of products for materials. But as biological literatures, there are only the following figures by A. H. Laurie (on the base of Capt. Sörlle and Dr. Lukas) and N. Peters (on the base of Zenkovic). They weighed very few whales and that did not weighed for themselves, only making public what was reported. On the base of these few figures, however , the formula was proposed for calculating and the graph showing body weight for body length was made.

species	sex	body length	body weight	remarks
blue whale	?	27.18 m	122.0 tons	located in South Georgea (by Capt. Sorlle)
	?	20.30	48.9	
	?	23.72	63.0	this whale found in the Arctic (by Dr. Lukas)
fin whale	F.	20.80	53.8	located in the North Pacific. (by Zenkovic)
	F.	19.90	48.6	
	M.	18.85	34.0	
humpback	F.	13.9	32.4	
	F.	12.9	27.4	
sperm	M.	13.45	22.7	
	M.	18.0	53.4	
grey	F.	13.35	31.5	

In the Antarctic whaling season 1947/48, under the supervision of Mr. Terry and Col. Winston, representative of G. H. Q., 30 blue whales (*Balaenoptera musculus*) (11 males and 19 females) and 16 fin whales (*Balaenoptera physalus*) (6 males and 10 females) which were caught by the Nisshin-maru and the Hashidate-maru, were weighed with the following method. Yet, even they were so insufficient as data that in the season 1948/49, 2 blue whales (1 male and 1 female) and 13 fin whales (4 males and 9 females) were weighed on board the Japanese fleets.

Thus, data of 32 blue whales (12 males and 20 females) and 29 fin whales (10 males and 19 females) were collected. Here, the author makes public these data with some observation. Indeed, what a hard job the whale body weighing was. It was carried out in the frigid Antarctic O-cean with storming snow and piercing winds for some hours.

The author is very grateful to General manager and his staffs and workers for their endeavour contributing much to the whaling field.

2. Method of work.

When a whale was ascending on the slip way, the former whale had been thrown into the boiler, without a part of it left on the flensing deck of the factory ship. As soon as the whale stopped on the deck and finished to be measured its length, rough dissecting began and at the same time, whale carcass which had been classified in each part was further dissected into easy blocks for weighing. Bones were cut into about 50 to 60 cms cube and weighed with a 200 kg. platform scale. Of course great care was paid not to double weigh and add the same block. Thus dissected and weighed blocks were added in each part of them (e. g. blubber muscle, large intestine, kidney, etc.) to be proposed as data. Sawdusts and scraps were collected into the item "others" but blood left flowing was unable to be weighed, Stomach and intestine contents, urine and show were excluded.

The classification is shown in the table at the end of this report. There are five parts roughly divided, blubber, muscle, internal organs, bones and others. Individual figures, for instance, on pancreas, oesophagus, blubber of lower jaw etc., are not always accurate, but what is collected as internal organs or blubber is reliable to be correct. This is due to the difference of dissecting methods between the Hashidate-maru and the Nisshin-maru and to attachment to other parts by times and manners. For instance, pancreas was weighed with stomach or intestines; or oesophagus was measured with trachea, or blubber was classified in different ways by each whale.

In the appendaged table, there are some whales with oil yield, which was not always obtained from the one whale only but was calculated out. After scrutinizing the calculating standard, however, it was considered so reliable that they were similarly treated.

3. Body weight and length.

With the close relation between body weight and length, the more the latter increases, the more the former increases. If whales were of quite same shape, theoretically doubled body length should increase the body weight cubicly.

Fig. 1. Weight of Whales According to Body Length (Blue Whale)

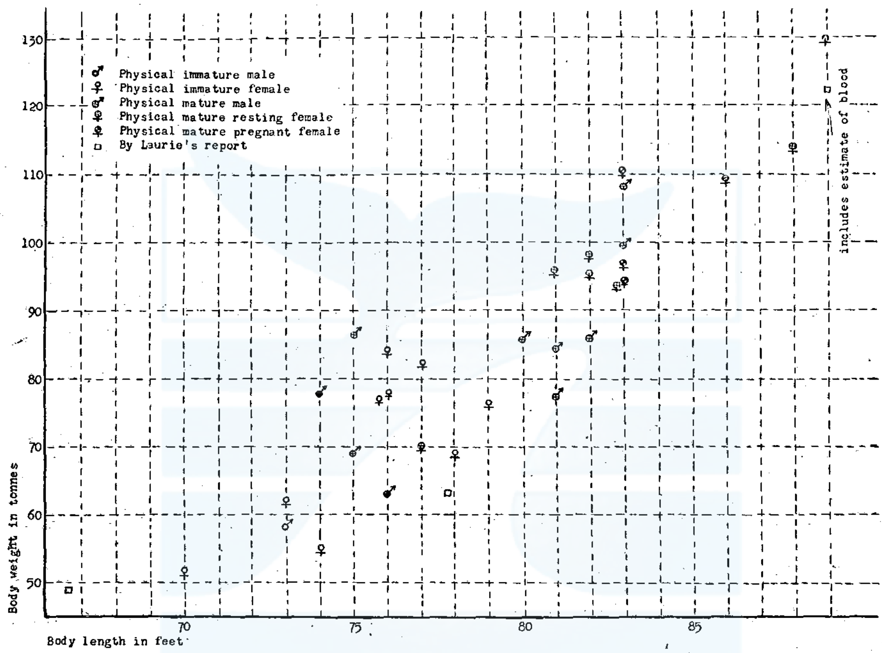


Fig. 1 shows body weight of blue and fin whales in the ordinate and body length in the abscissa.

Observation of Fig. 1 gives clear trend of body weight increase in proportion to body length increase. Difference of body weight between male and female scarcely seems to change. For whales of the same length, rather speaking, male seems a little heavier.

The remarkable difference of weight in individuals of the same length probably means the seasonal variation. For instance, a male of 74 feet and 77 tons, a male of 75 feet and 86 tons, a male of 77 feet and 98 tons, a male of 83 feet and 107 tons, 3 females of 76 feet, a female of 81 feet and 69 tons etc. were captured after the middle of January. On the contrary, a male of 76 feet and 63 tons, a male of 81 feet and 77 tons, a female of 78 feet and 69 tons etc. were caught before the middle of January. Previously the author reported on the seasonal variation of thickness of blubber that it became after fatter the middle of January. Of course, this fact has a close relation with whales migration, showing that there are many whales newly arriving at the Antarctic till the middle of January. As stated below, first of all, muscle begins to grow fat and blubber is influenced by it, perhaps after the middle of January. The body weight too seems to show the same trend.

In the table, Laurie's values were indicated with the mark □. They distribute near the author's values. Though in this measurement no blood was added, Laurie added the presumed 8 tons to 1 instance among three instances. But the figure was not revised. Laurie showed the increasing curve of body weight for these three instances but it is too small in number of whales investigated to calculated the average body weight by body length or vice versa and if the seasonal or the sexual variation is taken into consideration, it would be more difficult. So it will be reported elsewhere. Here, the author quotes only Laurie's figures in Fig. 2 (A. H. Laurie: Some aspects of respiration in Blue whales: Discovery Reports Vol. XV p. 405. 1933).

Fig. 3 shows fin whales in the same way. Those which were indicated with marks ♂ or ♀, based on Peter's Report. These whales were found in the Arctic and seemed different from those in the Antarctic, though they were described anyhow. Among them, a male of 65 ft. and 48 tons, a female of 70 ft. and 60 tons, and a female of 74 ft. and 68 tons were all caught after the middle of January but a female captured on 25 February was of 76 feet and 57 tons. So whales which were caught after the middle of January were not always fatter and heavier than other whales of the same length.

Fig. 1 and Fig. 3 are of the same scale but fin whales are more regular than blue whales. In other words, there is a little fluctuation of body weight by body length. And the body weight curves by body length are so similar that the prolonged curve of fin whales joins with that of blue whales. Few values on short female and long male in body length don't give the clear difference of body weight between male and female. But the author thinks body weight by body length shows nearly complete coincidence.

4. Weight of each part of whale carcass.

From the above mentioned result, the author showed weight of each part, (blubber, muscle, internal organs and bones) by body length. Among Figs. 4 to 19, the half shows the real weight and another half, percentage for total body weight. These 16 figures are of the same scale.

Fig. 2. Calculated Relation between the Length and Weight of Blue Whales. (by A. H. Laurie)

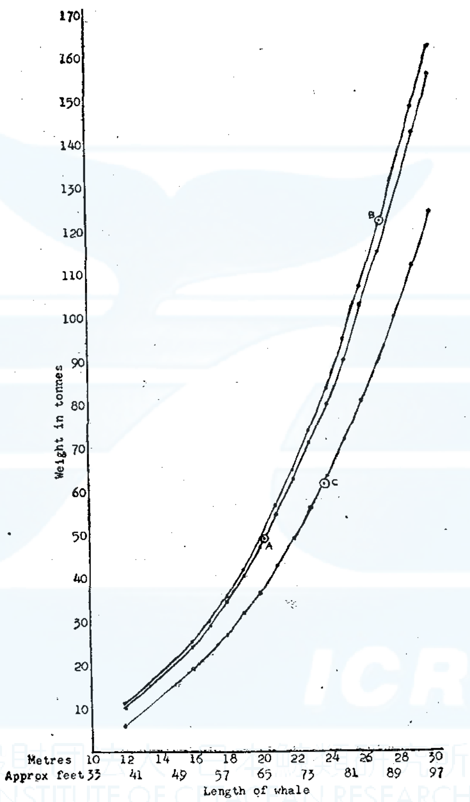


Fig. 3. Weight of Whales According to Body Length (Fin Whale).

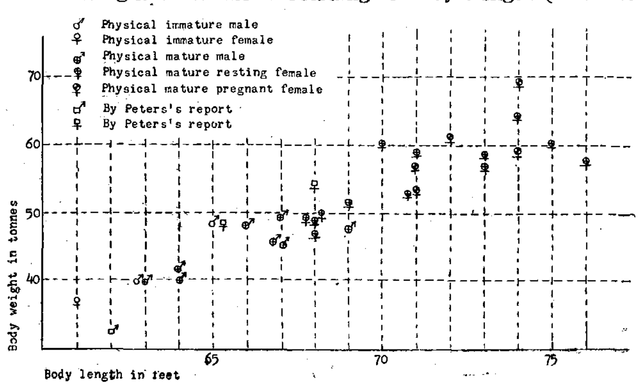


Fig. 4. Weight of Blubber in Different Length of Whale (Blue Whale)

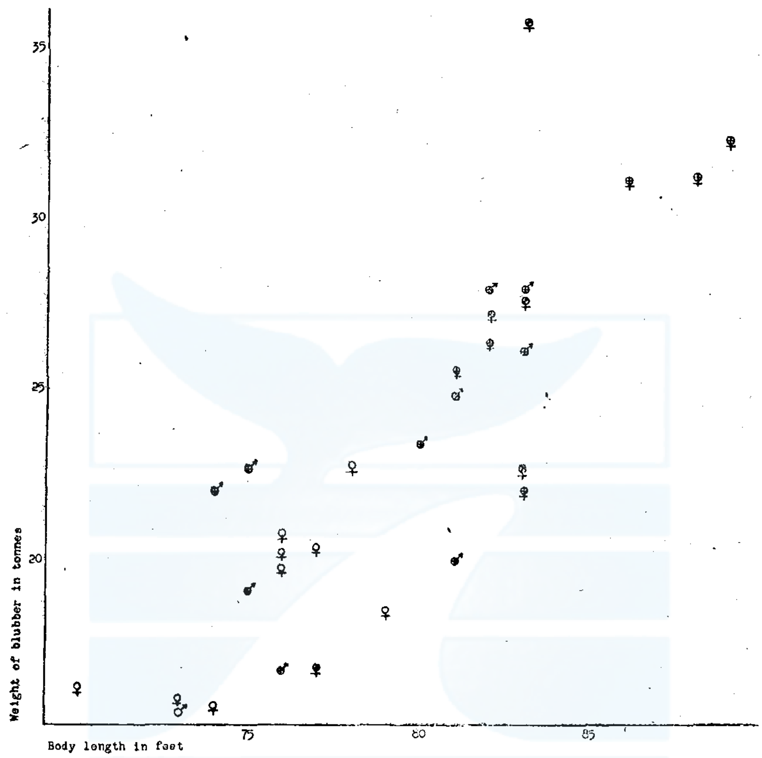


Fig. 5. Percentage of Weight of Blubber to Total Weight of Whale (Blue Whale)

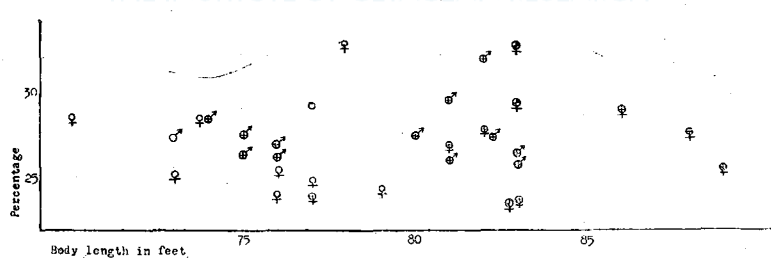


Fig. 6. Weight of Muscles in Different Length of Whale (Blue Whale)

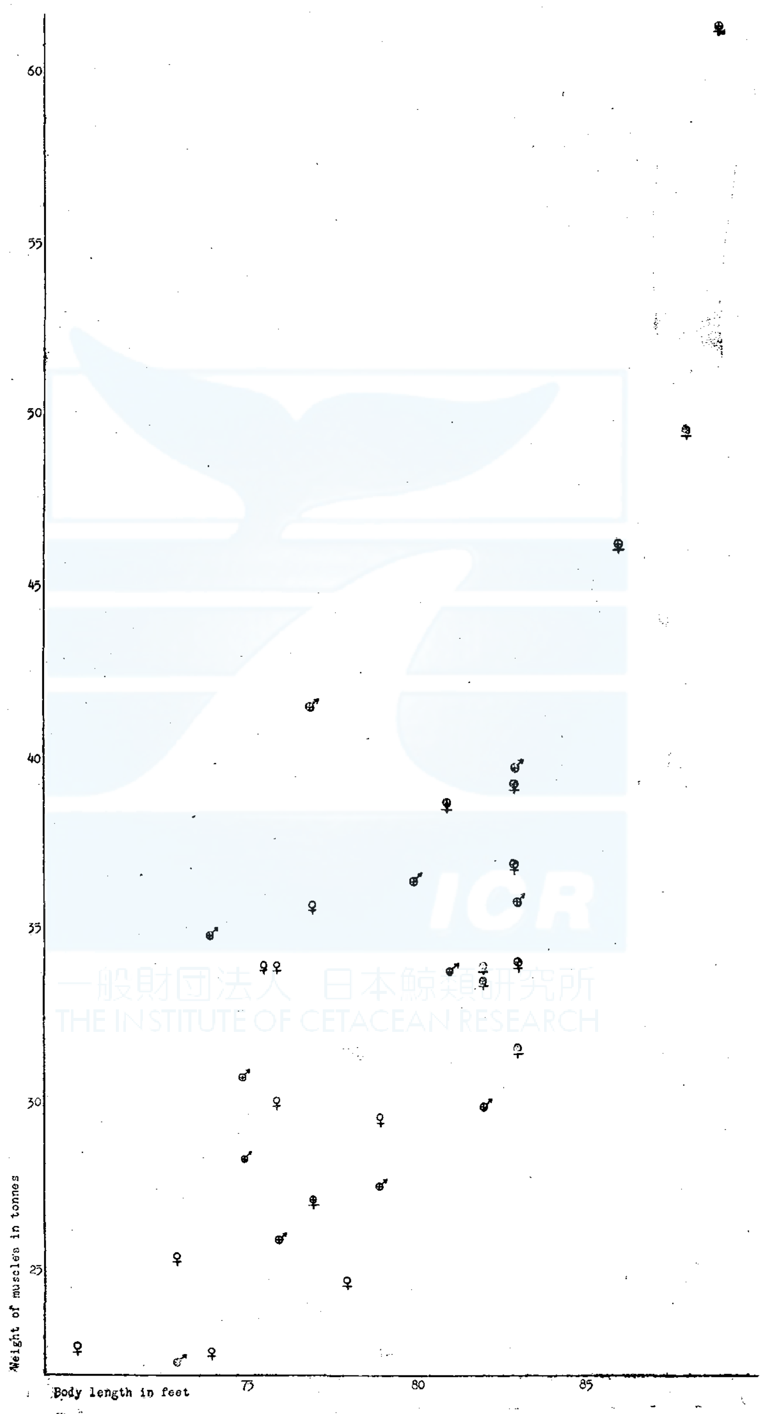


Fig. 7. Percentage of Weight of Muscles to Total Weight of Whale (Blue Whale)

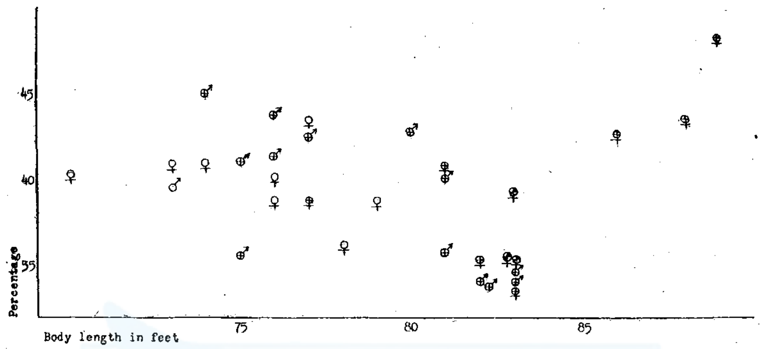


Fig. 8. Weight of Internal Organs in Different Length of Whale (Blue Whale)

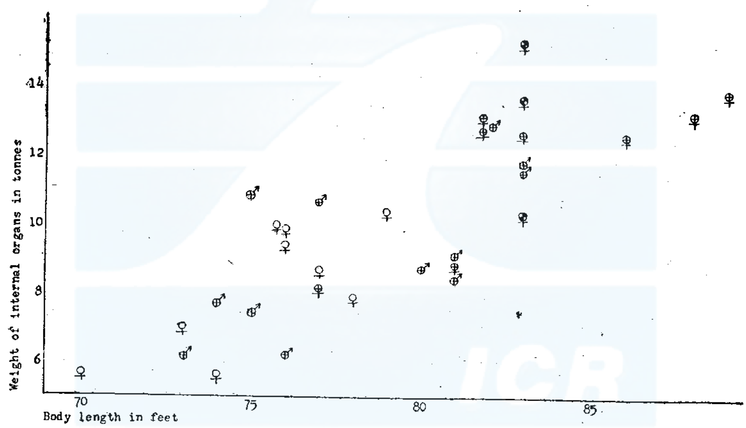


Fig. 9. Percentage of Weight of Internal Organs to Total Weight of Whale (Blue Whale)

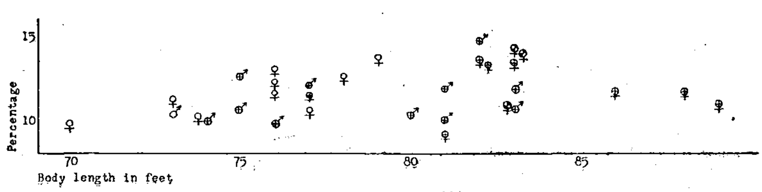


Fig. 10. Weight of Bones in Different Length of Whale (Blue Whale)

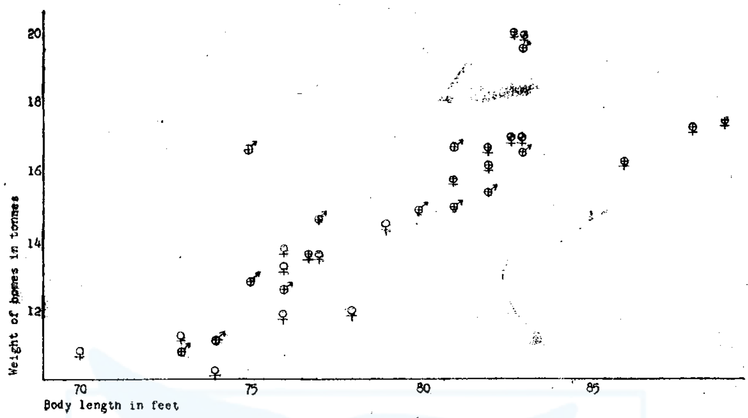


Fig. 11. Percentage of Weight of Bones to Total Weight of Whale (Blue Whale)

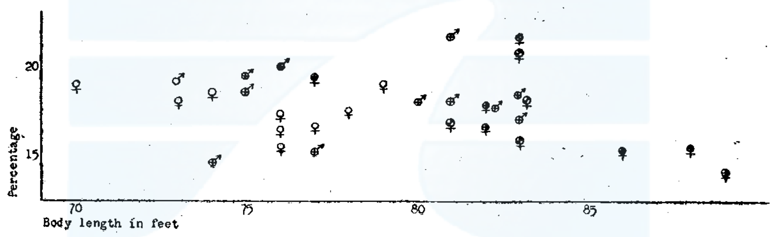


Fig. 12. Weight of Blubber in Different Length of Whale (Fin Whale)

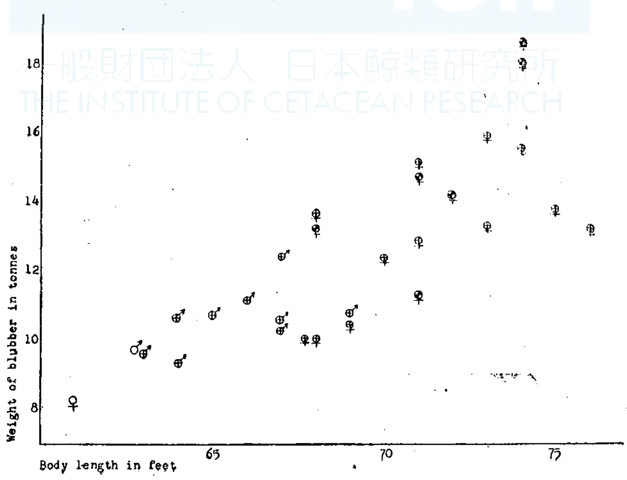


Fig. 13. Percentage of Weight of Blubber to Total Weight of Whale (Fin Whale)

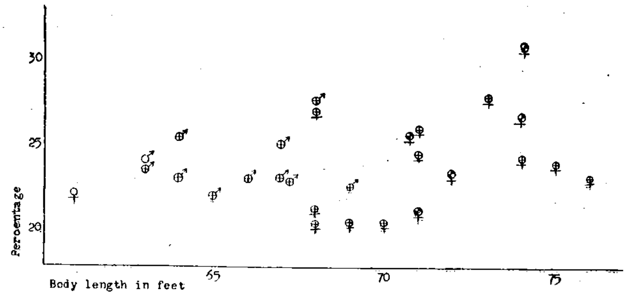


Fig. 14. Weight of Muscles in Different Length of Whale (Fin Whale)

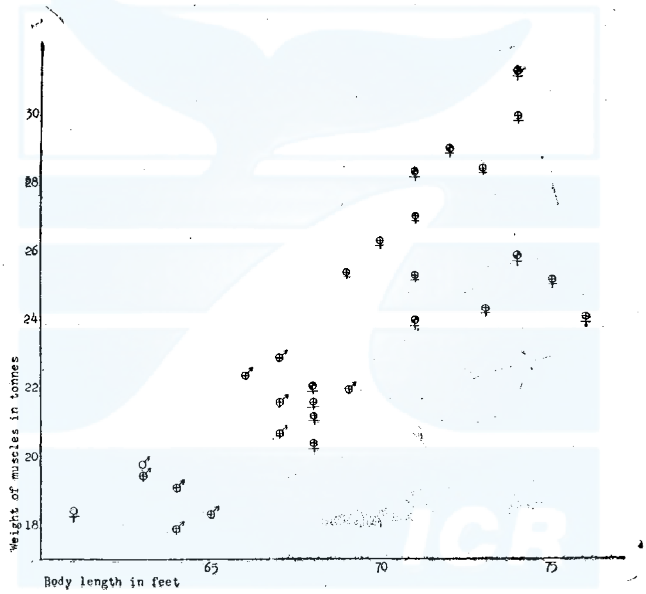


Fig. 15. Percentage of Weight of Muscles to Total Weight of Whale (Fin Whale)

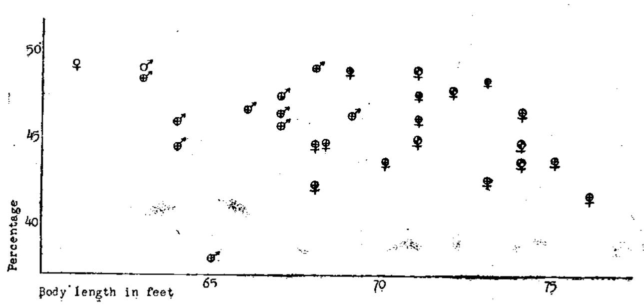


Fig. 16. Weight of Internal Organs in Different Length of Whale (Fin Whale)

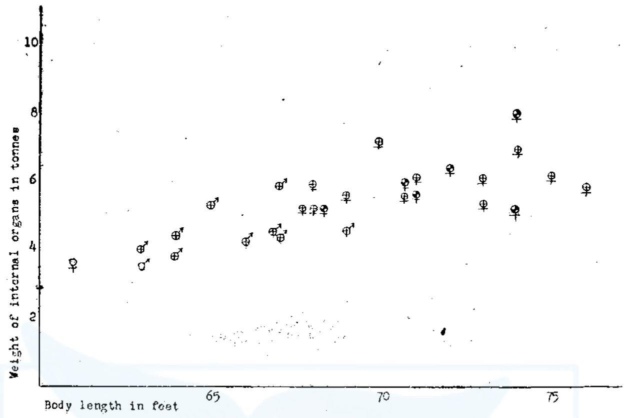


Fig. 17. Percentage of Weight of Internal Organs to Total Weight of Whale (Fin Whale)

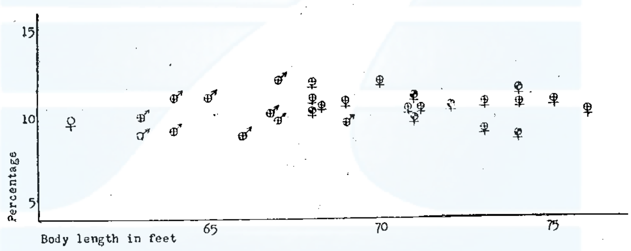


Fig. 18. Weight of Bones in Different Length of Whale (Fin Whale)

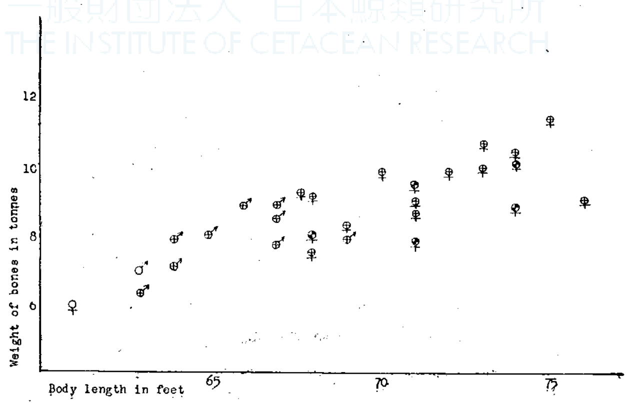
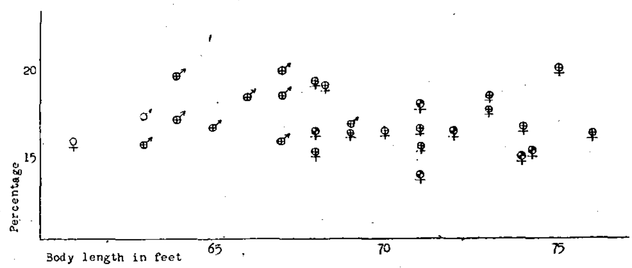


Fig. 19. Percentage of Weight of Bones to total Weight of Whale (Fin Whale)



First of all, as for the real body weight, weight of muscle shows the remarkable change for body length and that of blubber follows it. Both of them show the comparatively large value even in small body length. On the contrary, change of weight of internal organs and bones for body length is not remarkable, showing little unevenness on the average body weight curve. These make us consider that as for body weight or fatness, muscle part shows the most no table change and next blubber part, from the point of view of both age (body length) and whaling season. Bones and internal organs have been little influenced. Three whales which are found far above others both in Figs. 8 and 10 are good examples. All of them were fat and caught after the middle of January.

5. Percentage of the weight af each part for the total weight.

Each part of the above mentioned fat whales, if shown in percentage for total body weight, shows averaged and nearly same value, without unevenness in the figure showing real weight. Especially, internal organs give only a small fluctuation. This means the weight without the relation to the body length. Though instances are few, perhaps naturally the weight of internal organs of pregnant whales (excluding foetus) depends upon the pregnant period and yet is heavier than those of other whales.

The same observation on bones gives us the result that male is larger than female in percentage of weight of bones. This means male is socalled more "large boned" and has more sturdy constitution than female. Generally on mammals like human being their growth does not follow the development of muscles till a certain age. In this investigation, short whales, young whales, show the bigger percentage of weight of bones, this is probably due to the fact that whales too are a mammal.

The percentages of weight of muscle and blubber show larger individual fluctuation for they are much influenced by seasonal fatness as stated in paragraph 4. Generally speaking, male seems to show larger percentage in the weight of muscle and female so in the weight of blubber.

The quite same thing can be said on fin whales too. Male is superior in bone and muscle and female in blubber and internal organs. Individual fluctuation of body weight depends much upon muscle and blubber such as blue whales.

6. The relation between weight and maturity sexual and physical.

Male whales of which testic's weight reached 10 kgs. for blue whales and 5 kgs. for fin whales were regarded as mature. Female whales, of which the presence of more than 1 corpora lutea was found were regarded as mature. (This classification by weight of testic shall be explained elsewhere)

Whales with epiphyses of vertebrae ankylosed to contrum were regarded as mature. Even if they had ankylosed lumbar whales with thoracic region not ankylosed were regarded as immature. (Pregnant blue and resting fin whale contain one whale like this respectively)

According to the above maturity classification, percentage of weight of blubber, muscle, internal organs and bones for the total body weight and average body weight and length are shown in the following table.

TABLE 1.

Average body length and weight and percentage of weight of each part of bodies for total body weight.

1. By sexual maturity

a. Blue Whales

name of part	male immature	male mature	male total	female immature	female mature pregnant	female mature resting	female subtotal	total
blubber	27.32%	27.69%	27.66%	26.64%	28.41%	26.35%	26.91%	26.79%
muscle	39.62	39.20	39.24	40.39	36.76	39.66	38.87	39.55
internal organs	10.75	11.24	11.20	11.55	13.02	11.91	12.21	11.91
bones	19.18	17.88	17.99	17.49	18.07	16.90	17.22	17.35
average body weight	56.48 tons	84.95	82.58	71.26	100.31	100.45	100.41	87.29
average body length	73.0 ft.	78.8	78.3	75.4	83.0	83.5	83.4	79.80
number of whales investigated	1	11	12	9	3	8	11	20

b. Fin Whales

name of part	male immature	male mature	male total	female immature	female mature pregnant	female resting	female subtotal	total
blubber	23.95%	23.44%	23.49%	22.13%	25.77%	23.54%	24.28%	24.17%
muscle	48.69	45.47	45.77	49.21	45.88	45.01	45.30	45.50
internal organs	8.75	10.09	9.96	9.76	10.37	10.73	10.61	10.56
bones	17.34	17.49	17.47	15.81	15.59	17.08	16.59	16.55
average body weight	40.39 tons	45.17	44.68	37.37	58.34	55.34	56.34	55.36
average body length	63.0 ft	65.8	65.5	61.0	71.7	71.3	71.4	70.9
number of whales investigated	1	9	10	1	6	12	18	19

2. By physical maturity

a. Blue Whales

Name of parts	male immature	male mature	male total	female immature pregnant	female resting	female sub total	female mature pregnant	female resting	female sub-total	total
blubber	28.08%	27.23	27.66	30.89	26.63	27.17	23.44	25.90	25.29	26.79
muscle	41.61	36.85	39.24	37.46	39.71	39.48	35.37	41.59	40.03	39.53
internal organs	10.38	12.01	11.20	12.45	11.65	11.75	14.16	12.03	12.56	11.91
bones	17.47	18.50	17.99	16.79	17.32	17.26	20.63	16.73	17.71	17.35
average body weight	74.60 tons	90.55	82.58	102.22	79.65	81.81	96.49	109.56	106.54	87.29
average body length	76.0 ft.	80.7	78.3	83.0	77.8	78.4	83.0	86.0	85.3	79.8
number of whales investigated	6	6	12	2	14	16	1	3	4	20

b. Fin Whales

Name of parts	male immature	male mature	male total	female immature pregnant	female resting	female sub total	female mature pregnant	female resting	female sub-total	total
blubber	23.53%	23.43	23.49	23.37	22.77	22.95	28.17	24.61	25.53	24.17
muscle	45.20	46.63	45.77	47.30	45.67	46.16	44.46	44.94	44.79	45.50
internal organs	9.89	10.06	9.96	10.51	10.84	10.74	10.23	10.44	10.37	10.56
bones	17.65	17.21	17.47	15.87	16.37	16.22	15.31	17.71	16.91	16.55
average body weight	42.6 tons	47.66	44.68	57.29	51.00	52.89	59.38	57.42	58.08	55.35
average body length	64.3 ft.	67.3	65.5	71.3	69.0	69.7	72.0	72.2	72.2	70.9
number of whales investigated	6	4	10	3	7	10	3	6	9	19

The author would like to call attention to the fear that a few number of sexually immature whales measured might make the special circumstances (for instance, seasonal variation) magnify.

According to this table, as thought hitherto, physically mature whales gave larger percentage of weight of bones than immature. And it is especially interesting that sexually immature blue whales show larger percentage. Perhaps naturally as explained above, male whales have always the larger percentage of bones, whatever maturiry they may be in. The percentage of weight of internal organs is reversely larger in female whales. And it is larger in mature than immature whales. Pregnant whales always show large percentage of weight of internal organs blubber, and muscles. In natural, the percentage of weight of bones becomes smaller with the increase of other parts. But their real weights are increased, though the increasing ratio is small.

7. Different weight of each part of whale body by species.

The percentage of weight of blubber is about 26 % for blue whales and about 24 % for fin whales. On the contrary, the percentage of weight of muscle is about 39 % for blue whales and more than 45 % for fin whales. But the weight of bones and internal organs are both by about 1 % larger in blue whales, which is not a larger difference.

The raw material for oil was roughly calculated with the above data as follows. Fin whale of 69 ft. and 51.7 tons (average of 29 male and female whales) gives about 21 ton material and blue whale of 80 ft. and 87.3 tons (average of 32 male and female whales) gives only 39 ton material. If they are conversed into blue whale unit, the latter is 39 tons and the former, 42 tons. So, the conclusion is that; it is more profitable to catch fin whales over 70 feet than blue whales under 80 feet.

TABLE. 2. Comparative Table of Weight and Length by Whale Species.

	Blue whales	Fin whales
average body length	79.55 ft.	69.06 ft
average body weight	87.29 tons	51.67 tons
muscle	39.43 %	45.54 %
internal organs	11.64 %	10.35 %
blubber	27.12 %	23.93 %
bones	17.69 %	16.86 %
material for oil (body weight multiplied by percentage of blubber and bones)	39.11 tons	21.09 tons

8. Conclusion

As mentioned above, number of whales measured is about 30, each blue and fin. Though further investigations are necessary for the observation, by sex, and sexual or physical condition, the author could get the above result anyhow. He quite owed it to all member of whaling fleets.

Resumé

1. Body weight increased with body length. Its increasing ratio was nearly same for blue and fin whales.
2. Seasonal increase of body weight was remarkable in muscle part, next blubber part and not so in bones and internal organs.
3. The notable increase of body weight was found after the middle of January in the Antarctic.
4. Males had more developed muscle and bones than females. Blubber and internal organs were heavier in females than in males.
5. From the point of view of oil material, fin whales is superior (of course it depends upon body length also).

The above is a part of author's observation and he eagerly hopes to study these data from all points of view, for the main purpose of this report is to make public data of whale carcass weighing.

As for body weight, he would like to study on the relation between foetus and adult and on variation of weight of important internal organs such as liver. They are so late for this report that he wants to make it his preliminary report.

References

A. H. Laurie: Some aspects of respiration in Blue and Fin whale, appendix, A note on the weight of some Blue whales. Discovery Reports Vol. XV p. 405, 1933.

H. Ohmura, Y. Matsuura and I. Miyazaki: Whales, their science and real whaling. 1942.

Explanation for table of measurement on each whale.

No of whale treated.

N No. ....means No. of whales treated aboard the Nisshin-maru, Taiyo Gyogyo K. K.

H No. ....means No. of whale treated aboard the Hashidate-maru, Nihon Suisan K. K.

Sex and species

Blue whale...............B

Fin whale................F

Male whale..............M

Female whale............ F

Time and Data when whales were captured.

The first 4 figures mean time in 24 hour system.

The following 2 figures mean date and the next English letters mean November for N, December for D, January for J, February for F, March for M, and April for A.

Body length was expressed in feet.

Weight of testis or overies.

right and left one totalled in Kgs.

Diameter of testis or number of corpora lutea.

Three dimensions of testis were measured in cms, separately right and left.

Number of corpora lutea in ovaries was expressed, totalled functional and old, right and left.

Ankylosis of vertebrae.

+ means ankylosed and — means not ankylosed on whales measured in the season 1947/48.

A means ankylosed (indistinct border between centrum and epiphysis).

a means ankylosed (distinct border).

n means not ankylosed (thin cartilage between centrum and epiphysis).

N means not ankylosed (thick cartilage).

The first (right) letter means the thoracic region and the second (left) letter, lumbet region.

Degree of white scars.

The left figures mean degree of white scars as following classes.

No scar....................0

Rare scars 1

a few scars 2

many scars.................3

extremely many scars 4

The right letter, a means older scars than last year's. b means older scars as many as last year's. c means fewer old scars than last year's.

Thickness and colour of mammary gland.

It is expressed in cms. Its colour is shown as follows.

white........................W
peach........................P
yellowish brown...............Y
brown........................B
reddish yellow...............Ry
dark yellow..................Dy
red..........................R

Sex of foetus and its body length.

male.........................M
female.......................F

Body length is expressed in feet.

Yield of oil is expressed in Barrels. After page 13, in the items the left figures mean weight in tons and the right ones show its % for the total body weight. (1 Barrel=1/6 ton, 1 ton=1,016 kgs)

year	1947 ～ 1948															
Serial number & Sex	N.No.113.B.M.		N.No.148.B.F.		H.No.271.B.F.		H.No.281.B.F.		N.No.207.B.F.		N.No.210.B.F.		H.No.325.B.F.		N.No.223.B.M.	
Date & Time, Killed	12.50.24.D		17.20.29.D.		16.10.30.D.		09.55. 2.J.		09.00. 7.J.		67.20. 8.J.		16.25. 9.J.		12.00. 11.J.	
Body length in feet	82		83		83		79		83		70		77		81	
Weight of Testes or Ovaries in kg.	34.3		8.3		7.0		2.0		2.8		0.8		1.5		33.0	
Size of Testes or Number of Corpora lutea	73×26×12 80×23×11		13		16		0		2		0		1		80×22×13 82×22×10	
Ankylose of Vertebrae	+ +		− +		+ +		− −		− −		− −		− −		− −	
White scars	3		4		4.a		1.a		2		3		1.a		3	
Thickness & Colour of Mammary gland			5		8.ry		8.y		4		3		3.p			
Sex & Body length of Foetus			M. 10−7		F. 4−2				F. 6−7							
Oil yield in Brl.	133.63		179.68		143.04		114.6		150.93		92.59		86.88		143.84	
	T	%	T	%	T	%	T	%	T	%	T	%	T	%	T	%
Blubber	27.90	31.83	35.868	32.55	22.615	23.44	18.439	24.18	27.55	29.24	16.11	28.41	16.708	23.85	24.81	29.52
Meat	29.77	33.97	39.294	35.65	34.142	35.37	29.504	38.69	37.01	39.27	22.91	40.40	27.146	38.74	33.84	40.26
Internal organs	12.91	14.73	15.388	13.96	13.660	14.16	10.416	13.65	10.30	10.93	5.55	9.79	8.196	11.70	8.46	10.06
Heart	0.56		0.615		0.522		0.464		0.30		0.23		0.178		0.31	
Lung & Bronchus	0.86		0.555		0.691		0.591		0.39		0.34		0.597		0.68	
Stomach	0.26		0.543		0.400		0.299		0.29		0.21		0.248		0.19	
Intestine	1.12		1.371		1.621		1.184		0.95		0.60		1.270		0.91	
Kidney	6.31		0.367		0.460		0.272		0.25		0.19		0.285		0.29	
Liver	0.90		0.937		1.153		0.990		0.75		0.56		0.704		0.60	
Others	8.90		11.000		81.813		6.616		7.37		3.42		4.914		5.48	
Bone	15.38	17.55	17.16	15.57	19.906	20.63	14.450	18.94	16.98	18.02	10.79	19.02	13.614	19.43	15.01	17.86
Skull	4.32		4.55		5.026		3.756		4.06		3.50		3.566		3.31	
Vertebrae	6.46		7.27		9.326		6.152		8.12		4.84		5.800		8.15	
Ribs	1.18		1.74		2.117		1.846		1.58		1.13		1.723		1.52	
Jaw bone	2.02		2.26		2.103		1.796		1.82		1.34		1.645		1.13	
Others	1.46		1.34		1.334		0.900		1.40		0.98		6.880		0.90	
Others	1.68	1.92	2.499	2.27	6.171	6.40	3.468	4.54	2.39	2.54	1.35	2.38	4.397	6.28	1.93	2.30
Total weight	87.64		110.209		96.494		76.277		94.23		56.71		70.061		84.05	

Year	1947 ~ 1948															
Serial number & Sex	N. No.230. B.F.		H. No.367.B.M.		N. No.239.B.M.		N. No.247.B.M.		N. No.279. B.F.		H. No.435. B.F.		N. No.280.B.M.		H. No.438.B.M.	
Date & Time, Killed	12.35. 12. J.		13.20. 14. J.		03.40. 15. J.		11.15. 16. J.		06.50. 21. J.		12.55. 21. J.		13.15. 21. J.		15.50. 22. J.	
Body length in feet	78		76		73		75		76		83		74		83	
Weight of Testes or Ovaries in kg.	0.5		22.5		4.6		13.3		0.9		3.9		38.5		31	
Size of Testes or Number of Corpora lutea	0.		61×19×13 60×18×13		38×11×8 36×12×7		40×17×10 43×16×11		0		31		59×23×18 66×25×16		62×26×15 65×24×14	
Ankylosis of Vertebrae	− −		− −		− −		− −		− −		+ +		− −		+ +	
White scars	2		3c		2		2		3		4a		3		42	
Thickness & Colour of Mammary gland	2								3		10dy					
Sex & Body length of Foetus																
Oil yield in Brl.	103.16		75.54		74.22		110.31		113.13		92.16		107.94		122.76	
	t	%	t	%	t	%	t	%	t	%	t	%	t	%	t	%
Blubber	22.69	32.92	16.556	26.25	15.43	27.32	19.02	27.58	20.68	26.64	22.034	23.57	22.000	28.42	27.891	25.87
Meat	24.83	36.03	25.879	41.04	22.38	39.62	28.33	41.07	34.04	43.85	31.605	33.80	34.93	45.12	39.838	36.95
Internal organs	7.941	11.52	6.172	9.79	6.07	10.75	7.373	10.69	9.491	12.22	12.683	13.56	7.739	9.99	11.573	10.74
Heart	0.30		0.257		0.11		0.18		0.33		0.320		0.23		0.344	
Lung & Bronchus	0.68		0.461		0.53		0.46		0.68		0.927		0.47		0.889	
Stomach	0.25		0.260		0.25		0.30		0.30		0.492		0.28		0.280	
Intestine	1.13		0.765		0.86		1.02		1.11		1.647		0.95		1.374	
Kidney	0.20		0.208		0.16		0.24		0.25		0.343		0.18		0.400	
Liver	0.70		0.688		0.56		0.75		0.94		1.085		0.75		1.347	
Others	4.681		3.533		3.60		4.423		5.881		7.869		4.879		6.939	
Bone	11.98	17.38	12.595	19.97	10.83	19.18	12.75	18.49	11.93	15.37	20.080	21.48	11.10	14.34	19.607	18.19
Skull	2.92		3.515		2.78		3.06		3.05		5.570		3.05		5.484	
Vertebrae	5.84		5.478		4.77		5.75		4.58		8.681		4.31		8.440	
Ribs	1.08		1.402		1.04		1.29		1.50		2.154		1.40		2.335	
Jaw bone	1.12		1.397		1.19		1.51		1.67		2.434		1.40		2.182	
Others	1.02		0.803		1.05		1.14		1.13		1.241		0.94		1.166	
Others	1.49	2.16	1.860	2.95	1.77	3.13	1.50	2.17	1.49	1.92	7.100	7.59	1.65	2.13	8.895	8.25

Year	1947 ～ 1948															
Serial number & Sex	N. No.319. B.F.		N. No.337. B.F.		H. No.631. B.F.		N. No.411. B.F.		N. No.415. B.M.		H. No.734. B.M.		H. No.736. B.F.		H. No.742. B.F.	
Date & Time, Killed	16.10. 27. J.		12.35. 2. F.		19.35. 7. F.		22.40. 14. F.		17.00. 15. F.		09.30. 20. F.		18.30. 20. F.		21.30. 21. F.	
Body length in feet	89		74		76		86		77		75		73		77	
Weight of Testes or Ovaries in kg.	4.1		0.6		1.4		9.6		30.5		30.5		1.2		1.1	
Size of Testes or Number of Corpora lutea	19		0		0		30		58×22×14 58×22×15		62×22×15 70×22×13		0		0	
Ankylosis of Vertebrae	+ +		− −		− −		+ +		− −		+ +		− −		− −	
White scars	4		2		3a		4		4		4a		1a		1a	
Thickness & Colour of Mammary gland	8		3		5dy		9						2p		2p	
Sex & Body length of Foetus																
Oil yield in Brl.	159.25		76.41		101.16		159.08		152.93		110.70		76.98		100.62	
	T	%	T	%	T	%	T	%	T	%	T	%	T	%	T	%
Blubber	32.36	25.37	15.58	28.16	19.698	25.44	31.24	28.76	28.70	29.40	22.659	26.26	15.753	25.27	20.333	24.70
Meat	61.51	48.23	22.67	40.97	30.062	38.83	46.41	42.73	41.61	42.62	30.730	35.62	25.495	40.92	35.797	43.50
Internal organs	13.944	10.93	5.6406	10.20	10.030	12.96	12.60	11.60	10.74	11.00	10.848	12.59	7.033	11.27	8.701	10.58
Heart	0.43		0.16		0.371		0.59		0.21		0.333		0.297		0.215	
Lung & Bronchus	1.09		0.48		0.466		0.70		0.59		0.644		0.481		0.590	
Stomach	0.47		0.25		0.243		0.54		0.53		0.321		0.183		0.231	
Intestine	1.49		0.71		1.193		1.59		1.13		1.021		1.004		0.945	
Kidney	0.36		0.13		0.278		0.49		0.33		0.283		0.167		0.200	
Liver	1.00		0.56		0.827		1.30		1.16		0.958		0.601		0.700	
Others	9.104		3.3506		6.652		7.39		6.79		7.288		4.300		5.820	
Bone	17.54	13.75	10.21	18.45	13.299	17.18	16.26	14.97	14.64	14.99	16.734	19.40	11.261	18.07	13.671	16.62
Skull	4.88		2.54		3.485		4.80		3.58		5.014		3.035		3.480	
Vertebrae	7.32		4.19		6.170		6.39		6.35		6.736		5.164		6.194	
Ribs	1.47		1.16		1.358		1.64		1.67		1.916		1.094		1.498	
Jaw bone	1.99		1.12		1.398		2.07		1.76		2.044		1.257		1.544	
Others	1.88		1.20		0.888		1.36		1.28		1.024		0.711		0.955	
Others	2.19	1.72	1.23	2.22	4.336	5.59	2.11	1.94	1.94	1.99	5.296	6.13	2.786	4.47	3.787	4.60
Total Weight	127.544		55.3306		77.425		108.62		97.63		86.267		62.328		82.289	

Year	1947 ~ 1948												1948 ~ 1949			
Serial number & Sex	RN. No. 462. B.F.		H. No. 745. B.F.		N. No. 471. B.M.		H. No. 819. B.F.		H. No. 827. B.M.		H. No. 831. B.F.		H. No. 79. B.M.		H. No. 831. B.F.	
Date & Time. Killed	07.30. 23.F.		18.25. 23.F.		00.40. 25.F.		19.20. 3.M.		15.25. 5.M.		18.20. 7.M.		11.20. 26.D.		19.50. 2.M.	
Body length in feet	88		76		80		82		83		81		81		82	
Weight of Testes or Ovaries in kg.	5.6		1.3		29.0		2.4		32.5		5.8		44.6		4.8	
Size of Testes or Number of Corpora lutea	13		0		71 × 27 × 12 64 × 27 × 12		2		79 × 23 × 12 84 × 23 × 12		6		77 × 24 × 16 75 × 25 × 18		4	
Ankylosis of Vertebrae	− −		− −		+ +		− −		+ +		− −		a a		n n	
White scars	4		2a		4		1a		1a		4a		4c		3c	
Thickness & Colour of Mammary gland	9		5p				6p				5Ry				3p	
Sex & Body length of Foetus																
Oil yield in Brl.	179.51		104.28		142.07		154.92		140.40		159.06		118.63		159.66	
	₮	%	₮	%	₮	%	₮	%	₮	%	₮	%	₮	%	₮	%
Blubber	31.28	27.50	20.271	24.05	23.31	27.31	26.307	27.70	26.068	26.24	25.526	26.75	19.916	25.89	27.201	27.28
Meat	49.64	43.64	33.964	40.30	36.47	42.73	33.523	35.30	35.893	36.13	38.847	40.71	27.454	35.70	33.995	34.09
Internal organs	13.176	11.58	9.949	11.80	8.709	10.21	12.815	13.50	11.823	11.91	8.792	9.21	9.135	11.88	13.1228	13.16
Heart	0.42		0.738		0.25		0.520		0.176		0.227		0.439		0.297	
Lung & Bronchus	0.98		0.545		0.67		0.456		0.407		0.561		0.437		0.556	
Stomach	0.45		0.336		0.25		0.450		0.305		0.304		0.284		0.379	
Intestine	1.35		1.183		1.09		1.395		1.357		0.937		1.299		1.148	
Kidney	0.35		0.308		0.26		0.350		0.317		0.300		0.235		0.299	
Liver	0.95		0.805		0.70		0.827		1.235		0.666		0.763		0.938	
Others	8.676		6.034		5.489		8.816		8.025		5.767		5.678		9.5058	
Bone	17.31	15.22	13.832	16.42	14.87	17.42	16.665	17.55	16.644	16.76	15.800	16.55	16.691	21.70	16.235	16.28
Skull	4.91		3.569		3.78		4.660		4.205		2.806		4.773		4.480	
Vertebrae	7.63		6.716		6.49		7.600		7.465		7.509		7.264		7.230	
Ribs	1.42		1.239		1.84		1.595		2.021		2.590		1.758		1.731	
Jaw bone	2.00		1.440		1.35		1.786		2.030		1.892		1.767		1.754	
Others	1.35		0.868		1.41		1.025		0.923		1.003		1.029		1.040	
Others	2.34	2.06	6.264	7.43	1.99	2.33	5.646	5.95	8.900	8,96	6.463	6.78	3.716	4.83	9.159	9.19

Year																
Serial number & Sex	H. No.152.F.M.		N. No.152.F.M.		H. No.284.F.F.		H. No.314.F.M.		N. No.211.F.M.		N. No.224.F.F.		N. No.225.F.F.		N. No.236.F.F.	
Date & Time, Killed	09.25. 30.D.		10.15. 30.D.		06.50. 3.J.		16.45. 7.J.		11.40. 8.J.		15.35. 11.J.		17.15. 11.J.		14.30. 13.J.	
Body length in feet	64		67		69		66		63		74		75		74	
Weight of Testes or Ovaries in kg.	12.7		21.6		0.4		24.4		10.2		2.4		2.7		2.1	
Size of Testes or Number of Corpora lutea	56×13×12 56×17×9		56×24×12 61×20×11		1		65×21×13 58×23×13		56×17×7 57×16×7		21		20		14	
Ankylosis of Vertebrae	− −		− −		− −		+ +		− −		+ +		+ +		+ +	
White scars	4		4		1a		4a				4				4	
Thickness & Colour of Mammary gland					3b						7		8		6	
Sex & Body length of Foetus															M. 9−1	
Oil yield in Brl.	54.73		57.57		46.80		47.28		49,48		68.26		60.23		77.76	
	T	%	T	%	T	%	T	%	T	%	T	%	T	%	T	%
Blubber	9.27	23.00	10.341	22.86	10.533	20.39	11.091	23.07	9.57	23.80	15.60	24.28	13.78	23.92	18.56	26.69
Meat	17.891	44.40	20.747	45.86	25.358	49.08	22.391	46.56	19.50	48.50	29.93	46.57	25.22	43.78	31.17	44.82
Internal organs	4.411	10.95	4.398	9.72	5.583	10.78	4.226	8.79	3.96	9.85	6.972	10.85	6.212	10.79	7.982	11.48
Heart	0.150		0.131		0.239		0.136		0.13		0.18		0.13		0.30	
Lung & Bronchus	0.25		0.248		0.401		0.379		0.29		0.42		0.54		0.41	
Stomach	0.139		0.12		0.293		0.120		0.12		0.25		0.20		0.10	
Intestine	0.563		0.60		0.960		0.825		0.49		1.21		1.04		0.76	
Kidney	0.150		0.15		0.198		0.179		0.22		0.20		0.23		0.17	
Liver	0.560		0.464		0.592		0.617		0.35		0.49		0.56		0.40	
Others	2.599		7.685		2.900		1.970		2.36		4.222		3.512		5.842	
Bone	7.90	19.60	8.938	19.76	8.338	16.16	8.792	18.28	6.27	15.59	10.49	16.32	11.42	19.83	10.20	14.67
Skull	2.27		2.555		2.288		2.490		0.98		2.35		2.62		2.63	
Vertebrae	3.62		4.07		3.724		3.958		3.47		4.50		4.76		4.56	
Ribs	0.79		1.038		0.966		0.842		0.67		1.69		1.89		1.20	
Jaw bone	0.71		0.72		0.909		0.978		0.72		1.20		1.25		1.25	
Others	0.51		0.555		0.451		0.524		0.43		0.75		0.90		0.56	
Others	0.826	2.05	0.814	1.80	1.855	3.59	1.587	3.30	0.91	2.26	1.27	1.98	0.97	1.68	1.63	2.34
Total Weight	40.298		45.238		51.667		48.087		40.21		64.262		57.602		69.542	

Year	1947 ～ 1948															
Serial number & Sex	N. No.254. F.F.		N. No.262.F.M.		N. No.325. F.F.		N. No.357. F.F.		H. No.617.F.M.		H. No.702. F.F.		H. No.816. F.F.		N. No.487. F.F.	
Date & Time, Killed	20.40. 17. J.		19.35. 18. J.		17.10. 29. J.		01.20. 5. F.		21.35. 6. F.		21.15. 12. F.		10.30. 2. M.		11.15. 7. M.	
Body length in feet	72		64		71		71		69		68		68		68	
Weight of Testes or Ovaries in kg.	3.1		7.5		2.4		2.1		26.9		1.8		2.3		2.0	
Size of Testes or Number of Corpora lutea	5		45 × 13 × 10 44 × 12 × 9		7		16		72 × 21 × 11 72 × 21 × 11		1		6		15	
Ankylosis of Vertebrae	− −		− −		− −		+ +		+ +		− −		+ +		− −	
White scars	3		3		4		2		4a		4a		4a		4	
Thickness & Colour of Mammary gland	4				5		7				5dy		5dy		6	
Sex & Body length or Foetus	F. 7−10				M. 9−6											
Oil yield in Brl.	74.10		51.19		74.28		66.60		42.72		44.16		46.8		59.34	
	T	%	T	%	T	%	T	%	T	%	T	%	T	%	T	%
Blubber	14.19	23.37	10.59	25.43	14.75	25.57	15.18	25.94	10.778	22.66	10.028	21.17	9.966	20.55	13.70	27.57
Meat	29.09	47.91	19.11	45.88	28.30	49.06	27.02	46.18	21.963	46.16	21.181	44.72	20.436	42.14	26.65	43.57
Internal organs	6.399	10.54	3.778	9.07	5.692	9.87	6.062	10.36	4.535	9.54	5.162	10.89	5.168	10.65	5.885	11.84
Heart	0.16		0.13		0.14		0.18		0.220		0.205		0.142		0.17	
Lung & Bronchus	0.40		0.20		0.30		0.45		0.285		0.335		0.303		0.29	
Stomach	0.27		0.15		0.23		0.17		0.240		0.233		0.266		0.22	
Intestine	0.74		0.58		0.73		0.80		0.793		0.755		0.992		0.62	
Kidney	0.14		0.11		0.16		0.21		0.165		0.180		0.145		0.25	
Liver	0.56		0.38		0.54		0.53		0.475		0.448		0.517		0.50	
Others	4.129		2.228		3.592		3.722		2.357		3.006		2.803		3.835	
Bone	9.87	16.25	7.08	17.00	7.82	13.56	8.96	15.31	7.883	16.56	9.067	19.15	9.227	19.03	7.45	14.99
Skull	2.47		1.85		2.28		2.46		1.910		2.334		1.922		1.63	
Vertebrae	4.38		2.85		3.05		3.50		3.820		4.228		4.357		3.59	
Ribs	1.20		1.06		0.90		1.08		0.972		1.013		1.281		0.77	
Jaw bone	1.17		0.81		1.10		1.26		0.761		0.958		1.085		0.96	
Others	0.65		0.51		0.49		0.66		0.420		0.534		0.582		0.50	
Others	1.174	1.93	1.09	2.62	1.12	1.94	1.29	2.21	2.417	5.08	1.929	4.07	3.701	7.63	1.01	2.03
Total Weight	60.723		41.648		57.682		58.512		47.576		47.367		48.498		49.695	

Year	1948 ～ 1949															
Serial number & Sex	r/N. No.15.F.F.		N. No21. F.F.		N. No.25.F.M.		H. No.85.F.F.		H. No.86.F.F.		N. No.68.F.F.		N. No.105.F.F.		N. No.127.F.M.	
Date & Time, Killed	16.45. 17.D.		15.40. 18.D.		10.45. 19.D.		18.30. 27.D.		20.45. 28.D.		15.40. 30.D.		20.45. 6.J.		09.10. 10.J.	
Body length in feet	68		73		63		61		71		73		74		67	
Weight of Testes or Ovaries in kg.	3.5		2.8		4.0		0.6		2.0		1.8		4.1		13.3	
Size of Testes or Number of Corpora lutea	14		24		40×9×5 38×10×6		0		6		19		12		65×17×8 63×14×8	
Ankylosis of Vertebrae	a a		A A		n n		N N		n n		A A		a a		A A	
White scars	2c		3c		2b		3c		2c		3c		3c		2c	
Thickness & Colour of Mammary gland	7y		7y				3p		3.5Ry		6Dy		5y			
Sex & Body length of Foetus	F. 2−7								F. 5−4				M. 7−3			
Oil yield in Brl.	41.4		45.6		30.8		37.7		56.1				69.0		37.8	
	T	%	T	%	T	%	T	%	T	%	T	%	T	%	T	%
Blubber	13.337	27.00	15.862	27.76	9.673	23.95	8.270	22.13	11.324	21.18	13.335	22.78	18.249	30.81	10.460	22.93
Meat	22.124	44.80	24.287	42.51	19.665	48.69	18.391	49.21	24.019	44.93	28.365	48.46	25.419	43.76	21.614	47.39
Internal organs	5.1195	10.37	6.1728	10.81	3.532	8.75	3.646	9.76	5.951	11.13	5.364	9.17	5.230	8.83	4.540	9.96
Heart	0.233		0.320		0.100		0.133		0.182		0.238		0.252		0.500	
Lung & Bronchus	0.375		0.580		0.340		0.247		0.419		0.340		0.334		0.420	
Stomach	0.263		0.240		0.150		0.197		2.256		0.230		0.375		0.190	
Intestine	1.004		0.920		0.630		0.477		0.646		0.695		0.708		0.610	
Kidney	0.188		0.215		0.100		0.136		0.175		0.210		0.188		0.170	
Liver	0.450		0.645		0.360		0.344		0.515		0.500		0.512		0.370	
Others	2.6065		3.2528		1.852		2.112		3.758		3.151		2.861		2.280	
Bone	8.012	16.22	10.012	17.52	7.002	17.34	5.910	15.81	9.514	17.80	10.675	18.24	8.911	15.05	8.401	18.42
Skull	2.149		3.646		1.837		1.520		2.623		2.630		3.578		2.484	
Vertebrae	3.634		4.529		3.232		2.803		4.144		4.967		3.876		3.391	
Ribs	0.833		1.344		0.750		0.605		0.976		1.158		0.918		1.071	
Jaw bone	0.859		—		0.795		0.605		1.114		1.333		—		0.945	
Others	0.537		0.493		0.388		0.373		0.657		0.587		0.539		0.510	
Others	0.7934	1.61	0.800	1.40	0.514	1.27	1.154	3.09	2.651	4.96	0.790	1.35	0.918	1.55	0.594	1.30
Total weight	49.3859		57.1338		40.386		37.371		53.459		58.529		58.222		45.609	

Year	1948 ~ 1949									
Serial number & Sex	N. No.219. F.M.		N. No.540. F.F.		H. No.783. F.F.		H. No.795. F.F.		H. No.927. F.M.	
Date & Time, Killed	09.25. 21.J.		05.45. 26.F.		09.30. 25.F.		14.10. 26.F.		19.10. 14.M.	
Body length in feet	67		71		76		70		65	
Weight of Testes or Ovaries in kg.	30.8		1.2		1.2		1.7		19	
Size of Testes or Number of Corpora lutea	68 × 27 × 12 68 × 22 × 13		1		5		7		70 × 15 × 10 62 × 17 × 9	
Ankylosis of Vertebrae	A A		N N		N N		n a		n n	
White scars	4c		2b		1c		3c		3c	
Thickness & Colour of Mammary gland			4Ry		4.0p		6.5Ry			
Sex & Body length of Foetus										
Oil yild in Brl.	43.8						64.2		66.3	
	₮	%	₮	%	₮	%	₮	%	₮	%
Blubber	12.375	25.07	12.948	24.39	13.319	23.17	12.385	20.53	10.695	22.11
Meat	22.915	46.42	25.240	47.54	24.093	41.91	26.322	43.63	18.311	37.86
Internal organs	5.896	11.95	5.515	10.39	5.9116	10.28	7.2047	11.94	5.323	11.00
Heart	0.245		0.260		0.287		0.251		0.189	
Lung & Bronchus	0.435		0.330		0.358		0.420		0.429	
Stomach	0.230		0.300		0.396		0.267		0.241	
Intestine	0.790		0.671		0.944		0.940		0.682	
Kidney	0.230		0.215		0.201		0.330		0.138	
Liver	0.600		0.500		0.657		0.757		0.659	
Others	3.356		3.239		3.0686		4.2397		2.985	
Bone	7.636	15.57	8.669	16.33	9.132	15.89	9.800	16.24	8.027	16.60
Skull	2.030		2.283		2.583		2.693		2.195	
Vertebrae	3.381		3.542		4.478		4.289		3.417	
Ribs	0.865		1.020		0.686		1.122		1.097	
Jaw bone	0.940		1.330		1.058		1.205		0.794	
Others	0.470		0.494		0.327		0.491		0.524	
Others	0.489	0.99	0.716	1.35	5.032	8.75	4.619	7.66	6.010	12.43
Total Weight	[illegible]		[illegible]		57.4876		60.3307		48.366	