Statistic Study of Foetuses of Whales

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Introduction

The material of the present study regarding foetuses of whales is based upon the monthly reports forwarded to the Whaling Society by various whaling companies from 1911 to 1948. Most of such reports were destroyed by the fire during the War. Thanks to Mr. Ohmura's efforts, however, all the numbers issued in the following sixteen years, —1911, 1914, 1919, 1921, 1922, 1926, 1932, 1934, 1941, 1942, 1943, 1944, 1945, 1946, 1947 and 1948— have been recollected so as to be available for us at present. Moreover, six numbers of both 1910 and 1940, too, have been restored.

These whaling reports record particulars of individual animales of the monthly catch with such items as date of the catch, species, sex, body-length, foetus, stomach contents, and locality of the catch.

As for the older records of foetuses, they seem to have been made according to the rough estimation by the eye. Yet there may be no gross forgery about them, as in the case of body-lengths which are subject to body-length limitation and ratio money. Since 1946, however, the records have become authentic, because in that year whaling inspectors began to be employed in each landstation along our coasts, who, as in factory-ships, make biological investigation of the catch as well as superintend whaling operations. As anyone that has been on board a factory ship and at present in the scene of dissection of a carcass, can well suppose, foetueses below 5 inches are very apt to be overlooked. In fact, either for this reason or for the ship in recording, description of such small foetuses are extremely rare before 1945. Neither is it probable that before 1945 each ovaries with functional corpora lutea should have been operated upon so as to ascertain the presence of a foetus. The description of foetuses are confined to such large sized species as Sperm, Sei, Fin, Blue, Hump-back, Right and Grey whales. Of these the foetuses of Blue, Hump-back, Right and Grey whales are so few in number that it is hardly possible to study them with any statistic result.

Sex Ratio

As for Sperm whales, the ratio of males and females are 46.2% and 53.8% respectively: so it is roughly half and half. Since early days it has been said of Sperm whales, which have the habit of forming Harem, that females greatly outnumber males. This is by no means correct. According to the sex ratio of foetus of the same species, females slightly outnumber males, but this relation is quite reversed in the sex ratio of the caught whale. (males are 52.4%, females are 47.6%)

The sex ratio of the foetuses of Sei whales is 45.5% and 54.5%, showing the ratio of either sex is almost the same. This relation is not changed in the sex ratio of the caught whale. (males are 49.0%, females 51.0%)

Table 1.

Species / Year	Foetus of Fin				Foetus of Sei				Foetus of Sperm			
	Male	Female	Unknown	Total	Male	Female	Unknown	Total	Male	Female	Unknown	Total
1910	0	0	0	0	1	1	0	2	1	5	0	6
1911	1	0	0	1	2	2	1	5	3	3	1	7
1914	2	2	2	6	1	1	11	13	1	7	10	18
1919	0	0	0	0	1	0	2	3	8	4	0	12
1921	0	0	0	0	1	1	2	4	7	9	0	16
1922	0	0	0	0	2	0	0	2	6	9	3	18
1926	0	0	0	0	1	2	0	3	0	3	0	3
1932	4	1	5	10	5	9	2	16	0	2	3	5
1934	2	4	0	6	13	14	1	28	20	25	0	45
1940	4	2	0	6	1	1	0	2	8	13	0	21
1941	6	2	0	8	5	9	0	14	28	38	0	66
1942	6	8	0	14	6	14	0	20	2	4	0	6
1943	4	6	0	10	6	6	0	12	17	14	0	31
1944	3	2	0	5	8	7	1	16	19	21	2	42
1945	1	1	0	2	0	3	0	3	4	9	0	13
1946	1	6	0	7	4	4	0	8	22	29	0	51
1947	1	2	0	3	7	12	0	19	45	33	1	79
1948	3	0	0	3	17	11	1	29	56	60	2	118
Total	38	36	7	81	81	97	21	199	247	288	22	557
Sex ratio	51.4	48.6		100	45.5	54.5		100	46.2	53.8		100

So is the sex ratio of Fin whales, males being 51.4% while females 48.6%. According to Mr. Matsuura, female foetuses are less in number than male ones in Mystacoceti. But it cannot possibly be correct, for both the sex ratio of foetuses shown in Table 1 and that of the caught whale, indicate either in Mystacoceti or in Odontoceti the sex ratio is half and

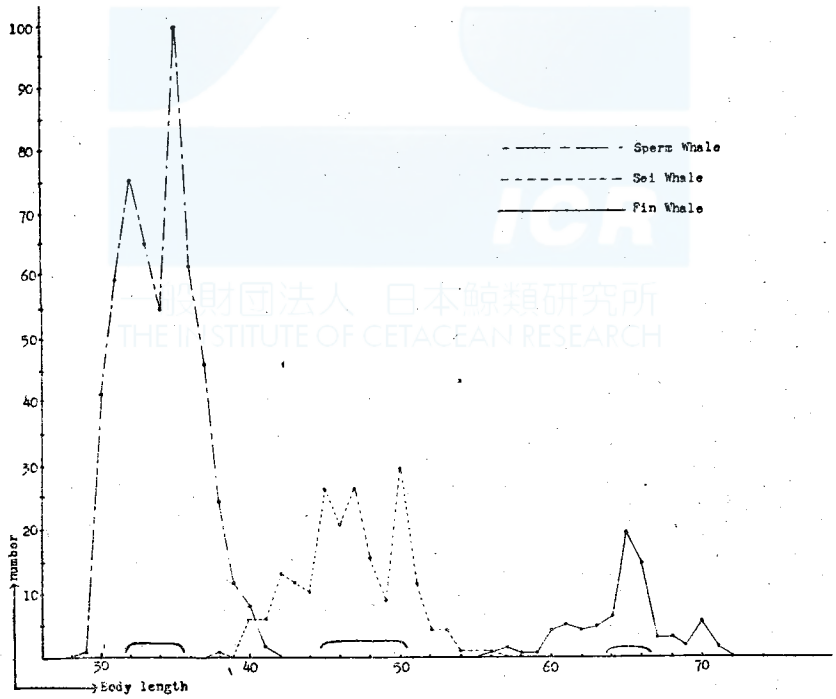
half.

Relation between Pregnancy and Body-length

Fig. 1 shows graphically the numbers of pregnant whales of the species of Sperm, Sei and Fin whales, respectively, according to their body-lengths. For lack of material, we had to omit the observation of pregnancy in other species. As for Fin whales, the minimum size of pregnant whales is 50 feet and the maximum size 71 feet, while the greatest number of pregnant cases, are seen in the body-lengths of 64—66 feet. In Sei whales, the minimum size is 38 feet, the maximum size 56 feet and the peak of pregnancy is formed between 45—50 feet. In Sperm whales, the maximum size, of pregnant animales is 46 feet but females measuring 30—37 feet, especially 32—35 feet are most frequently pregnant. In the adjacent waters of Japan the catch of Sperm whales below 30 feet is prohibited by body-length limitation, while Sperm whales measuring 30 feet are already sexually mature and therefore liable to pregnancy. For this reason the minimum size of pregnant of Sperm whales cannot be determined.

In recent years the size of the whales in the catch has been reduced

Fig. 1



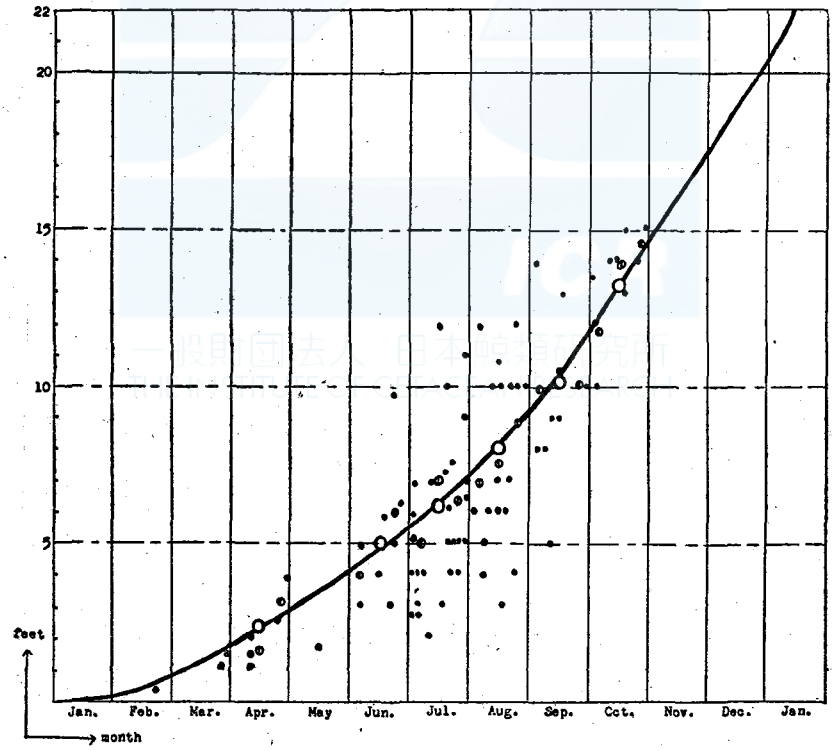
as is clearly seen in any body-length frequency curve. So in the stock of whales as they are in the sea, this curve of pregnancy may shift a little to the side of larger sizes.

Growth Curves

Now we are going to determine the pairing period, the duration of pregnancy, the delivery period and the body-length at delivery according to such species as Fin whales, Sei whales and Sperm whales.

(A) Regarding Fin whales, Fig. 2 shows coordinate with the transversal axis indicating months and the vertical axis indicating body-lengths of foetuses. The black dots representing the foetuses in our material, are placed on the coordinates according to their size and the time of the catch. Each signs of ⓘ represents an average body-length per ten days. Due to the scantiness of our material, tracing these signs of ⓘ would produce too rugged a curve. So we have shown an average body-length per month by small circles, and prepared a growth curve based on them. We have no foetus in our material for the month of November and of December. So

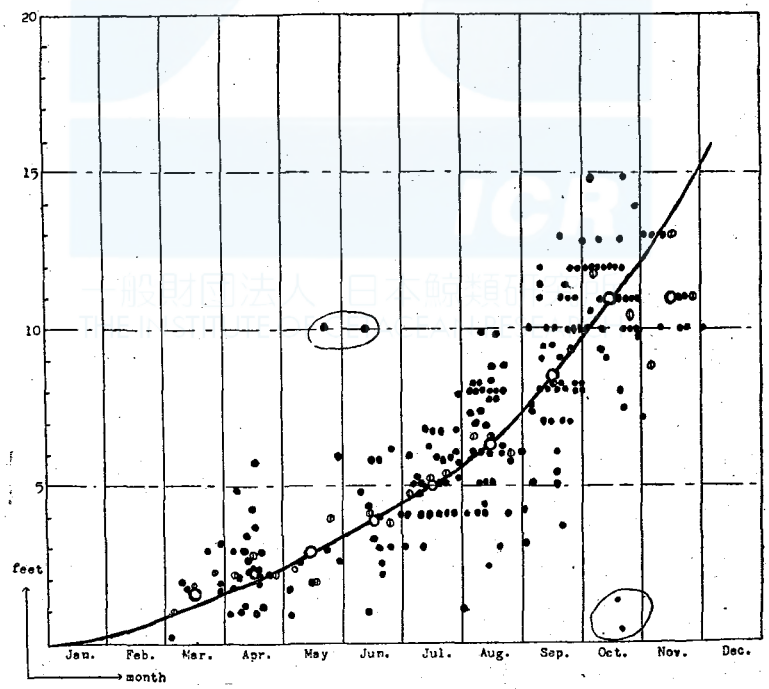
Fig. 2



we are obliged to prolong the growth curve which has already shown a clear tendency by the time it reaches the month of July-so as to complete the year's curve. If we are to apply the body-length of Fin whales at delivery, in the South Semisphere, 21—22 feet, determined by Mackintosh & Wheeler and Matthews, to our growth curve, the size will find its place on the curve at the beginning of January next year. The pairing period according to our growth curve comes in January. Therefore, if we are to assume,-and we have some reason to believe,-that the boby-lengths at delivery in both the semispheres are the same, the duration of pregnancy is twelve months and one decade. There is six months' variation in both the periods of pairing and of delivery between the South and the North Semispheres. Our growth curve has roughly two months' breadth.

(B) The coordinates in Fig. 3 have been prepared in the same way as those of Fin whales, and show the growth of foetuses of Sei whales. The signs of ⓘ represent average body-lengths per ten days, and the circles those per month. The records of foetuses in the months of March, April and May are exclusively those of the Bonin Islands sea area because there is no foetus found in other sea areas during that period. The season for

Fig. 3



Sei whales in the Bonin Islands sea area lasts only these three months and the foetuses found then are still very small in size as is shown in the curve. In July, August and September pregnant whales are captured mainly in the Sanriku sea area, and in October, mainly in the Hokkaidō Pacific sea area. These shifts in seasons and whaling grounds as well as the different growth stages of foetuses of the catch lead us to suppose that the Sei whales in our adjacent waters migrate according to the course and season above mentioned. If we had whaling landstation at the south of the Bonin Islands sea area we should get still amaller foetuses.

During the whaling operations in this season, some marking were discharged in the Bonin Islands sea area. The result of this experiments will clarify the course and the season of migration in several years.

The growth curve of Sei whales was shown in Fig. 3, run smooth upwards as far as the tenth month, after that the dots are hardly traceable. So we have prolonged the curve already drawn as in the case of Fin whales. According to this curve, foetuses measuring 13 feet are seven in number while those of 14 feet and of 15 feet number one and two respectively. From this we assume foetuses at delivery measure 14 to 15 feet and that delivery time is at the end of November. Like Fin whales, Sei whales have their pairing period in January, so that the duration of pregnancy is less than 11 months. Our growth curve of Sei whales has three months' breadth.

Sei whales are to be subdivided into totan whales (there are many designs like the surface of galvanized iron plate in abdomer.) and Sei whales proper. Totan whales are larger sized and supposed to belong to a Northern stock while Sei whales are of a Southern stock and mostly captured off the coast of Wakayama Prefecture. The differences of these two kinds of Sei whale have been a subject of many discussions but not yet put to any morphological investigation. Fig. 3 show four dots placed far apart from the main group. These four foetuses are all found in animals captured off Wakayama Prefecture. This will give rise to the question whether the Sei whales in that neighbouring sea are of different species from that of Totan whales or of the same species taking different course in their migration. The problem will be clarified by the further study of the locality of the catch, of the distribtion of body-lengths according to the sea areas and by experiments by marking as well as by morphological investigations.

(C) In order to ascertain the courses of migration of Sperm whales in the adjacent waters of Japan we marked the locality of the catch of each individual whale on a chart, which has led us to suppose that Sperm whales in those waters live in several different groups. So we have made our study of their foetuses according to the four different sea areas, the Bonin Islands, the Kinan, the Sanriku and the Hokkaidō-Pacific sea areas. In other respects, the method of our study is the same as in the case of Fin and Sei whales; we have drew the growth curves of the foetuses of Sprem whales by the average body-length per ten days and that per month.

In Fig. 4 you will find a growth curve of foetuses of Sperm whales in the Kinan sea area though the cruve is imperfect for lack of material. The curves in Fig. 5 shows the growth of the foetuses in the Bonin Islands sea area. The whaling season here lasts only three months, March, April and May, and yet we can clearly discern that foetuses group themselves along the two growth curves. Figs. 6 and 7 show the growth curves of the Sanriku and the Hokkaido-Pacific sea areas respectively, either of which show two groups of foetuses with different tendencies.

Fig. 4

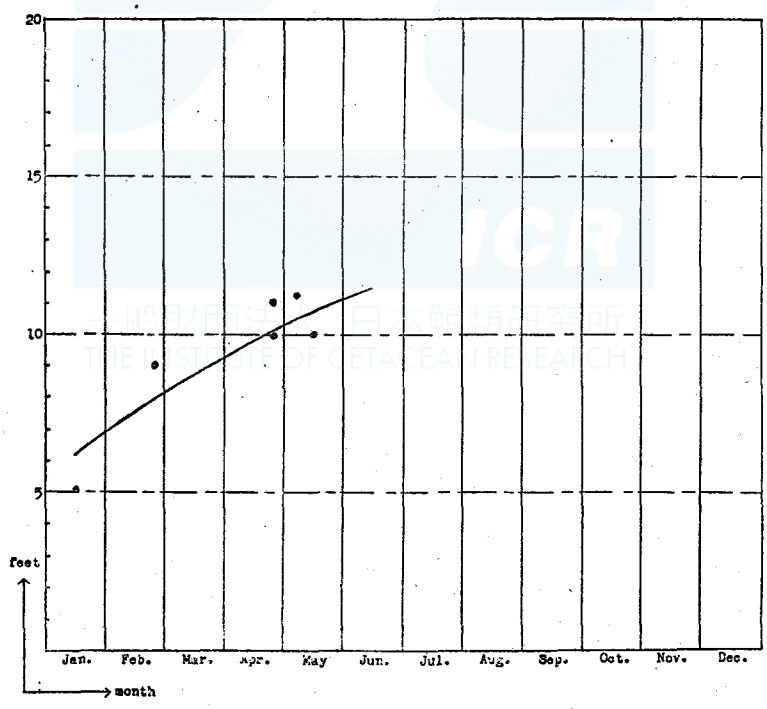


Fig. 5

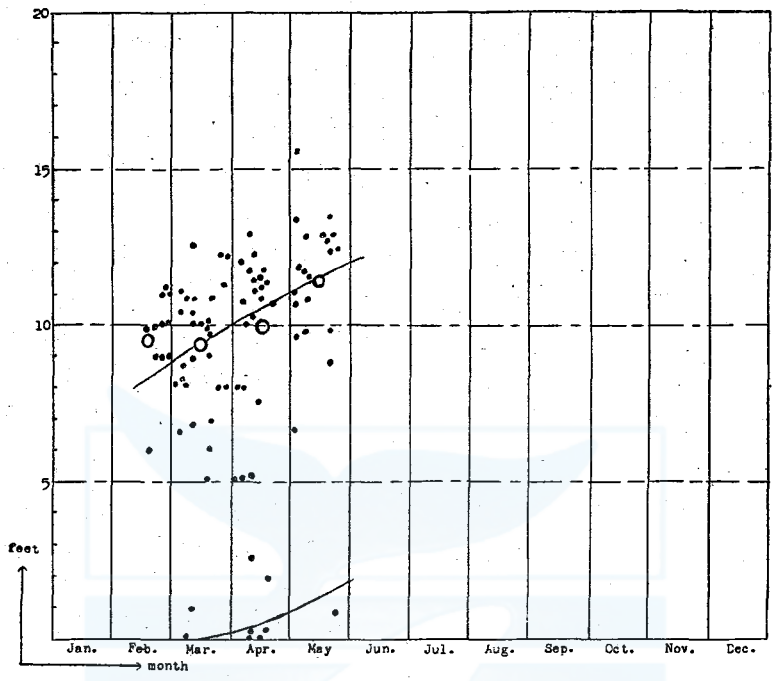

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Fig. 6

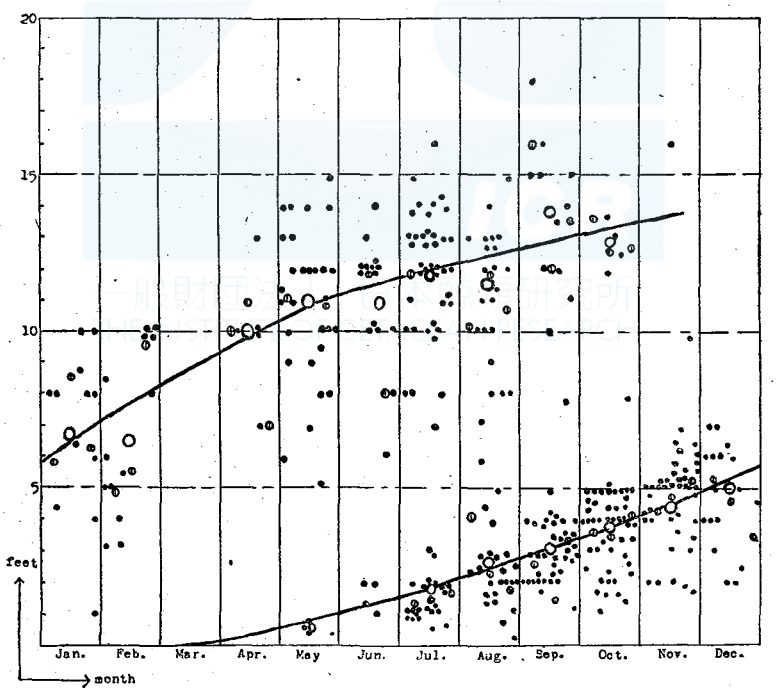
20
15
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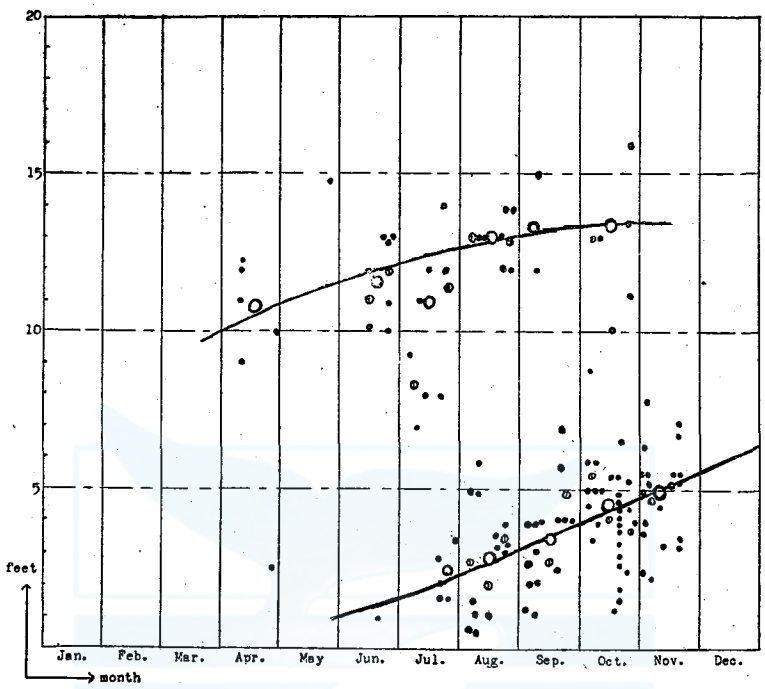
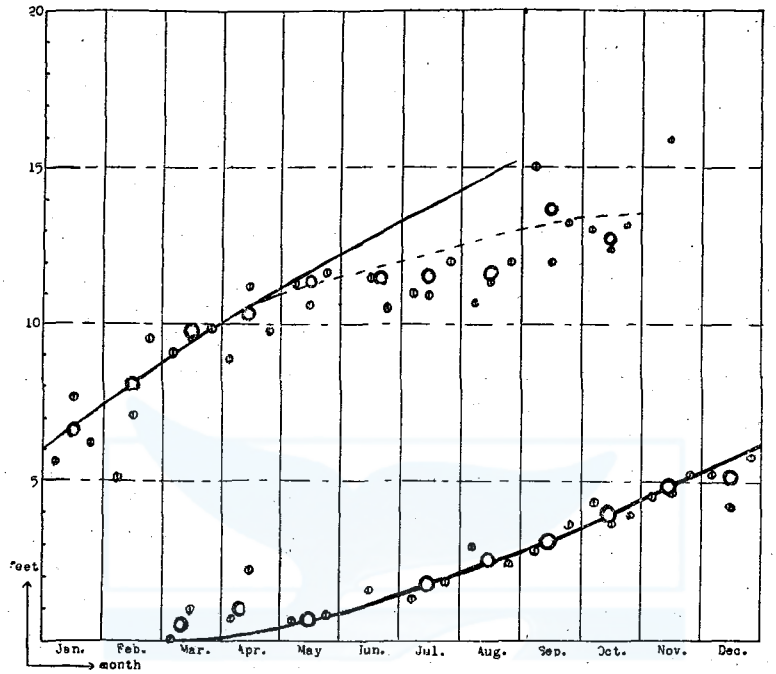
Fig. 7



Comparison of the curves of these four sea areas has proved that there is no variation between the tendencies of each curve. So, upon the combined data of these curves we have formed body-length distribution curves per months. Then tracing the vallegs appearing in the monthly curves, we calssified the foetuses into two groups, upper and lower. We have prepared a growth curve for each group of the foetuses based upon average body-lengths per ten days and per month in the same way as before. When we arrange the curve of the lower group to the left of the curve of the upper one we can complete the growth curve of the foetuses of Sperm whales. (Fig. 8)

According to this curve the pairing period of Sperm whales in our adjacent waters is March. As for the body-length at delivery, Wheeler made a report of a Sperm whale immediately after birth measuring 13.4 feet, captured in the neighbouring waters of Bermuda Island, the Atlantic, in 1933. So did Bennett of the one measuring 14.2 feet in 1840, and reported by Matsuura two measuring 17 feet. Figs 5, 6 and 7, foetuses measuring 13 feet are found in numbers but those of 14 feet are comparatively few while those of 15 feet are rare. From this we assume that the body-length

Fig. 8



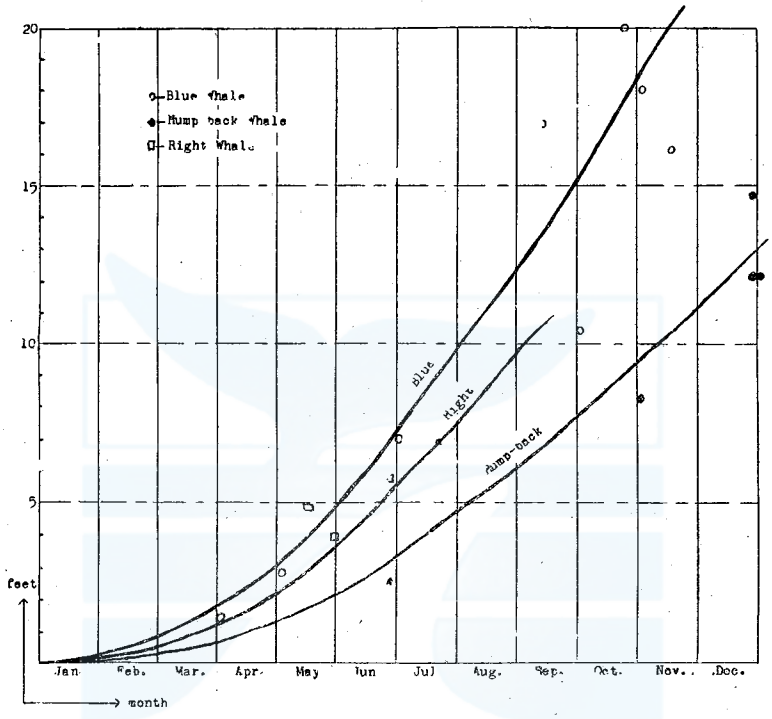
at delivery is 14—15 feet. The growth curve in Fig. 8 shows that the size of 14—15 feet is attained to at August, so that the delivery time of Sperm whales is to be determined as August. However, this growth curve whose composing members are rather homogeneous at first, grows in breadth and at the time of delivery it has the breadth of two months and a half. So the delivery period of Sperm whales may practically be determined as lasting from the end of July to the beginning of October.

If we are to determine the duration of pregnancy of Sperm whales from the delivery period shown on the curve of the foetuses, which is August, it lasts 17 months. The pairing period of Sperm whales differs from that of Baleen whales by two months, and the duration of pregnancy here determined is much longer than theirs, which naturally brings about a different delivery period.

(D) In this present study, we have determined the pairing period, the duration of pregnancy, the delivery period and the body-length at delivery of Fin whales, Sei whales and Sperm whales. Fig. 9 shows the distribution of the foetuses of Right, Blue and Hump-back whales in our material. The growth curves coincide, with six months' variation, with those of Blue and

Hump-back whales in the Antarctic prepared by Mackintosh & Wheeler and Matthews. The pairing period of Baleen whales in the adjacent waters of Japan and perhaps in the North semisphere at large is January.

Fig. 9



In Figs. 10, 11 and 12, you will find the seasonal distribution of foetus' body-length of Fin, Sei and Sperm whales in successive eight years.

Fig. 10

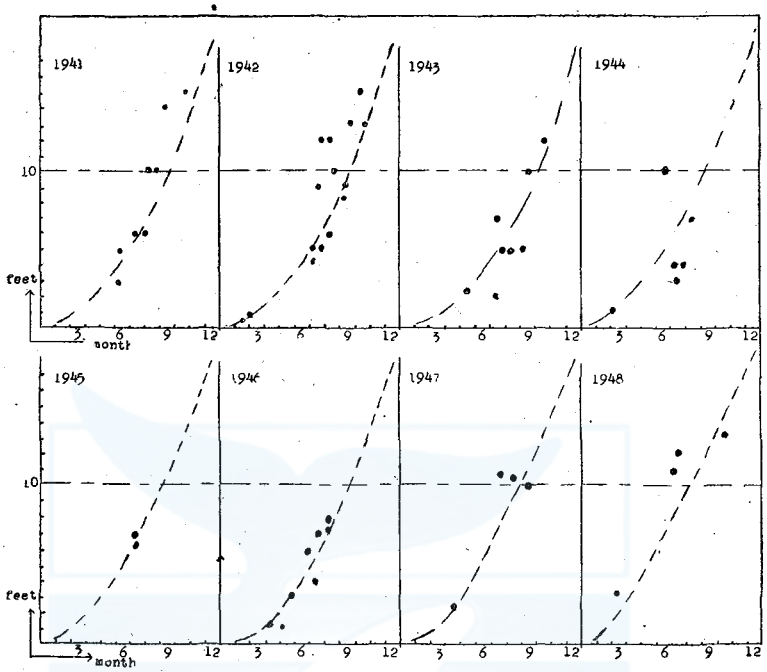

1941
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Fig. 11

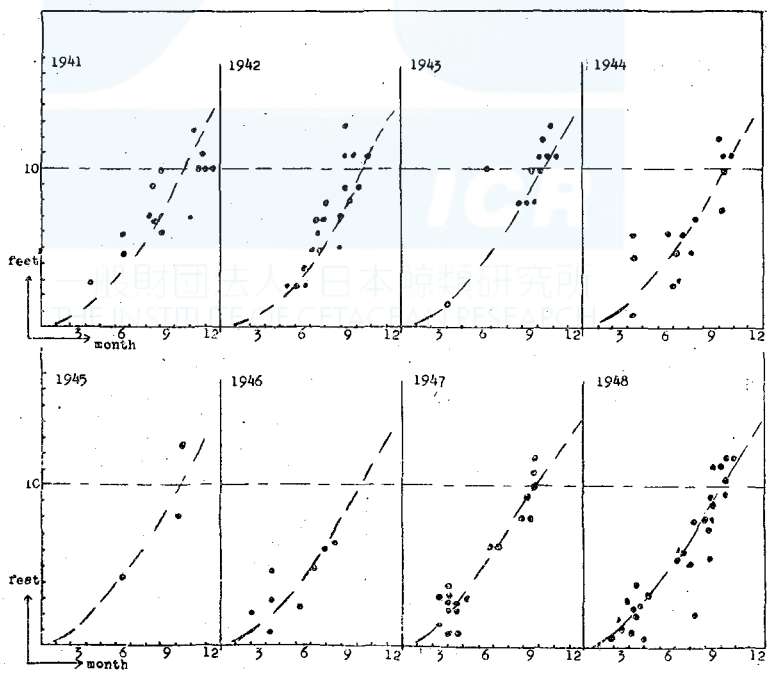
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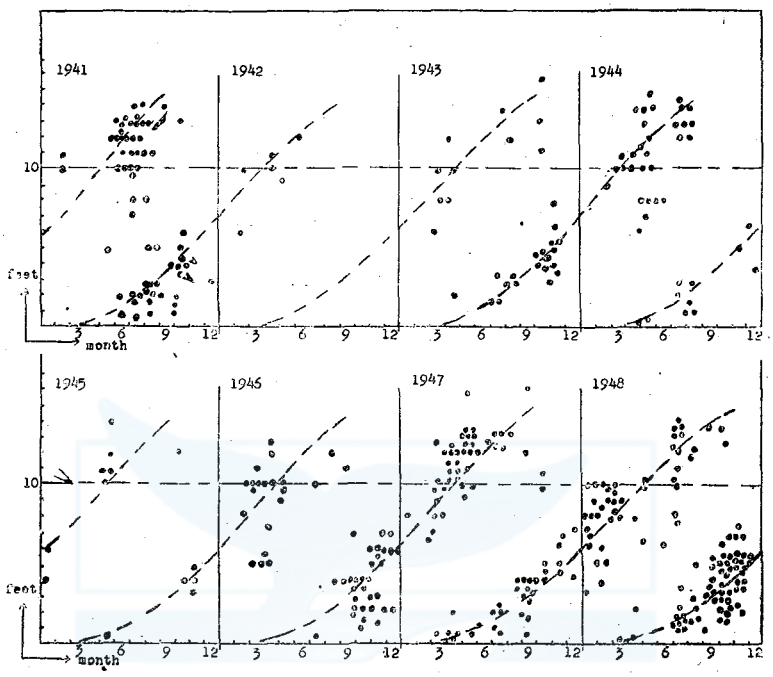
Fig. 12



(Mar. 7, 1949)