Biological Investigation on the Whales Caught by the Japanese Antarctic Whaling Fleets in the 1951–52 Season

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Introduction

In the 1951–52 season, Japan sent her sixth Antarctic whaling expedition since the cessation of the World War II. One of the features of this expedition was that it was the first one that Japan sent as a signatory to the International Whaling Convention. This report presents the summary of the results of that biological investigation on the whales taken by this expedition, of which the authors were in charge as the biologists on board the floating factories.

The expedition comprised three whaling fleets. The Tonan Maru fleet of the Nippon Suisan Co. Ltd. and the Nisshin Maru fleet of the Taiyo Gyogyo Co. Ltd. hunted primarily baleen whales. The Baikal Maru fleet of the Kyokuyo Hogei Co. Ltd. operated exclusively for sperm whales—a new type of operation which had never been attempted in the Antarctic waters. Either of the first two fleets was made up a newly built floating factory and new or newly outfitted catcher boats, and had considerably greater catching and processing capacities than its predecessor in the previous seasons.

All the fleets arrived on the whaling ground in November, 1951: Nisshin Maru on the 15th, Baikal Maru on the 16th, and Tonan Maru on the 23rd. Upon their arrival on the ground, they engaged in the catch of the sperm whales. While the Baikal Maru fleet continued this operation until February 20th, 1952, the other fleets turned to the baleen whaling when the season for baleen whales was opened on January 2nd, 1952. Fig. 1 shows the tracks of these fleets on the whaling grounds.

During the baleen whaling season lasting until March 5th, 1952, the Tonan Maru and the Nisshin Maru fleets hunted for blue and fin whales on the so-called "west Longitudes Ground," the waters bounded by latitudes 66° and 72°S and longitudes 160° and 180°W. According to the weather

and migration of whales, the operations took place either along the pack ice line or in the open waters.

Humpback whales were hunted only by the Tonan Maru fleet, and 37 were caught during the season which lasted from February 2nd to 5th, 1952.

Japanese fleets took a total of 3,826 whales throughout the season (Table 1). The catch of blue whales was very small (231 whales), and the major part of the total catch was accounted for by fin whales. This was probably due to the fact that most of the successful operations were made in the offshore waters in this season.

Table 1. Nos. of catches by species and fleets

	Blue		Fin		Humpback		Total	Sperm	Total
	Nos.	%	Nos.	%	Nos.	%			
Tonan-Maru fleet	115	8.8	1,159	88.4	37	2.8	1,311	362	1,673
Nisshin-Maru fleet	116	7.5	1,438	92.5	—	—	1,554	377	1,931
Baikarl-Maru fleet	—	—	—	—	—	—	—	222	222
Total	231	8.1	2,597	90.6	37	1.3	2,865	961	3,826

All the whales that were treated on board the floating factories were covered by the present investigation. The method of the investigation was the same as used in the preceding seasons. As the area of operation for baleen whales was very limited, no attempt was made to subdivide it in connection with the compilation of biological data of these species; the waters exploited in this season overlap Section III and a small eastern portion of Section II of last season (Ohno and Fujino: 1952).

Acknowledgement

The authors are profoundly indebted to the inspectors and the crew of the three fleets for their unsparing help to the present investigation. Inspectors for the Tonan Maru fleet were Messrs. Haruyuki Sakiura and Ryuzo Ohyama; for the Nisshin Maru fleet, Messrs. Yoshiro Teraoka and Heihachiro Kawamura; for the Baikal Maru fleet, Mr. Yasutake Nozawa.

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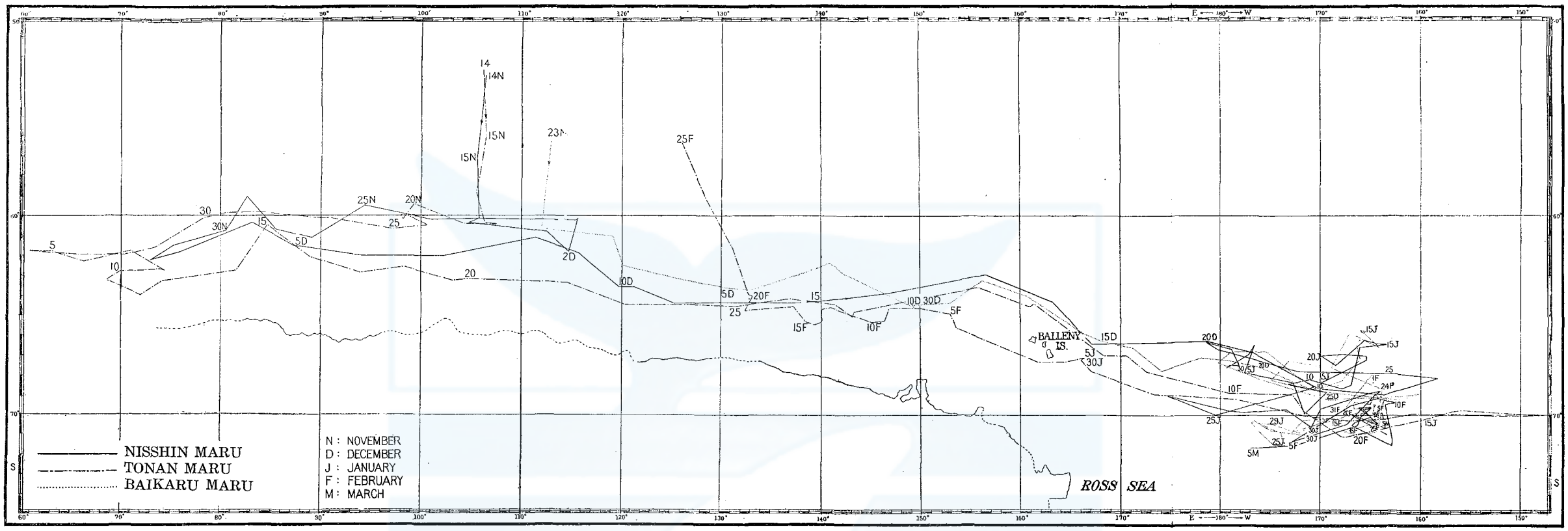
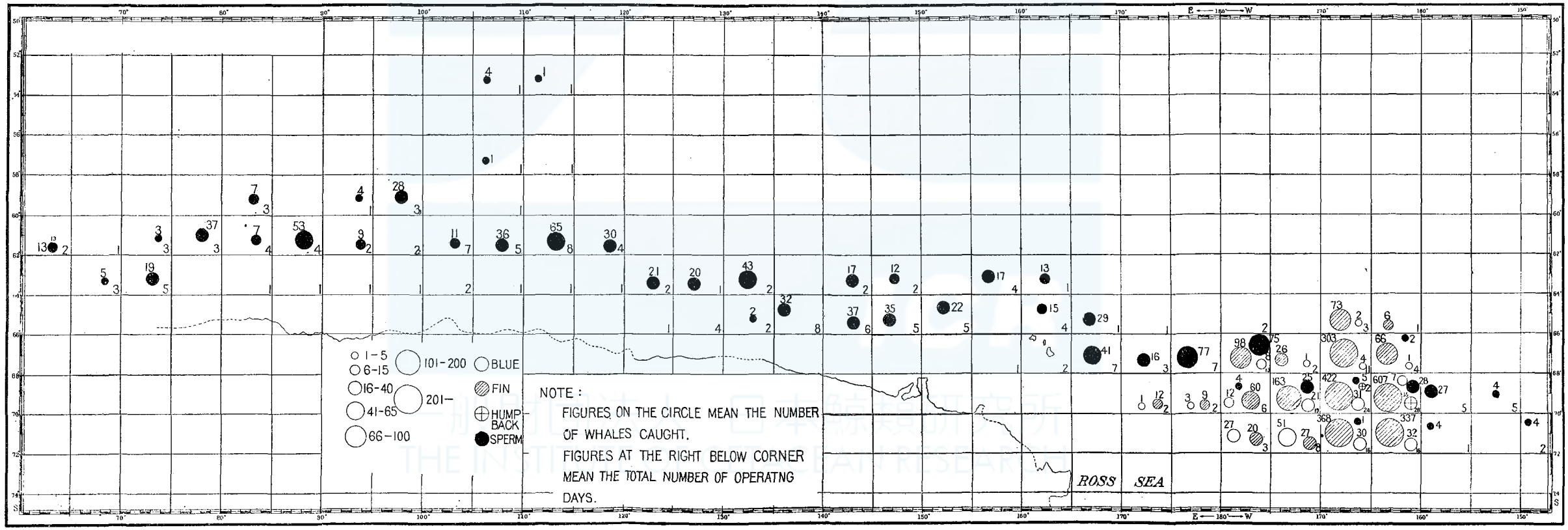

NISSHIN MARU
TONAN MARU
BAIKARU MARU
N : NOVEMBER
D : DECEMBER
J : JANUARY
F : FEBRUARY
M : MARCH
BAILENY IS.
ROSS SEA


1-5
6-15
16-40
41-65
66-100
101-200
201-
BLUE
FIN
HUMP-BACK
SPERM
NOTE :
FIGURES ON THE CIRCLE MEAN THE NUMBER OF WHALES CAUGHT.
FIGURES AT THE RIGHT BELOW CORNER MEAN THE TOTAL NUMBER OF OPERATNG DAYS.
ROSS SEA

Chapter I

Composition of the Catch

1. Composition by Species.

In Table 2 is given the break-down into species of the catches by the Japanese Antarctic whaling expeditions in post war seasons. The table clearly indicates the sharp decrease of the blue whale catch and a rapid increase of the fin whale catch in recent two seasons. In 1950–51 the ratio of blue whale to fin whale recorded the first remarkable fall down to 11.6/88.4, and the ratio further dropped this season to a low of 8.2/91.8. In the whole Antarctic catch, ratio was rather sustained until last season (28.5/71.5 in 1950–51), but dropped markedly this season (20/80). The above ratio for the Japanese catch in 1951–52 is considerably lower than that for the whole catch in Area V (the Ross Sea Area) in the same season, 24.2/76.8. This is probably due to the fact that the Japanese fleets operated chiefly in the open waters this season.

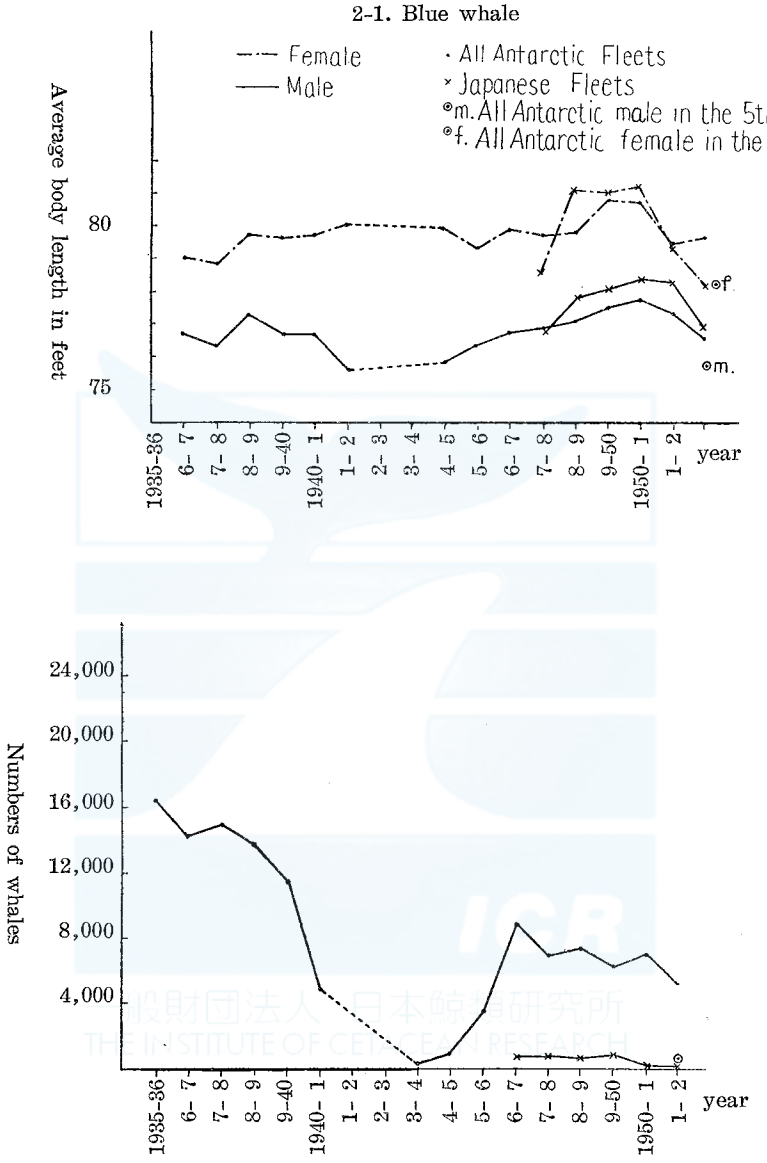
Table 2. Nos. of catch by species and years

	Blue		Fin		Hump.		Total	Sperm	Total
	Nos.	%	Nos.	%	Nos.	%			
1946—47	690	59.2	474	40.6	0	0	1,164	1	1,165
1947—48	710	53.9	608	46.1	0	0	1,318	2	1,320
1948—49	631	38.4	1,012	61.6	0	0	1,643	0	1,643
1949—50	817	42.2	1,056	54.4	67	3.4	1,940	172	2,112
1950—51	271	11.6	2,050	88.0	9	0.4	2,330	409	2,739
1951—52	231	8.1	2,597	90.6	37	1.3	2,865	961	3,826

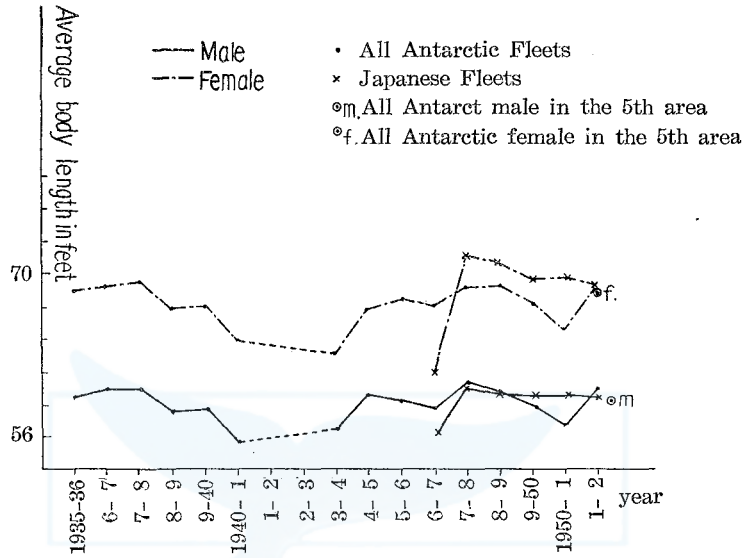
Humpback whales were hunted only by the Tonan Maru fleet this season, but the catch was greater than in last season.

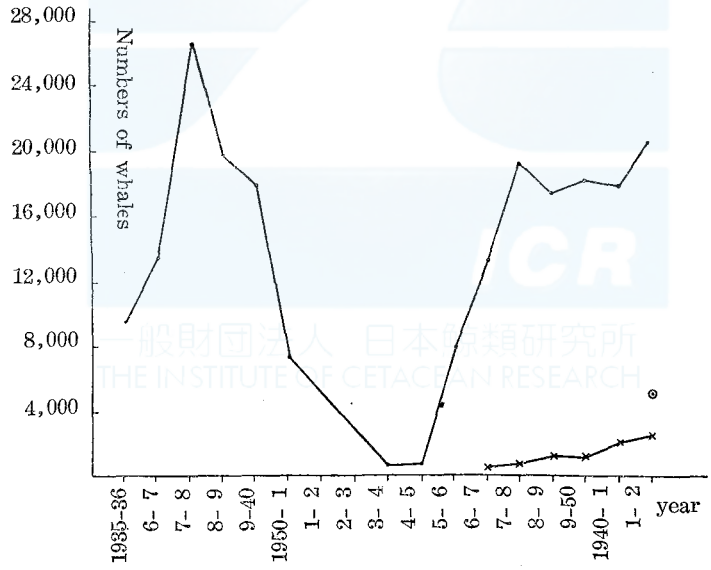
The catch of sperm whales was more than double that of the last season, owing to longer operation period and reinforced catching capacity. In recent seasons sperm whales have been caught in increasing numbers in the whole Antarctic waters.

Fig. 2. Yearly variation of numbers of whales and the average body length.

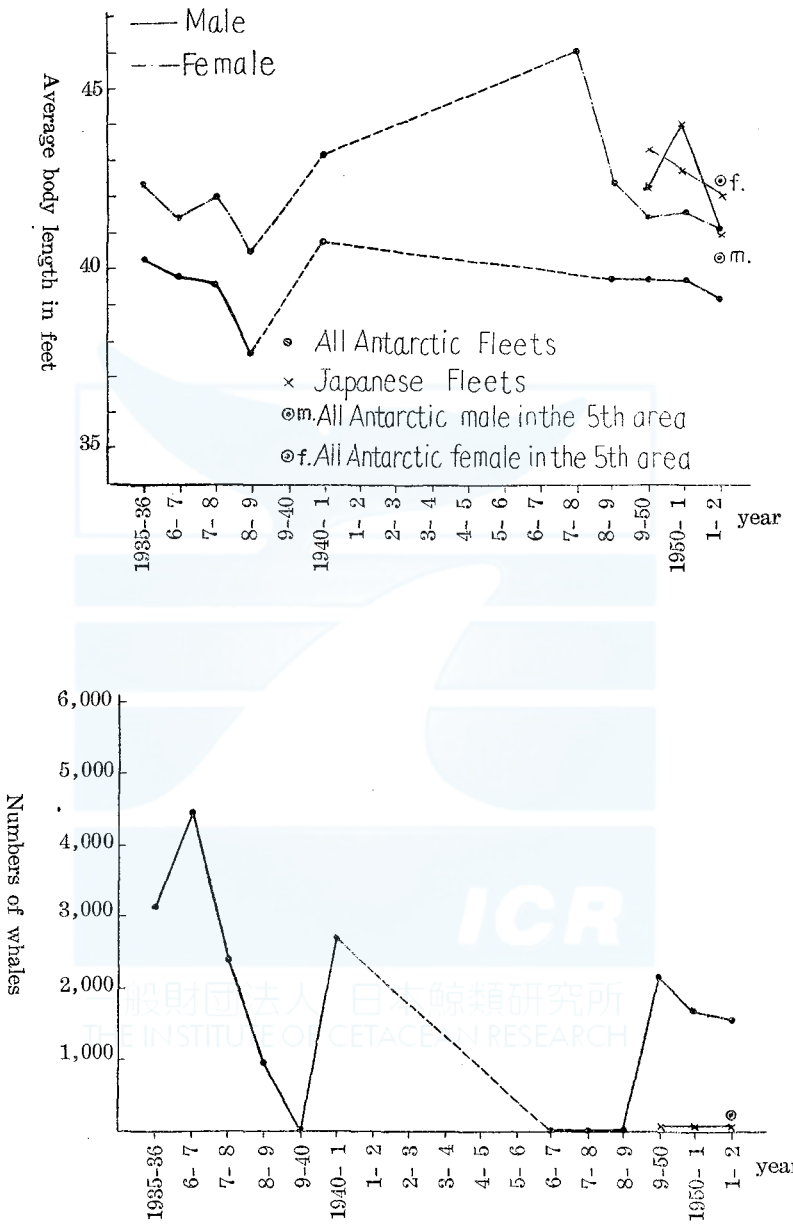


2-2. Fin whale

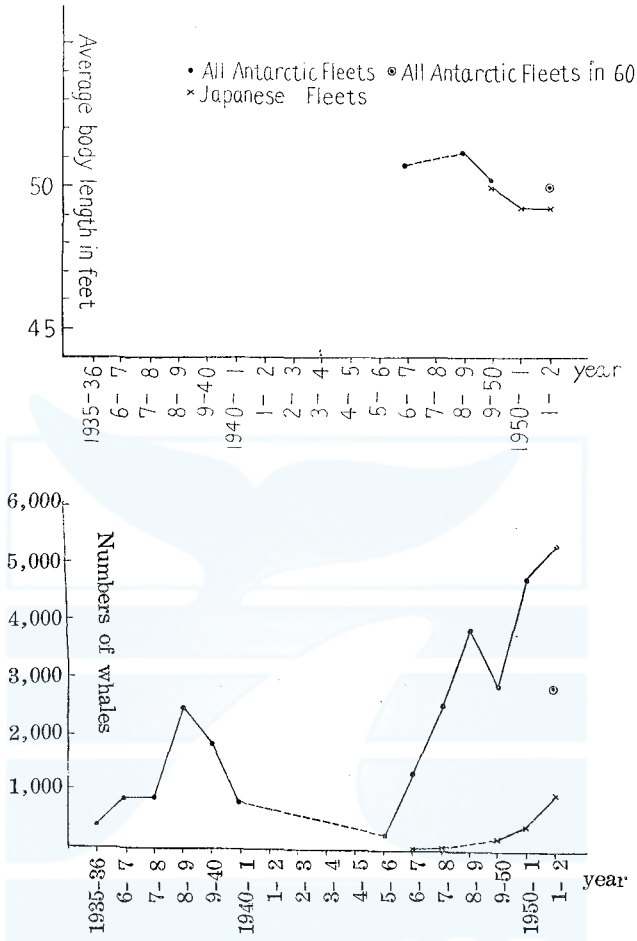




2-3. Humpback Whale



2-4. Sperm Whale



2. Sex Ratio.

This season's catches of blue, fin and humpback whales contained greater percentages of males than those of the last season (Fig. 3) or their parts made in Section III. (Table 3 and 4). This ground almost coincides with the waters exploited in the present season (Ohno and Fujino: 1952).

Catch statistics for preceding seasons indicate that the sex ratio was more changeable in Japanese catch than in the whole Antarctic catch. In 1951-52, Japanese blue and fin whale catch contained relatively more males than the whole Antarctic catch but as to humpback whales a lower percantage of males was associated with Japanese catch. (Fig. 3)

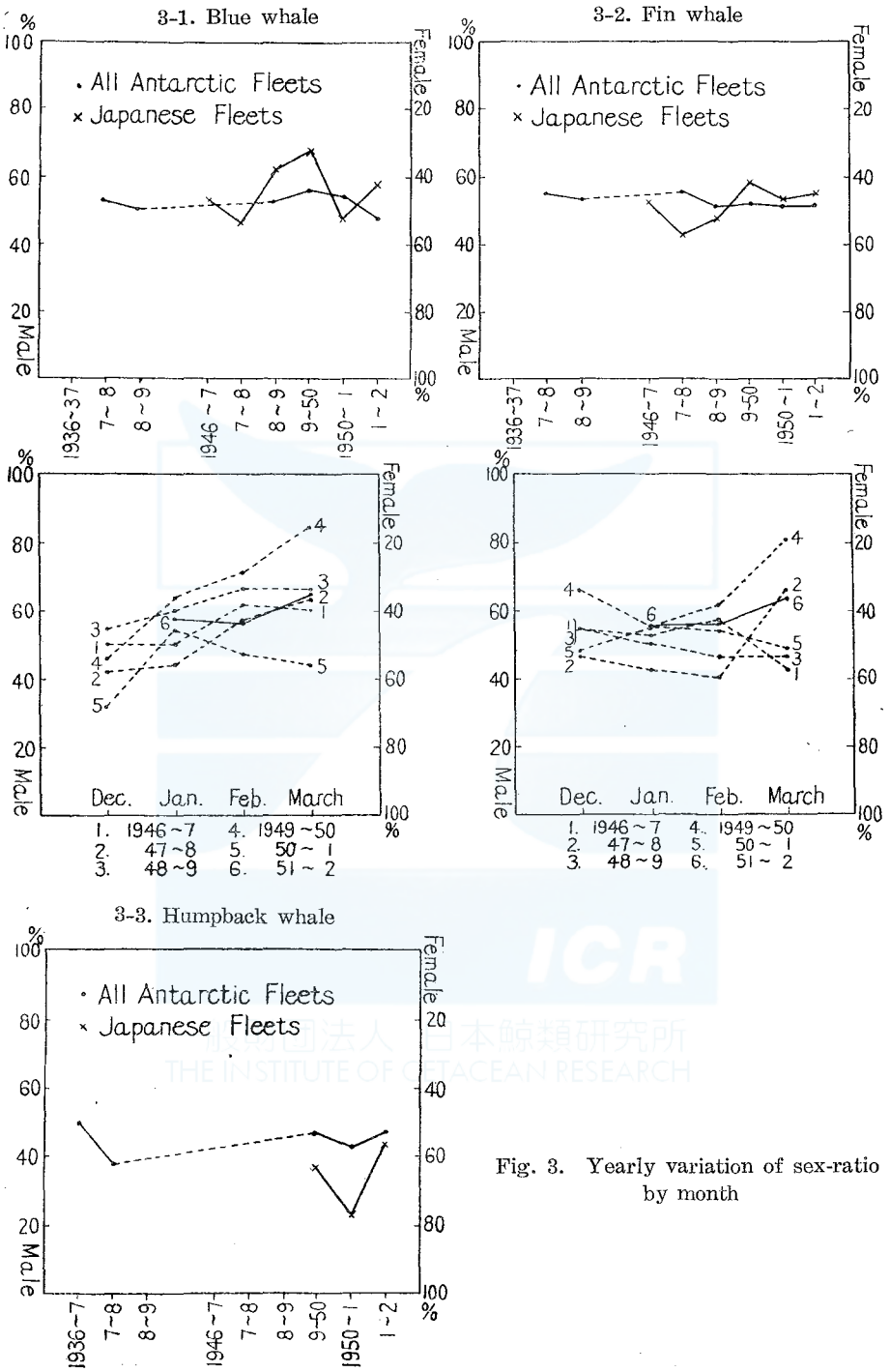


Fig. 3. Yearly variation of sex-ratio by month

Table 3. Nos. of catches and the sex ratio, monthly

		Male	Female	Total
Blue.	Jan.	76 (57.6)	56 (42.4)	132
	Feb.	46 (56.1)	36 (43.9)	82
	March	11 (64.7)	6 (35.3)	17
	Total	133 (57.6)	98 (42.4)	231
Fin.	Jan.	581 (54.8)	479 (45.2)	1,060
	Feb.	760 (55.5)	610 (44.5)	1,370
	March	106 (63.5)	61 (36.5)	167
	Total	1,447 (55.7)	1,150 (44.3)	2,597
Hump.	Feb.	16 (43.2)	21 (56.8)	37
Sperm	Nov.	220		220
	Dec.	600		600
	Jan.	45		45
	Feb.	96		96
	Total	961		961

Table 4. Nos. of catch and its sex ratio on the baleen whale in the 1950-51 season. (Ohno and Fujino, 1952)

	Male	Female	Total
Blue.	94 (51.9)	87 (48.1)	181
Fin.	580 (53.9)	496 (46.1)	1,076
Hump.	2 (22.2)	7 (77.8)	9

In every post-war seasons (except 1950–51), the proportion of males in Japanese blue whale catch remained almost unchanged during January and February and increased in March. In 1951–52, sex ratios followed this trend in both blue and fin whale catches (Table 3 and Fig. 3). The change of the sex ratio in the fin whale catch had not been so regular in past seasons as in the blue whale catch.

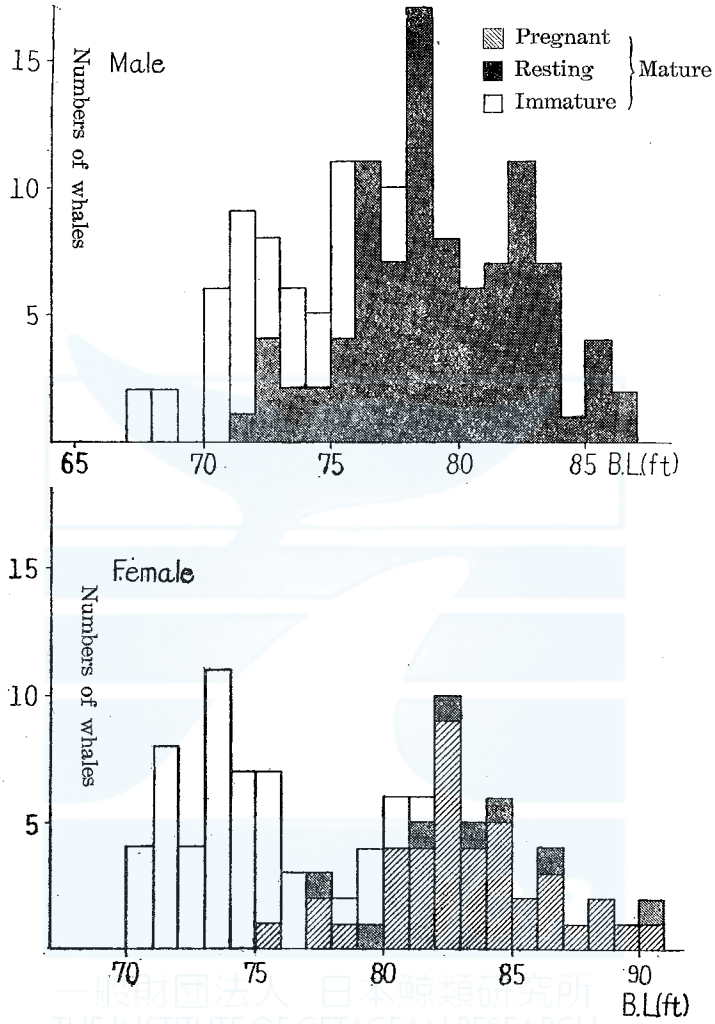
3. Size Composition

Figs. 4–1 to 4 show the length distribution of this season's catch by species and sexes, and Figs. 5–1 to 3 illustrate the percentage length distributions of the blue, fin and sperm whale catches in different months of this season. Percentage length distributions of the sperm whales caught in different whaling grounds are shown in Fig. 7.

Length compositions of the blue whales taken in this season and in last season hardly differ in either sexes, especially within the waters

Fig. 4. Composition of body length.

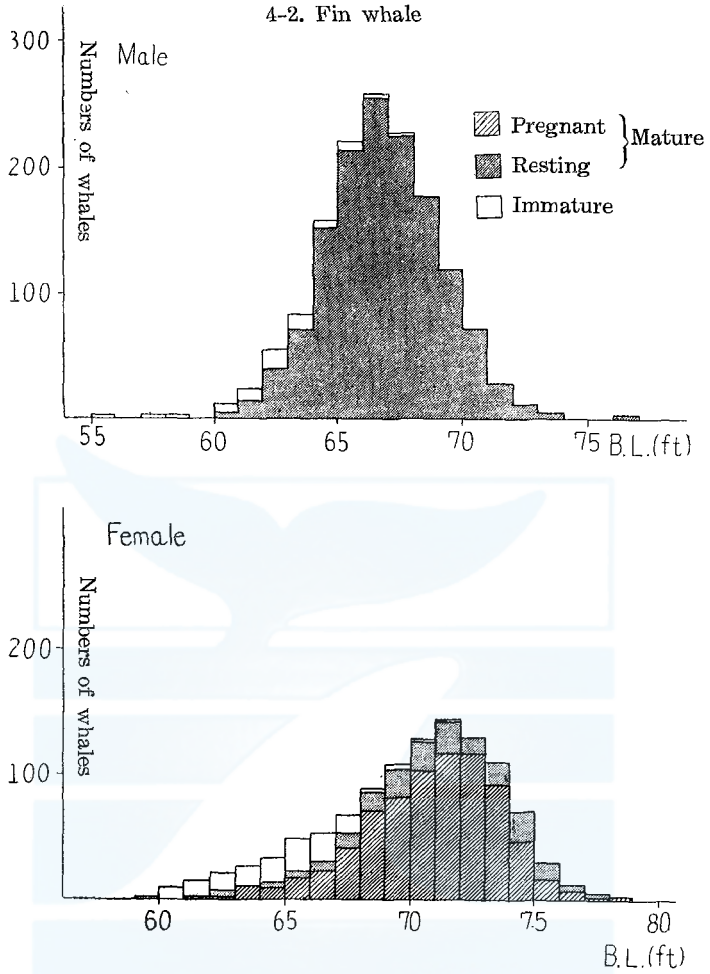
4-1. Blue whale



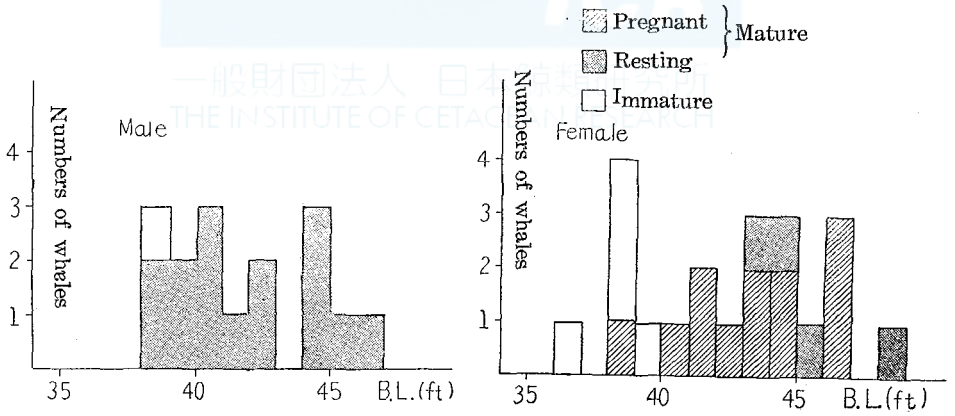
exploited during this season, as is clear from the comparison of Fig. 4–1. with Ohno & Fujino's Fig. 1 (1952). But the average length of this season's catch is smaller than that of last season's by 1.4 ft. and 1.1 ft. respectively in males and females. Compared with the catch in the season prior to 1950–51, this season's catch contained considerably more immature females.

In either sex of fin whales, the length composition of the catch was almost the same in this and last season.

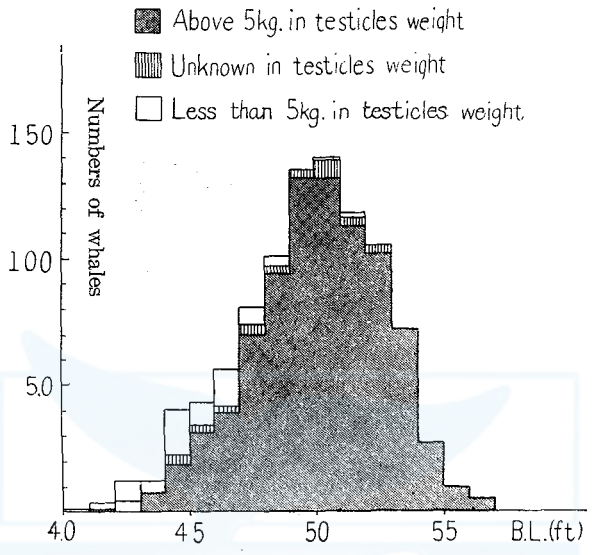
4-2. Fin whale



4-3. Humpback whale



4-4. Sperm whale



The catch of humpbacks has been too small to warrent the comparison of the length compositions of different season.

In sperm whales, there is fairly good agreement in length composition among the catches in post-war season, but there are indications that larger whales were caught in greater numbers in this season than in last season.

Average length of captured female blue whales increased steadily with the progress of the season (77.4 ft., 79.0 ft. and 80.5 ft. respectively for January, February and March), reflecting the increase in the proportion of larger females, while that of the males remained almost unchanged all through the season (76.9 ft. for January and February, and 76.7 ft. for March) (Table 5).

Length composition of the captured fin whales was almost the same in January and in February in either sex, but there occurred a slight increase in the proportion of smaller individuals in March (Fig. 5. 2 and Table 6). The average length, however, diminished gradually with the progress of the season.

Average length of the captured sperm whales varied considerably with months, partly due to the constant shift of the whaling ground for this species. The maximum was recorded in December, and the minimum in November and February (Table 8 and Fig. 5-3)

Table 5. The composition of catch on blue whale monthly

		Male			Female				Av. body length (feet)			Rate of mature			Rate of pregnancy
		Imm.	Mat.	Total	Imm.	Pre.	Rest.	Total	Male	Female	Total	Male	Female	Total	
1951-52 season	January	22	54	76	31	20	5	56	76.9	77.4	77.2	71.0	44.6	59.8	80.0
	February	12	34	46	17	17	2	36	76.9	79.0	77.8	73.9	52.8	64.6	89.5
	March	4	7	11	2	3	1	6	76.7	80.5	78.1	63.6	66.7	64.7	75.0
	Total	38	95	133	50	40	8	98	76.9	78.2	77.5	71.4	49.0	61.5	83.3
1950-51 season	III area	11	83	94	34	24	29	87	78.5	80.2	79.3	88.3	60.9	75.1	45.3
	whole area	17	112	129	62	38	42	142	78.3	79.3	78.9	86.8	56.3	70.8	47.5

Table 6. The composition of catch on fin whale by the decade of month

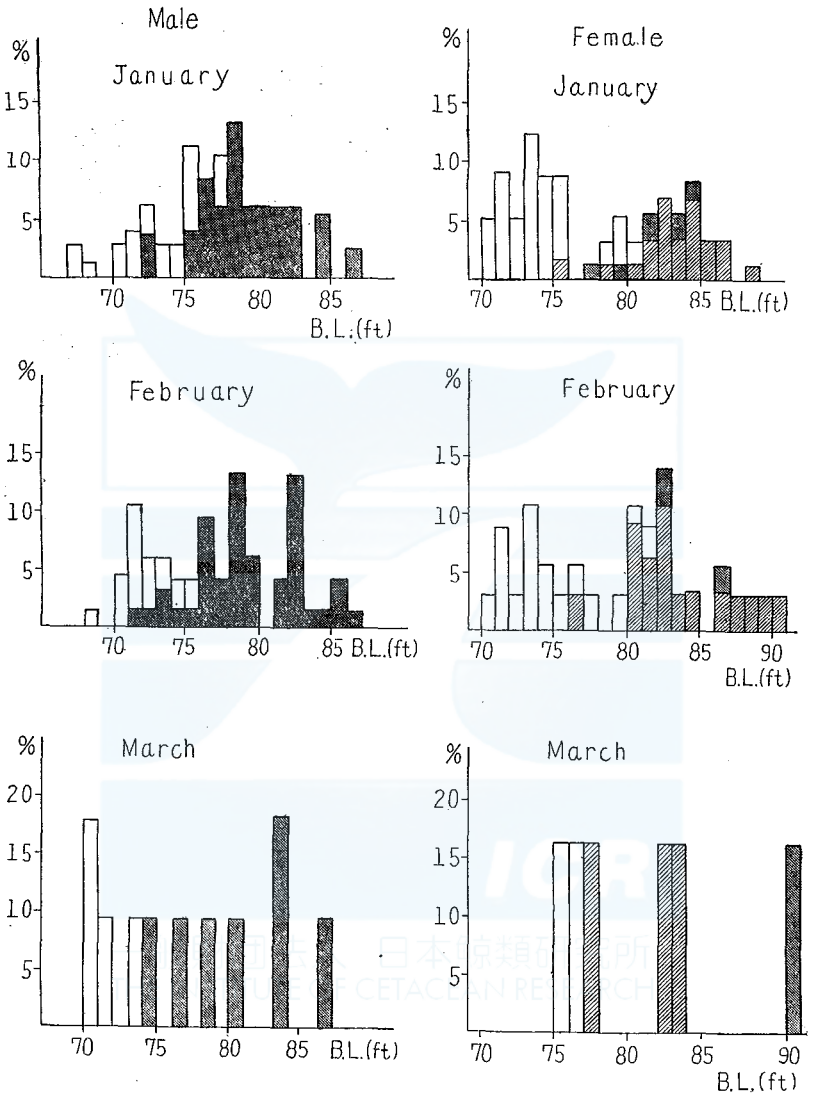
			Male				Female					Av. body length(feet)			Rate of mature			Rate of pregnancy
			Imm.	Mat.	uk.	Total	Imm.	Pre.	Rest.	uk.	Total	Male	Female	Total	Male	Female	Total	
1951-52 season	Jan.	1	9	130	1	140	18	117	18	1	154	66.4	69.9	68.2	93.5	88.2	90.8	87.4
		2	8	225	2	235	23	97	33	—	153	66.7	70.1	68.1	96.6	85.0	92.0	73.8
		3	10	195	1	206	19	125	28	—	172	66.4	69.9	68.0	95.1	89.0	92.3	81.7
		Total	27	550	4	581	60	339	79	1	479	66.5	70.0	68.1	95.3	87.4	91.8	81.1
	Feb.	1	13	213	2	228	30	133	34	1	198	65.9	69.6	67.6	94.2	84.8	89.8	78.7
		2	9	273	—	282	40	170	49	3	262	66.3	69.5	67.9	96.8	84.6	90.9	78.1
		3	12	238	—	250	36	89	25	—	150	65.6	68.7	66.8	95.2	76.0	88.0	77.2
		Total	34	724	2	760	106	392	108	4	610	66.0	69.3	68.3	95.5	82.5	89.7	78.4
	March		4	100	2	106	12	31	17	1	61	66.1	69.1	67.4	96.2	80.0	90.2	64.6
	Total		65	1,374	8	1,447	178	762	204	6	1,150	66.2	69.6	67.7	95.5	84.4	90.6	78.9
1950-51 season	III area		33	547	—	580	65	269	161	1	496	66.3	69.9	68.0	94.3	86.9	90.9	62.6
	whol areae		123	974	—	1,097	164	529	259	1	953	66.1	69.6	67.7	88.8	82.8	86.0	66.7

Table 7. The composition of catch on humpback whale

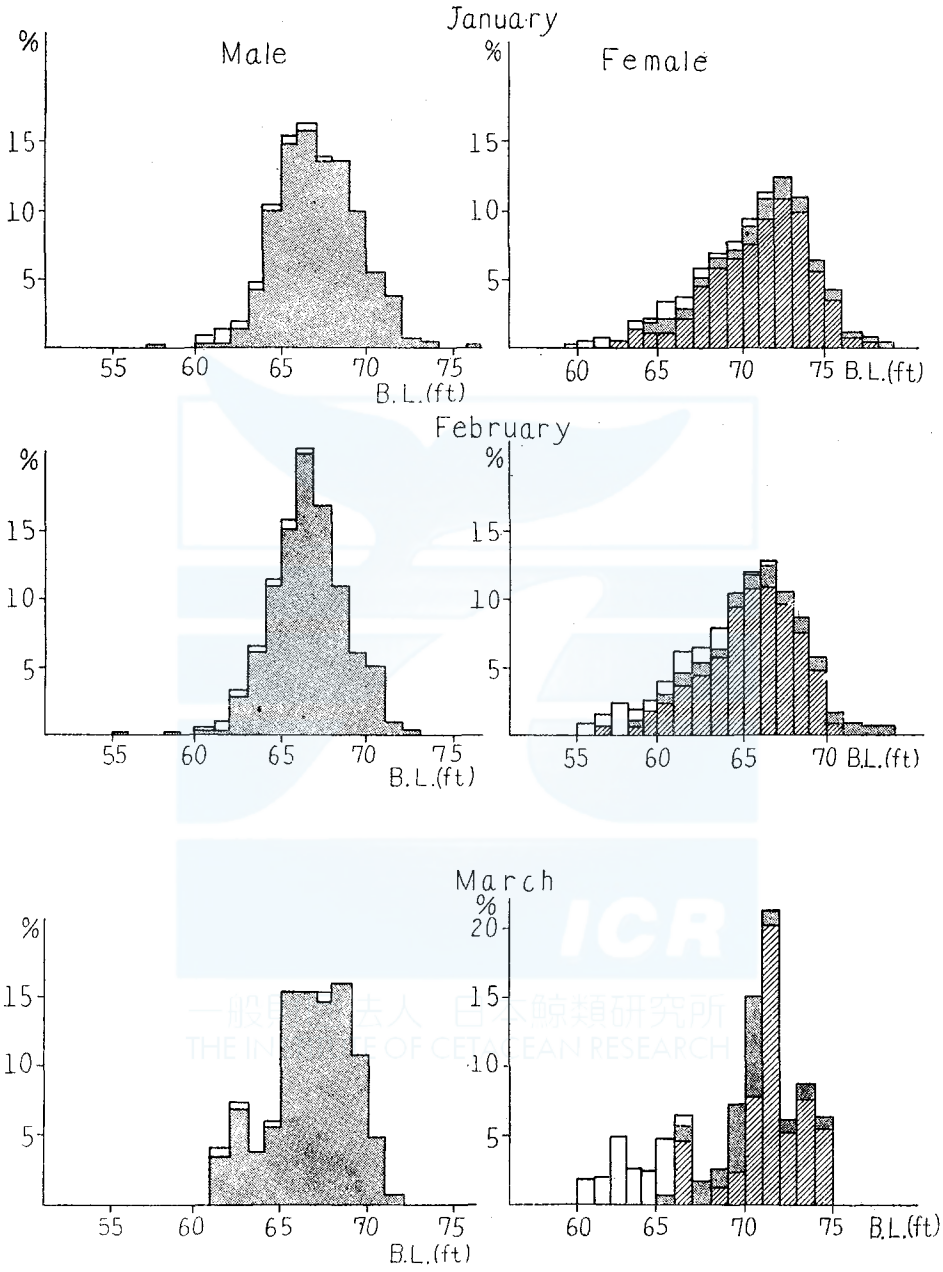
		Male			Female				Av. body length (feet)			Rate of mature			Rate of pregnancy
		Imm.	Mat.	Total	Imm.	Pre.	Rest.	Total	Male	Female	Total	Male	Female	Total	
1951-52	February	1	15	16	5	12	4	21	41.3	42.0	41.7	93.8	76.2	83.8	75.0
	1950-51 season	0	2	2	1	5	1	7	44.0	42.7	43.0	100.0	85.7	88.9	83.3

Fig. 5. Composition of body length by season.

5-1. Blue whale



5-2. Fin whale


January
Male
Female
February
March
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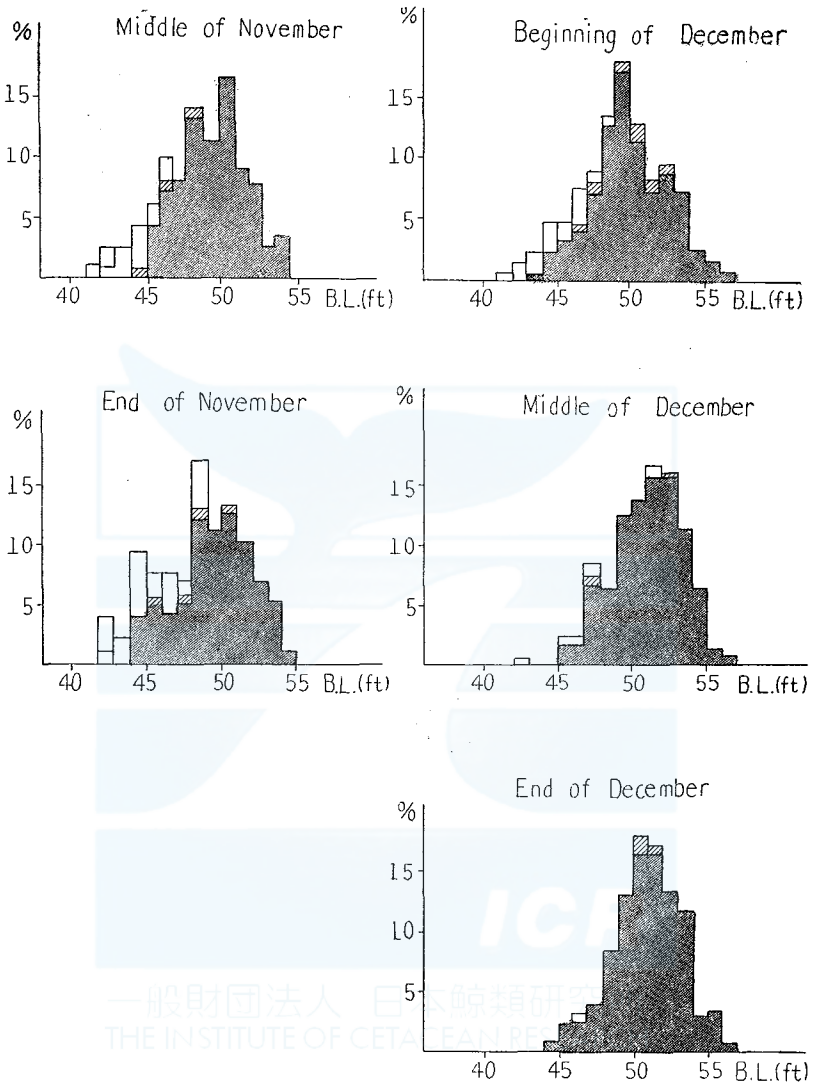
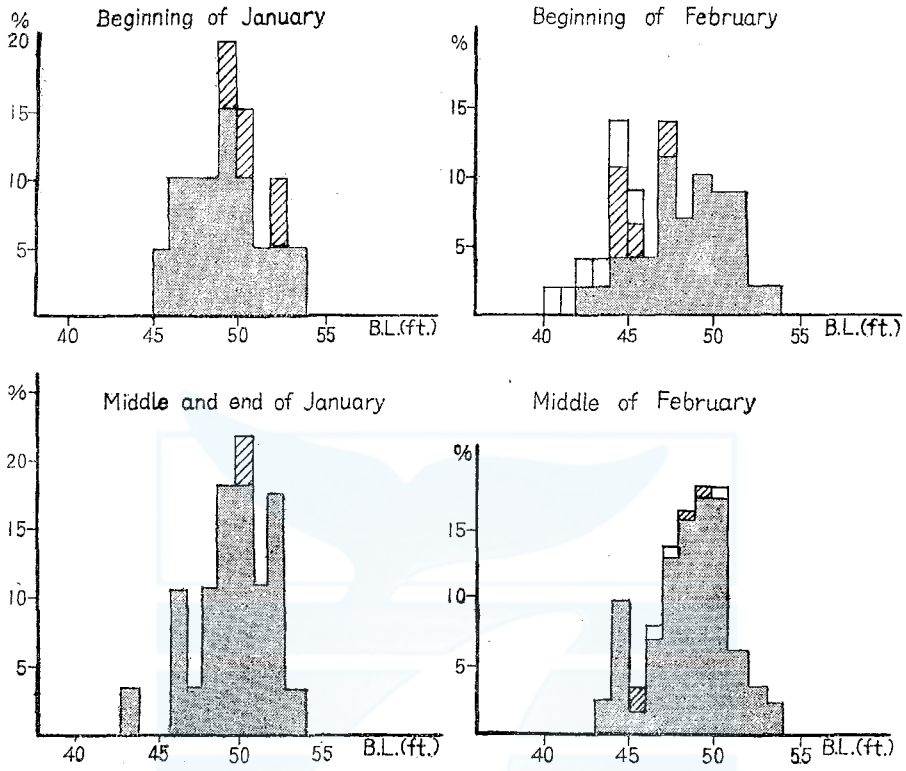
55
60
65
70
75
5
10
15
20

5-3. Sperm whale

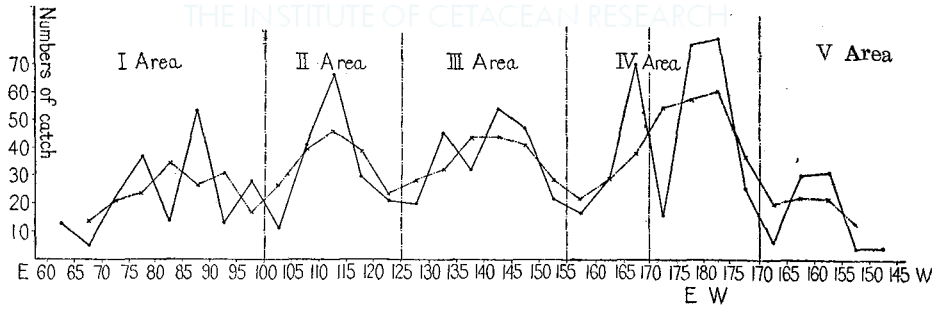


5-4. Sperm whale (Continued)



As sperm whales were hunted over a wide area from 60°E eastward to 145°W, it seems appropriate to analyse their catch in realtion to geographic positions. In Fig. 6 the catches made in each 50 (longitude) sector are plotted against the longitude. It is clear from this graph that there were five major grounds. Accordingly, the entire area is divided longitudinally into the following five parts, so that each part may include one major ground.

Fig. 6. Catch by area (Sperm whale)



Region			Longitude		Period of operation
I	From	60°E	eastward to	100°E	Late November through early December
II	〃	100°E	〃	125°E	Middle November through early December
III	〃	125°E	〃	155°E	Early and late December, and February
IV-1	〃	155°E	〃	170°E	Middle December and early January
IV-2	〃	170°E	〃	170°W	Late December and early January
V	〃	170°W	〃	145°W	Late Decomber and middle January

The percentage distribution and the average length of the catch made in each of these regions are respectively shown in Fig. 7 and Table 8. Fig. 7 shows that the proportion of large whales increases and that of young whales with the testes weight less than 5 kg. decreases with the shift of the whaling ground from the west to the east. In the easternmost region V no such young whales were caught. Another remarkable feature is that within one region the average size of the sperm whales considerably varies with months: in Region II, the whales caught in late November, which are represented by the minor mode around 44 ft. in the length distribution (Fig. 7), were much smaller than those taken in other period; in Region III, small whales predominated in the catch in February as compared with December (Table 8); in Regions IV and V the average length of the catch was smaller in January than in December. It is suggested by these examples that the whales taken at different places and time did not come from a single population of sperm whales with uniform biological properties. This point will be touched upon in another part of this report.

In the following paragraphs the average lengths of the baleen whales caught by Japanese fleets in this season are compared with those for the whale Antarctic pelagic catch of this season, and with those for the catch

Table 8. Sperm whale, nos, and the av. body length by the area and monthly (Japanese fleets)

	I	II	III	IV		V	mean		
				1	2			I	60～100°E
								II	100～125°E
Nov.	47.8(99)	48.5(121)					48.2(220)	III	125～155°E
Dec.	48.5(86)	49.1(48)	49.4(117) 49.7(7)	50.7(100)	50.4(192)	50.9(50)	49.9(600)	IV_1	155～170°E
Jan.				48.9(18)	50.0(2)	49.2(25)	49.2(45)	IV_2	170°E～170°W
Feb.			37.4(96)				47.4(96)	V	170～145°W
Total	48.1(185)	48.7(169)	48.6(220)	50.4(118) 50.4(312)	50.4(194)	50.3(75)	49.2(961)	( ) : nos.	

Fig. 7. Compositiion of body length by area.

Sperm whale

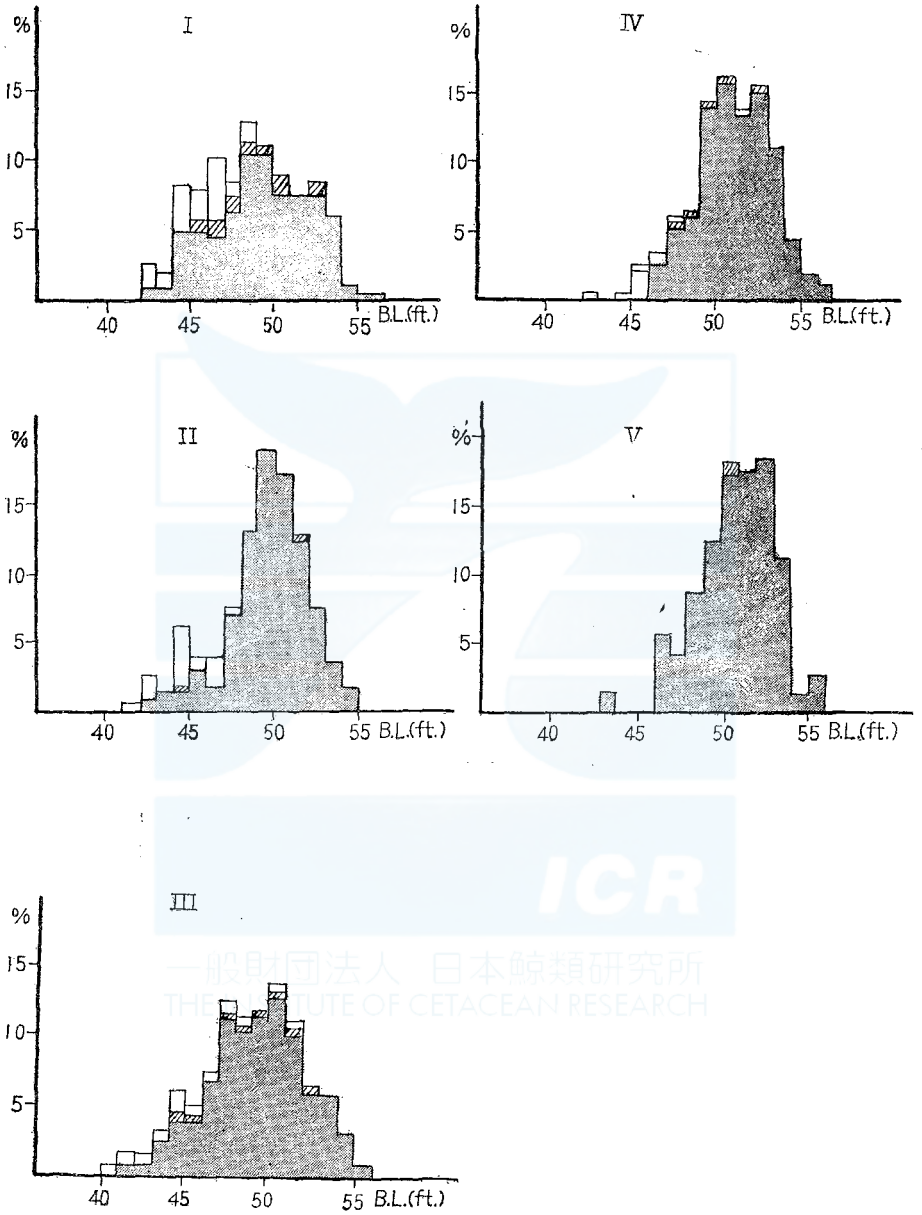


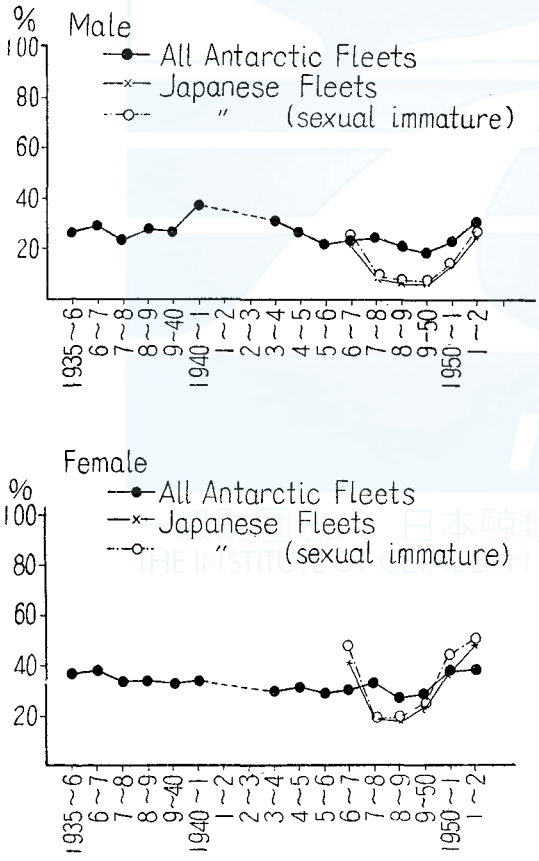
Table 9. Nos. of the observed whale and the av. body length in the V area and whole the Antarctic

	V Area						Whole Antarctic					
	Male		Female		Total		Male		Female		Total	
	Av. bl.	Nos.	Av. bl.	Nos.	Av. bl.	Nos.	Av. bl.	Nos.	Av. bl.	Nos.	Av. bl.	Nos.
Blue	75.7	825	78.2	792	76.9	1,617	76.5	2,367	79.6	2,542	78.1	4,909
Fin	66.2	2,584	69.5	2,488	67.8	5,072	66.4	9,579	69.6	8,601	68.0	18,380
Hump.	40.3	67	42.4	116	41.6	183	39.2	634	41.1	723	40.2	1,357
Sperm	55.3	1,296			50.3	1,296	49.9	5,187			49.9	5,187
Sperm	49.7	2,854			49.7	2,854						

1) 60°E~140W

Eig. 8. Rate of immature (classified by body length)

8-1. Blue whale



in Area V, where the Japanese operations took place.

Average length of the male blue whales taken by Japanese fleets exceeded the averages for the Antarctic pelagic catch and the catch in Area V by 0.4 ft. and 1.2 ft. respectively. As for female blue whales, the average length of the Japanese catch was exceeded by that of the Antarctic pelagic catch by 1.4 ft., and was the same with the average for the Area V catch.

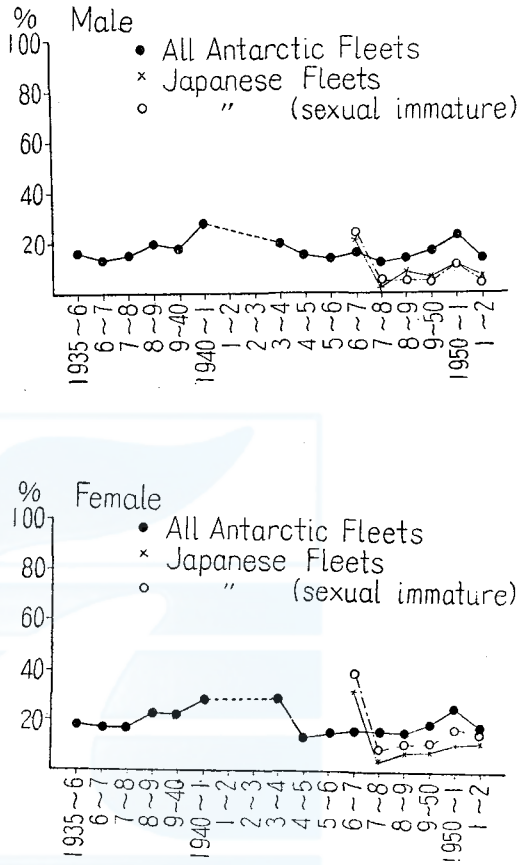
The average length of either sex of fin whales hardly differs in three kinds of the catch.

The catch of humpbacks was too small to justify any precise comparison. A tentative conclusion based on the available data is that the males caught by Japanese fleets were larger than those taken by the whole Antarctic pelagic operations and in Area V by about 2 and 1 ft.

in average respectively, and the females caught by Japanese fleets were, in average, about 1 ft. larger than those taken by the whole Antarctic pelagic whaling and a little smaller than those caught in Area V.

Average length of the sperm whales caught by the Japanese fleets in this season was 0.7 ft. smaller than the average of the Antarctic pelagic catch of the same season, and 0.5 ft. smaller than the average for the total catch in the waters 60°E eastward to 140°W, where the Japanese operations took place.

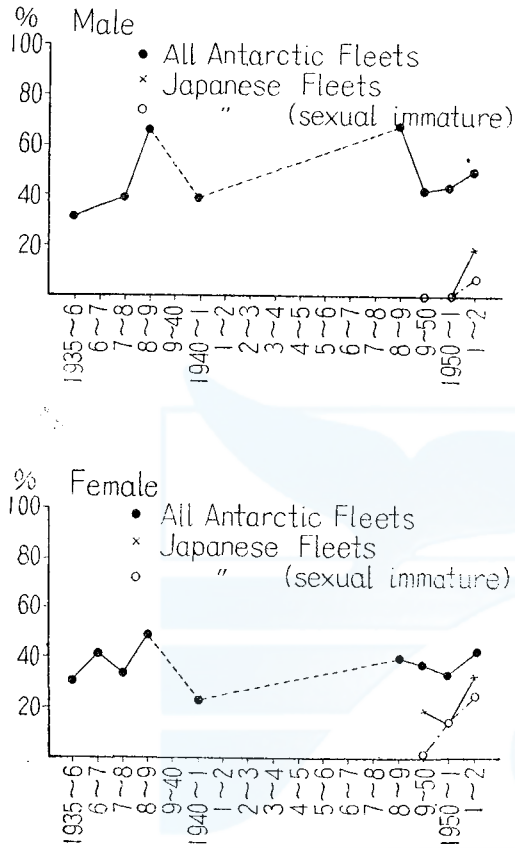
8-2. Fin whale



4. Immature Whales

According to Mackintosh & Wheeler's classification based on the body length, the percentage of sexually immature whales was calculated for the total Antarctic pelagic catches in seasons 1935/36 to 1951/52 and for the catches by the Japanese fleets in seasons 1946/47 to 1951/52, and illustrated in Fig. 8-1 to 3 respectively for blue, fin and humpback whales. As the data are available on the classification of the Japanese catches based on the examination of genital organs, these are also plotted in these graphs so as to be compared with the result of the former classification. In the latter method, females of any species lacking a corpus luteum on ovaries, and males of the blue, fin and humpback whales with a pair of testes weighing less than 10, 5, and 2 kg. respectively are considered sexually immature. The results of the two methods show fairly good agreement for both sexes of blue and fin whales, but the method based on body length usually results a slightly higher percentage of immature except for the males of fin whales (Figs. 8. 1 and 2), where the results of the two methods are in the reverse relation for certain seasons. When applied to humpback

8-3. Humpback whale



whales, two methods give considerably different results (Fig. 8–3).

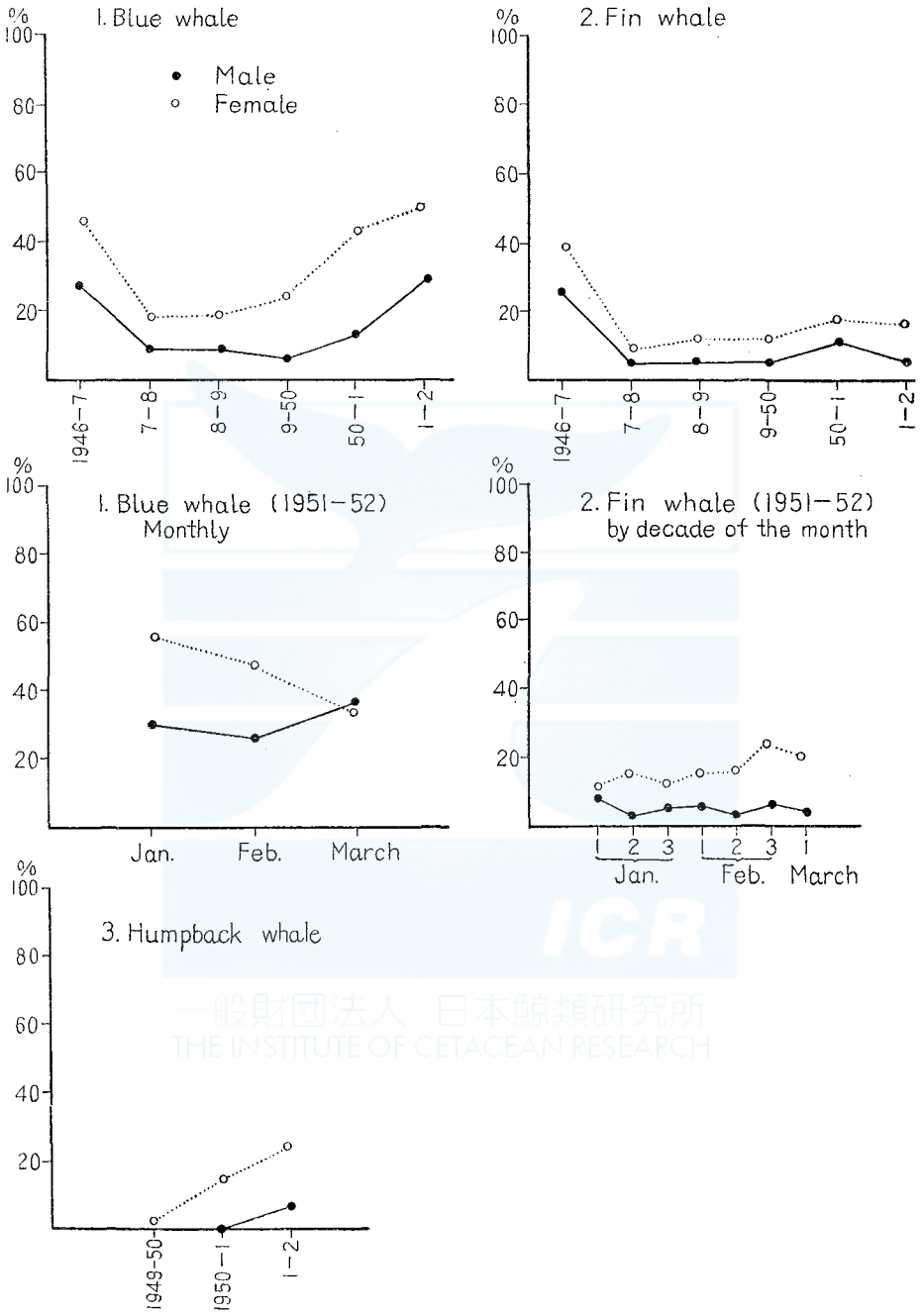
In 1946/47 the percentage of immature whales in the Japanese catch was as high as or higher than in the total Antarctic pelagic catch for either sex of blue and fin whales. Since the following season, however, the same percentage has been much lower in the Japanese catch than in the total Antarctic pelagic catch for these species, except the cases of female blue whales caught in 1950/51 and 1951/52 (Fig. 8–1 and 2).

As for humpback whales, the Japanese catch have contained immature whales in much smaller proportions than total Antarctic pelagic catch in the recent post-war seasons.

The fluctuation of the percentage of immature whales in the catch by Japanese fleets is illustrated in Fig. 9 by species and sexes for the period 1946/47 to 1951/52. Mature and immature whales are distinguished on the basis of the examination of genital organs. In the baleen whale species, the percentage of female immature was consistently higher than that of male immature, but the two percentages underwent similar changes during the period. Since the 1949/50 season the percentage of captured blue whale immature increased steadily, and in 1951/52 reached 29% and 51% respectively in males and females. On the contrary, a lower percentage of immaturity was recorded in 1951/52 for either sex of fin whales than in the previous season. The humpback catch of the 1951/52 season contained relatively more immature whales than in the previous season.

Within the 1951/52 season, the percentage of immaturity of male blue whales was lowest in February and highest in March, while that of female blue whales decreased steadily with months. In the males of fin whalse

Fig. 9. Rate of immature (sexual)

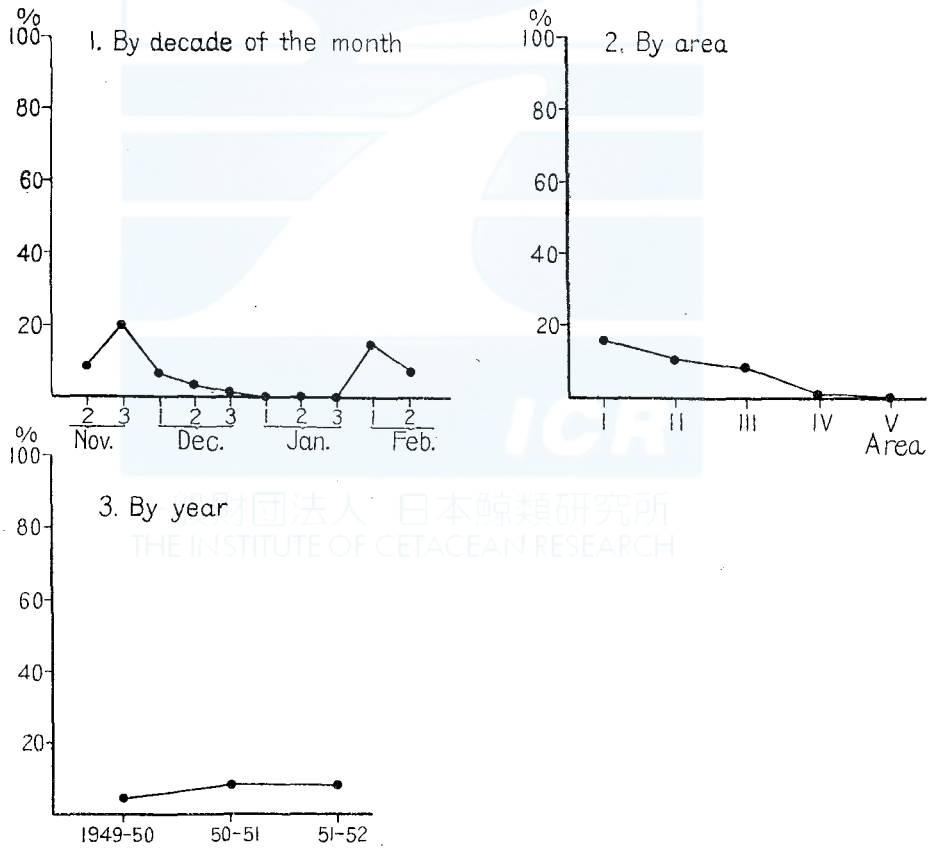


that percentage remained almost constant during the season, but in the females it followed a slightly upward trend.

No standard has yet been established to determine the sexual maturiy of male sperm whales. For temporary purposes, those males whose pair of testicles weighted less than 5 kg. are considered immature. According to this classificatian, 8.2% and 7.5% of the sperm whales taken by Japanese fleets in the 1950/51 and 1951/52 seasons respectively were sexually immature. In addition, some of the sperm whales were found to have very small testicles. These facts suggest the need to reexamine the conventional theory that sperm whales are all mature in the Antarctic waters.

The percentage of the captured sperm whale immature varied considerably with whaling grounds, months during the 1951/52 season (Fig. 10). While immature individuals constituted a considerable part of the catch in late November and early February, only one such individual

Fig. 10. Speam whale (under 5 kg in both testicle weight)



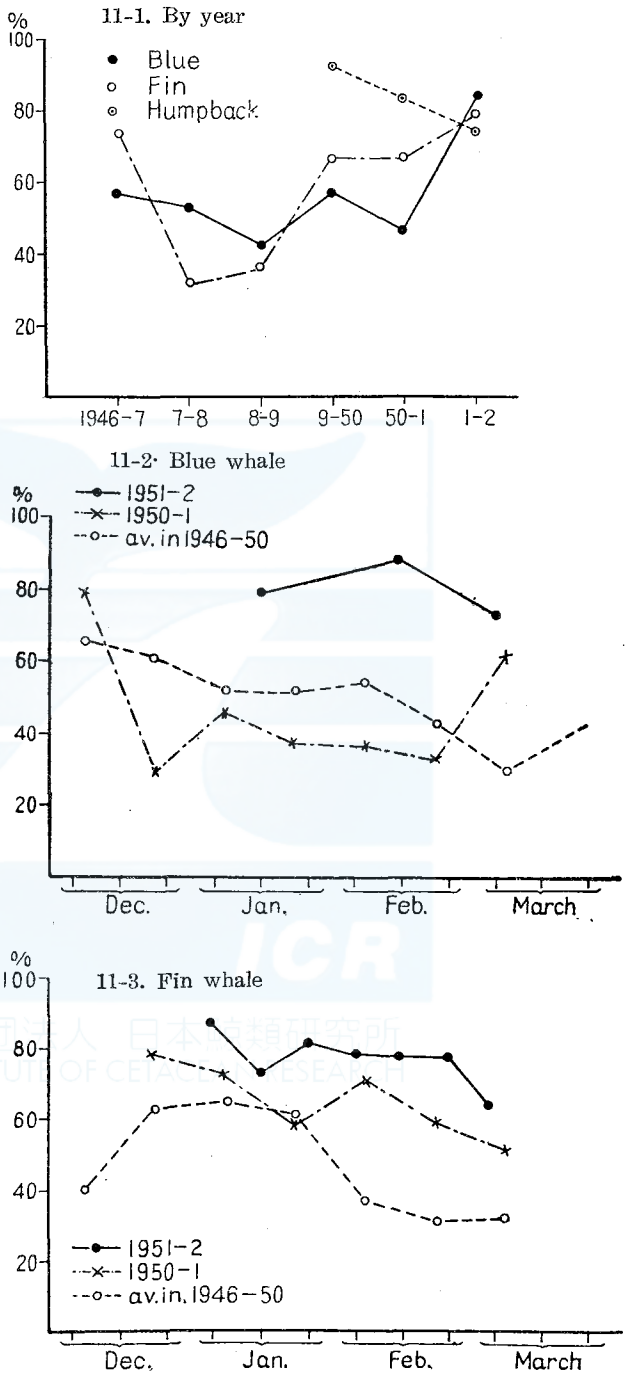
was caught during January. In Regions I, II, and III the catch contained a good number of immature whales, but their number markedly decreased in Region IV and none of them was caught in Region V.

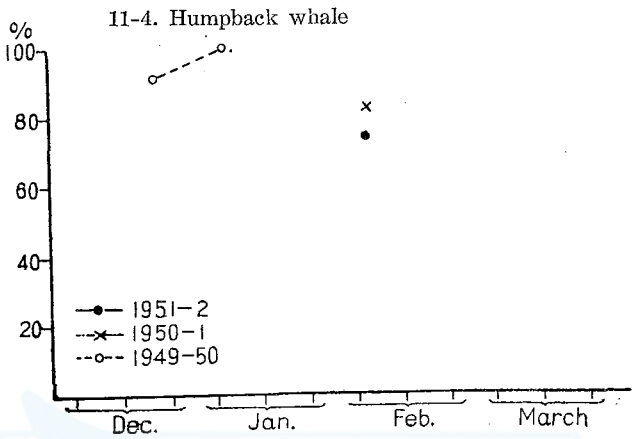
5. Percentage of Pregnancy

Pregnant whales constituted 83% and 79% respectively of the adult females of blue and fin whales caught by Japanese fleets in the 1951/52 season. These are the highest percentages ever recorded in post-war seasons (Fig. 11-1). Of 16 mature female humpbacks taken by these fleets, 14 or 75% were pregnant, a lower percentage of pregnancy than in the previous season.

During the season the percentage of pregnancy of blue whales fluctuated in much the same manner as the average for seasons 1946/47 to 1949/50, and a maximum of 90% occurred in February (Fig. 11-2). The same percentage of fin whales

Fig. 11. Rate of pregnancy





decreased as the season advanced, as was the case in preceding seasons. The decline was gradual during January and February except a temporary drop in middle January, and became sharp in March (Fig. 11–3).

Ohno and Fujino (1952) deduced from the low percentages of pregnancy for the later part of the season a tendency that pregnant whales leave the Antarctic for the warmer waters suitable for breeding earlier than the other whales. This seems to be the case, because the decrease in the proportion of females in the catch in the course of the season also suggests such a tendency.

Chapter II

Thickness of Blubber, Stomach Contents and External Parasites

1. Thickness of Blubber

It is generally believed that the whales become well nourished and the thickness of their blubber increases while they are engaged in feeding migration in the Antarctic waters and, as a result, the whales caught in the later part of the whaling season have thicker blubber than those taken in the earlier part. In addition, the presence of a sex difference in the thickness of the blubber has been suggested by past reports. It seems also probable that such physiological factors as sexual maturity or pregnancy control the thickness of the blubber. The data for the present season, therefore, have beeh analysed so as to ascertain these points.

The thickness of the blubber was measured on all the whales that were dismembered at that part of the body side where the mid-lateral

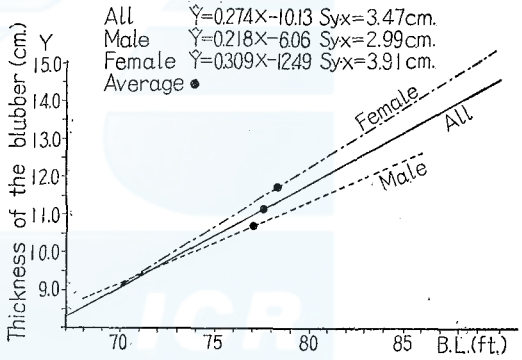
line intersects the vertical line passing the dorsal fin. These actual measurements, however, are not directly comparable, because the thickness of the blubber depends partly on the size of the whale, which varied greatly in the material under consideration. In view of this, a linear regression of the thickness of the blubber upon the length of the whale has been assumed, and the regression coefficient, the variance, and the adjusted mean thickness of the blubber are computed for each group of whales and used as the basis for comparison.

i) Blue whales

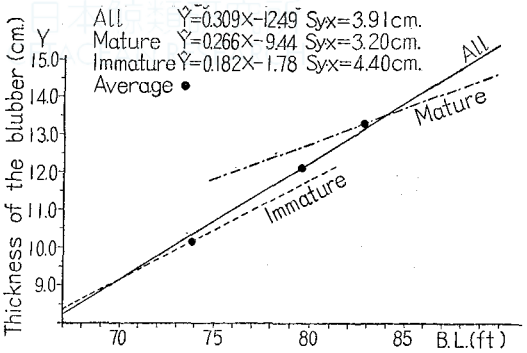
The results of the regression analysis are summarized in Table 10–1. Though the regression coefficient does not differ significantly in two sexes, significant sex difference exists in the variance and the adjusted mean, indicating that females had thicker blubber than the males of the same size (Fig 12–1). Between mature and immature females, too, significant difference is found in the variance and the adjusted mean and not in the regression coefficient, and the conclusion is that the mature females had thicker blubber for their lengths than the immature (Fig. 12–2). On the other hand, the regression coefficient, variance and adjusted mean computed separately for the males, immature females and mature females caught in January do not differ significantly from the same statistics for the respective group of whales taken during February and March (Fig. 12–3–5). (The whales caught in March are so small in number that they are combined with the catch in February.) This suggests that the increase in the thickness of the blubber was slight, if any, during the season. But in males and mature females the adjusted mean thickness of the blubber was greater, though

Fig. 12. Blue Whale, thickness of the blubber (regression estimating the thickness of the blubber contrusted with the body length)

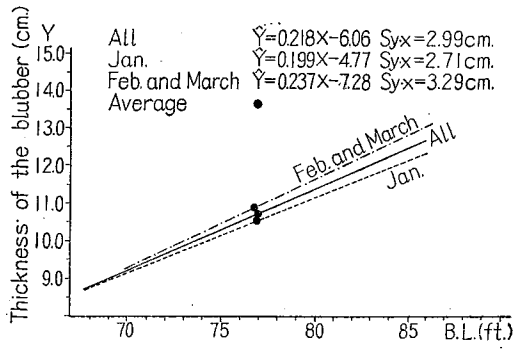
12-1. By sex



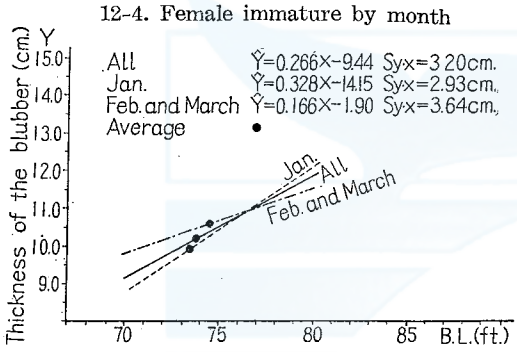
12-2. Female by maturity



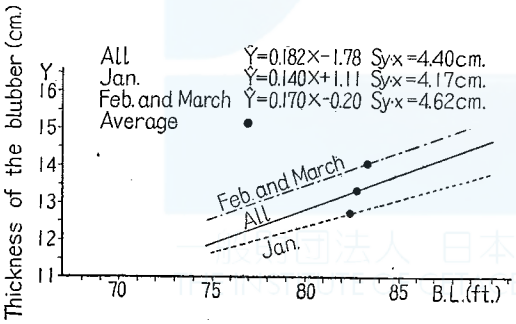
12-3. Male by month



12-4. Female immature by month



12-5. Female mature by month



not significantly, in February and March than in January, seemingly in favor of the conventional theory. In the immature females less than 77 ft. of length the blubber was thicker in February and March than in January, and the reverse was the case in the individuals of greater lengths. This result, however, can not be considered conclusive because it is based on the data of only 50 whales.

In a 84 ft. long mature female caught in January, the blubber was as thick as 21 cm. This whale was not included in the foregoing analysis, because it was statistically shown that its blubber was exceptionally thick.

ii) Fin whales.

Table 10–2. shows the summary of the results of the regression analysis for this species.

There is no doubt that females had thicker blubber than males, because the adjusted mean thickness of the blubber as well as the coefficient and variance of the regression differs highly significantly in the two sexes (Fig. 13–1).

Within the females, the blubber was increasingly thicker in the immature, resting and pregnant groups (Fig. 13–2): the adjusted mean of the thickness of the blubber differs highly significantly in the three groups, and the variance, between immature and pregnant and between

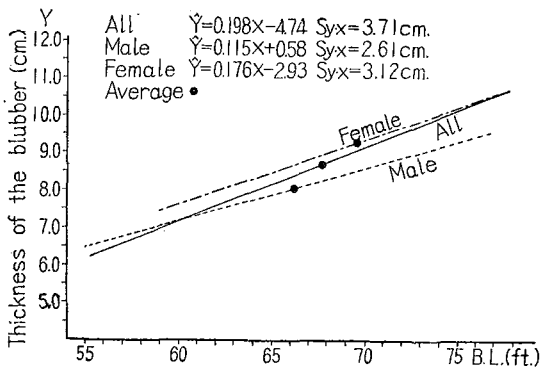
resting and pregnant, while there is no significant difference in the regression coefficient.

Comparison of the regressions for the males caught in different months indicates that statistically significant increase took place in the thickness of the blubber of the males in the course of the season (Fig. 13–3). In this case, the adjusted mean thickness differs highly significantly in the three month-groups, and the variance differs significantly between the January and the February group, while the differences are not significant between the coefficients of the three month-group regressions, and between the variances for the February and the March group.

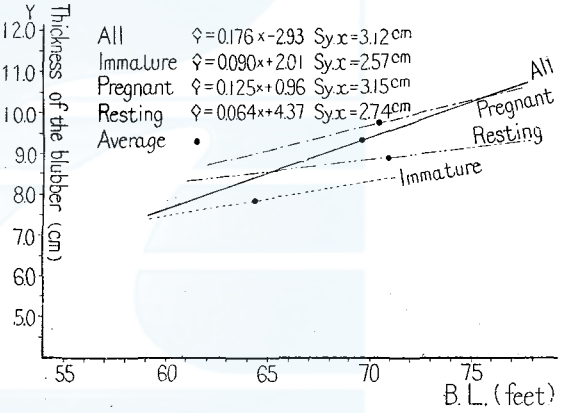
The data for the immature, pregnant, and resting females are also treated in the similar manner. With the immature females, highly significant difference in the regression coefficient and in the adjusted mean exists between the regressions for the January and the February groups, while only the regression coefficient differs in the February and the March group (Fig. 13–4). And the adjusted mean is greater in

Fig. 13. Fin whale, thickness of the blubber

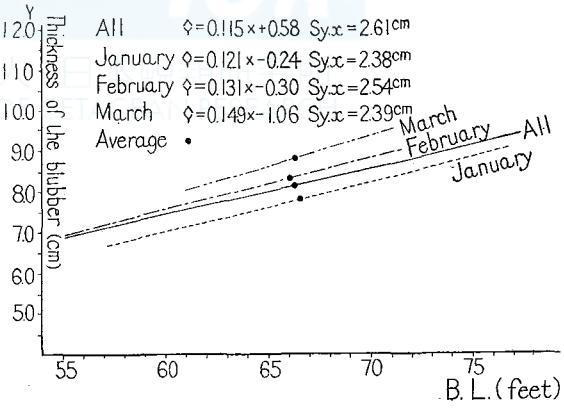
13-1. By sex



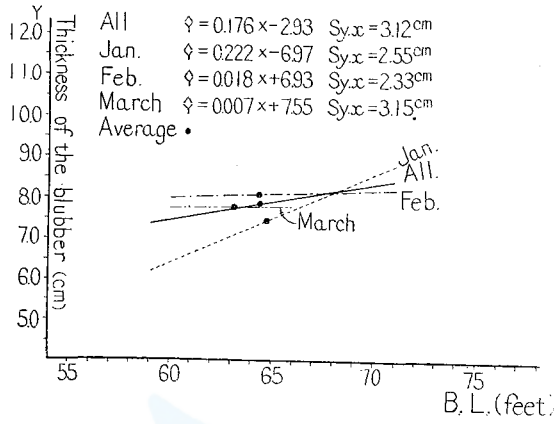
13-2. Female by maturity



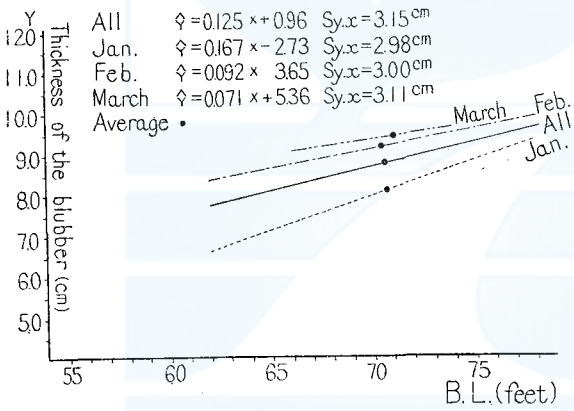
13-3. Male by month



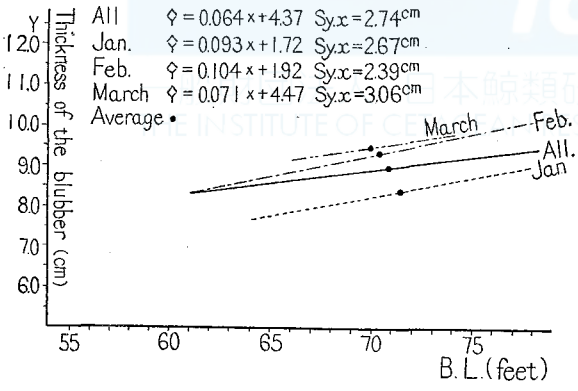
13. 4 Female immature by month



13. 5 Females pregnant by month



13. 6 Female, reating, monthly



the February group than in the January group. In both pregnant and resting whales, neither the regression coefficient nor the variance differs significantly in the three month-group regressions, and a significant difference in the adjusted mean occurs only between the January and the February group, a greater mean being associated with the latter month-group. (Figs. 13–5 and 6).

iii) Humpback whales

Neither the coefficient nor the variance of the regression of the blubber thickness upon the length of whale differs significantly in the two sexes of humpback whales, but the difference is significantly great in the adjusted mean of the blubber thickness; therefore, it may be said that females had thicker than the males of the similar size (Table 10–3 and Fig. 14).

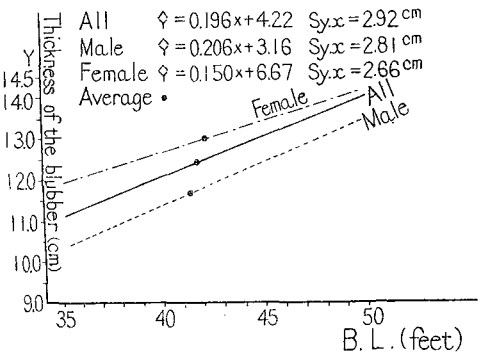
iv) Sprem whales.

As the catch of sperm whales consisted exclusively of males, comparison is made only between the catches in different months (Table 10–4 and Fig. 15). In the first three month groups, i. e., November to January, both the variance and the adjuted mean thickness of the blubber vary significantly

or highly significantly, whereas the regression coefficient is not significantly different. And the trend of the adjusted mean thickness for these months is such that the thickness of the blubber decreased with months, contrary to the case in blue and fin whales. In the January and the February group, the variance and the adjusted mean do not differ significantly, while the regression coefficient differs highly significantly. Accordingly, there is little ground to discuss the change in the proportionate thickness of the blubber during these months.

Possible explanations of the aforementioned trend of the proportionate thickness of the blubber during the season may be: (1) sperm whales grew thinner for want of suitable food during their

Fig. 14. Humpback whale



Ffg. 15. Sperm whale, monthly

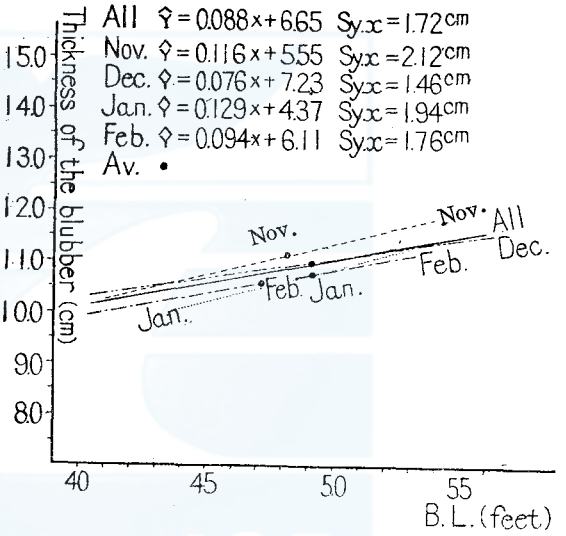


Table 10-1. Blue whale, the relation between the thickness of blubber and the body length

	Whole male and female	Female mature and imm.	Male Jan. and others	Imm. flemale Jan. and others	Mature female Jan. and other
Difference of regression coefficiency	○	○	○	○	○
Difference of variance	* *	*	○	○	○
Difference of adjusted mean	* *	*	○	○	○

[Note] ○ no significant difference.
* significant difference in 5% c.v. level.
** significant difference in 1% c.v. level.

Table 10-2. Fin whale

	Whole male and female	Female			Male		Imm. female		Pre. female		Rest. female	
		imm. and pre.	imm. and rest.	pre. and rest.	Jan. and Feb.	Feb. and March	Jan. and Feb.	Feb. and March	Jan. and Feb.	Feb. and March	Jan. and Feb.	Feb. and March
Difference of regression coefficiency	**	○	○	○	○	○	**	*	○	○	○	○
Difference of variance	**	**	○	**	*	○	○	○	○	○	○	○
Difference of adjusted mean	**	**	**	**	**	**	**	○	**	○	**	○

Table 10-3. Humpback

	Whole male and female
Difference of r.c.	○
Difference of v.	○
Difference of a.m.	*

Fig. 10-4. Sperm whale

	Male		
	Nov. and Dec.	Dec. and Jan.	Jan. and Feb.
Difference of r.c.	○	○	**
Difference of. v.	**	**	○
Difference of a.m.	**	*	○

stay in the Antarctic; (2) although the supply of food was sufficient, there was a constant recruitment of thin whales from the northern waters throughout the season; or (3) the fatness of the sperm whales differed in different whaling grounds, and the waters exploited early in the present season were inhabited by relatively fat whales. The first explanation is false, because the amount of the stomack content increased with the progress of the season (p. 183). The latter two hypotheses seem to be valid, for they are supported also by the study of external parasites (p. 189).

2. Stomach Contents

Observation was made of the quantity and composition of the stomach contents which issued from the first stomach at the dissection of the whale carcass. The quantity of the stomach contents was recorded in the usual manner with the following notation which represents the degree of impregnation of the first stomach: R (75—100%), rrr (50—75%), rr (25—50%), r (less than 25%), and O (empty).

The results of the observation on the baleen whales and the sperm whale are presented separately because of the difference in their feeding habits.

i) Baleen whales

Stomach contents consisted exclusively of the krill, *Euphausia superba*,

in blue whales. They consisted also of the krill in the majority of fin whales, but in their minority the first stomach contained a few small fish besides the krill.

In Table 11-1 and 12-1 the blue and fin whales caught during each 10-day period are broken down according to the quantity of the stomach contents. Table 11-2 and 12-2 are the percentage expressions of the same break-downs.

As is clear from Table 11-2, the first stomach was empty in 54% of the blue whales caught during the present season, and was filled with food in 6% of them. And there was a steady decrease in the frequency from the "O" class toward the "R" class. Both the percentage of the whales with an empty first stomach and that of the whales with a filled first stomach varied during the season: the former was high as 67% at the beginning of the season, but decreased progressively, till the minimum of 35% was reached in March; the latter varied between O and 11%, and the maximum occurred in late January.

By comparison, the first stomach was empty in 57% of fin whales,

Table 11-1. Blue, nos. of whales by the degree of the quantity of stomach contents by the decade of month.

	January			February			March	Total
	1	2	3	1	2	3		
R	1	0	10	0	4	0	0	15
rrr	2	4	8	0	5	3	2	24
rr	3	3	10	0	7	1	6	30
r	1	4	13	7	8	2	3	38
o	14	9	50	9	32	4	6	124
Total	21	20	91	16	56	10	17	231

Table 11-2. Blue, the rate of nos. by the degree of the quantity of the stomach contents by the decade of month

	January			January			March	Total
	1	2	3	1	2	3		
R	4.76	0.00	10.99	0.00	7.14	0.00	0·00	6.49
rrr	9.52	20.00	8.79	0.00	8.93	30.00	11.76	10.39
rr	14.29	15.00	10.99	0.00	12.50	10.00	35.29	12.99
r	4.76	20.00	14.29	43.75	14.29	20.00	17.65	16.45
o	66.67	45.00	54.95	56.25	57.14	40.00	35.29	53.68
Total	100.0 %	100.00%	100.09%	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %

and was filled in 8%; the frequency diminished from the "O" class towards the "R" class, as was the case in blue whales. The percentage of the whales with an empty first stomach showed a lower tendency throughout the season, though it never dropped below 51%. On the contrary, the percentage of the whales showing the filled first stomach generally increased with the progress of the season. Similar trends have been reported to have prevailed in the 1949/50 season.

Table 12-1. Fin, nos. of whales by the degree of the quantity of the stomach contents by the decade of month

	January			February			March	Total
	1	2	3	1	2	3		
R	3	23	26	33	52	33	25	195
rrr	19	26	29	29	56	52	25	236
rr	45	40	41	50	91	55	13	335
r	49	49	56	60	66	51	14	345
o	178	250	226	254	279	209	90	1486
Total	294	388	378	426	544	400	167	2597

Table 12-2. Fin, the rate of nos. by the degree of the stomach contents by the decade of month

	January			February			March	Total
	1	2	3	1	2	3		
R	1.02	5.93	6.88	7.75	9.56	8.25	14.97	7.51
rrr	6.46	6.70	7.67	6.81	10.29	13.00	14.97	9.09
rr	15.31	10.31	10.85	11.74	16.91	13.75	7.78	12.94
r	16.67	12.63	14.81	14.08	12.13	12.75	8.38	13.29
o	60.54	64.43	59.79	59.62	51.10	52.25	53.89	57.18
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

The krills contained in the first stomach were graded large (L), medium (M), or small (S), according as their majority measured over 5 cm., between 4 and 5 cm., or less than 4 cm. in size. Tables 13-1 and 14-1 show the actual frequencies of occurrence of L, M and S during each 10-day period in the blue and fin whales respectively. Table 13-2 and 14-2 show the corresponding percentage frequencies.

The krills from the first stomach of blue whales were small in 62% of the cases, medium-sized in 28%, and large in only 10% (Table 12-2). They were all small at the beginning of the season, and the medium-sized and large krills appeared for the first time respectively in late January

and in early February. These larger krills became commoner with the progress of the season, and occurred much oftener than small krills in March.

Table 13-1. Blue, nos. of whales by the size of krill by the decade of month

	January			February			March	Total
	1	2	3	1	2	3		
L	0	0	0	2	2	0	7	11
M	0	0	14	1	10	2	3	30
S	7	11	27	4	12	4	1	66
Total	7	11	41	7	24	6	11	107

Table 13-2. Blue, the rate of nos. by the size of krill by the decade of month

	January			February			March	Total
	1	2	3	1	2	3		
L	0.00	0.00	0.00	28.57	8.33	0.00	63.64	10.28
M	0.00	0.00	34.15	14.29	41.66	33.33	27.27	28.04
S	100.00	100.00	65.85	57.14	50.00	66.67	9.1	61.68
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

The stomack contents of fin whales consisted of small, mediumsized and large krills respectively in 69, 30 and 1% of the cases. It is noteworthy that the occurrence of large krills was much rarer than in blue whales. The relative frequency of S diminished with time from early January through February, and then increased in March, while that of M increased steadily throughout January and February and decreased in March. large kills made their first appearance in middle January. It was probably because blue and fin whales were hunted on different whaling grounds that the behaviours of the relative frequencies of L, M and S differed in the two species.

The results for the humpbacks are shown in Table 15. The whales showing the empty first stomach accounted for 35% of the catch, and small krills predominated in the stomach contents.

ii) Sperm whales

Squids were by far the most important, and in many cases the only,

Table 14-1. Fin, nos. of whales by the size of krill by the decade of month

	January			February			March	Total
	1	2	3	1	2	3		
L	0	1	4	0	7	1	0	13
M	5	13	35	35	113	101	26	328
S	111	124	113	137	143	82	46	756
Total	116	138	152	172	263	184	72	1097

Table 14-2. Fin, the rate of nos. by the size of krill by the decade of month

	January			February			March	Total
	1	2	3	1	2	3		
L	0.00	0.72	2.63	0.00	2.66	0.54	0.00	1.19
M	4.31	9.42	23.03	20.35	42.97	54.89	36.11	29.90
S	95.69	89.86	74.34	79.65	54.37	44.57	63.89	68.92
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table 15. Humpback, nos. and the rate of krill by the size and the quantity

	Quantity					Total	%
	o	r	rr	rrr	R		
S		2	6	6	8	22	59.4
M					2	2	5.4
O	13					13	35.2
Total	13	2	6	6	10	37	
%	35.2	5.4	16.2	16.2	27.0		100.0

constituent of the stomach contents of sperm whales, and there were indications that these squids belonged to the several distinct species including the well-known "king". The minor constituents were the fishes of several species, the results of whose taxonomic studies will appear as a separate work.

The quantity of the stomach contents was recorded with the same notation as was used in baleen whales. And the actual and percentage break-downs of the captured sperm whales according to the quantity of

the stomach contents are shown in Tables 16-1 and 16-2 respectively. The first stomach was empty in 46% of the sperm whales, and the number of the whales steadily decreased from the "O" class toward the "R" class.

The percentage of the whales showing an empty first stomach was subject to the considerable variation throughout the season, which may be ascribable in part to the shift of the whaling ground. It was lowest in late November through early December, and highest in February.

Table 16-1. Sperm, nos. of whales by the degree of the quantity of stomach contents by the decade of month

	November		December			January	February	Total
	2	3	1	2	3			
R	0	1	4	5	9	2	5	26
rrr	3	13	17	17	10	5	7	72
rr	14	29	54	48	16	9	8	178
r	22	45	59	52	34	13	14	239
o	46	47	78	143	54	16	62	446
Total	85	135	212	265	123	45	96	961

Table 16-2. Sperm, the rate of nos. by the degree of the quartity of stomach contents by the decade of month

	November		December			January	February	Total
	2	3	1	2	3			
R	0.00	0.74	1.89	1.89	7.32	4.44	5.21	2.71
rrr	3.53	9.63	8.02	6.42	8.13	11.11	7.29	7.49
rr	16.47	21.48	25.47	18.11	13.01	20.00	8.33	18.52
r	25.88	33.33	27.83	19.62	27.64	28.89	14.58	24.87
o	54.12	34.81	36.79	61.51	43.90	35.56	64.58	46.41
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table 16-3. Sperm, the rate of nos. by the degree of the quantity of stomach contents by the decade of month

	November		December			January	February	Total
	2	3	1	2	3			
R+rrr	3.53	10.37	9.91	8.31	15.45	15.55	12.50	10.20
rr+r	42.35	54.81	53.30	37.73	40.65	48.89	22.91	43.39
$\frac{R+rrr}{rr+r}$	0.08	0.18	0.18	0.22	0.38	0.32	0.55	0.24

Among the whales whose first stomach contained any food, there was a tendency for the proportion of those whose stomach was impregnated with food to higher degrees to increase with the time. This is demonstrated in Table 16–3 where "R+rrr" and "rr+r" refer to the sums of those percentage frequencies which are shown in Table 16–2. The steady increase in the value of the ratio (R+rrr)/(rr+r) represents the aforementioned tendency.

3. External Parasites

Observation was made, according to the usual method, of the skin of the whales for evidence of infection with external parasites, and the results are summarized in Table 17 for different species of whales.

Table 17. Blue, Fin, Sperm and Humphack, the rate of infection by sp. of parasites

	Blue			Fin		
	nos. of observed	nos. of infected	rate of infection	nos. of observed	nos. of infected	rate of infection
Cyamus sp.	231	5	2.16	2597	38	1.46
Coronula sp.	〃	1	0.43	〃	2	0.08
Conchoderma sp.	〃	0	0.00	〃	1	0.04
Pennella sp.	〃	3	1.30	〃	3	0.12
Diatom film	〃	45	19.45	〃	529	20.37
Not infected			23.34			22.07

	Sperm			Humpback		
	nos. of observed	nos. of infected	rate of infection	nos. of observed	nos. of infected	rate of infection
Cyamue sp.	961	187	19.15	37	25	67.57
Coronula sp.	〃	7	0.73	〃	37	100.00
Conehoderma sp.	〃	21	2.19	〃	37	100.00
Pennella sp.	〃	2	0.21	〃	0	0.00
Diatom film	〃	341	35.48	〃	0	0.00
Not infected			50.47			0.00

The percentage of the whales infected with external parasites was much the same in blue and fin whales, respectively 23.34% and 22.07%. The major part of the cases was accounted for by the diatom film, and the minor part, by *Cyamus*, *Pennella*, *Coronula*, and *Conchoderma* in the descending order of importance. Nearly one half of the captured sperm whales were infected by the external parasites, mostly by diatoms

or *Cyamus*. All the humpback whales were infected by both *Coronula* and *Conchoderma*, and about two-thirds of them were infected also with *Cyamus*. But no humpbacks showed the infection with *Pennella* or with the diatom film. Compared with the last season, the percentage infected with the diatoms was lower in any whale species, but the percentages infected with other parasites were much the same as in the last season.

While the occurrence of *Coronula*, *Conchoderma* and *Pennella* on the blue and fin whales was limited to January, and that of *Cyamus* to January and February, the diatom film grew increasingly common on these whales with the progress of the season. This observation was in good agreement with the conventional theory that the diatom film is developed but the other parasites fall off while the whales are migrating over the Antarctic waters.

Further details of the occurrence of the diatom film on blue and fin whales are shown in Tables 18-1 to 19-2 and Fig. 16. As is clear from Fig. 16, the percentage of the blue infected with the diatom film, especially of those suffering from heavy infection, showed marked decrease both in early February and in March. Similar decrease in early February was reported in last season. In fin whales the percentage infection increased with the progress of the season, with a concurrent increase in the percentage suffering from relatively heavy infection.

It is generally believed that diatom spores attach to the whale skin after whales have entered the Antarctic waters, and that it takes these spores at least one month to grow to form a diatom film visible to the naked eye. In that case, the fact that a considerable part of blue and fin whales are found free from diatom film even at the end of the whaling season may indicate that the migration of these species from lower latitudes into the Antarctic continues for a considerable length of time after the season is opened.

Table 18-1. Blue whale, nos. of infected by sp. of parasites and the decade of month

	January			February			March	Total
	1	2	3	1	2	3		
Cyamus sp.	0	1	0	0	3	1	0	5
Coronula sp.	0	0	0	0	0	0	0	0
Conchoderma sp.	0	0	1	0	0	0	0	1
Pennella sp.	1	1	1	0	0	0	0	3
Diatom film	0	4	16	1	20	3	1	45
nos. of observed	21	20	91	16	56	10	17	231

Table 18-2. Fin whale, nos. of infected by sp. of parasites and the decade of month

	January			February			March	Total
	1	2	3	1	2	3		
Cyamus sp.	5	7	12	4	6	4	0	38
Coronula sp.	0	0	2	0	0	0	0	2
Conchoderma sp.	0	0	1	0	0	0	0	1
Pennella sp.	0	2	3	0	0	0	0	5
Diatom film	35	48	60	87	129	115	55	529
nos. of observed	294	388	378	426	544	400	167	2597

Table 19-1. Blue whale, nos. of infected by diatoms by the decade of month

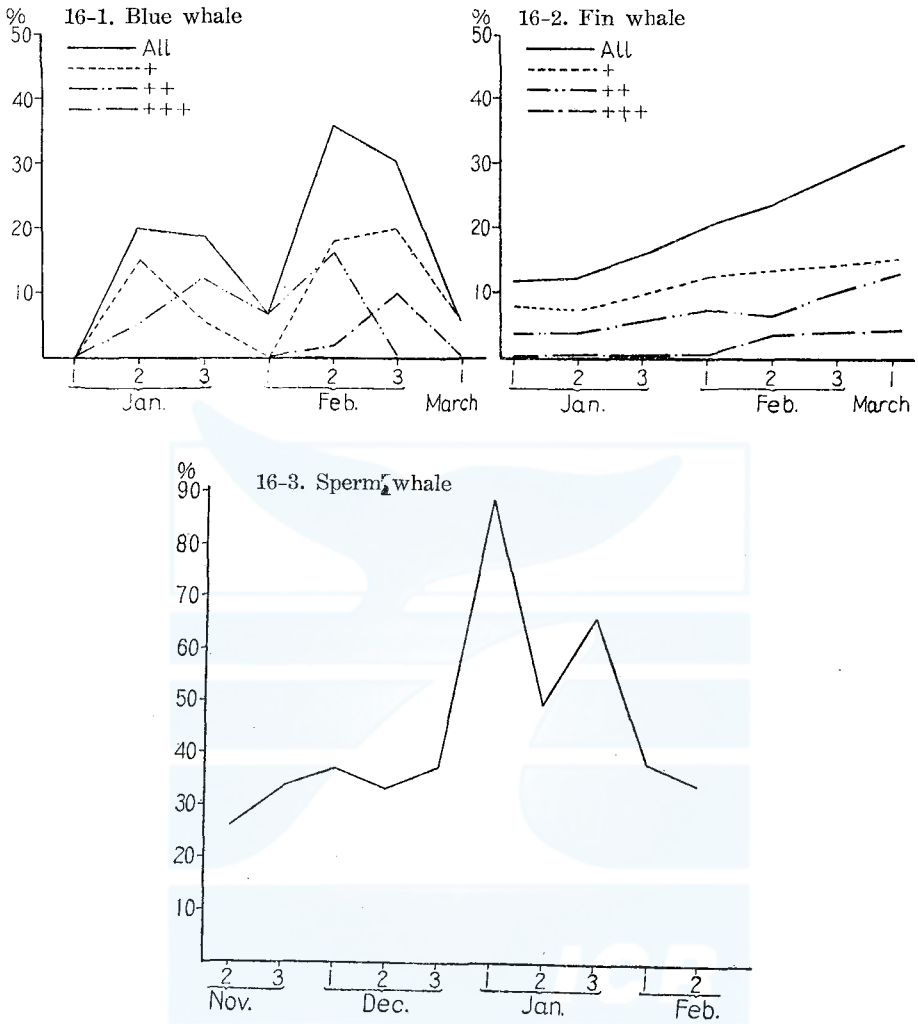
	January			February			March	Total
	1	2	3	1	2	3		
##	0	0	0	0	1	1	0	2
#	0	1	11	1	9	0	0	22
+	0	3	5	0	10	2	1	21
O	21	16	75	15	36	7	16	186
Total	21	20	91	16	56	10	17	231

Table 19-2. Blue whale, the rate of infection of diatoms by the decade of month

	January			February			March	Total
	1	2	3	1	2	3		
##	0.00	0.00	0.00	0.00	1.79	10.00	0.00	0.87
#	0.00	5.00	12.09	6.25	16.07	0.00	0.00	9.52
+	0.00	15.00	5.49	0.00	17.86	20.00	5.88	9.09
O	100.00	80.00	82.42	93.75	64.29	70.00	94.12	80.52
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The occurrence of varions external parasities on sperm whales is shown in Tables 20-1 and 21-1, and the corresponding percentage infection in Tables 20-2 and 21-2. The subdivision of the whaling ground used in Tables 20-1 and 20-2 is the same that has been described in connection with the analysis of size composition data (p. 163). Nearly one half of the sperm whales captured during the season was infected with external parasites. Diatom film was most important among the parasites, and was found in 36% of the whales, mostly on the anterior part of the head. *Cyamus* graded next in importance, occurring on 19% of the total

Fig. 16. The rate of infection of Diatoms by the decade of the month



catch. Other parasites were far less important. The percentage infection with diatom film was high in regions I and V, and low in region II. The percentage infection with *Cyamus* ranged from 37% in region V to 17% in region IV (Table 21–2).

The percentage infection with *Cyamus* varied greatly with time, and the maximum occurred in both late December and middle January (Table 22–2). The percentages infected with *Coronula* and *Pennella* were low, and reached the maximum respectively in early January and late November. The latter parasite was not found from late December onwards.

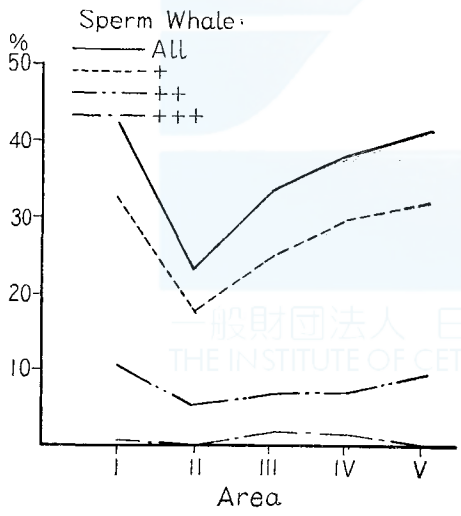
Table 20-1. Fin whale, nos. of infected by diatoms by the decade of month

	January			February			March	Total
	1	2	3	1	2	3		
##	0	3	1	2	20	16	7	49
#	11	16	22	32	35	42	22	180
+	24	29	37	53	74	57	26	300
O	259	340	318	339	415	285	112	2068
T.	294	388	378	426	544	400	167	2597

Table 20-2. Fin whale, the rate of infection by diatoms by the decade of month

	January			February			March	Total
	1	2	3	1	2	3		
##	0.00	0.77	0.26	0.47	3.68	4.00	4.19	1.89
#	3.74	4.12	5.82	7.51	6.43	10.50	13.17	6.93
+	8.16	7.47	9.79	12.44	13.60	14.25	15.57	11.55
O	88.10	87.63	84.13	79.58	76.29	71.25	67.07	79.63
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Fig. 17. The rate of infection of Diatoms by whaling area



The precentage showing diatom film also varied irregularly with time (Table 22-2 and Fig. 16-3). It was low in middle November as well as during February. In the former period the operation took place in region II, and during the latter, in region III where small whales of average length of 47.4 ft. were dominant. While percentage infection was very high in early January when the operation took place in the western half of region IV (around 160°E), it dropped considerably in the middle and late parts of the month, when the fleet shifted eastward and operated in the other half of region IV and in region V.

It may be concluded from the foregoing that the variation in the percentage infection with diatom film is associated not only with the time but also with the geographical position. This is a strong indication that

sperm whales with different history were found in different whaling grounds, or that the sperm whales over these grounds did not come from a single population. Furthermore, the considerable variation with time in the percentage infection with diatom film and the consistent occurrence of *Cyamus* throughout the season suggest that there was a constant recruitment of sperm whales from lower latitudes all through the season (p. 178).

Table 21-1. Sperm whale, nos. of infected by sp. of parasites, degree of quantity and area

	I				II				III			
	+	++	+++	Total	+	++	+++	Total	+	++	+++	Total
Cyamus sp.	27	4	2	33	14	13	3	30	33	9	3	45
Coronula sp.	0	0	0	0	2	0	0	2	3	0	0	3
Conchoderma sp.	4	1	1	6	2	3	0	5	3	0	0	3
Pennella sp.	1	0	0	1	0	0	0	0	0	0	0	0
Diatom film	59	18	1	78	30	9	0	39	54	15	4	73
nos. of not infected				83				97				117
nos. of observed				185				169				220

	IV				V				Total			
	+	++	+++	Total	+	++	+++	Total	+	++	+++	Total
Cyamus sp.	32	17	4	53	14	9	0	23	120	52	12	184
Coronula sp.	2	0	0	2	0	0	0	0	7	0	0	7
Conchoderma sp.	4	2	0	6	1	0	0	1	14	6	1	21
Pennella sp.	1	0	0	1	0	0	0	0	2	0	0	2
Diatom film	93	22	4	120	24	7	0	31	260	71	9	340
nos. of not infected				154				34				485
nos. of observed				312				75				951

Table 21-2. Sperm whale, the rate of the infection by sp. of parasites, degree of quantity and area

	I				II				III			
	+	++	+++	Total	+	++	+++	Total	+	++	+++	Total
Cyamus sp.	15.14	2.70	1.62	18.38	8.28	7.69	1.78	17.75	15.00	4.09	1.36	20.45
Coronula sp.	0.00	0.00	0.00	0.00	1.18	0.00	0.00	1.18	1.36	0.00	0.00	1.36
Conchoderma sp.	2.70	0.54	0.54	3.78	1.18	1.78	0.00	2.96	1.36	0.00	0.00	1.36
Pennella sp.	0.54	0.00	0.00	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diatom film	32.43	10.27	0.54	42.16	17.75	5.33	0.00	23.08	24.55	6.81	1.82	33.18
rate of not infected				44.86				57.40				53.18
rate of observed				100.00				100.00				100.00

	IV				V				T.			
	+	++	+++	Total	+	++	+++	Total	+	++	+++	Total
Cyamus sp.	10.26	5.45	1.28	16.99	18.67	12.00	0.00	36.67	12.62	5.47	1.26	19.35
Coronula sp.	0.64	0.00	0.00	0.64	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.74
Conchoderma sp.	1.28	0.64	0.00	1.92	1.33	0.00	0.00	1.33	1.47	0.63	0.11	2.21
Pennella sp.	0.32	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.21
Diatom film	29.81	7.05	1.28	38.46	32.00	9.33	0.00	41.33	27.34	7.46	0.95	35.75
rate of not infected				49.36				45.33				51.00
rate of observed				100.00				100.00				100.00

Table 22-1. Sperm whale, nos. of infected by sp. of parasites and the decade of month

	November		December			January			February		Total
	2	3	1	2	3	1	2	3	1	2	
Cyamus sp.	14	24	40	50	29	2	9	0	7	9	184
Coronula sp.	2	0	1	1	0	2	0	0	0	1	7
Conchoderma sp.	5	0	6	6	0	1	1	0	1	1	21
Pennella sp.	0	1	0	1	0	0	0	0	0	0	2
Diatom film	22	45	75	88	46	16	12	2	17	18	341
nos. of not infected	46	71	104	139	63	1	8	1	23	29	485
nos. of observed	85	135	212	265	123	18	24	3	44	52	961

Table 22-2. Sperm whale, the rate of infection by sp. of parasites and the decade of month

	November		December			January			February		Total
	2	3	1	2	3	1	2	3	1	2	
Cyamus sp.	16.47	17.78	19.80	18.88	23.58	11.11	37.00	0.00	15.91	17.27	19.15
Coronula sp.	2.35	0.00	0.50	0.38	0.00	11.11	0.00	0.00	0.00	1.92	0.73
Conchoderma sp.	5.88	0.00	2.97	2.26	0.00	5.56	4.17	0.00	2.27	1.92	2.19
Pennella sp.	0.00	0.74	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.21
Diatom film	25.88	33.33	37.13	33.21	37.40	88.89	50.00	66.67	38.64	34.55	35.48
rate of not infected	54.12	52.59	51.49	52.45	51.22	5.56	33.33	33.33	52.27	55.66	50.47

Chapter III

Weight of Testicles and Number of Corpora Lutea

1. Weight of Testicles in Relation to Length of Whale.

Figs. 18–1 to 18–4 show the relation between the combined weight of the pair of testicles and the length of male whales in blue, fin, humpback and sperm whales respectively. In every species there is a general increase in the weight of testicles with increasing length of the whale.

The graphs for blue and fin whales, however, suggest more than this general relationship. Fig. 18–1 indicates that male blue whales with the testicles weighing between 7 and 12 kg. were rare. This may be taken to indicate that the weight of testicles from 7 to 12 kg. corresponds to the puberty of male blue whales when a rapid increase in the weight of testicles takes places. Since the pair of testicles weighed over 10 kg. in the minority of the males between 71 and 75 ft., but in almost all the males larger than 77 ft., it may be said that male blue whales attain sexual maturity at the lengths between about 71 and about 77 ft.

In fin whales (Fig. 18–2), the rapid growth of testicles concurrent with puberty is indicated by the scarcity of the males showing the testicles weight of 5 kg. As the weight of testicles less than 5 kg. was associated generally with the lengths under 67 ft. and that over 5 kg. with the lengths 60 ft. or more, it seems that male fin whales attain sexual maturity at the length between 60 and 67 ft.

The data for humpbacks are not plentifully enough to justify any detailed analysis (Fig. 18–3).

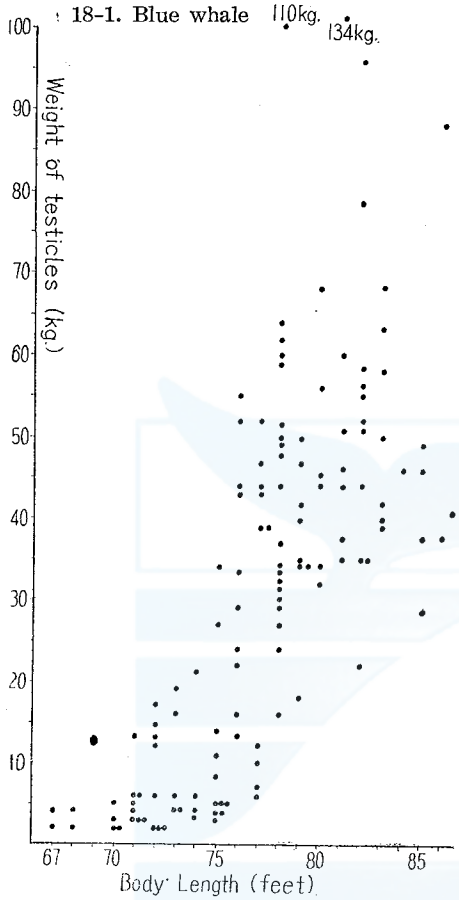


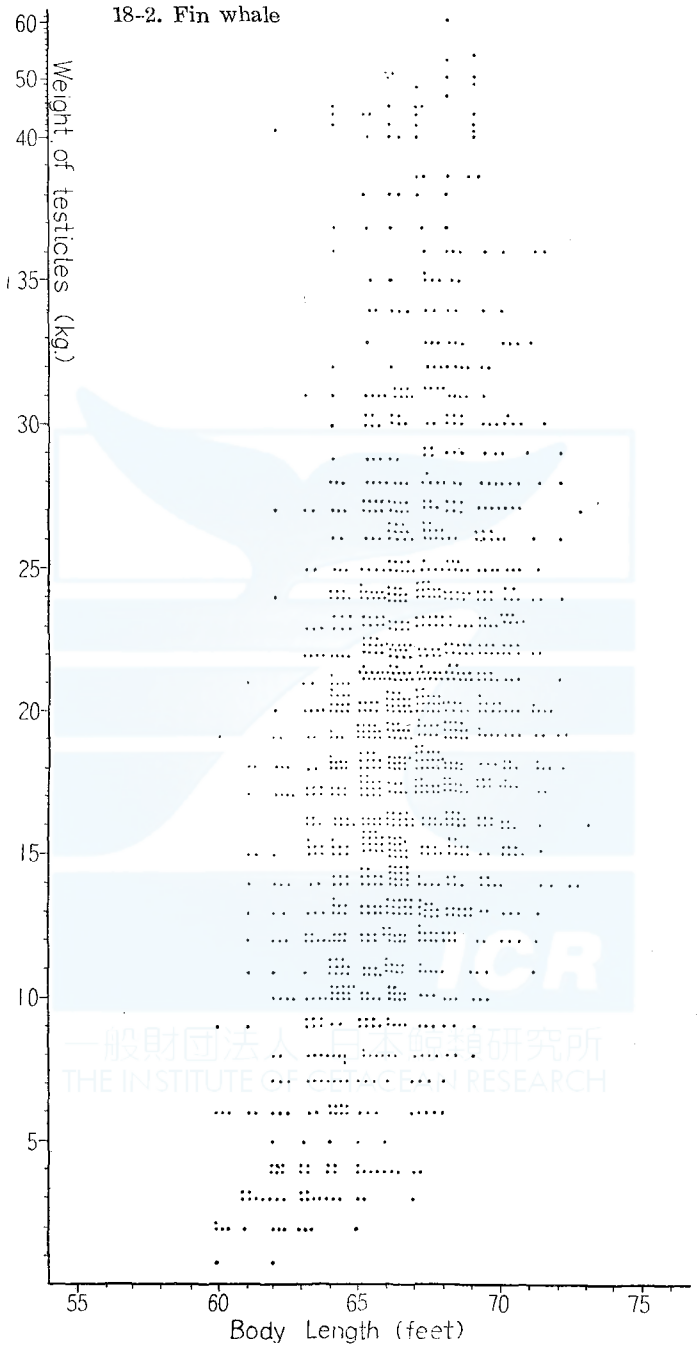
Fig. 18. The relations between body length and the testicles weight

The rapid growth of testicles during puberty is not clearly represented in the graph for sperm whales (Fig. 18–4). It is noteworthy, however, that a considerable percentage of the captured sperm whales had very small testicles. In Table 23 are classified the sperm whales whose pair of testicles weighed less than 6 kg. It is clear from this table that the pair of testicles weighed less than 5kg. In 27% of the catch, and less than 2 kg. in 1%. This fact strongly suggests that, contrary to conventional belief a considerable portion of the sperm whales found in the Antarctic waters are sexually immature. A similar tendency was also encountered in last season (Ohno and Fujino: 1952).

2. *Number of Corpora Lutea in Relation to Length of Whale.*

Fig. 19. 1 to 19. 3 show the relation between the number of corpora lutea and the length of female whales in different species.

18-2. Fin whale



In blue whales, the smallest female showing a corpus luteum meaured 75 ft. (Fig. 19-1), and the corpora lutea number generally increased with the length of whale. While this general relationship holds well in the length classes 75 to about 85 ft., there occurs an decreasing tendency of the corpora lutea number in the larger females—a strange feature which

18-4. Sperm whale

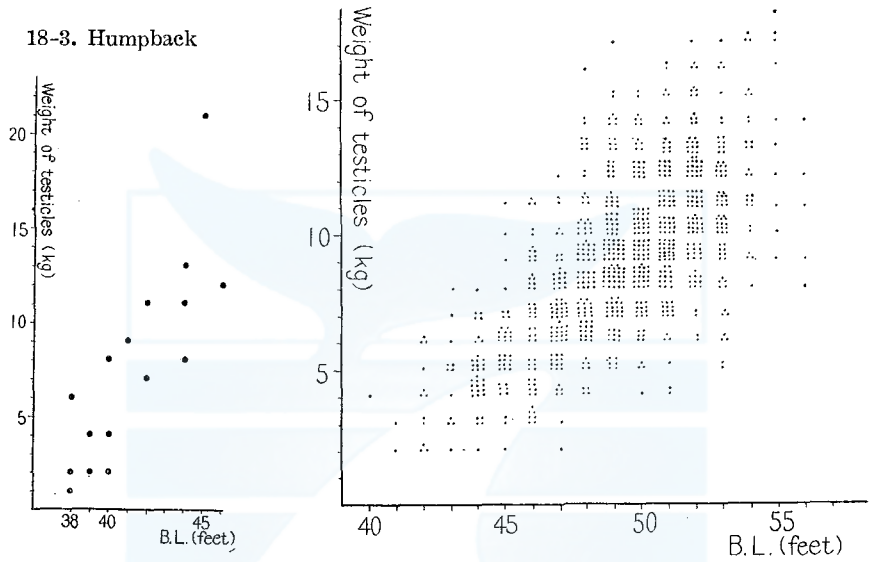
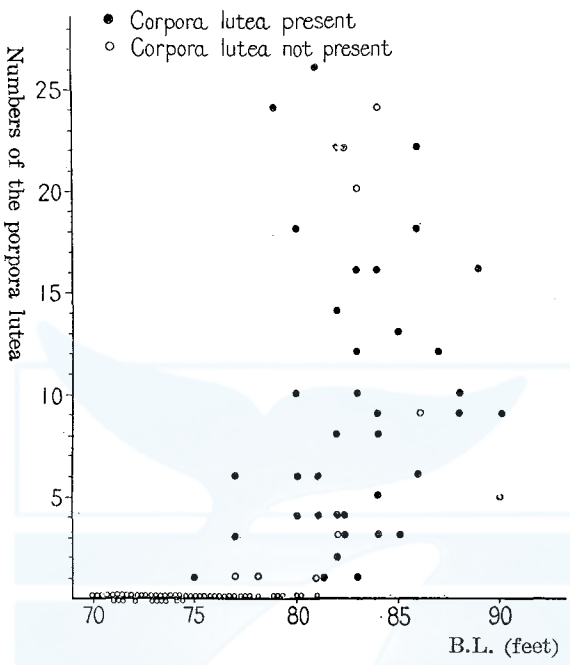


Table 23. Sperm whale, nos. and the rate of whale with lighter testicles in weight by body length

	under 1 kg		under 2 kg		under 3 kg		under 4 kg		under 5 kg		under 6 kg		nos. of observed
	nos.	%	nos.	%	nos.	%	nos.	%	nos.	%	nos.	%	
40							1	100.0	1	100.0	1	100.0	1
41			1	33.3	2	66.7	2	66.7	2	66.7	3	100.0	3
42			3	25.0	5	41.7	8	66.7	9	75.0	12	100.0	12
43			1	8.3	4	33.3	5	41.7	9	75.0	10	83.3	12
44			1	2.8	5	13.9	18	50.0	28	77.8	31	86.1	36
45			1	2.5	3	7.5	9	22.5	21	52.5	32	80.0	40
46					7	13.0	15	27.8	21	38.9	27	50.0	54
47			1	1.3	2	2.6	7	9.1	19	24.7	36	46.8	77
48							4	4.1	9	9.2	24	24.5	98
49									6	4.5	15	11.4	132
50							1	0.8	4	3.0	10	7.5	133
51							2	1.7	3	2.6	6	5.2	115
52											2	2.0	102
53									2	2.8	5	6.9	72
Total			8	0.9	28	3.2	72	8.1	134	15.1	214	24.1	887

Fig. 19. The relations between body length and the nos. of corpora lutea

19-1. Blue whale

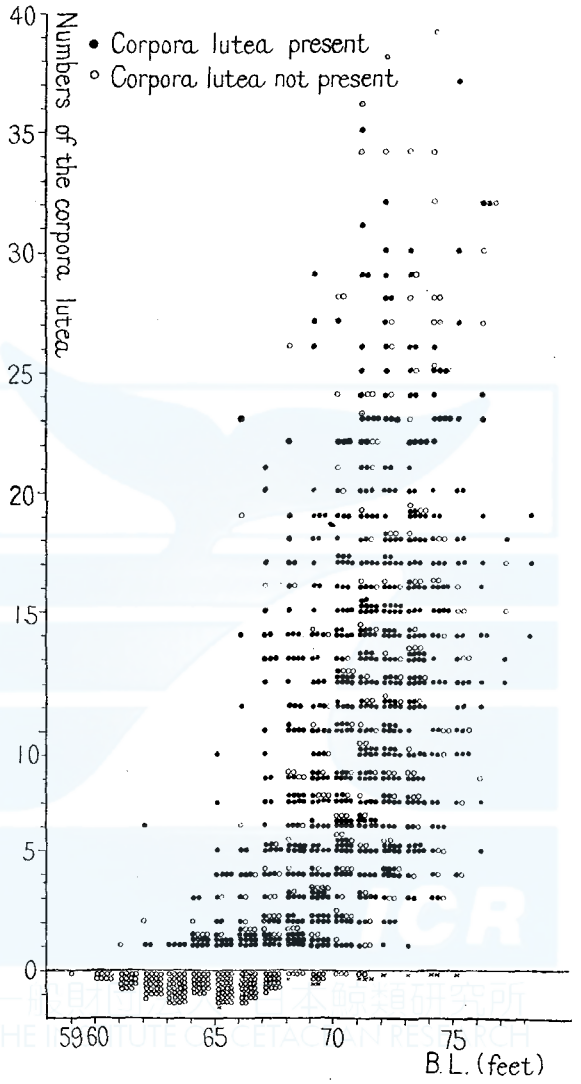


was not recognized in last season. As a result, corpora lutea number over 20 was confined to the females from 79 to 86 ft. in size. Since it is well established that corpora lutea persist all the life of blue whales, it may be that among very large females of this species the individuals having many corpora lutea suffer a higher rate of natural mortality or are less liable to be captured than those having relatively smaller number of corpora lutea.

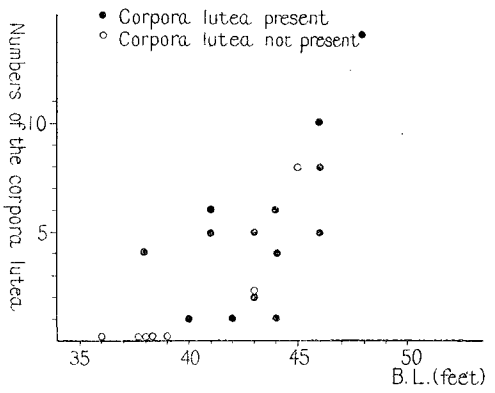
In fin whales, too, very high corpora lutea number, namely over 34 occurred in the length classes 68–74 ft, and the number never exceded 20 in very large females measuring 77 to 78 ft. in length, I although the general trend was that the larger the whales, the more corpora lutea on their ovaries (Fig. 9–2). A similar tendency was observed in last season. The lower tendency of the corpora lutea number in very large females may be explained in the same manner as in the case of blue whales.

In humpback whales, the number of corpora lutea increased with the length of whale. An exceptionally high corpora lutea number, namely 32, was shown by a female measuring 48 ft. in length.

19-2. Fin whale



19-3. Humpback whale



Chapter IV

Foetuses

1. Occurrence and Growth of Foetuses.

In Table 23 is summarized the occurrence of foetuses in the female whales captured during the present season.

Twin and triplet foetuses occurred only in fin whales. Eleven females of this species were found with twin foetuses, and one, two, and three corpora lutea were functional in 5, 5 and 1 of these mothers, respectively. In two mothers of the second group, the two functional corpora lutea were found on one ovary. In the mother showing three functional corpora lutea, the twin foetuses were of different sex. Triplet foetuses were met with in a single instance, where two larger foetuses were female and dead measuring 17 ft. 8 in. and 15 ft. in length and the smallest one, 5 ft. 2 in long, was male and alive.

A slight preponderance of male foetuses over female was observed in the three species of whales examined. This tendency had been recognized in blue and fin whale foetuses during last season (Table 24). The marked variation in the sex ratio of humpback foetuses may be ascribed to the scarcity of data.

As far as blue and fin whales are concerned, the preponderance of males over females is more considerable in the adults that are captured by pelagic whaling than in foetuses (Table 25). This fact may suggests that females of these species suffer a higher mortality rate after birth than males, or have an tendency to migrate over other waters than those covered by pelagic operations.

The length of foetus is plotted against the date of capture in Figs. 20–1 to 20–3 by species. The seasonal changes in the foetus size as

Table 24. Nos. of foetuses

		January				February				March				Total				
		male	female	u.k.	Total	male	female	u.k.	Total	male	female	u.k.	Total	male	female	u.k.	Total	
Blue	nos.	9	11		20	9	7		16	2	1		3	20	19		39	
	sex ratio	45.0	55.0			56.25	43.75			66.7	33.3			51.3	48.7			
Fin.	nos.	167	160	1	328	197	193	1	391	14	15		29	37.8	368	2	748	twins 11 pairs
	sex ratio	51.1	48.9			50.5	49.5			48.3	51.7			50.7	4.93			triplets 1 pair
Hump.	nos.					7	5		12					7	5		12	
	sex ratio					58.3	41.7							58.3	41.7			

Table 25. Sex ratio of foetuses in 1950-51 (Ono and Fujino, 1951)

	male	female	nos.
Blue	52.6	47.4	38
Fin	51.0	48.9	533
Hump.	40.0	60.0	5

Table 26. Sex ratio of whales caught

	male	female	nos.
Blue	57.6	42.4	231
Fin	55.7	44.3	2597
Hump.	43.2	66.8	37

shown by Figs. 20–1 and 20–2 are in good agreement with the growth curves proposed by Mackintosh and Wheeler as well as with the results obtained in last season.

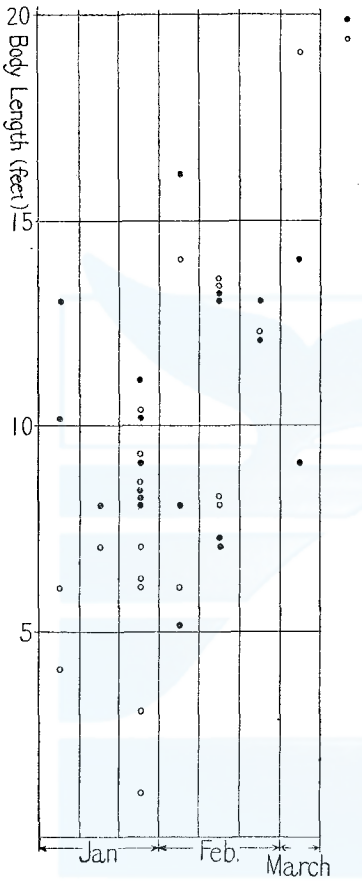
2. Relation between Foetus Size and the Diameter of Functional Corpus Luteum of the Mother.

The diameter of the functional corpus luteum of the mother whale is plotted against the length of the foetus in Figs. 21–1 to 21–4 by species. A tendency that the diameter of functional corpus luteum diminishes with the increase in foetues size is observed, though not clear, in fin and humpback whales.

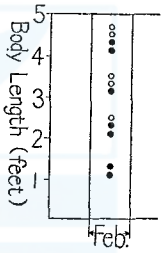
3. Relation between Foetus Size and the Thickness of Mammary Glands of the Mother.

Fig. 20. The length of the foetuses by season

20-1. Blue whale



20-3. Humpback whale



The said relation is depicted in Figs. 22. 1 to 22. 4 for different species. In every species there is a slight indication that the thickness of mammary grands deminishes as the foetus grows larger.

20-2. Fin whale

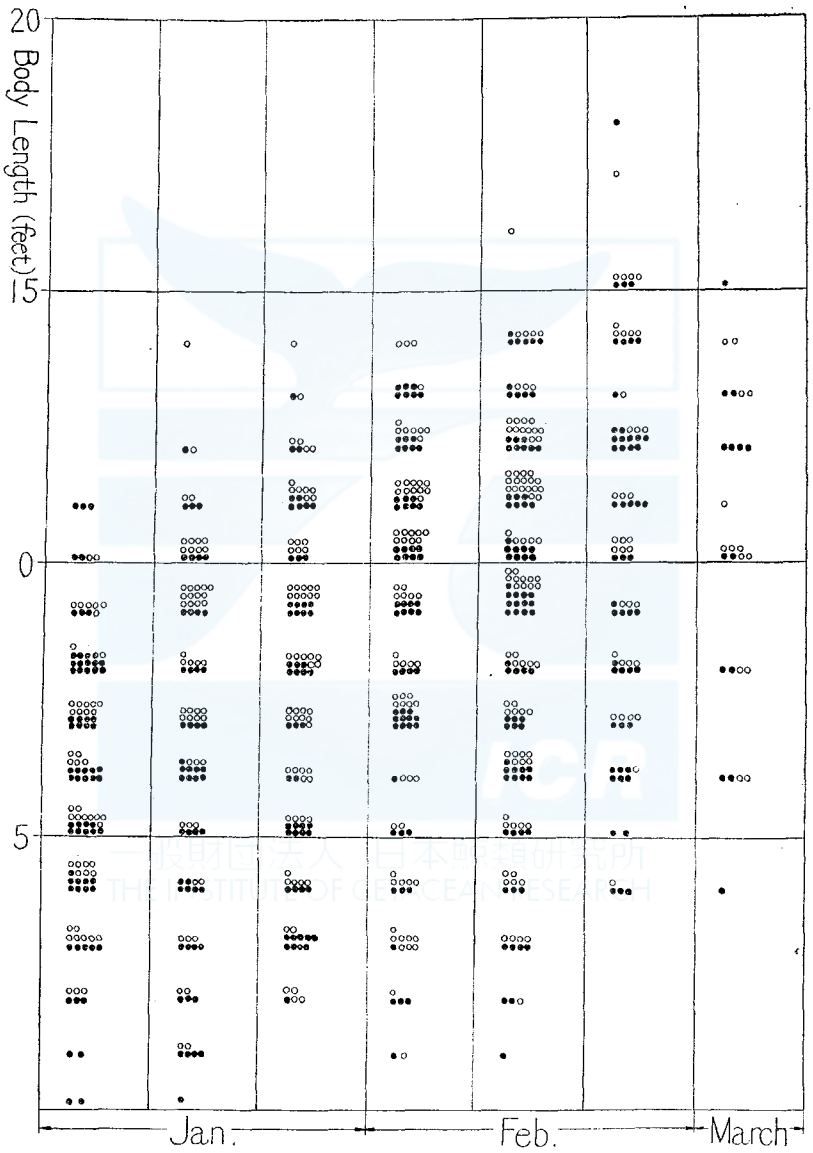


Fig. 21. The relations between the size of foetuses and the size of the functional corpora lutea of the mother whale.

21-1. Blue whale

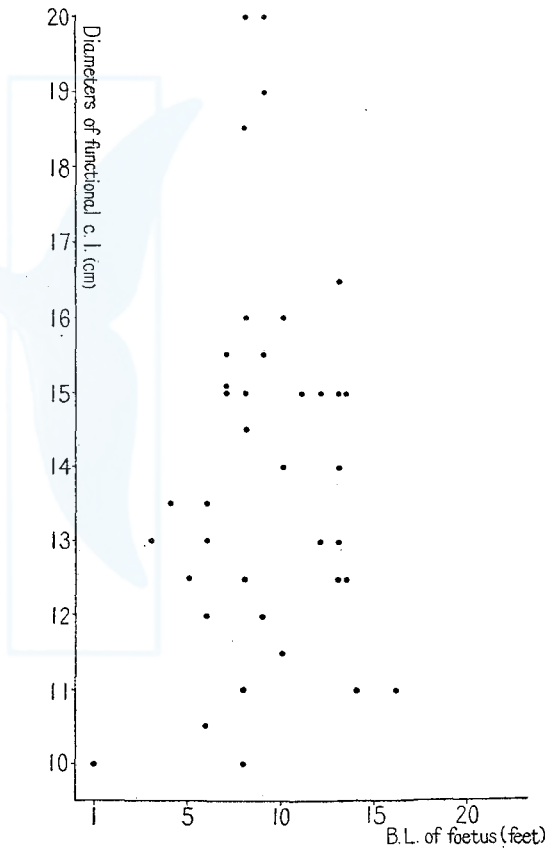
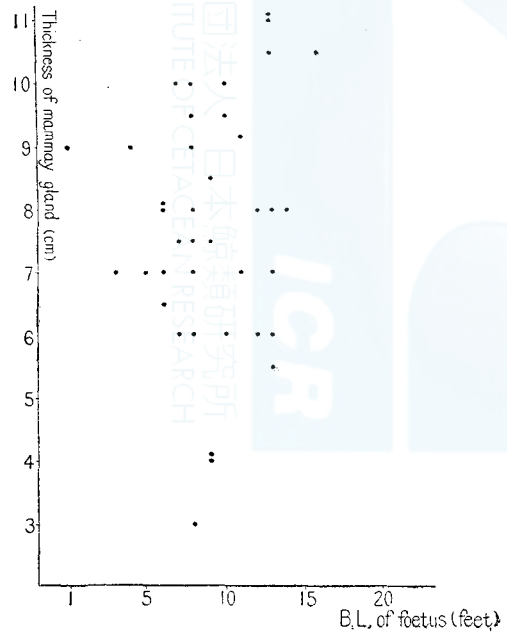
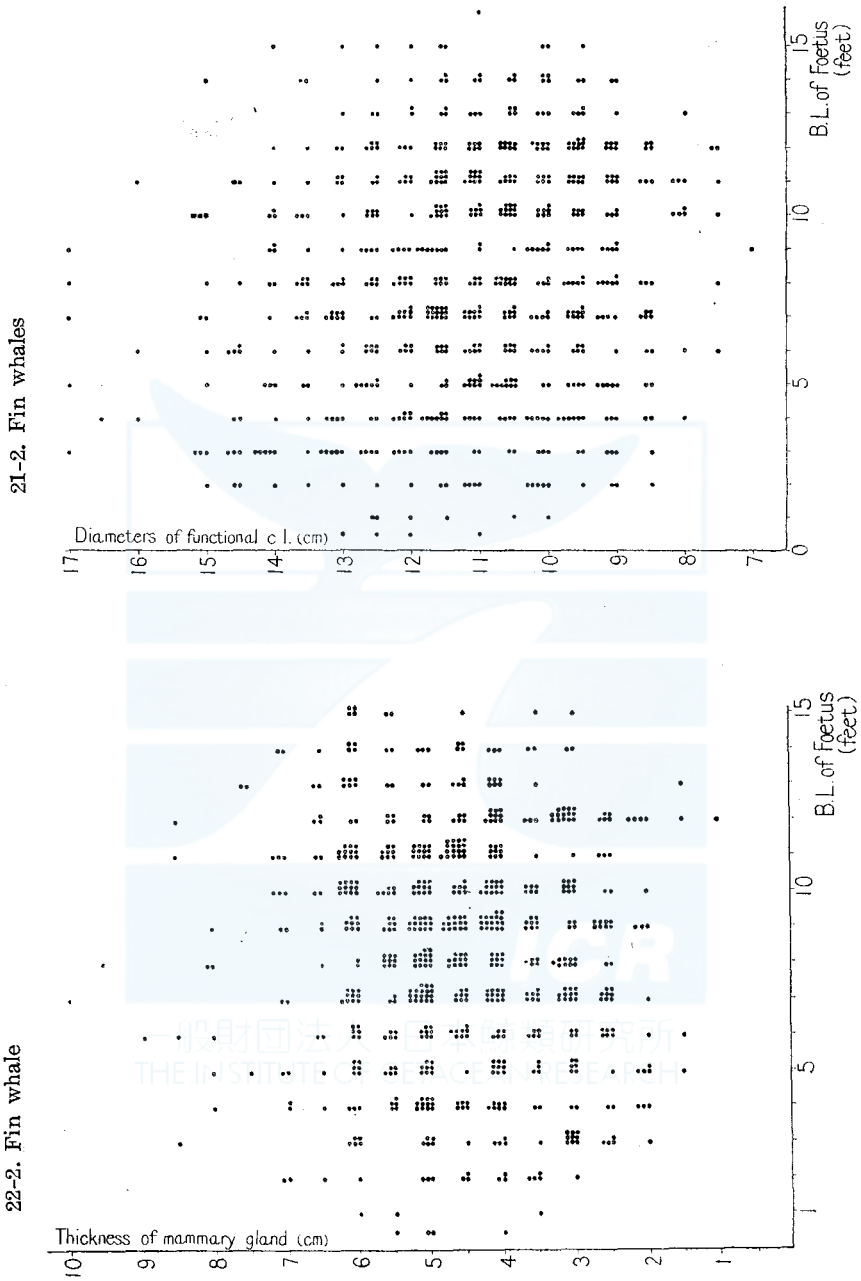


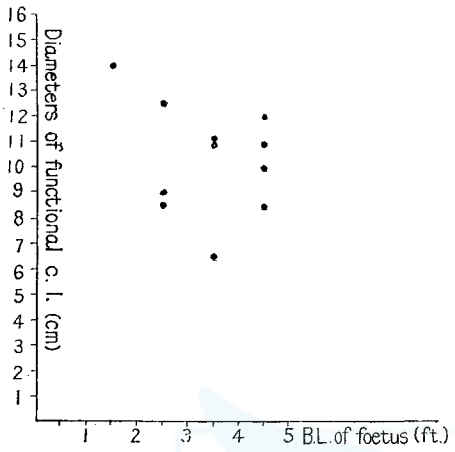
Fig. 22. The relations between the size of foetuses and the thickness of the mammary gland.

22-1. Blue whale

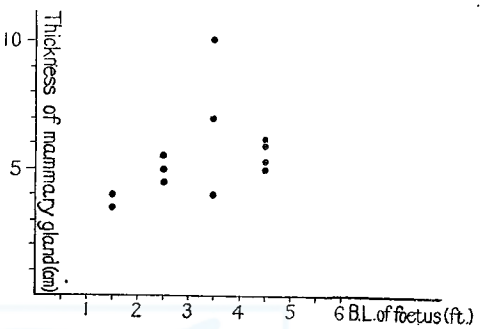



21-2. Fin whales
Diameters of functional c l. (cm)
B.L. of Foetus (feet)
22-2. Fin whale
Thickness of mammary gland (cm)
B.L. of Foetus (feet)

21-3. Humpback whale



22-3. Humpback whale



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Appendix

Table 1. The organization of fhe Japanese Antarctic whaling fleets

Tonan-maru fleets				Nisshin-maru fleet				Baikal-maru fleet			
Name of boat	Total tonnage	Engines		Name of boats	Total tonnage	Engines		Name of boats	Total tonnage	Engines	
		sp.	Hp.			sp.	Hp.			sp.	Hp.
Tonan-maru	19,320.38	turbin	8,000	Nisshin-maru	16,777.09	diesel	8,000	Baikal-maru	4,744.43	diesel	3,200
Koyo-maru	366.92	diesel	1,800	Seki-maru	365.02	,,	1,600	No. 1 Kyo-maru	285.30	,,	950
No. 2 Koyo-maru	367.88	,,	1,800	No. 7 Seki-maru	306.56	,,	1,600	No. 3 Kyo-maru	370.25	,,	1,800
No. 3 ,,	367.88	,,	1,800	No. 11 ,,	473.32	,,	2,000	No. 5 Kyo-maru	373.72	,,	1,800
Konan-maru	379.76	,,	1,600	No. 2 Fumi-maru	304.00	,,	1,600	No. 6 Kyo-maru	374.65	,,	1,800
No. 2 Konan-maru	378.33	diesel	1,600	No. 3 Fumi-maru	312.45	diesel	1,600	No. 15 Kyo-maru	334·07	recip.	1,400
No. 3 ,,	417.43	,,	1,800	No. 6 ,,	304.00	,,	1,600	Nichinan-maru	5,296.28	turbin	4,000
No. 5 ,,	434.29	,,	1,800	No. 7 ,,	451.35	,,	2,000				
No. 6 ,,	433.83	,,	1,800	No. 8 ,,	451.35	,,	2,000				
No. 8 Syonan-maru	355.79	recip.	1,000	No. 11 ,,	473.58	,,	2,000				
No. 11 Syonan-maru	354.25	recip.	1,000	No. 12 Fumi-maru	473.18	diesel	2,000				
No. 2 Takunan-maru	343.46	,,	990	Tenyo-maru	11,224.20	turbin	5,000				
No. 3 ,,	343.46	,,	990	No. 2 Tenyo-maru	10,619.69	diesel	5,400				
No. 6 ,,	345.96	,,	990	No. 3 ,,	3,689.31	,,	2,250				
Shinano-maru	538.59	diesel	750	Banshu-maru	983.35	,,	710				
No. 3 Kyo-maru	370.25	diesel	1,800	No. 32 Banshu-maru	782.21	diesel	630				
No. 5 ,,	373.72	,,	1,800	No. 35 ,,	991.81	,,	630				
Settsu-maru	9,329.06	,,	3,200	No. 36 ,,	998.71	,,	490				
Kaiko-maru	2,940.67	,,	1,440	Kinjo-maru	11,108.88	,,	3,400				
Chikuzen-maru	1,161.53	,,	880	No. 3 Seki-maru	307.02	,,	1,400				
Sagami-maru	999.72	diesel	880	No. 5 Fumi-maru	384.80	diesel	1,600				
Tone-maru	535.05	,,	550	No. 8 Seki-maru	308.18	,,	1,600				
Tatsuta-maru	543.90	,,	550	No. 38 Banshu-maru	998.71	,,	490				
Gyokuei-maru	10,419.42	,,	4,000			,,					

Table 2. Production, oil and others
(unit: metric tons, but kg in liver oil; raw material)

(i) Sperm whale

Production / Heet	Sperm oil	Frozen materia			Satted material							Total	Liver oil
		Meat	Blubber	Liver	Tail flukes	Blubber for leather	Main blubber	Spermaceti case	Gelatine	Fibrous head tissue	Others		
Tonan-maru fl.	3,620.0				89.0	29.5			36.5	9.5		3,784.5	7,390
Nisshin-maru fl.	3,483.0				85.0	166.0		120.0				3,854.0	5,100
Baikal-maru fl.	1,810.0	71.0	222.0	88.0	71.0	128.0	40	146.0			3	2,579.0	
Total	8,913.0	71.0	222.0	88.0	245.0	323.5	40	266.0	36.5	9.5	3	10,217.5	12,490

(ii) Whale-bone whale

Fleets		Tonnan-maru fl.				Nisshin-maru fl.				Total			
Sp. of whales		B	F	H	Total	B	F	H	Total	B	F	H	Total
Nos. of treated		115	1,159	37	1,311	116	1,438		1,554	231	2,597	37	2,865
B. W. U.				709.3				777.0				1,486.3	
Whale oil				16,248.0				18,950.0				35,198.0	
Frozen	Meat			7,198.7				12,577.5				19,776.2	
	Sunoko[1]							458.0				458.0	
	Others			55.9				74.5				130.4	
Salted	Meat			832.5				1,227.0				2,059.5	
	Sunoko			549.5				668.0				1,217.5	
	Unesu[2]							2,703.0				2,703.0	
	Une[3]			1,147.2				270.0				1,417.2	
	Oba			244.0				258.0				502.0	
	Others			7.6				47.5				55.1	
Total				26,283.4				37,233.5				63,516.9	
Liver oil				18,112				23,600				41,712	

Note: 1) Layer of connective tissues covering the meat of the ventral grooves
2) Ventral grooves with layer of connective tissues
3) Ventral grooves

Table 3. Catches and the production by fleets in 1951-52 Antarctic Whaling

Name of fleet by country	nos. of catch						Production (Barrel)			nos. of factory ships	nos. of catcher boats	nos. of. treated B.W.U.	whale oil productio per B.W.U.
	Blue	Fin.	Hump.	Sei	Sperm	Total	whale oil	sperm oil	Total				
Norway													
Antarctic	78	956	—	18	91	1,143	77,250	5,050	82,300	1	12	553.2	139.6
Kosmos III	422	1,031	5	—	234	1,692	129,250	11,550	140,800	1	15	933.0	138.5
Kosmos IV	123	1,901	31	—	375	2,430	140,900	18,244	159,144	1	15	1,074.4	131.1
Norhval	343	1,076	1	—	360	1,780	113,500	17,800	131,300	1	15	877.4	129.4
Pelagos	128	918	222	—	141	1,409	83,329	7,000	90,329	1	12	667.4	124.9
Sir J.C. Ross	58	1,245	2	1	116	1,422	97,500	6,240	103,740	1	14	677.5	143.9
Suderoy	304	492	—	—	121	917	68,500	6,020	74,520	1	9	551.0	124.3
Thorshammea	205	208	359	—	321	1,093	56,000	16,000	72,000	1	12	445.8	125.6
Thorshavet	329	521	48	—	398	1,296	82,648	21,721	104,369	1	14	607.7	136.0
Thorshovdi	101	1,343	—	2	135	1,581	118,124	7,245	125,369	1	14	766.3	154.1
United Kingdom													
Balaena	601	1,066	43	—	324	2,034	143,700	16,300	160,000	1	18	1,136.9	126.4
Southern Harvester	104	1,430	—	7	418	1,959	117,950	23,990	141,940	1	14	809.2	145.8
Southern Venturer	444	649	402	—	468	1,963	119,006	25,526	144,532	1	15	923.4	128.9
Union of South Africa													
Abraham Larsen	613	1,511	8	—	362	2,494	164,193	19,837	184,030	1	16	1,358.2	120.9
Netherlands													
Willem Barendsz	425	717	150	—	357	1,650	93,000	17,300	110,300	1	12	833.1	111.6
Panama													
Olympic Challenger	424	900	62	1	21	1,408	95,946	1,127	97,073	1	16	889.1	107.9
Japan													
Nisshin Maru	116	1,439	—	—	377	1,932	111,471	20,488	131,959	1	14	834.0	133.7
Tonan Maru	115	1,163	37	—	362	1,677	95,576	21,294	116,870	1	13	708.8	134.8
Baikal Maru	—	—	—	—	222	222	—	10,647	10,647	1	5	—	—
U.S.S.R.													
Slava	191	1,951	175	3	139	2,459	140,294	7,353	147,647	1	15	1,229.0	114.2
Total	5,124	20,518	1,545	32	5,342	32,561	2,048,137	280,730	2,328,869	20	270	15,875.3	129.0

Table 4. Composition of whales

1. Blue whale, whole season.

B.L. \ Sex	Male			Female				
					Mat.			
	Imm.	Mat.	Total	Imm.	Pre.	Rest.	Total	Total
67	2		2					2
8	2		2					2
9	0		0					0
70	6		6	4			4	10
1	8	1	9	8			8	17
2	4	4	8	4			4	12
3	4	2	6	11			11	17
4	3	2	5	7			7	12
5	7	4	11	6	1		7	18
6	0	11	11	3	0		3	14
7	2	8	10	0	2	1	3	13
8		17	17	1	1	0	2	19
9		8	8	3	0	1	4	12
80		6	6	2	4	0	6	12
1		7	7	1	4	1	6	13
2		11	11		9	1	10	21
3		7	7		4	1	5	12
4		1	1		5	1	6	7
5		4	4		2	0	2	6
6		2	2		3	1	4	6
7					1	0	1	1
8					2	0	2	2
9					1	0	1	1
90					1	1	2	2
Total	38	95	133	50	40	8	98	231
a.v. B.L.			76.9				78.2	77.5
Sex ratio			57.6				42.4	100

Blue Whale, January.

B.L. \ Sex	Male			Female				
					Mat.			
	Imm.	Mat.	Total	Imm.	Pre.	Rest.	Total	Total
67	2		2					2
8	1		1					1
9	0		0					0
70	2		2	3			3	5
1	3		3	5			5	8
2	2	3	5	3			3	8
3	2	0	2	7			7	9
4	2	0	2	5			5	7
5	6	3	9	4	1		5	14
6	0	6	6	0	0		0	6
7	2	6	8	0	0	1	1	9
8		0	10	1	1	0	2	12
9		5	5	2	0	1	3	8
80		5	5	1	1	0	2	7
1		5	5		2	1	3	8
2		5	5		4	0	4	9
3		4	4		2	1	3	7
4		0	0		4	1	5	5
5		2	2		2		2	4
6					2		2	2
7					0		0	0
8					1		1	1
9								
90								
Total	22	54	76	31	20	5	56	132
av. B. L.			76.9				77.4	77.2
Sex ratio			57.6				42.4	100

by the body length.

Blue Whale, February

B.L. \ Sex	Male			Female				
					Mat.			
	Imm.	Mat.	Total	Imm.	Pre.	Rest.	Total	Total
67								
8	1		1					1
9	0		0					0
70	2		2	1			1	3
1	4	1	5	3			3	8
2	2	1	3	1			1	4
3	1	2	3	4			4	7
4	1	1	2	2			2	4
5	1	1	2	1			1	3
6		4	4	2			2	6
7		2	2	0	1		1	3
8		6	6	0	0		0	6
9		3	3	1	0		1	4
80		0	0	1	3		4	4
1		2	2	1	2		3	5
2		6	6		4	1	5	11
3		1	1		1	0	1	2
4		1	1		1	0	1	2
5		2	2		0	0	0	2
6		1	1		1	1	2	3
7					1		1	1
8					1		1	1
9					1		1	1
90					1		1	1
Total	12	34	46	17	17	2	36	82
av. B. L.			76.9				79.0	77.8
Sex ratio			56.1				43.9	100

Blue Whale, March

B.L. \ Sex	Male			Female				
					Mat.			
	Imm.	Mat.	Total	Imm.	Pre.	Rest.	Total	Total
67								
8								
9								
70	2		2					2
1	1		1					1
2	0		0					0
3	1		1					1
4		1	1					1
5		0	0	1			1	1
6		1	1	1			1	2
7		0	0		1		1	1
8		1	1		0		0	1
9		0	0		0		0	0
80		1	1		0		0	1
1		0	0		0		0	0
2		0	0		1		1	1
3		2	2		1		1	3
4		0	0				0	0
5		0	0				0	0
6		1	1				0	1
7							0	0
8							0	0
9							0	0
90						1	1	1
Total	4	7	11	2	3	1	6	17
a.v. B.L.			76.7				80.5	78.1
Sex ratio			64.8				35.2	100

Table 4. (cont.)

2. Fin whale, whole season.

B.L. \ Sex	Male				Female						
						Mat.					
	Imm.	Mat.	u.k.	Total	Imm.	Pre.	Rest.	Lact.	u.k.	Total	Total
55	1			1							1
6	0			0							0
7	1			1							1
8	1			1							1
9	0			0	1					1	1
60	6	5		11	8					8	19
1	8	13		21	15		1			16	37
2	13	36		49	21	3	1			25	74
3	14	74		88	28	4	0			32	120
4	7	149	1	157	19	11	4			34	191
5	8	208	2	218	28	19	2		1	50	268
6	3	255	4	262	26	23	9		0	58	320
7	3	224	0	227	17	41	13		0	71	298
8		175	0	175	4	72	13		1	90	265
9		117	1	118	6	82	19	1	1	109	227
70		73		73	3	101	26	0	0	130	203
1		32		32	2	115	30	1	1	149	181
2		10		10		113	21		1	135	145
3		2		2		88	25		0	113	115
4		0		0		45	22		1	68	68
5		0		0		26	9			35	35
6		1		1		13	4			17	18
7						3	2			5	5
78						3	1			4	4
Total	65	1374	8	1447	178	762	202	2	6	1150	2597
a.v. B.L.				66.2						69.6	67.7
Sex ratio				55.7						44.3	100

Fin whale, January.

B.L. \ Sex	Male				Female						
						Mat.					
	Imm.	Mat.	u.k.	Total	Imm.	Pre.	Rest.	Lact.	u.k.	Total	Total
55											
6											
7	1			1							1
8	0			0							0
9	0			0	1					1	1
60	3	1		4	3					3	7
1	3	2		5	5					5	10
2	6	8		14	2	2				4	18
3	6	24		30	12	3				15	45
4	1	60		61	4	7	3			14	75
5	4	84	2	90	9	9	0			18	108
6	1	89	2	92	10	8	3			21	113
7	2	82		84	5	21	4			30	114
8		81		81	4	27	3			34	115
9		58		58	2	33	5		1	41	99
70		32		32	2	36	10			48	80
1		22		22	1	49	11			61	83
2		4		4		58	7			65	69
3		2		2		41	11			52	54
4		0		0		21	11			32	32
5		0		0		15	6			21	21
6		1		1		7	2			9	10
7						1	2			3	3
78						1	1			2	2
Total	27	550	4	581	60	339	79	0	1	479	1060
a.v. B.L.				66.5						70.0	68.1
Sex ratio				54,8						45.2	100

Table 4. (cont.)

Fin whale, February.

B.L. \ Sex.	Male				Female						
						Mat.					
	Imm.	Mat.	u.k.	Total	Imm.	Pre.	Rest.	Lact.	u.k.	Total	Total
55	1			1							1
6	0			0							0
7	0			0							0
8	1			1							1
9	0			0							0
60	3	4		7	4					4	11
1	4	7		11	9		1			10	21
2	6	21		27	16	1	1			18	45
3	8	46		54	14	1	0			15	69
4	5	85		90	13	4	1			18	108
5	4	108		112	17	10	1		1	29	141
6	2	150	2	154	15	13	5		0	33	187
7		127		127	12	20	8		0	40	167
8		77		77	0	44	9		1	54	131
9		48		48	4	47	11	1	0	63	111
70		36		36	1	59	13	0	0	73	109
1		9		9	1	56	16	1	0	74	83
2		6		6		52	13		1	66	72
3						42	13		0	55	55
4						22	9		1	32	32
5						11	3			14	14
6						6	2			8	8
7						2				2	2
8						2				2	2
Total	34	724	2	760	106	392	610	2	4	160	1370
a. v. B.L.				66.0						69.3	68.3
Sex ratio				55.5						44.5	100

Fin whale, March.

B.L. \ Sex.	male				Female						
						Mat.					
	Imm.	Mat.	u.k.	Total	Imm.	Pre.	Rest.	Lact.	u.k.	Total	Total
55											
6											
7											
8											
9											
60					1					1	1
1	1	4		5	1					1	6
2	1	7		8	3					3	11
3	0	4		4	2					2	6
4	1	4	1	6	2					2	8
5	0	16	0	16	2		1			3	19
6	0	16	0	16	1	2	1			4	20
7	1	15	0	16		0	1			1	17
8		17	0	17		1	1			2	19
9		11	1	12		2	3			5	17
70		5		5		6	3			9	14
1		1		1		10	3		1	14	15
2						3	1			4	4
3						5	1			6	6
4						2	2			4	4
5											
6											
7											
8											
Total	4	100	2	106	12	31	17	0	1	61	167
a. v. B.L.				66.1						69.1	67.4
Sex ratio				63.5						36.5	100

Table 4. (cont.)

3. Humpback whale.

B.L. \ Sex.	Male			Female				Total
					Mat.			
	Imm.	Mat.	Total	Imm.	Pre.	Rest.	Total	
36				1			1	1
7				0				0
8	1	2	3	3	1		4	7
9		2	2	1			1	3
40		3	3		1		1	4
1		1	1		2		2	3
2		2	2		1		1	3
3		0	0		2	1	3	3
4		3	3		2	1	3	6
5		1	1		0	1	1	2
6		1	1		3	0	3	4
7						0	0	0
48						1	1	1
Total	1	15	16	5	12	4	21	37
av. B.L.			41.3				42.0	41.7
Sex. ratio			43.2				56.8	100

4. Sperm whale, by season.

B.L. \ Sea.	Whole season
40	1
1	3
2	12
3	12
4	40
5	43
6	56
7	81
8	101
9	135
50	140
1	118
2	105
3	72
4	27
5	10
56	5
Total	961
av. B.L.	49.2

B.L. \ Sea.	Nov.	Dec.	Jan.	Feb.
40				1
1	1	1		2
2	7	3		4
3	4	3	1	12
4	17	11	0	6
5	17	19	1	6
6	20	25	5	14
7	16	48	3	11
8	31	54	5	14
9	24	88	9	13
50	32	86	9	7
1	23	84	4	3
2	15	81	6	2
3	9	59	2	
4	4	23		
5		10		
56		5		
Total	220	600	45	96
av. .BL.	48.2	49.9	49.2	47.4

5. Sperm whale, by area.

B.L. \ Area	I	II	III	IV	V
40			1		
1		1	2		
2	5	4	2	1	
3	4	2	5	0	1
4	15	11	13	1	0
5	16	7	11	9	0
6	19	7	16	10	4
7	18	12	27	21	3
8	25	23	26	21	6
9	21	33	27	45	9
50	18	29	31	48	14
1	14	20	25	46	13
2	15	12	15	49	14
3	11	5	12	36	8
4	2	3	6	15	1
5	1		1	6	12
6	1			4	
Total	185	169	220	312	75
av. B.L.	48.1	48.7	48.6	50.4	50.3

Table 5. Whales caught by species, sex and groups of size.

Blue whale

Group \ Nos. and the rate / Year	Numbers						Ratio					
	1946 ~47	1947 ~48	1948 ~49	1949 ~50	1950 ~51	1951 ~52	1946 ~47	1947 ~48	1948 ~49	1949 ~50	1950 ~51	1951 ~52
Group 1 (und. 70 ft.)	23	9	5	1	6	14	3.3	1.3	0.8	0.1	2.2	6.0
,, 2 (71-85 ft.)	634	639	583	763	241	205	91.0	90.0	92.4	93.4	88.9	88.7
,, 3 (over 8 ft.)	33	62	43	53	24	12	4.8	8.7	6.8	6.5	8.9	5.3
Total	690	710	631	817	271	231	100.0	100.0	100.0	100.0	100.0	100.0
imm. (und. 73 ft.)	85	28	30	40	13	33	23.0	8.7	7.7	7.2	10.1	24.8
Male mat. (over 74 ft.)	284	310	361	517	116	100	77.0	91.3	92.3	92.8	89.9	75.2
total	369	338	391	557	129	133	100.0	100.0	100.0	100.0	100.0	100.0
imm. (und. 77 ft.)	131	71	44	57	51	47	40.8	19.1	18.3	21.9	35.9	48.0
Female mat. (over 78 ft.)	190	301	196	203	91	51	59.2	80.9	81.7	78.1	64.1	52.0
total	321	372	240	260	142	98	100.0	100.0	100.0	100.0	100.0	100.0

Fin whale

Group \ Nos. and the rate / Year	Numbers						Ratio					
	1946 ~47	1947 ~48	1948 ~49	1949 ~50	1950 ~51	1951 ~52	1946 ~47	1947 ~48	1948 ~49	1949 ~50	1950 ~51	1951 ~52
Group 1 (und. 55 ft.)	2	0	0	0	2	1	0.4	0.0	0.0	0.0	0.1	0.0
,, 2 (56-65 ft.)	217	110	237	283	556	712	45.8	18.1	23.4	26.8	27.1	27.4
,, 3 (over 66 ft.)	255	498	775	773	1492	1884	53.8	81.9	76.6	73.2	72.8	72.6
Total	474	608	1012	1056	2050	2597	100.0	100.0	100.0	100.0	100.0	100.0
imm. (und. 62 ft.)	54	6	43	36	117	84	21.6	2.3	8.8	5.8	10.7	5.8
Male mat. (over 63 ft.)	194	257	445	583	980	1363	78.4	97.7	91.2	94.2	89.3	94.2
total	250	263	488	619	1097	1447	100.0	100.0	100.0	100.0	100.0	100.0
imm. (und. 64 ft,)	72	13	39	33	104	116	32.1	3.8	7.4	7.6	10.9	10.1
Female mat. (over 65 ft.)	152	332	485	404	849	1034	67.9	96.2	92.6	92.4	89.1	89.9
total	224	345	524	437	953	1150	100.0	100.0	100.0	100.0	100.0	100.0

Humpback whale

Group \ Nos. and the rate / Yera	Numbers			Ratio		
	1949~50	1950~51	1951~52	1949~50	1950~51	1951~52
Group 1 (und. 35 ft.)	0	0	0	0.0	0.0	0.0
,, 2 (36-45 ft.)	57	7	32	85.1	77.8	86.3
,, 3 (over 46 ft.)	10	2	5	14.9	22.2	13.7
Total	67	9	37	100.0	100.0	100.0
imm. (und. 38 ft.)	0	0	3	0.0	0.0	18.7
Male mat. (over 39 ft.)	24	2	13	100.0	100.0	81.3
total	24	2	16	100.0	100.0	100.0
imm. (und. 40 ft.)	8	1	7	18.6	14.3	33.3
Female mat. (over 41 ft.)	35	6	14	81.4	85.7	66.7
total	43	7	21	100.0	100.0	100.0

Table 6. Rate of pregnancy, by the season.

1. Blue whale.

Year		December		January		February		March		Total
		Former half	Latter half	Former half	Latter half	Former half	Latter half	Former 1st D.	Latter half	
av. in 1946~50	(1) Mat. Famale	53	195	150	158	117	118	46	9	846
	(2) Preg. 〃	35	120	79	82	64	52	14	4	450
	(3) Rate of pre.	66.0	61.5	52.7	51.9	54.7	44.1	30.4	44.4	53.2
1950~51	(1)		10	10	24	16	9	11		80
	(2)		8	3	11	6	3	7		38
	(3)		80.0	30.0	45.8	37.5	33.3	63.6		47.5
1951~52	(1)			25		19		4		48
	(2)			20		17		3		40
	(3)			80.0		89.5		75.0		83.3

2. Fin whale

Year		December			January			February			March			Total
		Form. half		Latter half	Form. half		Latter half	Form. half		Latter half	Form. half		Latter half	
		1st D.	2nd D.	3rd D.	1st D.	2nd D.	3rd D.	1st D.	2nd D.	3rd D.	1st D.	2nd D.	3rd D.	
av. in 1946~50	(1)	10		106	201		286	409		153	127			1292
	(2)	4		67	131		176	151		48	41			618
	(3)	40.0		63.2	65.2		61.5	36.9		31.4	32.3			47.8
1950~51	(1)			142	150		135	145		122	93			787
	(2)			112	109		80	104		72	48			525
	(3)			78.9	72.7		59.3	71.7		59.0	51.6			66.7
1951~52	(1)				135	130	153	167	219	114	48			966
	(2)				118	96	125	133	171	88	31			762
	(3)				87.4	73.8	81.7	78.7	78.1	77.2	64.5			78.9

3. Humpback whale.

		December		January		Feb.	Total
		Former half	Latter half	Former half	Latter half	Former half	
1949~50	(1)		34	6			40
	(2)		31	6			37
	(3)		91.2	100.0			92.5
1950~51	(1)					6	6
	(2)					5	5
	(3)					83.3	83.3
1951~52	(1)					16	16
	(2)					12	12
	(3)					75.0	75.0