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REPORT 4

AN ANALYSIS OF RECENT CATCHES OF  
HUMPBACK WHALES FROM  
THE STOCKS IN GROUPS IV AND V

Prepared for the International Commission on Whaling

Marine Biological Laboratory  
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## SUMMARY

Recent catches (from 1949/50 to 1955/56) of humpback whales from the southern stocks known as Groups IV and V are analysed.

The composition of catches from the Group IV stock (Western Australia and Antarctic region between longitude 70°E. to 130°E.) progressively declined from 1949 to 1954. Following a reduction in the quotas allotted on the Western Australian coast, the composition of the 1955 and 1956 catches in this region improved very considerably. This was largely due to the more stringent selection of larger whales in those years. The catch of humpback whales from Antarctic Area IV in 1956 showed slight improvement in some (but not all) aspects.

In the Group V stock, (longitude 130°E. to 160°W.), the composition of catches on the eastern Australian coast was reasonably stable from 1952 to 1953, but showed some less favourable trends in 1954. The improved composition of catches on the eastern Australian coast in 1955 and 1956, following immediately upon the reduction of Western Australian quotas, might indicate that the cut in the west stimulated more careful selection on the east coast.

In contrast, the composition of catches in Antarctic Area V declined in 1955 and 1956. Assuming the selection factor had remained at about the same level, this suggests a slight decline in the condition of the Group V stock.

The analyses of the material available from recent catches in the Groups IV and V stocks of humpback whales suggest that the stocks will not withstand continuous fishing above the present (1956) intensity.

In a comparison of humpback whaling in Antarctic and temperate waters; it appears that better utilization and management of these stocks is at present possible in temperate rather than Antarctic waters.

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AN ANALYSIS OF RECENT CATCHES OF HUMPBACK WHALES

FROM THE STOCKS IN GROUPS IV AND V

I. INTRODUCTION

The Group IV stock of humpback whales is that fished in Antarctic waters between longitudes 70°E. and 130°E. during the southern summer, and on the Western Australian coast in the winter.

In the Antarctic the open season for the taking of humpback whales is confined to the first four days of February in each year. This has been done in order to restrict the total catch of humpback whales from Antarctic waters to approximately 1250 per year. In the 1956 season a total of 1432 humpback whales was taken in this four day season in the Antarctic.

On the Western Australian coast, the three stations which operated up to 1955 (at Point Cloates, Carnarvon, and Albany) were allotted separate annual quotas. Until 1954, the annual quotas were as follows - 1951, 1250; 1952, 1250; 1953, 1300; 1954, 1320. Prior to the 1955 season the quotas at the two larger stations (at Point Cloates and Carnarvon) were reduced by 100 humpbacks each, so that the total catch allowed on the Western Australian coast in 1955 and 1956 was 1120 humpback whales. This reduction was made because of evidence of some deterioration in the Group IV stock.

In 1956 the station at Carnarvon, previously operated by the Australian Whaling Commission, was sold to the Norwest Whaling Company. This company did not operate its station at Point Cloates (22°35'S, 133°E.) during the 1956 season, but combined the quotas of the two stations (each of 500 humpback whales) and concentrated catching vessels and equipment at Carnarvon.

The Group V stock of humpback whales is that fished in Antarctic waters between longitudes 130°E. and 160°W. during the southern summer, and on the coasts of New Zealand, eastern Australia, and Norfolk Island in the winter.

The two whaling stations on the eastern coast of Australia (at Tangalooma and Byron Bay) have been allotted annual quotas of 600 and 120 humpback whales respectively.

The small whaling station on Norfolk Island, some 800 miles east of Australia, was opened in 1956. A quota of 150 humpback whales was granted to this station for its first season, and in subsequent seasons 120 humpbacks or such other number as the Minister may determine in the light of scientific evidence regarding the stocks of whales and the need for the conservation of resources.

The five whaling stations operated by Australia filled their quotas in the 1956 season. The individual catches at each station were:-

#### Western Coast

Carnarvon (24°53'S, 113°38'E.)	
Norwest Whaling Company	1000 humpback whales
Albany (35°05'S, 117°56'E.)	(119 humpback whales
Cheynes Beach Whaling Company	( 1 fin whale

#### Eastern Coast

Tangalooma (27°11½'S, 153°23½'E.)	
Whale Products Pty. Limited	600 humpback whales
Byron Bay (28°37½'S, 153°38'E.)	120 humpback whales
Norfolk Is. and Byron Bay Whaling Co. Ltd.	

#### East of Australia

Norfolk Island (25°S, 167°85'E.)	150 humpback whales
Norfolk Is. and Byron Bay Whaling Co. Ltd.	

The analysis of the catch returns of these whaling stations (as well as those of the station at Point Cloates) up to the end of the 1956 season, are presented in this report. Catches of humpback whales from Areas IV and V of the Antarctic from 1950 to 1956 are also analysed, so that the effects of the total fishing effort upon the two populations may be examined.

## II. GROUP IV

### (a) General

The closing of the station at Point Cloates and the transfer of its humpback quota, catching vessels, and certain machinery to the Station at Carnarvon, has meant that in the 1956 season there has been some change in the fishing effort on the Western Australian coast. This must be considered when studying the results of that season.

The increased capacity of the Carnarvon factory enabled that station to process a greater number of whales per day (Fig.1) in 1956 than in previous years. Whilst the average number of whales taken per day increased over previous years the average rate per catcher day compares with the 1955 figure for the Point Cloates Station. This is demonstrated in Table I where the average catch per catcher day at Carnarvon and Point Cloates is shown for each season from 1950.

The gunners of the catchers operating from Carnarvon in 1956 were required as in 1955 to select carefully the largest whales available. The greater concentration of catching power might be expected to allow the selection of larger whales to be applied more effectively.

#### (b) Sex Ratio

Table 2 shows the numbers and percentages of females in the seasonal catches of humpback whales for individual coast stations, the combined catches of Western Australian coast stations, and for Antarctic Area IV, from 1949 to 1956.

In a comparison between the two areas, it is seen that in earlier seasons (1949-51), females dominated catches in Antarctic Area IV, while males were predominant in catches from the warmer waters of the Western Australian coast. This has been accepted as the normal condition found in stocks of humpback whales which have not been over exploited.

In more recent years (1952-1955), the proportion of females in the catches declined in Antarctic Area IV, and rose on the Western Australian coast, so that in both areas the catches contained almost the same numbers of males and females. Whatever the reason for the marked disparity normally found between the sex ratios in catches from Antarctic and temperate waters, its disappearance in recent years within the Group IV stock suggests that this population has been adversely affected.

In 1956 the proportion of females in the catch has increased in Antarctic Area IV and decreased in the total catch on the Western Australian coast.

The rise in the percentage of females in the 1956 catch from Antarctic Area IV is difficult to interpret on the information available. It might be suggested that it resulted from a more careful selection of larger individuals, but this is not confirmed by an examination of the catch.

The fall in the percentage of females taken on the Western Australian coast during 1956 is simply due to the change in the catching conditions in that year. In 1956 the quota previously taken at Point Cloates was transferred to Carnarvon (where the proportion of females has always been lower than in catches at Point Cloates, as shown in Table 2). At Carnarvon 1000 humpback whales were taken in 1956 compared with 500 humpbacks in 1955. This extended the catching period in 1956 for four weeks longer than in 1955, and in this month (September) the proportion of females in that region is always low. This is evident in Figure 2 which shows the percentages of females in weekly catches at Carnarvon during 1955 and 1956. Over the same period of operations in these years, the proportions of females were almost identical.

### (c) Mean Lengths

Table 3 lists the mean lengths of males and females for the annual catches of individual and combined stations in the Western Australian coast, as well as those for Antarctic Area IV from the 1949/50 season to that of 1955/56.

At Carnarvon, the mean lengths of both males and females were almost the same in 1956 as in 1955, considerably higher than in previous seasons. When the catches for all Western Australian coastal stations are combined, the mean lengths of both males and females were higher in 1956 than in 1955. This is mainly due to the fact that in the 1955 season when the Point Cloates station was operating, the mean lengths of both the males and females at that station were lower than at Carnarvon, tending to depress the mean lengths of the combined catch in that season.

Figure 3 shows the mean lengths of all males and females taken each year from 1949 on the Western Australian coast and from Antarctic Area IV. The total catches of humpback whales from this Group IV stock (Antarctic Area IV plus Western Australian coast) for each year from 1949 to 1956 are also set out in Figure 3. This figure shows that with a total catch exceeding 2,000 humpback whales both in 1951 and 1952 and only slightly lower catches in succeeding years, the mean lengths of males and females taken both on the Western Australian coast and in the Antarctic, declined from 1951 until 1954. As far as is known, the degree of selection of whales for killing was approximately constant over these years.

On the Western Australian coast, since the reduction of the quotas (prior to the 1955 season), the mean lengths of both males and females have returned to the levels of earlier

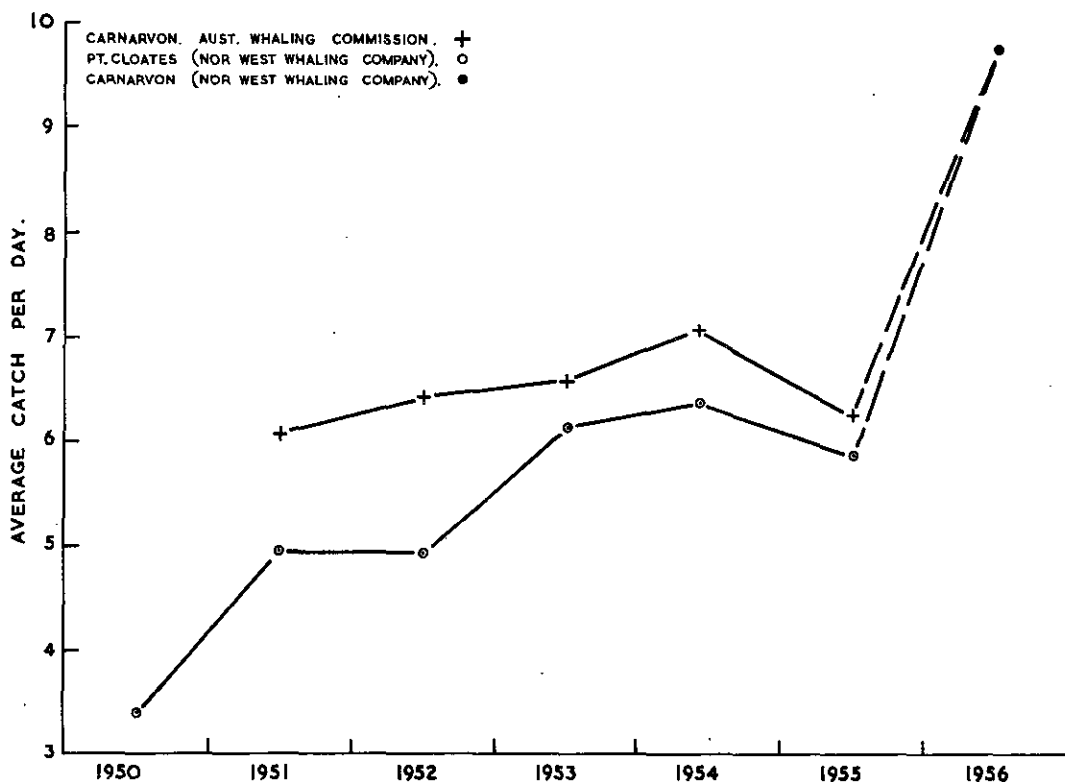


Fig. 1.- Average daily rates of catching at Carnarvon and Point Cloates for each season of operations.

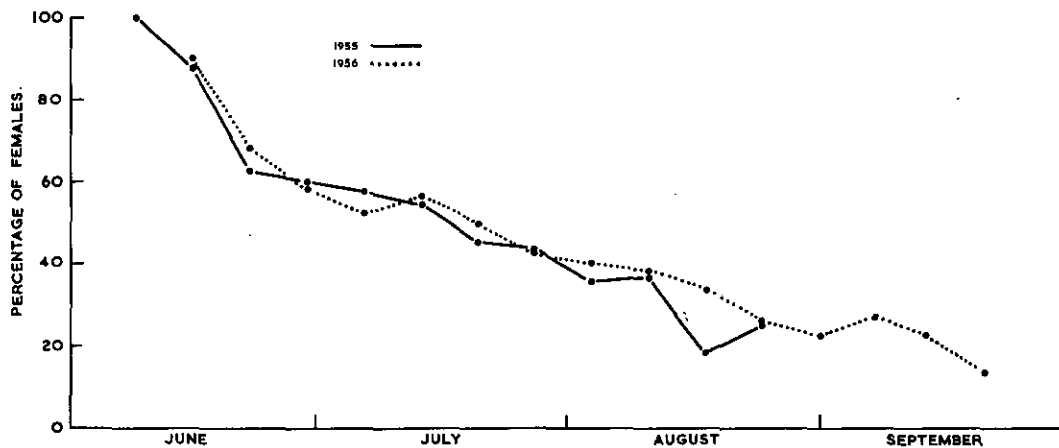


Fig. 2.- Percentages of females in the catches during each week of operation at Carnarvon in 1955 and 1956.



TABLE 1.WESTERN AUSTRALIAN COASTAVERAGE CATCHING RATES AT POINT CLOATES & CARNARVON  
IN SEASONAL CATCHESPOINT CLOATES

Year	Date of Opening	Date of Closing	Total days	Total catch	Avg.no. whales per day	No. catchers	No. of catcher days	Avg. no. of whales/catcher/day.
1950	June 29	Oct. 9	103	348	3.38	2 *	162	2.15
1951	June 21	Oct.14	116	574	4.95	3 *	211	2.72
1952	June 23	Oct. 9	109	536	4.92	3 *	232	2.31
1953	June 10	Sept.15	98	600	6.12	3 *	269	2.23
1954	June 14	Sept.15	94	600	6.38	3	282	2.13
1955	June 27	Sept.19	85	500	5.88	3	255	1.96

CARNARVON

1951	June 25	Oct. 9	107	650	6.07	3 *	286	2.27
1952	June 2	Sept.1	92	600	6.52	3 *	196	3.06
1953	June 8	Sept.6	91	600	6.59	3 *	143	4.19
1954	June 8	Aug.31	85	600	7.06	2	170	3.53
1955	June 8	Aug.26	80	500	6.25	2	160	3.12
1956	June 12	Sept.22	103	1000	9.71	5 *	508	1.97

\* One or more catchers not used for full season.

TABLE 2

HUMPBACK WHALES : GROUP IV  
SEX RATIO IN SEASONAL CATCHES  
1949 - 1956

## WESTERN AUSTRALIAN COAST

Station	Year	Total Catch	Sex unknown	No. Males	No. Females	% Females
Point Cloates	1949	190	-	135	55	28.9
	1950	348	1	212	135	38.8
	1951	574	4	386	184	32.3
	1952	536	5	283	248	46.7
	1953	600 +	5	306	289	48.2
	1954	600	11	271	318	54.0
	1955	500	2	228	270	54.2
Carnarvon	1951	650	3	521	126	19.5
	1952	600	-	360	240	40.0
	1953	600	-	367	233	38.8
	1954	600	-	353	247	41.2
	1955	500	-	272	228	45.6
	1956	1000	-	617	383	38.3
Albany	1952	51	-	23	28	54.9
	1953	100	-	53	47	47.0
	1954	120	-	68	52	43.3
	1955	120 *	-	80	40	33.3
	1956	119	-	59	60	50.43

+ Excluding three taken under special licence for research purposes.

\* Excluding six taken under special licence for research purposes.

TABLE 2 (Cont'd.)

HUMPBACK WHALES : GROUP IVSEX RATIO IN SEASONAL CATCHES1949 - 1956WESTERN AUSTRALIAN COAST

Station	Year	Total Catch	Sex unknown	No. Males	No. Females	% Females
All Western Australian Coast Stat- ions	1949	190	-	135	55	28.9
	1950	388	1	250	137	34.9
	1951	1224	7	907	310	25.5
	1952	1187	5	666	516	43.7
	1953	1300 +	5	726	569	43.9
	1954	1320	11	692	617	47.1
	1955	1120 *	2	580	538	48.1
	1956	1119	-	676	443	39.6

ANTARCTIC  
AREA IV

1949/50	779	-	354	425	54.6
1950/51	1112	-	468	644	57.9
1951/52	1127	-	546	581	51.6
1952/53	193	-	103	90	46.6
1953/54	258	-	133	125	48.4
1954/55	0	-	-	-	-
1955/56	824	-	320	504	61.2

+ Excluding three taken under special licence for research purposes.

\* Excluding six taken under special licence for research purposes.

TABLE 3HUMPBACK WHALES : GROUP IVMEAN LENGTHS (FEET) OF MALES AND FEMALES IN SEASONAL CATCHES1949 - 1956

## WESTERN AUSTRALIAN COAST

Station	Year	Males		Females	
		No.	Mean length	No.	Mean length
Point Cloates	1949	135	40.36	55	41.43
	1950	212	39.86	135	41.13
	1951	386	39.99	184	40.89
	1952	283	39.94	248	41.26
	1953	306	39.14	289	40.73
	1954	271	38.90	318	40.15
	1955	228	39.33	270	41.19
	1956				
Carnarvon	1950	38	41.50	2	41.00
	1951	521	40.16	126	40.92
	1952	360	39.44	240	41.25
	1953	367	38.90	233	40.68
	1954	353	38.54	247	40.75
	1955	272	40.37	228	42.45
	1956	617	40.52	383	42.38
	1957				
Albany	1952	23	40.74	28	43.17
	1953	53	39.52	47	40.25
	1954	68	39.43	52	41.44
	1955	80	39.73	40	41.14
	1956	59	38.53	60	41.95
	1957				

TABLE 3 (Cont'd.)

HUMPBACK WHALES : GROUP IVMEAN LENGTHS (FEET) OF MALES AND FEMALES IN SEASONAL CATCHES1949 - 1956WESTERN AUSTRALIAN COAST

Station	Year	Males		Females	
		No.	Mean length	No.	Mean length
All Western Australian Coast Stations	1949	135	40.36	55	41.43
	1950	250	40.10	137	41.15
	1951	907	40.11	310	40.92
	1952	666	39.48	516	41.35
	1953	726	39.05	569	40.67
	1954	692	38.77	617	40.50
	1955	580	39.88	538	41.72
	1956	676	40.35	443	42.32

ANTARCTIC AREA  
IV

1949/50	354	39.48	425	41.14
1950/51	468	39.44	644	41.22
1951/52	546	39.00	581	40.72
1952/53	103	38.11	90	40.26
1953/54	133	38.83	125	39.72
1954/55	0	-	-	-
1955/56	320	38.78	504	40.52

years; in fact the mean length of the females is now considerably higher than ever before. In contrast the mean lengths of males and females taken in Antarctic Area IV during 1956, while showing some increase in the case of the females, remained well below the means for earlier seasons (1949/50 and 1950/51). This emphasises that in the last two seasons there has generally been far more stringent selection of the larger humpback whales on the Western Australian coast.

#### (d) Length Frequencies

The length frequency distribution of the male humpback whales taken each year by combined stations on the Western Australian coast and also for corresponding seasons in Antarctic Area IV is shown in Table 4. From this table it can be seen that up to 1954 there has been a marked swing towards the lower length ranges in the catches both from the Western Australian coast and also from Antarctic Area IV.

In the catches of males on the Western Australian coast during 1955 and 1956, the length frequency distribution improved considerably, returning in 1956 to a similar distribution as in 1951. On the other hand, the length frequency distribution of males taken in Antarctic Area IV in 1956 showed little improvement upon that of the 1954 catch in Antarctic Area IV.

Table 5 shows the length frequency distribution of the females in the same seasons and regions as for the males in Table 4. In the case of the females (Table 5) there has also been a swing, up to 1954, towards the lower length ranges. However, with the females, although the numbers in the lower length groups increased, the drop in the higher length groups was less marked than in the males.

In 1955 and 1956, the length frequency distribution of the females taken on the Western Australian coast improved greatly, in fact in 1956 it was better than in any previous year. However, although there was some improvement in the length frequency distribution of females taken in Antarctic Area IV during 1956, the distribution remained lower than that in 1950 and 1951 catches in the same region.

#### (e) Sexually Immature Whales

It has been demonstrated that on the Western Australian coast male humpback whales reach puberty at a mean length of 36 feet 9 inches (Chittleborough 1955a) and the females reach puberty at a mean length of 38 feet 6 inches (Chittleborough 1955b). In this report it is proposed for convenience to

consider those males at or less than 36 feet 6 inches and females at or less than 38 feet 6 inches in length as sexually immature individuals. On this basis the percentages of immature males and females within a commercial catch may be calculated with reasonable accuracy.

Table 6 lists the numbers and percentages of immature males and females in the catches of individual and combined stations on the Western Australian coast, and in the catches from Antarctic Area IV, for each season of operation from 1949 to 1956. Figure 4 shows the percentages of immature males and females in the yearly catches of each sex from the Western Australian coast and from Antarctic Area IV.

In the case of males, the proportion of immature individuals in the Western Australian catch (Fig. 4) increased from 1949 to a maximum in 1954. After 1954 the quotas at the two larger stations were reduced and in 1955 and 1956 the percentage of immature males in the Western Australian catch decreased very considerably. In Antarctic Area IV, the percentage of immature males, generally higher than in the Western Australian catches, rose to a high peak in 1953, fell in 1954, and in 1956 remained at a similar level to that in the 1954 catch.

In the case of the females, Figure 4 shows that from 1949 to 1954 the proportion of immature individuals in the catches of females rose very considerably both on the Western Australian coast and also in Antarctic Area IV. However, on the Western Australian coast, following the reduction in the humpback quota, the percentage of immature females decreased sharply in 1955 to a lower level than in any previous years. In 1956 the proportion of immature individuals in the catch of females from the Western Australian coast decreased even further. This was mainly the result of the closing of the station at Point Cloates and the concentration of catching effort at Carnarvon. In Antarctic Area IV, the percentage of immature females was lower in 1956 than in 1954, but was still well above the level of earlier seasons and almost three times that of the 1956 catch on the Western Australian coast.

(f) Ovulation counts as an index of the relative age distribution in catches of females

It is known that corpora albicantia persist in the ovaries of whales for very long periods, if not throughout the life of each female (see Mackintosh 1942). Thus the number of ovulations that has occurred in a female may be counted. Such counts have been used as an index of relative

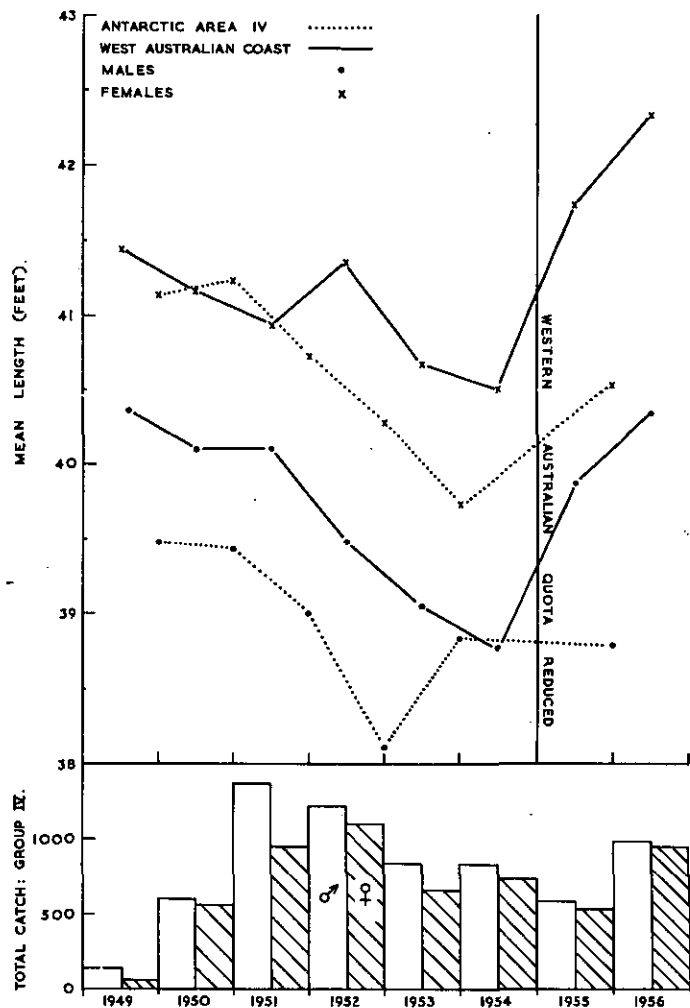


Fig. 3.- Above: Mean lengths of males and females in seasonal catches of combined Western Australian shore-stations and of Antarctic Area IV.

Below: Total catches of males and females from the Group IV stock in each year from 1949 to 1956.

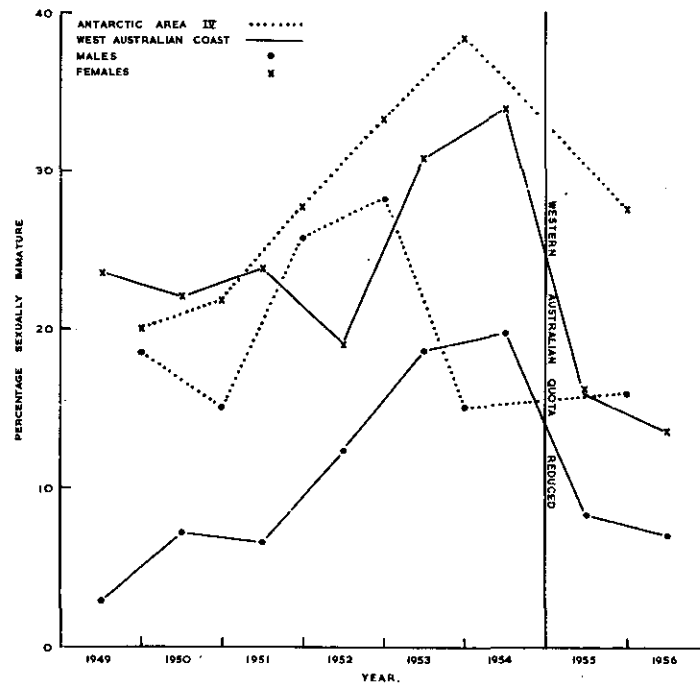


Fig. 4.- Percentages of sexually immature males and females in yearly catches of combined Western Australian stations and of Antarctic Area IV.



TABLE 4

HUMPBACK WHALES : GROUP IVLENGTH FREQUENCIES IN SEASONAL CATCHESMALES

Length (feet)	<u>WESTERN AUSTRALIAN COAST</u>							<u>ANTARCTIC AREA IV</u>						
	1950	1951	1952	1953	1954	1955	1956	1949 /50	1950 /51	1951 /52	1952 /53	1953 /54	1954 /55	1955 /56
27	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	2	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	-	-	1	-	1	-	-	2	3	2	1	-	-	-
31	1	-	-	-	-	-	-	-	1	1	-	-	-	1
32	2	-	1	4	-	-	-	2	5	7	1	-	-	-
33	-	5	3	4	-	-	2	4	10	13	5	-	-	-
34	-	-	5	1	-	1	-	8	4	2	-	-	-	1
35	5	17	37	49	46	16	11	19	11	68	10	11	-	14
36	10	38	36	62	72	27	28	31	38	46	12	9	-	35
37	15	64	69	84	87	35	30	34	57	40	14	19	-	53
38	16	81	71	112	127	60	55	22	40	43	19	24	-	48
39	38	133	102	111	113	98	78	36	55	63	13	24	-	42
40	51	168	96	96	84	133	131	58	62	74	9	19	-	58
41	41	167	84	66	61	63	114	40	60	62	5	8	-	34
42	41	108	60	68	51	69	102	46	56	52	6	11	-	16
43	17	72	49	28	23	42	72	25	33	28	4	3	-	8
44	8	37	17	21	18	19	29	16	15	21	2	3	-	8
45	4	15	8	16	6	12	18	8	17	13	1	3	-	2
46	1	3	3	4	3	4	2	2	-	5	-	1	-	-
47	-	-	1	-	-	1	3	1	1	3	1	1	-	-
48	-	-	-	-	-	-	1	-	-	-	-	-	-	-
49	-	-	-	-	-	-	-	-	-	1	-	-	-	-
50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	250	908	643	726	692	580	676	354	468	546	103	133	0	320

NON TAKEN

TABLE 5

HUMPBACK WHALES : GROUP IVLENGTH FREQUENCIES IN SEASONAL CATCHESFEMALES

Length (feet)	WESTERN AUSTRALIAN COAST							ANTARCTIC AREA IV						
	1950	1951	1952	1953	1954	1955	1956	1949 /50	1950 /51	1951 /52	1952 /53	1953 /54	1954 /55	1955 /56
27	-	-	-	-	-	-	-	-	-	2	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	1	1	-	1	-	2	1	1	-	-	-	-
30	-	-	1	2	-	-	-	1	1	1	-	2	-	-
31	-	-	1	1	-	-	-	-	1	5	-	-	-	1
32	1	-	-	1	1	-	1	4	5	4	-	1	-	2
33	-	1	1	-	3	2	1	6	9	8	3	-	-	-
34	1	1	-	-	-	-	-	3	4	3	-	-	-	-
35	4	12	17	36	42	7	6	11	15	52	7	11	-	15
36	9	9	27	33	48	13	11	13	26	32	3	5	-	43
37	8	25	31	41	46	20	7	18	28	24	7	11	-	37
38	7	26	21	58	62	37	13	27	50	29	10	18	-	40
39	10	27	42	51	53	48	33	38	47	48	8	13	-	46
40	16	38	46	47	63	70	58	45	48	58	9	18	-	63
41	12	33	57	53	42	54	37	36	69	52	10	12	-	65
42	21	36	58	55	53	58	48	62	97	54	13	9	-	60
43	15	38	56	51	61	60	53	47	79	54	5	8	-	39
44	9	29	48	57	57	54	68	49	71	43	3	5	-	38
45	11	17	33	27	33	39	43	32	35	40	4	4	-	24
46	9	10	24	29	32	38	26	15	28	37	3	5	-	23
47	2	4	14	17	9	23	20	11	18	18	1	-	-	7
48	2	2	7	8	7	9	10	4	10	10	4	2	-	1
49	-	1	1	1	3	3	7	1	2	2	-	-	-	-
50	-	1	2	-	1	2	1	-	-	2	-	1	-	-
51	-	-	-	-	-	-	-	-	-	2	-	-	-	-
52	-	-	-	-	1	-	-	-	-	-	-	-	-	-
	137	310	488	569	617	538	443	425	644	581	90	125	0	504

NONE TAKEN

TABLE 6  
HUMPBACK WHALES : GROUP IV  
SEXUALLY IMMATURE IN SEASONAL CATCHES  
1949 - 1956

## WESTERN AUSTRALIAN COAST

Station	Year	Males			Females		
		Total No.	Immature No.	%	Total No.	Immature No.	%
Point Cloates	1949	135	4	2.95	55	13	23.64
	1950	212	18	8.49	135	30	22.22
	1951	386	28	7.25	184	46	25.00
	1952	283	36	12.72	248	56	22.58
	1953	306	45	14.71	289	87	30.10
	1954	271	55	20.30	318	127	39.94
	1955	228	32	14.04	270	64	23.70
Carnarvon	1950	38	-	0	2	0	0
	1951	521	32	6.14	126	28	22.22
	1952	360	45	12.50	240	42	17.50
	1953	367	81	22.01	233	70	30.04
	1954	353	68	19.26	247	71	28.74
	1955	272	6	2.21	228	12	5.26
	1956	617	33	5.35	383	35	9.14
Albany	1952	23	1	4.35	28	0	0
	1953	54	10	18.52	46	18	39.13
	1954	68	13	19.12	52	11	21.15
	1955	80	11	13.75	40	12	30.00
	1956	59	13	22.03	60	10	16.67

TABLE 6 (Cont'd.).

HUMPBACK WHALES : GROUP IVSEXUALLY IMMATURE IN SEASONAL CATCHES1949 - 1956

## WESTERN AUSTRALIAN COAST

Station	Year	Males			Females		
		Total No.	Immature No.	%	Total No.	Immature No.	%
All Western Australian Coast Stations	1949	135	4	2.95	55	13	23.64
	1950	250	18	7.20	137	30	21.90
	1951	907	60	6.62	310	74	23.87
	1952	666	82	12.31	516	98	18.99
	1953	727	136	18.71	568	175	30.81
	1954	692	136	19.65	617	209	33.87
	1955	580	49	8.45	538	88	16.36
	1956	676	46	6.80	443	45	10.16

## ANTARCTIC AREA IV

1949/50	354	66	18.64	425	85	20.00
1950/51	468	72	15.38	644	140	21.75
1951/52	546	141	25.82	581	161	27.71
1952/53	103	29	28.16	90	30	33.33
1953/54	133	20	15.04	125	48	38.40
1954/55	0	-	-	0	-	-
1955/56	320	51	15.94	504	138	27.38

age (Pike 1953; Chittleborough 1955b). If the number of ovulations is recorded for each individual in a large sample of females, the frequency distribution of these ovulation counts may be used as a measure of the age distribution within that sample.

This has been applied to the female humpback whales taken in Australian waters. Table 7 summarizes the distribution of the numbers of ovulations that occurred in females sampled at random from catches on the Western Australian coast. For convenience the ovulation counts have been arbitrarily grouped, generally in units of three. No attempt will be made here to fix the absolute age within each of these groups, but the frequency distributions given in Table 7 do give a measure of the relative age distribution of the females sampled from season to season.

Figure 5 shows these results in histogram form. Assuming that the samples were representative of the females taken in each year, the following deductions can be made. In 1951 and 1952, the younger age groups amongst the sexually mature females (i.e., 1-6 ovulations) dominated the catches of females. In 1953 and 1954 there was a decline in the relative age distribution so that immature (0 group) and recently mature (1-3 ovulations) females were predominant while the proportions of slightly older whales (4-9 ovulations) decreased. Relatively old females (16-18 ovulations and those with over 18 ovulations) were never abundant and showed little change over these four years.

This evidence of a decline in the relative age distribution as indicated by ovulation counts is quite independent of the evidence from the analysis of catch returns kept by whaling inspectors, and confirms that up to 1954 there had been a decline in the composition of the catch.

In 1956 the frequency distribution of ovulation counts showed a marked improvement. The proportions of relatively old females (16-18 ovulations and those with over 18 ovulations) remained almost unchanged, but the youngest group of whales (0 group) decreased very considerably while the middle age classes (4-15 ovulations) increased. This can be interpreted as the result of the more stringent selection of larger individuals which is known to have been applied in 1956.

## (g) Pregnancy

Table 8 shows the numbers and percentages of females in advanced pregnancy amongst the sexually mature females taken in yearly catches of individual stations on the Western Australian coast and also amongst the sexually mature females in seasonal catches from Antarctic Area IV over the corresponding period. It is immediately obvious that fewer females in advanced pregnancy are taken in warmer waters than in Antarctic regions (see also Table 15 for the Group V stock). This is because pregnant females in the Antarctic are in approximately mid-pregnancy, while those along the Australian coast carry near-term foetuses and a considerable number of calves are born before the females reach the northern whaling areas.

In some females taken at Western Australian coastal stations, conception has only recently occurred, but the early embryos are seldom located and few of these females are recorded as pregnant. For this reason there has been no attempt to include females in early pregnancy in Table 8.

There have been fairly consistent differences in the frequency of advanced pregnancy in the catches at each of the three areas on the Western Australian coast where humpback whaling has been carried out. The southern-most station (near Albany) operating upon whales which have most recently arrived from Antarctic waters, generally takes the highest percentage of late-pregnant females. However, as this station has a small annual quota, the actual number of late-pregnant females taken is not disturbing when compared with Antarctic catches of pregnant females.

In the more northerly regions of Carnarvon and Point Cloates, relatively fewer females in advanced pregnancy are taken. A lower proportion of late-pregnant females is taken off Carnarvon than at Point Cloates, apparently due to differences in the local conditions.

## (h) Discussion and Conclusions regarding the Group IV Stock of Humpback Whales

There is considerable evidence both from the Western Australian coast and from Antarctic Area IV that from 1949 to 1954 there was a decline in the composition of the catches of humpback whales. Since the degree of selection had remained at comparable levels from year to year, this decline in the composition of the catches may logically be interpreted as reflecting a deterioration in the condition of this stock of humpback whales.

TABLE 7  
FREQUENCY DISTRIBUTION OF OVULATION COUNTS  
FROM FEMALE HUMPBACK WHALES IN RECENT  
CATCHES ON THE WESTERN AUSTRALIAN COAST

Year	1951	1952	1953	1954	1955	1956
No. of pairs of ovaries examined.	92	274	244	122	*	279
Ovulation counts - % frequency distribution.	0	17.4	17.9	29.1	27.9	8.6
1-3	31.5	24.5	28.7	25.4		28.7
4-6	20.7	22.6	12.3	14.8		19.4
7-9	13.0	13.9	12.3	8.2		10.4
10-12	7.6	6.2	4.1	9.8		11.8
13-15	2.2	2.6	3.3	4.1		10.4
16-18	4.3	3.3	2.5	1.6		2.9
> 18	3.3	9.1	7.8	8.2		7.9

\* 1955 Sample selected : not representative.

TABLE 8

HUMPBACK WHALES ; GROUP IVFEMALES IN ADVANCED PREGNANCY FROM SEASONAL CATCHES

## WESTERN AUSTRALIAN COAST

Station	Year	No. of mature females	Females in advanced pregnancy	
			No.	Percentage
Point Cloates	1949	42	3	7.1
	1950	105	23	21.9
	1951	138	13	9.4
	1952	192	38	19.8
	1953	202	49	24.3
	1954	191	27	14.1
	1955	206	14	6.8
	Carnarvon	1951	98	5
1952		198	7	3.5
1953		163	16	9.8
1954		176	11	6.3
1955		216	1	0.5
1956		348	25	7.2
Albany	1952	28	11	39.3
	1953	28	12	42.9
	1954	41	18	43.9
	1955	28	1	3.6
	1956	50	13	26.0
Total 1949-1956		2450	287	11.7



TABLE 8 (Cont'd.)

HUMPBACK WHALES : GROUP IVFEMALES IN ADVANCED PREGNANCY FROM SEASONAL CATCHES

Station	Year	No. of mature females	Females in advanced pregnancy	
			No.	Percentage
ANTARCTIC AREA IV				
	1949/50	340	169	49.7
	1950/51	504	303	60.1
	1951/52	420	152	36.2
	1952/53	60	40	66.7
	1953/54	77	32	41.6
	1954/55	0	-	-
	1955/56	366	155	42.3
	Total			
	1950-56.	1767	851	48.2

In 1955, after a reduction of the quotas on the Western Australian coast, the composition of the catch in that region improved very considerably. There can be little doubt that this improvement was mainly due to the much higher degree of selection that is known to have been applied in that year.

In 1956 the constitution of the catch on the Western Australian coast was more favourable than that of the 1955 season. There was a similar stringent selection of larger whales in 1956 as in 1955. As a result of the closing of the station at Point Cloates in 1956 and the transfer of that station's quota, catching vessels, and some factory equipment to the Carnarvon station, the selection factor could be applied more effectively. Further, local conditions in the Carnarvon area afford more advantages for whaling than Point Cloates (for example, the lower proportion of females and lower percentage of mature females in advanced pregnancy).

The composition of the catch in Antarctic Area IV during 1956 showed a little improvement in some (but not all) aspects when compared with the catch in 1954, but the 1956 catch does not compare favourably with the composition of the corresponding catch on the Western Australian coast. This suggests that the Group IV stock as a whole has not yet recovered from its earlier decline.

The success of the more careful selection of larger individuals, applied on the Western Australian coast in the last two seasons, suggests that the Group IV stock is capable of being conserved at an economic level if the total annual catch is not increased and if selection is maintained at a high level.

### III. GROUP V

#### (a) General

In the following sections when considering trends within the recent catches of humpback whales from Antarctic Area V, the illegal catch reported to have been taken by the factory ship "Olympic Challenger" in 1955 has been omitted. Between January 5 and March 7, 1955, this factory ship apparently took a total of 1125 humpback whales in Antarctic waters. Of these, 1097 were taken in Antarctic Area V and 28 from Area IV. But only 170 humpback whales (from Antarctic Area V) were reported to the International Whaling Statistics (see the Norwegian Whaling Gazette, August 1955, p.446). These 170 whales are included in the

statistics of Tables 9-13 and Table 15 of the present report. Although the remainder of this vessel's catch for 1955 is not shown in the following analyses, the possible effects of this large catch of poorly selected whales should be noted when considering the state of the Group V stock in relation to fishing intensity.

In the analysis of catch returns of humpback whales taken in warmer regions of the Group V stock, the records from the station on Norfolk Island have been kept separate from those of the stations on the eastern coast of Australia (at Tangalooma and Byron Bay). This is being done while the movements and dispersal of humpback whales in the southwest Pacific region are being investigated. Although humpback whales considered as the Group V stock may presumably mingle in Antarctic waters, it is possible (but not proven) that individual whales follow fairly similar courses each year in their northward migration. For example, some may return to the eastern coast of Australia each winter and so be isolated to some extent from those which pass New Zealand and the islands to the north. The small station at Norfolk Island affords an excellent opportunity to study this point.

#### (b) Sex Ratio

The sex ratio in the yearly catches of individual and combined stations on the eastern Australian coast, of Norfolk Island, and of seasonal catches in Antarctic Area V (from the 1949/50 season) is shown in Table 9. In this stock of humpback whales females continue to predominate in Antarctic catches while males constitute the greater part of catches made in warmer waters.

On the eastern Australian coast, the proportion of females in the catch has increased slightly but fairly regularly from 1952 to 1956. In some years this increase may be related to a change in the period of whaling operations (for example the earlier catching at Byron Bay in 1955 than in 1954), but in addition this steady increase in the percentage of females might be due to an increase in the selection of larger whales (females generally being larger than males).

#### (c) Mean Lengths

Table 10 lists the mean lengths of males and females in yearly catches of individual and combined stations on the eastern Australian coast, of Norfolk Island, and of seasonal catches in Antarctic Area V from 1950. The mean lengths for both sexes in yearly catches from the eastern

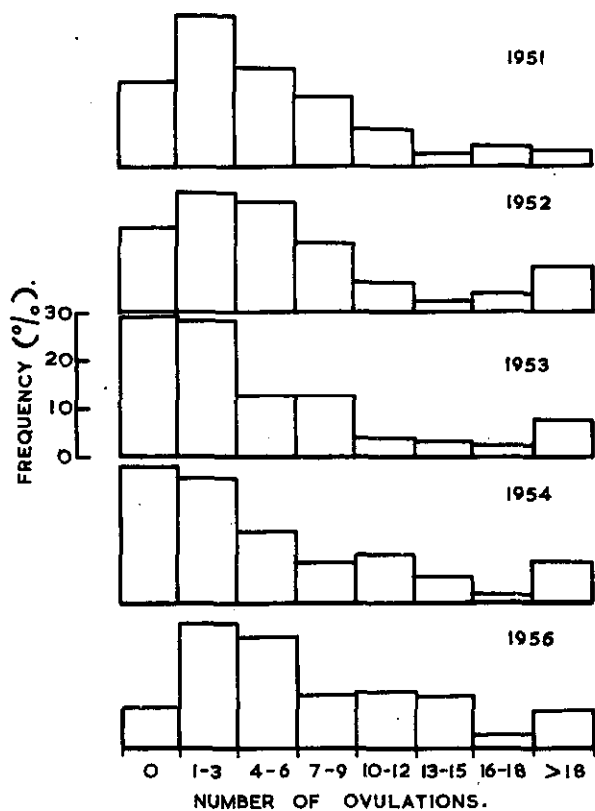
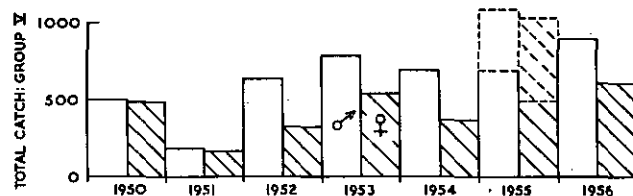
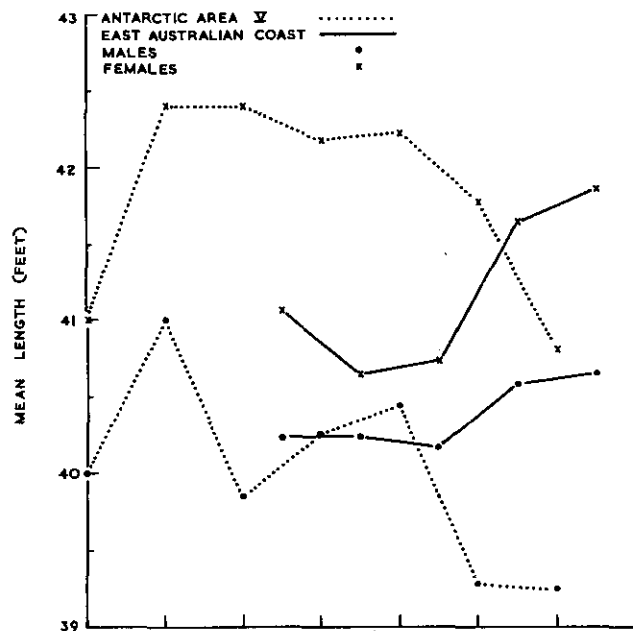


Fig. 5.- Relative age distribution (based on ovulation counts) of females sampled from catches on the Western Australian coast.



\*Broken portion indicating the catch of 927 humpback whales reported to have been taken illegally from this stock (not included in mean lengths).

Fig. 6.- Above: Mean lengths of males and females in seasonal catches of combined Eastern Australian coast stations and of Antarctic Area V. Below: Total catches of males and females from the Group V stock in each year from 1950 to 1956.

TABLE 9

HUMPBACK WHALES : GROUP VSEX RATIO IN SEASONAL CATCHES

## EASTERN AUSTRALIAN COAST

Station	Year	Total Catch	Sex unknown	No. Males	No. Females	% Females
Tangalooma	1952	600	1	499	150	25.1
	1953	700	-	509	191	27.3
	1954	598	-	420	178	29.8
	1955	600	-	429	171	28.5
	1956	600	-	407	193	32.2
Byron Bay	1954	120	-	91	29	24.2
	1955	120	-	65	55	45.5
	1956	120	-	78	42	35.0
All Eastern Australian Coast Stations	1952	600	1	499	150	25.1
	1953	700	-	509	191	27.3
	1954	718	-	511	207	28.8
	1955	720	-	494	226	31.4
	1956	720	-	485	235	32.6
Norfolk Is.	1956	150	-	92	58	38.7
ANTARCTIC AREA V						
	1949/50	903	-	441	462	51.2
	1950/51	228	-	105	123	53.9
	1951/52	183	-	67	116	63.4
	1952/53	516	-	215	301	58.3
	1953/54	150	-	75	75	50.0
	1954/55	348	-	124	224	64.4
	1955/56	467	-	222	245	52.5

TABLE 10

## HUMPBACK WHALES : GROUP V

MEAN LENGTH (FEET) OF MALES AND FEMALES IN SEASONAL CATCHES

## EASTERN AUSTRALIAN COAST

Station	Year	Males		Females	
		No.	Mean Length	No.	Mean Length
Tangalooma	1952	449	40.25	150	41.06
	1953	509	40.25	191	40.66
	1954	420	40.13	178	40.57
	1955	429	40.46	171	41.30
	1956	407	40.63	193	41.73
Byron Bay	1954	91	40.34	29	41.84
	1955	65	41.54	55	42.77
	1956	78	40.74	42	42.40
All Eastern Australian Coast Stations	1952	449	40.25	150	41.06
	1953	509	40.25	191	40.66
	1954	511	40.17	207	40.74
	1955	494	40.59	226	41.66
	1956	485	40.65	235	41.85
Norfolk Is.	1956	92	41.31	58	42.09

## ANTARCTIC AREA V

1949/50	441	40.01	462	41.00
1950/51	105	41.00	123	42.41
1951/52	67	39.86	116	42.41
1952/53	215	40.27	301	42.19
1953/54	75	40.46	75	42.23
1954/55 *	124	39.29	224	41.77
1955/56	222	39.25	245	40.80

\* Excluding 927 humpback whales reported to have been taken illegally.

Australian coast and from Antarctic Area V are plotted in Figure 6. Also shown in Figure 6 are the total numbers of males and females taken from the Group V stock in each year from 1950 to 1956. These totals include catches from the eastern Australian coast, Norfolk Island, New Zealand, and Antarctic Area V, indicating also the catch of 927 humpback whales reported to have been taken illegally from this stock in 1955.

In the case of the males, Figure 6 shows that from 1952 to 1954 the mean lengths of the males from the eastern Australian coast were similar to those from Antarctic Area V. In 1955 and 1956 the mean lengths of the males from Antarctic Area V fell considerably, yet in these years on the eastern Australian coast the mean lengths of the males increased.

With the females the change in recent years has been even more marked. Figure 6 shows that from 1952 to 1954 the mean lengths of the females taken on the eastern Australian coast were considerably below those from Antarctic Area V. But from 1955 to 1956 this condition was reversed as the mean length of females from the eastern Australian coast increased and that from Antarctic Area V declined.

#### (d) Length Frequencies

Table 11 shows the length frequency distribution of males in yearly catches on the eastern Australian coast from 1952 to 1956, on Norfolk Island in 1956, and from Antarctic Area V from 1950 to 1956. It also shows that in 1955 and 1956 there was a slight improvement in the length frequency distribution of males taken on the eastern Australian coast, the proportions of males in the smaller length ranges decreasing. At the same time catches of males from Antarctic Area V showed an increase in the proportions of males in the lower length groups.

Table 12 shows corresponding records for the females in the catches. This table shows that for females on the eastern Australian coast there was a slightly poorer length frequency distribution in 1954, some improvement in 1955, and a definite trend towards the upper length ranges in 1956. In Antarctic Area V the length frequency distribution of females in the catches showed relatively minor fluctuations up to 1954, but swung towards the lower length ranges in 1955 and 1956.

## (e) Sexually Immature Whales

Using the same criteria for immaturity as for the Group IV humpback whales, Table 13 shows the numbers and percentages of sexually immature males and females in the yearly catches from individual and combined catches on the eastern Australian coast, from Norfolk Island, and from Antarctic Area V from 1950 to 1956. Figure 7 shows the percentages of immature males and females in the annual catches from the eastern Australian coast and from Antarctic Area V.

Considering first the males, Figure 7 shows that on the eastern Australian coast the percentage of immature males in the yearly catch has remained very low, with relatively slight fluctuations, from 1952 to 1956. In catches from Antarctic Area V the percentage of immature males has been higher and fluctuated more, but reached its highest level in 1955, falling slightly in 1956. In general the percentages of immature males in catches from Antarctic Area V have been lower than from corresponding catches in Antarctic Area IV (cf. Figs. 4 & 7).

In the case of the females, Figure 7 shows that on the eastern Australian coast the percentage of immature females rose to a peak in 1954 but decreased considerably in 1955 and continued to fall slightly in 1956. In Antarctic Area V the percentage of immature females, initially lower than on the eastern Australian coast, increased greatly in 1956. These recent changes in the percentages of immature females in catches from the eastern Australian coast and from Antarctic Area V are reciprocal to the changes in the mean lengths of females in the same catches (cf. Figs. 6 & 7).

## (f) Ovulation counts as an index of the relative age distribution in the catches of females

On the same basis as described for the Group IV stock (Section II(f)), Table 14 summarizes the distribution of the numbers of ovulations that had occurred in females sampled at random from the catches at the Tangalooma station. Figure 8 shows these results in histogram form. Assuming that the samples were representative of the females taken on the eastern Australian coast each year, they afford some measure of changes in the age distribution within the catches. On this evidence Figure 8 indicates that in 1952 and 1953 the age distribution of the females taken on the eastern Australian coast was similar, except that fewer old females (16-18 ovulations and those with more than 18 ovulations) were taken in 1953 (and in succeeding years).



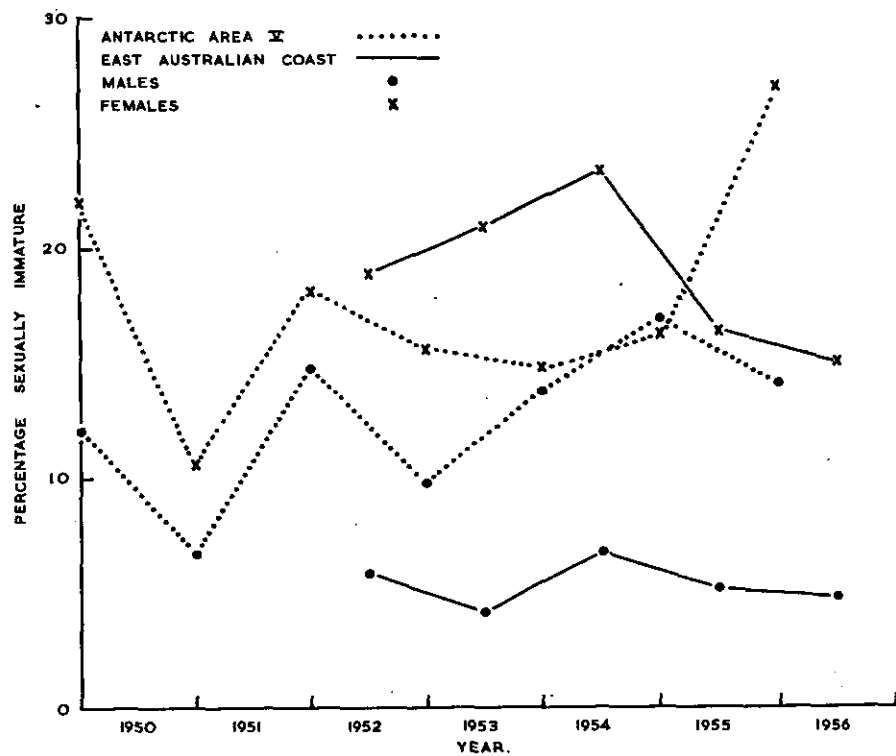


Fig. 7.- Percentages of sexually immature males and females in yearly catches of combined Eastern Australian coast stations and of Antarctic Area V.

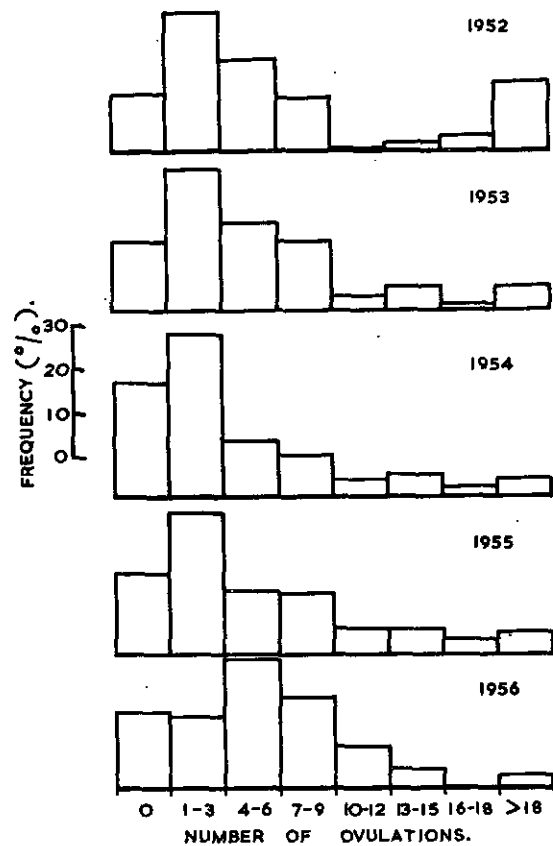


Fig. 8.- Relative age distribution (based on ovulation counts) of females sampled from catches on the Eastern Australian coast (Tangalooma).

TABLE 11

HUMPBACK WHALES : GROUP VLENGTH FREQUENCIES IN SEASONAL CATCHESMALES

Length (feet)	<u>EASTERN AUSTRALIA</u>					Norfolk Island	<u>ANTARCTIC AREA V</u>							
	Coastal						1956	1949	1950	1951	1952	1953	1954	1955
	1952	1953	1954	1955	1956			/50	/51	/52	/53	/54	/55	/56
25	-	-	-	-	-	-	3	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	1	-	-	-	-	-
30	-	-	1	-	1	-	1	1	-	-	-	-	-	-
31	1	1	-	-	-	-	-	-	-	-	-	-	-	-
32	1	-	1	-	1	-	5	-	-	1	1	1	-	-
33	1	-	1	2	2	-	7	1	-	3	-	-	1	1
34	1	2	-	1	-	-	3	-	-	1	-	-	1	4
35	6	9	18	10	7	2	16	2	6	4	3	12	11	11
36	15	9	13	13	11	4	20	3	3	12	6	6	15	15
37	20	31	18	21	22	4	27	4	3	18	5	11	24	24
38	42	50	59	32	25	3	26	9	6	20	4	16	37	37
39	65	75	75	55	56	6	55	4	3	20	3	14	25	25
40	77	76	89	92	97	8	73	13	11	33	11	21	36	36
41	86	94	78	79	82	16	60	22	11	24	13	9	28	28
42	71	89	78	82	81	17	62	16	6	39	9	17	19	19
43	40	56	47	66	51	15	38	8	3	11	11	9	11	11
44	15	14	19	30	27	11	21	13	7	16	6	4	6	6
45	6	3	11	7	15	3	17	7	6	8	1	2	4	4
46	1	-	3	3	6	2	3	1	1	2	1	-	-	-
47	-	-	-	1	-	1	4	1	-	1	-	-	1	1
48	-	-	-	-	1	-	-	-	-	1	1	-	-	-
49	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-	-	1	-	-	-	-
	448	509	511	494	485	92	441	105	67	215	75	124	222	

TABLE 12.

HUMPBACK WHALES ; GROUP VLENGTH FREQUENCIES IN SEASONAL CATCHESFEMALES

Length (feet)	<u>EASTERN AUSTRALIA</u>					Norfolk Island	<u>ANTARCTIC AREA V</u>							
	Coastal						1956	1949 /50	1950 /51	1951 /52	1952 /53	1953 /54	1954 /55	1955 /56
27	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	1	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	-	-	-	-	-	-	1	-	-	1	-	-	-	-
31	-	-	-	-	-	-	6	-	-	-	-	-	-	-
32	1	2	3	-	-	-	5	-	1	-	-	1	-	-
33	-	2	4	-	1	-	6	-	-	1	-	-	-	2
34	-	1	-	-	1	-	3	-	-	-	-	-	-	1
35	5	7	9	7	3	4	19	2	5	11	2	3	-	5
36	5	11	4	3	4	1	17	4	3	11	2	6	-	14
37	11	7	6	12	15	4	11	4	4	13	3	16	-	17
38	6	11	20	13	10	3	33	3	8	10	4	10	-	27
39	15	21	28	21	11	3	26	5	3	13	1	22	-	21
40	14	11	16	27	22	6	48	10	4	29	7	23	-	28
41	19	29	31	22	23	4	54	17	9	17	9	21	-	25
42	20	34	24	27	30	5	61	15	12	48	13	31	-	23
43	21	32	19	27	42	5	57	11	16	32	10	23	-	31
44	14	12	17	23	34	4	50	23	15	34	4	16	-	20
45	11	5	8	22	20	4	28	12	16	32	5	21	-	18
46	1	1	12	9	9	6	20	10	11	25	10	14	-	5
47	4	3	5	9	8	4	11	3	4	11	3	9	-	6
48	-	-	1	3	2	5	5	3	4	7	2	7	-	-
49	-	1	-	-	-	-	-	1	1	3	-	1	-	2
50	-	1	-	-	-	-	-	-	-	2	-	-	-	-
51	-	-	-	1	-	-	-	-	-	1	-	-	-	-
52	1	-	-	-	-	-	-	-	-	-	-	-	-	-
	148	191	207	266	235	58	462	123	116	301	75	224		245

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TABLE 13

HUMPBACK WHALES : GROUP VSEXUALLY IMMATURE IN SEASONAL CATCHES1949 - 1956EASTERN AUSTRALIAN COAST

Station	Year	Males			Females		
		Total No.	Immature No.	%	Total No.	Immature No.	%
Tangalooma	1952	448	26	5.80	150	28	18.92
	1953	509	21	4.13	191	40	20.94
	1954	420	30	7.14	178	46	25.84
	1955	429	21	4.90	171	31	18.12
	1956	407	22	5.41	193	32	16.58
Byron Bay	1954	91	4	4.40	29	2	6.90
	1955	65	4	6.15	55	6	10.91
	1956	78	1	1.28	42	3	7.14
All Eastern Australian Coast Stations	1952	448	26	5.80	148	28	18.92
	1953	509	21	4.13	191	40	20.94
	1954	511	34	6.65	207	48	23.19
	1955	494	25	5.06	226	37	16.37
	1956	485	23	4.74	235	35	14.89
Norfolk Island	1956	92	6	6.52	58	13	22.41

ANTARCTIC AREA V

1949/50	441	55	12.47	462	102	22.08
1950/51	105	7	6.67	123	13	10.57
1951/52	67	10	14.93	116	21	18.10
1952/53	215	21	9.77	301	47	15.61
1953/54	75	10	13.33	75	11	14.67
1954/55	124	21	16.94	224	36	16.07
1955/56	222	31	13.96	245	66	26.94

TABLE 14  
FREQUENCY DISTRIBUTION OF OVULATION COUNTS  
FROM FEMALE HUMPBACK WHALES IN  
CATCHES AT TANGALOOMA - EASTERN AUSTRALIA

Year	1952	1953	1954	1955	1956	
No. of pairs of ovaries examined	105	122	148	115	97	
	0	13.3	15.6	25.7	18.3	17.5
	1 - 3	31.4	32.8	37.2	32.2	16.5
	4 - 6	21.0	19.7	12.8	14.8	28.9
	7 - 9	12.4	15.6	9.5	13.9	20.6
	10 -12	1.0	3.3	4.1	6.1	9.3
	13 -15	1.9	5.7	4.7	6.1	4.1
	16 -18	3.8	1.6	2.0	3.5	0
	> 18	15.2	5.7	4.1	5.2	3.1

Ovulation counts.-  
% frequency distribution.

In 1954 there was a marked swing towards younger females in the catch, the groups 0 (immature) and 1-3 ovulations (recently matured) increasing at the expense of the slightly older females (groups with 4-6 and 7-9 ovulations). This is consistent with the poorer length frequency distribution in females from the eastern Australian coast in 1954 (Table 12), and the higher proportion of immature females (Fig. 7).

In 1955 the age composition of the females (as indicated by ovulation counts) improved, but had not returned to the condition of earlier years (1952 and 1953). The distribution of ovulation counts for 1956 indicated that the age distribution of the females in the catch on the Eastern Australian coast improved considerably, being more favourable than in any previous year. Younger whales (group 0) were still evident, but relatively older whales (groups with 4-6 and 7-9 ovulations) dominated the catch. This improvement in the age distribution would be consistent with a more careful selection of larger individuals.

#### (g) Pregnancy

Table 15 shows the numbers and percentages of females in advanced pregnancy amongst the sexually mature females in yearly catches at individual stations on the Eastern Australian coast from 1952 to 1956, and from Antarctic Area V from 1950 to 1956. No females in advanced pregnancy were taken at Norfolk Island in 1956.

As discussed earlier in the case of the Group IV stock, more pregnant females were taken in the Antarctic than in the warmer northern waters, but in the latter region additional females (not included in Table 15) would be in very early stages of pregnancy. In the catches on the eastern coast of Australia the percentages of females in advanced pregnancy fluctuate each year, but about different levels at each station. Similar differences between the percentages of pregnant females at individual stations are found on the Western Australian coast (Table 8).

#### (h) Discussion and Conclusions Regarding the Group V stock of Humpback Whales

In its first season of operation, the catch taken by the station on Norfolk Island compared very favourably with the 1956 catch on the eastern coast of Australia. Some aspects, for example the mean length of the males and the length frequency distribution of the males, were better than on the eastern coast of Australia. The percentage of

females was slightly higher at Norfolk Island, as was the percentage of immature females, but neither of these features was very adverse.

On the eastern Australian coast, the 1954 catch of females contained some unfavourable trends, i.e., from the evidence of lengths, a slightly poorer length frequency distribution and more immature individuals, and on the evidence of ovulation counts, a marked swing towards young individuals. Increased mean lengths of both males and females, more favourable length frequency distribution in both sexes, the taking of fewer immature females, the improvement in the age distribution of females based on evidence from ovulation counts indicate a considerable improvement in the catch composition of whales taken in 1955 and 1956 on the eastern Australian coast. It may be remembered that, just prior to the 1955 season, there was a reduction in the quota of whales to be taken on the Western Australian coast. It is suggested that this reduction in the West has stimulated a more careful selection of larger individuals on the east coast in 1955 and 1956.

In contrast, the composition of the catches in Antarctic Area V considerably declined in 1955 and 1956; the mean lengths of both males and females decreased, the length frequency distribution swung towards the lower length ranges in both sexes, and the proportion of immature females rose greatly. Unless it can be proved that there was far less selection of whales in Antarctic Area V during the 1954/55 and 1955/56 seasons than in previous seasons, these trends in the catches of the last two years may be interpreted as reflecting a slight decline in the condition of the Group V stock of humpback whales. The large catch reported to have been taken illegally during 1955 in Antarctic Area V by the factory ship "Olympic Challenger," when superimposed upon all other humpback whales taken in that year from the Group V stock (see Fig. 6) could have played a part in causing this apparent decline.

Although more evidence is required from catches in the immediate future, it appears that the Group V stock will not withstand continuous fishing at any higher level than that allowed at present.

#### IV. COMPARISON OF HUMPBACK WHALING IN ANTARCTIC

##### AND TEMPERATE WATERS

From the analyses of recent catches from the Group IV and V stocks of humpback whales as given in this report, the

TABLE 15

HUMPBACK WHALES : GROUP VFEMALES IN ADVANCED PREGNANCY FROM SEASONAL CATCHES

## EASTERN AUSTRALIAN COAST

Station	Year	No. of Mature Females in advanced females	No. of Mature Females in advanced pregnancy	
			No.	%
Tangalooma	1952	122	8	6.6
	1953	151	11	7.3
	1954	132	19	14.4
	1955	140	*12	8.6
	1956	161	8	5.0
Byron Bay	1954	27	5	18.5
	1955	49	8	16.3
	1956	39	5	12.8
Total 1952 - 56		821	76	9.3

\* Including one case of twins

## ANTARCTIC AREA V

1949/50	360	142	39.4
1950/51	110	49	44.5
1951/52	95	53	55.8
1952/53	254	94	37.0
1953/54	64	46	71.9
1954/55	188	126	67.0
1955/56	179	87	48.6
Total 1950 - 56	1250	597	47.8



following comparison is made between the composition of catches in Antarctic and Australian waters.

(1) Sex ratio.- Catches on the Western Australian coast generally contain a lower proportion of females than catches in Antarctic Area IV (Table 2). Catches on the eastern Australian coast always contain far lower proportions of females than in Antarctic Area V (Table 9).

(2) Mean length of males.- The mean lengths of the males in the catches are generally higher on the Western Australian coast than in Antarctic Area IV (Fig. 3), and in recent years (1955 and 1956) higher on the eastern Australian coast than in Antarctic Area V (Fig. 6).

(3) Mean length of females.- The mean lengths of the females in the catches are usually higher on the Western Australian coast than in Antarctic Area IV (Fig. 3), but lower on the eastern Australian coast than in Antarctic Area V, except for the 1956 catches (Fig. 6).

(4) Percentage of immature males.- There are generally considerably lower proportions of immature males in Australian catches than in Antarctic catches (Figs. 4 and 7).

(5) Percentage of immature females.- The percentages of immature females are lower in catches on the Western Australian coast than in Antarctic Area IV (Fig. 4), but higher in catches on the eastern Australian coast than in Antarctic Area V, except for the 1956 catches (Fig. 7).

(6) Pregnancy.- Catches from the Antarctic contain far higher proportions of females in advanced pregnancy than catches in Australian waters (Tables 8 and 15). Two points should be stressed here. Firstly, some females taken in Australian waters having recently conceived may not have been recorded as pregnant. Secondly, the proportions of pregnant females recorded in Antarctic catches (e.g. in Tables 8 and 15) should be regarded as minimal, since much higher proportions of mature females in Antarctic waters were found to be pregnant when carefully examined by Norwegian observers (Chittleborough 1957).

In an evaluation of the aspects given above, it would appear more favourable (from the point of the conservation of the humpback stocks) to take these whales in temperate regions rather than in Antarctic waters. It may be argued that the whales are fatter in the southern feeding grounds, but this is compensated for by the efficiency and lower running costs of shore stations; storage space is available for more complete extraction of whale meal and dehydrated whale solubles.

Some of the aspects of the catch composition which are more favourable on the Australian coast may be largely due to the more careful selection of the larger whales. The fixed quotas allotted to individual stations on the Australian coast reduce the competition between stations, encouraging more careful selection to be applied and also more efficient treatment, so that production per whale may approach an optimum. In contrast, for the Antarctic factory ship, speed of catching and processing is vital under the present system to ensure the highest proportion of the Antarctic catch. These factors do not lead to the best utilization of the remaining stocks of whales.

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