DISCOVERY REPORTS

Issued by the Discovery Committee
Colonial Office, London
on behalf of the Government of the Dependencies
of the Falkland Islands

VOLUME I

CAMBRIDGE
AT THE UNIVERSITY PRESS
1929

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LIST OF PERSONNEL, AND PREFACE

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VOLUME I

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PREFACE

WHALING operations by modern methods began in the Dependencies of the Falkland Islands in 1904 and rapidly developed. By 1912–13 the number of the small steamships known as whale catchers which were employed had risen to twenty-one in South Georgia, and thirty-two in the South Shetlands. The whaling industry in the Dependencies had become the largest in the world, a position which it still retains. From 1909–10 to 1917–18, over three million barrels of whale oil were produced, valued at over £20,000,000. In the ensuing years the industry underwent a remarkable development, and in the single season 1928–29 the output was 1,047,000 barrels valued at £5,513,000.

Almost from the beginning the Government of the Falkland Islands exercised control over the industry by means of a system of leases and licenses, which was given legal form in the Whale Fishery Ordinance, 1908. The primary object of such control was to regulate the use of Crown lands, harbours and territorial waters by the whalers. It was not long, however, before there were complaints that the whalers utilised only the blubber and abandoned the remainder of the carcases. As the industry grew, apprehensions were expressed that such intensive pursuit threatened the maintenance of the stock of whales. These apprehensions were strongly reinforced by the lessons of whaling history, which abounds in examples of the destruction of whaling industries in particular localities through over-fishing. Accordingly the Colonial Government sought to employ its control to effect the prevention of waste and the protection of the stock of whales.

The first problem, that of the prevention of waste, at that time presented no difficulties except those of enforcement and of reasonable adaptation to commercial possibilities and requirements, and waste was in fact reduced within narrow limits during a long period. But there has now developed a type of whaling not amenable to control, to which reference is made below.

When the Colonial Government approached the second problem, that of the protection of the stock, it soon became evident that the biological knowledge required for scientific control was almost totally lacking and could not be acquired except by means of costly and prolonged investigations conceived on broad lines. Existing knowledge of the specific differences of whales was not inconsiderable, but was inadequate in important respects; in particular the question whether southern Blue and Fin whales were distinguishable from the northern forms was still unsettled. Very little was certainly known about the breeding habits, migrations, rate of growth, length of life or food of the whales hunted in the Dependencies. No indication could be given regarding the probable amount of the annual increase of a particular species, and consequently it was impossible to estimate the number of whales which might be taken annually without diminishing the stock.

It was clear that no really scientific solution of the problem could be obtained for many years. In the meantime the Colonial Government could only have recourse to an empirical restriction of the pursuit of whales, based on the statistics of catch and the opinions of scientific men and practical whalers, and exercised mainly by means of a limitation of the number of licensed whale catchers, and to some extent by prohibition of the hunting of species which seemed especially endangered.

Before the War the question of the researches required to place control on a scientific footing began to engage attention, and as a preliminary step the late Major G. E. H. Barrett-Hamilton was employed during the Southern summer of 1913–14 to make anatomical investigations of the carcases of whales at the whaling stations in South Georgia. Major Barrett-Hamilton died at his post, and nothing further could be done until near the conclusion of the War. A Committee, the Inter-Departmental Committee on Research and Development in the Dependencies of the Falkland Islands, was then appointed to consider not only the preservation of the whaling industry, but also other industries actual or potential, and in particular a scheme for the employment of a research vessel mainly in the study of whales. The Committee's report was published in 1920, and the *Discovery* investigations are the outcome of that report.

In the study of Blue and Fin whales considerable progress has already been made, and though the age which these species attain is still a matter of conjecture, the principal features of their life history up to sexual maturity have been ascertained, while measures have been taken to decide whether the northern and southern stocks are specifically or racially distinguishable. These investigations are obviously essential to the enquiry, and there are others no less important. The industry in the South Atlantic suffers from marked annual fluctuations: these are bound up with the extensive migrations which the whales are known to undertake and, it may safely be assumed, are governed by alterations in the food supply and other factors in their environment. To trace the reasons for these fluctuations is a fundamental part of the work. It involves a study of the migrations of whales, of their food, and of the conditions which affect its abundance; a study of the minute plants on which all animal life in the sea, including whale life, ultimately depends; and a study of the physical constitution and movements of the water. Such investigations will undoubtedly have as much importance in enquiries into southern whaling as they have been shown to possess in northern fishery problems. They all converge upon the central problem of estimating the number of whales of each species which may be taken annually without depleting the stock.

Meanwhile changes have occurred in the conduct of the industry which have materially affected the administrative position. Until the last few years whaling could not be carried on without the use of harbours and territorial waters. Control by the Colonial Government was thus made feasible and was in fact effectual. The whaling companies have now, however, introduced methods which enable the utilisation of whales to be carried on in the open sea without the use of territorial waters. This kind of whaling is commonly described as pelagic whaling, and is carried out upon a scale already large and still increasing. Such whaling is of course beyond the jurisdiction of the Colonial Government, and the natural effect of its growth is that the problem of the control of whaling in the Dependencies has outgrown the sphere of the local Government and entered that of international affairs. The need for the information which the investigations seek to obtain has not been diminished, but has indeed increased proportionately with the increased destruction of whales. It should be realised, however, that the machinery of international agreement is much more cumbrous than that of action by the local Government, and that the difficulties of utilising the results obtained will be correspondingly augmented.

The *Discovery* investigations are concerned not only with whaling, but, so far as their resources permit, with all economic questions arising in the Dependencies. Apart from whaling, the principal subjects in which work is being carried on are those of marine survey, sealing and fisheries. In the immense area of the Dependencies there is an enormous amount of marine survey work remaining to be done, and such work is being undertaken as far as the means at the Committee's disposal allow. At present the more active work of this department is confined to South Georgia, but visits have already been made to the South Shetlands and work has been begun in that area. The records of marine casualties emphasize the need for such work and the regions at present under survey are those which are of particular importance for the navigation of whaling vessels.

In regard to sealing, work is being done upon the fur-seal rookeries of the Falkland Islands, and the stocks of elephant-seals in South Georgia. The former now promise well for the future, and the latter are under conservative management and have been the subject of a profitable industry for a number of years.

Some preliminary work has been done on fisheries, but no ground of special promise has yet been discovered.

The main objects of the investigation are economic and it is to the economic aspect of the work that the energies of the scientific staff are primarily directed. But the wide scope of the enquiry affords opportunity for many observations whose value, in the present state of our knowledge, would seem to be purely scientific. Such work, undertaken without ulterior motive, has in the past often yielded results of the highest economic importance, and has therefore been given a place in the general plan of operations; it is undertaken, however, only when it involves no interference with the economic programme. The Committee is indebted to a number of specialists in different branches of marine science for assistance in the preparation of results, and their papers, some of which will be of purely scientific interest, will be published with the others.

It may be added that many of the reports which follow are records of work still in progress, and that in some cases they may need modification in the light of further experience.

ROWLAND DARNLEY

January 1930

CORRIGENDA

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Depth 1000 m., σt, *for* 27·37 *read* 27·52
p. 31, St. **96**, **N 70 V**, Time, Hauled, *for* 0845 *read* 1015
p. 35, St. **102**, **N 100 H**, 52 m., Time, Hauled, *for* 1324 *read* 1317
N 100 H, 104 m., Time, Hauled, *for* 1325 *read* 1317
p. 39, St. **117**, **N 100 H**, Depth *for* 90(–0) *read* 99(–0)
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p. 41, St. **125**, Depth 100 m., σt, *for* 27·32 *read* 27·34
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Depth 600 m., σt, *for* 27·78 *read* 27·71
p. 45, St. **135**, Depth 140 m., Temp., *for* 0·22 *read* – 0·22
p. 45, St. **136**, Depth 210 m., σt, *for* 27·65 *read* 27·59
p. 49, St. **149**, **OTL**, etc., Time, Hauled, *for* 1158 *read* 1128
St. **150**, Gear, *for* **N 70 H** *read* **N 100 H**
p. 51, St. **160**, Depth 50 m., σt, *for* 26·95 *read* 26·97
p. 57, St. **190**, **N 70 V**, Depth, *for* 100–0 *read* 100–50
p. 59, St. **194**, Depth 300 m., σt, *for* 27·77 *read* 27·73
p. 62, St. **200**, Hour, *for* 1455 *read* 1445
p. 81, *for* St. **256** **TYF** 250(–0) *read* St. **257** **TYF** 250(–0)
p. 83, St. **265**, *for* **N 50 V** 50–0, etc., *read* **N 70 V** 50–0, etc.
p. 85, St. **265**, *for* **N 70 H** 500–250, etc., *read* **N 70 V** 500–250, etc.
St. **269**, Gear, *for* **TYF** *read* **N 450**
p. 93, St. **WS 8**, Gear **N 70 H**, Depth, *for* 87 *read* 50
for 174 *read* 100
p. 95, St. **WS 16**, **N 100 H**, Depth 90 m., Time, Hauled, *for* 2122 *read* 2222
St. **WS 20**, **N 70 V**, Time, Hauled, *for* 0915 *read* 1015
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St. **WS 30**, Depth 100 m., S ‰, *for* 34·95 *read* 33·95
p. 101, St. **WS 35**, Depth, *for* 105 *read* 145
p. 107, St. **WS 46**, **N 100 H**, Depth, *for* 143 *read* 146
p. 108, St. **WS 61**, Position, *for* 53° 37′ 30″ S *read* 52° 37′ 30″ S
p. 109, St. **WS 54**, Depth, *for* 600 *read* 500
St. **WS 58**, **N 100 H**, Depth, *for* 100 *read* 56
for 200 *read* 112
p. 110, St. **WS 61**, Position, *for* 53° 37′ 30″ S *read* 52° 37′ 30″ S
p. 117, St. **WS 95**, **DC**, Time, Hauled, *for* 0522 *read* 0532
p. 119, St. **WS 103**, **N 70 V**, Time, Hauled, *for* 2315 *read* 2305
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for 20° E *read* 15° E

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p. 61, St. **198**, Depth 1500 m., S ‰ value 34·87 too high
σt value 28·09 too high
p. 63, St. **199**, Depth 700 m., S ‰ value 35·01 too high
σt value 28·18 too high
p. 111, St. **WS 61**, Depth 2000 m., S ‰ value 34·47 too low
σt value 27·66 too low

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STATION LIST
1925–1927

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DISCOVERY INVESTIGATIONS STATION LIST

1925–1927

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DISCOVERY INVESTIGATIONS
STATION LIST
1925–1927
(Plates I—VI)

INTRODUCTION

THE following lists contain particulars of all stations made by the R.R.S. 'Discovery', the R.S.S. 'William Scoresby' and by the staff of the Marine Biological Station at South Georgia up to the end of September 1927.

Stations made by the 'Discovery' are entered first and have no letters prefixed to the numbers. Those of the 'William Scoresby' follow (pp. 92–131) and are distinguished as WS 1, WS 2, etc. Finally (pp. 132–137) those of the Marine Biological Station are given, numbered MS 1, MS 2, etc.

Positions are given either in latitude and longitude or as true bearings of some fixed point on land.

The abbreviations used in denoting the nature of the bottom are:

blk.	black	g.	gravel	rad.	radiolarian
br.	brown	gl.	globigerina	rd.	red
c.	coarse	gn.	green	s.	sand
cl.	clay	gy.	grey	sft.	soft
crl.	coralline	h.	hard	sh.	shells
d.	dark	m.	mud	spk.	specks
di.	diatom	oz.	ooze	st.	stones
f.	fine	r.	rock	w.	white

∸ placed above the figure for the sounding indicates that bottom was not reached.

The directions of wind, sea and swell are true bearings and with the two first the force is expressed in terms of Beaufort's scale. Weather is indicated by Beaufort's symbols. Barometer readings are corrected for latitude and temperature. The air temperature was read in degrees Fahrenheit and is here converted to Centigrade. The age of the moon is expressed in days: the phases new moon, first quarter, full moon and last quarter are thus represented respectively by the numbers 1, 8, 15 and 22.

In the chemical observations all temperatures are fully corrected. Salinity (S $^{\circ}/_{\circ\circ}$) was determined by the chemical estimation of the chlorine content. Density (σt) is calculated from the corrected readings for temperature and salinity. Estimation of the hydrogen-ion concentration (pH) was made by the colorimetric method, phenol red and thymol blue being used as indicators. Phosphate content was determined by Atkins' method.

The following symbols are used for nets, apparatus, etc.:

B — Oblique.

BTS — Small beam trawl. Beam 8 ft. in length (2·45 m.): mesh at cod-end $\frac{1}{2}$ in. (12·5 mm.)*.

DC — Conical dredge. Mouth 16 in. in diameter (40·5 cm.), with canvas bag.

* All measurements are taken from knot to knot along one side of the mesh, not diagonally with the mesh stretched.

DGA	Depth gauge, Admiralty pattern.
DGB	Depth gauge, Budenberg pattern.
DGT	Depth gauge, reversing thermometer type.
DL	Large dredge. Light pattern, 4 ft. in length (1·2 m.).
DLH	Large dredge. Heavy pattern, 4 ft. in length (1·2 m.).
H	Horizontal.
HH	Hand harpoon.
KT	Kelvin tube.
LH	Hand lines.
N 4–T N 7–T	Nets with mesh of 4 mm. or 7 mm. (0·16 in. or 0·28 in.) attached to back of trawl.
N 50	50 cm. tow-net. Mouth circular, 50 cm. in diameter (19·5 in.): 200 meshes to the linear inch.
N 70*	70 cm. tow-net. Mouth circular, 70 cm. in diameter (27·5 in.): mesh graded, at cod-end 74 to the linear inch.
N 100	1 m. tow-net. Mouth circular, 1 m. in diameter (3·3 ft.): mesh graded, at cod-end 16 to the linear inch. From July 1, 1927, this net was replaced by another, of similar pattern, but with the cod-end made of stramin with 11–12 meshes to the linear inch.
N 200	2 m. tow-net. Mouth circular, 2 m. in diameter (6·6 ft.): mesh graded, at cod-end 4 mm. (0·16 in.).
N 450	$4\frac{1}{2}$ m. tow-net. Mouth circular, $4\frac{1}{2}$ m. in diameter (14·8 ft.): mesh graded, at cod-end 7 mm. (0·28 in.).
NC 50	Coarse 50 cm. tow-net. Mouth circular, 50 cm. in diameter (19·5 in.): 25 meshes to the linear inch.
NCS–D NCS–N NCS–T	Tow-net of coarse silk, with 16 meshes to the linear inch, attached to dredge, trawl, or other net.
NH	Hand net.
NHS	High-speed tow-net. Mouth 3 in. in diameter (7·5 cm.): mesh 74 to the linear inch.
NRL	Large rectangular net. Frame 8 ft. long and $2\frac{1}{4}$ ft. wide (2·45 m. × 0·7 m.) with bag of $\frac{1}{2}$ in. mesh (12·5 mm.).
NRM	Medium rectangular net. Frame 4 ft. long and $1\frac{1}{4}$ ft. wide (1·22 m. × 0·38 m.), with bag of 7 mm. mesh (0·28 in.).
NRS	Small rectangular net. Frame 3 ft. long and 1 ft. wide (0·9 m. × 0·3 m.), with bag of 4 mm. mesh (0·16 in.).
NS	Seine net. Length 30 fathoms (55 m.): mesh at cod-end $1\frac{1}{2}$ in. (3·8 cm.).
OTC	Commercial otter trawl. Head rope 80 ft. long (24·5 m.): mesh at cod-end $1\frac{1}{2}$ in. (3·8 cm.).
OTL	Large otter trawl. Head rope 40 ft. long (12·2 m.): mesh at cod-end $1\frac{1}{4}$ in. (3·2 cm.).
OTM	Medium otter trawl. Head rope 30 ft. long (9·14 m.): mesh at cod-end $1\frac{1}{4}$ in. (3·2 cm.).
RM	Mussel rake.
SL	Sondeur Léger.
STB	Baillie Sounding Rod.
STN	Sounding rod, Nansen-Ekman type.
TD	Transparency (or Secchi) disc, 50 cm. in diameter (19·5 in.).
TGL	Large gauze fish-trap. Cylindrical, 3 ft. long and 1 ft. in diameter (0·9 m. × 0·3 m.): gauze with 8 meshes to linear inch.
TGM	Medium gauze fish-trap. Cylindrical, $1\frac{1}{2}$ feet long and 6 in. in diameter (45 cm. × 15 cm.): gauze with 16 meshes to linear inch.
TGS	Small gauze fish-trap. Cylindrical, 9 in. long and 3 in. in diameter (23 cm. × 7·5 cm.): gauze with 34 meshes to linear inch.

* In some early labels this net is incorrectly referred to as "N 75."

TNL	Large fish-trap. Rectangular, 4 ft. by 4 ft. by $2\frac{1}{2}$ ft. (1·2 m. × 1·2 m. × 0·75 m.), with netting or wire of $\frac{1}{2}$ in. mesh (12·5 mm.).
TYF	Young-fish trawl. Mouth about 20 ft. in circumference (6 m.): bag of stramin with 11 to 12 meshes to linear inch. Fished until July 1926, with poles and otter-boards, thereafter attached to a circular tow-net frame 2 m. in diameter (6·6 ft.).
V	Vertical.

Unless specially noted to the contrary (by the addition of V) nets N 200 and N 450 were towed horizontally. To the symbols for smaller tow-nets (N 100, N 70, N 50, NC 50) B, H or V is always added to indicate the direction in which the haul was taken.

Vertical nets were hauled at 1 m. per second and, unless the haul ended at the surface, were closed by the Nansen method.

Oblique nets were hauled as soon as shot at a speed of 10 m. per minute, with the ship moving at about 2 knots.

Horizontal nets were shot open, but except for surface work were very frequently closed on the Nansen principle before being hauled. When no addition is made to the figures in the depth column, it is always to be understood that the tow-net or young-fish trawl was closed before hauling; but when such an expression as (– 0) or (– 50) follows the figure for depth, it is implied that the net, though fishing for the time indicated at the major depth, was hauled open to the surface or to a higher level. Plankton nets catch practically nothing while being shot: if closed before hauling there is good reason to believe that all the organisms were caught at the indicated depth. When, however, the net is hauled open to a higher level there is less certainty of this; for though it may have been towed for a considerable time at the greater depth, some organisms will have been caught during its upward passage.

When, at a single station, a number of similar hauls was made with the same type of net, the hauls are distinguished by letters which are entered in the "Remarks" column.

For determining the levels at which horizontal nets were towed and from which oblique nets were hauled, Kelvin tubes or depth gauges were constantly employed. A symbol indicating the type of gauge will be found in the "Remarks" column, and if no such symbol occurs it is to be understood that the depth was estimated.

Times are expressed on the 24-hour system, the day ending with midnight (0000). The entry under "shot" states the time when all the warp was paid out. That under "hauled" either gives the time when hauling began, or, with closing nets, the time when the messenger was estimated to have arrived. When series of vertical nets were taken, only the times for the beginning and end of the series are given. The times given are "ship's time," corresponding nearly with local mean time. In order to distinguish hauls which were made when it was dark, those times which fall between sunset and sunrise are printed in heavy type.

Length of tow was measured by the ship's log, by time and estimated speed, or by differences in observed positions.

At the end of the lists (p. 138) will be found a summary of the stations made by the 'Discovery' and 'William Scoresby' with references to the charts on which the positions are marked. A chart of South Georgia is added, on which the names of all places mentioned in the list of MS stations will be found.

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
		1925										
1	Clarence Bay, Ascension I, 7° 55′ 15″ S, 14° 25′ 00″ W	16 xi	1600	20 crl. s. sh.	SE	4	SE	3	b. c.	1013·3	23·9	mod. S swell
2	Clarence Bay, Ascension I, Catherine's Pt and Collyer Pt	17 xi	1200	—	S	3	SE	3	b. c.	1014·0	25·0	mod. S swell
3	29° 31′ 06″ S, 13° 56′ 45″ W	3 xii	1000	—	ENE	3	ENE	3	b. c.	1023·8	20·0	mod. E swell
		1926										
4	Tristan da Cunha, 36° 55′ 00″ S, 12° 12′ 00″ W	30 i	1200	37 st.	NNW	4	NNW	4	b. c.	1019·4	15·6	mod. S swell
			1600	—	W	5	conf.	4	b. c.	1019·0	16·7	mod. conf. swell
		31 i	1200	—	SW	6–7	WSW	6	b. c. g.	1014·8	16·1	heavy conf. swell
5	Tristan da Cunha, Quest Bay	31 i	1500	7–12 g. r.	W	6–7	—	0	b. c.	1016·0	16·7	heavy NW swell
6	Tristan da Cunha, 3 miles N 30° E of Settlement	1 ii	1300	80–140 r.	WSW	2	WSW	4	b. c.	1017·5	16·7	
7	39° 24′ 30″ S, 12° 08′ 00″ W	3 ii	1100	3200 gl. oz.								
			1200	—	WSW	3	WSW	2	o.	1016·7	12·2	v. heavy SW swell
			1600	·	WSW	3	WSW	3	o.	1016·1	11·1	,,
8	42° 36′ 30″ S, 18° 19′ 30″ W	8 ii	1030	3375 gl. oz.								
			1200	—	WNW	4	WNW	4	o. m.	1001·1	11·7	v. heavy conf. swell
			1600	—	NW	4	NW	4	o.	998·2	11·1	,,
			2000		NW	4	NW	4	b. c.	1000·5	10·6	,,
9	46° 11′ 30″ S, 22° 27′ 30″ W	11 ii	0730	4090 gl. oz.								
			0800	—	NW	3	NW	3	o. m. p.	1009·3	4·4	mod. NW swell
			1200	–	NW	3	NW	2	b. c	1009·3	7·8	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	Hauled	Length of tow (miles)	Remarks
1	26	18	23·62	36·08	24·62	8·34	—	—	**NRM**	16–27	1630			
2	27	—	—	—	—	—	—	—	**Sh. coll.**	0	1130	1330		
3	15	—	—	—	—	—	—	—	**N 200**	500–700	1000	1100	2	DGB
4	17	0	14·59	34·85	25·96	—	—		**DL**	40–46	1400	1423		
		35	13·64	34·99	26·26	8·10			**N 70 H**	0–10	1600	1620		
	18	—		—	—	—	—	—	**N 100 H**	0–10	1750	1855		A
		—	—	—	—	—	—		,,	0–10	**2215**	0900	—	B 30–31 i 1926
		—	—	—	—	—	—	—	**LH**	40	1430	1000	—	30 i–1 ii 1926
5	18	—		—	—		—		**NRM**	7–12	1500	1630	—	several short hauls inside *Macrocystis* belt
6	19	—		—	—		—	—	**DL**	80–140	1315	1330	—	dredge hitched
7	21	0	12·71	34·79	26·01	8·24								
		5	12·66	34·79	26·32	—	41							
		10	12·64	34·79	26·32									
		20	12·61	34·79	26·33									
		30	12·60	34·81	26·35									
		40	12·54	34·80	26·35									
		50	12·46	34·79	26·36	8·24								
		75	11·96	34·81	26·47									
		100	10·85	34·83	26·59	8·22	95							
		150	10·20	34·83	26·70									
		200	9·85	34·79	26·85									
		300	8·97	34·60	26·84									
		400	6·97	34·43	27·28									
		500	5·52	34·33	27·19	8·14								
		1000	3·11	34·22	27·35									
		1500	2·66	34·51	27·30									
		2000	2·65	34·74	27·74	8·14	125							
		3000	2·41	34·80	27·81	8·14	90							
8	25	0	9·10	34·23	26·51	8·29		5·86	**N 200**	600–700	1410	1550	3	DGB
		5	9·10	34·25	26·53	—	—	—	**N 100 H**	0–10	1520	1540	½	
		10	9·08	34·25	26·54	—	—	—	,,	0	1615	1625	¼	
		20	9·03	34·27	26·57	8·34	—	6·10	**N 200**	1500–1700	1910	**2123**	3¾	DGB
		30	9·00	34·23	26·54									
		40	8·88	34·27	26·59									
		50	8·86	34·23	26·56									
		75	8·73	34·22	26·56									
		100	8·58	34·22	26·62									
		150	7·13	34·23	26·82									
		200	6·74	34·23	26·87									
		300	5·17	34·23	27·07									
		400	4·21	34·18	27·14									
		500	3·54	34·12	27·16									
		1000	2·68	34·22	27·31									
		2000	2·77?	34·72	27·71?	8·24		4·08						
		3000	1·97	34·77	27·81	8·16	—	4·00						
9	28	0	7·23	34·00	26·62	8·30	—	—	**N 70 V**	50–0	0730			
		5	7·23	34·00	26·62	—	105	—	,,	100–50				
		10	7·23	34·00	26·62	—	—	—	,,	250–100	—	0800		
		20	7·23	34·00	26·62	8·26		—	**N 200**	1250(–0)	1137	1445	4½	DGB
		30	7·19	34·00	26·63	—	—	—	**N 450**	3500(–0)	1137	1530	4½	net partially lost
		40	7·18	34·02	26·65	—	—		**N 100 H**	0–5	1206	1221	½	
		50	6·88	34·02	26·69									
		75	5·13	34·03	26·91									
		100	4·78	34·09	26·99	8·24	112							
		150	4·53	34·14	27·07									

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
9 *cont.*	46° 11′ 30″ S, 22° 27′ 30″ W	1926 11 ii										
10	46° 35′ 00″ S, 24° 15′ 30″ W	13 ii	1400	4402 rad. oz.								
			1600	—	SW	4	SW	5	o.	1025·1	6·1	
11	50° 26′ 00″ S, 30° 27′ 00″ W	16 ii	1000	5000 rad. oz.								
			1200	—	WNW	4	WNW	4	o.	1005·6	6·1	
12	51° 55′ 00″ S, 32° 27′ 30″ W	18 ii	1300	2744 di. oz.								
			1600	—	—	0–1	—	0	b.	1014·0	5·2	v. heavy W swell
			2000	—	—	1	—	0	b.	1016·1	—	,,

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
9 *cont.*		200	3·80	34·14	27·15									
		300	3·29	34·13	27·18									
		400	2·93	34·14	27·24									
		500	2·74	34·20	27·28									
		1000	2·58	34·29	27·37									
		1500	2·50	34·70	27·72									
		2000	2·33	34·74	27·76	8·16	149							
		3000	1·34	34·74	27·84	8·09	179							
		4000	0·42	34·70	27·89	8·06								
10	2	0	7·43	34·05	26·63	8·34	—	6·27	**N 70 V**	50–0	1430			
		5	7·46	34·05	26·63	—		—	,,	100–50				
		10	7·46	34·05	26·63		—		,,	250–100				
		20	7·43	34·06	26·64	8·29		6·28	,,	500–250	—	1550		
		30	7·41	34·05	26·63									
		40	7·38	34·05	26·64									
		50	7·37	34·05	26·64									
		75	6·54	34·18	26·85									
		100	5·96	34·29	27·01	8·23								
		150	4·94	34·23	27·10									
		200	4·38	34·16	27·10									
		300	3·49	34·16	27·19									
		400	2·81	34·14	27·25									
		500	2·64	34·18	27·29									
		1000	2·54	34·47	27·53									
		1500	2·41	34·68	27·70									
		2000	2·33	34·79	27·80	8·16	—	4·15						
		3000	1·40	34·79	27·87	8·08	—	4·32						
11	5	0	5·36	33·95	26·83	8·26	—		**N 70 V**	50–0	1000			
		5	5·36	33·95	26·83	8·22	89	—	,,	100–50				
		10	5·36	33·96	26·84	8·22	—	—	,,	250–100				
		20	5·36	33·96	26·84	8·24		—	,,	500–250		1300		
		30	5·35	33·95	26·83	8·24								
		40	5·38	33·93	26·80	8·22								
		50	5·33	33·94	26·82	8·26								
		75	2·38	33·96	27·13	8·26								
		100	0·89	33·93	27·21	8·16	151							
		150	0·36	34·00	27·30	8·16								
		200	1·08	34·14	27·37	8·08								
		300	1·60	34·31	27·47	7·98								
		400	1·94	34·43	27·54	7·96								
		500	2·02	34·54	27·63	7·96								
		1000	1·95	34·42	27·52	7·96								
		1500	1·94	34·70	27·76	8·00								
		2000	—	34·81	—	8·00	138							
		3000	0·97	34·71	27·83	8·01	196							
		4500	0·15	34·65	27·83	8·01	209							
12	7	0	3·82	33·86	26·91	8·29	—	6·95	**N 70 V**	50–0	1415			
		5	3·71	33·86	26·92			6·81	,,	100–50				
		10	3·32	33·86	26·96	—		6·91	,,	250–100				
		20	3·10	33·86	26·98	8·29	—	6·94	,,	500–250	—	1615	—	net slightly torn
		30	3·10	33·86	26·98			6·85	**N 450**	1200–1500	**1930**	**2100**	1·5	
		40	3·05	33·87	27·00			6·92						
		50	2·61	33·89	27·05	—	—	7·02						
		75	0·51	33·91	27·22	·	—	7·12						
		100	0·25	33·94	27·25	8·16		6·93						
		150	0·02	34·11	27·41	—		6·08						
		200	0·39	34·04	27·33	—		5·48						
		300	1·64	34·07	27·27	—	—	4·33						
		400	1·82	34·52	27·64	—	—	4·04						

2

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
12 *cont.*	51° 55′ 00″ S, 32° 27′ 30″ W	1926 18 ii										
13	5·7 miles N 49½° E of Jason Lt, S Georgia	3 iii	0930	143 gy. m.								
			1200	—	SE	3	SE	3	b. c.	994·7	2·2	
14	15·4 miles N 44½° E of Jason Lt, S Georgia	3 iii	1250	260 gy. m.	SE	2	S	2	o.	995·0	2·2	mod. NW swell
15	25 miles N 45½° E of Jason Lt, S Georgia	3 iii	1605	191 gy. m.	SW	2	SE	3	b. c.	995·8	2·2	
16	36·5 miles N 46° E of Jason Lt, S Georgia	3 iii	1905	727 di. oz.								
			2000	—	SW	2	—	0	o. g.	998·2	1·7	mod. NW swell
17	46 miles N 46° E of Jason Lt, S Georgia	4 iii	0000	1950 di. oz. st.	SE	3	—	0–1	o. g.	997·7	2·2	v. heavy NW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
12 *cont.*		500	1·85	34·61	27·70	—	—	3·94						
		600	1·87	34·61	27·76	—	—	3·97						
		1100	1·58	34·70	27·79		—	4·07						
		1600	1·08	34·70	27·82	—	—	4·33						
		2000	0·63	34·70	27·85	8·04	—	4·46						
		2600	0·47	34·70	27·86	—	—	4·54						
13	18	0	3·00	33·39	26·62	8·22	—	—	**N 70 V**	50–0	0930			
		5	3·00	33·39	26·62	—	—		,,	100–50				
		10	3·00	33·39	26·62	—	—	—	,,	135–100	—	0950		
		20	2·82	33·40	26·65	·	—	—	**N 200 V**	130–0	0955	1005		
		30	2·80	33·48	26·72									
		40	2·80	33·51	26·75									
		50	2·77	33·57	26·79									
		75	2·67	33·62	26·85									
		100	2·25	33·64	26·89									
		135	2·22	33·66	26·90									
14	18	0	3·01	33·84	26·98	—	—	—	**N 70 V**	50–0	1250			
		5	3·01	33·80	26·95	—	—	—	,,	100–50				
		10	3·00	33·80	26·95	—	-	—	,,	250–100				
		20	3·00	33·80	26·95	-	—	—	**N 200 V**	100–0				
		30	2·96	33·80	26·96		—		,,	250–100	—	1315		
		40	2·96	33·80	26·96									
		50	2·90	33·78	26·95									
		75	1·04	33·77	27·07									
		100	0·67	33·84	27·15									
		150	0·72	33·95	27·24									
		200	1·12	34·09	27·32									
		250	1·62	34·22	27·40									
15	18	0	2·77	33·80	26·97	—	108	—	**N 70 V**	50–0	1605			
		5	2·77	33·71	26·90	-	95	—	,,	100–50				
		10	2·77	33·71	26·90	—	76		,,	190–100				
		20	2·72	33·69	26·88	—	111	—	**N 200 V**	50–0				
		30	2·67	33·73	26·92		110	—	,,	100–50				
		40	2·54	33·64	26·86	—	113	—	,,	185–100	—	1630		
		50	1·62	33·64	26·93	—	120							
		75	0·84	33·71	27·04		131							
		100	0·72	33·75	27·08	—	128							
		140	0·64	33·78	27·11	—	135							
		175	1·13	33·84	27·12	—	160							
16	18	0	2·72	33·80	26·97	—	-	—	**N 70 V**	50–0	**1905**			
		5	2·72	33·80	26·97	·	—	—	,,	100–50				
		10	2·72	33·75	26·93	—	—	-	,,	250–100				
		20	2·72	33·75	26·93	—	·	—	,,	500–250				
		30	2·67	33·80	26·98	·	—	—	,,	700–500	—	**2045**		
		40	2·64	33·82	27·00	—	—	—	**N 200 V**	50–0	**1915**			
		50	2·63	33·84	27·01	—	—	—	,,	100–50				
		75	0·74	33·85	27·15	—	—	—	,,	500–100	—	**2000**		
		100	0·42	33·93	27·23									
		150	0·64	33·96	27·25									
		200	1·41	34·14	27·35									
		300	1·88	34·25	27·40									
		400	2·04	34·34	27·47									
		500	0·50	34·36	27·58									
		700	2·03	34·51	27·60									
17	19	0	2·62	33·78	26·97	—	—	—	**N 70 V**	50–0	**0000**			
		5	2·62	33·78	26·97	—	—	—	,,	100–50				
		10	2·62	33·77	26·95	—	—	—	,,	250–100				

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
17 *cont.*	46 miles N 46° E of Jason Lt, S Georgia	1926 4 iii										
18	4·8 miles N 34° E of C Saunders, S Georgia	4 iii	1105 1200	140 r. —	SW	3	SW	3	b. c.	999·9	3·3	mod. NW swell
19	10 miles N 39° E of C Saunders, S Georgia	4 iii	1335	200 gn. m.								
20	14·6 miles N 41° E of C Saunders, S Georgia	4 iii	1530 1600	210 gn. m.	SW	2	SW	2	b. c.	1001·4	4·4	mod. NW swell
21	20·5 miles N 44° E of C Saunders, S Georgia	4 iii	1750	326 m. r.								

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/oo	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
17 *cont.*		20	2·62	33·75	26·94	—	—	—	**N 70 V**	500–250				
		30	2·62	33·80	26·98	—	—	—	,,	750–500	—	**0235**		
		40	2·57	33·80	26·98	—	—		**N 200 V**	50–0	**0000**			
		50	2·42	33·80	27·00		—	—	,,	100–50				
		75	1·53	33·82	27·08	—	—	—	,,	500–100	—	**0115**		
		100	-0·18	33·95	27·29									
		150	0·77	34·14	27·39									
		200	1·44	34·29	27·46									
		300	1·94	34·45	27·55									
		400	2·09	34·58	27·66									
		500	2·07	34·59	27·66									
		1000	1·78	34·72	27·79									
		1500	1·28	34·73	27·83									
		1900	0·93?											
18	19	0	3·12	33·80	26·94	—	—	—	**N 70 V**	50–0	1105			
		5	3·07	33·80	26·94	—	—	—	,,	100–50				
		10	3·02	33·78	26·94		—	—	,,	135–100				
		20	2·92	33·78	26·95	—	—	—	**N 100 V**	135–0				
		30	2·87	33·84	26·99	—	—	—	**N 200 V**	50–0				
		40	2·75	33·84	27·00	—	—		,,	135–50	—	1155		
		50	2·57	33·87	27·04									
		75	2·22	33·89	27·08									
		100	2·02	33·89	27·10									
		130	1·81	33·87	27·10									
19	19	0	3·02	33·79	26·94	—	—		**N 70 V**	50–0	1340			
		5	3·02	33·75	26·91		—	—	,,	100–50				
		10	2·93	33·75	26·93	—		—	,,	190–100				
		20	2·84	33·75	26·93	—	—	—	**N 100 V**	190–0				
		30	2·73	33·75	26·94	—	—	—	**N 200 V**	50–0				
		40	2·69	33·77	26·95		—		,,	100–50				
		50	2·62	33·78	26·97	—	—	—	,,	190–100	—	1420		
		75	1·97	33·80	27·03									
		100	1·12	33·84	27·12									
		150	0·62	33·91	27·21									
		190	0·64	34·02	27·30									
20	19	0	3·22	33·82	26·95	—	—	—	**N 70 V**	50–0	1530			
		5	3·22	33·82	26·95	—	—	—	,,	100–50				
		10	3·17	33·80	26·93		—	—	,,	200–100				
		20	3·02	33·80	26·95	—		—	**N 100 V**	200–0				
		30	2·97	33·80	26·95	—	—	—	**N 200 V**	50–0				
		40	2·82	33·80	26·96		—	—	,,	100–50				
		50	2·60	33·80	26·98	—	—	—	,,	200–100	—	1650		
		75	1·11	33·86	27·13									
		100	0·62	33·91	27·21									
		150	0·64	33·99	27·27									
		199	1·32	34·18	27·39									
21	19	0	3·10	33·80	26·94	—	—	—	**N 70 V**	50–0	1750			
		5	3·06	33·80	26·94	—	—	—	,,	100–50				
		10	2·98	33·78	26·94	—	—	—	,,	250–100				
		20	2·92	33·78	26·95	—	—	—	**N 100 V**	300–0				
		30	2·84	33·78	26·97	—	—	—	**N 200 V**	50–0				
		40	2·69	33·80	26·98	—	—	—	,,	100–50				
		50	2·22	33·82	27·03	—	—	—	,,	250–100	—	**1900**		
		75	0·63	33·86	27·17									
		100	0·45	33·95	27·26									
		150	0·87	34·04	27·31									
		200	1·57	34·18	27·38									
		300	1·72	34·31	27·47									

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
22	12 miles N 22½° E of Jason Lt, S Georgia	1926 4 iii	2000	—	W	5	SW	5	b. c.	1016·6	2·8	
23	5·3 miles N 44° E of Merton Rock, S Georgia	14 iii	1200	228 gn. m.	—	0–1	—	0	c.	982·0	5·0	v. heavy NW swell
24	10 miles N 72° E of Jason Lt, S Georgia	14 iii	1600	—	NW	5	NW	5	b. c.	984·9	5·0	v. heavy NW swell
25	18 miles N 60° E of Jason Lt, S Georgia	14 iii	2000	—	NW	5	NW	5	b. c.	987·7	5·5	v. heavy NW swell
26	26·5 miles N 54° E of Jason Lt, S Georgia	14 iii										
27	W Cumberland Bay, S Georgia; 3·3 miles S 44° E of Jason Lt	15 iii	1200 1230	— 110 m. r.	NW	4	NW	4	o. f. g.	987·3	2·2	v. heavy NW swell
28	W Cumberland Bay, S Georgia; 3·3 miles S 45° W of Jason Lt	16 iii	1050 1150 1200	65 m. 168 m. —	NNW	3	—	0	b. c.	977·0	9·4	
29	W Cumberland Bay, S Georgia; 5·9 miles S 51° W of Jason Lt	16 iii	1330	23 m. st.	NW	3	NW	2	b. c.	977·0	7·2	
30	W Cumberland Bay, S Georgia; 2·8 miles S 24° W of Jason Lt	16 iii	1450 1600	251 m. st. —	SW	7	SW	2	b. c. q.	984·2	8·3	
31	13·5 miles N 89° E of Jason Lt, S Georgia	17 iii	1750 2000	220 gn. m.	SE	6	SE	5	o. g.	963·3	3·9	heavy conf. swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/oo	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
22	19	—		—	—	—	—	—	**N 200 H**	60(–0)	**2020**	**2150**	3	
									,,	0	**2030**	**2140**	2·3	
23	1	0	2·67	33·80	26·98	—	—	—	**N 70 V**	50–0	1215			
		5	2·72	33·82	26·99	—	—	—	,,	100–50				
		10	2·57	33·91	27·07	—	—	—	,,	190–100				
		20	2·52	33·91	27·08	—	—	—	**N 50 V**	100–0	—	1255		
		30	2·52	33·78	26·98	—	—	—	**N 100 H**	60(–0)	1305	1320		
		40	2·38	33·84	27·03	—	—	—	,,	0	1310	,,		
		50	2·32	33·89	27·07									
		75	2·22	33·93	27·11									
		100	1·53	33·96	27·19									
		150	1·14	34·00	27·25									
		193	0·94	34·04	27·29									
24	1	—	—	—			—	—	**N 100 H**	60(–0)	1600	1700		
									,,	0	,,	,,		
25	1	—	—	—	—	—	–	—	**N 100 H**	60(–0)	**1825**	**1935**		
									,,	0–5	,,	,,		
26	—	—	—	—	—	—	—	—	**N 100 H**	60(–0)	**2045**	**2125**		
									,,	0–5	,,	,,		
27	2	—	—	—	—	—	—	—	**DL**	110	1230	1255	—	bag torn
28	3	0	2·77	32·07	25·59	—	—	—	**DC**	168	1150	1205		
		5	2·56	32·84	26·23									
		10	2·85	33·60	26·81									
		15	3·00	33·62	26·81									
		20	2·84	33·66	26·85									
		30	2·84	33·74	26·92									
		40	2·74	33·74	26·93									
29	3	0	2·78	32·41	25·86	—	—	—	**DC**	23	1345	1350		
		5	2·65	33·12	26·44									
		10	2·78	33·66	26·86									
		15	2·83	33·75	27·93									
		20	2·83	33·73	27·91									
30	3	0	2·93	32·68	26·06	—	—	—	**N 70 V**	50–0	1500			
		5	2·87	32·77	26·15	—	—	—	,,	100–50				
		10	2·92	33·40	26·65	—	—	—	,,	230–100	—	1600		
		15	2·87	33·66	26·85	—	—	—	**DLH**	251	1600	1610	—	stop of bridle parted
		20	2·83	33·73	26·90	—	—	—	,,	251	1635	1645		
		30	2·82	33·78	26·95									
		40	2·82	33·77	26·93									
		50	2·72	33·77	26·94									
		75	2·57	33·78	26·97									
		100	2·39	33·82	27·02									
		150	1·67	33·84	27·08									
		200	0·92	34·00	27·26									
31	4	0	3·02	33·71	26·88	—	—	—	**N 50 V**	100–0	1755			
		5	3·02	33·73	26·89	—	—	—	**N 70 V**	50–0				
		10	3·02	33·75	26·91	—	—	—	,,	100–50				
		20	2·94	33·75	26·92	—	—	—	,,	220–100	—	**1845**		
		30	3·02	33·86	26·99	—	—	—	**N 100 H**	0–5	**1910**	**2045**	3	
		40	2·94	33·89	27·03	—	—	—	,,	50(–0)	,,	,,	3	
		50	2·50	33·88	27·06	—	—	—	,,	90(–0)	,,	,,	3	
		75	2·15	33·88	27·09									
		100	1·64	33·89	27·33									
		150	1·02	34·00	27·26									
		200	0·83	34·04	27·30									

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
32	22·8 miles N 70½° E of Jason Lt, S Georgia	1926 17 iii	0000		SW	7	SW	7	o.	969·4	2·2	v. heavy conf. swell
33	33 miles N 37° E of Jason Lt, S Georgia	18 iii	0800	—	var.	2	-	0	o. q.	984·8	5·0	heavy conf. swell
34	43 miles N 39° E of Jason Lt, S Georgia	18 iii	1200	—	SW	5	SW	6	b. c. q.	989·1	5·5	heavy W swell
35	53 miles N 40° E of Jason Lt, S Georgia	18 iii	1500		SW	5	SW	4	o.	993·6	3·9	v. heavy W swell
36	38 miles N 39° E of Jason Lt, S Georgia	18 iii	2000		SW	5	SW	4	o. m.	991·7	2·2	v. heavy W swell
37	28 miles N 36° E of Jason Lt, S Georgia	18–19 iii	0000	-	SSW	5	SW	5	o. g.	992·0	1·7	v. heavy W swell
38	18·5 miles N 33° E of Jason Lt, S Georgia	19 iii	0400	—	WSW	4	WSW	3	b.	995·7	1·7	heavy W swell
39	E Cumberland Bay, S Georgia. From 8 cables S 81° W of Merton Rock to 1·3 miles N 7° E of Macmahon Rock	25 iii	1445 1600	179 gy. m. 235 gy. m.	S	3	--	0	o. s.	988·5	0·6	
40	7 miles N 39° E of Barff Pt, S Georgia	28 iii	1000	-	N	3	N	1–2	b. c.	1010·5	1·1	
41	16½ miles N 39° E of Barff Pt, S Georgia	28 iii	1112	272 gy. m.								
41 A	16½ miles N 39° E of Barff Pt, S Georgia. (Ship anchored by stern with kedge)		1200	—	N	3	-	0	c.	1010·5	2·8	
41 B	" "	-	1600	—	NW	4	NW	3	b. c. m.	1005·2	2·2	slight N swell
41 C	" "											

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. °Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	Hauled	Length of tow (miles)	Remarks
32	4	—	—	—	—	—	—	—	**N 100 H**	0–5	**2300**	**2358**	3	
									,,	50(–0)	,,	,,	3	
									,,	90(–0)	,,	,,	3	DGA
33	5	—	—	—	—	—	—	—	**N 100 H**	0–5	0945	1040	3	
									,,	50(–0)	,,	,,	3	
									,,	90(–0)	,,	,,	3	
34	5	—		—	—	—	—		**N 100 H**	0–5	1225	1335	3	
									,,	50(–0)	,,	,,	3	
									,,	90(–0)	,,	,,	3	
35	5	—	—	—		—	—	—	**N 100 H**	0–5	1505	1620	3	
									,,	50(–0)	,,	,,	3	
									,,	90(–0)	,,	,,	3	
36	5	—	—	—	—	—		—	**N 100 H**	0–5	**2010**	**2150**	3	
									,,	50(–0)	,,	,,	3	
									,,	90(–0)	,,	,,	3	
37	6	—	—	—	—	—	—	—	**N 100 H**	0–5	**0005**	**0120**	3	
									,,	50(–0)?	,,	,,	3	net slipped to end of warp
									,,	90(–0)	,,	,,	3	
38	6	—	—	—	—	—	—	—	**N 100 H**	0–5	**0355**	**0505**	3	
									,,	50(–0)	,,	,,	3	
									,,	90(–0)	,,	,,	3	
39	12	0	2·85	32·97	26·18	—	—	—	**OTL**	179–235	1445	1545	3·2	
		175	1·02	34·02	27·28	—	—	—	**N 4–T**					
									N 7–T					
40	14	—	—	—	—	—	—	—	**N 100 H**	0–5	1000	1018	1	
									,,	50(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
41	14	—	—	—	—	—	—	—	**N 100 H**	0–5	1112	1135	1	
									,,	50(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
41 A	—	0	2·43	33·86	27·04	8·26	—	6·74	**N 70 V**	50–0	1300			
		5	2·42	33·86	27·04	8·26	—	5·84	,,	100–50				
		10	2·42	33·86	27·04	8·25	—	6·83	,,	150–100				
		20	2·41	33·84	27·03	8·25	—	6·37	,,	265–150	—	1345		
		30	2·40	33·84	27·03	8·25	—	4·46						
		40	2·31	33·84	27·04	8·25	—	5·40						
		50	2·27	33·86	27·05	8·25	—	6·83						
		75	2·22	33·87	27·07	8·25	—	6·43						
		100	1·22	33·93	27·18	8·17	—	4·19						
		150	0·80	34·07	27·33	8·12	—	5·82						
		200	1·42	34·23	27·42	7·97	—	4·87						
		250	1·72	34·40	27·53	7·96	—	4·43						
41 B	—	—	—	—	—	—		—	**N 70 V**	50–0	1540			
									,,	100–50				
									,,	150–100				
									,,	265–150	—	1605		
									N 200 V	50–0	1500			
									,,	100–50				
									,,	150–100				
									,,	265–150	—	1545		
41 C	(2)—	0	2·37	33·86	27·04	8·26	102	—	**N 50 V**	250–0	1715	1730		
	2	5	2·42	33·86	27·04	8·25	111	—	**N 70 V**	50–0	1700			
		10	2·42	33·84	27·03	8·25	128	—	,,	100–50				
		20	2·42	33·84	27·03	8·25	128	—	,,	150–100				
		30	2·40	33·85	27·04	8·25	131	—	,,	240–150	—	1728		
		40	2·39	33·84	27·03	8·25	123							
		50	2·31	33·86	27·05	8·25	123							
		75	2·22	33·87	27·07	8·25	128							

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
41 C *cont.*	16½ miles N 39° E of Barff Pt, S Georgia. (Ship anchored by stern with kedge)	1926 28 iii										
41 D	,, ,,	—	2000	—	NW	5	NW	4	o. r.	994·6	1·1	N swell rising
41 E	,, ,,	—	2100	—	NW	5–6	NW	4–5	o. r.	—	—	heavy N swell
42	Off mouth of Cumberland Bay, S Georgia. From 6·3 miles N 89° E of Jason Lt to 4 miles N 39° E of Jason Lt	1 iv	1200 1310	204 m. 120 m.	SE NE	5 5	SE NE	5 4	o. h.	986·0	3·3	mod. E swell
43	15 miles N 58° E of Jason Lt, S Georgia	3 iv	1330	—	WNW	5	WNW	4	o. m.	1004·5	3·3	mod. NW swell
44	32 miles N 51° E of Jason Lt, S Georgia	3 iv	2000	—	WNW	6	WNW	4	o. f.	1007·2	2·8	mod. NW swell
45	2·7 miles S 85° E of Jason Lt, S Georgia	6 iv	1155 1200 1306	270 gy. m. 238 gy. m.	—	0–1	—	0	b. c.	991·4	3·3	heavy NW swell
46	51° 13′ 00″ S, 49° 50′ 00″ W	21 iv	2200	—	SW	7	SW	6	o.	1023·8	5·5	
47	50° 55′ 00″ S, 54° 38′ 00″ W	23 iv	2200	—	SW	3	SW	3	b. c.	1003·5	2·9	mod. SSE swell
48	8·3 miles N 53° E of William Pt Beacon, Port William, Falkland I	3 v	1200 1317	105 s. sh. 115 s. sh.	NE	4	NE	4	o. v.	994·1	6·7	
49	13·5 miles N 51° E of C Bougainville, E Falkland I	3 v	2100	—	—	0	—	0	b. c.	995·2	7·2	
50	2·3 miles S 80° E of Eddystone Rock, E Falkland I	4 v	1200	·	WNW	3	WNW	3	b. c.	1004·7	8·3	slight conf. swell
51	Off Eddystone Rock, E Falkland I. From 7 miles N 50° E to 7·6 miles N 63° E of Eddystone Rock	4 v	1315 1555 1600	115 f. s. 105 f. s. ·	— WNW	0–1 5	— WNW	0 4	o. b. c.	992·4 1005·5	6·1 7·2	slight swell mod. conf. swell
52	Port William, E Falkland I, 7·4 cables N 17° E of Navy Pt	5 v	2000	17	NW	5	NW	5	o. r.	995·4	7·7	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
41 C *cont.*		100	1·12	33·93	27·19	8·17	197?							
		150	0·77	34·07	27·33	8·11	138							
		200	1·37	34·23	27·42	7·97	138							
		250	1·76	34·38	27·52	7·96	183?							
41 D	—	—	—	—	—	—	—	—	**N 70 V**	50–0	**1910**			
									,,	100–50				
									,,	150–100				
									,,	240–150	—	**1955**		
									N 200 V	50–0	**1900**			
									,,	100–50				
									,,	150–100				
									,,	240–150	—	**2030**		
41 E	—	0	2·42	33·78	26·99	8·20	—	5·82	**N 70 V**	50–0	**2105**			
		5	2·42	33·78	26·99	8·24	—	6·13	,,	100–50				
		10	2·42	33·83	26·99	8·25	—	4·82	,,	150–100				
		20	2·42	33·84	27·03	8·25	—	5·93	,,	250–150	—	**2140**		
		30	2·41	33·84	27·03	8·25	—	6·87						
		40	2·34	33·84	27·03	8·25	—	6·22						
		50	2·32	33·86	27·03	8·25	—	5·72						
		75	1·95	33·87	27·09	8·25	—	6·03						
		100	1·02	33·95	27·22	8·12	—	5·94						
		150	0·72	34·07	27·34	7·98	—	5·38						
		200	1·38	34·23	27·42	7·97	—	2·81						
		250	1·50	34·25	27·43	7·96	—	3·65						
42	18	100	2·08	33·86	27·06	—	—	—	**OTL**					
									N 7–T	120–204	1210	1310	4·6	
									N 4–T					
43	20	—	—	—	—	—	—	—	**N 100 H**	0–5	1338	1445	1	
									,,	75(–0)	,,	,,	1	
									,,	150(–0)	,,	,,	1	KT
44	20	—	—	—	—	—	—	—	**N 100 H**	0–5	**1855**	**2000**	1·3	
									,,	55(–0)	,,	,,	1·3	
									,,	110(–0)	,,	,,	1·3	
									,,	170(–0)	,,	,,	1·3	
45	23	0	2·55	33·82	27·01	—	—	—	**NH**	0	1135			
		260	1·37	34·22	27·40	—	—	—	**OTL**					
									N 7–T					
									N 4–T	238–270	1155	1306	4	
									NCS–T					
46	10	0	5·02	34·02	26·92	—	—	—	**N 100 H**	0–5	**2200**	**2215**		
47	12	0	5·88	34·05	26·83	—	—	—	**N 100 H**	0–5	**2200**	**2220**		
48	20	0	7·35	33·86	26·49	—	—	—	**OTL**					
		105	7·14	33·77	26·45	—	—	—	**N 7–T**	105–115	1214	1317	—	net very badly torn
									N 4–T					
									NCS–T					
49	20	0	7·5	33·77	26·40	—	—	—	**N 100 H**	0–5	**2100**	**2120**		
50	21	0	8·25	33·82	26·33	—	—	—	**N 100 H**	0–5	1050	1115		
									,,	50(–0)	,,	,,		
51	21	0	8·1	33·80	26·33	—	—	—	**DLH**	115	1320	1328		
		110	7·86	33·80	26·38	—	—	—	**OTL**					
									N 7–T					
									N 4–T	105–115	1517	1547		
									NCS–T					
52	22	—	—	—	—	—	—	—	**LH**	17	**2100**			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
53	Port Stanley, E Falkland I. Hulk of "Great Britain"	1926 12 v	1600	—	SW	5	—	0	b. c.	1010·5	6·7	
54	Port Stanley, E Falkland I	15 v	1600	—	NE × N	2	—	0	b. c.	1006·1	6·7	
55	Entrance to Port Stanley, E Falkland I, 2 cables S 24° E of Navy Pt	16 v	1200 1415 1430	— 16 10	W	2	—	0	o. d.	1005·6	6·7	
56	Sparrow Cove, Port William, E Falkland I, 1½ cables N 50° E of Sparrow Pt	16 v	1530 1545	10½ 16								
57	Port William, E Falkland I, 5½ cables S 20° W of Sparrow Pt	16 v	1600 1615	15 15	—	0–1	—	0	b. c.	1009·2	6·1	
58	Port Stanley, E Falkland I	19 v	1600		NW	7	NW	3	o. d.	1009·0	7·8	
59	51° 22′ 00″ S, 57° 20′ 00″ W	20 v	1600	—	N	2	·	0	b. c. v.	1016·1	6·6	
60	50° 45′ 00″ S, 56° 33′ 00″ W	21 v	0400	—	SE	2	—	0	b. v.	1017·6	6·6	heavy N swell
61	50° 00′ 00″ S, 55° 36′ 00″ W	21 v	1200	—	SE	4	ESE	4	f.	1020·8	5·0	
62	49° 22′ 00″ S, 54° 48′ 00″ W	22 v	0000		E	3	—	0	o. d. m.	1022·2	5·6	heavy N swell
63	48° 50′ 00″ S, 53° 56′ 00″ W	22 v	1000	—	SE × E	4	SE × E	4	o. u.	1021·5	5·0	heavy N swell
64	48° 34′ 00″ S, 53° 34′ 30″ W	22 v	1600	4136 gl. oz.	NNW	2	NNW	2	o. d. m.	1020·0	8·3	mod. N swell
65	48° 18′ 00″ S, 53° 09′ 00″ W	22 v	2000	—	NNW	2	NNW	2	o. d. m.	1020·0	7·2	mod. N swell
66	48° 09′ 00″ S, 52° 50′ 00″ W	23 v	0400	—	—	0	—	0	o.	1018·7	8·9	mod. N swell
67	47° 18′ 00″ S, 51° 52′ 00″ W	23 v	1200	—	ESE	6	ESE	5	o. d. m.	1000·0	10·5	mod. N swell
68	46° 40′ 00″ S, 51° 22′ 00″ W	24 v	0000	—	SE	8	SE	7	o. u. d.	1009·0	10·5	conf. swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
53	2	—	—	—	—	—	—	—	RM	0–2	1400	1500		
54	5	—	—	—	—	—	—	—	Sh. coll.	—	1500			
55	6	0	5·85	32·99	26·03	—	—	—	BTS	10–16	1415	1430		
		10	5·85	33·28	26·26	—	—	—	NCS–T					
56	6	0	6·10	33·37	26·27	—	—	—	BTS	10½–16	1530	1545		
		16	6·34	33·69	26·50	—	—	—	NCS–T					
57	6	0	5·95	33·21	26·17	—	—	—	BTS	15	1600	1615		
		15	6·29	—	—	—	—	—	NCS–T					
58	8	—	—	—	—	—	—	—	N 70 H	0–1	1510	1520		
									RM	1–2	1530	1535	—	piles of Govt Jetty
									N 70 H	0–5	1600	1610		
59	9	—	—	—	—	—	—	—	N 100 H	0–5	1645	1725	1	
									,,	40(–0)	,,	,,	1	
									,,	75(–0)	,,	,,	1	
60	10	—	—	—	—	—	—	—	N 100 H	0–5	0317	0350	1	
									,,	40(–0)	,,	,,	1	
									,,	75(–0)	,,	,,	1	
61	10	—	—	—	—	—	—	—	N 100 H	0–5	1220	1240	1	
									,,	55(–0)	,,	,,	1	
									,,	95(–0)	,,	,,	1	
62	11	—	—	—	—	—	—	—	N 100 H	0–5	0130	0207	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
									N 70 H	0–5	,,	,,	1	net torn away
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
63	11	—	—	—	—	—	—	—	NH	0	1000			
64	11	—	—	—	—	—	—	—	N 100 H	0–5	1630	1705	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
									N 70 H	0–5	,,	,,	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
65	11	—	—	—	—	—	—	—	N 200 H	120(–0)	2111	2141	1	
66	12	—	—	—	—	—	—	—	N 100 H	0–5	0355	0430	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
									N 70 H	0–5	,,	,,	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
67	12	—	—	—	—	—	—	—	N 100 H	0–5	1320	1345	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
									N 70 H	0–5	,,	,,	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
68	13	—	—	—	—	—	—	—	N 100 H	0–5	0055	0120	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	net badly torn
									N 70 H	0–5	,,	,,	1	
									,,	45(–0)	,,	,,	1	about half sample lost
									,,	90(–0)	,,	,,	1	net badly torn

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
69	45° 06′ 00″ S, 49° 00′ 00″ W	1926 25 v	1600	—	E	6	E	6	b. c.	1027·7	8·9	conf. swell
70	44° 15′ 00″ S, 47° 58′ 00″ W	26 v	2000	—	ENE	7	ENE	7	o. u. q.	1020·6	10·5	heavy conf. swell
71	43° 20′ 00″ S, 46° 02′ 00″ W	30 v	0730	5460 di. oz. rd. cl.								
			0800	—	WSW	5	WSW	3	c. g.	1006·0	11·1	heavy NE swell
			1200	—	SW	6	SW	6	o. r. g.	1003·0	10·0	,,
			1600	—	SW	6–7	SW	6	b.	1006·9	8·3	mod. conf. swell
72	41° 43′ 20″ S, 42° 20′ 40″ W	1 vi	1100	5420								
			1200	—	NNE	4	NNE	4	o.	1002·2	13·6	mod. conf. swell
			1600	—	N × W	3	N × W	2	b. p. q.	997·5	13·3	,,
			2000	—	NW	4	N × W	2	b. l.	996·3	13·9	,,
73	41° 07′ 00″ S, 39° 33′ 00″ W	2 vi	2000	—	WSW	3	SW	4	b. c.	1012·8	11·1	mod. conf. swell
74	40° 30′ 40″ S, 38° 14′ 50″ W	3 vi	0800	—	W	3	W	3	b. c.	1018·5	12·6	heavy N swell
			0930	5446 di. oz. rd. cl.								
			1200	—	W × S	4	SW	4	b. c.	1018·5	11·7	v. heavy conf. swell
			1600	—	W	3	W	3	b. c.	1020·8	12·2	,,

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
69	14	—			—		—		**N 100 H**	0–5	**1655**	**1725**	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
									N 70 H	0–5	,,	,,	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
70	14	—		—	—				**N 100 H**	0–5	**2043**	**2120**	1	
71	18	0	10·16	34·34	26·43	8·30	—	—	**N 70 V**	50–0	0730			
		5	10·15	34·34	26·43	8·30	—		,,	100–50				
		10	10·15	34·35	26·44	8·30		—	,,	250–100				
		20	10·13	34·36	26·47	8·30	—	—	,,	500–250				
		30	10·13	34·35	26·45	8·30			,,	750–500				
		40	10·13	34·35	26·45	8·26		—	,,	1000–750	—	1110		
		50	10·18	34·35	26·44	8·26	—		**TYF**	2000(–0)	1430	1530		
		75	10·12	34·35	26·44	8·24								
		100	7·89	34·43	26·87	8·24								
		150	6·94	34·43	27·01	8·23								
		200	6·12	34·36	27·05	8·20								
		300	4·85	34·27	27·23	8·16								
		5400	0·15	34·63	27·79	8·15								
72	20	0	12·65	34·67	26·22	8·30	—	—	**N 70 V**	50–0	1120			
		5	12·63	34·67	26·22	8·30		—	,,	100–50				
		10	12·63	34·67	26·22	8·30	—	—	,,	250–100				
		20	12·62	34·67	26·23	8·30	—	—	,,	500–250				
		30	12·62	34·67	26·23	8·30	—	—	,,	750–500				
		40	12·61	34·69	26·24	8·30		—	,,	1000–750	—	1510		
		50	12·61	34·68	26·24	8·30	—		**N 450**	2000(–0)	**1715**	**1846**	4·5	net torn
		75	10·29	34·43	26·48	8·29								
		100	8·89	34·42	26·70	8·27								
		150	7·61	34·51	26·97	8·08								
		200	6·50	34·42	27·04	8·08								
		300	4·62	34·23	27·13	8·08								
		400	4·03	34·18	27·16	8·06								
		500	3·42	34·18	27·22	8·06								
		1000	2·64	34·33	27·40	7·98								
		1500	2·75	34·60	27·61	7·98								
		2000	2·78	34·78	27·76	7·97								
		3000	2·67	34·86	27·83	7·98								
		4000	1·39	34·76	27·84	7·98								
		5000	0·27	34·69	27·85	7·98								
73	21	—	—		—	—	—	—	**N 100 H**	0–5	**2020**	**2050**	1	
74	22	0	13·61	34·86	26·17	8·32	—	—	**N 70 V**	50–0	0930			
		5	13·61	34·86	26·17	8·32	—	—	,,	100–50				
		10	13·61	34·85	26·16	8·32	—		,,	250–100				
		20	13·63	34·85	26·16	8·32	—	—	,,	500–250				
		30	13·73	34·85	26·14	8·32	—		,,	750–500				
		40	13·94	34·99	26·21	8·32	—		,,	1000–0	—	1210		
		50	14·06	35·00	26·20	8·32	—	—	**N 100 H**	0–5	1455	1530	1	
		75	14·26	35·21	26·32	8·32	—	—	,,	45(–0)	,,	,,	1	
		100	14·52	35·46	26·45	8·30	—		,,	90(–0)	,,	,,	1	
		150	13·30	35·30	26·59	8·29								
		200	12·01	35·10	26·69	8·28								
		300	11·29	34·71	26·52	8·26								
		400	10·97	34·42	26·34	8·26								
		500	5·34	34·25	27·06	8·14								
		1000	3·05	34·23	27·30	8·12								
		2500	2·96	34·88	27·82	8·04								
		4000	2·00	34·81	27·85	8·04								
		5400	0·51	34·67	27·83	8·02								

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
		1926										
75	40° 08′ 00″ S, 37° 15′ 00″ W	4 vi	1600	—	—	1	SW	1	o.	1027·8	11·1	mod. SSW swell
76	39° 50′ 30″ S, 36° 23′ 00″ W	5 vi	1200	—	W	2	—	0	b. c.	1027·5	12·9	slight SW swell
77	39° 19′ 30″ S, 35° 27′ 40″ W	6 vi	0800	—	—	0–1	—	0	b. c.	1024·8	11·7	slight SW swell
			0950	5186 di. oz. rd. cl.								
			1200	—	—	0–1	—	0	b. c.	1024·5	15·0	”
78	35° 18′ 00″ S, 19° 01′ 10″ W	12 vi	0800	—	SW	3	SW	3	b. c.	1016·4	12·2	heavy SW swell
			0935	3410 gl. oz.								
			1200	—	WSW	2	WSW	2	b. c.	1016·0	13·9	heavy WSW swell
			1600	—	NNE	2	NNE	2	o. g.	1015·2	11·1	heavy conf. swell
79	34° 48′ 00″ S, 16° 36′ 00″ W	13 vi	1200	—	N × E	4	N × E	4	o. r.	1006·6	11·1	heavy SW swell
			1600	—	W × N	2	W × N	2	b. c.	1004·1	15·0	heavy conf. swell
80	32° 46′ 00″ S, 10° 00′ 00″ W	17 vi	0000	—	W × N	5	W × N	4	b. c.	1015·0	16·1	heavy W swell
81	32° 45′ 00″ S, 8° 47′ 00″ W	18 vi	1200	—	W	4	W	3	b. c.	1014·2	17·2	heavy conf. swell
82	32° 42′ 00″ S, 2° 05′ 00″ W	20 vi	2200	—	S	4	S	5	b. c.	1027·3	13·3	bright moonlight
83	32° 30′ 50″ S, 1° 23′ 30″ W	21 vi	0930	4308 gl. oz.								
			1200	—	—	0–1	—	0	c. v.	1027·1	15·6	heavy SW swell
			1600	—	WNW	5	WNW	4	o.	1026·9	15·0	heavy conf. swell
			2000	—	WNW	5	WNW	4	c.	1025·3	16·1	”

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME		Length of tow (miles)	
											Shot	Hauled		
75	23	—	—	—	—	—	—	—	**N 70 H**	75(–0)	1340	1550	1	
76	24	—	—	—	—	—	—	—	**N 450**	1500(–0)	1152	1340	1·1	
77	25	0	13·99	34·92	26·13	8·34	—	—	**N 70 V**	50–0	0950			
		5	13·99	34·92	26·13	8·34	—	—	,,	100–50				
		10	13·99	34·92	26·13	8·34	—	—	,,	250–100				
		20	13·99	34·94	26·16	8·34	—	—	,,	500–250				
		30	13·99	34·96	26·17	8·34	—	—	,,	750–500				
		40	13·99	34·96	26·17	8·34	—		,,	1000–750	—	1230		
		50	13·36	34·87	26·24	8·34								
		75	12·51	34·78	26·34	8·32								
		100	11·11	34·85	26·65	8·32								
		150	8·75	34·60	26·87	8·29								
		200	7·22	34·42	26·85	8·29								
		300	5·12	34·29	27·12	8·06								
		400	4·79	34·23	27·11	8·04								
		500	—	34·18	—	8·04								
		1000	2·93	34·25	27·30	8·02								
		1500	2·66	34·43	27·49	8·02								
		2000	2·65	34·60	27·62	8·00								
		3500	2·56	34·85	27·82	8·00								
		5000	0·13	34·67	27·68	8·00								
78	3	0	14·19	35·00	26·17	8·34	—	—	**N 70 V**	50–0	0935			
		5	14·19	35·00	26·17	8·34	—	—	,,	100–50				
		10	14·19	35·00	26·17	8·34	—	—	,,	500–0				
		20	14·19	35·00	26·17	8·34	—	—	,,	1000–0	—	1215		
		30	14·19	35·00	26·17	8·34	—	—	**TYF**	1000(–0)	1300	1435	3	
		40	14·19	35·00	26·17	8·34	—	—	**NH**	0	1130			
		50	14·19	35·00	26·17	8·34	—	—	**N 100 H**	110(–0)	1355	1455	1	
		75	14·04	35·03	26·22	8·34								
		100	14·02	35·08	26·27	8·34								
		150	13·04	35·26	26·51	8·34								
		200	12·19	35·14	26·68	8·34								
		300	11·16	35·00	26·77	8·32								
		400	10·49	34·90	26·81	8·30								
		500	8·36	34·58	26·92	7·70								
		1000	3·11	34·23	27·29	8·07								
		1500	2·68	34·47	27·52	7·70								
		2000	2·74	34·66	27·66	8·05								
		3000	2·48	34·87	27·85	8·05								
79	4	—	—	—	—	—	—	—	**N 450**	1000–0	1420	1525	1·5	net largely torn away
80	7	—	—	—	—	—	—	—	**N 200**	30–0	**2250**	**2325**		
81	8	—	—	—	—	—	—	—	**N 450**	650(–0)	1005	1135	2·3	DGT
82	10	—	—	—	—	—	—	—	**N 200**	75(–0)	**2210**	**2310**	1·7	
83	11	0	16·31	35·43	26·03	8·34	—	—	**N 70 V**	50–0	0945			
		5	16·31	35·43	26·03	8·34	—	—	,,	100–50				
		10	16·31	35·43	26·03	8·34	—	—	,,	250–100				
		20	16·31	35·43	26·03	8·34	—	—	,,	500–250				
		30	16·31	35·44	26·04	8·34	—	—	,,	750–500				
		40	16·31	35·44	26·04	8·34	—	—	,,	1000–750				
		50	16·31	35·44	26·04	8·34	—	—	,,	2000–1500	—	1230		
		75	16·30	35·44	26·04	8·34	—	—	**N 200**	650(–0)	**2012**	**2112**		
		100	16·19	35·43	26·06	8·34								
		150	14·36	35·30	26·36	8·34								
		200	13·11	35·17	26·43	8·34								

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
83 *cont.*	32° 30′ 50″ S, 1° 23′ 30″ W	1926 21 vi										
84	32° 52′ 00″ S, 1° 55′ 00″ E	22 vi	1900	2233								
			2000	gl. oz.	WNW	6	WNW	6	b. c.	1018·9	13·9	
85	33° 07′ 40″ S, 4° 30′ 20″ E	23 vi	1200	—	—	0–1		1	b. c.	1021·6	16·1	heavy NW swell
			1330	4943								
			1600	—	—	0–1	—	1	c.	1019·1	16·1	heavy W swell
			2000	—	WNW	2	—	1	c. m.	1020·6	15·6	,,
86	33° 25′ 00″ S, 6° 31′ 00″ E	24 vi	1200		NW	5	NW	4	b. c.	1021·6	17·2	mod. W swell
			1600	—	NW	5	NW	4	b. c. q.	1020·7	16·1	,,
87	33° 53′ 45″ S, 9° 26′ 30″ E	25 vi	1030	5081 gl. oz.								
			1200	—	NW	4	NW	4	b. c.	1020·1	16·6	heavy NW swell
			1600		NW	5	NW	4	b. c.	1019·2	16·1	mod. NW swell
88	34° 04′ 00″ S, 13° 00′ 00″ E	27 vi	0800	—	SSE	4	SSE	3	b. c.	1023·1	17·8	heavy SW swell
			1200	—	SSE	3	SSE	2	b. c.	1023·6	16·1	,,
89	34° 05′ 15″ S, 16° 00′ 45″ E	28 vi	1110	3926 gl. oz.								
			1200	—	—	0–1	—	0	c.	1024·5	16·1	heavy SW swell
			1600	—	—	0–1	—	0	b. c. v.	1024·5	16·1	,,

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
83 *cont.*		300	12·07	34·97	26·58	8·34								
		400	11·49	34·97	26·69	8·32								
		500	11·06	34·94	26·78	8·29								
		1000	5·16	34·32	27·13	8·07								
		1500	3·13	34·36	27·39	8·02								
		2000	2·80	34·60	27·61	7·97								
84	12	2000	2·71	34·79	27·77	—	—	—	**DLH**	2000–0	**1930**	**1958**	—	dredge failed to reach bottom
									NCS–D					
85	13	0	16·26	35·48	26·07	8·35	25	—	**N 70 V**	50–0	1345			
		5	16·19	35·50	26·11	8·34	28	—	,,	100–50				
		10	16·12	35·50	26·12	8·34	28	—	,,	250–100				
		20	16·05	35·52	26·15	8·34	28	—	,,	500–250				
		30	16·02	35·52	26·16	8·34	28	—	,,	500–0				
		40	16·01	35·51	26·15	8·34	29	—	,,	750–500				
		50	15·98	35·52	26·17	8·34	30	—	,,	1000–750	—	1630		
		75	15·81	35·51	26·20	8·34	28	—	**N 450**	2000(–0)	**1805**	**2007**	2·0	
		100	15·01	35·50	26·38	8·34	28							
		150	14·24	35·50	26·52	8·34	28							
		200	13·11	35·19	26·54	8·32	38							
		300	11·66	35·02	26·68	8·30	48							
		400	9·95	34·83	26·85	8·20	56							
		500	8·59	34·68	26·95	8·20	63							
		1000	3·51	34·41	27·38	8·07	106							
		1500	2·76	34·67	27·65	8·07	114							
		2000	2·74	34·88	27·84	8·02	112							
		3000	2·36	34·97	27·92	8·02	112							
		4800	1·01	34·85	27·94	8·02	123							
86	14	—	—	—	—	—	—	—	**N 450**	1000(–0)	1155	1615	3·0	
87	15	0	16·51	35·55	26·07	8·35	—	—	**N 70 V**	50–0	1045			
		5	16·51	35·55	26·07	8·35	—	—	,,	100–0				
		10	16·51	35·55	26·07	8·35	—	—	,,	100–50				
		20	16·51	35·55	26·07	8·35	—	—	,,	250–135				
		30	16·51	35·55	26·07	8·35	—	—	,,	500–250				
		40	16·51	35·53	26·06	8·35	—	—	,,	1000–0	—	1315		
		50	16·51	35·55	26·07	8·35	—	—	**TYF**	1000(–0)	1540	1710	1·7	
		75	16·51	35·55	26·07	8·35								
		100	16·51	35·55	26·07	8·35								
		150	16·51	35·50	26·03	8·35								
		200	16·29	35·50	26·08	8·35								
		300	15·21	35·50	26·33	8·35								
		400	14·31	35·28	26·36	8·34								
		500	13·37	35·17	26·57	8·34								
		1000	7·57	34·56	27·00	8·29								
		1500	3·42	34·31	27·57	8·08								
		2000	2·82	34·56	27·57	7·98								
		2900	2·49	34·85	27·83	7·97								
		4800	1·06	34·76	27·87	7·97								
88	17	—	—	—	—	—	—	—	**N 100 H**	3000–0	1130	1315	3·5	
89	18	0	16·53	35·55	26·07	8·35	—	—	**N 70 V**	50–0	1115			
		5	16·51	35·53	26·06	8·35	—	—	,,	100–50				
		10	16·51	35·53	26·06	8·35	—	—	,,	250–100				
		20	16·51	35·53	26·06	8·35	—	—	,,	500–0				
		30	16·51	35·53	26·06	8·35	—	—	,,	500–250				
		40	16·51	35·53	26·06	8·35	—	—	,,	750–500	—	1330		
		50	16·51	35·53	26·06	8·35	—	—	**N 200 H**	180(–0)	1435	1535	2·2	KT
		75	16·41	35·52	26·07	8·35	—	—	**TYF**	1000(–0)	1420	1555	2·2	
		100	16·24	35·50	26·09	8·35								

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
89 *cont.*	34° 05′ 15″ S, 16° 00′ 45″ E	1926 28 vi										
90	Simon's Town, False Bay, S Africa. Basin of H.M. Dockyard	10 vii	1200	—	var.	3	—	0	c. p.	1028·4	14·4	
			1600		—	0–1		0	c.	1027·0	12·2	
			0000			0–1	—	0	b. c.	1030·5	12·2	
		11 vii	0000			0–1		0	b. c.	1031·5	15·0	
		12 vii	0800			0–1		0	b. c.	1029·9	14·4	
91	0·5 mile off Roman Rock, False Bay, S Africa	8 ix	1200	35 s.	SE	3	SE	2	b. c.	—	14·9	
92	34° 30′ 00″ S, 18° 29′ 00″ E	22 ix	1600	—	WSW	3	WSW	2	b. c.	1020·5	13·9	mod. W swell
93	33° 08′ 00″ S, 17° 50′ 00″ E	23 ix	1200	—	SW	5	SW	4	b. c.	1024·3	13·3	heavy SW swell
			1310	165 gn. m.								
			1600	—	SW	4	SW	3	b. c.	1022·1	14·4	heavy W swell
94	33° 18′ 00″ S, 17° 40′ 00″ E	23 ix	1600	—	SW	4	SW	3	b. c.	1022·1	14·4	heavy W swell
			1745	281 gn. m.								
			2000	—	SSE	4	SSE	3	b. c.	1024·1	13·9	,,
95	33° 30′ 00″ S, 17° 29′ 00″ E	23–24 ix	2230	440 gn. m.								
			0000	—	SW	3	SW	3	b. c.	1026·1	13·3	heavy SW swell
96	33° 06′ 00″ S, 17° 01′ 00″ E	24 ix	0710	620 m. gl. oz.								
			0800	—	S	3	S	3	b.	1025·0	14·4	v. heavy SW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. °Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
89 *cont.*		150	14·96	35·25	26·19	8·35								
		200	14·83	35·37	26·33	8·32								
		300	12·21	35·01	26·60	8·32								
		400	10·60	34·90	26·79	8·32								
		500	8·53	34·54	26·86	8·29								
		1000	3·52	34·38	27·37	8·00								
		1500	2·72	34·61	27·63	7·98								
		2000	2·83	34·85	27·80	7·97								
		3000	2·40	34·83	27·83	7·96								
90	2–7	—	—	—	—	—	—	—	**NH**	0–2	1000	1400		
									NRM	10–12	1430	1530		
									TGL	10	**2100**	0900	—	10–11 vii
									LH	10	—	—		11 vii
									TGL	10	**1800**	0830		11–12 vii
									NH	1	0930		—	12 vii
									Sh. coll.	—	1400		—	15 vii. Dry dock
91	2	0	13·51	35·28	26·72	—		—	**TYF**	0–5	1100	1120		
		17	13·45	35·23	26·64		—		**NRL**	35	1140	1205		
		34	13·44	35·23	26·63	—	—		**NCS–N**					
92	16	—	—	—	—			—	**N 100 H**	0–5	1605	1655	1	
									,,	50	1600	1700	1	
93	17	0	14·06	35·39	26·50	—	26		**N 70 V**	50–0	1310	—		TD 14½ m. (sunlight)
		5	14·01	35·39	26·51	—	30	—	,,	100–50				
		10	13·99	35·37	26·49		88?		,,	155–100	—	1400		
		20	13·84	35·35	26·50	—	34	—	**N 100 H**	0–5	1440	1550	2½	
		30	13·81	35·35	26·51	—	38		,,	70	1435	1535	2½	
		40	13·76	35·36	26·53		38	—	,,	140	1444	1600	2½	KT
		50	13·51	35·35	26·57	—	45	—	**N 70 H**	0–5	1440	1550	2½	
		75	11·62	35·03	26·70		81		,,	70	1435	1535	2½	
		100	9·40	34·78	26·90		83	—	,,	140	1444	1600	2½	KT
		150	8·12	34·63	26·99	—	96							
94	17	0	14·43	35·41	26·43		—	—	**N 70 V**	50–0	1800			
		5	14·42	35·41	26·43	—	—	—	,,	100–50				
		10	14·42	35·41	26·43	—	—		,,	250–100	—	1825		
		20	14·41	35·42	26·43	—		—	**N 100 H**	0–5	**1855**	**2005**	1	
		30	14·39	35·42	26·44	—	—		,,	90	,,	,,	1	
		40	14·31	35·42	26·46	—	—	—	,,	180	**1905**	**2010**	1	KT
		50	14·22	35·42	26·47			—	**N 70 H**	90	**1855**	**2005**	1	
		75	13·82	35·37	26·53	—	—	—	,,	180	**1905**	**2010**	1	KT
		100	12·76	35·17	26·59									
		150	10·78	34·88	26·74									
		200	9·50	34·74	26·86									
		250	8·30	34·65	26·98									
95	17	0	15·26	35·43	26·26	8·35	30	—	**N 70 V**	50–0	**2230**			
		5	15·26	35·43	26·26	8·35	30		,,	100–50				
		10	15·26	35·44	26·27	8·35	30	—	,,	250–100				
		20	15·22	35·44	26·28	8·35	30	—	,,	420–250	—	**2330**		
		30	15·21	35·44	26·28	8·35	34	—	**N 100 H**	0–5	**0007**	**0050**	1	
		40	15·14	35·44	26·30	8·35	40		,,	70	**0005**	**0050**	1	
		50	14·66	35·44	26·40	8·35	40	—	,,	140	**0012**	**0055**	1	KT
		75	14·39	35·43	26·45	8·35	40	—	**N 70 H**	0–5	**0007**	**0050**	1	sample lost
		100	13·36	35·26	26·55	8·32	48	—	,,	70	**0005**	**0050**	1	
		150	11·86	35·07	26·69	8·30	64		,,	140	**0012**	**0055**	1	KT
		200	10·41	34·83	26·77	8·25	80							
		300	8·30	34·70	27·02	8·20	93							
		400	7·60	34·51	26·97	8·17	116							
96	18	0	15·11	35·48	26·34	—	—		**N 70 V**	50–0	0730	—	—	TD 16 m. (sunlight)
		5	15·11	35·48	26·34	—	—		,,	100–50				
		10	15·11	35·48	26·34	—	—		,,	250–100				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
96 *cont.*	33° 06′ 00″ S, 17° 01′ 00″ E	1926 24 ix										
97	33° 11′ 00″ S, 16° 55′ 30″ E	24 ix	1200	—	SW	3	SW	2	b.	1025·6	13·9	heavy SW swell
			1330	995 gl. oz.								
			1600	—	SW	3	SW	2	b.	1023·9	14·4	”
98	33° 23′ 00″ S, 15° 50′ 00″ E	25 ix	0700	3640 gl. oz.								
			0800	—	W	4	W	3	o. d.	1020·4	11·1	heavy W swell
			1200	—	W	3	W	3	o. m. d.	1021·2	14·4	”
			1600	—	S × W	3	S × W	3	c.	1020·2	15·0	heavy SW swell
99 A	33° 20′ 00″ to 33° 11′ 00″ S, 17° 17′ 00″ to 17° 26′ 00″ E	27 ix	0700	470 h.								
			0800	—	SE	5	SE	4	b.	1030·0	13·3	heavy conf. swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/∞	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
96 *cont.*		20	15·11	35·48	26·34	—	—	—	**N 70 V**	500–250	—	0845		
		30	15·11	35·48	26·34	—	—	—	**N 100 H**	0–5	1020	1135	1	
		40	15·11	35·48	26·34	—	—	—	,,	90	1025	1135	1	
		50	15·11	35·46	26·33	—	—	—	,,	180	1030	1130	1	KT
		75	14·66	35·44	26·40	—	—	—	**N 70 H**	0–5	1020	1135	1	
		100	14·11	35·33	26·44	—	—	—	,,	90	1025	1135	1	
		150	12·92	35·14	26·54	—	—	—	,,	180	1030	1130	1	KT
		200	12·49	35·05	26·54									
		300	12·11	34·81	26·45									
		400	10·28	34·60	26·61									
		600	4·78	34·38	27·21									
97	18	0	15·56	35·50	26·26	—	—	—	**N 70 V**	50–0	1340	—	—	TD 17 m.
		5	15·56	35·50	26·26	—	—	—	,,	100–50				
		10	15·51	35·50	26·27	—	—	—	,,	250–100				
		20	15·36	35·50	26·30	—	—	—	,,	500–250				
		30	15·29	35·46	26·29	—	—	—	,,	750–500	—	1540		
		40	15·11	35·44	26·31	—	—	—	**N 100 H**	0–5	1558	1645	1	
		50	14·81	35·44	26·35	—	—	—	,,	75(–0)	1555	1650	1	
		75	14·41	35·41	26·43	—	—	—	,,	150(–0)	1600	1655	1	KT
		100	13·59	35·30	26·51	—	—	—	**N 70 H**	75	1555	1650	1	
		150	12·38	35·02	26·54	—	—	—	,,	150(–75)	1600	1655	1	KT
		200	12·01	35·02	26·62									
		300	11·12	34·90	26·70									
		400	9·49	34·72	26·82									
		500	7·72	34·57	27·00									
		700	4·86	34·34	27·20									
		950	3·83	34·34	27·31									
98	19	0	15·61	35·52	26·26	8·35	34	—	**N 70 V**	50–0	0715			
		5	15·61	35·52	26·26	8·35	33	—	,,	100–50				
		10	15·61	35·52	26·26	8·35	30	—	,,	250–100				
		20	15·61	35·52	26·26	8·35	30	—	,,	500–250				
		30	15·61	35·52	26·26	8·35	34	—	,,	750–500				
		40	15·61	35·52	26·26	8·35	34	—	,,	1000–750				
		50	15·51	35·48	26·23	8·35	33	—	,,	2000–1500				
		75	14·62	35·43	26·40	8·35	38	—	,,	3000–2000	—	1300		
		100	13·91	35·30	26·46	8·32	44	—	**N 100 H**	0–5	1430	1512	1	
		150	12·51	35·06	26·55	8·32	53	—	,,	65	1428	1518	1	
		200	11·40	34·88	26·62	8·30	65	—	,,	130	1435	1520	1	KT
		300	10·50	34·85	26·76	8·30	76	—	**N 70 H**	0–5	1430	1512	1	net slightly torn
		400	8·71	34·63	26·91	8·30	84	—	,,	65	1428	1518	1	
		600	5·79	34·40	27·13	8·12	106	—	,,	130	1435	1520	1	KT
		800	3·36	34·23	27·26	8·07	114							
		1000	3·20	34·42	27·32	8·00	119							
		1500	2·78	34·65	27·65	7·96	129							
		2500	2·61	34·82	27·80	7·96	118							
		3500	2·16	34·82	27·84	7·96	119							
99 A	21	0	15·06	35·44	26·32	—	—	—	**N 100 H**	0–5	0900	0957	1	
		5	15·06	35·44	26·32	—	—	—	,,	90	,,	0952	1	
		10	15·06	35·44	26·32	—	—	—	,,	182	,,	0953	1	KT
		20	15·11	35·44	26·31	—	—	—	,,	266(–182)	,,	1015	1	
		30	15·11	35·44	26·31	—	—	—	,,	350(–266)	,,	1016	1	DGB
		40	15·11	35·45	26·32	—	—	—	**N 70 H**	0–5	1050	1106	$\frac{1}{4}$	
		50	14·82	35·44	26·37	—	—	—	,,	85	,,	1104	$\frac{1}{4}$	
		75	14·06	35·30	26·43	—	—	—	,,	170	,,	1105	$\frac{1}{4}$	KT
		100	13·87	35·23	26·47	—	—	—	,,	247	,,	1105	$\frac{1}{4}$	
		150	12·22	35·00	26·55	—	—	—	,,	325	,,	1106	$\frac{1}{4}$	DGB
		200	11·10	34·85	26·65									
		300	8·86	34·66	26·90									
		395	7·00	34·52	27·06									

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
99 B	33° 20′ 00″ to 33° 11′ 00″ S, 17° 17′ 00″ to 17° 26′ 00″ E	1926 27 ix	1200	—	SE	5	SE	4	b.	1029·1	13·9	heavy conf. swell
99 C	,, ,,	27 ix	1600	—	SE	6	SE	6	b.	1025·1	15·0	v. heavy conf. swell
99 D	,, ,,	27 ix	2000	—	SE	6	SE	6	b.	1024·8	12·8	heavy conf. swell bright starlight
99 E	,, ,,	27–28 ix	0000	—	SE	6	SE	6	b. c.	1022·0	15·0	heavy conf. swell moon rose 0105
99 F	,, ,,	28 ix	0400	—	SE	4	SE	4	b.	1021·2	14·4	heavy conf. swell
100	33° 20′ 00″ to 33° 46′ 00″ S, 15° 18′ 00″ to 15° 08′ 00″ E	30 ix	2000	—	—	0–1	—	0	b. c.	1025·8	13·9	heavy conf. swell
		30 ix–1 x	0000	—	SE	5	SE	4	b. c.	1025·4	13·9	heavy SE swell
		1 x	0800	—	SE	5	SE	5	b. c.	1023·1	13·3	mod. conf. swell
			1200	—	SE	5	SE	5	b. c.	1019·3	13·9	,,
		2 x	0400	—	SW	2	—	1	b. c.	1011·8	13·9	,,
			0800	—	WSW	5	WSW	4	b. c.	1011·9	13·9	,,

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. °Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
99 B	21	—	—	—	—	—	—	—	**N 100 H**	0–5	1230	1316	1	
									,,	70	,,	1313	1	
									,,	140	,,	1313	1	KT
									,,	215	,,	1314	1	
									,,	290	,,	1314	1	DGB
									N 70 H	0–5	1354	1406	¼	
									,,	65	,,	1404	¼	
									,,	130	,,	1404	¼	
									,,	202	,,	1405	¼	
									,,	275	,,	1405	¼	DGB
99 C	21	—	—	—	—	—	—	—	**N 100 H**	0–5	1654	1734	1	
									,,	80	,,	1733	1	
									,,	160	,,	1733	1	KT
									,,	230	,,	1734	1	
									,,	300	,,	1734	1	DGB
									N 70 H	0–5	**1832**	**1847**	¼	
									,,	77	,,	**1846**	¼	
									,,	155	,,	**1847**	¼	KT
									,,	232	,,	**1847**	¼	
									,,	310	,,	**1848**	¼	DGB
99 D	21	—	—	—	—	—	—	—	**N 100 H**	0–5	**2047**	**2131**	1	
									,,	52	,,	**2129**	1	
									,,	105	,,	**2130**	1	KT
									,,	167	,,	**2130**	1	
									,,	230	,,	**2131**	1	DGB
									N 70 H	0–5	**2209**	**2232**	¼	
									,,	47	,,	**2230**	¼	
									,,	95	,,	**2230**	¼	KT
									,,	147	,,	**2231**	¼	
									,,	200	,,	**2231**	¼	DGB
99 E	22	—	—	—	—	—	—	—	**N 100 H**	0–5	**0033**	**0104**	1	
									,,	51	,,	**0102**	1	KT
									,,	102	,,	**0102**	1	
									,,	163	,,	**0103**	1	
									,,	225	,,	**0103**	1	DGB
									N 70 H	0–5	**0143**	**0207**	½	
									,,	56	,,	**0203**	½	
									,,	112	,,	**0204**	½	KT
									,,	221	,,	**0204**	½	
									,,	330	,,	**0205**	½	DGB
99 F	22	—	—	—	—	—	—	—	**N 100 H**	0–5	**0435**	**0535**	1	
									,,	80	,,	**0534**	1	
									,,	160	,,	**0534**	1	KT
									,,	230(–0)	,,	**0535**	1	net slightly torn
									,,	300	,,	**0535**	1	DGB
									N 70 H	0–5	0612	0627	¼	
									,,	39	,,	0626	¼	
									,,	79(–0)	,,	0626	¼	KT
									,,	119	,,	0627	¼	
									,,	160	,,	0627	¼	DGB
100	24–28	—	—	—	—	—	—	—	**TYF**	0–5	**1925**	**2027**	2	A 30 ix
									,,	0–5	**2337**	**0038**	2·1	B 30 ix–1 x
									,,	0–5	0645	0746	1·5	C 1 x
									N 450	250	1320	1420	1·7	1 x. DGB
									TYF	450–550	0630	0832	3·3	C 2 x. DGB
									,,	475(–0)	0620	0832	3·3	2 x. DGB

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
		1926										
100 *cont.*	33° 20′ 00″ to 33° 46′ 00″ S, 15° 18′ 00″ to 15° 08′ 00″ E	2 x	1600		N	4	N	4	o.	1013·8	13·9	mod. conf. swell
		2–3 x	0000	—	N	3	N	4	b.	1016·5	13·9	,,
		3 x	0800	—	N	3	—	0	b.	1020·1	13·9	,,
		3–4 x	0000	—	NNW	5	NNW	4	b.	1014·0	13·3	mod. NW swell
		4 x	0800	—	NNW	6	NNW	5	o. m. r.	1008·9	13·9	mod. W swell
101	33° 50′ to 34° 13′ S, 16° 04′ to 15° 49′ E	14 x	1915	3734								
			2000	gl. oz.	—	0	—	0	b.	1015·6	13·3	v. heavy SW swell
			0000	—	WNW	3–4	WNW	3	b. c.	1015·7	13·9	mod. SW swell
		15 x	0800	—	W	4	W	3	o.	1015·1	13·9	,,
			1600	—	WSW	3	WSW	3	o. m. d.	1016·5	17·2	heavy SW swell
			0000	—	S × E	5	S × E	5	o.	1020·1	17·2	,,
102	35° 29′ 20″ S, 18° 33′ 40″ E	28 x	1000	1800 gl. oz.								
			1200	—	—	0	—	0	b. c.	1018·6	16·1	mod. SW swell
103	39° 04′ 00″ S, 17° 38′ 00″ E	30 x	0800	—	NW	6	NW	4	c.	1010·0	16·1	heavy conf. swell
			1200	—	NW	7–9	NW	5	o. r. g.	1009·4	16·7	heavy NW swell
104	41° 33′ 30″ S, 17° 58′ 00″ W	31 x	2000	—	SW	5–7	SW	6	b. c. q.	1010·0	7·9	v. heavy SW swell
			0000	—	SW	6–8	SW	6	o. r. g.	1010·0	7·2	,,
105	44° 32′ 00″ S, 18° 17′ 00″ E	3 xi	0800	—	SSW	7	SSW	8	o. g.	1017·3	3·3	v. heavy SW swell
			1200	—	SSW	6	SSW	7	c.	1022·1	4·4	,,
106	44° 42′ 30″ S, 17° 47′ 00″ E	3 xi	2000	—	SW × W	4	SW	3	o.	1027·4	3·3	heavy SW swell
			0000	—	WSW	4	SW	4	o.	1028·0	3·9	mod. SW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	Hauled	Length of tow (miles)	Remarks
100 *cont.*									**TYF**	625–675	1319	1530	—	D 2 x. DGB
									,,	1500–1550	**0045**	**0255**	3·6	B 2–3 x. DGT
									,,	260–310	0601	0801	2	C 3 x. DGB
									,,	900–1000	**2340**	**0140**	2·5	B 3–4 x
									,,	2500–2000	0745	0948	3	C 4 x
									,,	2500(–0)	0745	0948	3	4 x
101	8	—	—	—	—	—	—	—	**N 450**	2480–2580	**2022**	**2325**	3·3	14 x. DGT
									,,	1310–1410	0739	1040	2·5	15 x. DGT
									,,	850–950	1305	1610	4·3	15 x
	9	—	—	—	—	—	—	—	,,	350–400(–0)	**2042**	**2346**	6·2	15 x. DGB
102	22	0	15·46	35·36	26·17	8·35	—	—	**N 70 V**	50–0	1005	—	—	TD 17 m. (overcast)
		5	15·46	35·35	26·17	8·35	—	—	,,	100–50				
		10	15·42	35·36	26·18	8·35			,,	250–100				
		20	15·41	35·36	26·18	8·35	—	—	,,	500–250				
		30	15·31	35·35	26·19	8·35	—	—	,,	750–500				
		40	15·23	35·35	26·21	8·35		—	,,	1000–750	—	1156		
		50	15·12	35·37	26·25	8·35	—	—	**N 100 H**	0–5	1245	1317	1	
		75	13·57	35·26	26·57	8·35	—	—	,,	52	,,	1324	1	
		100	12·36	35·03	26·56	8·30		—	,,	104	,,	1325	1	KT
		150	11·80	34·97	26·63	8·29	—	—	**N 70 H**	0–5	1338	1348	¼	
		200	10·75	34·83	26·61	8·26	—	—	,,	48	,,	1345	¼	
		300	9·80	34·78	26·83	8·26	—	—	,,	97	,,	1346	¼	KT
		400	7·02	34·52	27·06	8·26								
		600	4·51	34·31	27·10	8·13								
		800	3·63	34·35	27·23	8·00								
		1200	2·84	34·57	27·58	7·98								
		1750	2·84	34·83	27·79	7·96								
103	24	0	18·92	35·52	25·46	8·40	—	—	**N 70 V**	50–0	0910			
		5	18·92	35·53	25·47	8·40	—	—	,,	100–50				
		10	18·92	35·53	25·47	8·40	—	—	,,	250–100				
		20	18·92	35·54	25·48	8·40	—	—	,,	500–250	—	1115		
		30	18·92	35·54	25·48	8·40	—	—	**N 100 H**	0–5	1303	1344	1	
		40	18·92	35·54	25·48	8·40	—	—	,,	78	,,	,,	1	
		50	18·92	35·54	25·48	8·40	—	—	,,	157	,,	,,	1	KT
		75	18·52	35·55	25·61	8·40								
		100	18·23	35·61	25·70	8·40								
		150	17·86	35·54	25·75	8·40								
		200	16·69	35·54	26·02	8·38								
		300	15·24	35·47	26·30	8·33								
		400	13·51	35·34	26·36	8·29								
		500	13·26	35·33	26·41	8·26								
		1200	5·06	34·36	27·14	8·00								
104	25	—	—	—	—	—	—	—	**N 100 H**	0–5	**2118**	**2147**	1	
									,,	56(–0)	,,	,,	1	
									,,	112	,,	,,	1	KT
									N 70 H	0–5	**2212**	**2227**	¼	
									,,	55	,,	**2224**	¼	
									,,	110	,,	**2225**	¼	KT
105	27	—	—	—	—	—	—	—	**N 100 H**	0–5	1000	1033	1	
									,,	58(–0)	,,	1030	1	
									,,	117	,,	1031	1	KT
									N 70 H	62	1054	1101	¼	
									,,	124	,,	,,	¼	KT
106	27	—	—	—	—	—	—	—	**N 100 H**	0–5	**2113**	**2143**	1	
									,,	62	,,	**2141**	1	
									,,	124	,,	**2142**	1	KT
									N 70 H	0–5	**2200**	**2210**	¼	
									,,	63	,,	,,	¼	
									,,	126	,,	,,	¼	KT

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
107	45° 03′ 00″ S, 17° 03′ 00″ E	1926 4 xi	0800	—	W × N	5	NW	4	o.	1023·5	5·0	mod. SW swell
			1200	—	W × S	5	W × S	5	o.	1020·8	5·6	,,
			1600	—	NNW	5	NNW	4	o.	1017·9	6·7	mod. conf. swell
108	45° 44′ 00″ S, 15° 38′ 30″ E	5 xi	0800	—	W	5	W	4	o.	1009·3	4·4	v. heavy W swell
			1200	—	W	5	W × N	6	c.	1007·8	5·5	,,
109	46° 25′ 00″ S, 15° 13′ 00″ E	5 xi	2000	—	SW×W	3	SW	4	c.	1004·8	9·4	v. heavy W swell
			0000	—	SW×W	4	SW	4	o.	1001·8	6·7	mod. SW swell
110	47° 54′ 00″ S, 12° 39′ 30″ E	7 xi	0800	—	NW	4	NW	4	o. d.	984·4	2·9	mod. NW swell
			1200	—	W × S	4	NNW	4	c.	986·6	3·3	,,
111	48° 12′ 00″ S, 12° 31′ 00″ E	7 xi	2000	—	SSW	5	SSW	5	o. d.	993·8	1·7	heavy SW swell
			0000	—	SSW	6	SW	6	o.	999·8	1·1	,,
112	49° 31′ 00″ S, 10° 48′ 00″ E	9 xi	0800	—	W × N	6	W × N	6	o. g.	985·0	2·2	heavy NW swell
			1200	—	W × N	6	W × N	6	o. g.	995·3	2·2	,,
113	50° 09′ 00″ S, 10° 21′ 00″ E	9 xi	2000	—	W × N	6	W × N	5	o. s.	991·8	1·1	heavy W swell
			0000	—	W × N	7	W × N	6	o. q.	992·9	1·1	mod. W swell
114	52° 25′ 00″ S, 9° 50′ 00″ E	12 xi	0800	—	SW	4	SW	2	c. g.	999·7	– 2·2	heavy NW swell
			1200	—	SW × S	4	SW × S	5	c. g.	1003·0	– 1·1	,,

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
107	28	0	5·91	34·02	26·81	8·35	—	—	**N 70 V**	50–0	0910	—	—	TD 17 m. (overcast)
		5	5·91	33·99	26·79	8·35	—	—	,,	100–40				
		10	5·91	34·02	26·81	8·35	—	—	,,	250–80				
		20	5·90	34·02	26·81	8·35	—	—	,,	500–250				
		30	5·90	34·02	26·81	8·35	—	—	,,	750–500				
		40	5·90	34·02	26·81	8·35	—	—	,,	1000–750	—	1150		
		50	5·90	34·02	26·81	8·35	—	—	**N 450**	850–950	1315	1520	3	DGB
		75	5·90	34·02	26·81	8·35								
		100	5·75	34·00	26·81	8·30								
		150	4·91	33·96	26·88	8·28								
		200	4·60	34·00	26·94	8·28								
		300	4·30	34·20	27·14	8·17								
		400	3·96	34·20	27·17	8·10								
		600	3·24	34·22	27·16	8·04								
		800	2·96	34·29	27·34	7·96								
		1500	3·61	34·20	27·11	7·96								
		2000	3·65	34·27	27·26	7·96								
		3000	2·62	34·54	27·58	7·96								
108	1	—	—	—	—	—	—	—	**N 100 H**	0–5	0941	1004	1·1	
									,,	45(–0)	,,	,,	1·1	
									,,	91(–0)	,,	,,	1·1	KT
									N 70 H	0–5	1029	1039	¼	
									,,	60	,,	,,	¼	
									,,	120	,,	,,	¼	KT
109	1	—	—	—	—	—	—	—	**N 100 H**	0–5	**2118**	**2218**	1	
									,,	96	,,	,,	1	
									,,	192	,,	,,	1	KT
									N 70 H	0–5	**2236**	**2248**	¼	
									,,	70	,,	**2246**	¼	
									,,	140	,,	,,	¼	KT
110	3	—	—	—	—	—	—	—	**N 100 H**	0–5	0907	0942	1	
									,,	89	,,	,,	1	
									,,	178	,,	,,	1	KT
									N 70 H	0–5	1005	1015	¼	
									,,	75	,,	,,	¼	
									,,	150	,,	,,	¼	
111	3	—	—	—	—	—	—	—	**N 100 H**	0–5	**2109**	**2139**	1	
									,,	65	,,	,,	1	
									,,	130	,,	,,	1	KT
									N 70 H	0–5	**2207**	**2219**	¼	
									,,	84	,,	,,	¼	
									,,	168	,,	,,	¼	KT
112	5	—	—	—	—	—	—	—	**N 100 H**	0–5	0934	1028	1	
									,,	58	,,	,,	1	
									,,	117	,,	,,	1	KT
									N 70 H	0–5	1045	1102	¼	
									,,	53	,,	,,	¼	
									,,	107	,,	,,	¼	KT
113	5	—	—	—	—	—	—	—	**N 100 H**	0–5	**2110**	**2135**	1	
									,,	40	,,	,,	1	
									,,	81	,,	,,	1	KT
									N 70 H	0–5	**2152**	**2205**	¼	
									,,	37	,,	,,	¼	
									,,	74	,,	,,	¼	KT
114	8	745	2·08	34·67	27·72	—	—	—	**N 100 H**	0–5	0916	1015	1	
									,,	90	,,	,,	1	
									,,	180(–90)	,,	,,	1	KT

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
114 *cont.*	52° 25′ 00″ S, 9° 50′ 00″ E	1926 12 xi	1600	—	SW × S	4	SW × S	5	c.	1007·1	−1·7	heavy NW swell
115	52° 39′ 00″ S, 9° 33′ 00″ E	12 xi	2000	—	SW×W	4	SW×W	3	b. c.	1011·3	−1·7	heavy NW swell
			0000	—	SW×W	3	SW×W	3	b. c.	1007·8	−2·2	mod. NW swell
116	54° 30′ 00″ S, 5° 34′ 00″ E	14 xi	2000	—	NW×W	6	NW	1	o. f.	976·6	0·0	
			0000	—	NW×W	6	NW	2	o. f.	974·8	−0·6	
117	About 5 miles N 72° E of Bouvet I, 54° 20′ 40″ S, 3° 48′ 45″ E	17 xi	1200	—	WSW	4	WSW	4	o. s. g.	1003·5	3·9	
			1230	1723 di. oz.								
			1600	—	WSW	2	—	1	o. s. g.	1002·1	−3·3	heavy NW swell
118	53° 07′ 00″ S, 1° 26′ 00″ W	19 xi	0800	—	S × E	4	S × E	3	o.	995·3	−2·8	mod. E swell
			1200		W × S	3	E × S	4	o.	1001·0	−1·1	slight ESE swell
119	53° 02′ 00″ S, 1° 56′ 00″ W	19 xi	2000		NW	4	NW	3	o. s. g.	1003·4	−0·6	
			0000	—	N × W	5	NW	4	o. s. g.	1004·2	−1·1	
120	51° 44′ 00″ S, 5° 19′ 00″ W	22 xi	1200	—	SSW	7	SW	5	o. s.	1013·2	−1·1	heavy W swell
121	50° 59′ 00″ S, 11° 44′ 00″ W	25 xi	2000	—	NW×W	4	NW×W	2	o.	1018·5	1·1	mod. W swell
			0000	—	NW×W	5	NW×W	4	o. f. r.	1017·9	1·1	”
122	Maiviken, W Cumberland Bay, S Georgia	14 xii	1200	—	—	0	—	0	b. c.	1000·7	13·3	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
114 *cont.*									**N 70 H**	0–5	1036	1104	? ¼	
									,,	91	,,	,,	? ¼	
									,,	183	,,	,,	? ¼	KT
									N 450	650–700	1154	1354		DGT
115	8	—	·	—	—	—	—	· -	**N 100 H**	0–5	**2109**	**2133**	1	
									,,	53	,,	,,	1	
									,,	106	,,	,,	1	KT
									N 70 H	0–5	**2153**	**2202**	¼	
									,,	40(–0)	,,	,,	¼	
									,,	80(–0)	,,	,,	¼	KT
116	10	—	—	—	—	·	—	—	**N 100 H**	0–5	**2020**	**2050**	1	
									,,	55	,,	,,	1	
									,,	110(–0)	,,	,,	1	KT
									N 70 H	0–5	**2115**	**2125**	¼	
									,,	69	,,	,,	¼	
									,,	139	,,	,,	¼	KT
117	13	0	– 1·58	33·86	27·26	8·12	—	—	**N 70 V**	50–0	1230			
		5	– 1·55	33·93	27·34	8·07	—	—	,,	100–50				
		10	– 1·55	34·20?	27·54?	8·07	—	—	,,	250–100				
		20	– 1·55	33·87	27·28	8·07	—	—	,,	500–300				
		30	– 1·55	33·82	27·24	8·07	—	—	,,	750–500	—	1440		
		40	– 1·55	34·02	27·40	8·07	—	—	**N 100 H**	0–5	1505	1532	1	
		50	1·55	33·93	27·34	8·07	·	—	,,	49	,,	,,	1	
		75	– 1·45	34·05	27·41	8·03	—	—	,,	90(–0)	,,	,,	1	KT
		100	· 1·43	34·07	27·43	7·97	—	—	**N 70 H**	0–5	1550	1601	¼	
		150	0·45	34·47	27·67	7·97	—		,,	58	,,	,,	¼	
		200	1·10	34·56	27·70	7·95		—	,,	117(–20)	,,	,,	¼	KT
		300	1·45	34·64	27·74	7·95								
		400	1·45	34·69	27·78	7·95								
118	15	—	—	—	—	·	—	—	**N 100 H**	0–5	0919	1001	1	
									,,	100	,,	,,	1	
									,,	200	,,	,,	1	KT
									N 70 H	0–5	1021	1035	¼	
									,,	91	,,	,,	¼	
									,,	182	,,	,,	¼	KT
119	15	—	—	—	—	—	—		**N 100 H**	0–5	**2034**	**2108**	1	
									,,	90	,,	,,	1	
									,,	180	,,	,,	1	KT
									N 70 H	0–5	**2128**	**2137**	¼	
									,,	90	,,	,,	¼	
									,,	180	,,	,,	¼	
120	18	—	—	—	—	—	—	—	**N 100 H**	340–360(–0)	1115	1327	6·4	
									,,	575–675	1115	1334	6·4	DGB
121	20	—	—		—	—	—	—	**N 100 H**	0–5	**2108**	**2137**	1	
									,,	58	,,	,,	1	
									,,	117	,,	,,	1	KT
									N 70 H	0–5	**2155**	**2203**	¼	
									,,	67	,,	,,	¼	
									,,	134	,,	,,	¼	KT
122	10	0	4·65	—	—	—	—	—	**N 70 H**	0–1	—	—	—	} in upper freshwater lake
		½	4·1											
		1	2·4											
		0	3·4	—	—	—	—	—	**N 70 H**	0–1	-		—	} in lower freshwater lake
		0	3·7											
									Sh. coll.				—	Maiviken beach

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
123	Off mouth of Cumberland Bay, S Georgia. From 4·1 miles N 54° E of Larsen Pt, to 1·2 miles S 62° W of Merton Rock	1926 15 xii	1200	—	NE	3	NE	2	b. c. m.	1005·7	2·8	
			1305	250 gy. m.								
			1525	230 gy. m.								
			1600		NE	3	—	0	o. m.	1003·5	2·2	
124	53° 45′ 30″ S, 36° 32′ 30″ W	18 xii	1600	220 gy. m.	NE	4	NE	3	o. s.	1001·4	1·7	
125	53° 28′ 30″ S, 36° 20′ 30″ W	18–19 xii	2300	3140								
			0000	—	ENE	4	ENE	3	o.	1005·7	0·6	
			0400	—	S × W	4	SW	3	b. c.	1005·9	1·1	
126	53° 58′ 30″ S, 37° 08′ 00″ W	19 xii	1055	100 c. blk. s. m.								
			1200	—	NE	2	NE	2	o. s.	1008·5	1·7	
127	53° 48′ 30″ S, 37° 08′ 00″ W	19 xii	1345	157 gn. m. blk. spk.								
			1600	—	—	0–1	—	0	c.	1007·9	2·8	slight W swell
128	53° 38′ 30″ S, 37° 08′ 00″ W	19 xii	1710	167 r.	—	0	—	0	o. v.	1007·9	1·1	slight W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
123	11	0	1·05	33·77	27·07	—	—	—	**OTL**					
		240	–0·20	34·04	27·36	—	—	—	**N 7–T**	230–250	1315	1445	5·7	
		0	2·15	32·70	26·14	—	—	—	**N 4–T**					
		220	1·15	33·77	27·06	—	—	—	**NCS–T**					
124	14	0	1·80	33·78	27·03	8·30	144?	7·58	**N 50 V**	100–0	1600			
		5	1·80	33·78	27·03	8·30	126?	7·54	**N 70 V**	50–0				
		10	1·70	33·78	27·04	8·30	88	7·56	,,	100–50				
		20	1·47	33·78	27·04	8·30	88	7·57	,,	210–100	—	1650		
		30	1·10	33·80	27·09	8·30	84	7·66	**N 100 H**	0–5	1742	1821	1	
		40	1·05	33·80	27·10	8·28	86	7·54	,,	90	,,	,,	1	
		50	0·82	33·80	27·11	8·28	91	7·56	,,	180(–90)	,,	,,	1	KT
		75	0·20	33·86	27·19	8·28	96	7·58	**N 70 H**	0–5	1838	1847	¼	
		100	–0·75	33·91	27·29	8·16	111	7·38	,,	65	,,	,,	¼	
		150	–0·10	34·09	27·39	8·00	116	6·47	,,	130	,,	,,	¼	KT
		200	0·60	34·23	27·47	7·96	125	5·46						
125	14	0	1·45	33·82	27·09	8·30	90	—	**N 50 V**	100–0	**2300**			
		10	1·43	33·82	27·09	8·30	94	—	**N 70 V**	50–0				
		20	1·20	33·82	27·11	8·30	93	—	,,	100–50				
		30	1·10	33·82	27·11	8·30	91	—	,,	250–100				
		40	1·00	33·86	27·14	8·30	90	—	,,	500–250				
		50	0·85	33·86	27·15	8·30	94	—	,,	750–500				
		60	0·52	33·86	27·17	8·30	93	—	,,	1000–750	—	**0150**		
		80	–0·20	33·91	27·26	8·19	101	—	**N 100 H**	0–5	**0204**	**0243**	1	
		100	–0·50	34·00	27·32	8·04	105	—	,,	70	,,	,,	1	
		150	0·36	34·18	27·46	7·98	110	—	,,	140	,,	,,	1	KT
		200	1·50	34·36	27·51	7·95	116	—	**N 70 H**	0–5	**0302**	**0317**	¼	
		300	1·85	34·49	27·59	7·90	124	—	,,	70	,,	,,	¼	
		400	2·02	34·58	27·66	7·92	125	—	,,	140	,,	,,	¼	KT
		600	2·03	34·63	27·70	7·92	125							
		800	1·92	34·68	27·74	7·98	119							
		1000	1·82	34·72	27·78	7·98	116							
		1500	1·61	34·74	27·82	7·98	121							
126	15	0	1·28	33·77	27·05	8·30	99	—	**N 50 V**	100–0	1055	—	—	net touched bottom
		5	0·76	33·80	27·11	8·15	100	—	,,	80–0				
		10	0·30	33·86	27·18	8·10	108	—	**N 70 V**	50–0				
		20	–0·15	33·86	27·21	8·08	105	—	,,	100–50	—	1120		
		30	–0·18	33·87	27·23	8·08	108	—	**N 100 H**	0–5	1144	1203	1	
		40	–0·25	33·87	27·23	8·08	106	—	,,	23	,,	,,	1	
		50	–0·40	33·89	27·25	8·08	110	—	,,	47	,,	,,	1	KT
		60	–0·55	33·89	27·26	8·05	111	—	**N 70 H**	0–5	1214	1222	¼	
		80	–0·65	33·93	27·29	8·00	115	—	,,	22	,,	,,	¼	
		95	–0·60	33·95	27·31	8·00	119	—	,,	44(–0)	,,	,,	¼	KT
127	15	0	1·92	33·77	27·01	8·30	100	7·51	**N 50 V**	100–0	1345			
		5	1·60	33·77	27·03	8·30	99	7·51	**N 70 V**	50–0				
		10	1·45	33·78	27·06	8·28	98	7·60	,,	100–50				
		20	1·28	33·77	27·05	8·28	96	7·62	,,	150–110	—	1407		
		30	0·89	33·78	27·10	8·28	95	7·64	**N 100 H**	0–5	1452	1519	1	
		40	0·70	33·80	27·12	8·26	96	7·78	,,	41	,,	,,	1	
		50	–0·35	33·86	27·22	8·04	108	7·60	,,	82	,,	,,	1	KT
		60	–0·61	33·87	27·25	8·00	108	7·55	**N 70 H**	0–5	1530	1538	¼	
		80	–0·71	33·89	27·27	8·00	111	7·17	,,	38	,,	,,	¼	
		100	–0·60	33·98	27·34	7·96	114	6·90	,,	79	,,	,,	¼	KT
		150	–0·50	34·04	27·37	7·96	115	6·59						
128	15	0	1·48	33·84	27·10	8·30	92	—	**N 50 V**	100–0	1710			
		5	1·40	33·84	27·10	8·30	91	—	**N 70 V**	50–0				
		10	1·35	33·84	27·11	8·30	91	—	,,	100–50				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
128 *cont.*	53° 38′ 30″ S, 37° 08′ 00″ W	1926 19 xii										
129	53° 28′ 30″ S, 37° 08′ 00″ W	19 xii	2000	—	—	0	—	0	o. v.	1010·2	1·1	slight W swell
			2015	1001 blk. s. gn. m. st.								
			0000		—	0 1	—	0	o	1011·3	1·1	,,
130	54° 06′ 00″ S, 36° 23′ 00″ W	20 xii	0800	—	SW	2	SW	2	b.	1009·3	2·2	slight W swell
			1033	122 gn. m.								
			1200	—	NW	2	NW	3	b. c.	1005·5	6·1	,,
131	53° 59′ 30″ S, 36° 11′ 00″ W	20 xii	1325	240 gy. m. st.								
			1600	—	W	5	W	4	b. c.	1003·1	5·6	mod. W swell
132	53° 52′ 00″ S, 35° 58′ 30″ W	20 xii	1700	180 h.								
			2000	—	W	5	W	4	o.	1000·7	1·7	mod. W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
128 *cont.*		20	1·28	33·84	27·11	8·26	90	—	**N 70 V**	160–100	—	1748		
		30	0·72	33·84	27·15	8·18	99	—	**N 100 H**	0–5	1809	1831	1	
		40	0·30	33·84	27·17	8·14	103	—	,,	50(–0)	,,	,,	1	
		50	0·00	33·87	27·22	8·06	104	—	,,	100	,,	,,	1	KT
		60	– 0·10	33·86	27·20	8·04	104	—	**N 70 H**	0–5	1844	1851	¼	
		80	– 0·51	33·89	27·26	7·96	109	—	,,	47	,,	,,	¼	
		100	– 0·55	33·98	27·34	7·96	115	—	,,	95	,,	,,	¼	KT
		130	– 0·50	34·02	27·36	7·94	116							
		160	– 0·25	34·07	27·39	7·94	124							
129	15	0	1·75	33·82	27·07	8·30	99	7·64	**N 50 V**	100–0	2015			
		5	1·60	33·82	27·08	8·30	103	7·60	**N 70 V**	50–0				
		10	1·50	33·82	27·08	8·30	106	7·64	,,	100–50				
		20	1·30	33·82	27·10	8·30	98	7·62	,,	250–100				
		30	0·92	33·84	27·13	8·30	95	7·60	,,	500–250				
		40	0·75	33·86	27·15	8·30	93	7·62	,,	780–500				
		50	0·47	33·86	27·17	8·24	93	7·60	,,	950–750	—	**2228**		
		60	0·35	33·87	27·20	8·16	101	7·58	**N 100 H**	0–5	**2250**	**2310**	1	
		80	0·01	33·87	27·22	8·10	94	7·51	,,	42(–0)	,,	,,	1	net torn
		100	– 0·37	33·91	27·27	8·04	106	7·52	,,	84(–0)	,,	,,	1	KT
		150	– 0·55	34·04	27·38	7·98	111	6·81	**N 70 H**	0–5	**2328**	**2339**	¼	
		200	1·01	34·30	27·50	7·96	116	5·18	,,	44	,,	,,	¼	
		300	1·90	34·49	27·59	7·90	121	4·22	,,	88(–0)	,,	,,	¼	
		400	2·03	34·54	27·70	7·96	121	4·12						
		600	2·00	34·65	27·78	7·96	125	4·12						
		800	1·94	34·68	27·73	7·96	130	4·42						
		950	1·92	34·70	27·77	7·96	134	4·08						
130	16	0	1·85	32·14	25·72	8·32	83	—	**N 50 V**	100–0	1033			
		5	1·78	33·39	26·73	8·32	85	—	**N 70 V**	50–0				
		10	1·75	33·71	26·98	8·32	95	—	,,	115–50	—	1045		
		20	1·45	33·77	27·04	8·30	93	—	**N 100 H**	0–5	1121	1147	1	
		30	1·15	33·77	27·06	8·30	93	—	,,	38	,,	,,	1	
		40	0·97	33·80	27·10	8·22	89	—	,,	77	,,	,,	1	KT
		50	0·22	33·82	27·17	8·18	98	—	**N 70 H**	0–5	1159	1209	¼	
		60	0·02	33·86	27·20	8·08	103	—	,,	37	,,	,,	¼	
		80	– 0·20	33·89	27·24	8·00	106	—	,,	75	,,	,,	¼	
		100	– 0·31	33·91	27·27	8·00	108							
		120	– 0·30	33·93	27·27	8·00	114							
131	16	0	1·95	33·82	27·05	8·30	91	7·43	**N 50 V**	100–0	1325			
		5	1·85	33·84	27·07	8·30	86	7·37	**N 70 V**	50–0				
		10	1·72	33·84	27·08	8·30	91	7·45	,,	100–50				
		20	1·22	33·84	27·11	8·30	93	7·73	,,	230–100	—	1420		
		30	1·01	33·84	27·13	8·26	93	7·68	**N 100 H**	0–5	1430	1508	1	
		40	0·94	33·84	27·13	8·26	95	7·48	,,	64	,,	,,	1	
		50	0·88	33·86	27·15	8·20	96	7·44	,,	128	,,	,,	1	KT
		60	0·50	33·87	27·19	8·16	99	7·48	**N 70 H**	0–5	1522	1532	¼	
		80	– 0·65	33·91	27·28	8·09	108	7·36	,,	62	,,	,,	¼	
		100	– 0·63	33·95	27·31	8·03	113	7·41	,,	124	,,	,,	¼	KT
		150	– 0·28	34·04	27·36	7·98	118	6·76						
		200	0·12	34·13	27·41	7·98	121	6·11						
		240	0·81	34·27	27·49	7·98	125	5·27						
132	16	0	1·45	33·86	27·11	8·30	105	—	**N 50 V**	100–0	1700			
		5	1·30	33·87	27·14	8·30	99	—	**N 70 V**	50–0				
		10	1·25	33·86	27·12	8·30	100	—	,,	100–50				
		20	1·25	33·87	27·14	8·30	99	—	,,	170–125				
		30	0·45	33·90	27·21	8·26	100	—	,,	170–0	—	1750		
		40	0·20	33·90	27·23	8·20	103	—	**N 100 H**	0–5	1804	1825	1	
		50	0·05	33·91	27·25	8·15	105	—	,,	38	,,	,,	1	
		60	– 0·21	33·96	27·30	8·04	116	—	,,	76(–0)	,,	,,	1	KT

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
132 *cont.*	53° 52′ 00″ S, 35° 58′ 30″ W	1926 20 xii										
133	53° 45′ 30″ S, 35° 46′ 30″ W	20–21 xii	2012	802 h.								
			0000	—	W	6–7	W	6	o.	1000·2	1·1	slight W swell
134	54° 22′ 00″ S, 35° 56′ 00″ W	21 xii	1200	—	WNW	3	WNW	3	b. c.	995·9	2·8	
			1440	176 gy. m.								
			1600	—	NE	2	NE	2	o.	994·7	1·7	
135	54° 22′ 00″ S, 35° 39′ 00″ W	21 xii	1805	243 gn. m.								
			2000	—	E	2	E	1	o. m.	994·7	1·7	
136	54° 22′ 00″ S, 35° 21′ 00″ W	21 xii	2138	246 blk. st. m.								
			0000	—	E	2	E	1	o. f.	993·0	0·0	
137	54° 19′ 30″ S, 35° 03′ 30″ W	22 xii	0307	740 r.								
			0400	—	—	0–1	—	0	o. f.	992·1	0·0	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
132 *cont.*		80	–0·40	33·96	27·31	8·04	116	·	**N 70 H**	0–5	1839	1847	¼	
		100	–0·31	33·99	27·33	7·97	118	—	,,	45	,,	,,	¼	
		140	–0·10	34·08	27·38	7·97	120	—	,,	90	,,	,,	¼	KT
		175	0·20	34·16	27·44	7·97	123							
133	16	0	0·50	33·80	27·13	8·16	95	8·02	**N 50 V**	100–0	2012			
		5	0·50	33·80	27·13	8·16	94	7·65	**N 70 V**	50–0				
		10	0·50	33·80	27·13	8·16	95	7·64	,,	100–50				
		20	0·50	33·80	27·13	8·16	105	7·65	,,	270–100				
		30	0·45	33·80	27·13	8·16	96	7·75	,,	500–250				
		40	0·50	33·82	27·15	8·16	101	7·77	,,	750–500	—	**2350**		
		50	0·50	33·82	27·15	8·16	104	7·65	**N 100 H**	0–5	**0012**	**0119**	1	
		60	0·00	33·82	27·18	8·16	104	—	,,	50	,,	,,	1	
		80	–1·00	33·91	27·29	8·02	105	7·32	,,	100	,,	,,	1	KT
		100	–0·68	33·96	27·32	8·00	110	6·97	**N 70 H**	0–5	**0136**	**0154**	¼	
		150	0·22	34·09	27·38	7·96	114	6·20	,,	48	,,	,,	¼	
		250	1·81	34·47	27·58	7·96	118	4·55	,,	97	,,	,,	¼	KT
		350	1·92	34·49	27·59	7·96	119	4·38						
		500	2·08	34·58	27·66	8·00	118	4·54						
		600	2·02	34·59	27·67	8·00	120	4·18						
		750	1·95	34·59	27·67	8·07	123	4·34						
134	17	0	2·41	33·51	26·78	8·30	94	—	**N 50 V**	100–0	1440			
		5	2·41	33·53	26·79	8·30	94	—	**N 70 V**	50–0				
		10	2·29	33·55	26·82	8·30	93	—	,,	100–50				
		20	1·22	33·70	27·00	8·30	89	—	,,	170–100	—	1502		
		30	1·10	33·78	27·08	8·30	90	—	**N 100 H**	0–5	1530	1604	1	
		40	1·05	33·78	27·09	8·24	91	—	,,	61	,,	,,	1	
		50	0·80	33·78	27·10	8·20	94		,,	123	,,	,,	1	KT
		60	0·72	33·80	27·12	8·15	89	—	**N 70 H**	0–5	1617	1630	¼	
		80	0·42	33·82	27·15	8·10	99		,,	60	,,	,,	¼	
		100	0·23	33·87	27·20	8·10	106	—	,,	120	,,	,,	¼	KT
		130	0·10	33·82	27·17	8·05	111							
		165	0·00	33·88	27·22	8·05	114							
135	17	0	1·88	33·78	27·03	8·30	90	7·44	**N 50 V**	100–0	1805			
		10	1·85	33·79	27·03	8·30	85	7·45	**N 70 V**	50–0				
		20	1·80	33·78	27·03	8·24	85	7·47	,,	100–50				
		30	1·40	33·79	27·06	8·24	86	7·54	,,	230–100	—	1830		
		40	1·21	33·87	27·15	8·20	89	7·60	**N 100 H**	0–5	1902	1931	1	
		50	0·88	33·87	27·17	8·20	90	7·53	,,	75	,,	,,	1	
		60	0·72	33·89	27·19	8·20	98	7·53	,,	150	,,	,,	1	KT
		80	0·22	33·89	27·21	8·12	100	7·53	**N 70 H**	0–5	1944	1959	¼	
		100	0·09	33·89	27·22	8·06	94	7·57	,,	64	,,	,,	¼	
		140	0·22	33·93	27·27	8·00	111	7·21	,,	128	,,	,,	¼	KT
		180	0·21	34·05	27·36	8·00	115	6·57						
		220	0·88	34·25	27·47	7·96	120	5·58						
136	17	0	1·40	33·87	27·13	8·30	118?	—	**N 50 V**	100–0	**2138**			
		10	1·32	33·88	27·14	8·30	103	—	**N 70 V**	50–0				
		20	1·09	33·88	27·15	8·30	105	·	,,	100–50				
		30	0·72	33·89	27·19	8·30	105	—	,,	235–100	—	**2210**		
		40	0·70	33·89	27·19	8·30	103	—	**N 100 H**	0–5	**2234**	**2301**	1	
		50	0·50	33·89	27·20	8·17	105		,,	49	,,	,,	1	
		60	0·45	33·91	27·22	8·17	103	—	,,	99(–0)	,,	,,	1	KT
		80	0·01	33·96	27·29	8·07	116	—	**N 70 H**	0–5	**2317**	**2330**	¼	
		100	–0·20	34·04	27·36	8·00	120	—	,,	48	,,	,,	¼	
		150	0·20	34·13	27·41	7·96	123	—	,,	96	,,	,,	¼	KT
		210	1·72	34·47	27·65	7·96	125							
137	18	0	1·22	33·84	27·11	8·30	90	7·76	**N 50 V**	100–0	**0307**			
		10	1·20	33·84	27·12	8·30	93	7·73	**N 70 V**	50–0				

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
137 *cont.*	54° 19′ 30″ S, 35° 03′ 30″ W	1926 22 xii										
138	54° 17′ 00″ S, 34° 47′ 00″ W	22 xii	0800 1200	2530 r. —	NE ENE	1 3	— ENE	1 3	c. c.	998·1 992·3	1·1 2·8	
139	53° 30′ 15″ S, 35° 50′ 45″ W	22–23 xii	2000 2200 0000	— 3230 r. —	NW WNW	1 6	— NW	1 6	b. c. f. c.	994·2 991·9	1·7 1·1	heavy NW swell „
140	Stromness Hr to Larsen Pt, S Georgia. From 54° 02′ S, 36° 38′ W to 54° 11′ 30″ S, 36° 29′ W	23 xii	1440 1600 1800	136 gn. m. st. 122 gn. m. st.	NW	4	NW	4	o. r.	989·6	2·2	slight NW swell
141	E Cumberland Bay, S Georgia, 200 yds from shore, under Mt Duse	29 xii	1453 1527 1545 1600	22 m. 27 m. 17 m. —	 NW	 3–6	 NW	 1	 b. c.	 1001·4	 8·9	
142	E Cumberland Bay, S Georgia. From 54° 11′ 30″ S, 36° 35′ W to 54° 12′ S, 36° 29′ 30″ W	30 xii	1200 1300 1450	— 88 m. 273 m.	NE	5	NE	2	o. r. g.	973·0	7·22	
143	Off mouth of E Cumberland Bay, S Georgia, 54° 12′ S, 36° 29′ 30″ W	30 xii	1450 1600	273 m. —	 SW	 9	 SW	 7	 o. r. g.	 972·0	 4·4	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
137 *cont.*		20	0·83	33·84	27·14	8·30	98	7·83	**N 70 V**	100–50				
		30	0·35	33·84	27·17	8·30	103	7·67	,,	250–100				
		40	0·30	33·84	27·17	8·25	103	7·69	,,	500–250				
		50	0·20	33·84	27·18	8·20	103	7·69	,,	700–500	—	0515		
		60	0·15	33·86	27·19	8·15	99	7·69	**N 100 H**	0–5	0528	0600	1	
		80	−0·20	33·91	27·26	8·10	101	7·49	,,	66	,,	,,	1	
		100	−0·20	33·96	27·30	8·05	113	6·92	,,	132	,,	,,	1	KT
		150	0·51	34·14	27·41	8·00	120	5·96	**N 70 H**	0–5	0612	0626	¼	
		200	1·36	34·33	27·50	7·95	125	5·11	,,	60	,,	,,	¼	
		300	1·90	34·47	27·58	7·95	129	4·30	,,	120	,,	,,	¼	KT
		500	1·94	34·60	27·68	7·95	121	4·32						
		700	1·86	34·69	27·75	7·98	123	4·33						
138	18	0	1·20	33·84	27·12	8·30	95		**N 50 V**	100–0	0800	—	—	net split
		10	0·85	33·84	27·14	8·30	91	—	**N 70 V**	50–0				
		20	0·75	33·84	27·15	8·30	91	—	,,	100–50				
		30	0·48	33·84	27·16	8·20	96	—	,,	250–100				
		40	0·15	33·86	27·19	8·20	103	—	,,	500–250				
		50	−0·02	33·86	27·20	8·15	104	—	,,	750–500				
		60	−0·38	33·87	27·24	8·10	105	—	,,	1000–750				
		80	−0·55	33·91	27·28	8·05	109	—	,,	2000–1000		1050		
		100	−0·40	33·98	27·33	8·00	119	—	**N 100 H**	0–5	1102	1140	1	
		150	1·22	34·28	27·46	7·95	125	—	,,	77	,,	,,	1	
		200	1·72	34·42	27·54	7·95	126	—	,,	155	,,	,,	1	KT
		300	1·94	34·52	27·62	7·95	126	—	**N 70 H**	0–5	1151	1205	¼	
		400	2·02	34·63	27·70	7·95	125	—	,,	74	,,	,,	¼	
		600	1·94	34·68	27·74	7·95	125	—	,,	148	,,	,,	¼	KT
		800	1·78	34·72	27·79	8·00	123							
		1000	1·64	34·72	27·80	7·98	125							
		1500	1·32	34·72	27·82	7·98	125							
		2000	0·90	34·71	27·84	7·98	125							
139	18	0	1·01	33·86	27·14	8·30	88	—	**N 70 V**	50–0	**2205**			
		10	1·01	33·87	27·16	8·30	90	—	,,	100–50				
		20	1·00	33·87	27·16	8·30	86	—	,,	250–150				
		30	0·72	33·87	27·18	8·30	95	—	,,	250–170	—	**2350**		
		40	0·13	33·88	27·21	8·20	96	—	**N 100 H**	0–5	**0008**	**0041**	1	
		50	0·00	33·88	27·22	8·15	92	—	,,	90	,,	,,	1	
		60	−0·12	33·89	27·24	8·15	94	—	,,	180	,,	,,	1	KT
		80	−0·34	33·93	27·28	8·10	98	—	**N 70 H**	0–5	**0116**	**0126**	¼	
		100	−0·22	33·96	27·30	8·10	111	—	,,	62	,,	,,	¼	
		150	0·20	34·14	27·43	8·05	114	—	,,	124	,,	,,	¼	KT
		200	0·45	34·16	27·42	8·00	114							
		300	1·42	34·38	27·54	7·95	120							
		400	1·74	34·45	27·57	7·95	123							
		600	1·99	34·61	27·69	7·95	115							
		800	1·90	34·70	27·77	7·95	123							
140	19	120	−0·24	33·91	27·26	—	—	—	**OTL** **N 7–T** **N 4–T** **NCS–T**	122–136	1448	1635	—	net badly torn
141	24	0	3·10	—	—	—	—	—	**BTS** **NCS–T**	17–27	1453	1545	—	two short hauls on steeply shelving ground at edge of kelp
142	25	80	0·45	33·82	27·15	—	—	—	**OTL** **N 7–T** **N 4–T** **NCS–T**	88–273	1317	1352	3·5	
143	25	—	—	—	—	—	—	—	**OTL** **N 7–T** **N 4–T** **NCS–T**	273	1525	1535		

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1927										
144	Off mouth of Stromness Hr, S Georgia. From 54° 04′ S, 36° 27′ W to 53° 58′ S, 36° 26′ W	5 i	1200	—	NW	4	NW	4	b. c.	990·6	2·8	mod. SE swell
			1255	155 gn. m. s.								
			1450	178 gn. m. s.								
			1600		NE	4	NE	4–5	b. c.	993·4	2·8	heavy SE swell
145	Stromness Hr, S Georgia. Between Grass I and Tonsberg Pt	7 i	1200	—	—	1	—	0	o. m. s.	998·6	5·5	
			1454	26								
			1530	35								
			1600	—	—	1	—	0	o. s.	998·6	1·7	
146	53° 48′ 00″ S, 35° 37′ 30″ W	8 i	1200	—	ESE	3	ESE	3	b. c.	1009·1	1·7	
			1345	728 r.								
			1600	—	SE	3	—	1	b. c.	1010·3	4·4	
147	53° 38′ 30″ S, 36° 02′ 00″ W	9 i	0800	—	WNW	2	WNW	2	b. c.	1010·2	4·4	
			0945	126 m.								
			1200	—	—	1	—	1	b. c.	1016·5	1·7	
148	Off C Saunders, S Georgia. From 54° 03′ S, 36° 39′ W to 54° 05′ S, 36° 36′ 30″ W	9 i	1600	—	WNW	6	WNW	5	b.	1017·1	3·9	
			1745	148 gy. m. st.								
			1855	132 gy. m. st.								
			2000		WNW	3	WNW	2	b.	1016·8	3·3	
149	Mouth of E Cumberland Bay, S Georgia. From 1·15 miles N 76½° W to 2·62 miles S 11° W of Merton Rock	10 i	0800	—	WNW	4	WNW	4	b. c.	1015·0	3·9	
			1037	200 m.								
			1200	234 m.	WNW	7	WNW	4	b. c.	1011·5	4·4	
150	From 53° 52′ 30″ S, 36° 00′ W to 53° 31′ S, 35° 24′ 30″ W	15–16 i	1600	—	NNW	4	NNW	4	o. f.	1006·1	3·3	heavy NW swell
			2000	—	NNW	3	NNW	3	o. f.	1003·6	2·2	,,
			0000	—	NNW	5	NNW	4	o. f. w.	1000·4	2·2	,,
			0400	—	NNW	3	NNW	3	o. f.	998·8	2·2	mod. NW swell
			0800	—	NNW	5	NNW	3	o. f.	997·4	2·2	,,
151	53° 25′ 00″ S, 35° 15′ 00″ W	16 i	0915	3200 di. oz.								
			1200	—	WSW	3	WSW	3	b. c.	1000·4	2·8	
			1600	—	SW	5	SW	5	b. c.	1005·8	3·3	
152	53° 51′ 30″ S, 36° 18′ 30″ W	17 i	0800	—	W × S	6	W × S	5	c. q.	1008·1	2·2	heavy W swell
			1100	245 r.								
			1200	—	W × N	4	W × N	3	b. c.	1006·7	2·9	slight W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
144	3	0	2·00	33·82	27·05	-			**OTL**	155–178	1307	1407	4·0	cod-end, N 7–T and N 4–T torn
		145	−0·15	33·98	27·32				**N 7–T**					
									N 4–T					
									NCS–T					
145	5	21	1·68	33·68	26·97		—	—	**BTS**	26–35	1454	1542		two short hauls on weedy ground
									NCS–T					
146	6	—	—	—		—			**DLH**	728	1358	1430		
147	7	0	1·35	33·82	27·10		109							
		5	1·00	33·80	27·10		110							
		10	0·85	33·81	27·12	—	116							
		20	0·84	33·81	27·12	—	118							
		30	0·84	33·81	27·12		118							
		40	0·80	33·81	27·12	—	118							
		50	0·75	33·83	27·13	—	118							
		60	0·72	33·83	27·14	·	118							
		80	0·60	33·83	27·14	—	118							
		100	0·25	34·04	27·33	—	128							
		115	0·25	34·05	27·34		132							
148	7	0	3·56	33·69	26·80	-	—	—	**OTL**	132–148	1755	1825	2·5	
		142	0·22	33·92	27·24	—	—	—	**N 4–T**					
									NCS–T					
149	8	0	3·00	33·68	26·85	-	-	—	**OTL**	200–234	1056	1158	3·0	
		190	0·25	34·13	27·40		—		**N 4–T**					
		0	4·10	33·22	26·39	—	—	—	**NCS–T**					
		230	−0·05	34·04	27·35									
150	13	—	—	—	—		—		**N 70 H**	0–5	1700	1715	0·6	50 consecutive hauls (A–AAA) of 15 mins. duration. A halt of 15 mins. between NN and OO. Sample OO lost. Sunset 2026; sunrise 0355
									,,	,,	0545	0600	0·6	
151	14	0	1·31	33·84	27·11	8·30	113		**N 50 V**	100–0	0915	—	—	TD 20 m.
		10	1·20	33·84	27·12	8·30	113	- -	**N 70 V**	50–0				
		20	0·92	33·84	27·13	8·30	114	-	,,	100–50				
		30	0·81	33·82	27·13	8·30	110		,,	250–100				
		40	0·76	33·82	27·14	8·30	110	- -	,,	500–250				
		50	0·60	33·84	27·15	8·24	109		,,	750–500				
		60	0·48	33·84	27·16	8·20	108		,,	1000–750		1155		
		80	0·26	33·87	27·20	8·20	106		**N 100 H**	0–5	1236	1314	1	
		100	−0·50	33·98	27·34	8·20	119		,,	56	,,	1312	1	
		150	−0·20	34·11	27·42	8·20	125		,,	112	,,	1313	1	KT
		200	0·85	34·30	27·51	8·15	139		**N 70 H**	0–5	1329	1340	¼	
		300	1·60	34·34	27·50	8·15	136	-	,,	66	,,	,,	¼	
		400	1·80	34·56	27·65	8·10	137		,,	132	,,	,,	¼	KT
		600	1·87	34·64	27·71	8·05	125		**N 450**	1025–1275	1512	1712	3·1	DGB
		800	1·73	34·67	27·75	8·00	125	-	**N 100 H**	500–625	1512	1705	3·1	
		1000	1·52	34·70	27·79	8·00	128							
		1500	1·07	34·70	27·83	7·96	125							
		2000	0·64	34·65	27·80	7·96	125							
		3000	0·30	34·65	27·82	7·96	130							
152	15	235	0·68	34·20	27·44		-		**DLH**	245	1114	1125		

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
		1927										
153	54° 08′ 30″ S, 36° 27′ 30″ W	17 i	1600	—	W × N	3	W × N	2	o.	1002·3	3·3	slight W swell
			1700	106 r.								
154	Jason Hr to Larsen Pt, S Georgia. From 2·6 miles S 84° W to 5½ cables S 26° E of Larsen Pt	18 i	0800	—	—	1	—	0	o. r. m.	991·2	3·3	
			1055	60 m.								
			1200	—	—	1	—	0	o. r. m.	984·3	3·3	slight W swell
			1205	160 m.								
155	4·1 miles S 26½° E of Larsen Pt, S Georgia	18 i	1430	260 m.								
			1600	—	SE	5	SE	2	o. f. d.	980·4	2·2	slight W swell
156	53° 51′ 00″ S, 36° 21′ 30″ W	20 i	1500	236 r.								
			1540	200 r.								
			1600	—	SSE	3	SE	3	o.	997·5	2·2	mod. SE swell
157	53° 51′ 00″ S, 36° 11′ 15″ W	20 i	1905	970								
			2000	di. oz. st. f. s.	SSE	3	SE	2	o.	997·2	1·7	mod. SE swell
158	53° 48′ 30″ S, 35° 57′ 00″ W	21 i	0800	—	ESE	3	ESE	3	o.	995·2	2·8	slight SE swell
			0840	401 r.								
			0955	411 r.								
159	53° 52′ 30″ S, 36° 08′ 00″ W	21 i	1200	160 r.	ESE	4	ESE	3	o.	994·6	2·2	
160	Near Shag Rocks, 53° 43′ 40″ S, 40° 57′ 00″ W	7 ii	1200	—	E	4	E	3	o. d.	992·1	2·2	mod. SW swell
			1320	177 gy. m. st. r.								
			1600	—	SSW	2	—	1	b. c.	994·4	3·9	,,
161	57° 21′ 20″ S, 46° 43′ 30″ W	14 ii	0800	—	W	4	W	2	o.	999·5	2·2	
			0905	3459 r.								
			1200	—	NNW	4	NW	2	o.	1001·5	2·2	
162	Off Signy I, S Orkneys, 60° 48′ 00″ S, 46° 08′ 00″ W	17 ii	1143	320								
			1200	gn. m.	—	1	—	0–1	o. m. s.	968·0	0·0	
163	Paul Harbour, Signy I, S Orkneys	17 ii	1535	18								
			1600	27	NE	2–3	—	0–1	c. g.	963·8	2·2	
164	E end of Normanna Strait, S Orkneys, near C Hansen, Coronation I	18 ii	1130	24								
			1200	—	—	1	—	0	o. m.	968·6	3·3	
			1215	36								
165	Dove Strait, SE of Queen's Bay, Signy I, S Orkneys	18–20 ii										

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
153	15	100	0·22	33·91	27·24	—	—	—	**DLH**	106	1707	1717		
154	16	55	0·55	33·80	27·13	—	—	—	**OTL**	60–160	1110	1140	2·8	
									N 7–T					
									N 4–T					
									NCS–T					
155	16	—	—	—	—	—	—	—	**OTL**	260	1445	1450	—	trawl hitched; greater part of net lost
									N 7–T					
									N 4–T					
									NCS–T					
156	18	—	—	—	—	—	—	—	**DLH**	200–236	1511	1521		
									,,	200–236	1545	1555		
157	18	—	—	—	—	—	—	—	**DLH**	970	1922	1935	—	stop parted; bag torn
158	19	—	—	—	—	—	—	—	**DLH**	401	0852	0902		
									,,	411	1004	1018		
159	19	—	—	—	—	—	—	—	**DLH**	160	1216	1220		
160	7	0	3·00	33·77	26·92	8·28	—	—	**N 50 V**	100–0	1320	—	—	TD 17 m.
		10	2·90	33·77	26·93	8·28	—	—	**N 70 V**	50–0				
		20	2·88	33·77	26·93	8·28	—	—	,,	100–50				
		30	2·87	33·76	26·93	8·28	—	—	,,	180–100	—	1350		
		40	2·88	33·75	26·92	8·28	—	—	**DLH**	177	1438	1442		
		50	2·80	33·80	26·95	8·20	—	—	**N 100 H**	0–5	1515	1543	1	
		60	1·81	33·86	27·08	8·13	—	—	,,	40	,,	,,	1	
		80	0·82	33·91	27·20	8·05	—	—	,,	80(–0)	,,	,,	1	KT
		100	0·70	34·04	27·31	7·98	—	—	**N 70 H**	0–5	1602	1613	¼	
		135	0·82	34·09	27·34	7·98	—	—	,,	42	,,	1611	¼	
		170	1·42	34·22	27·40	7·98	—	—	,,	84	,,	1612	¼	KT
161	13	0	1·45	33·58	26·90	8·16	—	—	**N 50 V**	100–0	0905	—	—	TD 13 m.
		10	1·44	33·80	27·07	8·16	—	—	**N 70 V**	50–0				
		20	1·43	33·80	27·07	8·16	—	—	,,	100–50				
		30	1·48	33·82	27·09	8·16	—	—	,,	250–100				
		40	1·45	33·82	27·09	8·16	—	—	,,	500–250				
		50	1·35	33·82	27·10	8·16	—	—	,,	750–500				
		60	1·32	33·83	27·10	8·16	—	—	,,	1000–750	—	1100		
		80	0·42	33·91	27·23	8·16	—	—	**N 100 H**	0–5	1158	1219	1	
		100	–0·10	34·09	27·40	8·11	—	—	,,	38	,,	,,	1	
		150	–0·08	34·18	27·47	8·11	—	—	,,	79(–0)	,,	,,	1	KT
		200	0·85	34·29	27·50	8·05	—	—	**N 70 H**	0–5	1235	1243	¼	
		300	1·94	34·61	27·69	7·98	—	—	,,	40	,,	,,	¼	
		400	1·82	34·69	27·75	7·98	—	—	,,	80	,,	,,	¼	
		600	1·74	34·70	27·78	7·98								
		800	1·57	34·70	27·79	7·95								
		1000	1·34	34·72	27·82	8·00								
		1500	0·91	34·72	27·85	8·00								
		2000	0·54	34·71	27·86	8·00								
		3000	0·09	34·67	27·86	8·02								
162	16	0	–0·80	33·21	26·71	—	—	—	**DLH**	320	1150	1154		
		310	–0·38	34·56	27·79									
163	16	—	—	—	—	—	—	—	**BTS**	18–27	1535	1540		
									NCS–T					
164	17	0	–0·31	33·53	26·96	—	—	—	**BTS**	24–36	1145	1200		
		18	0·76	33·66	26·99	—	—	—	**NCS–T**					
165	17	—	—	—	—	—	—	—	**TNL**	10				

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
166	SE point of Paul Hr, Signy I, S Orkneys	1927 19 ii	1200	—	SSW	2	—	0	o. m.	989·8	1·7	
			1600	—	—	0–1	—	0	o. m.	991·4	2·2	
167	Off Signy I, S Orkneys, 60° 50′ 30″ S, 46° 15′ 00″ W	20 ii	0800	—	SE	2	—	0	o.	998·1	2·2	192 icebergs in sight
			1045	344 gn. m.								
			1200	—	NW	3	NW	1	c.	995·0	1·1	
			1255	244 gn. m.								
168	60° 58′ 00″ S, 48° 05′ 00″ W	21 ii	1200	—	SW	6	SW	5	o.	989·0	0·0	
169	60° 48′ 50″ S, 51° 00′ 20″ W	22 ii	0800	—	SSW	2	—	0	b. v.	994·1	0·0	alongside tabular berg, 35 miles in length
			0905	2514 di. oz.								
			1200	—	SSW	2	—	0	b. v.	996·3	1·1	
			1530	1849 r.								
			1600	—	W × S	2	—	0	b. v.	997·9	1·7	
170	Off C Bowles, Clarence I, 61° 25′ 30″ S, 53° 46′ 00″ W	23 ii	1600	—	NE	5	NE	5	c.	992·6	1·1	
			1635	342 r.								
171	16 miles off C Melville, King George I, S Shetlands, 62° 07′ 00″ S, 57° 03′ 00″ W	25 ii	0800	—	ENE	3	ENE	2	o. s. g.	986·5	1·1	
			0905	1542 di. oz.								
			1200	—	ENE	3	ENE	2	o. s. m.	987·4	1·1	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
166	18	—	—	—	·	—			**Sh. coll.**	0–1	1500			
167	19	0	0·67	33·18	26·69	8·26	—	—	**N 50 V**	100–0	1045			
		10	0·68	33·31	26·80	8·26	—	—	**N 70 V**	50–0				
		20	−0·58	33·48	26·92	8·26	—	—	,,	100–50				
		30	0·60	33·62	27·05	8·20	—	—	,,	250–100				
		40	0·52	33·82	27·21	8·20	—	—	,,	340–0	—	1130		
		50	0·60	33·96	27·31	8·20	—		**OTL**					
		60	0·56	33·98	27·34	8·20	—	—	**N 7–T**	244–344	1210	1230	—	trawl hitched; net torn
		80	0·50	34·11	27·43	8·20	—		**N 4–T**					
		100	0·68	34·13	27·45	8·15	—	-	**NCS–T**					
		150	1·01	34·33	27·62	8·10								
		200	1·10	34·42	27·69	8·03								
		240	0·50	34·54	27·78	8·03								
168	20	0	−0·20	33·66	27·05	—	—	—	**N 100 H**	0–5	1146	1223	1	
									,,	78	,,	,,	1	
									,,	157	,,	,,	1	KT
									N 70 H	0–5	1239	1252	¼	
									,,	77	,,	,,	¼	
									,,	154	,,	,,	¼	KT
169	21	0	0·42	34·16	27·47	8·22	—	—	**N 50 V**	100–0	0905	—	—	TD 19 m.
		10	0·47	34·16	27·47	8·22	—	-	**N 70 V**	50–0				
		20	0·48	34·19	27·49	8·22	—		,,	100–50				
		30	0·50	34·20	27·50	8·22	—	-	,,	250–100				
		40	0·56	34·24	27·54	8·22	—	-	,,	500–250				
		50	0·58	34·25	27·55	8·22	-	—	,,	750–500				
		60	0·60	34·31	27·60	8·16	—	-	,,	1000–750				
		80	0·62	34·33	27·61	8·16	—	—	,,	2500–1500	—	1210		
		100	0·72	34·34	27·64	8·16	—		**TYF**	1000–1100	1238	1350	0·8	
		150	0·82	34·37	27·66	8·10								
		200	0·80	34·42	27·69	8·10								
		300	0·86	34·43	27·71	8·08								
		400	0·78	34·51	27·77	8·05								
		600	0·31	34·63	27·85	8·01								
		800	0·18	34·65	27·85	8·01								
		1000	0·10	34·65	27·84	8·03								
		1700	−0·25	34·63	27·84	8·03								
		2400	0·68	34·63	27·86	8·06								
170	21	0	0·65	33·91	27·21	—	—	—	**DLH**	342	1650	1655		
		335	0·42	34·47	27·72									
171	23	0	0·62	33·90	27·20	8·20	—	—	**N 50 V**	100–0	0905	—	—	TD 12½ m.
		10	0·60	33·91	27·21	8·20	—	—	**N 70 V**	50–0				
		20	0·60	33·92	27·21	8·20	—	—	,,	100–50				
		30	0·60	33·95	27·24	8·20	·	—	,,	250–100				
		40	0·60	33·91	27·21	8·20	—	—	,,	500–250				
		50	0·55	33·94	27·24	8·20	-	—	,,	750–500				
		60	0·45	33·95	27·25	8·16		-	,,	1000–750	·	1100		
		80	0·38	34·00	27·30	8·11	—	—	**N 100 H**	0–5	1119	1152	1	
		100	0·25	34·00	27·31	8·08	—	—	,,	64	,,	,,	1	
		150	−0·12	34·25	27·53	8·03	—	—	,,	128	,,	,,	1	KT
		200	0·00	34·40	27·64	8·03	—	-	**N 70 H**	0–5	1225	1232	¼	
		300	−0·60	34·47	27·73	8·03	—	—	,,	64	1207	1219	¼	
		400	0·55	34·51	27·76	8·03	·	—	,,	128	,,	,,	¼	
		600	0·94	34·52	27·79	8·03								
		800	1·03	34·54	27·81	8·03								
		1000	−1·34	34·58	27·85	8·03								
		1500	−1·68	34·61	27·89	8·03								

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
		1927										
172	Off Deception I, S Shetlands, 62° 59′ 00″ S, 60° 28′ 00″ W	26 ii	1200	—	NNW	5	NNW	3	o.	981·5	2·8	
			1245	525 r.								
173	Port Foster, Deception I, S Shetlands. Close to SE shore, near Lake Point	28 ii	1200	—	SW	3	—	0	o.	987·8	1·7	
			1445	5								
			1525	60								
			1600	—	SW	4	—	0	o.	986·6	1·7	
174	Deception I, S Shetlands. Outside entrance, W of Lt	28 ii–2 iii										
175	Bransfield Strait, S Shetlands, 63° 17′ 20″ S, 59° 48′ 15″ W	2 iii	2000	—	E	3	E	2	c.	997·3	1·7	
			2010	200 m. st. g.								
176	12 miles SW of Deception I, S Shetlands, 63° 09′ 30″ S, 60° 46′ 00″ W	5 iii	0800	—	NW	4	NW	2	o. f.	984·0	1·7	mod. SSW swell
			1200	—	—	0	—	1	o. f.	981·8	1·1	,,
177	27 miles SW of Deception I, S Shetlands, 63° 17′ 30″ S, 61° 17′ 00″ W	5 iii	1600	—	WNW	7	WNW	6	o. r. g.	979·3	0·5	
			1852	1080 m. cs. st.								
			2000	—	SW	6	SW	5	b. c.	984·3	1·7	
178	Melchior Hr, Schollaert Channel, Palmer Archipelago	9–11 iii										
179	Melchior I, Schollaert Channel, Palmer Archipelago. In creek to S of SW anchorage	10 iii	1200	—	—	1	—	0	o. s. m.	990·9	− 1·1	
			1430	4 r.								
			1530	10 r.								
			1600	—	—	1	—	0	o. s. m.	989·3	− 0·6	
180	1·7 miles W of N point of Gand I, Schollaert Channel, Palmer Archipelago	11 iii	0800	—	—	1	—	0	o. s. m.	983·6	0·0	
			0944	160 m. st.								
			1200	330 m. st.	—	1	—	0	o. s. m.	980·8	1·1	
			1600	—	—	1	—	0	o. m.	981·8	1·1	
181	Schollaert Channel, Palmer Archipelago, 64° 20′ 00″ S, 63° 01′ 00″ W	12 iii	0800	—	—	1	—	0	o. s.	980·9	− 0·6	
			1005	160 m.								
			1200	—	—	1	—	0	c. s. m.	981·3	0·0	
			1210	335 m.								
182	Schollaert Channel, Palmer Archipelago, 64° 21′ 00″ S, 62° 58′ 00″ W	14 iii	1200	—	SW	3	—	0	b. c.	983·7	2·8	
			1452	278 m.								
			1600	—	SW	3	—	0	b. c.	985·4	2·2	
			1605	500 m.								
183	Schollaert Channel, Palmer Archipelago, 64° 21′ 30″ S, 63° 00′ 00″ W	14 iii	2000	—	—	1	—	0	b. c.	988·0	1·7	
184	Fournier Bay, Anvers I, Palmer Archipelago, 64° 30′ 00″ S, 62° 54′ 00″ W	15–16 iii										

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
172	24	0	0·75	33·77	27·09	—	—	—	**DLH**	525	1300	1306	—	stop parted
		500	0·25	34·60	27·79									
173	26	5	1·01	33·73	27·04	—	—	—	**BTS** } **NCS–T** }	5–60	1445	1525	—	three short hauls on steeply shelving ground
		60	0·85	33·76	27·07									
174	26–28	—	—	—	—	—	—	—	**TNL** } **TGS** }	5–10				
175	28	0	0·35	34·04	27·32	—	—	—	**DLH**	200	**2018**	**2025**		
		190	– 0·48	34·34	27·62									
176	3	—	—	—	—	—	—	—	**N 100 H**	0–5	0948	1023	1	net slightly torn
									,,	89	,,	1021	1	
									,,	178	,,	1022	1	KT
									N 70 H	0–5	1037	1050	¼	
									,,	87	,,	,,	¼	
									,,	175	,,	,,	¼	KT
177	3	0	0·35	33·82	27·16	—	—	—	**NH**	0	1830			
									DLH	1080	**1908**	**1914**		
178	7	—	—	—	—	—	—	—	**TNL**	17				
179	9	—	—	—	—	—	—	—	**DS**	4–10	1430	1530	—	three short hauls
									N 70 H	0–1	1500	1510		
									Sh. coll.					
180	9	0	– 0·02	33·26	26·72	—	—	—	**DLH**	160	1001	1007		
		150	0·00	34·16	27·45	—	—	—	**OTL** } **N 7–T** } **N 4–T** } **NCS–T** }	160–330	1304	1334		
									N 100 H	0–5	1436	1500	1	
									,,	55	,,	1458	1	
									,,	110	,,	1459	1	KT
									N 70 H	0–5	1514	1524	¼	
									,,	43	,,	,,	¼	
									,,	86	,,	,,	¼	KT
181	10	0	– 0·05	33·10	26·59	—	—	—	**OTL** } **N 7–T** } **N 4–T** } **NCS–T** }	160–335	1035	1048		
		325	0·40	34·51	27·71	—	—	—						
182	12	0	– 0·21	32·94	26·47	—	—	—	**OTL** } **N 7–T** } **N 4–T** } **NCS–T** }	278–500	1512	1532		
		250	0·12	34·44	27·66	—	—	—						
183	12	—	—	—	—	—	—	—	**N 100 H**	0–5	1716	1747	1	
									,,	68	,,	,,	1	
									,,	137	,,	,,	1	KT
									N 70 H	0–5	1803	1812	¼	
									,,	69	,,	,,	¼	
									,,	140	,,	,,	¼	KT
184	13	—	—	—	—	—	—	—	**TNL**	36				

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
185	Gerlache Strait, Palmer Archipelago, 3·5 miles S 119° E of C van Wycks, Anvers I	1927 16 iii	1100	598 di. oz.								
			1200	—	NE	3		0	o. m.	999·1	0·6	
186	Fournier Bay, Anvers I, Palmer Archipelago, 64° 25′ 30″ S, 63° 02′ 00″ W	16 iii	1600	—	SE	5	—	0	o.	996·1	0·6	
			1700	295 m.								
187	Neumayr Channel, Palmer Archipelago, 64° 48′ 30″ S, 63° 31′ 30″ W	18 iii	0800	—	—	0	—	0	b. c.	988·6	0·6	
			0945	200 gy. m.								
			1200	—	—	0	—	0	b. c. s.	991·1	0·6	
			1218	354 m.								
			1325	259 m.								
			1600	—	—	0–1	—	0	b. c.	996·7	0·6	
188	SW of Bismarck Strait, Palmer Archipelago, 64° 58′ 00″ S, 65° 11′ 00″ W	19 iii	1600		ENE	6	ENE	5	o. s.	998·4	1·1	v. heavy swell
			2000	—	ENE	6	ENE	5	b. c.	995·1	0·6	,,
189	Port Lockroy, Wiencke I, Palmer Archipelago	22 iii	1200	—	NE	6	-	0	o. s.	968·0	0·6	
		23 iii	1600	—	NE	3		0	b. c.	976·7	1·1	
			2000	-	NE	3	-	0	b. c.	977·2	1·1	
			0000	—		0	—	0	b. c.	980·4	0·6	
		25 iii	0400			1		0	b. c.	996·3	0·6	
			0600	-	--	0	-	0	—		-5·0	
			0800			1	—	0	b. c.	998·3	0·6	
190	Bismarck Strait, Palmer Archipelago, 64° 56′ 00″ S, 65° 35′ 00″ W	24 iii	1140	308 r.								
			1200	—	—	0		0	b. c.	983·5	1·1	
			1415	315 m. r.								
			1541	93 r.								
			1600	126 st. m. r.		0–1	—	0	b. c.	987·5	1·1	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth metres	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
185	14	0	−0·34	33·36	26·81	8·16	—		**N 50 V**	100–0	1100			
		10	−0·34	33·37	26·82	8·16	—		**N 70 V**	50–0				
		20	−0·34	33·47	26·90	8·16			,,	100–50				
		30	−0·28	33·55	26·97	8·16		—	,,	250–100				
		40	−0·30	33·58	27·00	8·16	—	—	,,	500–250	—	1201		
		50	−0·30	33·60	27·02	8·16	—	—	**N 100 H**	0–5	1240	1336	1	
		60	−0·30	33·63	27·04	8·08	—	—	,,	95	,,	,,	1	
		80	−0·28	33·69	27·08	8·08			,,	190	,,	,,	1	KT
		100	−0·20	33·86	27·21	8·01			**N 70 H**	0–5	1349	1357	¼	
		150	0·10	34·25	27·51	7·96	—	—	,,	74	,,	,,	¼	
		200	0·20	34·38	27·62	7·96			,,	148	,,	,,	¼	KT
		300	−0·10	34·43	27·68	7·93								
		400	−0·12	34·47	27·71	7·93								
		540	−0·20	34·51	27·74	7·95								
186	14	·	—	—	—		—	—	**DLH**	295	1718	1729		
187	16	0	−0·05	33·42	26·86	8·16	—	—	**N 50 V**	100–0	0945	—	—	TD 14 m.
		10	−0·10	33·49	26·91	8·16		—	**N 70 V**	50–0				
		20	−0·05	33·49	26·91	8·14	—	—	,,	100–50				
		30	0·00	33·51	26·93	8·14	—	—	,,	195–100	—	1020		
		40	0·00	33·51	26·93	8·12	—	—	**N 100 H**	0–5	1039	1107	1	
		50	−0·05	33·54	26·95	8·08	—	—	,,	76	,,	,,	1	
		60	−0·02	33·60	27·00	8·07	·	-	,,	152	,,	,,	1	KT
		80	0·00	33·69	27·07	8·00	—	—	**N 70 H**	0–5	1120	1131	¼	
		100	−0·05	33·78	27·15	7·97			,,	88	,,	,,	¼	
		150	0·00	33·93	27·26	7·96	—	—	,,	177	,,	,,	¼	KT
		190	0·18	34·23	27·50	7·96		—	**OTL**					
									N 7–T	259–354	1235	1251	—	trawl hitched; net mainly lost
									N 4–T					
									NCS–T					
									DLH	259	1416	1421	—	stop parted
188	16	—	—	—	—	—	—	—	**N 100 H**	0–5	1629	1707	1	
									,,	81	,,	1705	1	
									,,	162	,,	1706	1	KT
									N 70 H	0–5	1721	1732	¼	
									,,	81	,,	,,	¼	
									,,	162	,,	,,	¼	KT
189	18–22	0	−0·92	33·38	26·86	–	—	-	**TNL**	7	—	–	—	21–23 iii
		10	−0·20	33·40	26·85	—		—	**NH**	0	1600		—	22 iii
		20	−0·10	33·54	26·95	-	—	—	**Sh. coll.**	—	—	—	—	22 iii
		28	−0·10	33·57	26·97	—		·	**N 70 H**	2	1730	**2030**	—	A} 23 iii. Streamed
									N 70 H	2	**2040**	**2355**	—	B} from anchored ship
									TNL	70	—	—	—	23–25 iii
190	21	0	−0·32	33·30	26·76	8·14	—	—	**N 50 V**	100–0	1140	—	—	TD 20 m.
		10	−0·32	33·37	26·82	8·14	—		**N 70 V**	50–0				
		20	−0·30	33·37	26·82	8·14		–	,,	100–0				
		30	−0·35	33·37	26·82	8·12	—	—	,,	250–100	—	1220		
		40	−0·32	33·42	26·87	8·12	—		**N 100 H**	0–5	1241	1318	1	
		50	−0·33	33·51	26·94	8·07		·	,,	65	,,	,,	1	
		60	−0·32	33·53	26·95	8·07			,,	130	,,	,,	1	KT. Net touched bottom
		80	−0·33	33·69	27·09	8·03	–	–	**N 70 H**	0 ·5	1338	1351	¼	
		100	−0·31	33·89	27·25	8·03	- -	—	,,	56	,,	,,	¼	
		150	0·20	34·27	27·53	7·97	—	—	,,	113	,,	,,	¼	KT
		200	0·38	34·40	27·62	7·96	—		**DLH**	315	1422	1427		
		300	0·55	34·49	27·68	7·93			,,	93–126	1544	1547		
									NRL	126	1622	1627		

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
191	Gerlache Strait, Palmer Archipelago, 2·5 miles N 114° E of C Astrup, Wiencke I	1927 25 iii	0800	—	—	1	—	0	b. c.	998·3	−0·6	
			1050	310 m. di. oz.								
			1200	—	—	0	—	0	b. c.	1000·9	0·6	
192	Off C Kaiser, Brabant I, Palmer Archipelago, 64° 14′ 00″ S, 61° 49′ 00″ W	27 iii	1200	—	—	1	—	1	c.	1004·8	−0·6	
			1440	800 di. oz.								
			1600	—	—	1	—	1	c.	1006·2	0·6	
193	17½ miles N of Hoseason I, Palmer Archipelago, 63° 24′ 00″ S, 61° 33′ 00″ W	28 iii	1100	1021 r.								
			1200	—	NE	3	NE	2	b. c.	1008·5	0·0	
			1600	—	NE	2	—	1	b.	1008·3	0·6	
194	2½ miles E of Deception I, S. Shetlands, 62° 57′ 30″ S, 60° 22′ 00″ W	28 iii	2000	—	—	1	—	1	b. v.	1008·7	0·6	
			2100	812 di. oz.								
			0000	—	NW	2	NW	2	o.	1009·0	0·0	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	Hauled	Length of tow (miles)	Remarks
191	22	0	−0·30	33·40	26·85	8·16	—	—	**N 50 V**	100–0	1050	·	—	TD 18½ m.
		10	0·31	33·43	26·87	8·14	—	—	**N 70 V**	50–0				
		20	0·30	33·46	26·89	8·14	—	—	,,	100–50				
		30	−0·24	33·51	26·94	8·14	—		,,	250–100	—	1130		
		40	−0·20	33·55	26·97	8·12	—	—	**N 100 H**	0–5	1152	1226	1	
		50	−0·18	33·66	27·05	8·08	—	—	,,	62	,,	,,	1	
		60	0·18	33·66	27·05	8·08	—	—	,,	124	,,	,,	1	KT
		80	0·18	33·66	27·05	8·08	·	—	**N 70 H**	0–5	1239	1247	¼	
		100	0·18	33·67	27·06	8·08	—	—	,,	66	,,	,,	¼	
		150	0·26	34·33	27·56	7·96	—	—	,,	132	,,	,,	¼	KT
		200	0·28	34·42	27·63	7·96								
		300	−0·11	34·50	27·73	7·96								
192	23	0	0·15	33·46	26·89	8·16	—	–	**N 50 V**	100–0	1440	--	—	TD 22 m.
		10	−0·32	33·48	26·91	8·14	—		**N 70 V**	50–0				
		20	−0·33	33·48	26·91	8·14	—	—	,,	100–50				
		30	−0·31	33·53	26·95	8·10	—	—	,,	250–100				
		40	−0·30	33·56	26·97	8·10	—	—	,,	500–250				
		50	−0·30	33·60	27·02	8·10	—	—	,,	750–500	—	1530		
		60	−0·29	33·60	27·02	8·09	—	—	**N 100 H**	0–5	1605	1634	1	
		80	−0·22	33·71	27·10	8·02	—	—	,,	53	,,	,,	1	
		100	−0·21	33·86	27·21	8·00	—	—	,,	106	,,	,,	1	KT
		150	0·00	34·22	27·49	7·98	—	—	**N 70 H**	0–5	1648	1657	¼	
		200	0·00	34·38	27·63	7·95	—	—	,,	61	,,	,,	¼	
		300	0·02	34·51	27·73	7·95	—	—	,,	122	,,	,,	¼	KT
		400	−0·06	34·54	27·76	7·95								
		600	−0·28	34·56	27·78	7·95								
		780	−0·49	34·58	27·81	7·96								
193	24	0	0·00	33·77	27·13	8·16	—	—	**N 50 V**	100–0	1100	—	—	TD 25 m.
		10	0·00	33·80	27·16	8·16	—	—	**N 70 V**	50–0				
		20	−0·08	33·86	27·20	8·14	—	—	,,	100–50				
		30	−0·10	33·95	27·29	8·09	—	—	,,	250–100				
		40	−0·11	34·02	27·35	8·09	—	—	,,	500–250				
		50	−0·15	34·10	27·41	8·07	—	—	,,	750–500				
		60	−0·17	34·14	27·45	8·07	—	—	,,	1000–750	—	1240		
		80	−0·20	34·27	27·55	8·04	—	—	**N 100 H**	0–5	1253	1326	1	
		100	−0·36	34·31	27·59	8·04	—	—	,,	73	,,	,,	1	
		150	−0·45	34·33	27·60	8·00	—	—	,,	146	,,	,,	1	KT
		200	−0·58	34·37	27·65	8·00	—	—	**N 70 H**	0–5	1345	1357	¼	
		300	−0·66	34·44	27·70	7·98	—	—	,,	75	,,	,,	¼	
		400	−0·26	34·51	27·74	7·96	—	—	,,	150	,,	,,	¼	KT
		600	−0·28	34·54	27·77	7·95								
		800	−0·40	34·54	27·78	7·97								
		950	−0·63	34·56	27·80	7·98								
194	24	0	0·41	33·78	27·13	8·14	—	—	**N 50 V**	100–0	**2100**			
		10	0·41	33·80	27·14	8·14	—	—	**N 70 V**	50–0				
		20	0·38	33·84	27·17	8·11	—	—	,,	100–50				
		30	0·21	33·95	27·27	8·10	—	—	,,	250–100				
		40	0·17	33·95	27·27	8·09	—	—	,,	500–250				
		50	0·13	33·95	27·27	8·04	—	—	,,	750–500	—	**2220**		
		60	0·11	33·97	27·29	8·04	—	—	**N 100 H**	0–5	**2253**	**2331**	1	
		80	0·00	34·07	27·38	8·02	—	—	,,	73	,,	,,	1	
		100	0·04	34·22	27·49	7·99	—	-	,,	146	,,	,,	1	KT
		150	0·00	34·33	27·58	7·99	—	-	**N 70 H**	0–5	**2350**	**2359**	¼	
		200	−0·22	34·38	27·64	7·97	—	—	,,	70	,,	,,	¼	
		300	0·32	34·53	27·77	7·96	—	—	,,	140	,,	,,	¼	
		400	0·19	34·58	27·78	7·96								
		600	0·90	34·54	27·81	7·97								
		780	−1·06	34·54	27·81	8·00								

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
195	Admiralty Bay, King George I, S Shetlands, 62° 07′ 00″ S, 58° 28′ 30″ W	1927 30 iii	0800	—	SW	3	—	0	b. c.	1007·3	0·6	
			1000	391 m. st.								
			1200	—	SW	6	—	0	o. m. s.	1004·0	0·6	
196	Bransfield Strait, S Shetlands, 62° 17′ 30″ S, 58° 21′ 00″ W	3 iv	0800	—	—	1	—	0	b. c.	996·4	−6·7	
			1055	1011 di. oz.								
			1200	—	SE	2	SE	3	b. c.	998·2	−5·6	slight SE swell
			1210	720 m. di. oz.								
197	Bransfield Strait, S Shetlands, 62° 27′ 00″ S, 58° 11′ 30″ W	3 iv	1600	—	SE	4	SE	3	b. c.	998·4	−6·1	slight SE swell
			1620	1974 di. oz.								
			2000	—	SE	4	SE	3	o.	1000·9	−6·7	,,
198	Bransfield Strait, S Shetlands, 62° 38′ 00″ S, 58° 04′ 00″ W	3–4 iv	2220	1600 di. oz.								
			0000	—	SE	4	SE	3	c.	1001·0	−7·2	slight SE swell
			0400	—	SE	4	SE	3	b. c.	997·3	−7·9	
199	Bransfield Strait, S Shetlands, 62° 49′ 00″ S, 57° 56′ 30″ W	4 iv	0800	—	ESE	5	ESE	4	c. v.	1002·2	−10·0	
			0900	735 di. oz.								
			1200	—	NE	5	NE	3	c. v.	1001·0	−8·9	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
195	26	0	0·32	33·86	27·18	—	—	—	**DLH**	391	1012	1018		
		380	0·04	34·36	27·61	—	—	—	**OTM**					
									N 7–T	391	1230	-	—	trawl hitched as soon as shot
									N 4–T					
									NCS–T					
196	2	0	0·15	33·84	27·18	8·16	—	—	**N 50 V**	100–0	1055		—	TD 18 m.
		10	0·18	33·86	27·19	8·16	—	—	**N 70 V**	50–0				
		20	0·18	33·85	27·18	8·12	—	—	,,	100–50				
		30	0·20	33·94	27·26	8·10	—	—	,,	250–100				
		40	0·20	33·95	27·27	8·10	—	—	,,	500–250				
		50	0·10	34·05	27·35	8·09	—	—	,,	700–500				
		60	– 0·04	34·05	27·36	8·07	—	—	,,	720	—	1240		touched bottom
		80	– 0·02	34·05	27·36	8·05	—	—	**N 100 H**	0 5	1301	1331	1	
		100	0·04	34·11	27·41	8·00	—	—	,,	91	,,	,,	1	
		150	– 0·21	34·14	27·45	8·00	—	—	,,	182	,,	,,	1	KT
		200	0·00	34·38	27·63	7·96	—	—	**N 70 H**	0–5	1346	1402	¼	
		300	– 0·72	34·42	27·69	7·95	—	—	,,	91	,,	,,	¼	
		400	– 0·21	34·51	27·74	7·95	—	—	,,	182	,,	,,	¼	KT
		650	– 0·73	34·47	27·74	8·01								
197	2	0	0·08	33·98	27·31	8·16	—	—	**N 50 V**	100–0	1620			
		10	0·05	34·04	27·35	8·16	—	—	**N 70 V**	50–0				
		20	0·07	33·98	27·31	8·16	—	—	,,	100–50				
		30	0·10	33·98	27·30	8·16	—	—	,,	250–100				
		40	0·10	34·04	27·34	8·16	—	—	,,	500–250				
		50	0·09	34·04	27·34	8·15	—	—	,,	750–500				
		60	0·10	33·98	27·30	8·13	—	—	,,	1000–750	—	**1805**		
		80	– 0·10	34·09	27·40	8·08	—	—	**N 100 H**	0–5	**1836**	**1914**	1	
		100	– 0·46	34·23	27·53	8·02	—	—	,,	67	,,	,,	1	
		150	– 0·68	34·41	27·67	7·98	—	—	,,	134	,,	,,	1	KT
		200	– 0·71	34·41	27·68	7·98	—	—	**N 70 H**	0–5	**1932**	**1943**	¼	
		300	– 0·82	34·56	27·81	7·96	—	—	,,	62	,,	,,	¼	
		400	– 0·85	34·57	27·83	7·96	—	—	,,	124	,,	,,	¼	KT
		600	– 1·11	34·60	27·85	7·96								
		800	– 1·33	35·06?	28·23?	7·98								
		1000	– 1·53	34·63	27·90	8·00								
		1500	– 1·67	34·65	27·91	8·00								
		1900	– 1·70	34·60	27·87	8·00								
198	2	0	– 0·20	33·98	27·32	8·16	—	—	**N 50 V**	100–0	**2220**			
		10	– 0·22	33·95	27·29	8·15	—	—	**N 70 V**	50–0				
		20	– 0·18	33·95	27·29	8·15	—	—	,,	100–50				
		30	– 0·45	34·04	27·37	8·12	—	—	,,	250–100				
		40	– 0·56	34·12	27·44	8·09	—	—	,,	500–250				
		50	– 0·58	34·12	27·44	8·09	—	—	,,	750–500				
		60	– 0·58	34·18	27·50	8·09	—	—	,,	1000–750	—	**0042**		
		80	– 0·50	34·17	27·49	8·03	—	—	**N 100 H**	0–5	**0102**	**0143**	1	
		100	– 0·59	34·29	27·58	7·98	—	—	,,	76	,,	,,	1	KT
		150	– 0·68	34·34	27·63	7·98	—	—	**N 70 H**	0–5	**0201**	**0216**	¼	
		200	– 0·63	34·42	27·68	7·98	—	—	,,	68	,,	,,	¼	
		300	– 0·70	34·47	27·74	7·96	—	—	,,	137	,,	,,	¼	KT
		400	– 0·85	34·47	27·74	7·96								
		600	– 0·76	34·49	27·75	8·00								
		800	– 0·94	34·52	27·78	8·00								
		1000	– 1·13	34·49	27·76	8·00								
		1500	– 1·74	34·87	28·09	8·01								
199	3	0	– 0·75	34·10	27·44	8·12	—	—	**N 50 V**	100–0	0900	—	—	TD 23 m.
		10	– 0·78	34·12	27·45	8·12	—	—	**N 70 V**	50–0				
		20	– 0·79	34·22	27·53	8·12	—	—	,,	100–50				
		30	– 0·79	34·22	27·53	8·10	—	—	,,	250–100				

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
199 *cont.*	Bransfield Strait, S Shetlands, 62° 49′ 00″ S, 57° 56′ 30″ W	1927 4 iv										
200	Bransfield Strait, S Shetlands, 62° 59′ 30″ S, 57° 49′ 00″ W	4 iv	1455	345 m. di. oz.								
			1600	—	NNE	4	NNE	3	c. v.	999·4	− 10·0	
201	Bransfield Strait, S Shetlands, 63° 00′ 30″ S, 59° 06′ 30″ W	5 iv	0800	—	WNW	5	WNW	3	o.	993·2	− 5·0	
			0820	343 m. di. oz.								
			1200	—	SE	3	SE	3	b. c.	993·7	− 6·1	
202	Bransfield Strait, S Shetlands, 62° 48′ 00″ S, 60° 05′ 00″ W	5 iv	1600	—	W	2	W	2	o.	994·9	− 3·9	
			1720	909 di. oz.								
			2000	—	W	2	W	2	o. s.	992·8	− 5·0	
203	Bransfield Strait, S Shetlands, 62° 56′ 00″ S, 59° 50′ 00″ W	5–6 iv	2240	949 di. oz.								
			0000	—	SW	2	SW	2	o. s. m.	993·4	− 4·4	
			0400	—	W	3	W	3	c. s. g.	991·5	− 1·7	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	Hauled	Length of tow (miles)	Remarks
199 *cont.*		40	0·80	34·18	27·51	8·10		—	**N 70 V**	500–250				
		50	0·80	34·25	27·56	8·08	—	—	,,	700–500		1030		
		60	0·78	34·18	27·51	8·08	—	—	**N 100 H**	0–5	1126	1208	1	
		80	0·70	34·22	27·53	8·08	—	-	,,	72	,,	,,	1	
		100	- 0·75	34·33	27·62	8·06	—		,,	145	,,	,,	1	KT
		150	- 0·98	34·36	27·66	8·06	—		**N 70 H**	0–5	1224	1238	¼	
		200	- 1·00	34·42	27·70	8·02	—	-	,,	85	,,	,,	¼	
		300	1·11	34·42	27·70	8·00	—	—	,,	170	,,	,,	¼	KT
		400	– 1·14	34·57	27·83	8·00								
		600	0·91	34·62	27·86	8·00								
		700	0·90	35·01	28·18	8·01								
200	3	0	0·70	34·20	27·52	8·09	—	—	**N 50 V**	100–0	1445			
		10	– 0·70	34·20	27·52	8·09	—	—	**N 70 V**	50–0				
		20	– 0·70	34·25	27·56	8·09	—	—	,,	100–50				
		30	– 0·70	34·16	27·49	8·09			,,	250–100				
		40	0·64	34·18	27·50	8·09	—	—	,,	300–250		1545		
		50	0·64	34·16	27·48	8·09	—	—	**N 100 H**	0–5	1602	1641	1	
		60	- 0·70	34·16	27·49	8·09	—	—	,,	69	,,	,,	1	? not fishing properly
		80	– 0·70	34·21	27·52	8·09	—	—	,,	138	,,	,,	1	KT
		100	0·70	34·21	27·52	8·09	—	—	**N 70 H**	0–5	1659	1716	¼	
		150	- 0·78	34·25	27·56	8·07	—	—	,,	56(–0)	,,	,,	¼	
		200	– 0·86	34·36	27·65	8·07	—	—	,,	113(–0)	,,	,,	¼	KT
		275	0·90	34·57	27·83	8·07								
201	4	0	– 0·50	34·07	27·41	8·12	—	—	**N 50 V**	100–0	0820			
		10	– 0·50	34·08	27·42	8·10	—	—	**N 70 V**	50–0				
		20	0·50	34·08	27·42	8·10	—	—	,,	100–50				
		30	0·50	34·11	27·44	8·09	—	—	,,	250–100				
		40	0·50	34·15	27·47	8·10	—		,,	330–250	—	0910		
		50	– 0·48	34·17	27·48	8·08	—	—	**N 100 H**	0–5	0930	1012	1	
		60	– 0·47	34·17	27·48	8·05	—	—	,,	60	,,	,,	1	
		80	– 0·61	34·18	27·50	8·04	—	—	,,	120(–0)	,,	,,	1	KT. Net torn
		100	– 0·72	34·27	27·58	7·99	—	—	**N 70 H**	0–5	1047	1054	¼	
		150	– 0·85	34·36	27·65	7·98	—	—	,,	45(–0)	1026	1041	¼	
		200	– 0·90	34·45	27·73	7·98	—	—	,,	90(–0)	,,	,,	¼	KT
		300	0·90	34·47	27·75	7·98								
202	4	0	0·08	33·83	27·18	8·14	—	—	**N 50 V**	100–0	1720			
		10	- 0·02	33·84	27·19	8·14	—	—	**N 70 V**	50–0				
		20	0·02	33·84	27·19	8·12	—	—	,,	100–50				
		30	0·02	33·82	27·18	8·12	—	—	,,	250–100				
		40	– 0·02	33·87	27·22	8·12	—	—	,,	500–250				
		50	0·02	33·93	27·26	8·11	—	—	,,	750–500		**1915**		
		60	0·00	33·99	27·31	8·10	–	—	**N 100 H**	0–5	**1930**	**2030**	1	
		80	0·00	34·05	27·36	8·06	—	—	,,	94	,,	,,	1	
		100	0·00	34·13	27·42	8·02	—		,,	188(–0)	,,	,,	1	KT
		150	0·15	34·28	27·53	7·99		—	**N 70 H**	0–5	**2050**	**2059**	¼	
		200	0·30	34·37	27·60	7·99	—		,,	62	,,	,,	¼	
		300	0·36	34·45	27·66	8·01	—		,,	124	,,	,,	¼	KT
		350	0·95	34·38	27·68	7·96								
		400	0·92	34·42	27·70	7·99								
		600	0·92	34·63	27·88	8·00								
		850	1·03	34·43	27·72	8·02								
203	4	0	0·10	34·00	27·32	8·14	—		**N 50 V**	100–0	**2240**			
		10	– 0·14	33·95	27·29	8·15	—	—	**N 70 V**	50–0				
		20	– 0·12	33·95	27·29	8·15	—	—	,,	100–50				
		30	– 0·11	33·96	27·30	8·13	—	—	,,	250–100				
		40	– 0·10	34·00	27·32	8·13	—	—	,,	500–250				
		50	– 0·12	34·00	27·33	8·12	—	—	,,	750–500				
		60	0·31	34·16	27·47	8·00	—		,,	930–750	—	**0030**		

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
203 *cont.*	Bransfield Strait, S Shetlands, 62° 56′ 00″ S, 59° 50′ 00″ W	1927 5 6 iv										
204	Bransfield Strait, S Shetlands, 63° 05′ 00″ S, 59° 42′ 00″ W	6 iv	0800	943 di. oz.	W	3	W	2	b. c.	992·4	−3·3	
205	Bransfield Strait, S Shetlands, 63° 14′ 00″ S, 59° 34′ 00″ W	6 iv	1200	235 r.	SW	2	SW	2	b. c. s.	992·9	−2·2	
206	Bransfield Strait, S Shetlands, 63° 26′ 00″ S, 59° 28′ 00″ W	6 iv	1545 1600	310 m. di. oz. —	—	1	—	1	o. s.	992·2	−1·7	
207	Bransfield Strait, S Shetlands. From 62° 54′ 00″ S, 59° 50′ 30″ W to 62° 49′ 30″ S, 60° 10′ 30″ W	7 iv	0400 0800	–	NW NW	4 6	NW NW	4 3	b. c. c. s.	991·8 992·0	−2·8 0·0	
208	Off Livingston I, S Shetlands, 62° 49′ 30″ S, 60° 10′ 30″ W	7 iv	1200	—	NW	6	NW	3	c. g. s.	990·6	−0·6	
209	Port Foster, Deception I, S Shetlands	14 iv	0800 0900	— 168 m.	—	1	—	0	c.	980·3	−1·1	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
203 *cont.*		80	0·42	34·22	27·51	8·00	—	—	**N 100 H**	0–5	**0045**	**0119**	1	
		100	−0·55	34·25	27·55	8·00	—	—	,,	90	,,	,,	1	
		150	−0·89	34·34	27·64	8·00	—	—	,,	180	,,	,,	1	KT
		200	−0·96	34·36	27·66	8·00	—	—	**N 70 H**	0–5	**0135**	**0146**	¼	
		300	0·94	34·42	27·70	8·00		—	,,	68	,,	,,	¼	
		400	0·96	34·46	27·73	8·01	—	—	,,	139	,,	,,	¼	KT
		600	0·77	34·49	27·75	8·01								
		800	−0·99	34·51	27·78	8·01								
		900	−1·10	34·53	27·80	8·02								
204	5	0	0·25	34·01	27·34	8·12	—		**N 50 V**	100–0	0800	—		TD 19 m.
		10	−0·29	34·00	27·34	8·12		—	**N 70 V**	50–0				
		20	−0·29	34·00	27·34	8·11	—	—	,,	100–50				
		30	−0·25	34·04	27·36	8·09	—		,,	250–100				
		40	0·25	34·04	27·36	8·09		—	,,	500–250				
		50	−0·20	34·02	27·35	8·06	—	—	,,	750–500	—	0907		
		60	0·30	34·05	27·38	8·06	—		**N 100 H**	0–5	0921	0953	1	
		80	0·31	34·13	27·44	8·03	—	—	,,	77	,,	,,	1	
		100	−0·32	34·13	27·44	8·01	—	—	,,	155	,,	,,	1	KT
		150	−0·59	34·22	27·52	7·98			**N 70 H**	0–5	1008	1020	¼	
		200	0·74	34·29	27·59	7·98	—	—	,,	78	,,	,,	¼	
		300	−0·89	34·37	27·67	7·98	—		,,	159	,,	,,	¼	KT
		400	0·93	34·42	27·70	7·98								
		600	−0·80	34·50	27·76	7·98								
		800	0·93	34·45	27·73	8·00								
205	5	0	−0·15	34·00	27·33	8·12		—	**N 50 V**	100–0	1200	—	—	TD 15½ m.
		10	−0·20	34·04	27·36	8·12	—	—	**N 70 V**	50–0				
		20	0·20	34·04	27·36	8·10			,,	100–50				
		30	−0·17	34·04	27·36	8·10	—	—	,,	225–100	—	1217		
		40	−0·39	34·07	27·40	8·07			**N 100 H**	0–5	1247	1316	1	
		50	−0·42	34·07	27·40	8·07	—	—	,,	59	,,	,,	1	
		60	−0·38	34·14	27·46	8·04	—	—	,,	119	,,	,,	1	KT
		80	−0·66	34·28	27·57	8·02	—		**N 70 H**	0–5	1330	1341	¼	
		100	−0·78	34·32	27·61	8·00	—	—	,,	62	,,	,,	¼	
		150	−0·92	34·39	27·68	8·00	—		,,	124	,,	,,	¼	KT
		215	−0·94	34·46	27·74	7·98								
206	5	0	−0·78	34·06	27·41	8·10		—	**N 50 V**	100–0	1545	—	—	TD 26 m.
		10	−0·77	34·06	27·41	8·10	—	—	**N 70 V**	50–0				
		20	−0·77	34·07	27·42	8·10		—	,,	100–50				
		30	−0·77	34·05	27·40	8·08	—		,,	250–100	—	1615		
		40	−0·63	34·07	27·41	8·04	—	—	**N 100 H**	0–5	1646	**1734**	1	net torn
		50	−0·45	34·13	27·44	8·04			,,	66	,,	,,	1	
		60	0·46	34·13	27·44	8·02	—	—	,,	132	,,	,,	1	KT
		80	−0·60	34·16	27·48	8·00	—	—	**N 70 H**	0–5	**1750**	**1806**	¼	
		100	−0·55	34·20	27·51	7·98	—		,,	65	,,	,,	¼	
		150	−0·62	34·27	27·57	7·98	—	—	,,	130	,,	,,	¼	KT
		200	−0·60	34·30	27·59	7·98								
		300	−0·81	34·34	27·64	8·00								
207	6	—	—	—	—	—	—		**N 70 H**	0–5	**0300**	**0310**	0·3	32 consecutive hauls (A–GG) of 10 mins. duration. Sunrise 0645
									,,	0–5	0814	0824	0·3	
208	6	787	−0·86	—	—	—	—		**TYF**	800(–0)	0920	1000	1·0	DGT
209	13	0	0·03	33·75	27·12	8·02		—	**N 50 V**	100–0	0900	—		TD 9 m.
		10	0·12	33·75	27·11	8·02	—	—	**N 70 V**	50–0				
		20	0·12	33·75	27·11	7·99	—	—	,,	100–50				
		30	0·12	33·77	27·12	7·97	—	—	,,	150–100		0940		

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
209 *cont.*	Port Foster, Deception I, S Shetlands	1927 14 iv										
210	Boyd Strait, S Shetlands. From 62° 47′ 00″ S, 62° 10′ 00″ W to 62° 39′ 30″ S, 62° 28′ 30″ W	14–15 iv	2000	—	SW	4	SW	3	b. c.	986·4	0·0	mod. SW swell
			0000	—	SW	4	SW	3	b. c.	989·0	−1·1	,,
			0400	—	WSW	3	—	1	b.	990·3	−1·1	,,
211	Drake Strait, 62° 35′ 00″ S, 63° 20′ 00″ W	15 iv	0800	—	NW	4	NW	3	o.	991·6	−0·6	mod. SW swell
			1130	2865 di. oz.								
			1200	—	NW	4	NW	3	c. s. q.	994·2	0·0	slight NW swell
			1600	—	NW	4	NW	3	b. c.	994·8	0·6	,,
212	Drake Strait, 61° 15′ 00″ S, 64° 42′ 50″ W	16 iv	0700	3350 di. oz.								
			0800	—	—	1	—	1	b. c.	999·6	0·6	heavy NW swell
			1200	—	NE	5	NE	4	o. s.	993·7	0·6	,,
213	Drake Strait, 60° 45′ 30″ S, 65° 27′ 30″ W	16 iv	2000	—	NNE	3	NNE	2	o. r.	987·6	2·2	heavy NW swell
			0000	—	NNE	4	NNE	3	o. f. r.	984·2	1·7	mod. NW swell
214	Drake Strait, 60° 11′ 00″ S, 66° 15′ 00″ W	17 iv	0745	*ca.* 4000								
			0800	—	SW	4	SW	2	o. d.	979·1	1·7	
			1200	—	SW	6	SW	6	o. d.	981·6	3·9	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
209 *cont.*		40	0·12	33·77	27·12	7·97								
		50	0·10	33·83	27·17	7·97								
		60	0·09	33·84	27·18	7·97								
		80	0·00	33·82	27·18	7·97								
		100	−0·20	33·89	27·24	7·96								
		130	−1·28	33·96	27·35	7·65								
		160	−1·51	34·07	27·45	7·67								
210	13	—	—	—	—	—	—	—	**N 70 H**	0–5	**2200**	**2210**	0·2	40 consecutive hauls (A–PP) of 10 mins. duration. Moonlight, moon set 0400
									,,	0–5	**0430**	**0440**	0·2	
211	14	0	0·49	33·64	27·00	8·16	—	7·52	**N 50 V**	100–0	0910	—	—	TD 26 m.
		10	0·23	33·64	27·02	8·16	—	—	**N 70 V**	50–0				
		20	0·22	33·63	27·01	8·16	—	7·61	,,	100–50				
		30	0·22	33·66	27·03	8·13	—	—	,,	250–100				
		40	0·25	33·62	27·00	8·09	—	7·94	,,	500–250				
		50	0·25	33·65	27·01	8·09	—	—	,,	750–500				
		60	0·23	33·65	27·02	8·09	—	7·68	,,	1000–750				
		80	−0·50	33·96	27·32	8·03	—	6·80	,,	2000–1600	—	1210		
		100	−0·05	34·09	27·39	7·98	—	—	**N 100 H**	0–5	1315	1352	1	
		150	1·51	34·44	27·57	7·98	—	4·52	,,	58	,,	,,	1	
		200	1·75	34·52	27·63	7·96	—	4·26	,,	117	,,	,,	1	KT
		300	1·76	34·59	27·68	7·96	—	4·26	**N 70 H**	0–5	1408	1423	¼	
		400	1·72	34·63	27·72	7·96	—	4·34	,,	64	,,	,,	¼	
		600	1·62	34·69	27·77	7·96	—	4·54	,,	128	,,	,,	¼	KT
		800	1·44	34·66	27·76	7·96	—	4·54						
		1000	1·31	34·65	27·76	7·97	—	4·54						
		1500	0·91	34·65	27·79	7·97	—	4·61						
		2000	0·62	34·65	27·80	7·97	—	4·88						
		2800	0·45	34·64	27·80	7·97	—	4·97						
212	14	0	1·16	33·68	26·99	8·16	—	7·68	**N 50 V**	100–0	0700			
		10	1·16	33·68	26·99	8·16	—	—	**N 70 V**	50–0				
		20	1·15	33·68	26·99	8·16	—	7·54	,,	100–50				
		30	1·15	33·68	26·99	8·16	—	—	,,	250–100				
		40	1·11	33·69	27·00	8·16	—	7·54	,,	500–250				
		50	1·10	33·71	27·02	8·16	—	—	,,	750–500				
		60	1·10	33·71	27·02	8·15	—	7·61	,,	1000–750				
		80	0·76	33·72	27·04	8·12	—	—	,,	1500–1000	—	1115		
		100	0·08	33·95	27·28	8·07	—	7·30	**NH**	0	1000			
		150	0·72	34·08	27·34	8·01								
		200	1·38	34·20	27·40	7·98								
		300	2·00	34·40	27·51	7·96								
		400	2·08	34·49	27·57	7·95	—	4·29						
		600	2·22	34·56	27·62	7·96								
		800	2·14	34·62	27·68	7·96								
		1000	2·04	34·66	27·72	7·97	—	4·29						
		1500	1·71	34·70	27·77	7·98								
		2100	1·28	34·71	27·81	7·98	—	4·63						
		3200	0·59	34·72	27·86	7·98	—	4·74						
213	14	—	—	—	—	—	—	—	**N 100 H**	0–5	**2206**	**2235**	1	
									,,	59	,,	**2233**	1	
									,,	119	,,	**2234**	1	KT
									N 70 H	0–5	**2249**	**2303**	½	
									,,	65	,,	,,	½	
									,,	131	,,	,,	½	KT
214	15	0	1·93	33·80	27·04	8·16	—	7·45	**N 50 V**	100–0	0745			
		10	1·93	33·80	27·04	8·16	—	—	**N 70 V**	50–0				
		20	1·98	33·80	27·03	8·16	—	7·39	,,	100–50				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
214 *cont.*	Drake Strait, 60° 11′ 00″ S, 66° 15′ 00″ W	1927 17 iv										
215	Drake Strait, 59° 58′ 00″ S, 67° 02′ 00″ W	17 iv	2000	—	SW	7	SW	7	o. g. h.	987·3	1·1	
			0000	—	SW	7	SW	7	o. g. h.	990·1	0·6	
216	Drake Strait, 58° 53′ 00″ S, 67° 55′ 00″ W	18 iv	1155	3650 r.								
			1200		NNW	4	NNW	3	b. c.	988·4	4·4	heavy W swell
			1600	—	NNW	4	NNW	3	b. c.	985·9	4·4	,,
217	Drake Strait, 58° 27′ 30″ S, 67° 55′ 00″ W	18 iv	2000	—	NNW	4	NNW	3	b. c.	985·6	4·4	heavy W swell
			0000	—	NNW	6	NNW	6	b. c.	984·4	5·0	,,
218	Drake Strait, 57° 32′ 00″ S, 67° 04′ 00″ W [station repeated on 21 iv, St. **219**]	19 iv	1200	4650	NW	6	NW	6	o. r. g.	979·1	5·6	heavy NW and ESE swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
214 *cont.*		30	1·96	33·81	27·04	8·16	—	—	**N 70 V**	250–100				
		40	1·93	33·81	27·05	8·16	—	7·32	,,	500–250				
		50	1·93	33·82	27·06	8·16	—	—	,,	750–500				
		60	1·92	33·82	27·06	8·15	—	7·43	,,	1000–750				
		80	1·91	33·82	27·06	8·15	—	—	,,	2000–1000	—	1215		
		100	1·89	33·82	27·06	8·14	—	7·41						
		150	1·25	33·99	27·23	8·09								
		200	1·54	34·06	27·28	8·09								
		300	1·57	34·16	27·35	8·02								
		400	2·20	34·22	27·34	7·99	—	6·73						
		600	2·39	34·35	27·44	7·95								
		800	2·34	34·49	27·55	7·95								
		1000	2·28	34·58	27·64	7·95	—	4·23						
		1500	2·07	34·67	27·72	7·97								
		2000	1·79	34·69	27·75	7·99	—	4·34						
215	15	—	—	—	—	–	—	—	**N 100 H**	0–5	**2216**	**2251**	1	
									,,	60(–0)	,,	,,	1	
									,,	120(–60)	,,	,,	1	KT
									N 70 H	0–5	**2309**	**2321**	¼	
									,,	64	,,	,,	¼	
									,,	128	,,	,,	¼	KT
216	16	0	3·92	34·00	27·02	8·18	—	6·80	**N 50 V**	100–0	1155	—	—	TD 32½ m.
		10	3·91	33·99	27·02	8·18	—	—	**N 70 V**	50–0				
		20	3·90	34·00	27·02	8·18	—	6·96	,,	100–50				
		30	3·90	34·05	27·06	8·18	—	—	,,	250–100				
		40	3·90	34·05	27·06	8·18	—	—	,,	500–250				
		50	3·90	34·05	27·06	8·16	—	—	,,	750–500				
		60	3·90	34·05	27·06	8·16	—	6·96	,,	1000–750				
		80	3·90	34·09	27·09	8·16	—	—	,,	1500–1000	—	1550	—	net foul
		100	3·89	34·09	27·09	8·16	—	6·93						
		150	3·58	34·11	27·14	8·12								
		200	2·92	34·13	27·22	8·10								
		300	3·22	34·18	27·24	8·07								
		400	2·80	34·21	27·29	8·04	—	6·44						
		600	2·51	34·30	27·39	7·98								
		800	2·53	34·45	27·51	7·97								
		1000	2·38	34·54	27·60	7·96	—	4·26						
		1500	2·19	34·70	27·74	7·96								
		2000	1·87	34·74	27·80	7·97	—	4·29						
		3500	0·91											
217	16	—	—		—	—	—	—	**N 100 H**	0–5	**2207**	**2244**	1	
									,,	77	,,	,,	1	
									,,	155	,,	,,	1	KT
									N 70 H	0–5	**2316**	**2325**	¼	
									,,	53	**2258**	**2312**	¼	
									,,	106(–0)	,,	,,	¼	KT
218	17	0	5·86	34·13	26·90	8·18	—	—	**N 50 V**	100–0	1205	—	—	high wind and rough sea; much stray on wires. Depths of water-bottles and nets below 100 m. unreliable. Nets below 250 m. not fishing properly
		10	5·85	34·13	26·90	8·18	—	—	**N 70 V**	50–0				
		20	5·85	34·14	26·92	8·18	—	—	,,	100–50				
		30	5·84	34·14	26·92	8·18	—	—	,,	250–180				
		40	5·83	34·14	26·92	8·18	—	—	,,	500–230				
		50	5·83	34·14	26·92	8·18	—	—	,,	750–500				
		60	5·83	34·14	26·92	8·18	—	—	,,	1000–750	—	1430	—	
		80	5·83	34·14	26·92	8·18								
		100	5·83	34·14	26·92	8·18								
		150	5·20	34·20	27·04	8·15								
		200	4·98	34·23	27·09	8·11								

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
218 *cont.*	Drake Strait, 57° 32′ 00″ S, 67° 04′ 00″ W	1927 19 iv										
219	Drake Strait, 57° 32′ 00″ S, 67° 04′ 00″ W	21 iv	1200	—	SSW	4	NE	4	b. c.	986·6	5·6	v. heavy conf. swell
			1600	—	SSW	4	NE	4	b. c.	985·7	4·4	,,
220	Drake Strait, 57° 16′ 00″ S, 67° 06′ 00″ W	21 iv	2000	—	NE	4	NE	4	c. q. r.	987·8	3·3	v. heavy conf. swell
			0000	–	NE	4	NE	4	o.	991·6	3·9	,,
221	Drake Strait, 56° 11′ 40″ S, 67° 32′ 30″ W	22 iv	1200	—	SW	5	SW	6	b. c.	1004·8	6·1	heavy W swell
			1255	112 r. sh.								
222	St Martin's Cove, Hermite I, Cape Horn	23 iv	0800	—	SW	2–5	—	0	o. g. r.	999·6	8·3	
			1200	-	SW	3	—	0	o. g. r.	996·7	7·2	
			1600	—	SW	2–4	—	0	o. g. r.	996·9	7·2	
		24 iv	1200	—	SW	2–5	—	0	o. g. r.	985·7	6·7	
		25 iv	1600	—	SW	3–8	—	0	o. g. r.	989·4	9·4	
223	St Francis' Bay, C Horn, 55° 51′ 15″ S, 67° 29′ 30″ W	27 iv	0730	—	N	4	—	0	b. c.	1009·3	6·1	
			0853	63 s.								
224	Off Cape Horn, 55° 46′ 30″ S, 66° 36′ 00″ W	27 iv	2000	—	N × E	6	N × E	5	o.	993·1	6·7	mod. N swell
			0000	—	N × E	7–8	N × E	6	o.	988·5	8·3	,,

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
218 *cont.*		300	4·89	34·23	27·10	8·11								
		400	4·89	34·26	27·12	8·09								
		600	4·54	34·23	27·14	8·09								
		800	4·37	34·23	27·16	8·07								
		1000	3·94	34·23	27·21	8·04								
219	19	0	5·88	34·11	26·88	8·18	—	6·93	**N 50 V**	100–0	1200	—	—	TD 27 m.
		10	5·88	34·11	26·88	8·18	—	—	**N 70 V**	50–0				
		20	5·87	34·13	26·90	8·18	—	6·73	,,	100–50				
		30	5·87	34·11	26·89	8·18	—	—	,,	250–100				
		40	5·87	34·13	26·90	8·18	—	—	,,	500–250				
		50	5·86	34·14	26·92	8·18	—	—	,,	750–500				
		60	5·86	34·16	26·93	8·18	—	6·73	,,	1000–750	—	1550		
		80	5·86	34·16	26·93	8·18								
		100	5·83	34·16	26·93	8·14	—	6·73						
		150	5·80	34·19	26·96	8·12								
		200	5·01	34·23	27·09	8·10								
		300	4·80	34·24	27·11	8·10								
		400	4·64	34·27	27·16	8·10	—	6·75						
		600	4·35	34·27	27·19	8·10								
		800	3·95	34·29	27·24	8·05								
		1000	3·41	34·33	27·33	7·99	—	4·93						
		1500	2·65	34·52	27·56	7·94								
		2000	2·46	34·61	27·65	7·98	—	3·80						
		3000	1·95	34·69	27·74	7·98	—	3·84						
220	19	—	—	—	—		—	—	**N 100 H**	0–5	**2215**	**2248**	1	
									,,	63	,,	,,	1	
									,,	126	,,	,,	1	KT
									N 70 H	0–5	**2305**	**2317**	¼	
									,,	68	,,	,,	¼	
									,,	137(–68)	,,	,,	¼	KT. ? not fishing properly
221	20	0	8·80	33·46	25·96	8·20	—	6·44	**N 50 V**	100–0	1255	—	—	TD 18 m.
		10	8·35	33·46	26·03	8·19	—	—	**N 70 V**	50–0				
		20	8·35	33·46	26·03	8·18		6·37	,,	100–50		1330		
		30	8·50	33·51	26·06	8·16								
		40	8·47	33·51	26·06	8·17	—	6·33						
		50	8·40	33·56	26·10	8·17								
		60	8·46	33·66	26·17	8·18		6·44						
		80	8·23	33·71	26·26	8·16	—	6·33						
		98	8·08	33·77	26·32	8·16	—	6·33						
222	21–23	0	8·70	32·48	25·20	—	—	—	**TNL**	30	—	—	—	22–23 iv
		10	8·56	32·79	25·47	—	—		**NRL** }	30–35				
		20	8·57	32·81	25·48	—		—	**NCS-N** }		0950	1015	—	23 iv
		33	8·66	32·90	25·53	—	—	—	**N 70 H**	0–5	1000	1010	—	23 iv
									Sh. coll.	—	1430	1600	—	23 iv
									TNL	35	—	—	—	23–24 iv
									Sh. coll.	—	1500	1630	—	25 iv. Freshwater lakes, 300–350 ft.
223	25	—	—	—	—	—	—		**NRL** }	63	0858	0905		
									NCS-N }					
224	25	—	—	—	—	—	—	—	**N 100 H**	0–5	**2118**	**2155**	1	
									,,	55	,,	,,	1	
									,,	110	,,	,,	1	KT
									N 70 H	0–5	**2210**	**2221**	¼	
									,,	56	,,	,,	¼	
									,,	113	,,	,,	¼	KT

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
225	54° 28′ 30″ S, 65° 18′ 30″ W	1927 29 iv	1500	91 r.								
			1600	—	NW	4	NW	3	b. c.	973·9	9·4	
226	54° 15′ 00″ S, 64° 18′ 00″ W	1 v	1200	—	WSW	5	WSW	5	b. c.	994·7	3·9	mod. NW swell
			1230	133 c. s. st.								
227	54° 02′ 00″ S, 63° 16′ 00″ W	1 v	2000	—	NW	4	NW	3	b. c.	996·7	6·1	
			2130	578 r.								
			0000	—	NW	5	NW	3	o.	995·4	5·6	
228	53° 33′ 00″ S, 61° 49′ 30″ W	2 v	0800	660 di. oz.	NW	5	NW	4	c.	993·7	7·2	heavy WSW swell
			1200	—	NW	6	NW	6	b. c.	992·4	8·3	„
229	53° 40′ 00″ S, 61° 10′ 00″ W	4 v	1600	—	WNW	4	WNW	3	o. r.	999·9	3·9	v. heavy W swell
			1640	384 s. st.								
			2000	—	W	2	W	1	o.	1002·2	5·0	„

Station	Age of moon (days)	Depth (metres)	Temp. °Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
225	27	0	8·08	32·69	25·47	8·19			**N 50 V**	75–0	1500	·	—	TD 19 m.
		5	8·08	32·68	25·47	8·19	–		**N 70 V**	50–0				
		10	8·08	32·66	25·45	8·18	—		,,	85–50		1525		
		20	8·08	32·68	25·47	8·18	—	—	**N 100 H**	0–5	1539	1612	1	
		30	8·08	32·68	25·47	8·18	—	—	,,	32	,,	,,	1	
		40	8·08	32·68	25·47	8·18		–	,,	64	,,	,,	1	KT
		50	8·08	32·70	25·48	8·18			**N 70 H**	0–5	1624	1634	¼	
		60	8·08	32·70	25·48	8·18	—		,,	36	,,	,,	¼	
		85	8·08	32·72	25·50	8·18	—	—	,,	73	,,	,,	¼	KT
226	1	0	7·50	33·45	26·14	8·18	-	—	**N 50 V**	100–0	1230	—		TD 25 m.
		10	7·51	33·45	26·14	8·18		·	**N 70 V**	50–0				
		20	7·52	33·41	26·12	8·18	—		,,	100–50				
		30	7·52	33·41	26·12	8·18			,,	130–100	-	1304		
		40	7·52	33·43	26·13	8·18		--	**N 100 H**	0–5	1326	1347	1	
		50	7·52	33·44	26·14	8·18	--		,,	41	,,	,,	1	
		60	7·52	33·47	26·16	8·18	-	—	,,	82	,,	,,	1	KT
		80	7·52	33·47	26·16	8·17	—	—	**N 70 H**	0–5	1405	1416	¼	
		100	7·52	33·48	26·17	8·17	—	—	,,	47	,,	,,	¼	
		130	7·52	33·48	26·17	8·17		—	,,	95	,,	,,	¼	KT
227	1	0	7·20	33·64	26·34	8·18	—	—	**N 50 V**	100–0	2130			
		10	7·20	33·69	26·38	8·18	-	—	**N 70 V**	50–0				
		20	7·17	33·71	26·41	8·18	—	—	,,	100–50				
		30	7·13	33·71	26·41	8·18		—	,,	250–100				
		40	7·10	33·74	26·44	8·18	—	—	,,	500–250	—	2230		
		50	7·03	33·77	26·47	8·18	-	—	**N 100 H**	0–5	2247	2316	1	
		60	6·83	33·81	26·53	8·18		—	,,	76	,,	,,	1	
		80	6·54	33·91	26·66	8·16	—	—	,,	152	,,	,,	1	KT
		100	6·41	33·97	26·71	8·15	—	—	**N 70 H**	0–5	2330	2344	¼	
		150	6·03	34·00	26·78	8·12	—	—	,,	85	,,	,,	¼	
		200	5·87	34·05	26·84	8·05	—	-	,,	170	,,	,,	¼	KT. Not fishing properly
		300	4·63	34·13	27·04	8·05								
		400	4·42	34·11	27·05	8·05								
		550	4·33	34·13	27·07	8·05								
228	2	0	6·31	33·97	26·72	8·18	—	—	**N 50 V**	100–0	0755	—	—	TD 23½ m.
		10	6·31	34·02	26·76	8·18		·	**N 70 V**	50–0				
		20	6·29	34·02	26·76	8·18	—	—	,,	100–50				
		30	6·30	34·02	26·76	8·18	–	—	,,	250–100				
		40	6·30	33·99	26·74	8·18	—		,,	500–250				
		50	6·29	34·03	26·76	8·18	-	---	,,	650–500		0935		
		60	6·25	34·03	26·76	8·18	—		**N 100 H**	0–5	0942	1009	1	
		80	5·87	34·04	26·83	8·16	—	—	,,	40(–0)	,,	,,	1	
		100	5·13	34·05	26·92	8·16	-	--	,,	80(–40)	,,	,,	1	KT
		150	4·46	34·11	27·05	8·12	—		**N 70 H**	0–5	1022	1030	¼	
		200	4·41	34·12	27·06	8·10	—	—	,,	45	,,	,,	¼	? not fishing properly
		300	4·19	34·13	27·09	8·06		·	,,	90	,,	,,	¼	KT. ? not fishing properly
		400	4·12	34·09	27·07	8·06								
		500	4·07	34·11	27·09	8·08								
		620	3·93	34·08	27·08	8·10								
229	4	0	6·17	33·95	26·72	8·18		-	**N 50 V**	100–0	1640			
		10	6·17	33·96	26·73	8·18	—	—	**N 70 V**	50–0				
		20	6·17	33·95	26·72	8·18	—	—	,,	100–50				
		30	6·17	33·97	26·74	8·18		-	,,	250–100				
		40	6·17	33·97	26·74	8·18	—		,,	370–250	-	1735		
		50	6·17	33·98	26·75	8·18	—		**N 100 H**	0–5	1809	1842	1	
		60	6·17	33·97	26·74	8·18	-	—	,,	46(–0)	,,	1837	1	mass of kelp on release gear
		80	6·17	33·99	26·75	8·16	—	—	,,	92	,,	1838	1	KT
		100	6·13	33·98	26·76	8·16	—	-	**N 70 H**	0–5	1929	1944	¼	

10

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
229 *cont.*	53° 40′ 00″ S, 61° 10′ 00″ W	1927 4 v										
230	53° 17′ 00″ S, 60° 25′ 00″ W	5 v	1600	—	W	5	W	4	b. c.	1009·0	8·9	heavy SW swell
			1740	675 m.								
			2000	—	W	3	W	2	o.	1020·0	8·3	,,
231	51° 29′ 30″ S, 57° 18′ 15″ W	28 v	1600	—	NNE	3	NNE	2	b. c. h.	1004·6	1·7	
			1645	143 s. sh.								
232	51° 19′ 45″ S, 57° 07′ 00″ W	28 v	2000	—	—	0–1	—	0	c.	1004·1	2·8	slight E swell
			2035	169 s. r.								
			0000	—	N	3	—	0	b. c.	1000·4	1·7	
233	51° 07′ 40″ S, 56° 53′ 00″ W	29 v	0800	—	WNW	2	WNW	2	b. c.	1005·3	3·9	
			0915	374 r.								
			1200	—	N × W	4	N × W	2	b. c.	1007·7	5·0	
234	50° 53′ 50″ S, 56° 36′ 30″ W	29 v	1325	492 r.								
			1600	—	N × W	3	N × W	2	c.	1007·1	2·8	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
229 *cont.*		150	5·84	34·00	26·80	8·16	—	—	N 70 H	65	1857	1916	¼	
		200	5·24	34·05	26·91	8·11	·	—	,,	130	1929	1943	¼	KT. ? not fishing properly
		300	4·65	34·09	27·01	8·07								water-bottle touched bottom
		315	4·54	34·13	27·05	8·07								
230	5	0	6·31	34·02	26·76	8·18	—	—	N 50 V	100–0	1740			
		10	6·31	34·02	26·76	8·18	—	—	N 70 V	50–0				
		20	6·27	34·03	26·77	8·18	—	—	,,	100–50				
		30	6·26	34·03	26·77	8·18	—	—	,,	250–100				
		40	6·26	34·03	26·77	8·18	—	—	,,	500–250				
		50	6·25	34·04	26·78	8·18	—	—	,,	660–500	—	1855		
		60	6·25	34·05	26·79	8·18	—	—	N 100 H	0–5	1917	1942	1	
		80	6·23	34·06	26·80	8·16	—	—	,,	70	,,	,,	1	
		100	6·05	34·09	26·84	8·13	—	—	,,	141	,,	,,	1	KT
		150	5·51	34·13	26·94	8·13	—	—	N 70 H	0–5	1955	2008	¼	
		200	5·33	34·15	26·99	8·09	—	—	,,	77	,,	,,	¼	
		300	4·65	34·18	27·09	8·07	—	—	,,	155	,,	,,	¼	KT
		400	4·41	34·18	27·11	8·07								
		520	4·28	34·23	27·17	8·21								
		650	5·23	34·22	27·05	8·21								
231	26	0	6·43	33·75	26·53	8·20	—	—	N 50 V	100–0	1645			
		10	6·47	33·75	26·53	8·20	—	—	N 70 V	50–0				
		20	6·47	33·75	26·53	8·20	—	—	,,	100–50				
		30	6·47	33·75	26·53	8·20	—	—	,,	135–100	—	1720		
		40	6·47	33·75	26·53	8·20	—	—	N 100 H	0–5	1748	1814	1	
		50	6·45	33·75	26·53	8·20	—	—	,,	45	,,	,,	1	
		60	6·45	33·76	26·53	8·15	—	—	,,	90	,,	,,	1	KT
		80	6·50	33·79	26·55	8·15	—	—	N 70 H	0–5	1845	1901	¼	
		100	6·49	33·82	26·59	8·13	—	—	,,	37	,,	1859	¼	
		135	6·43	33·83	26·59	8·13	—	—	,,	74	,,	1900	¼	KT
232	26	0	6·53	33·75	26·52	8·18	—	—	N 50 V	100–0	2035			
		10	6·53	33·75	26·52	8·18	—	·	N 70 V	50–0				
		20	6·53	33·75	26·52	8·18	—	—	,,	100–50				
		30	6·54	33·75	26·52	8·18	—	—	,,	160–100	—	2120		
		40	6·54	33·75	26·52	8·18	—	—	N 100 H	0–5	2137	2206	1	
		50	6·53	33·75	26·52	8·18	—	—	,,	47	,,	,,	1	? not fishing properly
		60	6·53	33·77	26·53	8·18	—	—	,,	95	,,	,,	1	KT
		80	6·53	33·77	26·53	8·16	—	—	N 70 H	0–5	2224	2238	¼	
		100	6·55	33·78	26·55	8·16	—	—	,,	45	,,	,,	¼	
		160	6·45	33·78	26·56	8·15	—	—	,,	91(–45)	,,	,,	¼	KT
233	27	0	6·23	33·84	26·63	8·18	—	—	N 50 V	100–0	0915	—	—	TD 24 m.
		10	6·24	33·84	26·63	8·18	—	—	N 70 V	50–0				
		20	6·25	33·84	26·63	8·18	—	—	,,	100–0				
		30	6·25	33·84	26·63	8·18	—	—	,,	250–100				
		40	6·25	33·84	26·63	8·18	—	—	,,	350–250	—	1025		
		50	6·30	33·84	26·62	8·18	—	—	N 100 H	0–5	1036	1108	1	
		60	6·19	33·85	26·64	8·15	—	—	,,	72	,,	,,	1	
		80	6·03	33·86	26·67	8·15	—	—	,,	145	,,	,,	1	KT
		100	6·05	33·88	26·69	8·14	—	—	N 70 H	0–5	1123	1134	¼	
		150	5·98	33·93	26·72	8·15	—	—	,,	56	,,	,,	¼	
		200	5·73	34·00	26·81	8·12	—	—	,,	112	,,	,,	¼	KT
		275	5·13	34·07	26·94	8·06								
		350	4·83	34·11	27·01	8·06								
234	27	0	6·23	33·82	26·62	8·16	—	—	N 50 V	100–0	1325	—	—	TD 23 m.
		10	6·24	33·82	26·62	8·16	—	—	N 70 V	50–0				
		20	6·25	33·82	26·62	8·16	—	—	,,	100–50				
		30	6·27	33·83	26·62	8·16	—	—	,,	250–100				
		40	6·32	33·82	26·61	8·16	—	—	,,	480–250	—	1430		

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
234 *cont.*	50° 53′ 50″ S, 56° 36′ 30″ W	1927 29 v										
235	50° 45′ 00″ S, 56° 18′ 30″ W	29 v	1740	600 m. f. s. blk. spk.								
			2000	—	NW	2	NW	1	o.	1007·6	2·2	
236	50° 35′ 30″ S, 55° 59′ 15″ W	29–30 v	2155	612 m. f. s. blk. spk.								
			0000	—	N × W	3	N × W	2	o.	1010·1	3·3	
237	50° 17′ 40″ S, 55° 31′ 30″ W	30 v	0800	—	NW	4	NW	3	b. c.	1010·8	6·1	
			0840	904 m. f. s. blk. spk.								
			1200	—	NW	5	NW	4	o.	1011·8	4·4	
238	48° 12′ 00″ S, 51° 56′ 30″ W	31 v	2000	—	NW	5	NW	3	o.	1010·8	7·2	slight N swell
			0000	—	NW × W	5–7	NW	6	o. p.	1009·9	4·4	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
234 *cont.*		50	6·32	33·82	26·61	8·16	—	—	**N 100 H**	0–5	1443	1533	1	
		60	6·33	33·82	26·61	8·13		—	,,	73	,,	,,	1	
		80	6·33	33·86	26·63	8·13		—	,,	146	,,	,,	1	KT
		100	6·31	33·87	26·65	8·10	—		**N 70 H**	0–5	1549	1559	¼	
		150	6·15	33·91	26·68	8·10	—		,,	56	,,	,,	¼	
		200	5·88	33·98	26·78	8·10	—	—	,,	113	,,	,,	¼	KT
		300	5·12	34·04	26·92	8·07								
		400	4·83	34·07	26·98	8·05								
		480	4·88	34·18	27·06	8·05								
235	27	0	5·82	34·05	26·84	8·16	—	—	**N 50 V**	100–0	**1740**			
		10	5·81	34·05	26·84	8·16	—	—	**N 70 V**	50–0				
		20	5·83	34·05	26·84	8·16	—	—	,,	100–50				
		30	5·83	34·06	26·85	8·16	—		,,	250–100				
		40	5·83	34·07	26·86	8·16	—	—	,,	500–250		**1850**		
		50	5·83	34·08	26·87	8·16	—	—	**N 100 H**	0–5	**1905**	**1941**	1	
		60	5·83	34·08	26·87	8·14	—		,,	70	,,	,,	1	
		80	5·84	34·08	26·86	8·12	—	—	,,	141	,,	,,	1	KT
		100	5·83	34·11	26·89	8·11	–	—	**N 70 H**	0–5	**1956**	**2009**	¼	
		150	5·31	34·14	26·98	8·10	—		,,	76	,,	,,	¼	
		200	4·93	34·16	27·04	8·10	—	—	,,	152	,,	,,	¼	KT
		300	4·90	34·20	27·07	8·08								
		400	4·22	34·23	27·18	8·08								
		580	4·01	34·23	27·20	8·06								
236	27	0	5·66	34·11	26·91	8·16	—	—	**N 50 V**	100–0	**2155**			
		10	5·66	34·11	26·91	8·16	—		**N 70 V**	50–0				
		20	5·69	34·12	26·91	8·16	—	—	,,	100–50				
		30	5·69	34·11	26·91	8·16	—	—	,,	250–100				
		40	5·63	34·11	26·91	8·16	—		,,	500–250	—	**2307**		
		50	5·56	34·13	26·93	8·16	—	—	**N 100 H**	0–5	**2322**	**2353**	1	
		60	5·55	34·12	26·93	8·16	—	—	,,	50	,,	,,	1	
		80	5·54	34·13	26·94	8·14	—	—	,,	100	,,	,,	1	KT
		100	5·53	34·12	26·93	8·12	—	–	**N 70 H**	0–5	**0010**	**0024**	¼	
		150	5·03	34·20	27·06	8·10	—		,,	46	,,	,,	¼	
		200	4·63	34·24	27·14	8·10	—	—	,,	92	,,	,,	¼	KT
		300	4·36	34·25	27·17	8·08								
		400	4·13	34·24	27·19	8·05								
		600	3·50	34·23	27·25	8·03								
237	28	0	5·66	34·14	26·94	8·14	—	—	**N 50 V**	100–0	0840	—	—	TD 21 m.
		10	5·64	34·13	26·92	8·14	—	—	**N 70 V**	50–0				
		20	5·64	34·13	26·92	8·14	—	—	,,	100–50				
		30	5·64	34·13	26·92	8·14	—	—	,,	250–100				
		40	5·64	34·13	26·92	8·14	—	—	,,	500–250				
		50	5·63	34·13	26·92	8·14	—	—	,,	750–500				
		60	5·62	34·13	26·93	8·14	—		,,	880–750	—	1040		
		80	5·62	34·13	26·93	8·14	—	—	**N 100 H**	0–5	1137	1212	1	
		100	5·54	34·13	26·94	8·14	—	—	,,	70	,,	,,	1	
		150	4·61	34·19	27·09	8·11	—	—	,,	140	,,	,,	1	KT
		200	4·50	34·23	27·14	8·10	—		**N 70 H**	0 5	1226	1240	¼	
		300	4·27	34·22	27·15	8·10	—		,,	85	,,	,,	¼	
		400	4·03	34·23	27·20	8·06	—	—	,,	170	,,	,,	¼	KT. ? not fishing properly
		500	3·82	34·23	27·22	8·04								
		700	3·20	34·25	27·29	8·01								
		850	2·81	34·30	27·37	7·98								
238	1	—	—	—	—	—	—	—	**N 100 H**	0–5	**2110**	**2140**	1	
									,,	74	**2108**	,,	1	
									,,	148	,,	,,	1	KT
									N 70 H	0–5	**2156**	**2212**	¼	
									,,	66	,,	,,	¼	
									,,	132	,,	,,	¼	KT

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
239	46° 56′ 00″ S, 46° 03′ 00″ W	1927 2 vi	0800	—	NW	2	NW	2	c.	1010·4	10·6	
			1200	—	NW	2	NW	3	o.	1007·3	9·4	mod. NW swell
			1600	—	NW	2	NW	3	o.	1004·3	9·4	slight NW swell
240	46° 36′ 30″ S, 45° 07′ 00″ W	2 vi	2000	—	SSW	5	SSW	4	o. d.	1005·8	8·3	
			0000	—	SSW	6	SSW	5	o.	1005·0	7·8	
241	40° 34′ 30″ S, 36° 35′ 30″ W	5 vi	2000	—	SW	3	SW	2	b. c.	1026·0	8·9	heavy SW swell
			0000	–	W	3	SW	4	b. c.	1027·2	9·4	
242	39° 16′ 30″ S, 30° 26′ 00″ W	7 vi	2000		SW	4	SW	4	o. q. r.	1031·9	11·7	
			0000	—	SW	2–3	SW	2	b. c.	1033·3	11·7	
243	From 38° 48′ 00″ S, 27° 22′ 00″ W to 38° 46′ 00″ S, 27° 04′ 00″ W	8–9 vi	2000	—	SW	2	SW	1	o.	1031·9	13·9	slight SW swell
			0000		—	0–1	SW	2	b. c.	1031·2	15·0	,,
			0400	—	WNW	3	WNW	3	b. c.	1031·8	15·0	
244	38° 26′ 30″ S, 24° 48′ 30″ W	9 vi	2000		NW	4	NW	3	b. c.	1025·9	13·3	
			0000		NW	4	NW	3	b. c.	1024·5	12·8	
245	38° 20′ 00″ S, 22° 18′ 00″ W	10 vi	1200		WNW	4	WNW	3	b. c.	1022·1	14·4	
			1600	—	W	4	W	4	b. c. d.	1020·0	13·9	
246	38° 00′ 30″ S, 18° 27′ 00″ W	11 vi	2000	–	WNW	5	WNW	4	o.	1017·4	13·9	
			0000	—	WNW	6	WNW	5	o. p.	1016·0	14·4	
247	37° 20′ 00″ S, 12° 47′ 30″ W	13 vi	2000	—	N	5	N	4	b. c.	1024·3	14·4	
			0000	—	N × E	6	N	5	o.	1023·8	13·9	
248	37° 15′ 00″ S, 12° 20′ 00″ W	14 vi	2000	—	—	0–1	conf.	3	o.	1018·6	15·6	
			0000	—	NNE	7	NNE	4	o. d.	1017·6	16·1	
249	36° 19′ 30″ S, 8° 40′ 30″ W	16 vi	2000	—	—	0–1	—	0	b.	1014·0	14·4	conf. swell
			0000	—	SW	4	NW	2	b. c. r.	1015·7	15·0	mod. W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
239	3	0	10·08	34·42	26·50	—	—	—	**N 450**	1050–1350(–0)	1123	1323	4	DGB
									N 100 H	1050–1350	,,	,,	4	
240	3	—	—	—	—	-	-	—	**N 100 H**	0–5	**2126**	**2150**	1	
									,,	35	,,	,,	1	
									,,	70(–0)	,,	,,	1	KT
									N 70 H	0–5	**2212**	**2222**	¼	
									,,	40(–0)	**2213**	,,	¼	
									,,	80(–40)	,,	,,	¼	
241	6	—	—		—	—	—	—	**N 100 H**	0–5	**2117**	**2156**	1	
									,,	76	,,	,,	1	
									,,	152	,,	,,	1	KT
									N 70 H	0–5	**2217**	**2229**	¼	
									,,	49(–0)	,,	,,	¼	
									,,	98	,,	,,	¼	KT. Not fishing properly
242	8	—	—	—	—	—	—	—	**N 100 H**	0–5	**2114**	**2146**	1	
									,,	68	,,	,,	1	
									,,	137	,,	,,	1	KT
									N 70 H	0–5	**2212**	**2230**	¼	
									,,	62	,,	,,	¼	
									,,	124	,,	,,	¼	KT
									N 100 B } **N 70 B** }	118–0	**2247**	**2308**	⅔	KT
243	9	0	14·70	35·16	26·19	at	2100	(time)	**N 70 H**	0–5	**2100**	**2100**	0·26	42 consecutive hauls (A–RR) of 10 mins. duration. Moon set 0130
		0	14·85	35·17	26·17	at	0030	,,						
		0	14·80	35·10	26·13	at	0400	,,	,,	0–5	**0350**	**0400**	0·26	
244	10	—	—	—	—	—	—	—	**N 100 H**	0–5	**2116**	**2142**	1	
									,,	55	,,	,,	1	
									,,	110(–0)	,,	,,	1	KT
									N 70 H	0–5	**2156**	**2207**	¼	
									,,	46	,,	,,	¼	
									,,	93	,,	,,	¼	KT
245	11	0	14·35	35·14	26·24	—	—	—	**N 450**	1800–2000	1225	1540	2·0	DGT
		1937	2·80	34·67	27·65									
246	12	—	—	—	—	—	—	—	**N 100 H**	0–5	**2114**	**2152**	1	
									,,	95	,,	,,	1	
									,,	190	,,	,,	1	KT
									N 70 H	0–5	**2209**	**2221**	¼	
									,,	77	,,	,,	¼	
									,,	154	,,	,,	¼	KT
247	14	—	—	–		—	—	—	**TYF**	100–115(–0)	**2110**	**2211**	1·9	KT
248	14	—	—	—	—	—	—	—	**TYF**	0–5	**2106**	**2224**	2·6	
									N 100 H	0–5	**2115**	**2146**	1	
									,,	95	,,	,,	1	
									,,	190	,,	,,	1	KT. Not fishing properly
									N 70 H	0–5	**2203**	**2215**	¼	
									,,	76	,,	,,	¼	
									,,	152	,,	,,	¼	KT
249	16	—	—	—	—	—	—	—	**N 100 H**	0–5	**2121**	**2150**	1	
									,,	60(–0)	,,	,,	1	
									,,	120(–60)	,,	,,	1	KT

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
249 *cont.*	36° 19′ 30″ S, 8° 40′ 30″ W	1927 16 vi										
250	36° 09′ 00″ S, 5° 33′ 00″ W	17 vi	2000		SE × S	5	SE × S	4	b. c.	1029·9	14·4	
251	35° 54′ 30″ S, 3° 01′ 30″ W	18 vi	2000 0000		SE ESE	4 5	SE SE	3 3	o. o.	1034·0 1033·3	12·8 12·2	mod. SSW swell
252	35° 26′ 00″ S, 1° 43′ 30″ E	20 vi	2000 0000		SE ESE	5 5	SE ESE	4 5	b. c. o.	1024·5 1023·9	12·8 12·2	mod. E swell
253	35° 06′ 00″ S, 2° 19′ 00″ E	21 vi	1200		ESE	4	ESE	4	o.	1023·3	16·1	
254	35° 04′ 00″ S, 2° 59′ 30″ E	21 vi	2000	—	SE	3	SE	3	b. c. w.	1024·2	15·6	
255	34° 59′ 00″ S, 5° 31′ 00″ E	22 vi	2000 0000	—	E ESE	0–1 3	— ESE	0 3	o. o.	1026·5 1024·4	16·1 16·7	mod. SW swell ,,
256	35° 14′ 00″ S, 6° 49′ 00″ E	23 vi	1200	-	ENE	3	ENE	3	b. c.	1021·3	17·8	heavy SSW swell
257	35° 01′ 00″ S, 10° 18′ 00″ E	24 vi	2000 0000	— —	N × W N × W	4 4	N × W N × W	3 3	b. c. o.	1014·1 1012·4	17·2 16·7	
258	35° 03′ 30″ S, 13° 55′ 00″ E	25 vi	2000 0000	— —	SSW SW	4 3	SSW SW	4 3	b. c. b.	1023·0 1024·0	15·0 16·1	heavy SW swell mod. SW swell
259	34° 59′ 00″ S, 16° 39′ 00″ E	26 vi	2000 0000	— -	ENE ENE	2 4	ENE ENE	2 3	o. o.	1018·5 1014·4	16·1 15·0	heavy SW swell mod. SW swell
260	33° 06′ 30″ S, 17° 45′ 15″ E	19 vii	0800 1040 1200	— 170 gn. m. s. —	S S	4 0–1	S —	2 0	b. b. c.	1020·5 1021·6	15·0 15·0	mod. S swell ,,

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
249 *cont.*									N 70 H	0–5	2210	2220	¼	
									,,	61	,,	,,	¼	
									,,	122	,,	,,	¼	KT
250	17	—	—	—	—	—	—	—	TYF	300(–0)	2043	2243	3·6	DGB
251	18	—	—	—	—	—	—	—	N 100 H	0–5	2116	2146	1	
									,,	79	,,	,,	1	
									,,	159	,,	,,	1	KT
									N 70 H	0–5	2205	2219	¼	
									,,	70	,,	,,	¼	
									,,	140	,,	,,	¼	KT
252	20	—	—	—	—	—	—	—	N 100 H	0–5	2105	2134	1	
									,,	67	,,	,,	1	
									,,	135	,,	,,	1	KT
									N 70 H	0–5	2150	2200	¼	
									,,	76	,,	,,	¼	
									,,	152	,,	,,	¼	KT
253	21	0	16·20	35·10	25·80	—	—	—	TYF	1000–1050	1142	1342	4·1	DGB
254	21	—	—	—	—	—	—	—	TYF	200(–0)	2039	2210	3·5	
255	22	—	—	—	—	—	—	—	N 100 H	0–5	2112	2147	1	
									,,	87	,,	,,	1	
									,,	175	,,	,,	1	KT
									N 70 H	0–5	2203	2214	¼	
									,,	55	,,	,,	¼	
									,,	110	,,	,,	¼	KT
256	23	0	17·20	35·55	25·91	—	—	—	TYF	850–1100 (–0)	1135	1335	2·8	DGB
									,,	250(–0)	2102	2235	3·8	DGB
257	24	—	—	—	—	—	—	—	N 100 H	0–5	2115	2145	1	
									,,	55	,,	,,	1	
									,,	111	,,	,,	1	KT
									N 70 H	0–5	2201	2214	¼	
									,,	53	,,	,,	¼	
									,,	106	,,	,,	¼	KT
258	25	—	—	—	—	—	—	-	TYF	320–450	2124	2255	2·7	DGB
259	26	—	—	—	—	—	-	·	TYF	170–250(–0)	2116	2240	2·8	DGB. Specimens erroneously labelled 370–450(–0) m.
									N 100 H	0–5	2129	2202	1	
									,,	85	,,	,,	1	
									,,	170	,,	,,	1	KT
									N 70 H	0–5	2218	2232	¼	
									,,	90	,,	,,	¼	
									,,	180	,,	,,	¼	KT
260	20	0	13·97	35·12	26·30	8·34	—	—	N 50 V	100–0	1040	—	—	TD 17½ m.
		10	13·96	35·12	26·30	8·34	—	—	N 70 V	50–0				
		20	13·96	35·14	26·32	8·34	—	—	,,	100–50				
		30	13·96	35·12	26·30	8·34	—	—	,,	165–100	–	1110		
		40	13·95	35·12	26·30	8·34	—	—	N 100 B } N 70 B }	104–0	1138	1158	⅔	KT
		50	13·39	35·07	26·38	8·32	—	—						
		60	12·59	34·99	26·48	8·25								
		80	11·40	34·94	26·67	8·20								
		100	9·52	34·76	26·84	8·01								
		130	8·53	34·67	26·95	7·89								
		168	8·40	34·60	26·92	7·85								

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
261	33° 06′ 30″ S, 17° 33′ 15″ E	1927 19 vii	1345	351 st.								
262	33° 06′ 30″ S, 17° 21′ 30″ E	19 vii	1600 1648	— 386 gn. m. blk. spk.	S	4	S	3	b. c.	1020·6	16·1	mod. S swell
263	33° 06′ 00″ S, 17° 08′ 00″ E	19 vii	2000	461	SE	3	SE	3	o.	1020·0	15·6	SSW swell
264	33° 06′ 00″ S, 16° 55′ 00″ E	19–20 vii	2330 0000	645 gl. oz. —	NE	2	NE	2	b. c.	1020·4	15·0	mod. SSW swell
265	33° 06′ 30″ S, 16° 32′ 00″ E	20 vii	0350 0400	1620 gl. oz. —	NNE	3	NNE	2	b. c.	1018·0	15·0	mod. S swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.[3]	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
261	20	0	14·01	35·13	26·31	8·34	—	—	**N 50 V**	100–0	1345			
		10	13·89	35·13	26·32	8·34	—	—	**N 70 V**	50–0				
		20	13·81	35·13	26·34	8·34	—	—	,,	100–50				
		30	13·74	35·12	26·34	8·34	—	—	,,	250–100				
		40	13·69	35·14	26·37	8·34	—	—	,,	345–250	—	1425		
		50	13·65	35·12	26·36	8·34	—	—	**N 100 B**	88–0	1445	1505	2/3	KT
		60	13·01	35·07	26·46	8·28	—	—	**N 70 B**					
		80	11·40	34·96	26·68	8·21								
		100	10·87	34·90	26·74	8·13								
		150	10·12	34·87	26·85	8·06								
		200	8·23	34·69	27·01	8·00								
		270	7·55	34·58	27·03	8·01								
		350	6·04	34·47	27·15	8·01								
262	20	0	15·33	35·23	26·10	8·35	—	—	**N 50 V**	100–0	1648			
		10	15·31	35·23	26·10	8·35	—	—	**N 70 V**	50–0				
		20	15·30	35·25	26·11	8·35	—	-	,,	100–50				
		30	15·29	35·26	26·14	8·35	—	—	,,	250–100				
		40	15·25	35·28	26·15	8·35	—	—	,,	380–250	—	**1725**		
		50	15·24	35·26	26·15	8·35	—	—	**N 100 B**	90–0	**1748**	**1808**	2/3	KT
		60	15·13	35·25	26·15	8·33	—	—	**N 70 B**					
		80	13·31	35·04	26·37	8·26								
		100	11·90	34·92	26·56	8·21								
		150	10·91	34·81	26·67	8·15								
		200	9·92	34·74	26·76	8·15								
		300	8·23	34·54	26·91	8·00								
		380	6·90	34·43	27·01	7·98								
263	20	0	15·45	35·32	26·14	8·35	—	—	**N 50 V**	100–0	**2002**			
		10	15·44	35·30	26·13	8·35	—	—	**N 70 V**	50–0				
		20	15·44	35·30	26·13	8·35	—	—	,,	100–50				
		30	15·41	35·30	26·14	8·35	—	—	,,	250–100				
		40	15·30	35·28	26·14	8·35	—	—	,,	450–250	—	**2042**		
		50	15·29	35·30	26·17	8·35	—	—	**N 100 B**	104–0	**2126**	**2146**	2/3	KT
		60	15·23	35·30	26·18	8·35	—	—	**N 70 B**					
		80	15·19	35·28	26·17	8·32								
		100	13·39	35·07	26·39	8·29								
		150	11·58	34·92	26·62	8·20								
		200	10·60	34·81	26·72	8·15								
		300	8·61	34·60	26·91	8·02								
		375	7·91	34·52	26·93	8·02								
		450	6·14	34·40	27·08	7·98								
264	20	0	15·24	35·30	26·18	8·35	—	—	**N 50 V**	100–0	**2330**			
		10	15·23	35·30	26·18	8·35	—	—	**N 70 V**	50–0				
		20	15·23	35·28	26·16	8·35	—	—	,,	100–50				
		30	15·23	35·29	26·17	8·35	—	—	,,	250–100				
		40	15·22	35·29	26·17	8·35	—	—	,,	500–250				
		50	15·22	35·28	26·16	8·35	—	—	,,	640–500	—	**0030**		
		60	15·18	35·28	26·17	8·35	—	—	**N 100 B**	80–0	**0059**	**0119**	2/3	KT
		80	15·13	35·26	26·17	8·34	—	—	**N 70 B**					
		100	13·32	35·01	26·36	8·30								
		150	11·32	34·90	26·66	8·22								
		200	10·28	34·78	26·75	8·14								
		300	8·70	34·60	26·92	8·05								
		400	7·23	34·40	26·93	8·04								
		600	4·22	34·40	27·31	8·01								
265	21	0	15·31	35·28	26·14	8·35	—	—	**N 50 V**	100–0	**0350**			
		10	15·31	35·28	26·14	8·35	—	—	,,	50–0				
		20	15·31	35·29	26·15	8·35	—	—	,,	100–50				
		30	15·31	35·28	26·14	8·35	—	—	,,	250–100				

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
265 *cont.*	33° 06′ 30″ S, 16° 32′ 00″ E	1927 20 vii										
266	29° 34′ 00″ S, 14° 24′ 00″ E	21 vii	2000	—	NW×W	2	NW	1	b.	1021·8	16·1	slight S swell
			0000	—	NW×W	3	NW	2	b.	1022·8	17·2	
267	24° 31′ 00″ S, 12° 15′ 30″ E	23 vii	2000	—	S × W	5	S × W	5	b. c.	1021·3	15·6	heavy SW swell
			0000	—	SSW	6	SSW	5	o.	1022·0	16·1	”
268	18° 37′ 00″ S, 10° 46′ 00″ E	25 vii	2000	—	SSE	6	SSE	5	b.	1021·7	14·4	mod. S swell
			0000	—	SSE	6	SSE	5	b.	1022·1	14·4	heavy S swell
269	15° 55′ 00″ S, 10° 35′ 00″ E	26 vii	2000	—	SSE	5	SSE	6	o.	1021·0	15·0	
270	13° 58′ 30″ S, 11° 43′ 30″ E	27 vii	2000	—	NNW	3	NNW	1	o.	1018·1	16·1	slight S swell
			0000	—	SW	3	SW	3	o.	1019·4	16·7	
271	Elephant Bay, Angola	28 vii	1200	—	—	0	—	0	o. h.	1017·3	20·0	
		29 vii	1600	—	S	4	—	0	b.	1015·3	17·2	
		30 vii	0800	—	—	0	—	0	o.	1018·6	17·2	
272	Off Elephant Bay, Angola. From 13° 11′ S, 12° 44′ 45″ E to 13° 09′ 45″ S, 12° 46′ E	30 vii	1120	73								
			1200	gn. s. m.	—	0	—	0	o.	1017·8	17·8	
			1308	91 gn. m. s.								
273	9° 38′ 00″ S, 12° 42′ 30″ E	31 vii	2000	—	—	0	—	0	b. c.	1018·2	21·7	
			0000	—	—	0	—	0	o.	1021·2	21·7	
274	Off St Paul de Loanda, Angola. From 8° 40′ 15″ S, 13° 13′ 45″ E to 8° 38′ 15″ S, 13° 13′ 00″ E	4 viii	1200	—	—	0	—	0	o.	1021·6	21·7	
			1310	64 gy. m.								
			1455	65 gy. m.								
			1600	—	W × S	2	—	0	b. h.	1014·1	21·7	
275	7° 51′ 00″ S, 12° 42′ 00″ E	4–5 viii	0000	—	W	3	—	0	b.	1017·1	22·8	
276	5° 54′ 00″ S, 11° 19′ 00″ E	5 viii	2000	—	—	0	—	0	b. c.	1015·0	21·7	slight SW swell
			0000	—	SW	3	SW	3	b.	1015·7	23·3	”
277	1° 44′ 00″ S, 8° 38′ 00″ E	7 viii	2000	—	SW	4	SW	2	o.	1014·3	23·9	slight SW swell
			0000	—	SW	4	SW	3	o.	1014·8	23·3	
278	Off Port Gentil, French Congo, 8 miles N 37° E of C Lopez Lt	8 viii	2000	—	—	0–1	—	0	o.	1012·2	24·4	
279	Off C Lopez, French Congo. From 8·5 miles N 71° E to 15 miles N 24° E of C Lopez Lt	10 viii	1025	58 m. f. s.								
			1200	—	SW	3	SW	2	o.	1018·2	24·4	
			1310	67 m. f. s.								

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
265 *cont.*		40	15·30	35·28	26·14	8·35	—	—	**N 70 H**	500–250				
		50	15·31	35·29	26·15	8·35	—	—	,,	750–500				
		60	15·23	35·26	26·15	8·35	—	—	,,	1000–750				
		80	15·19	35·25	26·14	8·30	—	—	,,	1500–1000	—	0555		
		100	14·57	35·25	26·27	8·26	—	—	**N 100 B**	165–0	0610	0630	2/3	KT
		150	12·95	35·08	26·48	8·21	—	—	**N 70 B**					
		200	11·31	34·94	26·69	8·19								
		300	9·18	34·69	26·94	8·15								
		400	7·48	34·52	26·99	8·05								
		600	6·88	34·56	27·11	7·98								
		800	6·74	34·56	27·12	7·98								
		1000	5·37	34·42	27·19	7·98								
		1500	4·20	34·42	27·32	7·96								
266	22	—	—	—		—	—	—	**TYF**	200(–0)	2124	2224	1·5	DGB
									N 100 B	124–0	2131	2151	2/3	KT
									N 70 B					
267	24	—	—	—	—	—	—	—	**TYF**	450–550(–0)	2135	2235	1·7	DGB
									N 100 B	117–0	2142	2202	2/3	KT
									N 70 B					
268	26	—	—	—	—	—	—	—	**TYF**	100–150(–0)	2120	2220	2·3	DGB
									N 100 B	73–0	2128	2148	2/3	KT
269	27	—	—	—	—	—	—	—	**TYF**	600–700(–0)	1909	2109	3·6	DGB
270	28	—	—	—	—	—	—	—	**TYF**	200(–0)	2121	2221	1·0	
									N 100 B	126–0	2131	2151	2/3	KT
									N 70 B					
271	1–3	—	—	—	—	—	—	—	**TNL**	18	—	—	—	28–29 vii
									LH	18	—	—	—	28–30 vii
									NS	5–0	—	—	—	29 vii
									Sh. coll.	—	—	—	—	29–30 vii
272	3	0	17·00	35·39	25·83	—	—	—	**OTL**	73–91	1148	1248	2·0	
		90	14·40	35·17	26·28	—	—	—	**N 4–T**					
									NCS–T					
273	4	—	—	—	—	—	—	—	**TYF**	200–230(–0)	2044	2144	1·9	DGB
									N 100 B	118–0	2053	2113	2/3	KT
									N 70 B					
274	7	0	18·84	35·32	25·32	—	—	—	**OTL**	64–65	1330	1430	2	
		63	14·40	35·25	26·33	—	—	—	**N 7–T**					
									N 4–T					
									NCS–T					
275	7	—	—	—	—	—	—	—	**N 50 H**	0–2	0030	0035		
									N 70 H	,,				
276	8	—	—	—	—	—	—	—	**TYF**	150(–0)	2051	2151	2·1	DGB
									N 100 B	110–0	2101	2121	2/3	KT
									N 70 B					
277	10	—	—	—	—	—	—	—	**TYF**	63(–0)	2042	2142	2	KT
									N 100 B	88–0	2053	2108	½	KT
									N 70 B					
278	11	—	—	—	—	—	—	—	**N 70 H**	0–1	2000	2230	—	from anchored ship
279	13	0	24·60	33·08	22·22	—	—	—	**OTL**	58–67	1135	1250		
		66	14·94	35·34	26·27	—	—	—	**N 7–T**					
									N 4–T					
									NCS–T					
									N 70 H	0–5	1201	1211		

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
		1927										
280	00° 36′ 00″ S, 8° 28′ 00″ E	10 viii	2000	—	SSW	3	SSW	2	o.	1014·0	25·0	slight S swell
			0000	—	SSW	3	SSW	2	o.	1014·7	23·9	
281	00° 46′ 00″ S, 5° 49′ 15″ E	12 viii	1200	—	SSW	3	SSW	2	b. c.	1014·8	23·9	
			1600	—	SSW	2	SSW	2	b. c. h.	1011·8	23·9	
282	1° 11′ 00″ S, 5° 38′ 00″ E	12 viii	2000	—	S	1	—	0	b.	1014·6	24·4	
			0000	—	SSW	2	SSW	2	b.	1019·5	23·9	
283	Off Annobon, G of Guinea, 0·75 to 1 mile N 12° E of Pyramid Rk, Annobon	14 viii	1200	—	SSW	4	SSW	3	b.	1014·8	21·7	mod. SSW swell
284	2° 13′ 00″ S, 1° 52′ 00″ E	15 viii	2000	—	SSW	3	SSW	2	b.	1015·9	22·9	slight SSW swell
			0000	—	SW	3	SW	2	o.	1019·5	22·2	mod. SW swell
285	2° 43′ 30″ S, 00° 56′ 30″ W	16 viii	2000	—	SW	3	SW	2	b.	1017·2	23·3	
			0000	—	SW	4	SW	3	b.	1016·0	23·9	
286	3° 06′ 30″ S, 3° 53′ 00″ W	17 viii	2000	—	S	2	S	2	b.	1016·0	22·9	slight SSW swell
			0000	—	S × E	3	S × E	3	b.	1018·4	23·9	slight S swell
287	2° 49′ 30″ S, 9° 25′ 30″ W	19 viii	2000	—	ESE	3	ESE	1	b. c.	1019·0	22·8	mod. SE swell
			0000	—	ESE	3	ESE	2	o. r.	1018·0	21·1	,,
288	00° 56′ 00″ S, 14° 08′ 30″ W	21 viii	2000	—	SSE	4	SSE	2	b.	1016·3	23·3	
			0000		SSE	4	SSE	3	b. c.	1019·4	22·9	
289	3° 04′ 45″ N, 16° 52′ 00″ W	23–24 viii	2000	—	SSE	5	SSE	4	b. c.	1016·5	25·0	
			0000	—	SE	5	SE	4	b. c.	1017·6	24·4	
290	3° 25′ 25″ N, 16° 50′ 52″ W	24 viii	0400	—	SE	5	SE	4	o.	1015·2	24·4	
			0420	5165								
			0800	—	SE	4	SE	3	b. c.	1016·6	25·0	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	Hauled	Length of tow (miles)	Remarks
280	12	—	—	—		—	—	—	**TYF**	100–200(–0)	**2058**	**2158**	2	DGB
									N 100 B / **N 70 B**	84–0	**2107**	**2127**	2/3	KT
281	14	—	—	—	—	—	—	—	**N 70 H**	0	1345	1415	—	A
									TYF	850–950(–0)	1347	1517	4	DGB
									N 70 H	0	1520	1530	—	B
282	14			—		—		—	**TYF**	300(–0)	**2051**	**2151**	2·2	DGB
									N 100 B / **N 70 B**	157–0	**2059**	**2119**	2/3	KT
283	16	0	21·32	35·70	24·94	—	—	—	**DLH**	77	1000	1130		
		21	16·59	35·50	26·01	—	—	—	,,	18–30				
284	17		—		—	—	—	—	**N 100 B** / **N 70 B**	71 0	**2205**	**2225**	2/3	KT
285	18	—		—	—	—	—	—	**N 450**	125–175(–0)	**2042**	**2142**	2·9	DGB
286	19	—	—	—	—	—	—	—	**TYF**	125(–0)	**2049**	**2149**	1·8	DGB
									N 100 B / **N 70 B**	102–0	**2057**	**2117**	2/3	KT
287	22	—	—	—	—	—	—	—	**TYF**	800–1000 (–0)	**1852**	**2052**	3·4	DGB
									N 100 B / **N 70 B**	124–0	**2013**	**2033**	2/3	KT
									N 70 H	0	**2145**			
288	24	—	—	—	—		—		**TYF**	250(–0)	**1859**	**2125**	5·2	DGB
									N 100 B	73–0	**2014**	**2034**	2/3	KT
									N 70 B	100–0	**2058**	**2118**	2/3	KT
									N 100 H	0	**2100**	**2120**		
289	26	0	25·30	35·28	23·48	8·35	—	—	**N 50 V**	100–0	**2030**			
		20	25·30	35·29	23·49	8·35	—	—	**N 70 V**	50–0				
		40	25·30	35·28	23·48	8·35	—		,,	100–50				
		50	25·30	35·29	23·49	8·35	—	—	,,	250–100				
		65	25·21	35·30	23·63	8·35	—	—	,,	500–250				
		80	23·88	35·46	24·05	8·35	—	—	,,	750–500				
		90	19·72	35·71	25·40	8·24	—	—	,,	1000–750	—	**0015**		
		100	16·61	35·55	26·05	8·04	—	—	**NH**	0	**2320**	**2340**		
		150	14·28	35·39	26·45	8·02	—	—	**TYF**	125–225(–0)	**0042**	**0112**	1·1	DGB
		200	13·48	35·26	26·52	7·99	—	—	**N 100 B** / **N 70 B**	132–0	**0048**	**0108**	2/3	KT
		300	11·68	35·07	26·72	7·99	—	—						
		400	11·47	34·99	26·80	7·95								
		500	7·49	34·70	27·14	7·85								
		600	7·00	34·67	27·18	7·90								
		800	6·27	34·50	27·15	7·96								
		1000	4·68	34·50	27·33	7·96								
290	27	0	25·58	35·30	23·44	8·35	—	—	**N 50 V**	100–0	**0420**			
		20	25·58	35·30	23·44	8·35	—	—	**N 70 V**	50–0				
		40	25·58	35·30	23·44	8·35	—	—	,,	100–50				
		50	25·58	35·30	23·44	8·35	—	—	,,	250–100				
		65	25·54	35·30	23·44	8·35	—	—	,,	500–250				
		80	23·99	35·34	23·92	8·35	—		,,	750–500				
		85	21·62	35·44	24·68	8·32	—	—	,,	1000–750	—	0700		
		90	19·45	35·71	25·46	8·22	—	—	**TYF**	100(–0)	0729	0800	1·4	DGB
		100	17·00	35·54	25·95	8·04	—	—	**N 100 B** / **N 70 B**	86–0	0738	0758	2/3	KT
		150	14·37	35·37	26·42	8·01	—	—						
		200	13·56	35·21	26·56	7·99								
		300	11·72	35·16	26·78	7·95								
		400	8·96	34·78	26·98	7·82								
		500	7·34	34·59	27·06	7·82								
		600	6·20	34·52	27·17	7·92								
		800	5·29	34·49	27·26	7·90								
		1000	4·60	34·49	27·33	7·98								

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
291	3° 46′ 00″ N, 16° 49′ 00″ W	1927 24 viii	1020 1200	6040 —	SE	5	SE	5	b. c.	1017·2	25·6	
292	4° 03′ 15″ N, 16° 51′ 00″ W	24 viii	1444 1600	5700 —	SE	5	SE	6	b. c.	1016·4	25·6	
293	4° 18′ 15″ N, 16° 51′ 00″ W	24 viii	2000 0000	— —	SE SE	5 4	SE SE	4 4	b. c. b. c.	1016·4 1019·8	25·0 25·0	
294	4° 33′ 15″ N, 16° 52′ 45″ W	25 viii	0400	—	S × E	4	S × E	4	b. c.	1015·6	23·9	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
291	27	0	25·68	35·34	23·42	8·36	—	—	**N 50 V**	100–0	1020			
		20	25·68	35·34	23·42	8·36	—	—	**N 70 V**	50–0				
		40	25·68	35·34	23·42	8·36	—	—	,,	100–50				
		60	25·21	35·34	23·56	8·36	—	—	,,	250–100				
		80	22·01	35·68	24·75	8·33	—	—	,,	500–250				
		90	19·22	35·74	25·54	8·20	—	—	,,	750–500				
		100	16·70	35·52	26·00	8·04	—	—	,,	1000–750	—	1159		
		150	14·18	35·32	26·41	7·97		—	**TYF**	100(–0)	1225	1255	1·2	DGB
		200	13·57	35·14	26·40	7·97	—	—	**N 100 B** }	113–0	1232	1252	2/3	KT
		300	11·51	35·05	26·73	7·86	—	—	**N 70 B** }					
		400	9·55	34·81	26·91	7·82								
		500	8·93	34·79	26·99	7·84								
		600	7·65	34·63	27·06	7·84								
		800	6·08	34·51	27·18	7·84								
		1000	5·11	34·51	27·30	7·86								
292	27	0	25·93	35·46	23·44	8·35	—	—	**N 50 V**	100–0	1444			
		20	25·93	35·46	23·44	8·35	—	—	**N 70 V**	50–0				
		40	25·93	35·46	23·44	8·35	—	—	,,	100–50				
		60	25·93	35·46	23·44	8·35	—	—	,,	250–100				
		70	25·82	35·50	23·50	8·35	—	—	,,	500–250				
		75	24·58	35·50	23·93	8·34	—	—	,,	750–500				
		78	24·08	35·52	24·09	8·32	—	—	,,	1000–750		1647		
		85	23·68	35·73	24·31	8·32	—	—	**TYF**	100–180(–0)	1713	1743	1	DGB
		90	20·22	35·82	25·35	8·14	—	—	**N 100 B** }	110–0	1721	1741	2/3	KT
		100	15·98	35·70	26·31	7·97	—	—	**N 70 B** }					
		150	14·18	35·53	26·58	7·96								
		200	13·40	35·41	26·65	7·96								
		300	12·07	35·32	26·84	7·84								
		400	9·20	35·05	27·14	7·78								
		500	8·40	34·89	27·15	7·78								
		600	6·96	34·79	27·20	7·80								
		800	5·39	34·67	27·39	7·81								
		1000	4·64	34·67	27·47	7·82								
293	27	0	26·01	35·46	23·44	8·36	—	—	**N 50 V**	100–0	**1940**			
		20	26·01	35·46	23·44	8·36	—	—	**N 70 V**	50–0				
		40	26·04	35·46	23·43	8·36	—	—	,,	100–50				
		60	26·13	35·48	23·41	8·36	—	—	,,	250–100				
		70	25·76	35·59	23·55	8·36	—	—	,,	500–250				
		75	23·73	35·71	24·38	8·34	—	—	,,	750–500				
		80	21·55	35·77	24·94	8·13	—	—	,,	1000–750				
		90	16·69	35·61	26·18	7·97	—	—	,,	1000–0	—	**2210**		
		100	15·44	35·52	26·19	7·96	—	—	**TYF**	100–120(–0)	**2225**	**2258**	0·9	DGB
		150	14·18	35·41	26·48	7·96	—	—	**N 100 B** }	84–0	**2235**	**2255**	2/3	KT
		200	13·28	35·32	26·59	7·96	—	—	**N 70 B** }					
		300	11·61	35·16	26·79	7·90								
		400	9·63	34·92	26·94	7·80								
		500	7·10	34·74	27·23	7·78								
		600	6·30	34·58	27·20	7·81								
		800	5·48	34·58	27·32	7·81								
		1000	4·67	34·60	27·42	7·86								
294	27	0	26·30	35·48	23·36	8·38	—	—	**N 50 V**	100–0	**0100**			
		20	26·30	35·48	23·36	8·38	—	—	**N 70 V**	50–0				
		40	26·30	35·48	23·36	8·38	—	—	,,	100–50				
		60	26·20	35·51	23·41	8·38	—	—	,,	250–100				
		80	23·54	35·71	24·33	8·36	—	—	,,	500–250				
		85	20·32	35·68	25·20	8·20	—	—	,,	750–500	—	**0310**		
		90	18·61	35·70	25·68	8·10	—	—	**NH**	0	**0300**			
		100	16·04	35·52	26·05	7·97	—	—	**TYF**	100–150(–0)	**0335**	**0407**	1·0	DGB

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
294 *cont.*	4° 33′ 15″ N, 16° 52′ 45″ W	1927 25 viii										
295	5° 30′ 30″ N, 17° 45′ 00″ W	25 viii	1200	—	SE	5	SE	5	b. c.	1020·1	26·1	
			1600	—	SE	5	SE	5	b. c.	1015·7	26·1	
296	8° 12′ 00″ N, 18° 49′ 00″ W	26 viii	2000	—	SSW	4	SSW	4	b. c.	1015·2	25·0	
297	12° 08′ 00″ N, 20° 53′ 30″ W	28 viii	2000	—	W	2	W	1	b. c.	1016·2	26·1	mod. SSW swell
298	13° 01′ 45″ N, 21° 34′ 45″ W	29 viii	1200	—	WNW	2	WNW	1	o.	1013·0	28·3	
299	Tarrafal, S Antonio, Cape Verde Is	4 ix	1200	—	—	0–1	—	0	b.	1014·1	28·9	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
294 *cont.*		150	14·26	35·44	26·49	7·95	—	—	**N 100 B**	101–0	**0345**	**0405**	$\frac{2}{3}$	KT
		200	13·30	35·28	26·56	7·96	—	—	**N 70 B**					
		300	11·99	35·19	26·73	7·83								
		400	9·08	34·88	27·03	7·75								
		500	7·88	34·78	27·15	7·70								
		600	6·66	34·69	27·23	7·76								
		800	5·32	34·54	27·30	7·76								
		1000	4·61	34·63	27·45	7·94								
295	27	2598	2·85	34·88	27·83	—	—	—	**TYF**	2500–2700 (–0)	1253	1553	5·8	DGT
296	28	—	—	—	—	–	—	—	**TYF**	450–500(–0)	**1833**	**2040**	4·6	DGB
									N 100 B	120–0	**2016**	**2036**	$\frac{2}{3}$	KT
									N 70 B					
297	2	—	—	—	—	—	—	—	**TYF**	200–300(–0)	**1851**	**2051**	3·7	DGB
									N 100 B	163–0	**2009**	**2029**	$\frac{2}{3}$	KT
									N 70 B					
298	3	—	—	—	—	—	—	—	**TYF**	900–1200 (–0)	1142	1255	2·1	DGB
299	8	0	25·22	36·36	24·33	—	—	—	**NRM**	7–11	1000	—	—	two short hauls
									N 70 H	0	1000			
									NH	0				
									LH	7				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 1	31° 52′ 00″ S, 17° 47′ 00″ E	1926 25 viii	1930	—	SW	3	S	4	b.	1031·0	12·2	
WS 2	22° 24′ 00″ S, 13° 25′ 00″ E	13 ix	2032	—	SSW	2	SSW	1–2	c.	1015·5	13·3	heavy SSW swell
WS 3	27° 50′ 00″ S, 15° 12′ 00″ E	17 ix	1918	—	SSE	4	SSE	4	b.	1021·2	12·8	heavy S swell
WS 4	32° 45′ 00″ S, 18° 10′ 00″ E	30 ix	1838	46	SSW	3	SSW	3	b.	1021·3	15·0	heavy SW swell
WS 5	35° 08′ 00″ S, 13° 46′ 00″ E	22 x	2100	—	var.	1–2	SE	5	o.	1011·4	15·0	heavy conf. swell
WS 6	35° 28′ 00″ S, 12° 12′ 00″ E	23 x	0900	—	ESE	5	ESE	5	o. r.	1011·2	15·9	heavy SE swell
WS 7	36° 39′ 00″ S, 10° 34′ 00″ E	23 x	2100	—	ESE	3	ESE	2	r.	1012·7	12·8	heavy ESE swell
WS 8	40° 36′ 00″ S, 5° 11′ 00″ E	25 x	0900	—	WNW	4	WNW	2	b. c.	1003·3	8·9	heavy SE swell
WS 9	41° 32′ 00″ S, 3° 41′ 00″ E	25 x	2100	—	SW	3	WNW	2–3	d. m.	1003·3	8·0	heavy SW swell
WS 10	44° 59′ 00″ S, 2° 44′ 00″ W	27 x	0905	—	WNW	4	WNW	3	b. c.	998·4	4·4	heavy W swell
WS 11	43° 53′ 00″ S, 4° 30′ 00″ W	27 x	2100	—	WSW	6–7	WSW	6	o. h. q.	1002·6	1·7	heavy W swell
WS 12	48° 00′ 00″ S, 10° 27′ 00″ W	30 x	0915	—	WSW	7	WSW	7	o. q.	1012·1	0·6	v. heavy SW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS: Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS: Gear	Depth (metres)	TIME: Shot	TIME: Hauled	Length of tow (miles)	Remarks
WS 1	17	0	12·59	34·92	26·51	—	46	—	**N 100 H**	37	**1930**	**2000**	1	
WS 2	6	0	13·29	35·01	26·37	—	95	—	**N 100 H**	62	**2032**	**2052**	1	KT
WS 3	10	0	12·19	34·81	26·43	—	75	—	**N 100 H**	73	**1918**	**1939**	1	KT
WS 4	24	—	—	—	—	—	—	—	**DL**	45–47	**1838**	**1855**	1	
WS 5	16	0	13·6	—	—	—	—	—	**N 100 H**	0–5	**2130**	**2200**	1	
									,,	50	**2125**	**2155**	1	
									,,	100	**2115**	**2155**	$1\frac{1}{3}$	
									N 70 H	0–5	**2300**	**2317**	$\frac{2}{3}$	
									,,	50	**2310**	**2317**	$\frac{1}{4}$	
									,,	100	**2320**	**2337**	$\frac{2}{3}$	
WS 6	17	0	13·78	35·25	26·44	—	—	—	**N 100 H**	0–5	0915	0945	1	
									,,	50	,,	,,	1	
									,,	100	,,	,,	1	
									N 70 H	0–5	1035	1043	$\frac{1}{4}$	
									,,	50	1011	1025	$\frac{1}{2}$	
									,,	100	1011	1030	$\frac{2}{3}$	
WS 7	17	0	13·19	35·08	26·43	—	—	—	**N 100 H**	0–5	**2134**	**2220**	$1\frac{3}{5}$	
									,,	55(–0)	**2132**	**2202**	1	
									,,	110(–55)	**2110**	**2202**	$1\frac{3}{5}$	KT
									N 70 H	0	**2132**	**2140**	$\frac{1}{4}$	
									,,	50	**2135**	**2143**	$\frac{1}{4}$	
									,,	100	**2125**	**2143**	$\frac{1}{2}$	
WS 8	19	0	9·30	34·29	26·53	—	—	—	**N 100 H**	0–5	0913	0944	1	
									,,	87	0911	0943	1	
									,,	174	0905	0943	$1\frac{1}{4}$	KT
									N 70 H	0–5	1002	1011	$\frac{1}{4}$	
									,,	87	1010	1018	$\frac{1}{4}$	
									,,	174	1004	1018	$\frac{1}{2}$	
WS 9	19	0	7·95	34·29	26·74	—	—	—	**N 100 H**	0–5	**2114**	**2144**	1	
									,,	87	,,	,,	1	
									,,	174	**2105**	,,	$1\frac{1}{3}$	KT
									N 70 H	0–5	**2209**	**2217**	$\frac{1}{4}$	
									,,	87	,,	,,	$\frac{1}{4}$	
									,,	174	**2200**	,,	$\frac{1}{2}$	
WS 10	21	0	4·94	34·14	27·03	—	—	—	**N 100 H**	0–5	0915	0945	1	
									,,	50(–0)	0912	0942	1	
									,,	100	0907	0942	$1\frac{1}{4}$	
									N 70 H	0	1017	1023	$\frac{1}{4}$	
									,,	57	1022	1029	$\frac{1}{4}$	
									,,	115	1016	1029	$\frac{1}{2}$	KT
WS 11	21	0	3·68	34·03	27·07	—	—	—	**N 100 H**	0–5	**2110**	**2140**	1	
									,,	50	**2115**	**2145**	1	
									,,	100	**2107**	**2148**	$1\frac{1}{4}$	
									N 70 H	0–5	**2155**	**2203**	$\frac{1}{4}$	
									,,	50	**2214**	**2222**	$\frac{1}{4}$	
									,,	100	**2208**	**2222**	$\frac{1}{2}$	
WS 12	24	0	1·7	33·87	27·11	—	—	—	**N 100 H**	0–5	0925	0955	1	
									,,	82	0936	1006	1	
									,,	164	0922	1006	$1\frac{1}{2}$	KT
									N 70 H	0–5	1001	1009	$\frac{1}{4}$	
									,,	104	1055	1106	$\frac{1}{4}$	KT
									,,	165	1027	1035	$\frac{1}{4}$	KT

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 13	50° 12′ 00″ S, 15° 13′ 00″ W	1926 1 xi	0940	–	WNW	4	WNW	4	o. m. d.	1012·4	2·5	heavy W swell
WS 14	50° 55′ 00″ S, 17° 49′ 00″ W	1 xi	2100	—	WNW	5–6	WNW	5	o.	1007·4	3·1	heavy W swell
WS 15	52° 40′ 00″ S, 23° 52′ 00″ W	3 xi	0905	—	NNE	2–3	NNE	2	c.	1007·1	– 0·8	slight S swell
WS 16	52° 56′ 00″ S, 26° 17′ 00″ W	3 xi	2100	—	W × S	6–7	W × S	6	o. p. r. s.	996·0	0·6	mod. conf. swell
WS 17	53° 57′ 00″ S, 33° 23′ 00″ W	5 xi	2120	—	W	2–3	W	2	o.	1013·7	– 1·1	mod. W swell
WS 18	54° 07′ 00″ S, 36° 23′ 00″ W	26 xi	1700	113 gy. m.	NNW	6–7	NNW	6–7	r. rs. o.	1007·1	1·7	mod. conf. swell
WS 19	54° 00′ 30″ S, 36° 20′ 30″ W	27 xi	1035	128 r.	NNW	6	NNW	6	o. r.	1004·2	2·78	mod. NW swell
WS 20	53° 52′ 30″ S, 36° 00′ 00″ W	28 xi	0830	535 r.	N	5	N	5	o. m. r.	996·6	1·7	heavy NNW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. °Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
WS 13	26	0	1·25	33·87	27·14	—	—	—	**N 100 H**	0–5	0945	1015	1	
									,,	50	0953	1023	1	
									,,	100	0944	1023	1⅓	
									N 70 H	0–5	1020	1028	¼	
									,,	50	1046	1054	¼	
									,,	100	1040	1054	½	
WS 14	26	0	1·9	33·87	27·10	—	—	—	**N 100 H**	0–5	**2113**	**2143**	1	
									,,	50	**2122**	**2152**	1	
									,,	100	**2115**	**2152**	1¼	
									N 70 H	0–5	**2147**	**2155**	¼	
									,,	50	**2217**	**2225**	¼	
									,,	100	**2211**	**2225**	½	
WS 15	28	0	0·8	33·91	27·20	—	—	—	**N 100 H**	0–5	0913	0943	1	
									,,	81	0917	0947	1	KT
									,,	183	0910	,,	1¼	KT
									N 70 H	0–5	0949	0957	¼	
									,,	91	1011	1019	¼	KT
									,,	200	1004	1019	½	KT
WS 16	28	0	− 0·3	33·82	27·19	—	—	—	**N 100 H**	0–5	**2107**	**2137**	1	
									,,	90	**2152**	**2122**	1	
									,,	183	**2109**	**2139**	1	KT
									N 70 H	0	**2152**	**2200**	¼	
									,,	190	**2136**	**2144**	¼	KT
WS 17	1	0	− 0·7	33·85	27·22	—	—	—	**N 100 H**	0–5	**2128**	**2158**	1	
									,,	101	**2213**	**2243**	1	KT
									,,	174	**2125**	**2155**	1	KT
									N 70 H	0–5	**2209**	**2217**	¼	
									,,	101	**2313**	**2321**	¼	KT
									,,	200	**2254**	**2302**	¼	KT
WS 18	21	0	0·2	33·74	27·10	—	88	—	**N 70 V**	50–0	1710			
		5	0·2	33·74	27·10	—	93	—	,,	100–0	—	1730		
		10	0·2	33·73	27·09	—	98	—	**N 100 H**	0–5	1912	1942	1	
		20	0·1	33·74	27·10	—	108	—	,,	49	1920	1950	1	KT
		30	0·35	33·81	27·15	—	113	—	,,	118	1905	1950	1½	KT
		40	− 0·4	33·86	27·22	—	118	—	**N 70 H**	0–5	1944	1952	¼	
		50	− 0·6	33·89	27·25	—	123	—	,,	46	**2015**	**2023**	¼	KT
		75	− 0·75	33·91	27·28	—	117	—	,,	128	**2008**	**2023**	½	KT
		100	− 0·9	33·93	27·30	—	119							
WS 19	22	0	0·2	33·83	27·17	—	97	—	**N 70 V**	50–0	1025			
		5	0·2	33·83	27·17	—	125?	—	,,	100–0	—	1100		
		10	0·2	33·83	27·17	—	111	—	**N 100 H**	0–5	1330	1400	1	
		20	0·2	33·83	27·17	—	106	—	,,	77	1333	1403	1	KT
		30	0·1	33·83	27·18	—	105	—	,,	164	1326	1403	1¼	KT
		40	0·1	33·83	27·18	—	108	—	**N 70 H**	0–5	1426	1434	¼	
		50	0·1	33·86	27·19	—	111	—	,,	62	1431	1439	¼	KT
		75	− 0·6	33·88	27·25	—	125	—	,,	155	1425	1439	½	KT
		100	− 0·9	33·92	27·29	—	130							
WS 20	23	0	0·45	33·82	27·15	—	89	—	**N 70 V**	50–0	0830			
		5	0·45	33·83	27·16	—	93	—	,,	100–50				
		10	0·4	33·83	27·16	—	93	—	,,	250–100				
		20	0·35	33·83	27·16	—	100	—	,,	500–250	—	0915		
		30	0·3	33·83	27·17	—	103	—	**N 100 H**	0–5	1035	1105	1	
		40	0·3	33·83	27·17	—	101	—	,,	86	1102	1132	1	KT
		50	0·3	33·84	27·17	—	101	—	,,	190	1054	1132	1¼	KT
		75	0·25	33·87	27·20	—	101	—	**N 70 H**	0–5	1230	1238	¼	

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
WS 20 *cont.*	53° 52′ 30″ S, 36° 00′ 00″ W	1926 28 xi										
WS 21	53° 45′ 30″ S, 35° 48′ 00″ W	28 xi	1400	899 g.	NNW	3	NNW	3	o. m. r.	993·0	1·67	mod. NW swell
WS 22	53° 38′ 00″ S, 35° 35′ 00″ W	30 xi	1415	2260	NNE	1–2	NNE	0–1	o. m. r. h. s.	991·8	1·1	slight conf. swell
WS 23	Government Jetty, Grytviken, S Georgia	7 xii	1500	—	E	2	—	0	b. c.	984·9	4·44	
WS 24	54° 12′ 07″ S, 36° 28′ 07″ W	10 xii	1530	172 gn. m. 212 gn. m.	—	0–1	—	0	o.	996·7	2·2	slight NE swell
WS 25	Undine Harbour (North), S Georgia	17 xii	2030	18 m. s.	var.	1	—	0	o.	997·2	1·39	
WS 26	53° 33′ 15″ S, 37° 45′ 15″ W	18 xii	1800	1180 gy. m.	E × N	3	E	2	o.	1002·9	1·39	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
WS 20 *cont.*		100	−0·1	33·89	27·23		105	—	**N 70 H**	71	1203	1211	¼	KT
		150	−0·55	33·96	27·31	—	133	—	,,	164	1155	1211	½	KT
		200	0·3	34·14	27·42	—	125							
		300	1·6	34·40	27·54	—	129							
		400	1·85	34·49	27·59	—	118							
		500	1·89	34·49	27·59	—	120							
WS 21	23	0	0·2	33·86	27·19	—	106		**N 70 V**	50–0	1400			
		5	0·2	33·86	27·19	—	109	—	,,	100–50				
		10	0·1	33·86	27·19	—	123	—	,,	250–100				
		20	0·1	33·86	27·19		118	—	,,	500–250				
		30	0·05	33·86	27·20		113	—	,,	750–500	—	1600		
		40	0·05	33·86	27·20	—	119		**N 100 H**	0–5	1635	1706	1	
		50	0·00	33·86	27·20	—	125		,,	95	1646	1716	1	KT
		75	−0·4	33·87	27·24	—	120	—	,,	192	1634	1716	1¼	KT
		100	−0·9	33·93	27·30	—	120	—	**N 70 H**	0–5	1710	1718	¼	
		150	0·2	34·07	27·39	—	126		,,	90	1743	1750	¼	KT
		200	1·4	34·33	27·49	—	129	—	,,	192	1735	1750	½	KT
		300	1·95	34·51	27·60	—	134							
		400	2·0	34·58	27·66	—	144							
		500	2·04	34·61	27·69	—	142							
		750	1·86	34·69	27·75	—	152							
WS 22	25	0	0·1	33·86	27·19	—	123	—	**N 70 V**	50–0	1415			
		5	0·1	33·86	27·19	—	123	—	,,	100–50				
		10	0·1	33·86	27·19	—	123	—	,,	250–100				
		20	0·00	33·86	27·20	—	123	—	,,	500–250				
		30	0·05	33·86	27·20	—	123		,,	750–500				
		40	−0·1	33·86	27·20		125	—	,,	1000–750	—	1850		
		50	−0·1	33·86	27·20	—	125		**N 100 H**	0–5	1909	1939	1	
		75	−0·15	33·87	27·23	—	132	—	,,	82	1910	1946	1¼	KT
		100	−0·65	33·93	27·29	—	133	—	,,	185	1903	1946	1¼	KT
		150	−0·3	34·04	27·36	—	145		**N 70 H**	0–5	**2009**	**2017**	¼	
		200	0·6	34·25	27·48		132	—	,,	71	**2014**	**2022**	¼	KT
		300	1·9	34·51	27·61	—	144		,,	165	**2007**	**2022**	½	KT
		400	2·2	34·58	27·64		152							
		500	1·94	34·61	27·69	—	148							
		750	1·82	34·69	27·75	—	149							
		1000	1·14	34·70	27·82		145							
WS 23	3	0	2·25	30·77	24·59	—	—	—	**NH**	0–1				
									N 50 H	0–1	1515	1545	—	net streamed by current
WS 24	6	0	1·92	33·49	26·79	—	101		**N 70 V**	50–0	1530			
		5	1·60	33·73	27·00	—	114	—	,,	100–50				
		10	0·94	33·73	27·04	—	114	—	,,	160–100				
		20	0·85	33·75	27·07		130		,,	200–100		1600		
		30	0·64	33·77	27·09	—	133		**N 100 H**	0–5	1651	1722	1	
		40	0·60	33·79	27·12	—	125	—	,,	68	,,	1721	1	
		50	0·33	33·80	27·14		132	—	,,	137	,,	,,	1	KT
		75	0·12	33·83	27·18	—	136	—	**N 70 H**	0–5	1746	1754	¼	
		100	0·05	33·85	27·19	—	144		,,	58	,,	,,	¼	
		150	−0·65	33·87	27·25		144	—	,,	117	,,	,,	¼	KT
		200	−0·97	34·12	27·45		151							
WS 25	13	—	—	—	—	—	—	—	**BTS**	18–27	**2030**	**2115**		
WS 26	14	0	1·70	33·82	27·07	—	106	7·40	**N 70 V**	50–0	1800			
		5	1·75	33·82	27·07	—	106	7·34	,,	100–50				
		10	1·70	33·82	27·07		105	8·08?	,,	250–100				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 26 *cont.*	53° 33′ 15″ S, 37° 45′ 15″ W	1926 18 xii										
WS 27	53° 55′ 00″ S, 38° 01′ 00″ W	19 xii	0600	80 g.	ENE	2	ENE	1	o. s.	1006·5	0·83	
WS 28	53° 48′ 15″ S, 38° 13′ 00″ W	19 xii	1000	346 gy. m. 150 gy. m.	NE × E	2–3	ENE	1	o. s.	1007·5	1·39	
WS 29	53° 41′ 15″ S, 38° 24′ 45″ W	19 xii	1350	614	ENE	2	ENE	1	o. s.	1007·9	1·67	
WS 30	53° 34′ 15″ S, 38° 36′ 15″ W	19–20 xii	1835	2582	ENE	2–1	—	0	c.	1009·9	1·67	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
WS 26 *cont.*		20	1·65	33·82	27·07	—	109	7·50	**N 70 V**	500–250				
		30	1·00	33·82	27·12	—	115	7·58	,,	750–500				
		40	0·63	33·82	27·14	—	120	7·46	,,	1000–750	—	**2215**		
		50	0·40	33·84	27·17	—	125	7·53	**N 100 H**	0–5	**2240**	**2311**	1	
		75	−0·45	33·87	27·24	—	130	7·31	,,	96	,,	,,	1	
		100	−0·60	33·91	27·27	—	134	7·31	,,	192	,,	,,	1	KT
		150	−0·55	34·00	27·34	—	145	6·66	**N 70 H**	0–5	**0003**	**0010**	¼	
		200	0·35	34·18	27·45	—	152	5·79	,,	70	,,	,,	¼	
		300	1·65	34·42	27·54	—	156	4·41	,,	141(–70)	,,	,,	¼	KT
		400	1·95	34·49	27·58	—	160	4·04						
		500	2·48	34·57	27·61	—	156	3·86						
		750	1·95	34·63	27·70	—	149	3·93						
		1000	1·87	34·67	27·74	—	147	3·84						
WS 27	15	0	1·00	33·82	27·12	—	99	—	**N 50 V**	70–0	0600			
		10	0·88	33·84	27·14	—	98	—	**N 70 V**	50–0				
		20	0·65	33·86	27·16	—	96	—	,,	75–50	—	0700		
		30	0·50	33·86	27·17	—	103	—	**N 100 H**	0–5	0745	0815	1	
		40	0·50	33·86	27·17	—	104	—	,,	53	,,	,,	1	
		50	0·50	33·87	27·19	—	110	—	,,	107	,,	,,	1	KT. Net touched bottom
		60	0·45	33·87	27·19	—	110	—	**N 70 H**	0–5	0842	0850	¼	
		70	0·45	33·87	27·19	—	111	—	,,	104	,,	,,	¼	KT
WS 28	15	0	1·35	33·78	27·07	—	99	7·39	**N 50 V**	100–0	1000	—	—	near large iceberg
		10	1·45	33·80	27·07	—	103	7·41	**N 70 V**	50–0				
		20	0·95	33·84	27·13	—	105	7·59	,,	100–50				
		30	0·70	33·84	27·15	—	106	7·42	,,	145–100	—	1100		
		40	−0·15	33·91	27·26	—	111	7·40	**N 100 H**	0–5	1119	1149	1	
		50	−0·35	33·91	27·26	—	125	7·42	,,	80	,,	,,	1	KT
		60	−0·65	33·95	27·31	—	125	7·10	**N 70 H**	0–5	1202	1210	¼	
		80	−0·70	33·95	27·31	—	130	7·14	,,	88	,,	,,	¼	KT
		100	−0·75	33·95	27·31	—	133	7·12						
		135	−0·75	33·96	27·32	—	134	7·02						
WS 29	15	0	1·85	33·80	27·04	—	104	—	**N 50 V**	100–0	1315			
		10	1·75	33·78	27·04	—	—	—	**N 70 V**	50–0				
		20	1·70	33·80	27·05	—	105	—	,,	100–50				
		30	1·55	33·80	27·06	—	100	—	,,	250–100				
		40	0·75	33·80	27·11	—	113	—	,,	500–250				
		50	0·15	33·87	27·21	—	116	—	,,	600–500	—	1520		
		60	−0·20	33·89	27·24	—	124	—	**N 100 H**	0–5	1602	1632	1	
		80	−0·45	33·95	27·30	—	132	—	,,	59	,,	,,	1	
		100	−0·60	33·96	27·31	—	142	—	,,	118	,,	,,	1	KT
		150	0·35	34·22	27·47	—	154	—	**N 70 H**	0–5	1700	1708	¼	
		200	0·90	34·33	27·53	—	164	—	,,	66	,,	,,	¼	
		300	1·75	34·47	27·59	—	162	—	,,	132(–66)	,,	,,	¼	KT
		400	1·95	34·55	27·64	—	184							
		500	2·02	34·56	27·64	—	174							
		600	2·11	34·65	27·70	—	169							
WS 30	15	0	1·80	33·82	27·06	—	78	7·82	**N 50 V**	100–0	1835			
		10	1·80	33·83	27·07	—	78	7·85	**N 70 V**	50–0				
		20	1·50	33·86	27·11	—	79	—	,,	100–50				
		30	1·10	33·86	27·13	—	88	7·75	,,	250–100				
		40	0·90	33·85	27·14	—	93	7·50	,,	500–250				
		50	0·90	33·86	27·15	—	100	7·48	,,	750–500				
		60	0·75	33·87	27·18	—	100	7·80	,,	1000–750	—	**2215**		
		80	−0·40	33·91	27·27	—	108	7·55	**N 100 H**	0–5	**2258**	**2328**	1	
		100	−0·70	34·95	27·31	—	115	7·69	,,	67	,,	,,	1	
		150	−0·30	34·09	27·40	—	114	6·48	,,	134(–67)	,,	,,	1	KT
		200	1·25	34·35	27·53	—	123	4·94	**N 70 H**	0–5	**0012**	**0019**	¼	
		300	1·85	34·51	27·61	—	126	4·43	,,	50	,,	,,	¼	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 30 *cont.*	53° 34′ 15″ S, 38° 36′ 15″ W	1926 19–20 xii										
WS 31	54° 52′ 00″ S, 35° 36′ 00″ W	20 xii	1600	76 st. r.	var.	1	—	0	c.	1002·2	4·41	
WS 32	Mouth of Drygalski Fjord, S Georgia	21 xii	1220	225 gy. m.	SSE	6–3	-	0	b. c.	994·1	7·5	
WS 33	54° 59′ 00″ S, 35° 24′ 00″ W	21 xii	1530	135 gy. m. st.	W	6–7	W	5	o. c.	991·9	2·22	
WS 34	55° 06′ 00″ S, 35° 11′ 00″ W	21 xii	1915	121 r. st.	WSW	7	WSW	7	c.	990·7	1·11	
WS 35	55° 13′ 15″ S, 34° 59′ 00″ W	21–22 xii	2305	161 s. g	WSW	6–7	WSW	7	o. s.	990·0	1·11	
WS 36	55° 20′ 15″ S, 34° 46′ 30″ W	22 xii	0430	1242	W	5	W	5–6	o. p. s.	989·9	1·11	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
WS 30 *cont.*		400	2·05	34·58	27·66	—	152	3·99	**N 70 H**	100	**0012**	**0019**	¼	KT
		500	2·04	34·60	27·67		125	3·97						
		750	1·90	34·69	27·75		136	3·79						
		1000	1·86	34·72	27·78	—	129	3·88						
		1500	2·00	34·74	27·79	—	126	4·05						
WS 31	16	0	2·30	33·73	26·95	—	75	—	**N 50 V**	70–0	1600			
		10	1·30	33·78	27·07	—	80	—	**N 70 V**	50–0				
		20	1·20	33·75	27·05		83	—	,,	70–50	—	1630		
		30	1·13	33·75	27·05	—	89	—	**N 100 H**	0–5	1653	1723	1	
		40	1·05	33·75	27·06	—	94	—	,,	53	,,	,,	1	KT
		50	0·90	33·82	27·13	—	106	—	**N 70 H**	0–5	1734	1742	¼	
		60	0·65	33·87	27·18		106	—	,,	57	,,	,,	¼	KT
WS 32	17	210	0·80	34·13	27·37	—	—	—	**BTS**	225	1220	1300		
WS 33	17	0	1·40	33·78	27·06	—	74	7·46	**N 50 V**	100–0	1530			
		10	1·45	33·78	27·06	—	83	7·60	**N 70 V**	50–0				
		20	1·40	33·78	27·06		81	7·48	,,	100–50				
		30	1·30	34·04	27·27	—	75	7·48	,,	130–100	—	1615		
		40	1·23	33·79	27·08	—	81	7·37	**N 100 H**	0–5	1702	1732	1	
		50	1·30	33·79	27·08	—	79	7·46	,,	65	,,	,,	1	
		60	1·00	33·86	27·14	—	80	7·52	,,	130	,,	,,	1	KT. Net touched bottom
		80	0·45	33·88	27·20	—	89	7·65?	**N 70 H**	0–5	1752	1800	¼	
		100	0·40	33·89	27·21	—	99	7·17	,,	97	,,	,,	¼	KT
		125	0·40	33·90	27·22	—	120	7·27						
WS 34	17	0	1·05	33·86	27·14	—	86	—	**N 50 V**	100–0	1915			
		10	1·00	33·84	27·13	—	86	—	**N 70 V**	50–0				
		20	1·00	33·84	27·13	—	88	—	,,	100–50	—	1945		
		30	0·95	33·84	27·13	—	89	—	**N 100 H**	0–5	2010	**2040**	1	
		40	0·95	33·84	27·13	—	91	—	,,	100	,,	,,	1	KT
		50	0·95	33·84	27·13	—	94	—	**N 70 H**	0–5	**2057**	**2105**	¼	
		60	0·95	33·84	27·13	—	99	—	,,	80	,,	,,	¼	KT
		80	0·75	33·87	27·18	—	100							
		100	0·25	33·89	27·22	—	110							
WS 35	17	0	0·60	33·84	27·15	—	93	7·30	**N 50 V**	100–0	**2305**			
		10	0·60	33·83	27·15	—	96	7·46	**N 70 V**	50–0				
		20	0·55	33·83	27·15	—	99	7·25	,,	100–50				
		30	0·60	33·83	27·15	—	101	7·53	,,	150–100	—	**2350**		
		40	0·60	33·83	27·15	—	100	7·26	**N 100 H**	0–5	**0155**	**0225**	1	
		50	0·60	33·83	27·15	—	101	7·34	,,	51	,,	,,	1	
		60	0·60	33·83	27·15	—	94	7·19	,,	102(–51)	,,	,,	1	KT
		80	0·50	33·86	27·17	—	93	7·43	**N 70 H**	0–5	**0255**	**0303**	¼	
		100	0·15	33·91	27·24	—	108	7·07	,,	66	,,	,,	¼	
		105	0·15	34·03	27·34	—	116	6·50	,,	132(–66)	,,	,,	¼	KT
WS 36	18	0	0·63	33·80	27·12	—	91	—	**N 50 V**	100–0	0430			
		10	0·63	33·80	27·12	—	91	—	**N 70 V**	50–0				
		20	0·60	33·78	27·11	—	94	—	,,	100–50				
		30	0·63	33·78	27·11	—	94	—	,,	250–100				
		40	0·63	33·75	27·08	—	95	—	,,	500–250				
		50	0·60	33·80	27·12	—	93	—	,,	750–500				
		60	0·50	33·79	27·13	—	98	—	,,	1000–750	—	0645		
		80	–0·25	33·81	27·18	—	113	—	**N 100 H**	5–0	0732	0802	1	
		100	–0·08	33·89	27·23	—	120	—	,,	77	,,	,,	1	
		150	0·90	34·09	27·34	—	125	—	,,	155	,,	,,	1	KT
		200	1·55	34·27	27·44	—	128	—	**N 70 H**	5–0	0832	0840	¼	
		300	2·00	34·43	27·54	—	129	—	,,	67	,,	,,	¼	
		400	2·03	34·51	27·58	—	134	—	,,	135	,,	,,	¼	KT

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 36 *cont.*	55° 20′ 15″ S, 34° 46′ 30″ W	1926 22 xii										
WS 37	54° 45′ 00″ S, 35° 11′ 00″ W	22 xii	1450	318 gy. m.	WSW	1–2	—	0	c.	991·2	2·78	
WS 38	54° 01′ 00″ S, 35° 14′ 00″ W	22–23 xii	2150	2103	N	1	N	1	b.	991·1	2·22	
WS 39	54° 08′ 00″ S, 35° 43′ 00″ W	23 xii	0600	237 gy. m.	NE×N	4	NE × N	3	c.	993·1	2·22	
WS 40	55° 09′ 00″ S, 35° 58′ 00″ W	1927 7 i	0630	183 gy. m.	SW	0–1	—	0	o. s.	999·7	−2·22	
WS 41	54° 32′ 45″ S, 36° 43′ 45″ W	7 i	1400	140 gy. m.	S	3	S	1	o.	998·3	1·11	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
WS 36 *cont.*		500	2.15	34.54	27.62	—	136							
		750	1.99	34.63	27.70	—	132							
		1000	1.81	34.70	27.77	—	126							
WS 37	18	0	1.33	33.84	27.11	—	100	7.30	**N 50 V**	100–0	1450			
		10	0.95	33.84	27.13	—	101	7.27	**N 70 V**	50–0				
		20	0.85	33.84	27.14	—	104	7.31	,,	100–50				
		30	0.83	33.85	27.15	—	100	7.06	,,	250–100				
		40	0.80	33.86	27.15	—	98	7.31	,,	300–250	—	1530		
		50	0.75	33.86	27.16	—	99	7.08	**N 100 H**	0–5	1622	1652	1	
		60	0.70	33.84	27.15	—	100	7.27	,,	80	,,	,,	1	
		80	0.53	33.84	27.16	—	104	7.14	,,	159	,,	,,	1	KT
		100	0.45	33.87	27.19	—	105	7.31	**N 70 H**	0–5	1725	1733	¼	
		150	−0.03	34.00	27.32	—	114	6.61	,,	64	,,	,,	¼	
		200	0.43	34.13	27.39	—	133	6.09	,,	128(−0)	,,	,,	¼	KT
		300	1.43	34.35	27.52	—	139	4.75						
WS 38	18	0	0.98	33.82	27.12	—	93	7.43	**N 50 V**	100–0	**2150**			
		10	0.95	33.82	27.12	—	94	7.56	**N 70 V**	50–0				
		20	0.90	33.82	27.13	—	95	7.41	,,	100–50				
		30	0.80	33.82	27.13	—	93	7.37	,,	250–100				
		40	0.70	33.82	27.14	—	93	7.48	,,	500–250				
		50	0.30	33.84	27.17	—	100	7.50	,,	750–500				
		60	0.23	33.82	27.17	—	101	7.50	,,	1000–750	—	**0010**		
		80	0.13	33.83	27.18	—	103	7.28	**N 100 H**	0–5	**0247**	**0317**	1	
		100	−0.20	33.95	27.29	—	114	6.88	,,	53	,,	,,	1	
		150	1.05	34.25	27.46	—	130	5.15	,,	106(−53)	,,	,,	1	KT
		200	1.50	34.36	27.52	—	130	4.62	**N 70 H**	0–5	0405	0413	¼	
		300	1.95	34.43	27.54	—	128	3.93	,,	59	0348	0356	¼	
		400	2.00	34.53	27.62	—	129	3.86	,,	118	,,	,,	¼	KT
		500	2.00	34.58	27.66	—	126	3.66						
		750	1.90	34.69	27.75	—	120	3.77						
		1000	1.73	34.70	27.78	—	125							
		1500	1.47	34.70	27.80	—	125	4.08						
WS 39	19	0	1.80	33.85	27.08	—	94	7.28	**N 50 V**	100–0	0600			
		10	1.75	33.87	27.11	—	100	7.37	**N 70 V**	50–0				
		20	1.70	33.87	27.11	—	103	7.38	,,	100–50				
		30	1.00	33.87	27.16	—	105	7.55	,,	230–100	—	0630		
		40	0.70	33.87	27.18	—	105	7.51	**N 100 H**	0–5	0723	0753	1	
		50	0.70	33.87	27.18	—	98	7.40	,,	87 ?	,,	,,	1	
		60	0.63	33.87	27.18	—	98	7.41	,,	173?	,,	,,	1	KT reading doubtful
		80	0.38	33.89	27.21	—	99	7.41	**N 70 H**	0–5	0821	0829	¼	
		100	0.08	33.89	27.23	—	106	7.30	,,	59	,,	,,	¼	
		150	−0.28	33.96	27.30	—	118	6.85	,,	117	,,	,,	¼	KT
		200	0.43	34.18	27.44	—	130	5.68						
WS 40	5	0	1.19	33.75	27.05	—	100	7.54	**N 50 V**	100–0	0630			
		10	1.24	33.77	27.05	—	91	7.59	**N 70 V**	50–0				
		20	1.24	33.75	27.04	—	91	7.19	,,	100–50				
		30	1.24	33.77	27.05	—	91	7.49	,,	175–100	—	0730		
		40	1.21	33.77	27.06	—	96	7.45	**N 100 H**	0–5	0812	0842	1	
		50	1.19	33.78	27.08	—	95	7.41	,,	72	,,	,,	1	
		60	1.09	33.78	27.08	—	103	7.35	,,	144	,,	,,	1	KT
		80	0.22	33.87	27.21	—	115	7.26	**N 70 H**	0–5	0908	0916	¼	
		100	−0.11	33.91	27.25	—	119	7.14	,,	54	,,	,,	¼	
		150	0.49	34.15	27.42	—	134	5.69	,,	108	,,	,,	¼	KT
WS 41	5	0	2.39	33.49	26.76	—	75	—	**N 50 V**	100–0	1400			
		10	2.24	33.55	26.82	—	79	—	**N 70 V**	50–0				
		20	2.19	33.77	26.99	—	78	—	,,	100–50				
		30	2.12	33.80	27.02	—	79	—	,,	140–100	—	1440		

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
WS 41 *cont.*	54° 32′ 45″ S, 36° 43′ 45″ W	1927 7 i										
WS 42	54° 41′ 45″ S, 36° 47′ 00″ W	7 i	1800	175 gy. m. st.	S × E	4	S	5	b. c.	999·5	0·55	
WS 43	54° 54′ 00″ S, 36° 50′ 00″ W	7–8 i	2230	200 gy. m. st.	SE	4	S	3	c. p. s.	1002·4	0·0	
WS 44	55° 06′ 00″ S, 36° 57′ 00″ W	8 i	0500	1470	SE × S	3	SE	3	c.	1007·8	0·55	
WS 45	54° 38′ 30″ S, 37° 30′ 55″ W	8 i	1650	180 gy. m. st.	SW	3	SW	3	c.	1014·3	1·11	
WS 46	54° 20′ 15″ S, 37° 32′ 30″ W	8 i	2150	194 gy. m. st.	SW	3	SW	3	o.	1005·8	1·11	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	Hauled	Length of tow (miles)	Remarks
WS 41 *cont.*		40	1·99	33·81	27·04	—	80	—	**N 100 H**	0–5	1508	1538	1	
		50	1·64	33·82	27·08	·	88	—	,,	73	,,	,,	1	
		60	1·04	33·84	27·13	—	104	—	,,	146	,,	,,	1	KT
		80	0·74	33·89	27·19	—	116	—	**N 70 H**	0–5	1604	1612	$\frac{1}{4}$	
		100	0·19	33·93	27·25	—	125	—	,,	55	,,	,,	$\frac{1}{4}$	
		125	0·14	33·96	27·28	—	134	—	,,	109	,,	,,	$\frac{1}{4}$	KT. Water bottle touched bottom at 130 m.
WS 42	5	0	2·39	33·60	26·84	—	75	7·61	**N 50 V**	100–0	1800			
		10	2·24	33·73	26·95	·	73	7·63	**N 70 V**	50–0				
		20	2·12	33·78	27·01	—	78	7·50	,,	100–50				
		30	2·09	33·78	27·01	—	76	7·48	,,	170–100	—	1835		
		40	1·82	33·79	27·04	—	80	7·64	**N 100 H**	0–5	2010	**2040**	1	
		50	1·39	33·81	27·08	—	86	7·73	,,	99	,,	,,	1	
		60	0·89	33·84	27·14	—	105	7·35	,,	198	,,	,,	1	KT
		80	0·32	33·87	27·20	—	115	7·19	**N 70 H**	0–5	**2104**	**2112**	$\frac{1}{4}$	
		100	0·02	33·90	27·24	—	125	7·40	,,	55	,,	,,	$\frac{1}{4}$	
		150	0·19	34·07	27·37	—	135	6·10	,,	110	,,	,,	$\frac{1}{4}$	KT
WS 43	5	0	1·62	33·75	27·02	—	91	—	**N 50 V**	100–0	**2230**			
		10	1·59	33·77	27·03	—	91	—	**N 70 V**	50–0				
		20	1·59	33·75	27·02	—	93	—	,,	100–50				
		30	1·54	33·75	27·02	—	91	—	,,	200–100	—	**2330**		
		40	1·49	33·77	27·04	—	94	—	**N 100 H**	0–5	**2346**	**0016**	1	
		50	1·41	33·81	27·08	—	100	—	,,	70	,,	,,	1	
		60	1·02	33·82	27·12	—	105	—	,,	141	,,	,,	1	KT
		80	0·17	33·87	27·21	—	115	—	**N 70 H**	0–5	**0053**	**0101**	$\frac{1}{4}$	
		100	– 0·11	33·89	27·23	—	125	—	,,	62	**0125**	**0133**	$\frac{1}{4}$	
		150	0·12	34·05	27·35	—	139	—	,,	124	**0053**	**0101**	$\frac{1}{4}$	KT
WS 44	6	0	1·49	33·75	27·03	—	98	7·46	**N 50 V**	100–0	0500			
		10	1·49	33·77	27·04	—	101	7·36	**N 70 V**	50–0				
		20	1·49	33·77	27·04	—	110	7·33	,,	100–50				
		30	1·49	33·75	27·03	—	103	7·29	,,	250–100				
		40	1·49	33·75	27·03	—	104	7·28	,,	500–250				
		50	1·49	33·75	27·03	—	105	7·29	,,	750–500				
		60	0·89	33·77	27·08		113	7·18	,,	1000–750	—	0740		
		80	0·02	33·77	27·12	—	118	7·20	**N 100 H**	0–5	0839	0909	1	
		100	– 0·46	33·85	27·21	—	125	7·05	,,	64	,,	,,	1	
		150	0·59	34·09	27·35	—	129	5·80	,,	128	,,	,,	1	KT
		200	1·72	34·27	27·43	—	136	4·91	**N 70 H**	0–5	0934	0942	$\frac{1}{4}$	
		300	1·69	34·34	27·49	—	137	4·52	,,	79	,,	,,	$\frac{1}{4}$	
		400	2·04	34·45	27·55	—	129	3·97	,,	159	,,	,,	$\frac{1}{4}$	KT
		500	2·04	34·52	27·61	—	126	3·89						
		750	2·08	34·63	27·69	—	125	3·79						
		1000	1·99	34·69	27·74	—	125	3·69						
WS 45	6	0	2·22	33·78	27·00	—	80	7·69	**N 50 V**	100–0	1650			
		10	2·19	33·80	27·01	—	80	7·62	**N 70 V**	50–0				
		20	2·04	33·78	27·02	—	75	7·77	,,	100–50				
		30	1·94	33·79	27·03	—	79	7·76	,,	175–100	—	1735		
		40	1·82	33·79	27·04	—	83	7·68	**N 100 H**	0–5	1801	1831	1	
		50	1·69	33·79	27·05	—	83	7·87	,,	51	,,	,,	1	
		60	1·02	33·80	27·10	—	100	7·54	,,	102	,,	,,	1	KT
		80	0·44	33·84	27·16	—	110	7·61	**N 70 H**	0–5	1856	1904	$\frac{1}{4}$	
		100	– 0·44	33·88	27·24	—	120	7·31	,,	53	,,	,,	$\frac{1}{4}$	
		150	0·22	34·06	27·36	—	133	5·93	,,	106	,,	,,	$\frac{1}{4}$	KT
WS 46	6	0	2·19	33·58	26·85	—	85	—	**N 50 V**	100–0	**2150**			
		10	2·19	33·60	26·86	—	85	—	**N 70 V**	50–0				
		20	1·89	33·73	26·98	—	90	—	,,	100–50				
		30	1·69	33·75	27·01	—	91	—	,,	171–50	—	**2240**	—	net touched bottom at 171 m.
		40	1·59	33·75	27·02	·	98	—	**N 100 H**	0–5	**2300**	**2330**	1	

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
WS 46 *cont.*	54° 20′ 15″ S, 37° 32′ 30″ W	1927 8 i										
WS 47	54° 22′ 00″ S, 37° 50′ 00″ W	9 i	0130	160 gy. m. st.	SW	3–4	SW	3	o.	1015·7	1·39	
WS 48	54° 24′ 00″ S, 38° 09′ 00″ W	9 i	0510	224 gy. m. st.	WSW	4	WSW	5	o.	1018·1	2·22	
WS 49	54° 28′ 00″ S, 38° 22′ 15″ W	9 i	0820	223 gy. m. st.	WSW	4	WSW	5	o.	1018·1	2·22	
WS 50	54° 30′ 30″ S, 38° 40′ 30″ W	9 i	1240	230 gy. m.	SW	3	SW	3	o.	1017·5	3·33	
WS 51	54° 34′ 00″ S, 38° 57′ 00″ W	9 i	1535	210 st.	WSW	3	WSW	2	o.	1017·5	3·06	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
WS 46 *cont.*		50	1·22	33·82	27·11	—	101	—	**N 100 H**	73	**2300**	**2330**	1	
		60	0·87	33·82	27·13	—	105	—	,,	143	,,	,,	1	KT
		80	0·19	33·87	27·21	—	119	—	**N 70 H**	0–5	**2356**	**0004**	¼	
		100	0·19	33·90	27·23	—	125	—	,,	87	,,	,,	¼	
		150	0·59	34·09	27·36	—	130	—	,,	174	,,	,,	¼	KT
WS 47	7	0	2·29	33·78	27·00	—	79	7·34	**N 50 V**	100–0	**0130**			
		10	2·29	33·76	26·97	—	84	7·39	**N 70 V**	50–0				
		20	2·24	33·77	26·98	—	84	7·39	,,	100–50				
		30	1·99	33·77	27·00	—	84	7·33	,,	150–100	—	**0205**		
		40	1·87	33·80	27·04	—	89	7·41	**N 100 H**	0–5	**0248**	**0318**	1	
		50	1·59	33·80	27·06	—	94	7·36	,,	63	,,	,,	1	
		60	1·34	33·81	27·09	—	93	7·42	,,	126	,,	,,	1	KT
		80	0·64	33·86	27·16	—	113	7·42	**N 70 H**	0–5	**0338**	0346	¼	
		100	0·29	33·92	27·24	—	116	7·21	,,	39	,,	,,	¼	
		150	0·14	34·02	27·33	—	130	6·17	,,	77	,,	,,	¼	KT
WS 48	7	0	2·09	33·77	26·99	—	88	—	**N 50 V**	100–0	0510			
		10	2·09	33·77	26·99	—	88	—	**N 70 V**	50–0				
		20	2·09	33·77	26·99	—	83	—	,,	100–50				
		30	1·99	33·78	27·02	—	84	—	,,	224–100		0545		
		40	1·32	33·85	27·11	—	90	—	**N 100 H**	0–5	0612	0642	1	
		50	0·79	33·89	27·18	—	96	—	,,	96	,,	,,	1	
		60	0·49	33·90	27·21	—	103	—	,,	192	,,	,,	1	KT
		80	0·34	33·91	27·23	—	104	—	**N 70 V**	0–5	0707	0715	¼	
		100	0·02	33·93	27·26	—	123	—	,,	100	,,	,,	¼	
		150	−0·06	34·00	27·32	—	125	—	,,	200	,,	,,	¼	KT
		200	0·64	34·18	27·43	—	139							
WS 49	7	0	2·19	33·78	27·00	—	71	7·88	**N 50 V**	100–0	0820			
		10	2·17	33·80	27·02	—	71	7·87	**N 70 V**	50–0				
		20	2·19	33·80	27·01	—	73	7·77	,,	100–50				
		30	2·19	33·80	27·01	—	71	7·73	,,	225–100	—	0900		
		40	2·14	33·82	27·04	—	73	7·79	**N 100 H**	0–5	0931	1001	1	
		50	1·82	33·82	27·06	—	85	7·36	,,	69	,,	,,	1	
		60	1·34	33·84	27·11	—	108	7·34	,,	137	,,	,,	1	KT
		80	0·62	33·87	27·18	—	115	7·25	**N 70 H**	0–5	1023	1031	¼	
		100	0·34	33·91	27·23	—	125	7·09	,,	80	,,	,,	¼	
		150	0·19	34·02	27·33	—	132	6·20	,,	161	,,	,,	¼	KT
		200	0·99	34·22	27·43	—	139	4·96						
WS 50	7	0	2·22	33·80	27·01	—	88	—	**N 50 V**	100–0	1240			
		10	2·19	33·82	27·03	—	80	—	**N 70 V**	50–0				
		20	2·12	33·84	27·05	—	81	—	,,	100–50				
		30	1·99	33·84	27·06	—	85	—	,,	225–100	—	1315		
		40	1·94	33·84	27·06	—	91	—	**N 100 H**	0–5	1334	1404	1	
		50	1·79	33·85	27·08	—	91	—	,,	71	,,	,,	1	
		60	1·49	33·89	27·14	—	100	—	,,	142	,,	,,	1	KT
		80	0·39	33·90	27·22	—	116	—	**N 70 H**	0–5	1427	1435	¼	
		100	0·09	33·94	27·26	—	124	—	,,	82	,,	,,	¼	
		150	−0·06	34·00	27·32	—	130	—	,,	164	,,	,,	¼	KT
		200	0·89	34·23	27·46	—	139							
WS 51	7	0	2·09	33·82	27·04	—	88	7·41	**N 50 V**	100–0	1535			
		10	2·04	33·80	27·03	—	88	7·43	**N 70 V**	50–0				
		20	1·97	33·82	27·05	—	90	7·34	,,	100–50				
		30	1·97	33·84	27·06	—	89	7·43	,,	210–100	—	1640		
		40	1·89	33·86	27·08	—	93	7·36	**N 100 H**	0–5	1654	1724	1	
		50	1·54	33·86	27·10	—	95	7·39	,,	64	,,	,,	1	
		60	1·12	33·87	27·15	—	103	7·32	,,	128	,,	,,	1	KT
		80	0·19	33·91	27·24	—	118	7·35	**N 70 H**	0–5	1744	1752	¼	
		100	0·07	33·93	27·26	—	121	6·93	,,	58	,,	,,	¼	

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
WS 51 *cont.*	54° 34′ 00″ S, 38° 57′ 00″ W	1927 9 i										
WS 52	54° 03′ 30″ S, 38° 35′ 00″ W	10 i	0630	184 gy. m.	NW	3	NW	3	o. m. e.	1012·4	3·06	
WS 53	From 54° 03′ 30″ S, 38° 35′ 00″ W to 53° 29′ 00″ S, 37° 13′ 45″ W	11–12 i	2130	—	var.	1	—	0	o.	1010·8	5·55	
WS 54	53° 29′ 00″ S, 37° 13′ 45″ W	12 i	0320	2281	NW×W	2–3	NW	1	o. f. e.	1017·4	0·83	
WS 55	53° 15′ 30″ S, 37° 13′ 45″ W	12 i	0935	—	NW×W	2–3	NW	1	o. f. e.	1017·4	0·83	
WS 56	Larsen Harbour, Drygalski Fjord, S Georgia	14 i	1300	—	var.	1–2	—	0	c.	998·8	7·2	
WS 57	53° 37′ 00″ S, 36° 51′ 00″ W	17 i	1150	—	NW	3–4	NW	1–2	o.	1004·8	3·33	
WS 58	53° 06′ 15″ S, 37° 06′ 30″ W	17 i	1702	—	NNE	3–4	NNE	1–2	o. p. r.	1001·2	2·5	
WS 59	52° 57′ 00″ S, 37° 06′ 30″ W	17 i	1858	—	NNE	3–4	NNE	3	o. m. d.	995·1	3·3	
WS 60	52° 47′ 00″ S, 37° 06′ 30″ W	17 i	2118	—	NNW	1–2	NNW	1	o. m. d.	994·9	3·1	
WS 61	53° 37′ 30″ S, 37° 06′ 30″ W	18 i	0054	2201 1892 st.	NW	1–2	—	0	o. f. d.	993·2	3·1	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
WS 51 *cont.*		150	0·24	34·09	27·38	—	132	6·08	**N 70 H**	119	1744	1752	¼	KT
		200	1·34	34·29	27·47	—	145	4·66						
WS 52	8	0	1·24	33·86	27·12	—	103	7·36	**N 50 V**	100–0	0630			
		10	1·29	33·86	27·12	—	106	7·25	**N 70 V**	50–0				
		20	1·17	33·86	27·13	—	106	7·27	,,	100–50				
		30	1·02	33·86	27·14	—	104	7·26	,,	180–100	—	0800		
		40	0·97	33·87	27·16	—	103	7·32	**N 100 H**	0–5	0830	0900	1	
		50	0·84	33·87	27·17	—	110	7·26	,,	100	,,	,,	1	
		60	0·39	33·91	27·23	—	113	7·21	**N 70 H**	0–5	0922	0930	¼	
		80	− 0·01	33·93	27·26	—	116	7·09	,,	54	,,	,,	¼	
		100	− 0·51	33·99	27·34	—	125	6·89	,,	108	,,	,,	¼	KT
		150	− 0·51	34·02	27·36	—	134	6·37						
WS 53	10	—	—	—	—	—	—	—	**N 100 H**	0–5	**2130**	**2145**	½	23 consecutive hauls (A–X) of 15 mins. duration
									,,	0–5	**0300**	**0315**		
WS 54	10	0	1·32	33·86	27·12	—	99	7·16	**N 50 V**	100–0	**0320**			
		10	1·14	33·86	27·13	—	105	7·21	**N 70 V**	50–0				
		20	1·00	33·86	27·14	—	110	7·27	,,	100–50				
		30	0·89	33·86	27·15	—	108	7·22	,,	250–100				
		40	0·87	33·86	27·15	—	108	7·28	,,	500–250	—	0420		
		50	0·84	33·86	27·15	—	106	7·18	**N 100 H**	0–5	0656	0726	1	
		60	0·79	33·87	27·17	—	111	7·26	,,	70	,,	,,	1	
		80	0·39	33·87	27·20	—	115	7·24	,,	140	,,	,,	1	KT
		100	− 0·21	33·99	27·32	—	128	6·70	**N 70 H**	0–5	0751	0759	¼	
		150	0·84	34·20	27·43	—	140	5·30	,,	70	,,	,,	¼	
		200	1·79	34·38	27·51	—	144	4·11	,,	140	,,	,,	¼	KT
		300	1·99	34·49	27·58	—	158	4·00						
		400	2·02	34·58	27·66	—	156	3·82						
		600	2·00	34·66	27·72	—	150	3·77						
WS 55	10	—	—	—	—	—	—	—	**N 100 H**	0–5	0942	1012	1	
									,,	82	,,	,,	1	
									,,	164	,,	,,	1	KT
WS 56	12	—	—	—	—	—	—	—	**NH**	2	—	—	—	collection of kelp root fauna
WS 57	15	—	—	—	—	—	—	—	**N 100 H**	0–5	1156	1226	1	
									,,	66	,,	,,	1	
									,,	132	,,	,,	1	KT
WS 58	15	—	—	—	—	—	—	—	**N 100 H**	0–5	1708	1738	1	
									,,	100	,,	,,	1	
									,,	200	,,	,,	1	KT
WS 59	15	—	—	—	—	—	—	—	**N 100 H**	0–5	1905	1935	1	
									,,	56	,,	,,	1	
									,,	113	,,	,,	1	KT
WS 60	15	—	—	—	—	—	—	—	**N 100 H**	0–5	**2125**	**2155**	1	
									,,	73	,,	,,	1	
									,,	146	,,	,,	1	KT
									N 70 H	50(–0)	**2220**	**2345**	3	
WS 61	16	0	1·57	33·87	27·12	—	101	7·31	**N 100 H**	0–5	**0100**	**0130**	1	
		10	1·56	33·86	27·10	—	106	7·25	,,	61	,,	,,	1	
		20	1·54	33·86	27·10	—	106	7·24	,,	132	,,	,,	1	KT
		30	1·50	33·86	27·11	—	108	7·19	**N 70 H**	0–5	**0157**	**0205**	¼	
		40	1·48	33·86	27·11	—	109	7·23	,,	80	,,	,,	¼	

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
WS 61 *cont.*	53° 37′ 30″ S, 37° 06′ 30″ W	1927 18 i										
WS 62	Wilson Harbour, S Georgia	19 i	1402	15–90	var.	1	—	0	o. f. r.	980·8	4·7	
WS 63	54° 36′ 00″ S, 39° 14′ 00″ W	20–21 i	1830	1752 gy. m. st.	SE	2–3	SE	1	o. c.	996·6	1·4	
WS 64	53° 48′ 45″ S, 38° 34′ 00″ W	21 i	0930 1200	137 gy. m.	ESE	3	ESE	1	o. g.	994·4	2·5	
WS 65	Undine Harbour (North), S Georgia	22 i	1200	—	var.	1	—	0	o.	1001·1	3·6	
WS 66	53° 31′ 15″ S, 42° 03′ 30″ W	18 ii	1005	150 s. st. sh.	W × N	5–6	conf.	6–7	b. q.	979·9	2·8	
WS 67	53° 19′ 00″ S, 45° 16′ 00″ W	20 ii	0615	1839	NNW	2–3	W	3	o. d.	999·8	5·0	mod. W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. °Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
WS 61 *cont.*		50	1·29	33·87	27·14	—	106	7·25	**N 70 H**	159	**0157**	**0205**	¼	KT
		60	0·98	33·87	27·16	—	111	7·27	**N 50 V**	100–0	**0230**			
		80	0·30	33·89	27·21	—	114	7·13	**N 70 V**	50–0				
		100	0·06	34·05	27·36	—	125	6·41	,,	100–50				
		150	0·69	34·41	27·60	—	139	5·45	,,	250–100				
		200	1·47	34·43	27·58	—	140	4·52	,,	500–250				
		300	1·92	34·54	27·64	—	137	4·01	,,	750–500				
		400	1·92	34·63	27·71	—	142	3·92	,,	1000–750	—	0530		
		500	1·95	34·67	27·73	—	137	3·96						
		750	1·75	34·72	27·79	—	139	3·87						
		1000	1·48	34·72	27·81	—	137	4·08						
		1500	1·04	34·72	27·84	—	133	4·28						
		2000	0·73	34·47	27·66	—	145	3·96						
WS 62	17	—	—	—	—	—	—	—	**BTS**	15–45	1402	1422		
									,,	26–83	1440	1504		
WS 63	18	0	2·58	33·71	26·91	—	95	7·24	**N 50 V**	100–0	1830			
		10	2·58	33·71	26·91	—	100	7·16	**N 70 V**	50–0				
		20	2·54	33·71	26·92	—	96	7·23	,,	100–50				
		30	2·52	33·71	26·92	—	100	7·25	,,	250–100				
		40	2·41	33·71	26·93	—	100	7·26	,,	500–250				
		50	1·22	33·77	27·05	—	106	7·36	,,	750–500				
		60	0·77	33·78	27·10	—	108	7·31	,,	1000–750	—	**2030**		
		80	−0·26	33·82	27·19	—	119	7·15	**N 100 H**	0–5	**2301**	**2331**	1	
		100	−0·61	33·89	27·25	—	123	7·06	,,	79	,,	,,	1	
		150	0·65	34·13	27·38	—	130	5·87	,,	157	,,	,,	1	KT
		200	1·54	34·25	27·42	—	133	4·95	**N 70 H**	0–5	**0006**	**0014**	¼	
		300	2·17	34·41	27·50		140	4·47	,,	80	,,	,,	¼	
		400	2·21	34·52	27·59	—	144	3·85	,,	161	,,	,,	¼	KT
		500	2·09	34·54	27·62	—	137	3·77						
		750	2·09	34·66	27·71	—	130	3·92						
		1000	1·82	34·71	27·78	—	130	4·00						
WS 64	19	—	—	—	—	—	—	—	—		—	—	—	current measurements by Ekman meter
WS 65	20	—	—	—	—	—	—	—	**Sh. coll.**	—	1200			
WS 66	17	—	—	—	—	—	—	—	**N 100 H**	0–5	1005	1035	1	
									,,	88	,,	,,	1	KT
									N 70 H	0–5	1054	1101	¼	
									,,	63	1058	1106	¼	
									,,	125	,,	,,	¼	KT
WS 67	19	0	3·69	33·80	26·88	—	—		**N 50 V**	100–0	0615			
		10	3·72	33·80	26·88	—	—	—	**N 70 V**	50–0				
		20	3·64	33·80	26·89	—	—	—	,,	100–50				
		30	3·56	33·80	26·89	—	—	—	,,	250–100				
		40	3·44	33·80	26·91	—	—	—	,,	500–250				
		50	3·39	33·78	26·90	—	—	—	,,	750–500				
		60	3·36	33·77	26·89	—	—	—	,,	1000–300				
		80	1·26	33·89	27·15	—	—	—	,,	1000–750	—	1030		
		100	1·16	33·95	27·21	—	—	—	**N 100 H**	0–5	1107	1137	1	
		150	1·53	34·04	27·25	—	—	—	,,	66	1200	1230	1	
		200	1·48	34·11	27·32	—	—	—	,,	133	1107	1137	1	KT
		300	2·09	34·23	27·37	—	—	—	**N 70 H**	0–5	1240	1248	¼	
		400	2·33	34·36	27·45	—	—		,,	66	,,	,,	¼	
		500	2·21	34·40	27·49	—			,,	133	,,	,,	¼	KT
		750	2·18	34·56	27·62									
		1000	2·13	34·63	27·69									
		1500	1·80	34·72	27·78									

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
WS 68	52° 53′ 00″ S, 48° 48′ 00″ W	1927 21 ii	0215	3197	SW	5–6	SW	6	c.	994·7	6·6	
WS 69	52° 19′ 00″ S, 52° 11′ 00″ W	22 ii	0015	2743	NNW	3	W	3	o. r.	996·5	6·93	W swell
WS 70	51° 58′ 00″ S, 55° 42′ 00″ W	22–23 ii	2145	—	NE	3	conf.	3	o. p.	1000·9	6·93	conf. swell
WS 71	6 miles N 60° E of C Pembroke Lt, E Falkland I 51° 38′ 00″ S, 57° 32′ 30″ W	23 ii	1355	82 s. 80 s.	NNW	6	NNW	5	o.	998·0	11·4	slight conf. swell
WS 72	51° 07′ 00″ S, 57° 34′ 00″ W	5 iii	1340 1620	95 s. sh. 95	NW×W	5	NW×W	5	c.	1009·3	7·8	
WS 73	51° 01′ 00″ S, 58° 54′ 00″ W. From 51° 02′ 00″ S, 58° 55′ 00″ W to 51° 00′ 00″ S, 58° 53′ 00″ W	6 iii	0700 0840	121 f. d. s. 130	WNW	5	WNW	4	b. c.	1007·8	10·0	NW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/oo	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
WS 68	20	0	5·29	33·96	26·84	—		—	**N 50 V**	100–0	**0215**			
		10	5·22	33·95	26·83	—		—	**N 70 V**	50–0				
		20	5·18	33·95	26·84	—	—	—	,,	100–50				
		30	5·15	33·95	26·84	—	—	—	,,	250–100				
		40	5·18	33·95	26·84	—	—	—	,,	500–250				
		50	5·14	33·96	26·85	—	—	—	,,	750–500				
		60	4·90	34·03	26·94	—	—	—	,,	1000–750	—	**0452**		
		80	4·12	34·16	27·13	—	—	—	**N 100 H**	0–5	0630	0701	1	
		100	3·96	34·16	27·14	—	—	—	,,	80	0631	,,	1	
		150	3·48	34·16	27·19	—	—	—	,,	161	,,	,,	1	KT
		200	3·41	34·16	27·20	—	—	—	**N 70 H**	0–5	0722	0730	¼	
		300	3·00	34·22	27·28	—	—	—	,,	66	0723	0731	¼	
		400	2·82	34·23	27·31	—	—	—	,,	132	,,	,,	¼	KT
		500	2·48	34·26	27·36									
		750	2·54	34·42	27·48									
		1000	2·36	34·56	27·61									
WS 69	21	0	7·01	34·07	26·71	—		—	**N 70 V**	50–0	**0015**			
		10	7·00	34·07	26·71	—	—	—	,,	100–50				
		20	6·97	34·07	26·71	—	—	—	,,	250–100	—	**0100**		
		30	6·97	34·07	26·71	—	—	—	**N 100 H**	0–5	**0244**	**0315**	1	
		40	6·88	34·11	26·76	—	—	—	,,	73	,,	**0322**	1	
		50	6·77	34·07	26·74	—	—	—	,,	146	,,	,,	1	KT
		60	6·79	34·07	26·74	—	—	—	**N 70 H**	0–5	**0348**	**0356**	¼	
		80	6·71	34·09	26·76	—	—	—	,,	55	**0344**	**0351**	¼	
		100	4·23	34·09	27·05	—	—	—	,,	110	,,	,,	¼	KT
		150	3·80	34·16	27·16	—	—	—	**N 70 V**	500–250	0630			
		200	3·42	34·13	27·17	—	—	—	,,	750–500				
		300	2·81	34·11	27·22	—	—	—	,,	1000–750				
		400	2·57	34·16	27·27	—	-	—	**N 50 V**	100–0	-	0800		
		500	2·42	34·18	27·31									
		750	2·51	34·31	27·40									
		1000	2·46	34·44	27·50									
WS 70	21	0	7·20	34·04	26·66	—	-	·	**N 50 V**	100–0	**2145**			
		10	7·19	34·07	26·68				**N 70 V**	50–0				
		20	7·14	34·08	26·70	—	—	—	,,	100–50				
		30	7·14	34·07	26·69	·		·	,,	250–100				
		40	6·91	34·07	26·72		—	—	,,	500–250				
		50	6·85	34·07	26·73	-	—	-	,,	750–500				
		60	6·77	34·07	26·74	·	·	—	,,	1000–750		**0026**		
		80	5·80	34·11	26·89		—	—	**N 100 H**	0–5	**0049**	**0119**	1	
		100	5·01	34·16	27·03	—	—	·	,,	73	,,	,,	1	
		150	4·35	34·16	27·10		—		,,	146	,,	,,	1	KT
		200	4·24	34·16	27·11	—	—	—	**N 70 H**	0–5	**0141**	**0149**	¼	
		300	4·07	34·19	27·16	—	-	·	,,	86	,,	,,	¼	
		400	3·89	34·19	27·18	·	—	—	,,	172	,,	,,	¼	KT
		500	3·76	34·19	27·19									
		750	3·25	34·20	27·25									
		1000	2·94	34·28	27·34									
WS 71	21	0	9·24	33·78	26·15		—	—	**OTC**	82–80	1410	1514	2	
		90	7·76	33·91	26·48									
WS 72	3	0	8·51	33·82	26·43	—	—		**OTC**	95	1520	1550	2	
		95	7·38	33·91	26·72		—	—	**N 7–T**					
									N 4–T					
									NCS–T					
WS 73	4	0	9·38	33·80	26·14		-	-	**OTC**	121–130	0715	0810	3	
		130	6·71	33·87	26·60	—	—	·	**N 7–T**					
									N 4–T					
									NCS–T					

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
WS 74	Anchorage, Elephant Jason I, W Falkland	1927 10 iii	1400	7	—	0	—	0	b.	1014·4	11·0	W swell
WS 75	51° 01′ 30″ S, 60° 31′ 00″ W. From 51° 00′ 00″ S, 60° 30′ 00″ W to 51° 02′ 42″ S, 60° 31′ 42″ W	10 iii	1730 1850	64 104	—	0	—	0	b. c.	1012·5	10·0	W swell
WS 76	51° 00′ 00″ S, 62° 02′ 30″ W. From 51° 00′ 00″ S, 62° 00′ 00″ W to 51° 00′ 00″ S, 62° 04′ 36″ W	11 iii	1325 1518	207 f. d. s. 205	NNW	4	NNW	3	b. c.	1000·6	11·10	
WS 77	51° 01′ 00″ S, 66° 31′ 30″ W. From 51° 00′ 00″ S, 66° 30′ 00″ W to 51° 02′ 00″ S, 66° 33′ 00″ W	12 iii	0935 1145	110 c. d. s. 113	W × S	6	W	6	b.	1002·8	11·4	
WS 78	51° 01′ 00″ S, 68° 04′ 30″ W. From 51° 01′ 00″ S, 68° 02′ 00″ W to 51° 01′ 00″ S, 68° 07′ 00″ W	13 iii	0550 0805	95 f. d. s. 71	NW	4	NW	4	b. c.	997·4	13·0	
WS 79	51° 01′ 30″ S, 64° 59′ 30″ W. From 51° 00′ 00″ S, 65° 00′ 00″ W to 51° 03′ 00″ S, 64° 59′ 00″ W	13 iii	1932 2225	132 f. d. s. 131	SSW	2	—	0	b. c.	1003·5	11·4	slight NW swell
WS 80	50° 57′ 00″ S, 63° 37′ 30″ W. From 50° 58′ 00″ S, 63° 39′ 00″ W to 50° 55′ 30″ S, 63° 36′ 00″ W	14 iii	0602 0822	152 f. d. s. 156	SW	3–4	SW	3	b. c.	1010·8	9·6	
WS 81	8 miles N 11° W of North I, W Falkland I. From 51° 30′ 00″ S, 61° 15′ 00″ W to 51° 30′ 30″ S, 61° 10′ 00″ W	19 iii	0653 0820	81 s. 82	S	2	S	1	b. c.	1016·3	10·0	
WS 82	54° 06′ 00″ S, 57° 46′ 00″ W. From 54° 05′ 00″ S, 57° 45′ 00″ W to 54° 07′ 00″ S, 57° 47′ 30″ W	21 iii	0453 0630	140 144	N × E	2–5	N × E	4	o. w.	982·6	7·5	wind and sea rising during trawling
WS 83	14 miles S 64° W of George I, E Falkland I. From 52° 28′ 00″ S, 60° 06′ 00″ W to 52° 30′ 00″ S, 60° 09′ 30″ W	24 iii	1032 1255	137 f. gn. s. sh. 129	SW	6	SW	6	b. c.	997·4	8·0	
WS 84	7½ miles S 9° W of Sea Lion I, E Falkland I. From 52° 33′ 00″ S, 59° 08′ 00″ W to 52° 34′ 30″ S, 59° 11′ 00″ W	24 iii	1640 1835	75 c. s. sh. st. 74	SSW	6	SSW	6	b. c.	1000·3	6·95	
WS 85	8 miles S 66° E of Lively I, E Falkland I. From 52° 09′ 00″ S, 58° 14′ 00″ W to 52° 08′ 00″ S, 58° 09′ 00″ W	25 iii	1645 1830	79 s. sh. 79	SE	2	SE	1	o.	1005·6	9·5	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
WS 74	8	—	—		-	—	—	—	**LH**	7	1400	1500		
WS 75	8	0 65	9·61 8·14	33·83 33·85	26·13 26·36	— —	— —	— —	**OTC N 7–T N 4–T NCS–T**	64–104	1742	1834	3	
WS 76	9	0 200	9·42 5·90	33·72 34·04	26·07 26·82	— —	— —	— —	**DC OTC N 7–T N 4–T NCS–T**	207 207–205	1325 1404	1340 1453	 3	
WS 77	10	0 115	9·77 8·30	33·40 33·43	25·77 26·02	— —	— —	— —	**DC OTC N 7–T N 4–T NCS–T**	110 110–113	0935 1035	1000 1132	 3	
WS 78	11	0 85	10·32 7·86	33·01 33·06	25·37 25·79	— —	— —	— —	**DC OTC N 7–T N 4–T NCS–T**	95 95–71	0550 0645	0601 0745	 3	
WS 79	11	0 125	9·26 7·83	33·62 33·64	26·03 26·25	— —	— —	— —	**DC OTC N 7–T N 4–T NCS–T**	132 132–131	**1932** **2015**	**1945** **2115**	 3	
WS 80	12	0 150	9·21 6·77	33·69 33·72	26·08 26·47	— —	— —	— —	**DC OTC N 7–T N 4–T NCS–T**	152 152–156	0602 0701	0617 0805	 3	
WS 81	16	0 75	8·90 8·22	33·86 33·89	26·26 26·39	— —	— —	— —	**OTC N 7–T N 4–T NCS–T**	81–82	0705	0802	3	
WS 82	18	0 130	6·64 6·62	34·05 34·08	26·74 26·76	— —	— —	— —	**OTC N 7–T N 4–T NCS–T**	140–144	**0518**	**0550**	2·5	
WS 83	20	0 120	8·43 7·60	33·73 33·83	26·23 26·44	— —	— —	— —	**DC OTC N 7–T N 4–T NCS–T**	137 137–129	1040 1125	1055 1225	 3	
WS 84	20	0 70	8·23 8·20	33·75 33·76	26·28 26·29	— —	— —	— —	**DC OTC N 7–T N 4–T NCS–T**	75 75–74	1640 1710	1650 1815	 3	
WS 85	21	0 75	8·38 8·30	33·78 33·79	26·29 26·30	— —	— —	— —	**DC OTC N 7–T N 4–T NCS–T**	79 79	1645 1715	1650 **1815**	 3	

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. °Cent.	Remarks
WS 86	53° 53′ 30″ S, 60° 34′ 30″ W. From 53° 53′ 00″ S, 60° 37′ 00″ W to 53° 54′ 00″ S, 60° 32′ 00″ W	1927 3 iv	0556 0925	151 s. sh. st. 147	NW	3–4		0	o. g.	986·7	8·5	NW swell
WS 87	54° 07′ 30″ S, 58° 16′ 00″ W. From 54° 09′ 00″ S, 58° 16′ 00″ W to 54° 06′ 00″ S, 58° 16′ 00″ W	3 iv	1745 2000	96 s. st. sh. 127	var.	1–2	-	0	o.	983·6	7·78	conf. swell
WS 88	54° 00′ 00″ S, 64° 57′ 30″ W. From 54° 00′ 00″ S, 65° 00′ 00″ W to 54° 00′ 00″ S, 64° 55′ 00″ W	6 iv	1540 1730	118 s. sh. st. 118	NE	4–5	NE	5	b. c.	993·0	7·22	
WS 89	9 miles N 21° E of Arenas Pt Lt, Tierra del Fuego. From 53° 01′ 00″ S, 68° 07′ 00″ W to 52° 59′ 30″ S, 68° 06′ 00″ W	7 iv	1037 1220	23 m. g. st. 21	SW	1		0	o. c.	993·0	8·89	ENE swell
WS 90	13 miles N 83° E of C Virgins Lt, Argentine Republic. From 52° 18′ 00″ S, 68° 00′ 00″ W to 52° 19′ 30″ S, 67° 57′ 00″ W	7 iv	1727 1912	82 f. d. s. 81	NE	0–1	—	0	b. w. c.	996·4	9·44	NNE swell
WS 91	52° 53′ 45″ S, 64° 37′ 30″ W. From 52° 54′ 30″ S, 64° 39′ 00″ W to 52° 53′ 00″ S, 64° 36′ 00″ W	8 iv	0654 0920	191 f. d. s. sh. 205		0	—	0	o. g. p.	997·8	9·16	N swell
WS 92	51° 58′ 30″ S, 65° 01′ 00″ W. From 52° 00′ 00″ S, 65° 00′ 00″ W to 51° 57′ 00″ S, 65° 02′ 00″ W	8 iv	1442 1635	145 f. d. s. st. 143		0	—	0	s. p. r.	999·3	8·89	N × E swell
WS 93	7 miles S 80° W of Beaver I, W Falkland I From 51° 51′ 00″ S, 61° 30′ 00″ W to 51° 54′ 00″ S, 61° 30′ 00″ W	9 iv	0511 0710	133 gy. s. 130		0	—	0	b. c.	1006·0	7·5	SE swell
WS 94	50° 00′ 15″ S, 64° 57′ 45″ W. From 50° 00′ 00″ S, 65° 00′ 00″ W to 50° 00′ 30″ S, 64° 55′ 30″ W	16 iv	0705 0908	110 f. d. s. 126	NW NE × N	2 5	NE × N NE × N	4 4	o. o.	1009·4 1009·4	8·89 8·89	
WS 95	48° 58′ 15″ S, 64° 45′ 00″ W. From 48° 57′ 00″ S, 64° 45′ 00″ W to 48° 59′ 30″ S, 64° 45′ 00″ W	17 iv	0521 0850	109 f. d. s. st. sh. 108	NW	2–3	—	0	c.	999·1	11·9	NW swell
WS 96	48° 00′ 45″ S, 64° 58′ 00″ W. From 48° 00′ 00″ S, 65° 00′ 00″ W to 48° 01′ 30″ S, 64° 56′ 00″ W	17 iv	1422 1719	96 f. d. s. 96	var.	1	—	0	b. c.	1001·8	12·2	N × E swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	Remarks
WS 86	2	0	7·09	33·96	26·61	-	–	-	**DC**	151	**0556**	**0612**		
		140	6·82	34·00	26·67	-	—	—	**OTC** **N 7–T** **N 4–T** **NCS–T**	151–147	0755	0855	3	
WS 87	2	0	6·67	34·09	26·76	—	—		**DC**	96	**1745**	**1800**		
		120	6·77	34·00	26·68	—	-	—	**OTC** **N 7–T** **N 4–T** **NCS–T**	96–127	**1815**	**1910**	3	
WS 88	5	0	8·805	33·35	25·88	—	—	—	**DC**	118	1540	1550		
		110	8·18	33·46	26·05	—	—	—	**OTC** **N 7–T** **N 4–T** **NCS–T**	118	1608	1713	3	trawl torn in two places
WS 89	6	0	9·29	32·88	25·43	—	—	—	**DC**	23	1037	1043		
		18	9·27	32·88	25·44	—		—	**OTC** **N 7–T** **N 4–T** **NCS–T**	23–21	1130	1205	1·6	
WS 90	6	0	9·07	32·90	25·48	—	—	—	**DC**	82	1727	**1735**		
		75	8·86	32·95	25·56	—	—		**OTC** **N 7–T** **N 4–T** **NCS–T**	82–81	**1752**	**1852**	2·4	
WS 91	7	0	8·32	33·33	25·93	—	—	—	**DC**	191	0654	0705		
		200	7·34	33·83	26·47	—	—	—	**OTC** **N 7–T** **N 4–T** **NCS–T**	191–205	0800	0906	2·4	
WS 92	7	0	8·80	33·31	25·85	—	–	-	**DC**	145	1442	1450		
		135	8·17	33·48	26·07	-	—	–	**OTC** **N 7–T** **N 4–T** **NCS–T**	145–143	1515	1617	3	
WS 93	8	0	8·16	33·70	26·26	—	—	—	**DC**	133	**0511**	**0520**		
		125	7·30	33·88	26·52	—	—	—	**OTC** **N 7–T** **N 4–T** **NCS–T**	133–130	**0550**	0652	3	trawl torn
WS 94	14	0	8·48	33·44	26·00	—	—	—	**DC**	110	0705	0715		
		120	7·95	33·34	26·00	—	—	—	**OTC**	110–126	0747	0847	3	
WS 95	15	0	9·70	33·42	25·80	—	—	—	**DC**	109	**0521**	**0522**		
		100	8·33	33·40	25·99	—	—	—	**OTC**	109–108	**0615**	0720	2·6	
									TYF	30(–0)	0810	0841	0·4	
WS 96	15	0	10·41	33·24	25·53	—	—	—	**DC**	96	1422	1432		
		90	10·04	33·30	25·63	—	-	—	**OTC**	96	1553	1653	3	

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
WS 97	49° 00′ 30″ S, 61° 58′ 00″ W. From 49° 00′ 00″ S, 62° 00′ 00″ W to 49° 01′ 00″ S, 61° 56′ 00″ W	1927 18 iv	0525 0750	146 s. g. st. 145	ENE	2–3	—	0	g. o. r.	995·1	9·7	conf. swell
WS 98	49° 54′ 15″ S, 60° 35′ 30″ W. From 49° 53′ 00″ S, 60° 37′ 00″ W to 49° 55′ 30″ S, 60° 34′ 00″ W	18 iv	1605 1815	173 f. d. s. 171	SE	6	SE	5	g. o. m.	989·7	7·78	
WS 99	49° 42′ 00″ S, 59° 14′ 30″ W. From 49° 41′ 00″ S, 59° 14′ 00″ W to 49° 43′ 00″ S, 59° 15′ 00″ W	19 iv	0510 0735	251 f. d. s. 225	S × W	5–6	S × W	5	b. c.	995·4	7·22	
WS 100	50° 53′ 00″ S, 61° 26′ 00″ W	23 iv	0410	132	W	4	W × N	4	c.	1008·5	8·3	
WS 101	50° 27′ 00″ S, 62° 06′ 00″ W	23 iv	1105	164	W	3	W	3	o. c.	1008·9	9·1	
WS 102	50° 05′ 00″ S, 62° 37′ 00″ W	23 iv	1630	147	W	2–3	W	3	b.	1009·1	8·8	
WS 103	49° 40′ 00″ S, 63° 13′ 00″ W	23–24 iv	2240	150	NW	2–3	NW	3	b. w.	1005·9	9·7	
WS 104	49° 18′ 00″ S, 63° 40′ 00″ W	24 iv	0505	137	NNW	3	NNW	4	b.	999·9	10·0	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. °Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
WS 97	16	0	8·90	33·71	26·16	—	—	–	**DC**	146	**0525**	**0542**		
		140	6·41	33·89	26·65	—	—	—	**OTC**	146–145	**0620**	0730	2·8	
WS 98	16	0	9·07	33·83	26·21	—	—	–	**DC**	173	1605	1612		
		165	5·30	33·98	26·85	—	—		**OTC**	173–171	1645	1755	3	
WS 99	17	0	8·25	33·84	26·35	—	—	-	**DC**	251	**0510**	**0527**		
		220	5·94	34·00	26·79	—	—	·	**OTC**	251–225	**0605**	0710	2·3	
WS 100	21	0	7·78	33·79	26·38	—	78	·	**N 50 V**	100–0	**0425**			
		10	7·74	33·78	26·38	—	80	—	**N 70 V**	50–0				
		20	7·73	33·82	26·41	—	80	—	,,	122–50	—	**0515**		
		30	7·70	33·77	26·37	—	80		**N 100 H**	0–5	**0546**	**0616**	1	
		40	7·68	33·76	26·37		81	—	,,	61	,,	,,	1	
		50	7·68	33·77	26·37	—	84	—	,,	122	,,	,,	1	KT. Net touched bottom
		60	7·66	33·80	26·40	—	88		**N 70 H**	0–5	**0646**	0654	¼	
		80	7·58	33·81	26·42		90	—	,,	49	,,	,,	¼	
		100	7·50	33·81	26·44	—	96		,,	99	,,	,,	¼	KT
		125	7·39	33·84	26·47	—	98							
WS 101	21	0	8·20	33·66	26·21	—	70	—	**N 70 V**	50–0	1105			
		10	8·14	33·66	26·22	—	79	—	,,	100–50				
		20	8·11	33·62	26·20	—	76		,,	150–100				
		30	8·23	33·59	26·16	—	76	—	**N 50 V**	100–0	—	1135		
		40	8·11	33·65	26·22	—	76	—	**N 100 H**	0–5	1153	1222	1	
		50	8·10	33·65	26·22	—	76	—	,,	52	,,	1226	1	
		60	8·09	33·66	26·23	—	78	—	,,	104	,,	,,	1	KT
		80	7·71	33·71	26·23	—	89		**N 70 H**	0–5	1245	1253	¼	
		100	7·62	33·79	26·40	—	91	—	,,	57	,,	,,	¼	
		155	6·96	33·87	26·57	—	105	—	,,	114	,,	,,	¼	KT
WS 102	21	0	8·97	33·64	26·08	—	70		**N 50 V**	100–0	1630			
		10	8·47	33·64	26·16	—	70	—	**N 70 V**	50–0				
		20	8·48	33·65	26·16	—	71		,,	100–50	—	1645		
		30	8·41	33·64	26·17		71	—	**N 100 H**	0–5	1700	**1730**	1	
		40	8·41	33·64	26·17	—	71	—	,,	44	,,	,,	1	
		50	8·41	33·64	26·17	—	71		,,	88	,,	,,	1	KT
		60	8·32	33·64	26·18	·	74	—	**N 70 H**	0–5	**1751**	**1800**	¼	
		80	8·37	33·68	26·20	—	74	—	,,	45	,,	,,	¼	
		100	7·06	33·73	26·43	—	99		,,	90	,,	,,	¼	KT
WS 103	21–22	0	8·49	33·67	26·17	—	70	—	**N 50 V**	100–0	**2240**			
		10	8·44	33·67	26·18	—	70	—	**N 70 V**	50–0				
		20	8·44	33·64	26·16	—	73		,,	111–50		**2315**		
		30	8·44	33·64	26·16	—	73	—	**N 100 H**	0–5	**2319**	**2350**	1	
		40	8·39	33·64	26·17	—	75		,,	54	,,	,,	1	
		50	8·34	33·64	26·18	—	75	—	,,	108	,,	,,	1	KT
		60	8·39	33·67	26·19	—	78	—	**N 70 H**	0–5	**0017**	**0028**	¼	
		80	6·70	33·68	26·44		103		,,	55	,,	,,	¼	
		100	6·64	33·64	26·42	—	106	—	,,	110	,,	,,	¼	KT
WS 104	22	0	8·24	33·57	26·13	—	76	·	**N 50 V**	100–0	**0505**			
		10	8·24	33·52	26·10	—	76		**N 70 V**	50–0	—	—		no catch: haul repeated at 0900
		20	8·24	33·52	26·10	—	75	—	,,	100–50	·	**0535**		
		30	8·24	33·52	26·10	—	85	·	**N 100 H**	0–5	**0601**	**0631**	1	
		40	8·24	33·57	26·13	—	84	—	,,	59	0657	0727	1	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 104 *cont.*	49° 18′ 00″ S, 63° 40′ 00″ W	1927 24 iv										
WS 105	48° 50′ 00″ S, 64° 24′ 00″ W	24 iv	1515	109	NW	3	NW	4	b.	999·5	11·6	
WS 106	48° 25′ 00″ S, 65° 00′ 00″ W	24 iv	2145	110	NW	1	--	0	b.	1002·4	13·3	
WS 107	48° 00′ 00″ S, 65° 29′ 00″ W	25 iv	0615	60	NW	2–3	NW	3	b.	1002·0	13·0	
WS 108	48° 30′ 45″ S, 63° 33′ 45″ W. From 48° 30′ 00″ S, 63° 36′ 00″ W to 48° 31′ 30″ S, 63° 31′ 30″ W	25 iv	1625 1825	118 f. d. s. 120	NNW	3	NNW	2	b.	1003·0	13·0	
WS 109	50° 18′ 48″ S, 58° 28′ 30″ W. From 50° 19′ 00″ S, 58° 27′ 00″ W to 50° 18′ 36″ S, 58° 30′ 00″ W	26 iv	1630	145 f. d. s.	WSW	6–7	WSW	6	b. c.	1016·4	7·7	
WS 110	53° 46′ 00″ S, 35° 47′ 00″ W	26 v	1100	988	W	6	W	6	b.	994·9	−1·7	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
WS 104 *cont.*		50	8·24	33·57	26·13	—	84	—	N 100 H	119	0601	0631	1	KT
		60	8·24	33·62	26·18	—	84	—	N 70 H	0–5	0744	0752	¼	
		80	8·28	33·63	26·18	—	88	—	,,	55	,,	,,	¼	
		90	7·00	33·57	26·31	—	103	—	,,	110	,,	,,	¼	KT
		100	7·00	33·57	26·31	-	103	—	N 70 V	50–0	0900			
		130	6·95	33·56	26·31	—	106							
WS 105	22	0	8·88	33·49	25·98	—	75		N 50 V	100–0	1515			
		10	8·84	33·55	26·03	—	74	—	N 70 V	50–0				
		20	8·80	33·55	26·04	-	78	–	,,	95–50		1540		
		30	8·76	33·55	26·05		78		N 100 H	0–5	1615	1645	1	
		40	8·76	33·55	26·05		78	—	,,	50	,,	,,	1	
		50	8·50	33·55	26·09	—	84	—	,,	101	,,	,,	1	KT
		60	8·47	33·51	26·06	—	84	—	N 70 H	0–5	1705	1713	¼	
		80	8·44	33·48	26·03	—	88	—	,,	50	,,	,,	¼	
		100	8·45	33·49	26·04	—	99		,,	100	,,	,,	¼	KT
WS 106	22	0	9·88	33·22	25·61	—	68		N 50 V	100–0	2145			
		10	9·88	33·28	25·65	—	68	—	N 70 V	50–0				
		20	9·83	33·30	25·67		73	—	,,	89–50	—	2215		
		30	9·82	33·28	25·66	—	73	—	N 100 H	0–5	2232	2302	1	
		40	9·72	33·30	25·68	—	73		,,	50	,,	,,	1	
		50	9·61	33·31	25·72	—	73	—	,,	100	,,	,,	1	KT
		60	9·56	33·34	25·75	—	73	—	N 70 H	0–5	2332	2342	¼	
		80	9·44	33·33	25·76	—	73	—	,,	41	,,	,,	¼	
		100	9·43	33·35	25·78	—	80	—	,,	82	,,	,,	¼	KT
WS 107	23	0	10·55	33·06	25·36	—	70	—	N 50 V	58–0	0615			
		10	10·54	33·06	25·36	—	70	·	N 70 V	58–0	—	0628		
		20	10·53	33·06	25·36	—	80	—	N 100 H	0–5	0634	0705	1	
		30	10·53	33·08	25·38	-	75	—	,,	60	,,	,,	1	KT
		40	10·51	33·10	25·40	—	73	-	N 70 H	0–5	0715	0723	¼	
		50	10·51	33·12	25·42	—	88	—	,,	56	,,	,,	¼	KT
WS 108	23	0	9·29	33·58	25·99	—	—	—	DC	118	1625	1635		
		110	6·92	33·58	26·34	—	—		OTC	118–120	1658	1759	3·3	
WS 109	24	—	—	—	—	—	-		DC	145	1640	1651		
									OTC	145	1713	1813	2·0	
WS 110	24	0	0·93	33·77	27·07	—	—	—	N 50 V	100–0	1100			
		10	0·94	33·77	27·07	—	—	—	N 70 V	50–0				
		20	0·94	33·78	27·09	—	—	—	,,	100–50				
		30	0·94	33·78	27·09	—	—	—	,,	250–100				
		40	0·94	33·78	27·09	—	—	—	,,	500–300				
		50	0·94	33·77	27·07	—	—	—	,,	750–500				
		60	0·96	33·78	27·09	—	—	—	,,	980–750	—	1600		
		80	0·99	33·78	27·09	—	—	—	N 100 H	0–5	1634	1704	1	
		100	1·00	33·80	27·10	—	—	—	,,	51	,,	,,	1	
		150	1·15	34·19	27·40	—	—	—	,,	102(–0)	,,	,,	1	KT
		200	1·48	34·27	27·45	—	—	—	N 70 H	0–5	1741	1749	¼	
		300	1·88	34·39	27·51	—	—	—	,,	62	,,	,,	¼	
		400	2·03	34·52	27·61	—	—	—	,,	124	,,	,,	¼	KT
		500	2·07	34·60	27·67									
		750	1·91	34·65	27·72									
		900	1·85	34·70	27·77									

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
WS 111	53° 39′ 00″ S, 35° 34′ 00″ W	1927 26–27 v	1930	1500	SW	2–3	SW	3	b.	990·5	−1·7	
WS 112	53° 54′ 30″ S, 36° 06′ 00″ W	27 v	1100	155 st.	W × N	5	W × N	3–4	c.	998·6	−1·1	
WS 113	54° 07′ 00″ S, 36° 24′ 00″ W	28 v	0845	155 gy. m. st.	WNW	6	WNW	6	b. c.	995·4	0·0	
WS 114	54° 00′ 00″ S, 36° 12′ 00″ W	28 v	1215	163	W	6	W	4	c.	996·9	0·0	
WS 115	51° 50′ 45″ S, 37° 08′ 00″ W	30 v	2100	—	W	2	W	3	b. c.	1014·4	−1·4	
WS 116	49° 02′ 00″ S, 35° 06′ 00″ W	31 v	2100	—	SSE	1	-	0	b.	1019·8	2·2	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
WS 111	24	0	0·46	33·87	27·19	—	—	7·71	**N 50 V**	100–0	**2115**			
		10	0·45	33·86	27·17	·	—	7·54	**N 70 V**	50–0				
		20	0·46	33·86	27·17	—		7·57	,,	100–50				
		30	0·47	33·86	27·17	—		7·64	,,	250–100				
		40	0·47	33·88	27·20		·	7·64	,,	500–250				
		50	0·47	33·87	27·19		—	7·61	,,	750–500				
		60	0·48	33·87	27·19		—	7·66	,,	1000–750	—	**0045**		
		80	0·48	33·86	27·17	—	—	7·64	**N 100 H**	0–5	**1946**	**2016**	1	
		100	0·47	33·91	27·22	—	—	7·64	,,	(100)–50	,,	,,	1	
		150	0·20	34·08	27·37	—	—	6·51	,,	(200)–100	,,	,,	1	
		200	1·02	34·27	27·48		—	5·47	**N 70 H**	0–5	**2049**	**2057**	¼	
		300	1·40	34·49	27·62	—	—	4·70	,,	42	,,	,,	¼	
		400	1·89	34·62	27·70	—	—	4·11	,,	84	,,	,,	¼	KT
		500	1·76	34·68	27·75	-	—	4·22						
		750	1·65	34·70	27·78	—	—	4·31						
		1000	1·52	34·70	27·79	—	—	4·29						
		1500	1·07	34·72	27·84	—	—	4·52						
WS 112	25	0	0·90	33·78	27·10	—	—	7·57	**N 50 V**	100–0	1100			
		10	0·93	33·78	27·09	—	·	7·50	**N 70 V**	50–0				
		20	0·93	33·78	27·09	—	—	7·54	,,	100–50				
		30	0·93	33·78	27·09	—	—	7·45	,,	150–100	—	1150		
		40	0·93	33·78	27·09	—	—	7·50	**N 100 H**	0–5	1233	1303	1	
		50	0·93	33·78	27·09		—	7·52	,,	73	,,	,,	1	
		60	0·94	33·78	27·09	—	—	7·50	,,	146	,,	,,	1	KT
		80	0·96	33·78	27·09	—		7·50	**N 70 H**	0–5	1322	1329	¼	
		100	1·04	33·98	27·25	-	—	6·80	,,	77	,,	,,	¼	
		150	1·10	34·05	27·29	—	—	6·28	,,	154	,,	,,	¼	KT
WS 113	26	0	0·90	33·78	27·10	—	—	7·68	**N 50 V**	100–0	0900			
		10	0·88	33·78	27·10	—		7·57	**N 70 V**	50–0				
		20	0·84	33·78	27·10	—	—	7·48	,,	100–50				
		30	0·84	33·78	27·10	—		7·59	,,	150–100	—	0945		
		40	0·85	33·78	27·10	—	—	7·64	**N 100 H**	0–5	1015	1045	1	
		50	0·90	33·78	27·10	—	—	7·64	,,	55	,,	,,	1	
		60	1·10	33·80	27·09	·	·	7·23	,,	110	,,	,,	1	KT
		80	1·10	33·82	27·11	—	—	7·14	**N 70 H**	0–5	1103	1111	¼	
		100	1·10	33·81	27·10	—	—	7·04	,,	31(–0)	,,	,,	¼	
		150	1·10	33·87	27·15	·		6·93	,,	62	,,	,,	¼	KT
WS 114	26	0	0·90	33·69	27·02	—		—	**N 50 V**	100–0	1215			
		10	0·90	33·69	27·02	—	—	—	**N 70 V**	50–0				
		20	0·90	33·69	27·02	-	—	—	,,	100–50				
		30	0·90	33·70	27·03	—	—	—	,,	150–100	—	1305		
		40	0·90	33·72	27·04	—	—	—	**N 100 H**	0–5	1321	1351	1	
		50	0·91	33·71	27·04	—	—	—	,,	58	,,	,,	1	
		60	0·93	33·73	27·04	—		—	,,	116	,,	,,	1	KT
		80	1·06	33·82	27·12	—	—	—	**N 70 H**	0–5	1411	1419	¼	
		100	1·04	34·00	27·26	—	—	—	,,	58	,,	,,	¼	
		150	1·15	34·11	27·34	—		—	,,	116	,,	,,	¼	KT
WS 115	1	·	—	—	—	—		—	**N 100 H**	0–5	**2110***	**2140***	1	
									,,	50*	,,	,,	1	
									,,	100*	,,	,,	1	
									N 70 H	0–5	**2200***	**2208***	¼	
									,,	50*	,,	,,	¼	
									,,	100*	,,	,,	¼	
WS 116	2	—		—	—	—	—	—	**N 100 H**	0–5	**2110***	**2140***	1	* Approximate times and depths given: actual data lost in storm following station 118
									,,	50*	,,	,,	1	
									,,	100*	,,	,,	1	
									N 70 H	0–5	**2200***	**2208***	¼	
									,,	50*	,,	,,	¼	
									,,	100*	,,	,,	¼	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 117	47° 24′ 15″ S, 30° 19′ 15″ W	1927 1 vi	2105	—	NW	5	NW	5	o.	1017·0	6·4	
WS 118	45° 42′ 45″ S, 25° 08′ 30″ W to 45° 37′ 30″ S, 24° 53′ 00″ W	2–3 vi	0000	—	NW	5	NW	6	o. r.	1010·1	7·8	
WS 119	42° 40′ 30″ S, 17° 46′ 15″ W	5 vi	2103		E	3–5	E	6	o.	1005·3	6·67	
WS 120	41° 28′ 15″ S, 13° 54′ 30″ W	6 vi	2104		SSW	1	—	0	b. c. p.	1021·0	7·8	
WS 121	40° 31′ 00″ S, 11° 01′ 00″ W	7 vi	1300	2000	NW×N	4	NW×N	4	b. c.	1024·6	11·3	
WS 122	40° 23′ 00″ S, 10° 29′ 00″ W	7–8 vi	2045	2000	W	3–4	—	0	b. c.	1024·4	11·1	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
WS 117	3	—	—	—	—	—	—	—	**N 100 H**	0–5	**2113**	**2143**	1	
									,,	45	,,	,,	1	
									,,	90	,,	,,	1	KT
									N 70 H	0–5	**2203**	**2210**	¼	
									,,	53	,,	,,	¼	
									,,	106	,,	,,	¼	KT
WS 118	4	—	—	—	—	—	—	—	**N 100 H**	0–5	**2134**	**2204**	1	
									,,	68	,,	,,	1	
									,,	137	,,	,,	1	KT
									N 70 H	0–5	**2222**	**2230**	¼	
									,,	66	,,	,,	¼	
									,,	132	,,	,,	¼	KT
									,,	0–5	**2330**	**2340**	⅓	28 consecutive hauls (A–CC) of 10 mins. duration
									,,	0–5	**0410**	**0420**	⅓	
WS 119	6	—	—	—	—	—	—	—	**N 100 H**	0–5	**2110**	**2140**	1	
									,,	100	,,	,,	1	
									,,	200	,,	,,	1	KT
									N 70 H	0–5	**2204**	**2212**	¼	
									,,	97	,,	,,	¼	
									,,	195	**2230**	**2238**	¼	KT
WS 120	7	—	-	—	—	—	—	—	**N 100 H**	0–5	**2111**	**2141**	1	
									,,	50	,,	,,	1	
									,,	101	,,	,,	1	KT
									N 70 H	0–5	**2159**	**2207**	¼	
									,,	53	,,	,,	¼	
									,,	106	,,	,,	¼	KT
WS 121	8	0	11·59	—	—	—	-	5·61	**N 50 V**	100–0	1300			
		10	11·59	34·60	26·37	—	—	5·61	**N 70 V**	50–0				
		20	11·59	34·60	26·37	—	—	5·65	,,	100–50				
		30	11·60	34·60	26·37	—	—	5·68	,,	250–100				
		40	11·60	34·65	26·41	—	—	5·64	,,	500–250				
		50	11·60	—	—	—		5·56	,,	750–420				
		60	11·60	34·56	26·34	—	—	5·61	,,	1000–0				
		80	11·60	—	—	—	—	5·60	,,	1000–700	—	**1700**		
		100	11·58	34·54	26·33	—	-	5·63	**N 100 H**	0–5	**1718**	**1748**	1	
		150	9·88	34·79	26·83	—	—	5·90	,,	50	,,	,,	1	
		200	9·64	34·80	26·88	—	—	5·38	,,	101	,,	,,	1	KT
		300	8·69	—	—	—	-	5·47	**N 70 H**	0–5	**1810**	**1818**	¼	
		400	7·54	34·50	26·96	—	—	5·22	,,	59	,,	,,	¼	
		500	6·30	34·49	27·13	—	—	4·96	,,	119	,,	,,	¼	KT
		750	4·74	34·18	27·08									
		1000	3·55	—	—	—	—	5·16						
		1500	2·68	34·39	27·45	—	—	5·13						
WS 122	8	0	11·59	34·47	26·27	—	—	—	**N 50 V**	100–0	**2045**			
		10	11·63	—	—	—	-	—	**N 70 V**	50–0				
		20	11·61	—	—	—	—	—	,,	100–50				
		30	11·64	34·52	26·30	—	—	—	,,	250–100				
		40	11·65	34·56	26·33	—	—	—	,,	500–250				
		50	11·67	34·58	26·34	—	—	—	,,	750–500				
		60	11·67	34·58	26·34	—	-	—	,,	1000–750	—	**2345**		
		80	11·69	34·61	26·37	—	—	—	**N 100 H**	0–5	**0016**	**0046**	1	
		100	11·69	34·60	26·35	—	·	—	,,	50	,,	,,	1	
		150	9·89	34·74	26·43	—	—	—	,,	101	,,	,,	1	KT
		200	9·52	34·76	26·51	—	—	—	**N 70 H**	0–5	**0111**	**0119**	¼	
		300	8·84	34·56	26·72	—	—	—	,,	52	,,	,,	¼	
		400	6·68	34·40	27·01	—	—	—	,,	104	,,	,,	¼	KT

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 122 *cont.*	40° 23′ 00″ S, 10° 29′ 00″ W	1927 7–8 vi										
WS 123	Gough I	8–9 vi										
WS 124	Gough I, Penguin I anchorage, 40° 16′ S, 9° 58′ W	9 vi	1824	40–60	NW	1	—	0	b. c.	1025·2	10·0	
WS 125	40° 14′ 45″ S, 10° 15′ 00″ W	9 vi	0715	2500	NW	1	—	0	b. c.	1025·2	10·0	
WS 126	40° 23′ 00″ S, 10° 15′ 00″ W	10 vi	0700	1500	NW	5	NW	3	b. c. p.	1022·4	9·4	
WS 127	40° 19′ 00″ S, 10° 06′ 00″ W	10 vi	1200	940 gl. oz.	NW	4	NW	4	o.	1020·2	10·5	
WS 128	West side of Gough I, inshore 40° 19′ 00″ S, 10° 04′ 00″ W	10 vi	1615	120–90	NW	4	NW	3	o.	1017·3	11·9	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	Hauled	Length of tow (miles)	Remarks
WS 122 *cont.*		500	5·48	34·34	27·12									
		750	4·11	34·22	27·17									
		1000	3·18	34·20	27·25									
		1500	2·66	34·50	27·53									
WS 123	9	—	—	—	—	—	—	—	**Sh. coll.**					
WS 124	10	-	—	—	—	—	—	- -	**DLH**	40–60	**1824**	**1833**		
WS 125	10	0	11·63		—	—	—	-	**N 50 V**	100–0	**1915**			
		10	11·61	34·56	26·33	-	—	-	**N 70 V**	50–0				
		20	11·59	34·56	26·34	—	—		,,	100–50				
		30	11·59	34·56	26·34	—			,,	250–100				
		40	11·58	34·56	26·34	—	-		,,	500–250				
		50	11·58	34·56	26·34	—	—		,,	750–500				
		60	11·55	34·58	26·37	-	—	—	,,	1000–750	–	**2220**		
		80	11·53	34·45?	26·26?	—	—	—	**N 100 H**	0–5	**2247**	**2317**	1	
		100	11·49	34·58	26·38	—	-		,,	82	,,	,,	1	
		150	10·99	34·54	26·44		—		,,	165(-82)	,,	,,	1	KT
		200	9·57	34·60	26·73	—	—	—	**N 70 H**	0–5	**2347**	**2355**	¼	
		300	7·97	34·49	26·89	—	—	—	,,	70	,,	,,	¼	
		400	6·48	34·43	27·06		—		,,	139	,,	,,	¼	KT
		500	5·48	34·31	27·09									
		750	3·81	34·20	27·19									
		1000	2·98	34·22	27·28									
		1500	2·66	34·52	27·55									
WS 126	11	0	11·79	34·56	26·30		—		**N 50 V**	100–0	**0700**			
		10	11·79	34·56	26·30	—	—		**N 70 V**	50–0				
		20	11·79	34·56	26·30	—	—	-	,,	100–50				
		30	11·79	34·56	26·30	—	-	—	,,	250–100				
		40	11·79	34·56	26·30	—	—		,,	500–250				
		50	11·79	34·56	26·30	—		-	,,	750–500				
		60	11·79	34·56	26·30		-	—	,,	1000–750	—	0940		
		80	11·75	34·59	26·33	—	-		**N 100 H**	0–5	1003	1033	1	
		100	11·70	34·65	26·39	—		—	,,	91	,,	,,	1	
		150	9·69	34·67	26·76	—	—	—	,,	183	,,	,,	1	KT
		200	9·19	34·67	26·85	—	—	—	**N 70 H**	0–5	1049	1057	¼	
		300	8·06	34·49	26·88	—	—		,,	73	,,	,,	¼	
		400	6·68	34·34	26·97			—	,,	146	,,	,,	¼	KT
		500	5·09	34·22	27·06									
		750	3·68	34·14	27·16									
		1000	2·97	34·25	27·31									
		1500	2·66	34·58	27·60									
WS 127	11	0	11·74	34·52	26·29		—	5·75	**N 50 V**	100–0	1200			
		10	11·71	34·58	26·34	—	—	5·60	**N 70 V**	50–0				
		20	11·69	34·58	26·34	—	—	5·61	,,	100–50				
		30	11·69	34·58	26·34			5·65	,,	250–100				
		40	11·69	34·58	26·34	·	—	7·31?	,,	500–250				
		50	11·69	34·58	26·34	—	—	5·72	,,	750–450				
		60	11·69	34·58	26·34	—	—	5·60	,,	1000–650	—	1430		
		80	11·67	34·58	26·34	—		5·60	**N 100 H**	0–5	1452	1522	1	
		100	11·60	34·58	26·36		—	5·54	,,	87	,,	,,	1	
		150	11·04	34·63	26·50		—	5·35	,,	174	,,	,,	1	KT. Physical observations at 500, and 850 unreliable
		200	9·79	34·69	26·76	—	—	5·36	**N 70 H**	0–5	1541	1549	¼	
		300	8·49	34·58	26·89	—	-	5·28	,,	87	,,	,,	¼	
		500	7·01	34·30	26·89	—		5·14	,,	174	,,	,,	¼	KT
		850	3·88	34·22	27·19	-		5·28						
WS 128	11	—	—	-	·	-	—	—	**DLH**	120–90	1626	1636		

Station	Position	Date	Hour	Sounding (metres)	WIND Direction	WIND Force	SEA Direction	SEA Force	Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
WS 129	40° 10′ 30″ S, 9° 40′ 45″ W	1927 11 vi	0715	1500	WNW	4–5	WNW	4	b. c.	1015·5	11·6	
WS 130	40° 06′ 00″ S, 9° 22′ 00″ W	11 vi	1255	1500	NW×W	4–5	NW×W	5	o. r.	1013·6	11·1	
WS 131	39° 35′ 00″ S, 3° 33′ 15″ W	12 vi	2126		SW	3–4	SW	4	o. p.	1019·8	9·4	
WS 132	38° 21′ 30″ S, 0° 37′ 15″ E	13 vi	2102	—	E × S	1	—	0	b. c.	1031·8	8·3	
WS 133	37° 49′ 30″ S, 5° 01′ 45″ E to 37° 38′ 45″ S, 5° 50′ 00″ E	14–15 vi	2105	—	NW	3–4	NW	4–5	b. c.	1028·3	14·4	
WS 134	36° 57′ 00″ S, 8° 44′ 30″ E	15 vi	2115	·	NW	4	NW	2	b. c.	1027·6	13·8	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME Shot	Hauled	Length of tow (miles)	Remarks
WS 129	12	0	11·65	34·58	26·35	-	—		**N 50 V**	100–0	**0715**			
		10	11·59	34·58	26·36	-	—	5·60	**N 70 V**	50–0				
		20	11·59	34·52	26·31	—	—	5·59	,,	100–50				
		30	11·59	34·51	26·30	—	—	5·62	,,	250–100				
		40	11·59	34·51	26·30	—		5·65	,,	500–250				
		50	11·59	34·53	26·32	—		5·59	,,	750–500				
		60	11·59	34·56	26·34		—	5·58	,,	1000–750		0945	1	
		80	11·59	34·56	26·34		—	5·60	**N 100 H**	0–5	1023	1053	1	
		100	11·50	34·64	26·42		—	5·44	,,	50	,,	,,	1	KT
		150	10·48	34·65	26·61	—		5·33	,,	99(–50)	,,	,,	¼	
		200	10·39	34·83	26·77		-	5·23	**N 70 H**	0–5	1121	1129	¼	
		300	8·27	34·54	26·90		—	5·27	,,	55	,,	,,	¼	KT
		400	6·21	34·34	27·03		—	5·08	,,	110	,,	,,		
		500	5·48	34·25	27·04	—		5·16						
		750	3·88	34·22	27·19									
		1000	3·05	34·22	27·28	—	—	4·82						
		1500	2·66	34·43	27·48		—	3·80						
WS 130	12	0	12·09	34·63	26·30	-	—	—	**N 50 V**	100–0	1255			
		10	12·10	34·65	26·31	—	—	—	**N 70 V**	50–0				
		20	12·10	34·66	26·32	-	—		,,	100–50				
		30	12·09	34·66	26·32	-	—	—	,,	250–100				
		40	12·09	34·63	26·30	—	—	—	,,	500–250				
		50	12·09	34·63	26·30	—		-	,,	750–500				
		60	12·09	34·62	26·30		—		,,	1000–750	—	1510		
		80	12·09	34·62	26·30	—	—	—	**N 100 H**	0–5	1529	1559	1	
		100	12·09	34·66	26·32	—	—	—	,,	52	,,	,,	1	
		150	10·71	34·87	26·74	-	—		,,	104	,,	,,	1	KT
		200	10·51	34·81	26·80	—	-	—	**N 70 H**	0–5	1621	1629	¼	
		300	8·69	34·63	26·90	-	—	—	,,	60	,,	,,	¼	
		400	7·06	34·43	26·98	- -	—		,,	120	,,	,,	¼	KT
		500	5·48	34·43	27·19									
		750	4·46	34·21	27·13									
		1000	3·27	34·23	27·27									
		1500	2·66	34·40	27·46									
WS 131	12	—	—	—		—		- -	**N 100 H**	0–5	**2126**	**2156**	1	
									,,	46	,,	,,	1	
									,,	92	,,	,,	1	KT
									N 70 H	0–5	**2223**	**2231**	¼	
									,,	56	,,	,,	¼	
									,,	112	,,	,,	¼	KT
WS 132	13	—	—	—	—	—	—	—	**N 100 H**	0–5	**2108**	**2138**	1	
									,,	73	,,	,,	1	
									,,	146	,,	,,	1	KT
									N 70 H	0–5	**2159**	**2207**	¼	
									,,	77	,,	,,	¼	
									,,	155	,,	,,	¼	KT
WS 133	14	—	—	—	—	—	—	—	**N 100 H**	0–5	**2112**	**2142**	1	
									,,	50	,,	,,	1	
									,,	99	,,	,,	1	KT
									N 70 H	0–5	**2200**	**2208**	¼	
									,,	57	,,	,,	¼	
									,,	115	,,	,,	¼	KT
									,,	0–5	**2230** /	**2240** /	⅓	57 consecutive hauls (A–GGG) of 10 mins. duration. Sunrise 0705
									,,	0–5	0750	0800	⅓	
WS 134	15	—	—	—	—	—	—	—	**N 100 H**	0–5	**2121**	**2151**	1	
									,,	62	,,	,,	1	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 134 *cont.*	36° 57′ 00″ S, 8° 44′ 30″ E	1927 15 vi										
WS 135	35° 29′ 45″ S, 13° 04′ 45″ E	16 vi	2109		var.	1	—	0	b. c. p.	1031·0	13·3	
WS 136	34° 16′ 15″ S, 17° 15′ 15″ E	17 vi	2108	—	ESE	2–3	ESE	2–1	b.	1020·4	16·6	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME		Length of tow (miles)	
											Shot	Hauled		
WS 134 *cont.*									**N 100 H**	124	**2121**	**2151**	1	KT
									N 70 H	0–5	**2213**	**2221**	¼	
									,,	55	,,	,,	¼	
									,,	111	,,	,,	¼	KT
									N 100 B	126–0	**2241**	**2301**		
									N 70 B	123–0	,,	,,		KT
WS 135	16	—	—	—	—	—	—	—	**N 100 H**	0–5	**2115**	**2145**	1	
									,,	62	,,	,,	1	
									,,	124(–62)	,,	,,	1	KT
									N 70 H	0–5	**2216**	**2224**	¼	
									,,	62	,,	,,	¼	
									,,	124	,,	,,	¼	KT
WS 136	17	—	—	—	—	—	—	—	**N 100 H**	0–5	**2114**	**2144**	1	
									,,	55	,,	,,	1	
									,,	110	,,	,,	1	KT
									N 70 H	0–5	**2207**	**2215**	¼	
									,,	85	,,	,,	¼	
									,,	171	,,	,,	¼	KT

Station	Position	Date	WIND		Sea	Weather	Moon (age in days)
			Direction	Force			
	S Georgia	1925					
MS 1	1 cable SSE of Hope Pt, E Cumberland Bay	11 ii	—	0	0	o.	18
MS 2	2½ cables E of Hope Pt, E Cumberland Bay	11 ii	—	0	0	o.	18
MS 3	E Cumberland Bay. ¾ mile SE × S of Hope Pt, to ½ mile SE of Hobart Rk	11 ii	—	0	0	o.	18
MS 4	½ mile SE of Hobart Rk, E Cumberland Bay	11 ii	—	0	0	o.	18
MS 5	E Cumberland Bay. 2 cables S of Hope Pt to 1¼ cables S × E of King Edward Pt Lt	11 ii	—	0	0	o.	18
MS 6	E Cumberland Bay. ¼ mile S of Hope Pt to 1¼ cables S × E of King Edward Pt Lt	12 ii	NW	3	0	o.	19
MS 7	¼ mile SW of Hope Pt, E Cumberland Bay	12 ii	NW	3	0	—	19
MS 8	E Cumberland Bay. ½ mile E to 1·8 miles E × S of Hope Pt	14 ii	NW	0	3	o. s. q.	20
MS 9	1·8 miles E × S of Hope Pt, E Cumberland Bay	14 ii	NW	0	3	o. s. q.	20
MS 10	E Cumberland Bay. ¼ mile SE of Hope Pt to ¼ mile S of Govt Flagstaff	14 ii	NW	0	3	o. s. q.	20
MS 11	¼ mile SSW of Hope Pt, E Cumberland Bay	14 ii	NW	0	3	o. s. q.	20
MS 12	E Cumberland Bay. 1 cable E to 1 mile S × E ½ E of Hobart Rk	17 ii	—	0	0	b. c.	23
MS 13	1¼ miles SSE of Hope Pt, E Cumberland Bay	17 ii	—	0	0	b. c.	23
MS 14	From 1·5 miles SE × S to 1·5 miles S ½ W of Sappho Pt, E Cumberland Bay	17 ii	—	0	0	b. c.	23
MS 15	E Cumberland Bay. 3 miles SW of Merton Rk to 2¼ miles NNW of Dartmouth Pt	17 ii	—	0	0	b. c.	23
MS 16	3 miles SW of Merton Rk, E Cumberland Bay	17 ii		0	0	b. c.	23
MS 19	3 miles SW of Merton Rk, E Cumberland Bay	9 iv	—	0	0	b. c.	14
MS 20	1¼ miles SW × W of Merton Rk, E Cumberland Bay	9 iv		0	3	o.	14
MS 21	2¾ miles N of Macmahon Rk, E Cumberland Bay	9 iv	·	0	3	o.	14
MS 22	1·3 miles N of Dartmouth Pt, E Cumberland Bay	9 iv		0	3	o.	14
MS 23	1¼ miles SW × W of Merton Rk, E Cumberland Bay	12 iv	—	0	3	b. c.	17
MS 24	E Cumberland Bay. ½ cable SE of Hope Pt to 4 cables S × E of Hobart Rk	13 iv		0	0	b. c.	18
MS 25	E Cumberland Bay. 4½ cables NE to 1¼ cables N × W of Hobart Rk	13 iv	—	0	0	b. c.	18
MS 26	E Cumberland Bay. (A) 3¼ miles SSW of Merton Rk to 4½ cables NE of Hobart Rk. (B) 4½ cables NE to 1¼ cables N × W of Hobart Rk	15 iv	—	0	4	o.	20
MS 27	1¼ miles SW × W of Merton Rk, E Cumberland Bay	29 iv	—	0	2	b. c.	6
MS 28	1¼ miles E of Hobart Rk, E Cumberland Bay	30 iv	—	0	2	b. c.	7

Station	HYDROLOGICAL OBSERVATIONS				BIOLOGICAL OBSERVATIONS				Remarks
	Depth (metres)	Temp. ° Cent.	S ‰	σt	Gear	Depth (metres)	TIME		
							Shot	Hauled	
MS 1	—	—	—		**NC 50 H**	15	1730	1745	
MS 2	—	—	—		**NC 50 H**	15	1750	1805	
MS 3	—		—	—	**DS**	70	1810	1830	
MS 4	—	—	—	—	**NC 50 H**	15	1820	1830	
MS 5	—	—	—	—	**DS**	30–20	1850	1910	
MS 6	—	—		—	**BTS**	24–30	1915	1935	
MS 7	0	5·57	30·95	—	**NC 50 H**	15	1925	1935	
MS 8	—		—	—	**BTS**	70–?	1545	1630	trawl did not reach bottom
MS 9	0	3·57	32·39	—	**NC 50 H**	0	1615	1625	
MS 10	—	—		—	**BTS**	26–18	1720	1740	
MS 11	—	—	—	—	**NC 50 H**	9	1730	1740	
MS 12		—	—	—	**BTS**	25–60	1545	1630	
MS 13	—	—		—	**NC 50 V**	35–0	1630		
MS 14	—	—	—		**DS**	190–110	1730	1800	a little glacier ice
MS 15			—	—	**DS**	110	1830	1900	
MS 16	—	—	—	—	**NC 50 V**	40–0	1815		
MS 19	—	—	—	—	**NC 50 V**	160–0	1100		
					,,	120–80			
					,,	80–40	—	1200	
MS 20	0	2·50	33·17	—	**NC 50 V**	200–160	1430		
					,,	40–0			
MS 21	0	2·00	32·41	—	**NC 50 V**	40–0	1530		
MS 22	0	2·07	32·30	—	**NC 50 V**	40–0	1605		
MS 23	0	2·42	33·21	26·53	**NC 50 V**	40–0	1215		
	40	2·39	33·80	27·00	,,	80–40			
	80	2·30	33·98	27·16	,,	120–80			
	120	2·26	33·86	27·05	,,	160–120			
	160	1·84	33·98	27·19	,,	220–160	—	1445	
MS 24	—	—	—	—	**BTS**	30	1530	1600	
					NC 50 H	10	1545	1555	
MS 25	—	—	—		**BTS**	36	1800	1825	
					NC 50 H	10	1815	1825	
MS 26	—	—	—	—	**NC 50 H**	10	1745	1800	A
					,,	10	1805	1815	B
MS 27	0	1·56	31·59	25·30	**NC 50 V**	40–0	1300	—	some glacier ice
	40	2·18	33·82	27·04	,,	80–40			
	80	2·13	33·84	27·05	,,	120–80			
	120	2·10	33·78	27·01	,,	160–120			
	160	1·76	33·87	27·14	,,	200–160	—	1700	
MS 28	0	1·22	26·69	—	**NC 50 V**	40–0	1130		

Station	Position	Date	WIND Direction	WIND Force	Sea	Weather	Moon (age in days)
	S Georgia	1925					
MS 29	$1\frac{1}{4}$ miles N of Dartmouth Pt, E Cumberland Bay	30 iv	—	0	2	b. c.	7
MS 30	$\frac{3}{4}$ mile NE × E of Macmahon Rk, E Cumberland Bay	30 iv	—	0	3	o.	7
MS 31	2 miles N $\frac{1}{2}$ E of Macmahon Rk, E Cumberland Bay	30 iv	—	0	3	o.	7
MS 32	E Cumberland Bay. $4\frac{1}{2}$ cables NE of Hobart Rk to $1\frac{1}{2}$ miles SSE of Hope Pt	1 v	—	0	2	b. c.	8
MS 33	1 cable E of Hobart Rk, E Cumberland Bay	1 v	—	0	2	b. c.	8
MS 34	E Cumberland Bay. (A) $3\frac{1}{4}$ miles SSW of Merton Rk to $4\frac{1}{2}$ cables NE of Hobart Rk. (B) $4\frac{1}{2}$ cables NE of Hobart Rk to $\frac{1}{2}$ cable S of Hope Pt	2 v		0	3	b. c.	9
MS 35	Coal Harbour	3 ix	NW	6	3	o.	16
MS 36	Wilson Harbour	5 ix	E	8	0	o.	18
MS 36B	King Haakon Bay	14 x	—	0	3	o.	26
MS 37	King Haakon Bay	15 x	—	0	4	o.	27
MS 38	King Haakon Bay to Wilson Harbour	15 x	WNW	8	4	o.	27
MS 39	King Haakon Bay to 3 miles S of Undine Harbour	25 x		0	3	o.	9
MS 40	$\frac{3}{4}$ mile S of C Pariadin to 5 miles W of Welcome I	25 x	—	0	0	f.	9
MS 41	2 miles NE of C Saunders to 2 miles N of C Constance	26 x	—	0	0	b. c.	10
MS 42	2 miles N of C Constance to $\frac{1}{4}$ mile S of Welcome I	26 x	—	0	0	b. c.	10
MS 43	$\frac{1}{4}$ mile S of Welcome I to $\frac{1}{2}$ mile N of Else Bay	26 x	—	0	0	b. c.	10
MS 44 to **MS 61**	Chemical observations, S.S. *Fleurus*, between S Georgia and Falkland Is						
		1926					
MS 62	E Cumberland Bay. $\frac{1}{2}$ cable E to $3\frac{3}{4}$ cables S of Hobart Rk	24 ii		0	0	b. c.	13
MS 63	E Cumberland Bay. 1·3 miles S × E to 1·6 miles SE × S of Hope Pt	24 ii	—	0	0	—	13
MS 64	1·8 miles SE × S of King Edward Pt Lt, E Cumberland Bay	24 ii	—	0	0	b. c.	13
MS 65	E Cumberland Bay. 1·6 miles SE of Hobart Rk to 1 cable N of Dartmouth Pt	28 ii	N	2	2	b. c.	16
MS 66	E Cumberland Bay. $2\frac{1}{4}$ miles SE of King Edward Pt Lt to $1\frac{1}{2}$ cables W × N of Macmahon Rk	28 ii	N	2	2	b. c.	16
MS 67	E Cumberland Bay. 3 cables NE of Hobart Rk to $\frac{1}{2}$ cable W of Hope Pt	28 ii	N	2	2	b. c.	16
MS 68	E Cumberland Bay. 1·7 miles S $\frac{1}{2}$ E to $8\frac{1}{2}$ cables SE × E of Sappho Pt	2 iii	—	0	0	f. r.	17

Station	HYDROLOGICAL OBSERVATIONS				BIOLOGICAL OBSERVATIONS				Remarks
	Depth (metres)	Temp. ° Cent.	S ‰	σt	Gear	Depth (metres)	TIME Shot	TIME Hauled	
MS 29	0	1·20	30·37	—	**NC 50 V**	40–0	1215		
MS 30	0	0·87	30·82	—	**NC 50 V**	40–0	1300	—	much glacier ice
MS 31	0	1·77	31·56	—	**NC 50 V**	40–0	1345		
MS 32		—	—		**BTS**	40	1545	1650	
					NC 50 H	0–5	1555	1610	
					,,	0–5	1610	1625	
MS 33		—			**BTS**	40	**1700**	**1710**	trawl hitched
MS 34	—	—		—	**NC 50 H**	20	1210	1225	A. Much glacier ice
					,,	20	1225	1240	B
MS 35	—	—		—	**NC 50 V**	20–0	0930		
MS 36	—	—		—	**NC 50 H**	0	1615	1625	
MS 36 B	—		—	—	**NHS**	0	1730	1745	
MS 37			—	—	**NHS**	0	1500	1615	
MS 38	—	—			**NHS**	0	1800	**1940**	
MS 39	—			—	**NHS**	0	1645	1855	
MS 40	—	—	—	—	**NHS**	0	**1905**	**2115**	
MS 41	—		—		**NHS**	0	1615	1815	
MS 42					**NHS**	0	1830	**2015**	
MS 43			—	—	**NHS**	0	**2020**	**2200**	
MS 62			—	—	**BTS**	31	1000	1030	some glacier ice
					N 70 H	0–5	1018	1028	
MS 63	0	3·62	—	—	**BTS**	23	1045	1115	
MS 64		—	—		**DS**	7–15	1120	1125	
					,,	7–15	1135	1140	
MS 65	—		—	—	**BTS** / **NCS–T**	39	1030	1045	trawl hitched
					N 70 H	0–5	1035	1045	
MS 66		—	—		**BTS** / **NCS–T**	18	1058	1115	
MS 67	—		—		**BTS** / **NCS–T**	38	1215	1237	
MS 68	0	2·89	31·87	25·43	**NRL** / **NCS–N**	220–247	1050	1110	
	5	2·64	33·40	26·66					
	10	2·83	33·68	26·86					
	20	2·92	33·80	26·96					
	30	2·90	33·89	27·03					
	40	2·82	33·91	27·05					
	50	2·73	33·77	26·94					
	75	2·71	33·73	26·91					
	100	2·43	33·80	27·00					

Station	Position	Date	WIND		Sea	Weather	Moon (age in days)
			Direction	Force			
	S Georgia	1926					
MS 68 *cont.*		2 iii					
MS 69	E Cumberland Bay. 1½ cables E × N to 8½ cables E × N of Macmahon Rk	5 iii		0	2	b. c.	20
MS 70	Maiviken, W Cumberland Bay	9 iii	—	0	0	b. c.	24
MS 71	E Cumberland Bay. 9¼ cables E × S to 1·2 miles E × S of Sappho Pt	9 iii		0	2	b. c.	24
MS 72	1·4 miles SE of Sappho Pt, E Cumberland Bay	9 iii	—	0	2	b. c.	24
MS 73	(omitted)						
MS 74	E Cumberland Bay. 1 cable SE × E of Hope Pt to 3·1 miles SW of Merton Rk	17 iii	—	0	2	o.	4
	Saldanha Bay, S Africa						
MS 75	South side of Riet Bay	11 viii	-	0	0	b. c.	4
MS 76	South side of Riet Bay	12 viii	—	0	0	o.	5
MS 77	Between Whaling St and Meuuw I	12 viii		0	0	o.	5
MS 78	Between Meuuw I and Schapen I	17 viii	SW	0	0	b. c.	9
MS 79	Across Riet Bay	22 viii	—	0	0	b. c.	14
MS 80	NW of Meuuw I	6 ix	—	0	0	b. c.	28
MS 81	1 mile W of Salamander Whaling St	6 ix	—	0	1	b. c.	28
MS 82	Off Salamander Pt	6 ix	—	0	0	b. c.	28

Station	HYDROLOGICAL OBSERVATIONS				BIOLOGICAL OBSERVATIONS				• Remarks
	Depth (metres)	Temp. ° Cent.	S ‰	σt	Gear	Depth (metres)	TIME Shot	TIME Hauled	
MS 68 *cont.*	150	2·15	33·86	27·06					
	220	0·76	33·96	27·24					
MS 69	—	—	—	—	**DS**	146	1800	1830	
MS 70	—	—	—	—	**Sh. coll.**				
MS 71	—	—	—	—	**BTS** / **NCS–T**	110–60	1500	1535	
MS 72	0	2·65	32·54	25·97					
	5	2·61	33·26	26·55					
	10	3·00	33·58	26·78					
	15	3·15	33·66	26·82					
	20	3·15	33·66	26·82					
	30	3·06	33·68	26·84					
	40	3·02	33·62	26·81					
	50	3·00	33·68	26·85					
	75	2·96	33·82	26·97					
	100	2·62	33·89	27·05					
	150	0·91	34·04	27·30					
MS 74	35	2·75	33·82	—	**BTS** / **NCS–T**	22–40	1430	1500	
MS 75	—	—	—	—	**HH**				
MS 76	—	—	—	—	**HH**				
MS 77	—	—	—	—	**LH**				
MS 78	—	—	—	—	**N 50 H**	0	1500	1510	
MS 79	—	—	—	—	**N 50 H**	0			
MS 80	—	—	—	—	**BTS**	4–10	1412	1427	
MS 81	—	—	—	—	**BTS**	8–10	1453	1508	
					N 50 H	0–4	1453	1500	
MS 82	—	—	—	—	**BTS**	7–14			

SUMMARISED LIST OF STATIONS

The positions of all stations made by the R.R.S. 'Discovery' and R.S.S. 'William Scoresby' in 1925–27 are shown on the charts reproduced in Plates I–V. The following lists indicate on which chart each of the stations is to be found. Plate VI is a map of South Georgia on which the place names in the list of MS stations are entered.

R.R.S. 'DISCOVERY'

Station	Date	Place	Plate
1, 2	16, 17. xi. 25	Ascension Island	
3	3. xii. 25	Mid South Atlantic	I
4–6	30. i.–1. ii. 26	Tristan da Cunha	I
7–12	3–18. ii. 26	Tristan da Cunha to South Georgia	I
13–45	3. iii.–6. iv. 26	Off South Georgia	II
46, 47	21, 23. iv. 26	South Georgia to Falkland Islands	I
48–58	3–19. v. 26	Off Falkland Islands	IV
59–89	20. v.–28. vi. 26	Falkland Islands to Cape Town	I, V
90–101	10. vii.–14. x. 26	Off South-west Africa	V
102–116	28. x.–14. xi. 26	South Africa to Bouvet Island	I
117–121	17–25. xi. 26	Bouvet Island to South Georgia	I
122–159	14. xii. 26–21. i. 27	Off South Georgia	II
160, 161	7, 14. ii. 27	South Georgia to South Orkneys	I
162–167	17–20. ii. 27	Off South Orkneys	I
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R.S.S. 'WILLIAM SCORESBY'

Station	Date	Place	Plate
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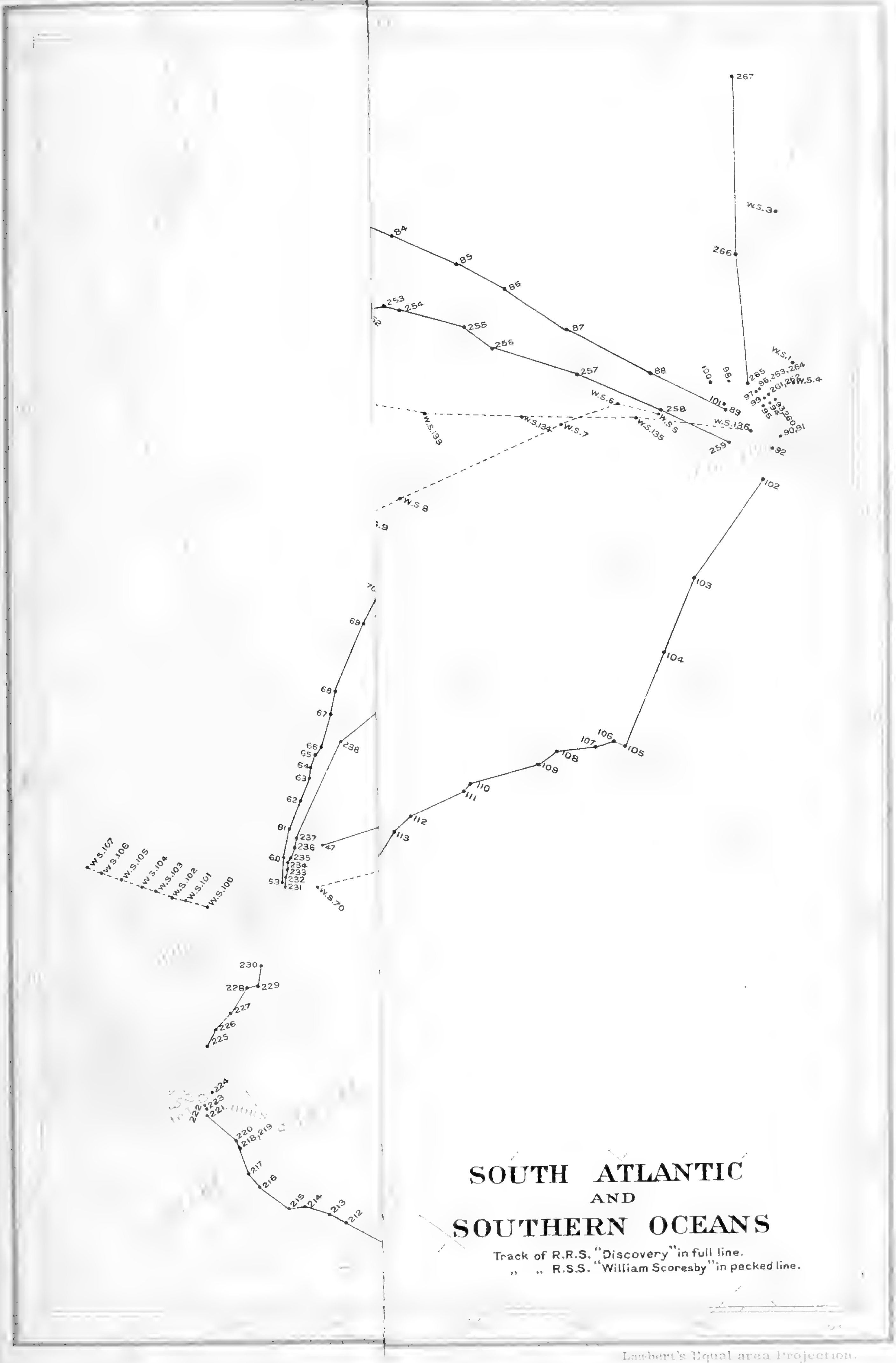
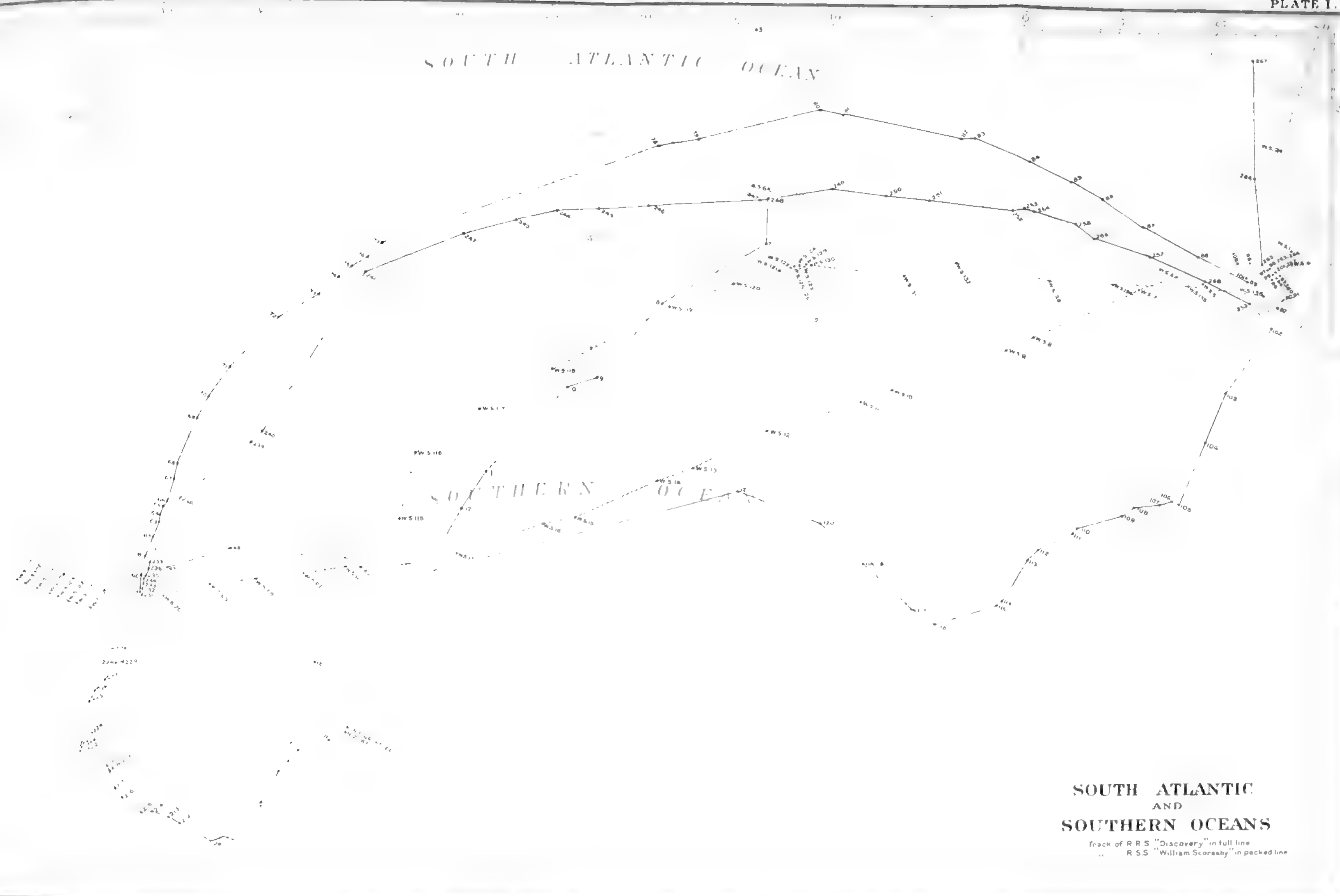
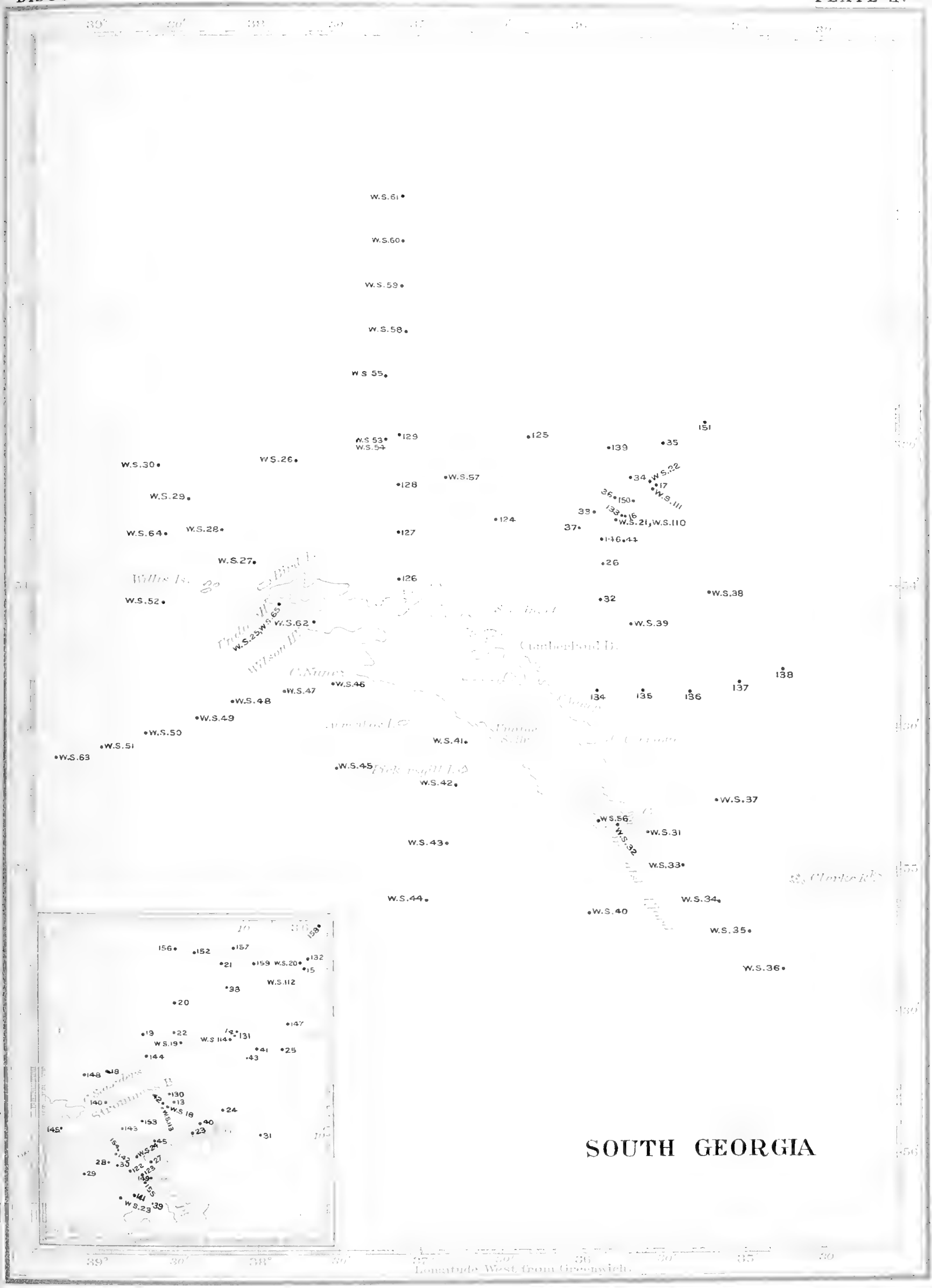


Lambert's Equal area Projection.


SOUTH ATLANTIC OCEAN
SOUTHERN OCEAN
SOUTH ATLANTIC
AND
SOUTHERN OCEANS
Track of R.R.S. "Discovery" in full line
" R.S.S. "William Scoresby" in pecked line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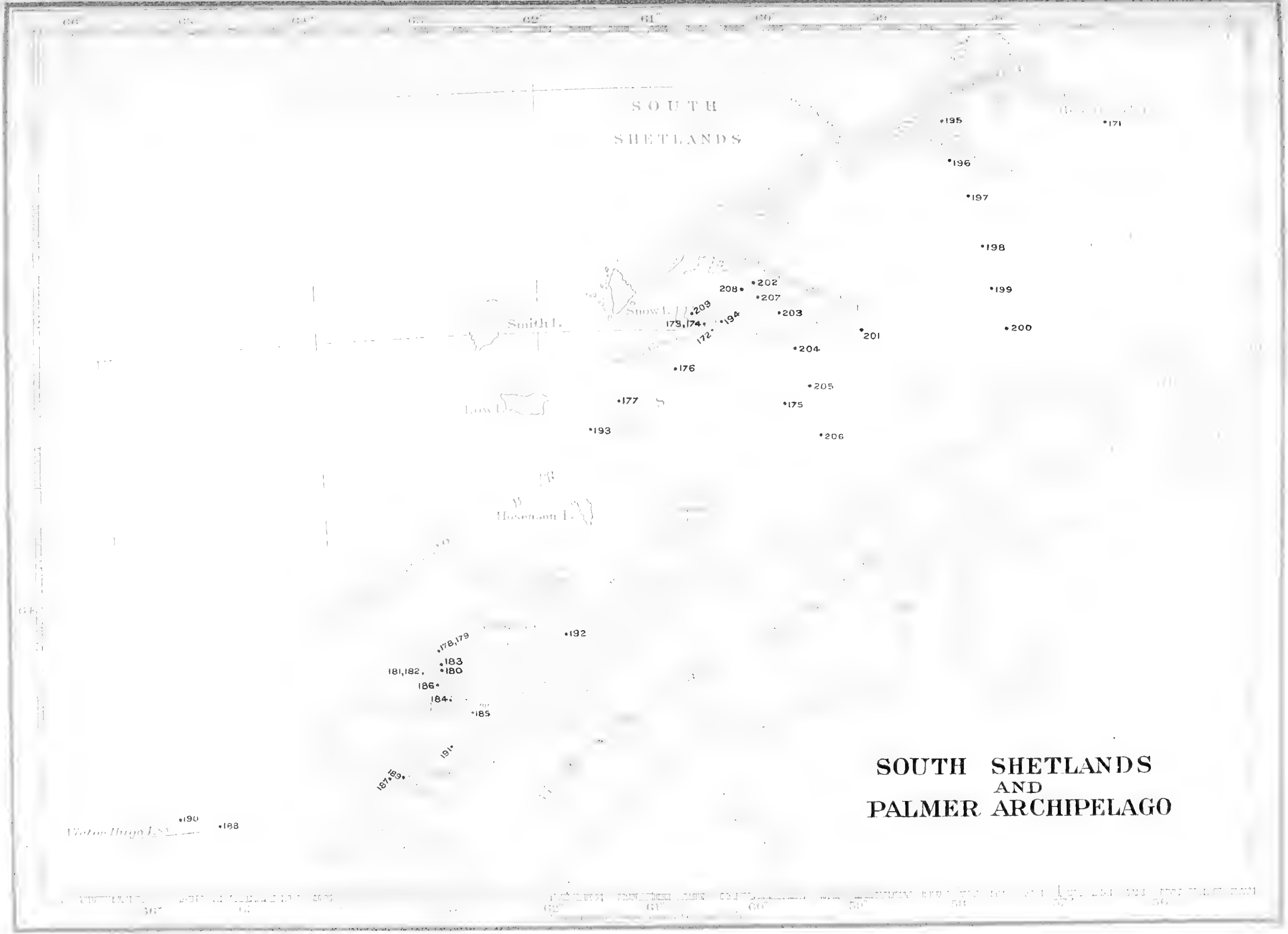
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Snow I.
Low I.
Hoseason I.
Victor Hugo I.
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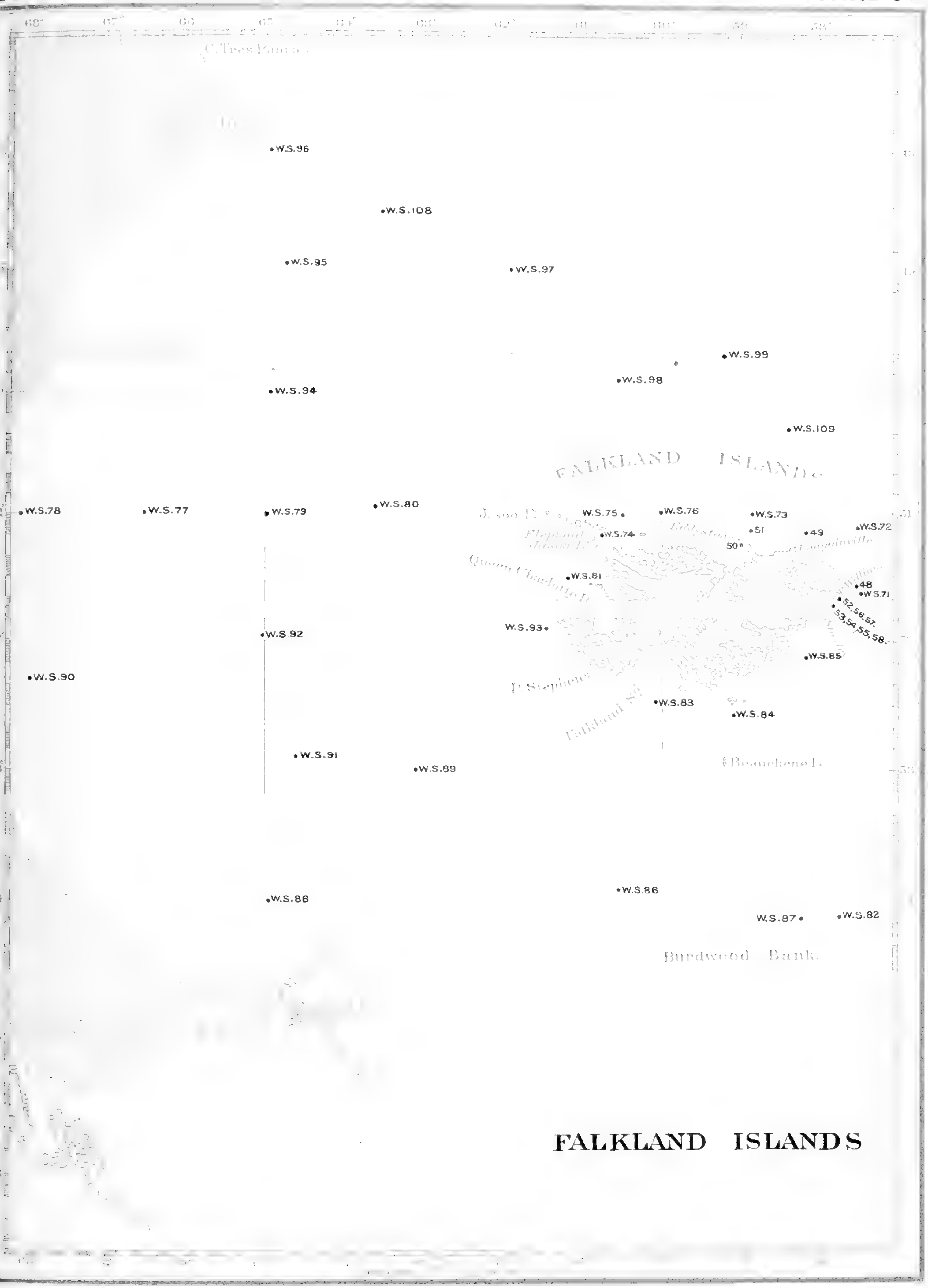
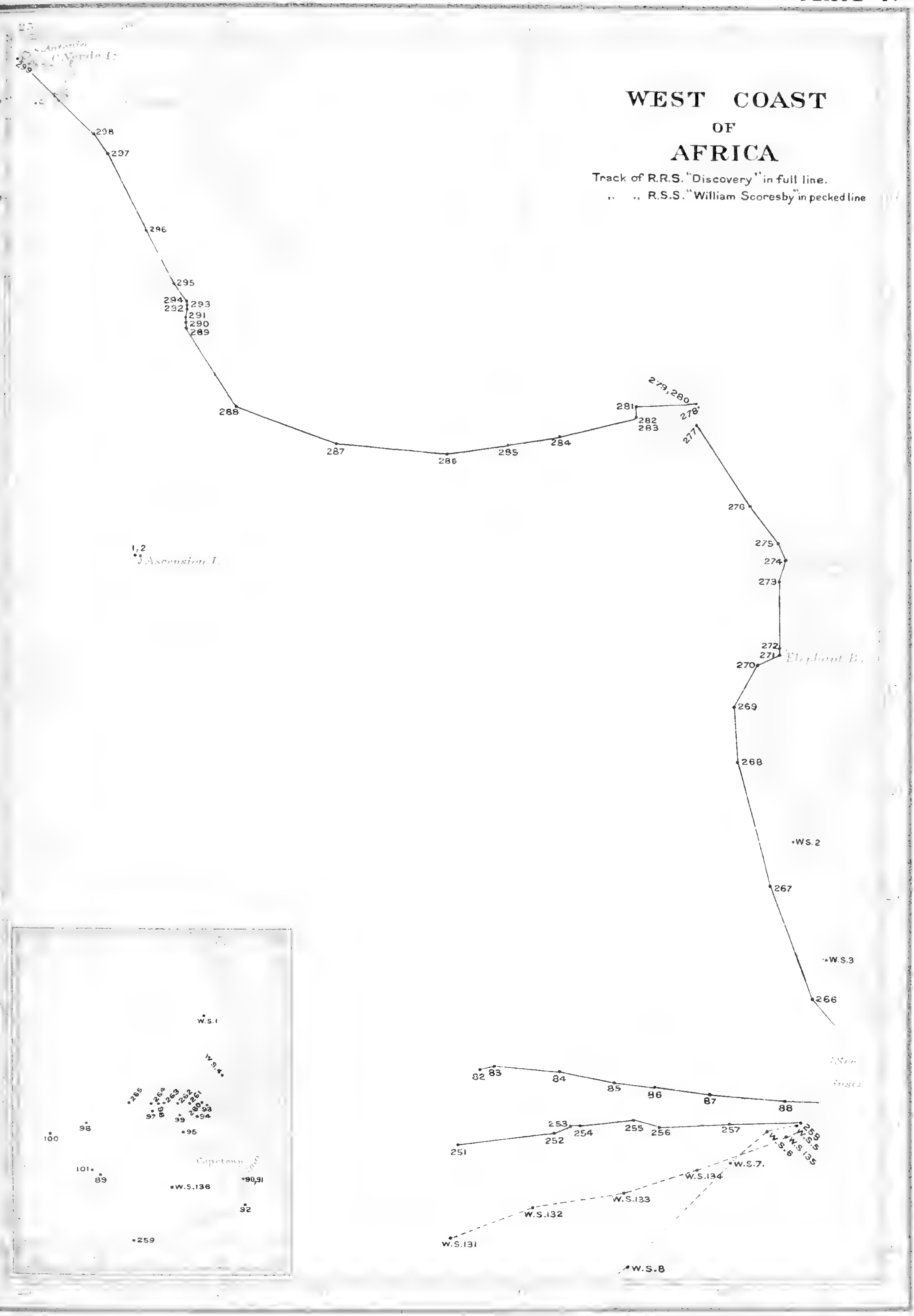
SOUTH SHETLANDS
AND
PALMER ARCHIPELAGO



FALKLAND ISLANDS


WEST COAST
OF
AFRICA
Track of R.R.S. "Discovery" in full line.
" " R.S.S. "William Scoresby" in pecked line
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Ascension I.
Elephant B.
Capetown
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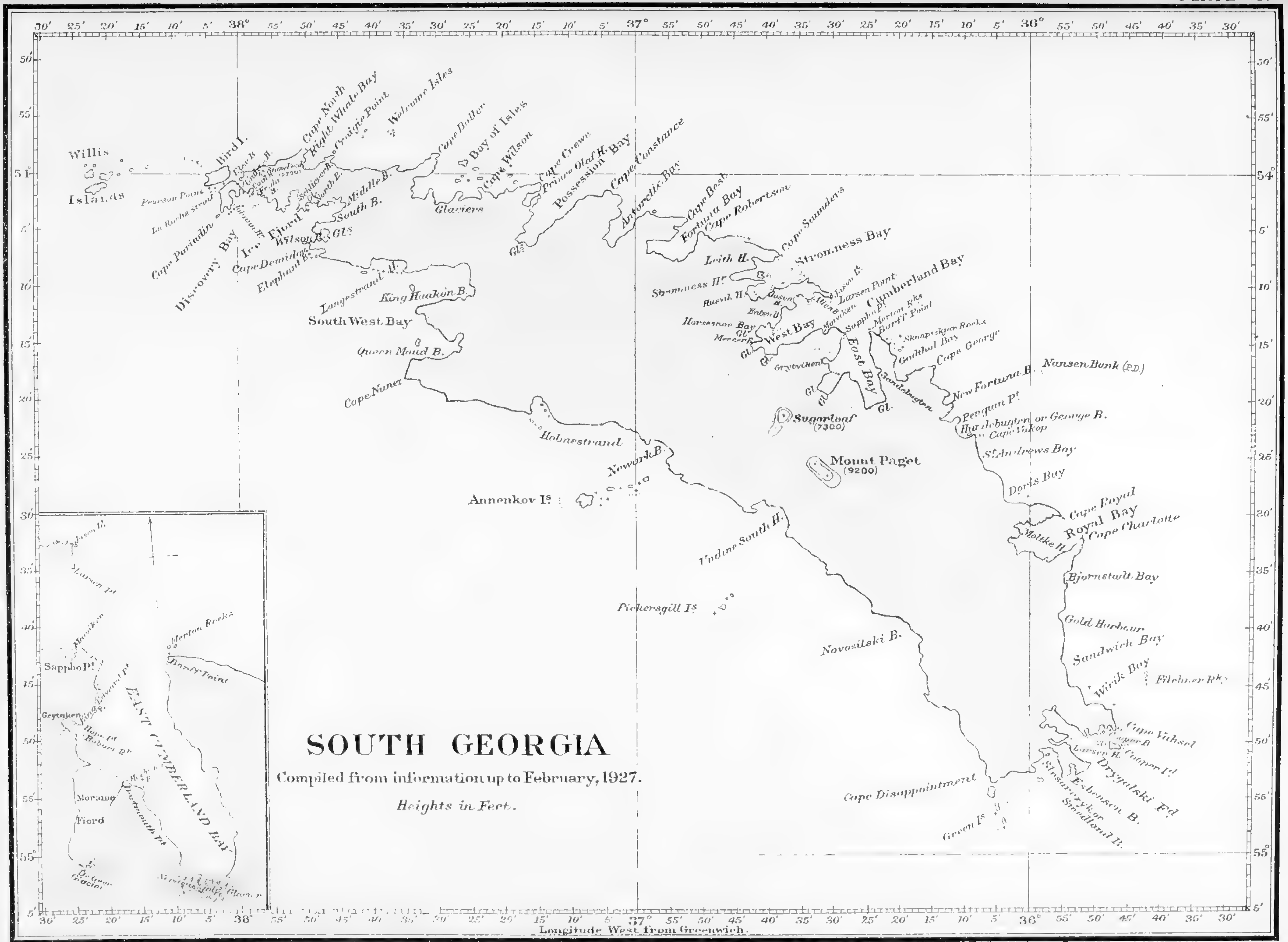

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DISCOVERY INVESTIGATIONS
OBJECTS, EQUIPMENT & METHODS

by

S. Kemp, A. C. Hardy *and*
N. A. Mackintosh

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DISCOVERY INVESTIGATIONS
OBJECTS, EQUIPMENT AND METHODS

PART I

THE OBJECTS OF THE INVESTIGATIONS

By STANLEY KEMP, Sc.D.

PART II

THE SHIPS, THEIR EQUIPMENT AND THE METHODS USED IN RESEARCH

By STANLEY KEMP, Sc.D., AND A. C. HARDY, M.A.

PART III

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By N. A. MACKINTOSH, A.R.C.S., M.Sc.

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DISCOVERY INVESTIGATIONS
OBJECTS, EQUIPMENT AND METHODS

PART I. THE OBJECTS OF THE INVESTIGATIONS

By Stanley Kemp, Sc.D.

THE proposal to send a scientific expedition to Antarctic waters was initiated by Mr E. R. Darnley, Chairman of the present Discovery Committee, rather more than ten years ago. The proposal had in view the systematic exploration of all the economic resources of the Dependencies of the Falkland Islands, but the main reasons for it are to be traced to the very rapid development of the whaling industry in those Dependencies, and to the fears which arose that this industry, like others formerly existing in both northern and southern hemispheres, would prove shortlived. For this reason the investigations undertaken bear mainly on the bionomics of the whales upon which the industry is based. The desirability of executing coastal surveys in the interests of the vessels which navigate these dangerous and largely uncharted waters was also realized.

Antarctic whaling by modern methods owes its origin to the Norwegian whaling pioneer, the late Captain C. A. Larsen, for it was due entirely to his enterprise and pertinacity in the face of much discouragement that operations were first begun at South Georgia in the season 1904–5. The venture was immediately successful: in the next season a whaling factory under Mr Alexander Lange, also a Norwegian, visited the South Shetland Islands, and by 1912 twenty-one whale-catching vessels were employed at South Georgia and thirty-two in the South Shetlands. Further development was restricted by Government action in the fear that the stock of whales would be unduly depleted, but during the war period a temporary increase was permitted.

From the first it was evident that a whaling field of the greatest importance had been discovered in the Dependencies of the Falkland Islands; before many years had passed it proved more productive than all those in the rest of the world combined and, until the present day, this leading position has been maintained.

The history of whaling in other waters, for nearly all the species which have formed the object of commercial enterprise, has followed one and the same lamentable course.[1] At first there is a period of great abundance, during which the industry develops rapidly and large profits are made. This, after a longer or shorter period, is followed by a decline which may be equally rapid, and culminates finally in the complete cessation of operations. Such has been the history of the Atlantic Right Whale or Nordkaper and of the Greenland Whale, species which have been hunted to the verge of extermination, while the northern rorqual fisheries, which have been conducted for little more than half a century, have declined to a mere vestige of their former greatness.

[1] For an authoritative history of whaling see Sir Sidney Harmer, *Proc. Linn. Soc. London*, session 140, pp. 52–95, 1928.

In a few instances the decline of a whale fishery has been due in part to causes other than depletion of the stock; but, bearing all the facts in mind, grave apprehension was felt regarding the future of the great whaling industry in the Dependencies of the Falkland Islands, and from the beginning the course of its development has been closely followed by Government. Regulations were put in force for the control of whaling, but it soon became evident that far more scientific knowledge was required for administrative purposes, and that the acquisition of such knowledge was the only way by which the permanent prosperity of the industry could ultimately be secured. It was accordingly suggested that a series of scientific investigations should be undertaken in southern waters and the question was referred by the Secretary of State for the Colonies to an Interdepartmental Committee. The Committee made a thorough examination of all the problems involved and in its report, published in 1920,[1] indicated the more important lines on which research was required. As a result of its recommendations the 'Discovery' was purchased, and in due course the present Discovery Committee was appointed by the Secretary of State to conduct the investigations. The cost of the work is defrayed from revenues raised from the whaling industry in the Dependencies of the Falkland Islands.

The main object of the work was thus to obtain further information on whales and on the factors which influence them, and before coming to a detailed description of the equipment and methods which are being employed, it will be useful to give some general account of the plan of operations which the Discovery Committee has adopted.

It was realized at the outset that a great deal of valuable information could be obtained by examination of whales brought in by whale-catchers. The precise identification of the common southern rorquals could not be regarded as definitely settled, for though it was generally recognized that the Blue and Fin Whales of the southern ocean closely resembled those to which the same names had been applied in the north, the possibility that the southern forms might represent a distinct race could not lightly be dismissed. Some might think this a question of purely zoological interest, but it must be pointed out that it has a very definite bearing on the economic aspect of whaling. If the rorquals in the south can be shown to be racially distinct from those which live in the north some degree of isolation of the two stocks may be inferred, and conversely, if no such distinction exists, some intermixture of these stocks is rendered probable. In dealing with migratory animals such as whales accurate knowledge on this point cannot fail to be valuable. It may set a limit to the area through which the southern stock ranges, and it will inevitably be of importance in studies of migration. This problem of the racial identity of southern whales is being attacked mainly by statistical methods.

In the economic study of any mammalian stock there are certain elementary facts which must be thoroughly understood before progress can be made. Among the more important are the rate of growth, the age at sexual maturity, the time of pairing, the period of gestation, the number at a birth, the length of the suckling period and the

[1] *Report of the Interdepartmental Committee on Research and Development in the Dependencies of the Falkland Islands*, Cmd. 657, London, 1920.

nature of the food. In whales most of these facts are less easily ascertained than in other mammals and the information already available was very deficient. By special anatomical investigation it is, however, possible to obtain results which will throw much light on such questions, and the Committee consequently decided to build a laboratory at South Georgia. This laboratory, which is known as the Marine Biological Station, is erected on King Edward Point in Cumberland Bay, close to the whaling station at Grytviken. Work has been in progress since January 1925, and it is hoped that the first series of results will shortly be published. A description of the building will be found on p. 223.

During the southern winter whales are for the most part absent from South Georgia, and at Grytviken it is thus not possible to follow by anatomical investigation the full cycle of reproductive change throughout the year. The Committee considered it most important that complete observations of this kind should be made, and mainly on this account they arranged for the transference of the shore staff to South Africa during the winter of 1926. Thanks to the kindness of Messrs Irvin and Johnson they were accommodated at the whaling station in Saldanha Bay.

But work on shore, no matter how intensively it is undertaken, can only give solutions to some of the problems which are involved. It requires to be supplemented by observations at sea, and the principal reason for such research is the necessity for a thorough study of the environment of southern whales. Experience has shown that the hydrological and planktonic methods employed by the International Council for the Exploration of the Sea have been productive of valuable results in the north-east Atlantic and it could not be doubted that equally good results would follow their application in the south. Whaling, like most fisheries, fluctuates greatly from season to season, and the causes of these fluctuations are to be sought in changes in the environment. The food of southern rorquals is now known to consist exclusively, or almost exclusively, of large Euphausian crustaceans, which themselves feed mainly on diatoms. On analogy with conditions ascertained in the north, the seasonal abundance of the Euphausians on the whaling grounds of the Dependencies will be preceded by a period of great reproductive activity in the phytoplankton. The phytoplankton in its turn is dependent on the physical and chemical constitution of the water, and it is to hydrological, and ultimately perhaps to meteorological conditions, that the fluctuations in the whaling industry are to be ascribed.

So much could be inferred from the scientific work which had been done in the north, but much special investigation in the south was needed before theory and fact were brought into accord. The life history of the Euphausian which forms the main food of whales was unknown and no information existed on its relations with the other constituents of the plankton. Knowledge of the southern phytoplankton was limited almost entirely to the specific identification of the various species, and data on the water movements and general hydrology of the south were wholly deficient.

It was accordingly decided to equip a vessel for oceanographic research in southern waters. The 'Discovery', originally built for the National Antarctic Expedition, 1901–3, of which Captain (then Lieut.) R. F. Scott was leader, was purchased and refitted for her new work, and in July 1925, with the consent of His Majesty the King, she was commissioned as the Royal Research Ship 'Discovery'.

In drawing up a programme for the scientific operations of this vessel the Discovery Committee recognized the immensity of the area in which observations were required and the numerous directions along which research might profitably be undertaken. But practical considerations made it necessary to set some limit to the scope of the work, and in the plan which was finally adopted preference was given to investigations holding the most early promise of useful economic results.

To examine the conditions existing on the whaling grounds of the Dependencies was evidently of first importance and an intensive survey of the waters in the neighbourhood of South Georgia was planned. In this survey, which it was hoped to repeat annually, observations on the plankton and hydrology were to be taken at close intervals, the former comprising both vertical and horizontal tow-net hauls, worked on a scheme intended to give strictly comparable results, the latter designed to supply the fullest possible information on the temperature, salinity, hydrogen-ion concentration and phosphate and oxygen content of the water.

Such intensive surveys would not, however, yield all the information desired. Experience in the north had shown that conditions in any localized area can be properly understood only by a study of the mass movements of water in the surrounding oceans; alterations in the direction and intensity of these movements will involve marked alteration in the physical and biological environment of any small area situated in their path. It was thus necessary to supplement the survey of the South Georgia grounds by other investigations—necessarily less intensive—spread over a wider field. The region enclosed by lines connecting the Falkland Islands, South Georgia, the South Orkneys, the South Shetlands and Cape Horn was considered the most important, but observations were to be made whenever practicable in other parts of the southern ocean.

It is in these investigations that the 'Discovery' has been primarily engaged during a commission which lasted two years,[1] but before she left this country the Committee foresaw that the work was likely to be more than a single square-rigged vessel could undertake and that certain other lines of research were beyond her power.

Whales are well known to be migratory animals. In the southern winter they are for the most part absent from the waters of the Dependencies and there is definite evidence that the Humpback travels up the west coast of Africa in the southern autumn and returns to the south in the following spring. There is good reason to believe that this species pairs, and that the young are born, during this sojourn in warmer waters, and the available evidence indicates that little or no food is taken at this time. In the south there are abundant food supplies and the migrations have in consequence been called respectively the breeding migration (northwards, in the southern winter) and the feeding migration (southwards, in the southern spring). Such information as we possess

[1] Some indication of the degree of success which has so far attended the work may be obtained by inspection of the charts accompanying the Station List, Plates I–V of this volume.

about Blue and Fin Whales suggests that these species have habits similar to those of the Humpback.

In the economic study of whales it is of the utmost importance that we should have fuller and more accurate knowledge of these migrations. From what has been stated above it will be seen that north and south migrations of the three most valuable species may be inferred, but we have as yet next to no knowledge of the routes taken and not a particle of evidence regarding east and west movements.

To ascertain whether such east and west movements exist is most essential; for if the whales move freely round the Antarctic Continent it follows that the southern stock forms a single entity: excessive hunting in any one area will affect all areas adversely. If, on the other hand, such movement does not exist, the depletion of one area will not reduce the stocks in other parts.

In tracing the migrations of fish the method most generally adopted is that of marking. Fish are caught, suitable marks bearing a reference number are attached to them, and they are then liberated. A proportion of these marked fish are recaptured in the course of commercial operations, and the offer of a reward increases the chance that the mark, together with the necessary data, will be returned to the fishery authority. By this means valuable information on the migrations of fish has been obtained, and some years ago it was suggested that a similar method might usefully be employed with whales. It is, for obvious reasons, more difficult to mark whales than fish, but as a result of experiments made before the 'Discovery' sailed on her first commission, a practicable method was discovered. The method is explained on p. 208.

In considering the design of a second ship for investigations in the south, the Committee attached great importance to this question of whale-marking. A vessel of comparatively high speed was necessary, built generally on the lines of a whale-catcher, but it was recognized that she would also be required to assist in routine work on plankton and hydrology, and it was also considered desirable that she should carry a full-sized otter trawl for the exploration of certain areas in the Dependencies which might prove commercially profitable.

These varied requirements have been successfully met in the Research Steamship 'William Scoresby'. This vessel is named after the celebrated whaling captain, whose *Account of the Arctic Regions*, published in 1820, may be regarded as the first scientific contribution to the study of whaling. The 'William Scoresby' was launched at Beverley on December 31, 1925, and except for a brief return visit to England in 1927 has since been almost continuously at work in the south.

It will be seen, from what has been said above, that in the organization of research into whaling problems the Discovery Committee is proceeding on three separate lines of enquiry. The work at the Marine Biological Station is designed to supply essential information on the biology of whales themselves, while the vessels are engaged in a study of the environment of whales and in experiments from which a knowledge of their migrations may be derived.

Reference has already been made to the work on whales carried out at Saldanha Bay in South Africa, and there have been other occasions when members of the scientific staff have been detached for special duty. Observations at whaling stations have thus been made at Durban in Natal and at Deception Island in the South Shetlands, while in the season 1927–8 a member of the staff accompanied the whaling factory 'Anglo-Norse' to the South Sandwich Islands—a region which had previously been little exploited by the whalers. The whales taken round these islands were examined, so far as was practicable, and some information obtained on the plankton and hydrology of the area. During the present season (1928–9) another member of the staff is on board the 'C. A. Larsen', a large whaling factory working in the Ross Sea.

Certain other work undertaken during the course of the investigations remains to be noticed.

Notwithstanding the number of expeditions which have undertaken oceanographic research in the south, the Antarctic still remains an unrivalled field for scientific effort. Since the primary aim of the investigations was an economic one, priority of place had evidently to be given to enquiries which might lead to immediately useful results; but it was recognized that occasions would arise when work in other directions could profitably be undertaken without detriment to the main objects of research, and it was the wish of the Committee that full use should be made of such opportunities.

The examination of the plankton conditions on the whaling grounds was already an important part of the programme of the 'Discovery', and in deciding what use might be made of occasions for work of a less obviously practical nature it was natural to consider an extension of these operations. The more strictly economic results were to be sought in the upper layers of the water, and work at greater depths, while it might also prove to have practical value, would without doubt result in a material increase in our knowledge of the biology of southern waters. When opportunity permitted, plankton nets, up to $4\frac{1}{2}$ metres in diameter of mouth, were accordingly used at all depths, and by this means a large amount of valuable material has been accumulated during the two years of the first commission.

An examination of the bottom fauna was evidently less relevant to the main purpose of the work, and it was decided that deep-sea trawling, which necessarily involves a great expenditure of time, could not be undertaken. The 'Discovery' was, however, supplied with a 40 ft. otter trawl and dredges, to be used in shallow water when circumstances allowed. The weather in the south is frequently unsuitable for off-shore work, and on a number of occasions the rich bottom fauna of the sheltered coastal waters of the Dependencies has been explored.

The 'William Scoresby', as has already been mentioned, was designed to carry a full-sized commercial otter trawl and the main purpose of this equipment was an examination of the supplies of fish on the submarine plateau situated between the Falkland Islands and the South American coast. There are grounds for the belief that fish exist in marketable quantities in this area, and a survey was planned in the hope that it might result in the establishment of a trawling industry in the locality. The 'William

Scoresby' has hitherto undertaken this work during the southern winter when the whaling stations in the Dependencies are closed.

At South Georgia Elephant Seals are abundant, and each year, when they haul up on the beaches during the breeding season, great numbers are killed for the oil contained in their blubber. The industry is a profitable one and has been carried on for many years under strict Government control. The regulations are well devised and there is happily little fear that the stock is being depleted; but since there are many points in the natural history of these animals on which little is known, the Committee considered that some attention should be paid to them in the course of the Discovery investigations. It was also thought that the bird life of the island should not be neglected. These two branches of work have been in the hands of one of the staff of the Marine Biological Station.

Prior to the commencement of the Discovery investigations little hydrographic surveying had been done in the Dependencies of the Falkland Islands, and the Discovery Committee hoped that in the course of their work it would be possible to make considerable improvements to existing charts. Of the known harbours few had been surveyed, the positions of many of the islands were doubtful and the whaling community was most anxious for better information. To carry out surveys in conjunction with the programme outlined above was admittedly not easy to arrange, but the Admiralty, through their representative on the Committee, strongly supported the proposal and a trained surveyor was seconded from their Hydrographic Department as one of the executive officers of the 'Discovery'. In spite of limited opportunities this officer was able during the past commission to carry out some important surveys in the Dependencies, and an account of the work done will be published in due course in these Reports. During the season 1928–9 assistants and a specially built motor launch have been placed at the disposal of this officer, who will be occupied entirely in hydrographic survey.

In all the investigations which have been made in the south, the co-operation of the whaling community has been a very material advantage, and we owe a debt of gratitude in particular to the managers of the land stations. Facilities for work on the flensing plane and opportunities for cruises on whale-catchers were freely given; labour, which often could ill be spared, was furnished for the preparation of whale skeletons or for work at the biological station; transport for personnel and material was placed when needed at our disposal, and arrangements made for periodic supplies of fresh provisions. To these benefits the managers added their own most generous hospitality. Our thanks are specially due to Capt. V. Esbensen at Grytviken, to Capt. T. Sörrle at Stromness, to Mr L. H. Hansen at Leith and to Capt. Øre at Deception Island.

The reconditioning of the R.R.S. 'Discovery' and the construction of the R.S.S. 'William Scoresby' were carried out by the Crown Agents for the Colonies with the advice of Messrs Flannery, Baggallay and Johnson, Ltd., Consulting Naval Architects. The Crown Agents have been responsible for all contracts for provisions and other supplies for the two vessels, as well as for the erection and equipment of the Marine

Biological Station. Their efficient assistance in all these matters has added largely to the success of the work.

In concluding this brief outline of the objects of the Discovery investigations it may be pointed out that the work is still in progress and that henceforward the presentation of results and the accumulation of fresh data will proceed simultaneously. Thanks to the courtesy of the Trustees of the British Museum accommodation for those of the scientific staff who are working up results in this country has been found at the Natural History Museum, South Kensington, where by reason of the reference collections and library, every possible facility is afforded. The members of the scientific staff are taking up the economic aspects of the material and data which have been collected, but the Committee has been fortunate in receiving promises of help from specialists in a number of subjects, and it is hoped that their contributions, which will mainly be of scientific interest, will also find a place in these Reports.

THE DISCOVERY INVESTIGATIONS, OBJECTS, EQUIPMENT AND METHODS

PART II. THE SHIPS, THEIR EQUIPMENT AND THE METHODS USED IN RESEARCH

By Stanley Kemp, Sc.D., and A. C. Hardy, M.A.

(Plates VII–XVII, text-figures 1–33)

In the Reports of most expeditions which have engaged in marine biological research such matters as scientific equipment and methods, if discussed at all, are dealt with very briefly. Yet there are reasons why these subjects should be treated in some detail: first because a description of methods, of nets and apparatus and of the way in which they were handled, will often be useful in the interpretation of results, and, secondly, because the experience gained by one expedition is likely to prove of service to another. In modern oceanographical work a technique of some elaboration is required, and if work is to run smoothly and without waste of time every detail of procedure must be thought out in advance. Mistakes are easily made and may be costly, and difficulties of many kinds must be overcome, especially if investigations in deep water are to be undertaken.

In this paper the equipment of the 'Discovery' and 'William Scoresby' is described at some length, with notes on the arrangement and fittings of the ships' laboratories and an account of the methods employed in hydrology and in the collection and preservation of zoological material. In various directions, but more particularly with biological gear, we have tried to make some improvement on established methods, and these attempts—not all of them successful—are discussed in their proper place. A large part of the biological work was concerned with plankton, and plankton methods and apparatus are in consequence treated in greater detail.

It is necessary in the first place to give some description of the vessels employed in the investigations, and for the following account of their arrangement and accommodation, together with the plans on Plates VIII and IX, we are indebted to Mr A. Harker of Messrs Flannery, Baggallay and Johnson, Ltd., Consulting Naval Architects to the Crown Agents for the Colonies.

THE ROYAL RESEARCH SHIP 'DISCOVERY'

CONSTRUCTION AND ORIGINAL DESIGN

The 'Discovery' was constructed by the Dundee Shipbuilding Company for the National Antarctic expedition of 1901–3, and was intended essentially for Antarctic exploration and polar research. The vessel was designed by Sir W. E. Smith, late Chief Constructor at the Admiralty, and was built under his direction and with the assistance of Admiralty officials. She is rigged as a barque with fore, main and mizen masts, and her principal dimensions are as follows:

	ft.	in.
Length overall	198	0
Length on water line from fore edge of stem to axis of rudder ...	172	0
Extreme breadth	34	0
Depth amidships from top of ceiling to top of upper deck beam	18	6
Designed draught	16	0
Designed displacement at 16 ft. 0 in. water line, about 1600 tons		

Construction. The ship was constructed of wood throughout with the exception of the fastenings, which were mostly of galvanized iron, except within a radius of 30 ft. of the magnetic centre or magnetic observatory, where they were of naval brass. The framing of the vessel generally was of English oak, grown to form wherever practicable; the beams on the main deck were, however, of pitch pine. The main planking was of Canadian elm below water and pitch pine above water, varying in thickness from 7 in. at the keel to about 4 in. at the sheer. An outside sheathing or doubling of green-heart about $3\frac{1}{2}$ in. thick was fitted fore and aft, extending about 11 ft. below the water line except at the forward end of the vessel where it was extended down to the keel at the forefoot as a special protection against ice. The inner bottom planking was of Riga fir about $3\frac{1}{2}$ in. thick, excepting below the clamps in the 'tween decks where it was about 4 in. thick. The beam shelves and clamps were exceptionally heavy, also the main waterways and inner waterways, resulting in the vessel having an average general thickness of 2 ft. throughout her girth.

The forefoot was of the most solid construction, with special ice protection extending to about 5 ft. above the load water line. This protection consisted generally of oak timbering built up behind the stem to a depth varying from 8 ft. at the head to about 10 ft. at the foot, and, on top of the wood, galvanized steel plates were also fitted to reduce chafe as far as possible. Beams and heavy diagonal timbers, all of oak, were introduced in the lower part of the vessel at the forward end to withstand ice pressure.

The decks of the ship were of Dantzig fir, varying from $3\frac{1}{2}$ in. in thickness on the weather deck to $2\frac{1}{2}$ in. on the lower-deck flats. The bulkheads—which were five in number—were of wood throughout, with the exception of that at the forward end of the boiler space, which was of steel to guard against deterioration due to heat from the boilers.

In the **Original Design of the Vessel** a topgallant forecastle was arranged forward, and the entrance to crew space and galley in a house abaft the fore-mast. Between the fore and main masts a magnetic observatory was built, with houses abreast of it on either side, occupied mainly by laboratories, and with the bridge above. The entrance to the wardroom was immediately abaft the magnetic observatory, and a large skylight for light and air to the wardroom was placed amidships.

The engine and boiler casings were of steel, situated between the main and mizen masts and extended at the forward end to form a winch house. This house accommodated a steam winch, having cylinders 8 in. in diameter and 12 in. in stroke. Hand steering gear only was fitted. It was of the ordinary barrel type, with purchase to the tiller at rudder head, and was placed at the after end of the vessel.

Separate hatches on the after deck provided access to a store room on the starboard side and to a sail and canvas room on the port side. Two houses were built, one on each side of the ship abreast of the screw aperture, for use as paint lockers, stores, armoury, etc.

Eight boats were provided in davits, the complement consisting of five 26-ft. whalers, one 20-ft. cutter, and two Norwegian prams.

The steam windlass was fitted on the upper deck, below the topgallant forecastle, with a vertical spindle extending to a capstan head above. On its starboard side a donkey boiler was placed, and a small coal bunker. The anchors and cables were specially heavy, and of the ordinary Admiralty pattern.

Below the upper deck, the 'tween decks at the forward end was occupied by store rooms and chain lockers. Between two bulkheads immediately abaft the chain locker was the galley, arranged on the centre line of the vessel, with compartments on either side used as a laboratory, a sick bay and store rooms. The crew and petty officers were berthed immediately abaft the galley space.

Between the forward end of the machinery space and the after end of the crew space was the wardroom, arranged centrally, with ten cabins on either side and across the after end, and a large pantry on the starboard side. The engine and boiler space, engineers' stores and workshop, wing coal bunkers, sail and canvas room and store rooms were at the after end of the vessel.

In the lower holds of the ship, below the accommodation spaces, the space was subdivided into stores and provision chambers with room for fresh-water tanks in the forward part. These tanks had a capacity of 25 tons and were made of zinc plates cased outside with wood. Amidships were coal bunkers, with ballast tanks below, the latter so designed that they could be used for carrying coal when required.

The propeller and rudder were both specially constructed, so that either could be removed and lifted on to the deck through trunk ways built between the skin of the vessel and the deck. This provision was made so that either the propeller or rudder could be dealt with at sea in the event of damage.

The propelling machinery originally installed is still in use and a description of it will be found on p. 159, which deals with the vessel as at present arranged. A full and interesting account of the design and construction of the ship as originally built will be found in a paper read by Sir W. E. Smith on April 12, 1905, before the 46th Session of the Institution of Naval Architects.[1]

Service with the Hudson's Bay Company. On completion of her service in Antarctic exploration the 'Discovery' was acquired by the Hudson's Bay Company, who con-

[1] Smith, *Trans. Inst. Naval Architects*, XLVII, pt. 1, 1905.

verted her for commercial trading purposes, her great strength rendering her very suitable for work in the Arctic fur trade. For her special service with this Company the windlass was removed from below the forecastle deck and fitted on the forecastle head, the space below the forecastle deck being used as accommodation for the crew. The magnetic observatory and the dredging laboratories on the sides of the vessel were extended to accommodate the ship's officers. The whole of the accommodation in the 'tween decks was removed, and the vessel was left with clear hold space from the collision bulkhead to the boiler-room bulkhead, so as to give as large a carrying capacity as practicable. The arrangements for unshipping the propeller at sea were dispensed with, and a permanent propeller shaft of the ordinary type was fitted. A number of fittings, including the engineers' workshop, were also removed, since they were considered unnecessary for ordinary trading purposes.

PURCHASE FOR WHALING RESEARCH AND RECONDITIONING

When the question of undertaking scientific research in Antarctic waters was considered by the Interdepartmental Committee for Research and Development in the Dependencies of the Falkland Islands, a special subcommittee under the chairmanship of Captain C. V. Smith, R.N., was appointed to advise on the type of vessel and equipment which would be necessary. The report of the subcommittee was published in 1920 with that of the Committee itself (Cmd. 657, p. 145), and recommended the provision of two wooden vessels with auxiliary steam power.

A second interdepartmental Committee was then appointed to consider the acquisition of two research vessels such as had been proposed. This Ship Committee included the Director and Assistant Director of Naval Construction, representatives of the Department of the Engineer-in-Chief of the Admiralty, the Consulting Naval Architects to the Crown Agents for the Colonies, the Royal Geographical Society and other Departments concerned in marine biological research. It was found impracticable owing to financial considerations to build the two ships required. The structural details and qualities of vessels which had already been used in polar research, and such whaling and sealing vessels as were on the market, were therefore examined, and after a number had been considered it was decided that the 'Discovery' most nearly met all requirements. In making this decision the Ship Committee was influenced largely by the great strength of the vessel and by the fact that she had been primarily constructed for work in the Antarctic. Navigating in ice-laden waters she would be safer than any other vessel afloat, and though it was realized that to winter in the south did not come within the scope of the work contemplated, the risk that she might on some occasion be hemmed in by ice could not be overlooked.

In consequence of this decision, and before purchase was completed, as detailed an examination as possible was made of the ship and her machinery; with the consent of her owners she was dry-docked for this purpose in January, 1923.

Reconditioning. A preliminary inspection had already shown that the vessel had "hogged" to the extent of $3\frac{3}{4}$ in. in 130 ft., indicating that she had been badly strained, and it was also found that owing to the lack of air courses to the inner timbers considerable deterioration had taken place. The extent of this deterioration could not be fully determined since it involved practically the entire stripping of the vessel. It was, however, evident that renovation and repair on a considerable scale would be required and that new masts, spars, sails and rigging were necessary. The machinery generally was in excellent repair, the main engines requiring little work to restore them to good condition. The main boilers bore signs of deterioration, owing to corrosion, and the lagging throughout required renewal.

These defects in condition were fully appreciated by the Ship Committee; but after careful consideration of the alternative of building a new vessel, and with the knowledge that no other second-hand ship of such robust construction as the 'Discovery' was obtainable, a recommendation was made that she should be purchased.

After purchase, which was effected in 1923, timbers which could not be examined earlier were found on disclosure also to be deteriorated, necessitating further renewals. The main framing of the ship was more or less affected throughout, particularly that portion which was above water. The stern was very badly deteriorated, the planking mostly in bad condition, and the main keel was found to have been damaged and to require renewal in part. A number of beams on both main and upper deck were found to be defective and the deck planking generally required renovation. Detailed specifications were prepared for the complete reconditioning of the ship, providing for renewal of all defective parts and including special accommodation and laboratories suitable for the intended service. Competitive tenders were invited, and the work was finally placed in the hands of Messrs Vosper and Co., Ltd., of Portsmouth.

During the reconditioning of the vessel and the complete renewal of masts, spars, sails and rigging, advantage was taken of previous experience to make certain alterations which were expected to improve her sailing qualities. For this reason the centre of effort was moved forward, by placing the fore and main masts farther forward than in the original arrangement, and a slight increase was also made in sail area. To facilitate the handling of sails it was decided to fit upper and lower topgallant sails (Plate VII) instead of the single topgallant sail of the original rig.

PRESENT ACCOMMODATION AND MACHINERY

The general arrangement of accommodation on the vessel after reconditioning is described below and illustrated in the profile and plans shown on Plates VIII and IX. The arrangements for scientific work are described separately on p. 160.

On the **Forecastle Head** the deck planking was completely renewed. A capstan head is placed in the centre of the deck, and at its after end two skylights are fitted for light and air to the galley The usual bollards and fair-leads are provided, together with special deck lights, giving light and air to the space below. A powerful searchlight is arranged near the after end of the deck, just forward of the skylights to the galley. Leadsman's sounding platforms are fitted on either side.

The **Bridge** is arranged on the top of the midship house and is of teak throughout, with rails, stanchions and weather boarding. The deck is kept very slightly wider than the width of the midship deck house, excepting for about 4 ft. fore and aft at the forward end, where it is extended on each side to about the maximum beam of the ship at the rail, to give good facility for conning the ship by the officer on watch. The standard compass is placed near the forward end of this bridge and telegraphs stand on each side for communication with the engine room. A steam and hand steering gear is fitted at the after end of the bridge, with a steering compass for the helmsman. The emergency batteries for the wireless installation are arranged in a special box immediately above the wireless house and on the port side. A laryngaphone telephone is fitted on the starboard side of the bridge for direct communication with the engine room.

The boats conform to Board of Trade requirements and consist of two 24 ft. whalers, two 18 ft. lifeboats, a dinghy and a pram. The whalers are carried on either side of the bridge, the dinghy and pram on top of the winch house, and the lifeboats on skids farther aft.

Upper Deck. Below the forecastle head a specially made steam and hand windlass is fitted for dealing with the vessel's cables: it is provided with a vertical spindle extending to the capstan head. The sheltered space abaft the windlass is used as a carpenter's shop, and on either side there is stowage for oilskins, and rooms and lockers for the storage of scientific and other gear. In the original arrangement an auxiliary steam boiler with a small coal bunker was fitted under the forecastle head; but this was removed, as it was not likely to be required and the room it was occupying could more usefully be devoted to other purposes.

Immediately abaft the forecastle and in the middle of the fore deck a wood house is built, about 8 ft. square. This house is divided into two compartments, the forward compartment being the entrance to the galley and the aft compartment the entrance to the crew's quarters. These two entrances being on opposite sides of the ship give the advantage of a lee door, since the galley and crew spaces are in communication below deck. Two large skylights are fitted, one forward and the other abaft the entrance to the deck house, supplying light and air to the galley and crew spaces. The upper parts of both skylights are portable to facilitate handling stores.

A large teak deck house, 27 ft. fore and aft and about 16 ft. wide, is constructed just forward of midships, between the fore and main masts. At the forward end of this deck house is a large chart room and at the after end a deck laboratory, both extending the full width of the house. Between the chart house and the deck laboratory are, on the starboard side, a spare cabin, with the lobby and entrance to the wardroom abaft it, and on the port side, a large deck locker for survey instruments, and the wireless cabin between it and the laboratory.

The chart house, apart from the usual furnishings, contains several special features: a chronometer box for three chronometers with electric lights for keeping the box at a constant temperature, a distance thermograph for giving continuous readings of the temperature of the water at a few feet below the surface, and an echo-sounding apparatus for dealing with soundings up to about 130 fathoms.[1] In addition to the above an experimental deep-sea echo-sounding apparatus was originally installed, but proved ineffective owing to loud water noises. After the sister keels had been fitted in 1926 these noises increased to such an extent as to render the apparatus unserviceable.

The wireless cabin contains two separate Marconi wireless sets, each of $1\frac{1}{2}$ kw. capacity; one set being the well-known quench-gap type and the other the continuous wave type. With this apparatus communication was on one occasion successfully maintained up to as much as 2680 miles.

The deck laboratory is fully described on p. 169.

The two deck houses referred to above—the entrance to the crew's quarters and galley and the midship deck house—are both of exceptional strength, the coamings being of heavy section teak, and the sides constructed of two thicknesses of teak, clinched together and with insulation between, making a very strong combination to withstand the severest weather conditions.

A large teak skylight is placed between the main-mast and the after end of the midship deck house, to supply light and air to the wardroom and the cabins which communicate with it.

At the forward end of the boiler casing a large steel house 10 ft. long and 16 ft. broad is erected to enclose the steam winch. The engine and boiler casings extend from the fore side of the mizen-mast to the after side of the winch house. On either side of the engine room casings is a series of ice tanks, fitted with steam pipes and with connections to the freshwater tanks. The tanks can thus be used for watering ship from ice when ordinary supplies are not available. Both casings and tanks are of steel, as originally fitted to the vessel. A single hatch is fitted abaft the engine casing on the after deck, for access to the sail and canvas store. A hand steering gear is fitted near the fore side of the propeller trunk hatch for use when under sail alone.

Two teak houses, constructed similarly to the houses on the fore deck, are arranged at the after end of the vessel abreast of the propeller trunk and inset from the rail. In these houses are included the lamp locker on the starboard side and an ammunition store on the port side, each provided with a small hatch giving sheltered access to the after peak. Large gratings are fitted at about half the height of the bulwarks at the extreme after end of the ship, covering the steering gear leads and tiller and affording a platform for handling nets.

The lighting of the compartments below deck is effected by means of deck lights. Port lights in the side of the ship would have been a danger in ice navigation and, in a wooden vessel, are difficult to arrange without materially reducing the strength of the

[1] For an explanation of this method of sounding see *Nature*, March 29, 1924, p. 463.

top sides. These lights are arranged so that either mushroom ventilators or ordinary flat deck lights can be fitted. In addition the screw tops of the mushroom ventilators can be removed and cowl ventilators or deadlights substituted when required.

Coaling scuttles, of cast iron and about 18 in. in diameter, are provided. Four of these scuttles are arranged immediately above the wardroom, and special portable trunks are provided for communication with the bunker space below the wardroom accommodation when coaling ship.

The space on the **Main Deck** forward of the boiler room is mainly devoted to living quarters. At the forward end of the ship immediately abaft the stem are stores for provisions and canteen supplies. Abaft this space the galley is situated on the centre line of the vessel; it is provided with a large cooking stove, and the galley store is placed on the port side abreast of the stove. On either side of the galley are separate compartments, that on the port side being the sick bay, while that on the starboard side consists of an insulating chamber with a CO_2 refrigerating machine, and abaft it a cabin for two petty officers. Abaft the galley space, as described above, the crew and petty officers are quartered, the petty officers' cabins (four in number) being constructed on the port side, and the crew occupying the remainder of this portion of the ship.

The wardroom accommodation extends from the forward end of the boiler room to the after end of the petty officers' and crew space, and contains ten cabins all communicating with a large wardroom about 24 ft. long by 12 ft. wide. The cabins and wardroom are comfortably furnished in polished mahogany. A pantry is provided for wardroom use and leading from the wardroom-lobby is a small officers' bathroom. On the port side at the forward end of the wardroom accommodation is a laboratory, with a small darkroom attached. The furniture of the wardroom consists of a large central table with swivel chairs, a bookshelf, slow combustion stove and small upright piano. An electric fan is fitted at the after end to assist ventilation.

Flush hatches are arranged in the main deck in convenient positions, as indicated in Plate IX, for communication with store rooms, provision lockers, freshwater compartments and bunkers below the main deck. Abaft the machinery space a large compartment is provided for the stowage of sails, canvas, blocks and other rigging stores.

Below the Main Deck, at the forward end and immediately abaft the stem, store rooms are arranged, with a chain locker in two compartments on the centre line. The remainder of the space between the chain locker compartment and coal bunker is a hold, divided into five compartments, the aftermost of which contains the freshwater tanks only. These tanks are six in number, each having a capacity of 5 tons, giving a total of 30 tons of fresh water for drinking purposes: they are all interconnected and any one tank can be used independently of the others. The freshwater tank compartment also contains bilge valve boxes, with pipes leading to each of the principal compartments forward of the freshwater tank space, and with valves operated from the main deck immediately above. A main suction line is led direct from the engine room to the bilge valve boxes.

The remainder of the compartments between the freshwater tank space and chain lockers are arranged for the stowage of provisions and scientific and other gear. Between the after end of the freshwater tank compartment and the fore end of the boiler space is a coal bunker, the total capacity of this and of the wing bunkers being 208 tons.

The whole of the spaces below the main deck are subdivided by means of wooden bulkheads, constructed of two thicknesses of tongued and grooved pine, one horizontal and one diagonal, with painted felt between. The two thicknesses are clinched with strong fastenings, providing a watertight construction. In addition to the thwartship bulkheads a similar fore and aft bulkhead extends from the after end of the bunker space to the after end of the chain locker, completely dividing the vessel on the centre line. The forward bulkhead of the boiler room is of steel as in the original arrangement, and in addition a light steel screen is fitted between the engine and boiler rooms.

Full advantage is taken of the space available in the 'tween decks alongside of and above the boilers for bunker space, the bunkers in this part of the ship being constructed of steel.

The **Propelling Machinery** is the same as in the original vessel and it has not been altered in any material way. Steam is supplied by two cylindrical boilers, each 10 ft. 3 in. in diameter and 9 ft. long, each having two furnaces: the combined total grate surface provided is 67 sq. ft. The maximum working pressure is 150 lb. per square inch.

The engines are of the triple expansion type designed to develop 450 H.P. when working at about 90 revolutions per minute. The diameters of the cylinders are: high pressure 14½ in., intermediate pressure 22½ in., low pressure 36 in.: length of stroke 30 in. The high and intermediate pressure slide valves are of the piston type, the low pressure being a flat valve, all actuated by the usual link motion. The condenser cooling surface is 560 sq. ft. The main air, feed and bilge pumps are worked by levers from the high pressure engine. The shafting is of steel, the crank webs being forged in one with the shaft. The propeller is two-bladed, 10½ ft. in diameter and with a pitch of 12 ft. The boss is of gun-metal, and the blades are of high tension bronze.

The auxiliary machinery fitted in connection with the main engines comprises a reversing engine, two centrifugal circulating pumps and an auxiliary feed pump. The circulating pumps are each capable of pumping 100 tons of water per hour; they have connections to the bilge and each is arranged with an auxiliary air pump. The outlet of the main condenser circulating water is kept well above the water line, and all pipes are arranged so that they can readily be drained and, as far as practicable, kept above the floor plates. Owing to the special service on which the vessel was to be employed all cylinders, including those of the auxiliary machinery, are made self-draining and each main engine cylinder is water-jacketed.

On reconditioning the ship certain new auxiliary machinery was installed: a 10 ton evaporator with freshwater distiller working in conjunction with it: an electric generating installation, consisting of a compound steam engine directly coupled to an electric generator, having an output of about 15 kw. at full power: an emergency generating set, fitted on the 'tween decks flat on the port side at the after end of the engine room, consisting of a 15 kw. generator driven by a direct coupled Parsons 21 B.H.P. petrol/paraffin motor having three cylinders. Either of these generating sets is capable of lighting the whole vessel, as well as supplying power for the searchlight and wireless installations.

The workshop, which had been removed whilst the vessel was in the service of the Hudson's Bay Company, was again provided during the reconditioning of the ship. The shop includes a small 6 in. Drummond lathe of up-to-date pattern with screw cutting and slide surfacing gear, arranged to be driven by electric motor and foot-treadle, a full equipment of tools and a small hand-drilling machine.

The arrangement whereby the rudder and propeller could be lifted on deck was dispensed with when the vessel entered the service of the Hudson's Bay Company. It was, however, restored during the reconditioning of the ship and is of the same design as shown in plate vii of the paper by Sir W. E. Smith referred to on p. 153.

In 1926, when the vessel was dry-docked at Simon's Town, sister keels were fitted to reduce the heavy rolling, which had been found a serious disadvantage in scientific work. In order to obviate any danger which might arise through contact with ice, these keels are attached in short lengths by bolts which will draw under any exceptional strain.

ARRANGEMENTS FOR SCIENTIFIC WORK

Some difficulty was experienced in making suitable arrangements for scientific investigations in the 'Discovery'. A square-rigged vessel was found to be ill-adapted for oceanographical work: standing rigging and running gear offer serious obstructions to the handling of large nets, and the plan which was finally adopted is not by any means ideal. With her high bulwarks ($4\frac{1}{2}$ ft. above deck level) and the pronounced "tumble home" of her sides it was impossible to work vertical nets and water bottles in the usual way. It was necessary to place the operator outboard, on a platform slung at deck level, a position not without its discomforts when the ship was riding to a heavy swell. A general idea of the deck arrangements can be obtained from Plate IX.

Main Winch. When the 'Discovery' was altered and refitted for her new work it was not found possible to change the position of the winch, which is placed, as it was in Captain Scott's time, abaft the main-mast and on the forward side of the engine-room casing. This position is not a good one, for the wires lead forward and must make two right-angle turns round fair-leads before they can be brought aft. The ideal position would be abaft the engine room, with ample clear space between the winch and the stern rail; but lack of room precluded this arrangement in the 'Discovery'.

The winch (Plate X, fig. 1) was made by Messrs Clarke, Chapman and Co., Ltd. It is of the horizontal steam trawler type, with 8 × 12 in. cylinders and with both single and double purchase steel gearing, fitted with machine-cut helical teeth. It carries two steel drums, with cast steel ribbed end flanges, and in each of these the barrel is 12 in. and the end flanges 48 in. in diameter. The drum on the port side is $12\frac{1}{2}$ in. in length, designed to take 1000 fathoms of steel wire rope $1\frac{5}{8}$ in. in circumference. That on the starboard side is 5 ft. in length and carries 5000 fathoms of tapered wire rope, $1\frac{3}{4}$ to $1\frac{1}{2}$ in. in circumference. The rope is guided on to the larger drum by a traversing gear driven either mechanically or by hand, and a similar form of hand-operated gear is fitted to the smaller drum. The engine is capable of developing 50 H.P. with a steam pressure of 150 lb., giving a pull of $3\frac{1}{2}$ tons on the rope from the top of the coil. The winch, which weighs $9\frac{1}{2}$ tons exclusive of wires, was designed to give a speed of haul on the top coil of 100 ft. per minute; the average rate is, however, in excess of this figure and with large plankton nets and dredges a speed of over 200 ft. per minute can be attained when required. As a protection against weather the winch is fitted inside a steel deck house, and warping drums, fitted to each end of the shaft, extend outside the house.

Though some defects are to be noted the winch on the whole proved very satisfactory, working smoothly and easily under all conditions.

In order to resist the enormous lateral thrust caused by winding in long lengths of wire rope under high tension, the end flanges of the drums, as noted above, were specially strengthened. The larger drum, however, is built in three pieces, riveted together, and on one occasion after deep-water operations it was found that the inner end flange no longer ran true. Later, in Simon's Town dockyard, the wire was rove off, and it was found that the rivets holding the end flange to the centre barrel had partially sheared. Repairs involved the dismantling of the winch house and occupied a considerable time. Experience indicates that large winch drums should, whenever possible, be cast in one piece.

Some difficulty was experienced in fitting the automatic traversing gear to the larger drum owing to the taper of the wire rope. The pitch of the screw on the rod which carries the traveller was made to suit the middle diameter of the wire, but in practice this did not work well. When more than half the wire is outboard the traveller, on hauling, moves too slowly, and the wire takes riding turns. To obviate this a clutch and alternative hand gear was subsequently fitted, but it would probably be better if the screw pitch were adjusted to the maximum diameter of the wire. The rollers of the traveller should be fitted with ball or roller bearings and should be sufficiently staggered to allow free passage to the swivel and shackles which form the connection between the wire and the bridles of the trawl.

The positions of the **Pedestal Fair-leads** are shown in Plate IX, and two of them are to be seen in Plate X, fig. 2: all are securely bolted to tie plates lying below the deck and stand with their centres 19 in. above deck level. In the single fair-leads the height of the revolving part is 9 in. and the minimum diameter 9 in.: in the double fair-lead these measurements are $6\frac{1}{2}$ and 12 in. respectively. The revolving parts were in the first place made of cast iron, but in the course of a year, during which comparatively little deep-water work was undertaken, it was found that the wire had cut deeply into them and spares made of manganese steel were substituted.

It will be seen that the arrangement of fair-leads allows the longer wire to be used on either side of the ship and it was hoped that two flights of nets, one deep and one shallow, could be towed at the same time.[1] In the 'Discovery' this was found impracticable in routine work, and though the young-fish trawl was often used with one wire, while a flight of shallow horizontal nets was towed with the other, it was not possible to work two sets of large nets simultaneously. It was found, moreover, that to shoot deep-water nets on the starboard side was likely to cause serious damage to the wire. After several long hauls had been made on this side of the ship it was discovered that the wire was rapidly becoming unlaid and it would no doubt have been ruined if this practice had been continued. This action, which was quite unexpected, is due no doubt to the two turns round the fair-leads, these turns being right-handed when facing the bow of the vessel. Hauling under a heavy strain on the starboard side tends to take out the lay; to work properly a wire laid up left-handed would be required, and this of course would prove equally inefficient on the port side. With the winch in a better position and straighter leads, trouble of this nature is not likely to occur.

The port and starboard stern **Fair-leads** are mounted in the rail, which is cut away for the purpose. They consist of four rollers, mounted in a heavy frame, with a snatch above: the vertical rollers are hourglass-shaped and all are brass bushed. The outboard horizontal roller was originally $3\frac{1}{2}$ in. in diameter, but was found to give too sharp a nip, flattening the wire unduly under heavy strains. A 5 in. roller was substituted and the diameter might be increased even further with advantage. The fair-leads gave a certain amount of trouble, for with heavy work it was found that the frames became strained and continual attention was needed to see that the rollers revolved freely. It is important that the frame should be of very solid construction and that all the rollers should be fitted with ball or roller bearings. The snatch at the top should be so made that, when it is open, the whole space between the vertical rollers is clear; if it overlaps the rollers, shackles and the screw stops used in plankton work are liable to jam when being hauled through the fair-lead.

Heavy Accumulators. The large compression springs shown in Plate IX (47) are for use as accumulators. By means of the nipper referred to on p. 207 the strain on the warp can be taken on this spring, which will thus compensate for sudden jars caused by the pitching of the ship and save the gear from damage. Full compression is reached with a strain of 6 tons. It was found in practice that the springs were too strong; they would need to be weaker and much longer in order to give sufficient play. Experience tends to show that heavy accumulators for deep-water work are not necessary. For plankton work at shallow depths a light accumulator giving plenty of play is an undoubted advantage, but with deep nets sufficient compensation is afforded by the spring of the wire rope and by the fact that under varying strains its curvature will alter.

[1] See Hjort, in Murray and Hjort, *Depths of the Ocean*, p. 49, fig. 32, London, 1912.

Auxiliary Winch-drum. Close to the winch on the starboard side is a drum fitted with clutch, brake and hand-operated traversing gear, designed to accommodate 3000 fathoms of wire 6 mm. in diameter (Plate X, fig. 2). It is driven by a sprocket wheel on the main shaft of the winch by means of a roller chain, the brake handle being extended to the control position in the winch house. When not in use the chain was disconnected. This auxiliary winch was intended for handling grabs and light bottom apparatus, but was used mainly for the storage of lengths of wire used with fish traps.

Light Deck Machines. For hydrological work and vertical plankton nets three small engines and drums are provided in addition to the sounding machine. All are placed on the port side and are used with wire 4 mm. in diameter. One engine, coupled to a drum holding 3500 fathoms of wire, is placed near the winch house (Plate XI, figs. 1, 2) and is used for vertical nets. The second, just forward of the bridge (Plate XII, figs. 1, 2), has two drums, one on either side, each with 500 fathoms of wire, and is used mainly for insulating water bottles worked at shallow depths. The third engine (Plate XIII, fig. 1), with 3500 fathoms of wire, is placed on the forecastle head and with it deep-water temperatures and salinities are taken with reversing water bottles. All three machines are fitted with the same type of engine, made by E. Reader and Sons —a twin cylinder two-crank engine, class D.F., with cylinders $3\frac{1}{2}$ in. in diameter by 3 in. stroke, designed to develop 9 brake horse-power at 500 revolutions per minute with 155 lb. steam pressure at the stop valve. Originally these engines were directly coupled to pinion shafts, driving spur wheels bolted to the rims of the drums, the ratio of gearing being 1·87 to 1 in the machine carrying 500 fathom drums and 3·47 to 1 in those with 3500 fathom drums. The machine with the shorter length of wire was quite satisfactory with this ratio, but the two deep-water machines, though they doubtless possessed sufficient power, proved unable to start with a standing weight of $2\frac{3}{4}$ cwt.[1] Even when the engine did start, with a lesser weight, it hauled very slowly and was liable to stop every time the vessel rolled to starboard. To overcome this difficulty further gearing was introduced by means of a lay shaft driven by sprocket wheels and a roller chain, the new gearing ratio being 6·3 to 1. This alteration was made to both deep-water machines and brought immediate improvement. The machines have since given complete satisfaction and we believe they could not be surpassed for oceanographical work. They start easily under any conditions, can on an average haul 1000 m of wire in $5\frac{1}{2}$ min.[2] and can be throttled down to the slowest possible movement, so that an instrument attached to the wire can be brought without the least trouble to the exact height required. It may be noted that these machines, with 6·3 to 1 gearing ratio and with the drum full of wire, can just lift a dead weight of $5\frac{1}{2}$ cwt.

[1] That is to say, with 3000 m. of wire, 3 reversing water bottles and a 28-lb. lead.

[2] With a series of Ekman reversing water bottles the rates of hauling were approximately:

From 4000 to 3000 m.	...	7 min.
„ 3000 „ 2000 „	...	6 „
„ 2000 „ 1000 „	...	5 „
„ 1000 „ surface	...	4 „

The drums carrying 500 fathoms of wire are 16 in. in extreme diameter and 5 in. in clear width; those with 3500 fathoms of wire are 28 in. in diameter and $9\frac{3}{4}$ in. in width. The centre hub in all the drums is 6 in. in diameter. The drums are a little small for the length of wire they are intended to carry; the full amount can only be accommodated when wound on under considerable strain, and to do this on board ship is a task of some difficulty. The drums are of cast steel with the ends strengthened with radiating ribs. They are clutched to the engine and are fitted with large band brakes, operated by a foot lever which can be locked when desired by means of a screw clamp.

Outboard Platforms, Samson Posts, Booms, etc. It has already been explained that in view of the pronounced "tumble home" of the ship's side it was necessary to work from outboard platforms, but this does not apply to the apparatus for deep water bottles on the forecastle head. The wire from this machine is led through snatch-blocks to the anchor davit, and the instruments are lowered into the water close to the bow, where the sheer is ample. With the other two machines, platforms, fitted with movable stanchions and chains, are hinged to the covering board, folding against the bulwarks when not in use.

When designing the equipment it was felt that the "tumble home" would also prove a difficulty in another way, for it seemed probable that if the wire were not to foul the ship's side during heavy rolling, it must be slung so far out that it would be beyond the reach of the man on the platform. To obviate this difficulty a samson post, 4 in. in diameter and 9 ft. 10 in. in length, is stepped in the rail and a boom of the same diameter and $10\frac{1}{2}$ ft. in length is hinged to the covering board opposite each of the drums of the two after machines. The boom is fitted with a sheave at the end and its topping lift passes through a fair-lead in the samson post to a small drum which can be turned by hand and locked in any position by ratchet and pawl. With this method the inclination of the boom, and consequently the distance of the wire from the ship's side, can be regulated to suit the prevailing conditions: in heavy weather the boom can be inclined well outboard and can be topped up to bring the wire within reach of the operator when the apparatus is at the surface. The arrangement is indicated in Fig. 1. In actual practice it was found that there was less danger of apparatus being damaged against the ship's side than was anticipated and that the use of booms and topping lifts was scarcely necessary. With the shallow-water machine they were, however, retained, with the addition of a fair-lead consisting of a box of four small rollers, to prevent the wire jumping out of the jib sheave. At the after machine a high davit was substituted (Plate XI, fig. 1) and this simpler arrangement, which permits the use of a slung block for the jib fair-lead, is to be preferred.

Light Accumulators. Light compression springs or accumulators, designed to take up sudden jars and minimise the effect of the rolling, are fitted to all the machines and in general design are somewhat similar to those used by Dr Schmidt in his oceanographical expeditions to the Mediterranean.[1] The plan adopted for the two after

[1] Schmidt, *Rep. Oceanogr. Exped. Mediterranean*, 1908–10, I, p. 10, fig. 7, 1912.

machines is seen in Fig. 1. It will be noticed that the recording sheave is hung low down on the samson post, in which position it can easily be read and the indicator

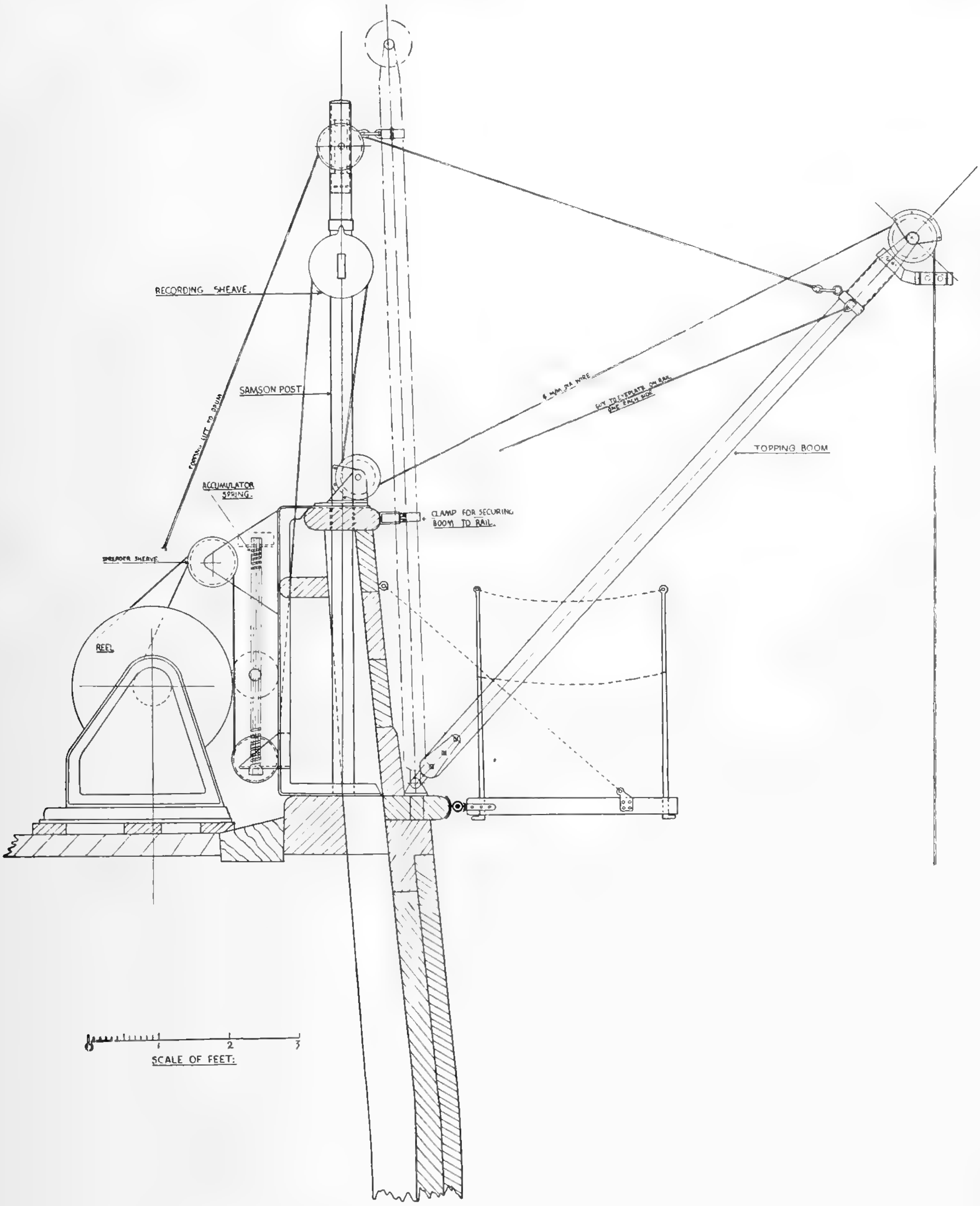


Fig. 1. Section of rail of R.R.S. 'Discovery', showing light deck machine for hydrological or plankton work, with arrangement of boom, outboard platform, accumulator, etc.

adjusted when necessary. For vertical nets in particular a considerable distance between water level and jib sheave is required, and if the recording sheave were slung from the head of the davit it would be difficult both to read and to adjust. For the lead from the forward machine on the forecastle head the anchor davit is employed, with a removable frame carrying the accumulator, and here, as shown in Plate XIII, fig. 2, the recording sheave is slung from the davit head. The sheaves used as fair-leads are all interchangeable: they are 8 in. in diameter and are made of cast steel with a brass bushing.

In the machine used for vertical plankton hauls it was hoped that the accumulator would tend to reduce inequalities in the speed of hauling due to the rolling of the vessel, and that with its help an even rate of 1 m. per second could more easily be maintained. As will be seen, however, from the diagram, the arrangement adopted involves the use of a number of sheaves, and it was found by experience that, if the wire was to be paid out rapidly without over-riding the sheaves, it was essential to use a comparatively light spring on the accumulator. With the greater strain of hauling this spring was always in full compression, and though a moderate amount of compensation for rolling was afforded by the engine itself (which slowed automatically as the vessel rolled to starboard), the accumulator gave no assistance. But though the accumulator thus had little value for the purpose for which it was primarily intended, it proved of benefit in other ways, for the wire could be paid out more rapidly and, except in the roughest weather, it indicated by a sudden extension the exact moment when the messenger effected the closure of the net. It was thus easy to observe whether the apparatus had worked properly and whether the vertical haul had been taken to the desired level. With the machine used for the Nansen-Petterson water bottle the accumulator was useful in the same way: it indicated the time of arrival of the messenger and hauling could begin at once.

As originally constructed the arrangement for spreading the wire as it was wound on the drums consisted of a sheave (Fig. 1) running freely on a shaft whose length was equal to the breadth of the drum, the sheave being moved from side to side by a forked lever. In the forward machine this fitting was replaced, at an early date, by a small carriage with three rollers (one horizontal and two upright) moved by a worm gear. A similar method would have been advantageous with the two other machines, for when being paid out, the wire showed a tendency to jump the sheave. The sheave at the bottom of the accumulator was also loose on its shaft and was free to move laterally for half the distance of that used for spreading the wire. By this arrangement a straighter lead was maintained, but the wire was still liable to over-ride the lower sheave, and to prevent this happening two cheek-plates with small rollers were fitted.

The **Recording Sheaves** used in the 'Discovery' to indicate the amount of wire paid out are of two kinds. For the heavy wire ropes carried on the main winch a large sheave was fitted on either side of the winch-house (Plate IX (46); pl. X, fig. 2), lying in the path taken by the wire in its passage from the outer pedestal fair-lead to the stern fair-lead. Each sheave is of brass, $1\frac{1}{2}$ m. in circumference, and actuates a Hardinge revolution counter through bevel gearing. Close contact is ensured by two subsidiary sheaves, so arranged that the wire is slightly deflected in its passage aft. This system has worked extremely well, but has the disadvantage that it will not permit the passage of shackles and swivels. When, as in trawling, it is required to wind the bridles on to the drum of the winch it is necessary to "hang off" the wire with chain strops. This could be obviated by mounting the counter on one of the pedestal fair-leads, though the accuracy would not be so great, owing to the smaller diameter and the tendency to wear.

The recording sheaves used with light wire on the plankton and hydrographic machines were slung sheaves of a comparatively cheap type; they were found to require continual attention, one of the principal difficulties being that the toothed wheel conveying the movement from the axle was insecurely attached to its shaft. The reverse direction of movement in alternate dials is also an inconvenience and the more expensive types in which this defect is overcome are to be preferred.

The **Wire Ropes** used are all of galvanized steel. The two light ropes were made by Bullivant and Co., Ltd., and the heavy warps by Thos. and Wm. Smith, Ltd. All have proved very satisfactory. The specifications of the ropes are as follows:

Purpose for which used	Vertical nets and water bottles	Fish traps, light plankton nets, etc.	Trawling, dredging and large plankton nets	Large plankton nets
Diameter (mm.)	4	6	13	12–14
Circumference (in.) ...	$\frac{1}{2}$	$\frac{3}{4}$	$1\frac{5}{8}$	$1\frac{1}{2}$–$1\frac{3}{4}$
Strands	6 × 7	6 × 7	6 × 17	6 × 12 6 × 17 6 × 19
Breaking strain	19·9 cwt.	45·5 cwt.	9·9 tons	7·3–11 tons
Weight per 100 ft. (lb.) ...	3·7	8·6	41	40 (average)
Lengths used (fathoms) ...	500 3500	25 × 120 3500	1000	5000

The long length of tapered rope is made in three sections, the reduction in diameter being effected by dropping wires at varying points spread over a long distance. In deep-water work, wire ropes are subject to stresses which approach the breaking strain more nearly than in any ordinary commercial use, and since a considerable part of the available strength is absorbed by the mere weight of wire outboard, the advantages of a tapered rope are manifest. The short lengths, 6 mm. in diameter, have an eye spliced at each end and can be connected by shackles. They are used for fish traps, the rope being unshackled and attached to the buoy when a sufficient length has been paid out.

For greasing wire ropes a mixture of 50 per cent tallow and 50 per cent castor oil was applied hot, forming a durable coating which partially filled up the lay. In cold weather it was liable to become too hard and to fall off as a powder, but this can be prevented by increasing the proportion of castor oil. This method gave excellent results, though we have since seen it stated that if tallow becomes rancid, free organic acids are developed which have a detrimental effect on wire ropes.

For determining strains a Salter **Dynamometer**, reading to a maximum of 6 tons, was used in conjunction with the nipper referred to on p. 207. With this apparatus it is, of course, only possible to read the dead weight or towing strain. With series of water bottles and with any open plankton nets the hauling strain is the greater, and this could only be registered by an instrument similar to the "tensimeter" sometimes used in aeronautical work.

The following examples of the strains recorded with the dynamometer may be given:

(i) With a 28 lb. sinker, three reversing water bottles and 3000 m. of 4 mm. wire: dead weight $2\frac{3}{4}$ cwt.

(ii) With a 100 lb. sinker, one $4\frac{1}{2}$ m. tow-net and 1800 m. of $1\frac{5}{8}$ in. wire rope, speed 2 knots: towing strain 22 to 27 cwt.

(iii) With a 100 lb. sinker, two Petersen young-fish trawls attached to 2 m. frames and 5000 m. of tapered warp, speed 2 knots: towing strain 41 cwt.

(iv) With a 40 ft. otter trawl working at depths of 250 to 350 m., with 800 to 1000 m. of $1\frac{5}{8}$ in. wire rope, speed 2–3 knots: average towing strain 18 to 24 cwt., rising occasionally on heavy ground to 31 cwt.

The **Sounding Machine**, of the well-known Lucas type, is placed on the port side of the forecastle head abreast of the hydrological machine (Plate XIII, fig. 1). The machine with its engine is mounted on a bedplate, fitted on a pedestal elevated above the deck, and so arranged that when not in use the whole machine can be brought inboard by means of screw gear fitted under the pedestal. The iron framework seen in the figure is for the support of a canvas cover. The drum of the sounding machine is $14\frac{1}{2}$ in. in extreme diameter, the hub $8\frac{1}{2}$ in. in diameter, and the width $5\frac{1}{2}$ in. The drum carries 5000 fathoms of single-strand piano wire.

The machine is driven by a Brotherhood 3 cylinder reversing engine, with cylinders set radially at equal angles of 120 degrees, all working on a common crankpin on the well-known Brotherhood principle. The cylinders are of 4 in. diameter and $2\frac{1}{2}$ in. stroke, and the drive from the engine to the sounding drum is by means of machine-cut gearing, the ratio of the gears being 2·4 to 1.

In bad weather the 'Discovery' rolled heavily and in a strong wind she drifted fast to leeward. In such circumstances sounding often proved a matter of great difficulty, and on a number of occasions the wire parted and the sounding tube was lost. These difficulties, however, were due to the conditions, the machine as a whole proving very satisfactory. One defect was the absence of a clutch. The gear wheel was secured to the shaft carrying the sounding drum by means of a set screw, which was removed at the beginning of sounding operations to allow free motion to the drum and inserted when bottom was reached. The engine was a little fierce in starting, and though it was always run free before hauling began, the delay occasioned by the adjustment of the set screw often prevented an easy start and the sudden jerk sometimes caused the wire to part. The fork for guiding the wire on to the drum did not prove satisfactory, and was replaced by a guide formed of three small rollers (two vertical and one horizontal) fitted to a transverse bar and moved by a lever.

The wire used is single-strand piano wire, 0·028 in. in diameter and with a breaking strain of 220 lb. Experiments were also made with a fine 7-strand wire 0·039 in. in diameter with a breaking strain of 250 lb.: it was found that the 7-strand wire was very perishable and its use was discontinued.

A Kelvin sounding machine, driven by electric motor, was fitted on the poop deck. This machine can be employed in the ordinary way for determining the depth when the vessel is stationary, and with the use of the well-known Kelvin tubes, reliable soundings can also be taken while the vessel is under way. As an aid in navigation it is a most valuable instrument and it was frequently used for taking soundings in the course of scientific work. The machine is provided with a dial which indicates the amount of wire run out, and the wire itself is $\frac{1}{16}$ in. in diameter, composed of seven strands of 24 S.W.G., and has a breaking strain of 280 lb.

The internal accommodation for scientific work on board the 'Discovery' comprises two laboratories, a darkroom, two holds, and a locker in the topgallant forecastle.

The **Biological Laboratory**, as already mentioned, is placed on the upper deck, at the after end of a deck house which also contains the chart room, a spare cabin and the wireless operator's room. It has a door on either side to the deck, and one leading into a vestibule at the head of the companion to the wardroom. The general arrangements are sufficiently well shown in the sketch (Fig. 2) and plan (Fig. 3), but one or two points perhaps deserve special mention.

The portholes are 14 in. in diameter and are placed much lower than usual, $3\frac{1}{2}$ in. above bench level, in order to give the best possible light for microscopic work; and, in view of the large amount of bench space that would have been taken up by their dead lights and screw clamps, those on the after bulkhead are reversed and are opened and closed from the outside. The benches give seating accommodation for four and are so placed that those using the centre table face thwartships, a position which is preferable for work in a rolling vessel. The chairs of the two side benches have folding backs; they run on brass rails flush with the deck and can be pushed under the bench when not in use. All microscope stands are drilled and can be bolted to a brass plate countersunk in the bench surface.

The swing table, 20 in. by 33 in., is built of teak, with iron stays carrying a tray below the table and a lead weight of 56 lb. This table was a very essential part of the equipment: except in the calmest weather it was in constant use. It would have been improved with more space round it. Two small swing tables, bracketed to the after bulkhead between portholes, were useful for small dishes of specimens.

The sink is supplied with fresh and salt water from two small tanks placed on the bridge, and above it, in an alcove built out over the companion, are three 20 litre glass

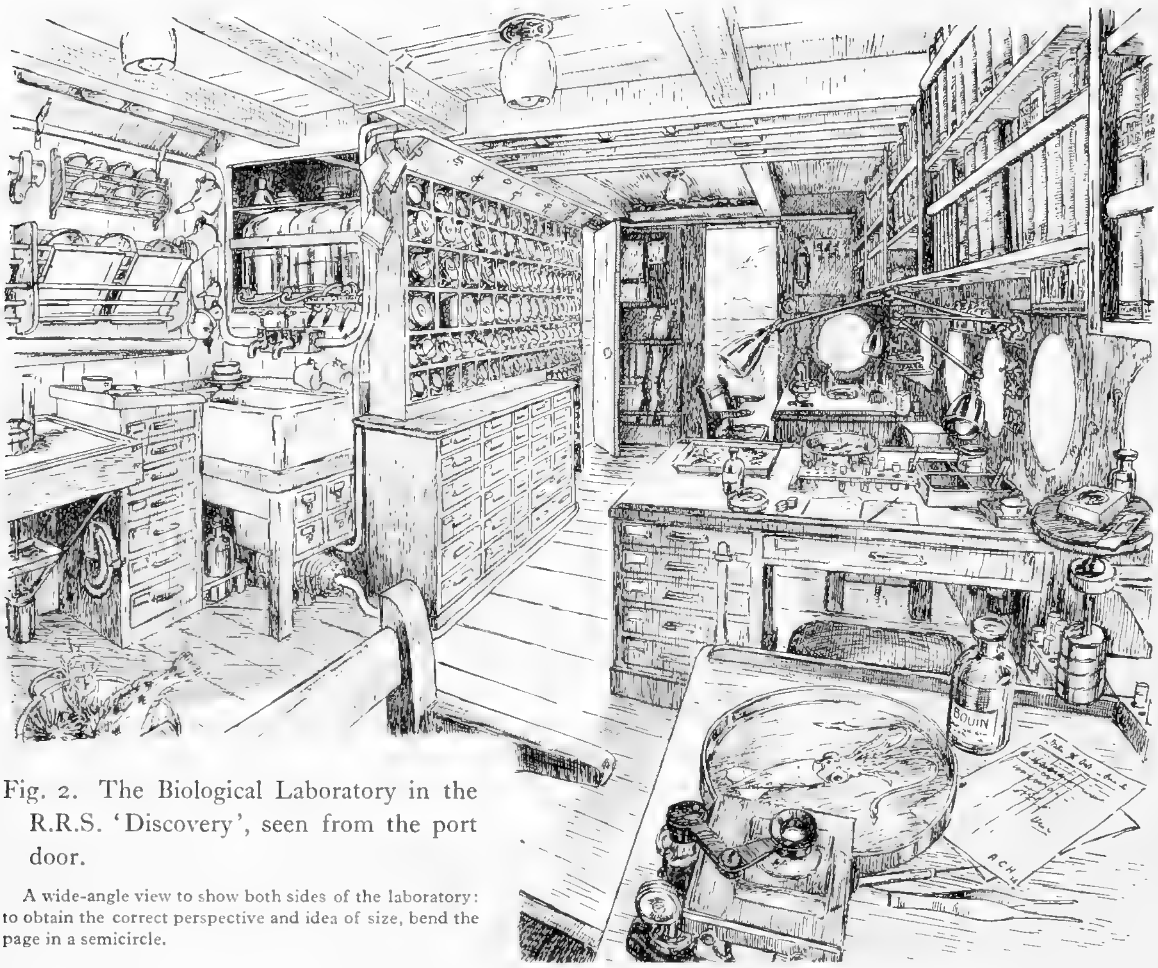


Fig. 2. The Biological Laboratory in the R.R.S. 'Discovery', seen from the port door.

A wide-angle view to show both sides of the laboratory: to obtain the correct perspective and idea of size, bend the page in a semicircle.

jars containing 75 per cent spirit, 10 per cent formalin and formalin of full strength. The supplies from these jars are led by rubber pipes to glass taps, mounted close together on a wooden base.[1] The jars are refilled by means of a small Merryweather hand pump, provided with rubber intake and outlet pipes. In practice this arrangement proved very convenient, but much labour would have been saved if it had been possible to accommodate larger jars. Successful hauls yielded vast quantities of material, and even when all the larger animals had been separately accommodated in tanks or stoneware jars, 20 litres of spirit frequently proved insufficient. The dilute formalin jar also had to be refilled continually during plankton investigations.

The rack for bottles, shown in Figs. 2 and 3, added greatly to the efficiency of work in confined quarters. It is built over a set of baize-lined drawers in which tubes were stored, and holds, in felt-lined pigeon-holes inclined at an angle of 20° from the horizontal, all the types of bottle used for the preservation of specimens. The main supply of bottles was kept in one of the holds, packed in felt-lined boxes, and in the rack

[1] The arrangement shown in Fig. 3 was found inconvenient and was modified at an early date to that shown in Fig. 2.

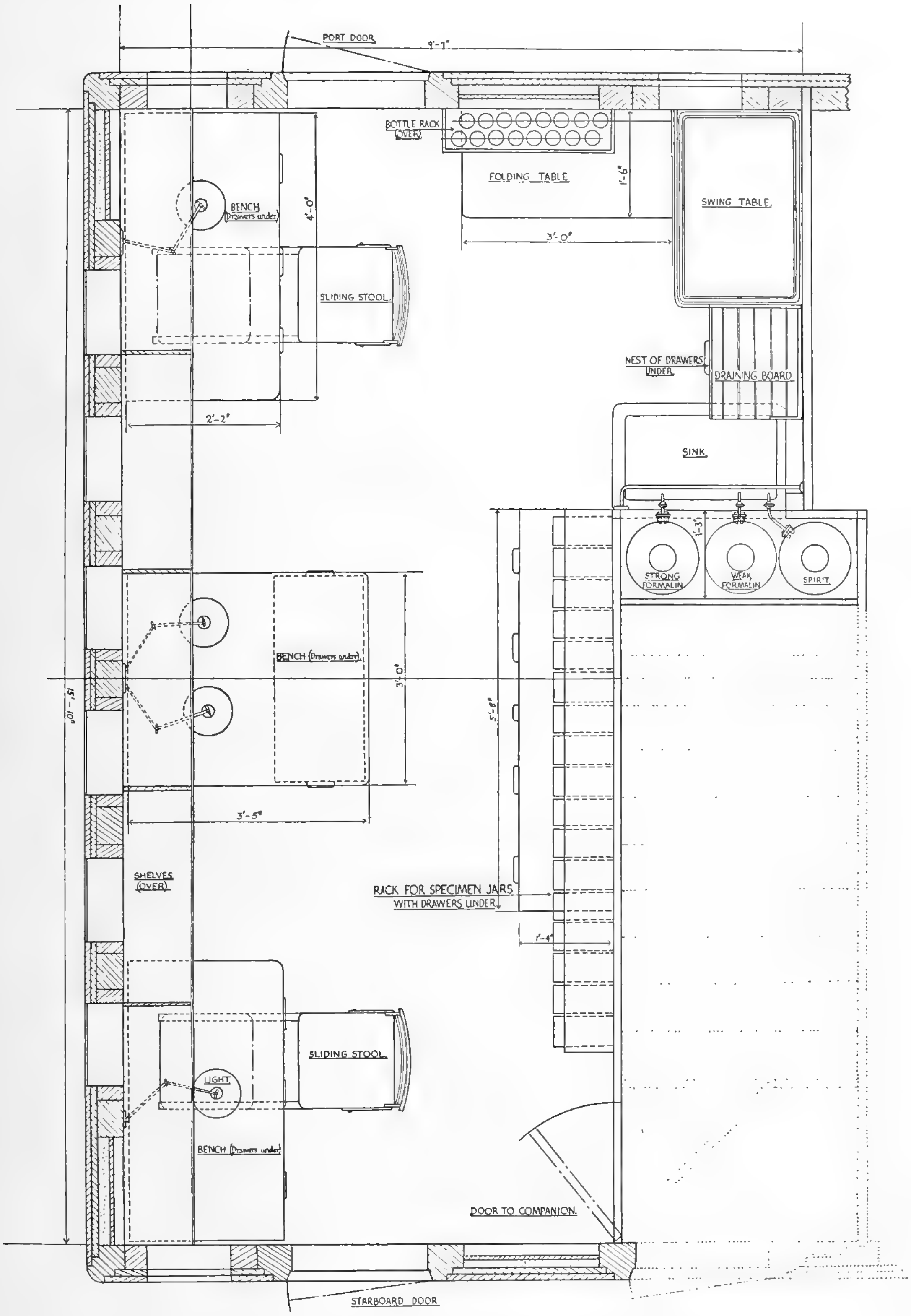


Fig. 3. Plan of Biological Laboratory in the R.R.S. 'Discovery'.

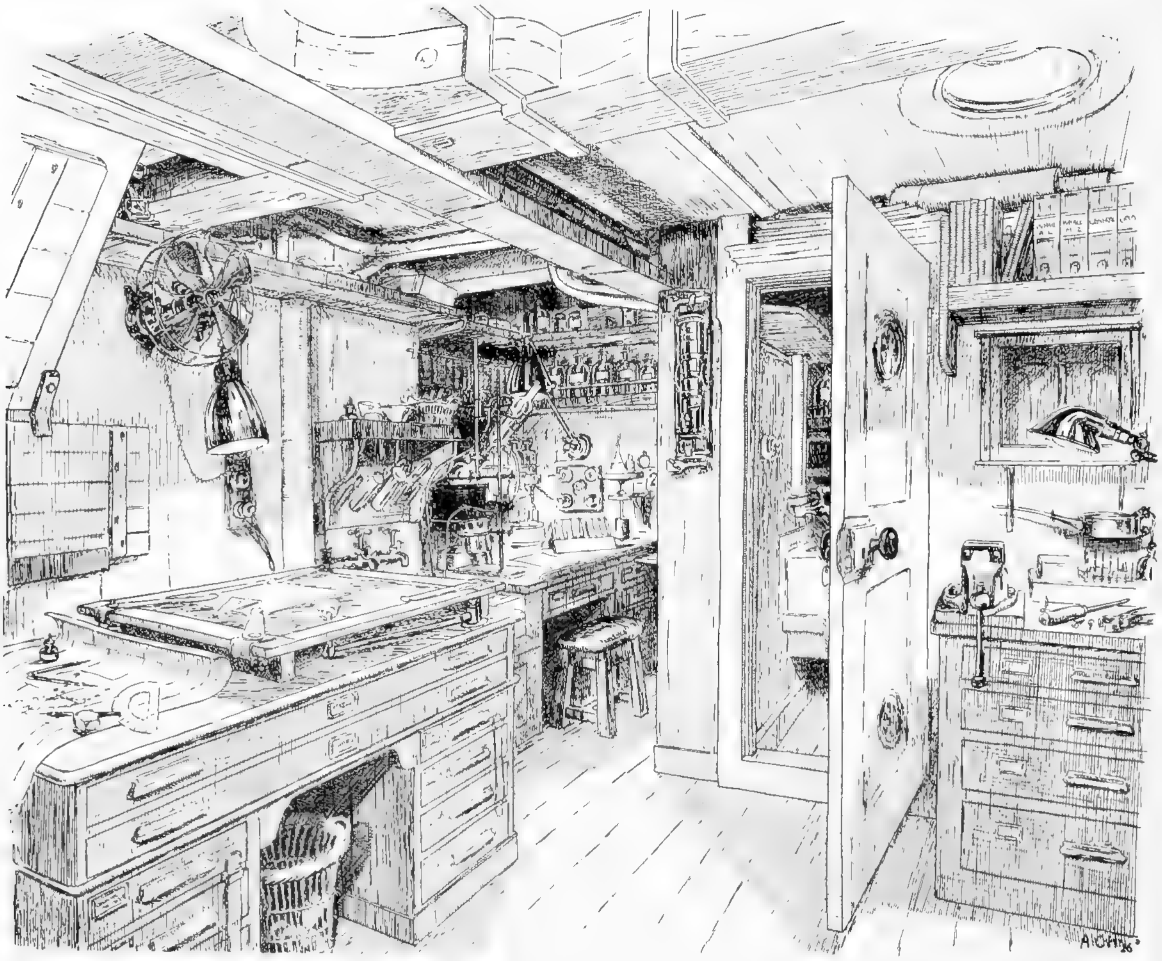


Fig. 4. The Chemical Laboratory in the R.R.S. 'Discovery': a view taken from the point marked * in Fig. 5.

there is room for more than a boxful of each size. When it was found that only a few empties of a particular size remained in the rack, a fresh box was brought up from the hold and empty and full bottles interchanged. Large specimen tubes, 12 to 24 in. in length, were stowed in a special rack built behind two of the bookshelves on the after bulkhead, the tubes, when wanted, being withdrawn from below. A row of lockers above the bottle rack was useful for miscellaneous articles.

The numerous other fittings used need not be mentioned in detail. Bars were required to keep books on their shelves and to prevent thwartships drawers from opening, while special chocks, brackets and racks were necessary for glass bowls, dishes and tubes, measuring cylinders, reagent bottles, trays, Kelvin tubes and other apparatus. At first it seemed that to accommodate all necessary gear would be impossible, but eventually a place was found for everything. Tidiness in such cramped surroundings was essential and breakages were inconsiderable, even in the worst weather.

The **Chemical Laboratory** (Figs. 4 and 5) is used for the chemical work and serves also as a workshop. It contains in addition to a work bench and large chart table, drawers, bins and cupboards for the storage of glassware and other gear. A small portion is shut off to form a darkroom, and both darkroom and laboratory are provided with sinks and supplies of fresh and salt water.

The chemical work was done in a very confined space, with stands for burettes and other apparatus screwed to the bench. Here the hydrogen-ion concentration of sea water was determined throughout the voyage, and, during the last year, all titrations

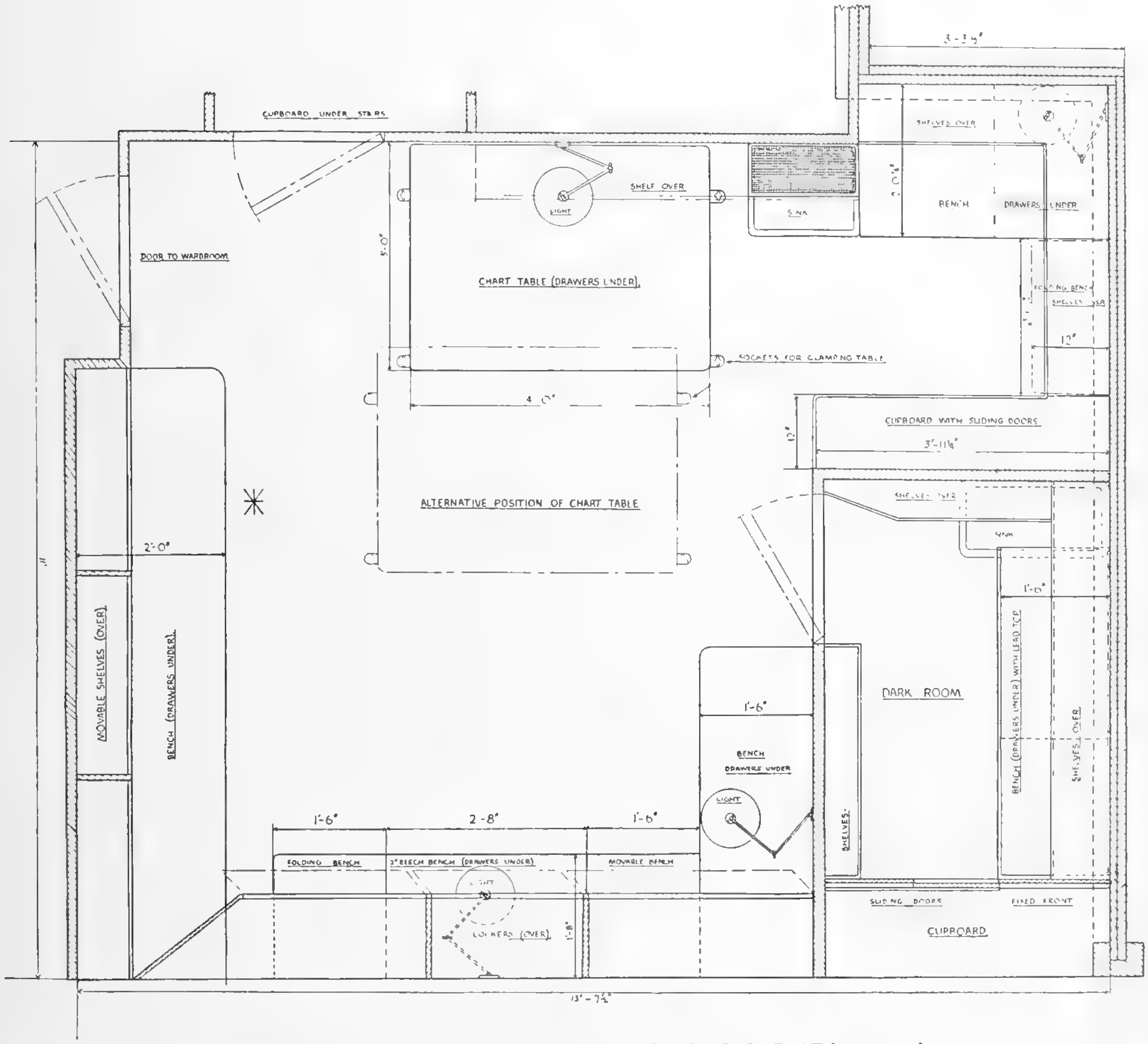


Fig. 5. Plan of the Chemical Laboratory in the R.R.S. 'Discovery'.

for salinity were also made on board. On the chart table a chart-tracing table was fitted, constructed to a design kindly given us by Lieut.-Comdr. J. R. Lumby. This apparatus consists of a heavy sheet of plate glass, mounted in a wooden frame and lighted from below by an electric lamp which can be moved anywhere in a horizontal plane. With it tracings can be made on thick paper, clips suitably mounted on the sides of the frame serving to keep the sheets adjusted while the work is in progress. A chemical balance is screwed to the bulkhead, but could, of course, be used only when the ship was in harbour. A Hearson electric oven, an electric hotplate and a Primus stove with water bath are also provided. The small workshop was in constant use for the adjustment and repair of scientific apparatus. The darkroom is 4 by 6½ ft. and has a sink, a lead-covered bench and other usual fittings.

THE RESEARCH STEAMSHIP 'WILLIAM SCORESBY'

CONSTRUCTION, ACCOMMODATION AND MACHINERY

As already explained this vessel was constructed to carry out investigations of three different kinds. She was to assist the 'Discovery' in routine observations on plankton and hydrography, to make trawling surveys in the neighbourhood of the Falkland Islands with a full-sized commercial trawl, and to undertake experiments in marking whales. In designing a ship for these varied purposes special consideration had to be given to the intended work of whale-marking. For this a vessel of high speed, able to turn with great rapidity, was essential, and it was decided that the design so far as practicable should follow that of a modern whale-catcher. An additional consideration was the need for very large bunker capacity, for it was realized that in the course of her work the vessel would be required to make direct passages between Cape Town and the Falkland Islands.

Construction. The vessel as finally designed was larger and more powerful than most whale-catchers. This was necessary to enable her to carry an exceptionally large amount of oil fuel and to attain a reasonably good speed, and also to accommodate the personnel which the work demanded. In other respects the vessel differs from most whaler-catchers in that she is considerably stronger in construction; her framing at the forward end is specially closely spaced and the bow plating doubled for a large extent of the forward part of the underwater portion of the vessel. In addition a doubling of steel plate extends throughout the length of the vessel at the water line. These special features are intended as protection against ice. The stem and rudder frame are also designed for encounter with ice, both being rabbeted or recessed so that the edges of the plating are protected against chafe.

The vessel was built by Messrs Cook, Welton and Gemmell, Ltd., and her principal dimensions are as follows:

	ft.	in.
Length over all	134	0
Length on water line	125	0
Beam moulded	26	0
Depth moulded	14	6
Designed draught	13	6 aft
Designed speed 12 knots		

When the ship returned to England after her first commission a few minor alterations were made. Her general arrangement, as now in service, is described below and is illustrated in Plates XIV–XVI. The equipment for scientific work is dealt with separately on p. 178.

At the forward end of the **Upper Deck** there is a short forecastle head, providing a platform, protected at the bow by a stout wooden bulwark, from which whale-marking experiments can be undertaken. At the after end of the forecastle a 16 in. searchlight projector is fitted on an elevated pedestal.

Immediately abaft the forecastle head is a steam and hand capstan, the base of the capstan head being fitted with a gypsey for dealing with the vessel's cables. The main-mast is of extra heavy steel construction, suitable for whaling if required, and is fitted near the centre of the fore deck. Immediately abaft the mast is a combined steel companion way and skylight, giving entrance and lighting to crew space, chart room and officers' quarters below deck. A large steam winch of special design is fitted at the after end of the fore deck. On the starboard side of the fore well deck, abreast of the main-mast, are the Lucas sounding machine and the hydrological reel, both driven by the same compound surface condensing engine. This machine and the winch are separately described on pp. 178, 179.

Immediately forward of the boiler casing the laboratory is constructed. It is built of teak, fitted with unusually large port lights, the construction being similar to that adopted for the deck houses in the 'Discovery'. Above the laboratory is the navigating bridge, with a teak wheelhouse to enclose the helmsman. The forward part of the bridge is extended out to the sides of the ship to enable the officer of the watch to see fore and aft on either side when coming alongside, and this extension is supported on heavy teak beams. The wheelhouse contains an echo-sounding installation for depths not exceeding 130 fathoms, in addition to a Kelvin liquid card compass and the engine-room telegraph. The roof of the wheelhouse is surmounted by a small bridge, upon which the standard compass is fitted, enclosed by brass rails and stanchions. Portable awnings are arranged above the navigating bridge and standard compass position and a Morse signalling lamp is fitted forward of the compass.

The engine and boiler casings, which are of steel, extend over practically the whole length of the engine and boiler space. On top of the casing between the funnel and the engine-room skylight a steel house is constructed for the wireless installation. The wireless installation is similar to that fitted in the 'Discovery', and consists of a Marconi quench-gap installation and a continuous wave set, both of $1\frac{1}{2}$ kw. capacity. In order to give quieter working conditions the alternator was fitted in the engine room, instead of in the wireless house as is customary.

The engine-room skylight is fitted immediately abaft the wireless house on the top of the engine casing, and is of steel with brass frames for the glass. This type of skylight was specially selected as suitable for both tropical and Antarctic conditions. At the after end of the engine casing on the main-deck level, room is provided for the steam steering gear, which is thus immediately under the eye of the engineer on watch. The galley is arranged at the extreme aft end of the engine casing and is divided from the steering-gear room by a thwartships alley way: this alley way has doors on both sides of the ship and affords sheltered access to the engine room as well as to the wardroom lobby and galley. Abaft the after end of the boiler casing, which is wider than the engine casing, small rooms are constructed on each side: the rooms on the starboard side are arranged for deck stores and lamp room, and on the port side as the crew's washhouse.

Abreast of the starboard side of the engine casing and fitted on the upper deck is the plankton reel, coupled to a compound surface condensing engine. This machine is described on p. 179.

On the after deck, abaft the galley, is a large teak skylight above the wardroom and living rooms. Hand-screw steering gear is provided immediately above the rudder head as a stand-by, and the usual gratings are fitted at the stern of the vessel above the steering quadrant and chains. Advantage was taken of the room below the gratings to fit small freshwater tanks for increasing the drinking-water supply. Four specimen tanks are secured on the starboard side of the after deck and one on the port side. The trawl gallows are on the port side of the vessel and are suitable for working a full-sized commercial trawl. The usual pedestal fair-leads are fitted on the fore deck for working the trawl in conjunction with the steam winch.

The following ship's boats are provided: two teak lifeboats, each 20 ft. long, 7 ft. beam and 3 ft. depth, carvel built, constructed to Board of Trade requirements and fitted under special davits arranged to pivot outboard from the casing sides. The latter arrangement is provided to keep the davits clear of the ship's rail for trawling and other purposes. A small teak dinghy is fitted on skids abreast of and level with the top of the galley and steering-gear houses. The davits for this dinghy are of the ordinary type, fitted on the starboard side.

Below the Upper Deck the vessel is subdivided transversely into six compartments by means of three watertight and two oiltight bulkheads. Forward of the collision bulkhead is a store room for ship's gear. Abaft the collision bulkhead is crew space, with accommodation for twelve men, to which access is obtained by a companion leading to a small lobby near the main-mast. Leading from this lobby is a small petty officers' mess room on the starboard side and a large chart room at the after end. Opening off the chart room are four cabins, two on either side, for junior officers, each with two beds. Forward of these cabins there is on the starboard side the steward's cabin, entered by way of the petty officers' mess room, and on the port side a scientific store opening on to the lobby.

The space below the forward accommodation is arranged with shelves, racks and bins for the storage of provisions, ship's gear and scientific stores. The forward end is partitioned off to form a chain locker.

Immediately abaft the forward accommodation the fuel bunkers are constructed. These bunkers have a capacity for 145 tons of oil fuel or 120 tons of coal. They are divided into four compartments: a cross bunker forward of the boilers with oiltight division on the fore and aft centre line, and two wing bunkers, one each side of the boiler space. This arrangement enables oil to be used from the cross bunker in the first place, thus easing the vessel's trim when making a long passage such as that from Cape Town to South Georgia. Directly abaft the fuel bunkers, and on each side of the boiler, freshwater feed tanks are constructed, having capacity for a total of 11 tons of feed water

The wardroom accommodation is situated immediately abaft the engine room, between the engine-room bulkhead and the aft peak bulkhead. The wardroom occupies the port aft portion of the space and, for a small ship, is very commodious: it is furnished and panelled in polished mahogany. Two single-berth cabins (those of the chief engineer and chief officer) are placed on the starboard side of the ship and open into the wardroom. Forward of the wardroom a lobby is provided, giving access to the cabin of the senior scientific officer on the starboard side and to that of the captain on the port side. At the forward end of the accommodation space there is a small store room and a refrigerating chamber on the starboard side, and on the port side a bathroom. Between these is the wardroom pantry, with a small service lift communicating with the galley on the main deck.

Below the after end of the wardroom accommodation a small aft peak tank is provided, having a capacity for about 1 ton of fresh water. The remainder of the space below the accommodation is divided into provision stores, bonded locker and freshwater tanks, the latter having a total capacity of 800 gallons.

Machinery. The main boiler is practically amidships, with the main engines immediately abaft it, separated by a screen bulkhead. The boiler is of the cylindrical marine type, 15 ft. 6 in. in diameter and 11 ft. 6 in. long, working at a pressure of 180 lb. per square inch. The main engines are of the ordinary triple expansion surface condensing type, having cylinders 16, 27, and 40 in. in diameter with a common stroke of 30 in. They are designed to develop 1050 H.P. when working at 120 revolutions per minute.

The oil-fuel installation is of the Wallsend-Howden type; the gear is in two separate units, either of which is capable of supplying the necessary fuel independently. Forced draught is supplied by means of a Howden forced-draught fan fitted in the engine room, with air casings trunked through into the stokehold.

The auxiliaries in the engine room are as follows: a centrifugal circulating pump with an all gunmetal casing driven by a single cylinder steam engine; a Weir's multiflow surface feed heater, using exhausts from auxiliaries; a Weir's feed pump with automatic feed control; a Caird and Rayner's 10-ton evaporator and distilling plant, and a Caird and Rayner's feed-water filter. The air pump, main feed pumps and bilge pumps are driven by levers from the main engines.

ARRANGEMENTS FOR SCIENTIFIC WORK

On board the 'William Scoresby', a smaller vessel, arrangements for scientific work are necessarily of a simpler character than in the 'Discovery'. Apart from the main winch there are only two auxiliary deck machines—one of which also drives the Lucas sounding machine—and there is only a single laboratory.

The **Main Winch** (Plate XVII, fig. 1) was specially constructed to carry three drums of wire rope: two of these are required for the heavy warps used with the otter trawl, and one, placed in the centre, for a long length of light rope employed in plankton investigations.

The winch is of the horizontal type and was made by the Strath Engineering Works of Aberdeen. The cylinders are of 9 in. diameter and 14 in. stroke, working at the full boiler pressure of 180 lb. to the square inch. The side and centre frames are of cast steel, and clutches, fitted on machined squares, are provided, so that any one drum can be used independently. The three main drums are each 48 in. in diameter and 33 in. between flanges, built up with cast steel hubs and mild steel end plates. The two side drums each hold 1000 fathoms of trawl warp, $2\frac{1}{2}$ in. in circumference, while the centre drum carries 3500 fathoms of rope, tapering in circumference from $1\frac{1}{8}$ to $1\frac{5}{8}$ in. Warping drums are fitted at each end of the main shaft. The piston rods and valve spindles are of manganese bronze, the latter being specially large to resist heavy wear and exposure. Drain cocks, lubricators and other necessary fittings are suitably arranged for service in the Antarctic. The reversing gear is of the link type. An independent brake, lined with wood and operated by screw gear, is fitted to each drum, and hand traversing gear is provided for guiding the wire on to the drums. The whole winch is assembled on a cast-iron bedplate, which is seated on a pitch-pine bed on the fore deck immediately forward of the laboratory. The weight of the winch without wire ropes is about $10\frac{1}{4}$ tons: with the three drums full of wire rope the total weight is about $18\frac{1}{2}$ tons.

Apart from being a little fierce in its action the winch has proved very satisfactory, giving no trouble in the course of long and continuous service.

In trawling operations the ropes from the port and starboard drums are led by fair-leads of the usual pattern to the gallows on the port side of the vessel, the arrangement being closely similar to that found on commercial trawlers. The cod-end of the trawl is lifted by a purchase from the main-mast on to the fore deck, where a pound is placed to receive the catch. In plankton operations with horizontal or oblique nets the boom of the main-mast is guyed over towards the port side, and the wire rope from the centre drum is led to a recording sheave slung at its foot. The rope then passes by way of a snatchblock at the head of the boom to the port quarter, and as soon as the nets have been shot, it is triced up in this position. The topping lift of the boom is attached to a large spring placed vertically on the forward side of the mast. By this arrangement, which acts as an accumulator, a certain amount of play is given to the boom and to the rope which it carries.

The two **Light Deck Machines** are placed on the starboard side of the vessel, one of them on the fore deck opposite the main-mast, and one further aft, abreast the engine and boiler casing. Both these machines are equipped with the same type of engine, made by Philip and Son of Dartmouth. The engine is of the compound enclosed type, with cylinders 4 and 8 in. in diameter and a common stroke of 5 in., working at a maximum of 600 revolutions a minute with a boiler pressure of 180 lb. to the square inch. Each of these engines is coupled to a drum which carries 3500 fathoms of light wire, 4 mm. in diameter. The drum is strongly constructed of cast steel; the centre hub is 8 in. in diameter, the extreme diameter over flanges is about 29 in., and the clear width between flanges is 10 in. With these dimensions the full amount of wire is easily stowed. The connection between the engine shaft and the gearing for driving the drum is by means of an ordinary dog clutch. The main spur wheel is bolted to the side of the drum, and the pinion wheel, driven direct from the engine shaft, gears with the spur wheel, giving a single purchase drive with a ratio of 5 to 1. A band brake operated by a foot lever is fitted, and is so arranged that the drum can be locked when desired. A fork, fitted with rollers and operated by hand-driven screw gear was originally provided for spreading wire on the drum. This fork proved unsatisfactory and it was replaced by a small traveller carrying three rollers—two vertical and one horizontal.

The after machine consists of the engine and drum described above and is used for vertical plankton nets. The forward machine is for hydrological work, and the engine, in addition to driving the drum of 4 mm. wire, is coupled on its forward side to a sounding machine (Plate XVII, fig. 2). The three units composing this machine are mounted on a common bedplate. The sounding machine is connected with the engine by means of a dog clutch and is driven by machine-cut bronze gearing.

During the first year of service it was found that in cold weather the drainage of the engines was insufficient, resulting in damage to the cylinders. On renewal larger drains and relief valves were fitted and the engines have since given no trouble.

In the 'William Scoresby' the operation of vertical nets and water bottles is more easily effected than in the 'Discovery'. Opposite each machine a davit is stepped in the rail, the wire from the drum leading direct to a recording sheave slung at the davit end. Accumulator springs of the type employed in the 'Discovery' were not fitted; instead, the recording sheave is attached to a long pin which passes through a hole in the end of the davit and is supported on the upper side by a compression spring. This device is not very effective, for the spring is too short to give sufficient play to the wire.

The **Recording Sheaves** for the plankton and hydrological machines are of the same pattern as in the 'Discovery' and showed the same defects (p. 167). A sheave of different pattern is used with the centre drum of wire rope on the main winch; it was supplied by the Laboratoire Hydrographique at Copenhagen and is of the heavy type described by Knudsen in 1923.[1] This sheave is of the most solid construction and has proved very satisfactory.

[1] Knudsen, *Pub. Circ., Cons. Explor. Mer*, 77, p. 14, 1923.

The **Wire Ropes** were made by the same firms that supplied those of the 'Discovery' and are to the following specifications:

Purpose for which used	Vertical nets and water bottles	Horizontal nets	Trawling
Diameter (mm.)	4	9–13	20
Circumference (in.) ...	$\frac{1}{2}$	$1\frac{1}{8}$–$1\frac{5}{8}$	$2\frac{1}{2}$
Strands	6 × 7	6 × 7 6 × 12 6 × 19	6 × 19
Breaking strain	19·9 cwt.	4·5–9·9 tons	21 tons
Weight per 100 ft. (lb.) ...	3·7	31 (average)	105
Length used (fathoms) ...	3500	3500	1000

The **Sounding Machine**, as already mentioned, was coupled to the engine which drives the drum used for hydrological work. It is a Lucas machine and apart from the difference in the drive is identical with that used in the 'Discovery'. In the position which the machine occupies, the jib sheave—which also registers the amount of wire paid out—extends outboard through an aperture in the bulwarks. Thus fitted it is liable to damage when the vessel is coming alongside; but the jib is portable, and can thus be removed when the machine is not required, while the aperture in the bulwarks can be closed by a sliding door. A Kelvin machine, for taking soundings in shallow water, is fitted in the stern: it is hand-driven, but otherwise similar to that in the 'Discovery'. This machine and the echo-sounding apparatus referred to on p. 175 were frequently used for taking soundings during scientific work. When trawling and dredging in coastal waters where the bottom was uneven the echo-sounding apparatus proved particularly useful. Continuous readings of the depth could be taken and the length of wire rope varied accordingly.

The **Laboratory** is situated immediately below the bridge and is 16 ft. broad and 9 ft. long. It has port and starboard doors and large portholes on three sides placed close to the level of the benches as in the 'Discovery'. On the after bulkhead, in the middle there is a sink supplied with fresh and salt water, and above it are large glass jars, fitted with taps, for alcohol and formalin. The space on either side of the sink is occupied by cupboards and sloping bottle racks. Along the forward bulkhead is a bench, extending round to the doors on either side, and interrupted in the middle by a small swing table. Above the portholes there are bookshelves and below the bench there are tiers of drawers. Three stools are provided, and a movable flap, attached to the bench, can be used as a writing desk. In bad weather it was found that the laboratory tended to become over-heated and to remedy this defect two small ventilators were fitted, opening on to the bridge.

For storage of scientific apparatus a locker is provided on the lower deck, opening off the lobby which gives access to the chart room; other scientific gear and material is stored in a hold below the forward accommodation.

APPARATUS AND METHODS

PLANKTON NETS AND APPARATUS

Six different types of plankton net were used in the investigations: a small silk net on a ring of 50 cm. diameter, a series of four nets of graded mesh, with diameters of 70, 100, 200 and 450 cm. respectively, and the Petersen young-fish trawl, which was used at first with the otter boards as a trawl proper and later as a tow-net on a 200 cm. ring. These nets will be referred to as the N 50, N 70, N 100, N 200, N 450 and TYF respectively.

The N 50 was almost exclusively used for vertical hauls, the N 70 vertically, horizontally or obliquely, the N 100 horizontally, obliquely, or very occasionally vertically, and the remainder horizontally only. All the nets could be closed, if necessary, by messengers and closing mechanisms on the Nansen principle.

Whilst differing in size of mesh and details of construction, according to their different functions, all the nets, with the exception of the TYF, follow the same general plan shown in Fig. 6. Between the ring *R* and the conical catching part of the net *BC* there

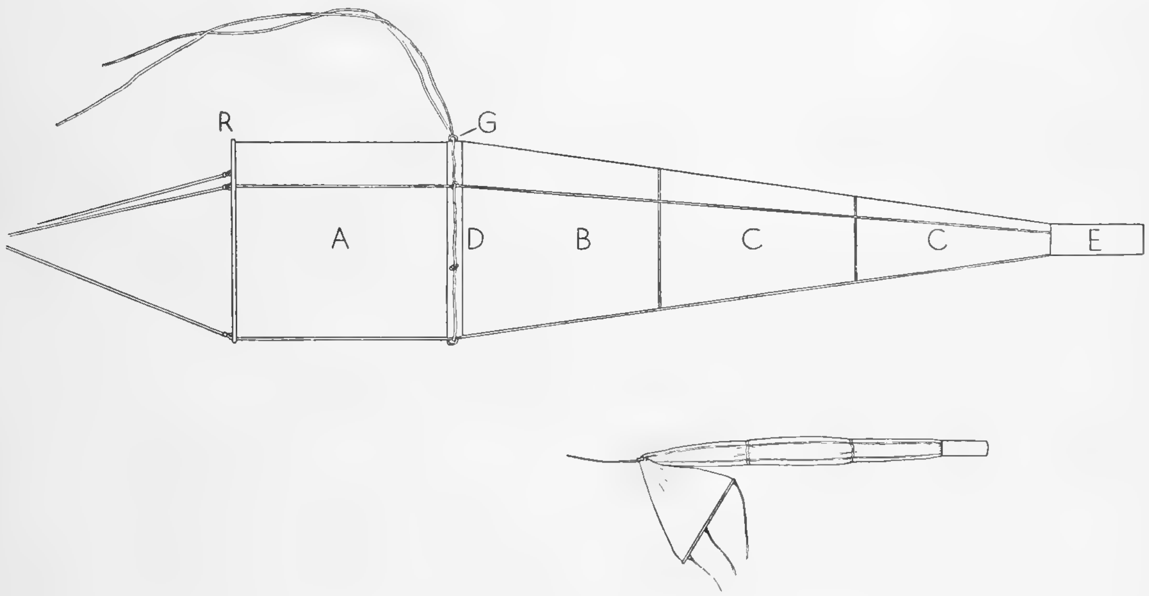


Fig. 6. Diagram of general tow-net design; for explanation see text. The smaller figure shows the net closed on the Nansen principle.

is a cylindrical portion *A*, separated from the latter by the canvas band *D*, which is fitted with small rings *G* to take a closing rope. In the nets of graded mesh the catching part *BC* is made of netting of two different sizes, the front part *B*, which is one-third of the length,[1] being of a coarser mesh than the remaining two-thirds *C*. The

[1] Except in the N 70, where the proportions are made to conform with a similar net used by Prof. Hjort in the north (see p. 183).

"cod-end" of the net tapers to join a canvas cylinder *E*, made to slip over and be clamped to the collecting bucket.

With the exception of the TYF the nets were made to our designs by the Marine Biological Association at Plymouth. They were all treated with copper-soap preservative as described by Dr W. R. G. Atkins[1], who kindly supplied much helpful advice as to the manner in which it should be applied. In spite of the fact that the nets were often kept under most unfavourable conditions, it was only on the rarest occasions that a net was found to have rotted: the use of copper soap as a preservative is strongly to be recommended.

Specifications of Plankton Nets

The design and function of each net will now be described in turn. Full details are included in order that references may be given and repetition avoided in future papers on plankton results.

The **N 50**, designed for the capture of diatoms particularly and the smaller plankton forms generally, is made of the finest bolting silk: that with 200 meshes to the linear inch. Its use formed part of the routine at each full station, a vertical haul being made with it from 100 m. to the surface at a speed not exceeding 1 m. per second. Like the N 70, next to be described, it is similar in size and mesh to that being used by Professor Hjort[2] in his plankton investigations in the northern whaling areas, so that comparisons between the conditions in the two hemispheres may more easily be made.

The ring, which has an opening of 50 cm. diameter, is made of galvanized iron, $\frac{3}{8}$ in. thick with round cross section, and has at three equidistant points a pair of small eyes of $\frac{3}{8}$ in. opening, one on each side of it, as shown in Fig. 7. These eyes form the points of attachment in front for the three bridles and behind for the lines attached to the bucket and weight. The bridles are of 3 mm. diameter phosphor-bronze rope, 3 ft. in length and with a brass eye spliced into each end. These are secured to the eyes on the ring by small shackles and drawn together at a towing shackle in front.

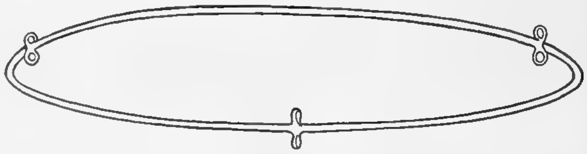


Fig. 7. Small tow-net ring.

In this net the sections *A* and *D* (Fig. 6) are continuous and of the same canvas material, making a cylinder 26 in. long. At its front edge it is sewn on to the ring *R* and behind to the conical net; on its outside are sewn six small brass rings at equal intervals, each 3 in. from its hind end, so that the net may be closed by a throttling rope if desired. The actual net, *BC*, 5 ft. 5 in. long, is of one material and tapers from a diameter of 50 cm. to one of 6 cm., where it joins the small canvas cylinder, 7·5 cm. long, for the attachment of the bucket. The netting employed is the silk bolting cloth made by Messrs John Staniar and Co. of Manchester, and known as their "No. 25

[1] Atkins, *Journ. Marine Biol. Assoc.*, n.s., XIV, p. 63, 1926.

[2] Nets of similar type are described and figured by him in Murray and Hjort's *Depths of the Ocean*, p. 46, London, 1912.

First Standard Quality Double Twist Silk", having approximately 200 threads to the linear inch. It was found that these nets, being made of such fine material, frequently split; in future they will be made with an outer cover of wide mesh netting to take the strain of the pressure when hauling.

The brass collecting bucket, which is separately described with those for the other nets on page 189, is secured to the small canvas cylinder at the tail of the net by means of a brass band and tightening screw. The wire stays supporting the bucket are of the same material as the bridles, but 9 ft. long; they are attached by small shackles to the eyes on the ring, seized to the eyes on the bucket holder and when, as usually, the net is used vertically, meet below at a shackle supporting a 7 lb. lead. The net as rigged for vertical use is shown in Fig. 8.

Fig. 8. The N 50 net rigged for vertical use.

The **N 70** net is designed for the capture of the medium and smaller sized organisms of the macroplankton, from small or young Euphausians and largest Copepods downwards, and is made with two grades of silk netting: 40 meshes to the inch in front and 74 behind. As explained elsewhere the use of this net formed part of the routine at all full stations, being used vertically and horizontally or obliquely. When used vertically it was hauled at a speed of 1 m. per second, and closed by messenger, closing mechanism and throttling rope when it had fished through the required layer. An account of the routine work with these nets will be found on pages 199–201.

It will first be described as rigged for vertical use.

The ring is similar to that used in the N 50, but has an opening 70 cm. in diameter. At first phosphor-bronze bridles were used, but when it was found that these sometimes fouled the closing mechanism on the way down, so preventing or precipitating its action, they were replaced by three brass rods. These are $\frac{1}{4}$ in. thick, 32 in. long and have an eye at each end carrying a brass ring; they are each shackled to the frame at one end and at the other meet in a shackle for attachment to the closing mechanism, thus forming a rigid tripod.

The section *A* (Fig. 6) is 21 in. long and made of strong $\frac{1}{4}$ in. mesh (knot to knot) netting. In front, where it has a rope margin, it is lashed to the frame, and behind it joins the canvas band *D*, which is 10 in. wide and has, like the N 50, six brass rings to take the closing rope. The catching part of the net *BC* tapers from this to the small canvas cylinder, 9 in. in circumference, for attachment to the bucket. It has a total length of 7 ft. 7 in., but is in two sections; the first, *B*, 3 ft. 2 in. long, is made from Messrs Staniar's "Quadruple Extra Heavy Quality Double Twist Swiss Silk" bolting cloth, No. 40, having 40 threads to the linear inch, and the second section, *C*, 4 ft. 5 in. long, from the same quality bolting cloth, No. 74, having approximately 74 threads to the linear inch.

Three phosphor-bronze wire ropes, 3 mm. in diameter, 14 ft. long and having brass eyes let in at each end, support the bucket (described on page 189) and the weight. They are shackled to the eyes on the frame and they have rings to take the closing rope, similar to and seized at a point in line with those on the net; further, to prevent their twisting round each other, they are seized to a stout brass ring 7 in. in diameter which passes round the net some 6 in. above the bucket; and finally, after passing through and being seized to the eyes on the bucket holder, they meet below the bucket in a shackle which supports an egg-shaped 40-lb. lead.

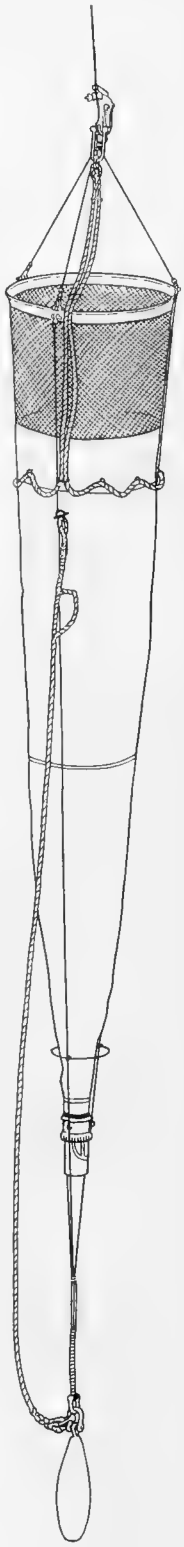


Fig. 9. The N 70 net rigged for vertical use.

The rope for closing the net is 2 in. in circumference and 16½ ft. long, with an eye at each end. It passes round the net through the rings on the band *D* and those on the stay wires; its two ends are shackled to a link on the closing mechanism, so that when the messenger releases the "bridle" rods, the net falls away and is caught by it in a noose. The closing mechanism is described on page 192.

As heavy a lead as 40 lb. was used below the net so that it would run out easily under its own weight. To facilitate the handling of the lead when the net comes to the surface a rope is kept attached to it; this is 15 ft. long and has at its upper end a small brass toggle, which can be slipped in and out of a ring on one of the support wires just below the closing band.

A sketch of the net fully rigged is shown in Fig. 9.

The arrangement of the bridle rods, support wires, rings, shackles, etc., has been evolved by the gradual modification in practice of less satisfactory designs. The rigging of such a net had seemed at first a simple matter; the practice, however, of carrying out routine hauls down to depths of 1000 m., often from a heavily rolling ship, showed that many and unexpected defects had to be overcome.

For horizontal use the net is exactly similar except that it has no weight or supporting wires, its bucket is of a simple light pattern (see page 191) and the bridles, instead of being brass rods, are three phosphor-bronze wires, 3 mm. in diameter and 4 ft. in length.

N 100. Designed for the capture of macroplankton, particularly the Euphausians and Amphipods, this net has been used extensively together with the N 70 for routine horizontal and oblique hauls. Only occasionally has it been fished vertically and then its rig was unaltered.

The ring is made of round-section galvanized iron 1 in. thick, has an opening of 1 m. diameter, and has on the outside an eye, of 2 in. diameter opening, as a fair-lead for the closing rope. The three bridles are of 4 mm. phosphor-bronze wire, each 5 ft. in length. The net which is lashed to the ring has the cylindrical section *A*, $3\frac{1}{2}$ ft. long, made of $\frac{1}{2}$ in. mesh (knot to knot) netting. The band *D* is of tarpaulin canvas, 6 in. wide, with six galvanized iron rings, 2 in. in diameter, sewn on the outside at equal intervals to take the closing rope. The conical catching part of the net, *BC*, is $10\frac{1}{2}$ ft. long, has a circumference in front of 11 ft. (100 cm. diameter), and tapers to a circumference of 1 ft. 8 in., where it joins a cylindrical section of canvas 1 ft. long for attachment to the bucket. Of the two sections *B* is $3\frac{1}{2}$ ft. long and made of 4 mm. mesh (knot to knot) netting, and *C* is 7 ft. long, made formerly of silk bolting cloth (Staniar's "Quadruple Extra Heavy Quality", No. 16), having 15 meshes to the inch, but replaced later, after July 1927, by stramin. The silk netting with only 16 fine threads to the inch was not strong enough and, even after being supported on the outside by a lacing of stout cord, had continually to be patched or renewed. The stramin is very strong and its threads, although only 11 or 12 to the linear inch, are very coarse, so that the filtration is no more, in fact rather less, than that of the silk netting formerly employed.

Down the length of the net run three 1 in. circumference ropes of log line. These are sewn through long thin strips of canvas to the netting sections *B* and *C*, sewn to the canvas band *D*, and in front threaded through the netting *A* and tied to the ring; behind they have a free end of about 18 in. for tying to the rings of the bucket.

The closing rope is 15 ft. long, and at one end has a large eye through which the other end passes, forming a noose.

The **N 200** net, similar to the N 100 only larger and of wider mesh, is designed to capture the rarer and faster-swimming pelagic forms which might escape the N 100, or to collect, if necessary, such forms as Euphausians in greater quantity than does the N 100. This latter necessity rarely arose since the N 100 usually provided more than sufficient material.

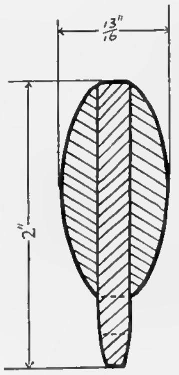


Fig. 10. Section of the stream-line frame for the N 200 net.

The ring is of galvanized steel, having a stream-line cross section as shown in Fig. 10, and an opening 2 m. in diameter. It was made up from two "half-rounds" and one "flat" riveted together: to those unacquainted with hydrodynamics it is surprising what a great difference there is in the resistance of a towed net with round-section frame and that of one with a stream-line frame. Along the hind margin of the frame are a number of $\frac{1}{4}$ in. holes at 4 in. intervals for lashing on the net. At one point an eye $2\frac{1}{2}$ in. in diameter is attached to the frame, as shown in Fig. 12, as a fair-lead for the closing rope; by this means, when the bridles are released, the frame is held by one edge, and is thus less liable to surge from side to side while being hauled to the surface.

The bridles consist of three 2 in. circumference ropes each 12 ft. long. The cylindrical section, *A*, is of 1 in. mesh (knot to knot) netting and is 7 ft. long. The band *D* is of tarpaulin canvas 6 in. wide, with eleven $2\frac{1}{2}$ in. galvanized iron rings sewn on at equal intervals. The catching part of the net *BC* has a total length of $19\frac{1}{2}$ ft., and tapers from a circumference of 22 ft. to 2 ft. 3 in., where it joins the canvas cylinder, 2 ft. long, for attachment to the bucket. The front section, *B*, 6½ ft. long, is of 7 mm. mesh (knot to knot) netting[1] (Fig. 11 *a*), and *C* is 13 ft. long, of 4 mm. mesh netting[1] (Fig. 11 *b*). As in the N 100 there are three longitudinal ropes, and in addition transverse ropes passing round the net, one between the sections *B* and *C* and one in the middle of *C*. These were originally made of log line to prevent any tendency to twist and so bunch up the net; but it was found not to be strong enough and was replaced by ordinary manila rope of 2 in. circumference. The bucket, like the others, is described on page 191. The closing rope is similar to that of the N 100, but 40 ft. long, 2½ in. in circumference and fitted with a large lignum-vitae bull's-eye.

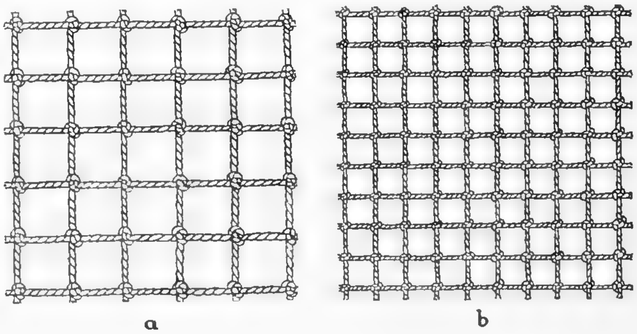


Fig. 11. Fine-meshed netting used in tow-net construction. Nat. size. *a*, 7 mm. mesh; *b*, 4 mm. mesh.

In practice this net was not used a great deal. When the larger, rarer and more active pelagic organisms were required the N 450, next to be described, which has an opening over five times in area that of the N 200, was used whenever possible. For collecting large quantities of the smaller forms the TYF was found to be more efficient.

N 450. This net, with an opening of 4½ m. diameter, is, we believe, the largest tow-net yet fished. Its function, as already indicated, is to capture the larger and more active pelagic animals, particularly the deep-sea forms such as medusae, crustacea, cephalopods and fish. It was feared by some that the difficulties in handling so large a net, especially from a vessel encumbered with much rigging, might prevent its frequent use. These fears, however, proved to be groundless.

That the resistance in towing so large a frame, and one stout enough to retain its shape out of water, should be reduced to a minimum was here a matter of great importance and, as in the N 200, a stream-line section of similar construction was adopted. The details and dimensions are given in Fig. 12. To facilitate stowage the frame was made in four sections to bolt together, and hinges were provided at two joints so that if necessary it could be collapsed into two semi-circular halves for taking inboard. This latter device, however, was found to be unnecessary and was never used. Despite its great strength it was found that, when hoisted into the air by one point, it tended to lose its circular shape; this was prevented by the introduction of a thin steel wire across the diameter of the ring from the point of suspension. As shown in Fig. 12 the bridles,

[1] To find a make of strong and fine netting suitable for these large plankton nets was a matter of considerable difficulty. The two sorts of square-meshed netting shown in Fig. 11, which were also used for fine nets attached to the trawl and for other purposes, were obtained from L. de Séréville, 3 Rue d'Hauteville, Paris X. The 4 mm. netting is supplied in widths of 2 m. 10 cm., and the 7 mm. in widths of 2 m. 50 cm.

four in number, are attached to shackles at the junctions of the four sections. The frames for both these and the N 200 nets were made and galvanized by Messrs F. Braby of Ida Works, Deptford, London.

The four bridles are of galvanized wire rope 6 mm. in diameter, each 20 ft. long. Section *A* is of netting[1] with $1\frac{1}{2}$ in. mesh (knot to knot), $15\frac{1}{2}$ ft. long. The tarpaulin canvas band *D* is 6 in. wide, but should have been considerably wider; it has fifteen 3 in. galvanized iron rings sewn on at equal intervals. The catching part of the net, *BC*, is 45 ft. long, tapering from a circumference of 50 ft. ($4\frac{1}{2}$ m. diameter) to one of 3 ft. at the cod-end, where it joins the canvas cylinder, 3 ft. long, for attachment to the bucket. The netting in section *B* is $\frac{1}{2}$ in. mesh (knot to knot),[1] and that in *C* of 7 mm. (knot to knot) mesh.[2] It was found an improvement to line the "cod-end" of the net with finer 4 mm. material. The longitudinal ropes, four in number, and two transverse ropes were, like those of the N 200, originally made of stout log line, but later were replaced by a soft 2 in. circumference rope of tarred hemp, known in Admiralty dockyards as "Rumbo". Experience showed, however, that any kind of twisted rope is liable to twist still further in use, thus rolling the net up and decreasing its circumference. In consequence all the ropes had to be removed and sewn on again after the turns had been taken out. For roping large plankton nets a flat braided sennet would perhaps be suitable, if log line of sufficient strength cannot be obtained.

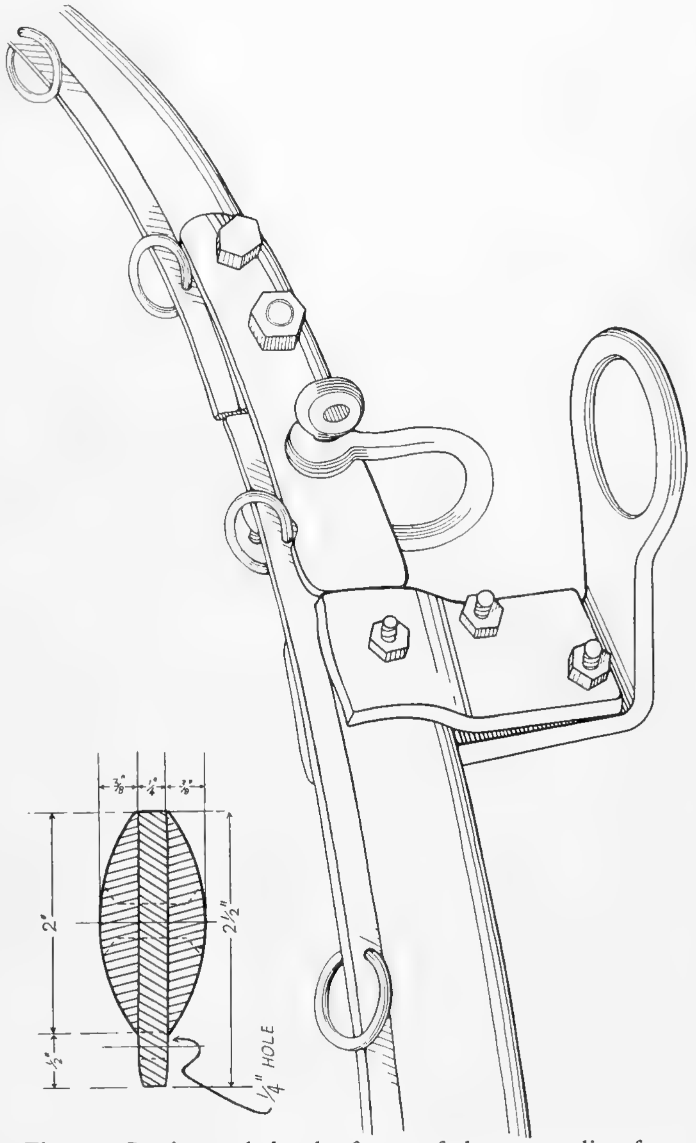


Fig. 12. Section and sketch of part of the stream-line frame for the N 450 net, showing the junction of two quadrants, a towing shackle, rings for the attachment of the net, and the fair-lead for the closing rope.

The specifications of the five types of tow-net are summarised in the table on p. 188.

[1] Made by Messrs Stuart and Jacks of Lowestoft.

[2] Made by L. de Séréville, see footnote to page 186.

TYF. This net is the Petersen young-fish trawl, similar to that modified and described in full by Clark[1] as his type *A*. At first it was used in the normal manner with

	N 50	N 70	N 100	N 200	N 450
Frame					
Diameter	50 cm.	70 cm.	1 m.	2 m.	4½ m.
Section	⅜ in., round	⅜ in., round	1 in., round	Stream-line	Stream-line
Towing bridles					
Material	Bronze	Bronze*	Bronze	Galv. steel	Galv. steel
Diameter	3 mm.	3 mm.	4 mm.	6 mm.	6 mm.
Length	3 ft.	4 ft.	5 ft.	12 ft.	24 ft.
Number	3	3	3	3	4
Cylindrical section *A*†					
Material		Netting	Netting	Netting	Netting
Mesh‡		¼ in.	½ in.	1 in.	1½ in.
Length	26 in. Canvas (sections *A* and *D*)	1 ft. 9 in.	3½ ft.	7 ft.	15½ ft.
Closing band *D*					
Material		Canvas	Tarpaulin canvas	Tarpaulin canvas	Tarpaulin canvas
Width		10 in.	12 in.§	18 in.§	24 in.§
Tapering section *B*					
Material		Silk	Netting	Netting	Netting
Mesh ‖		40 to linear in.	4 mm.	7 mm.	½ in.
Length	Silk 200 to linear in. 5 ft. 5 in. (sections *B* and *C*)	3 ft. 2 in.	3½ ft.	6½ ft.	15 ft.
Tapering section *C*					
Material		Silk	Stramin	Netting	Netting
Mesh ‖		74 to linear in.	12 to linear in.	4 mm.	7 mm.
Length		4 ft. 5 in.	7 ft.	13 ft.	30 ft.
Section *E* (canvas)					
Circumference ...	8 in.	9 in.	1 ft. 8 in.	2 ft. 3 in.	3 ft.
Length	2½ in.	3 in.	1 ft.	2 ft.	3 ft.
Longitudinal ropes¶					
Material	Bronze	Bronze	Log-line	Manila	"Rumbo" line**
Size	3 mm. diam.	3 mm. diam.	1 in. circum.	2 in. circum.	2 in. circum.
Number	3	3	3	3	4

* Brass rods were substituted when used vertically.
† The letters refer to Fig. 6, p. 181.
‡ Measured from knot to knot.
§ Widths latterly adopted.
‖ Measured from knot to knot unless otherwise stated.
¶ With transverse ropes also in N 200 and N 450.
** A specially flexible rope of tarred hemp.

poles and otter boards as a pelagic trawl, when it had a rectangular opening 6 ft. by 4 ft.; but later, after July 1926, the boards were discarded and the net, mounted upon the N 200 frame, used as an ordinary tow-net. In this form, as used by Russell[2] and

[1] Clark, R. S., *Journ. Marine Biol. Assoc.*, n.s., XII, p. 163, 1920.
[2] Russell, F. S., *ibid.* XIII, no. 4, 1925.

others, it is almost equally efficient, a good deal easier to handle, and can if necessary be closed on the Nansen principle.

It is an excellent net, yielding large catches of macroplankton with a wide range in size. It was used effectively at all depths.

Other Plankton Apparatus

The **Continuous Plankton Recorder,** a new instrument for giving, as the name implies, a continuous record of the plankton through which it has been towed, was tested on many occasions and in all recorded just over 2400 miles of plankton. A preliminary description has already appeared;[1] the full description will be published later in a report dealing with the results obtained by its use. Small plankton indicators[2] were occasionally used to indicate the presence or absence of diatoms or young Euphausians.

Buckets for Vertical Nets. In order to save time on routine stations when a number of vertical hauls are taken—and time in intensive plankton work is a vital factor—special buckets were designed. These are shown in Figs. 13 and 14. They are made of phosphor bronze and consist of two main parts: the holder *a*, a cylinder attached to the canvas end of the net by the band *d*, and the easily detachable bucket *b*, which is screwed tightly up to the holder *a* by the loose collar *c*. The collar is well milled, so that it can be tightly screwed up and quickly undone, and held to the holder *a* by a flange. The inside of the holder which fits into the canvas cod-end of the net is gently bevelled at the top so that no organisms can stick round the edge. The collar *d* grips the canvas where it joins the silk netting immediately round the outside of this edge; a piece of tape or rubber inside this band improves the grip. On the outside of the holder are three eyes *g*, to which are seized the supporting wires to the weight below. The bucket *b* bears a strong screw thread round its upper margin for engagement with the collar *c*. Below this is a series of windows covered with phosphor-bronze gauze: 140 meshes to the inch in the N 70 and 200 meshes to the inch in the N 50. Thus when the net leaves the water and is washed down, the plankton sample is reduced to a reasonable size in that part of the bucket below the windows. It is then unscrewed, replaced by another similar bucket, and is closed by the screw-on lid *f*, so that it may be put down without fear of upsetting, and the work carried on. Each lid bears on the top an oblong strip of ivorine, upon which the depth from which the haul was taken may be written. Opposite the gauze windows the top of the jar is hollowed out on the inside to form a lip for pouring out the sample. The windows of the larger jar are so shaped that they are the maximum size that will allow the sample to be poured out from the opposite side without fouling them: those of the smaller jar are made small and circular on account of the fragile nature of the very fine-meshed gauze. After the sample has been poured out a little water is washed through the windows from the outside and added to the sample, so collecting any

[1] Hardy, A. C., "A New Method of Plankton Research", *Nature*, CXVIII, p. 630, 1926.

[2] Hardy, A. C., *Min. Agric. Fisheries: Fishery Invest.*, ser. ii, VIII, no. 7, 1926.

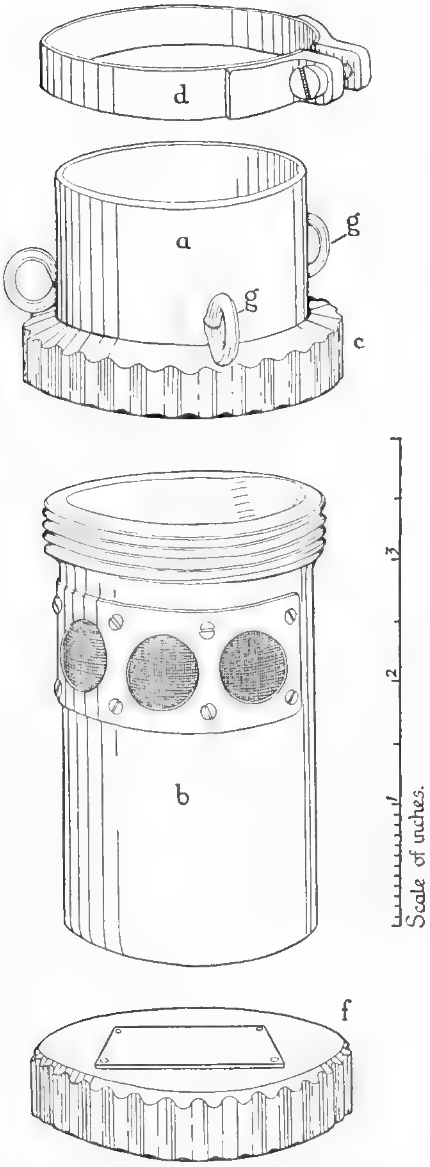


Fig. 13. Bucket, with attachment and lid, for vertical N 50 net: for explanation see text.

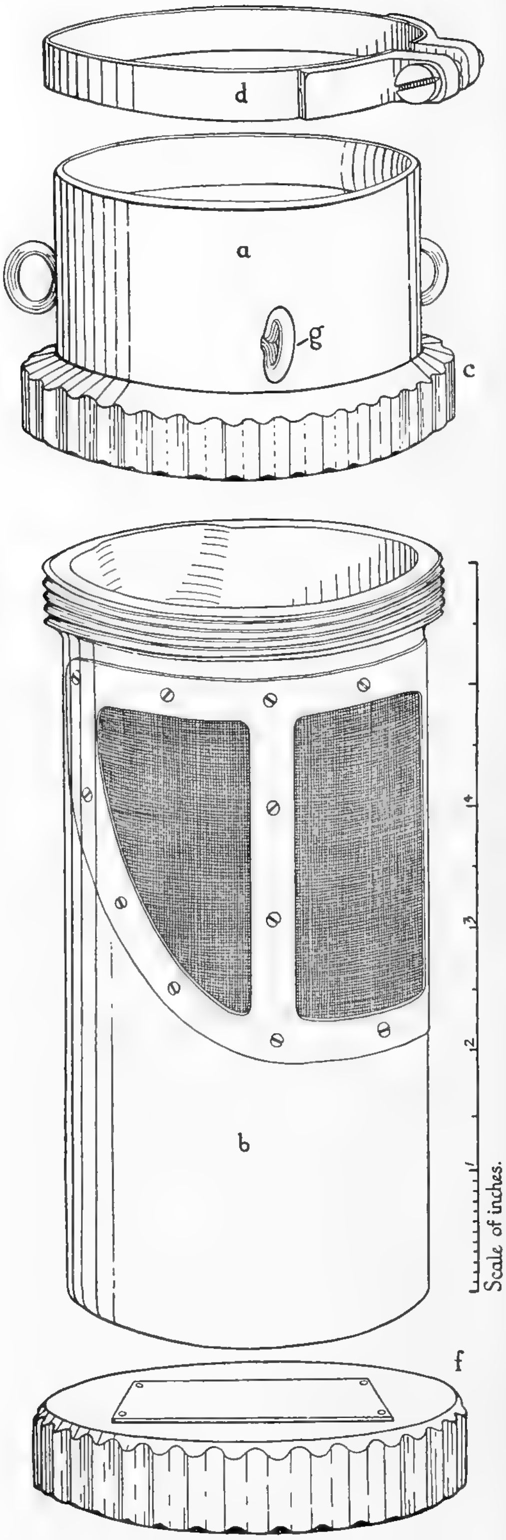


Fig. 14. Bucket, with attachment and lid, for vertical N 70 net: for explanation see text.

organisms which may have remained behind. These buckets were made by Messrs E. R. Watts and Sons.

Buckets for Horizontal Nets. For N 70 horizontal nets simple light cylindrical buckets, made from sheet brass, were used; they were $2\frac{3}{4}$ in. in diameter and 5 in. tall, with a wired strengthening rim round the top. The bucket is slipped inside the canvas cod-end until the rim comes just below the silk netting; here it is tied securely with twine.

The buckets used for the N 100, N 200 and N 450 nets, though differing in size, are all of the same pattern—that shown in Fig. 15. They are made of zinc with a wired edge at the top. Those for the N 100 nets have three rings on the side for the attachment of the longitudinal ropes; in those for the N 200 and N 450 nets the ropes are tied below the bucket. In all three the canvas cod-end is secured by a brass band with a fly nut.

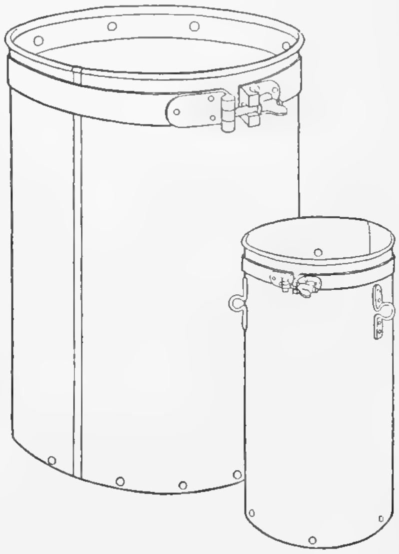


Fig. 15. Buckets for N 450 and N 100 horizontal nets.

The dimensions of the three buckets are as follows:

	N 100	N 200	N 450
Diameter...	6 in.	8 in.	12 in.
Height	12 in.	16 in.	18 in.
Width of band	$\frac{3}{4}$ in.	1 in.	$1\frac{1}{4}$ in.

These buckets and securing bands were found very convenient; but in time the former became distorted by the pressure exerted by the fly nut; to give greater strength a narrow band of galvanized iron was fixed on the inside, just below the rim.

The bucket for the TYF is the standard one made by the Marine Biological Association at Plymouth for this type of net. It is of galvanized iron $7\frac{1}{2}$ in. in diameter and $11\frac{1}{2}$ in. in height, and is fitted with four hinged lugs for attachment to the net, each $4\frac{1}{2}$ in. from the top.

In handling the plankton nets specified above attempts have been made in one or two directions to introduce improved methods. The smaller nets, N 70 and N 100, towed vertically or horizontally and used for routine observations, have with few exceptions been closed before being hauled, and the same procedure has been adopted, though with less success, with the larger nets. Depth gauges of various kinds have, moreover, been employed to determine the level at which horizontal nets were being towed. Before giving an account of the methods of handling the various plankton nets it will be convenient to describe this subsidiary apparatus.

The closing mechanisms used may be divided into three classes: those for vertical nets, those for 1 m. and 70 cm. horizontal nets and those for large horizontal nets.

Closing Mechanisms for Vertical Nets. The apparatus used during most of the commission for the closure of vertical nets is that shown in Fig. 16: in general design it closely resembles that employed by Hjort.[1] In our hands this type was found to give a certain amount of trouble: it was liable to release prematurely and sometimes the wire was found to have come out from the slot in the top lever, and by jamming the

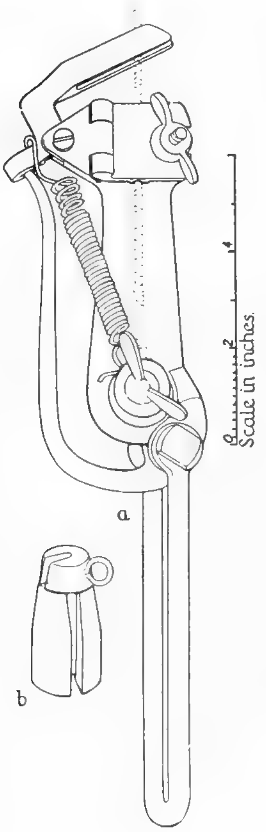


Fig. 16. Closing mechanism for vertical nets: *a*, mechanism; *b*, messenger.

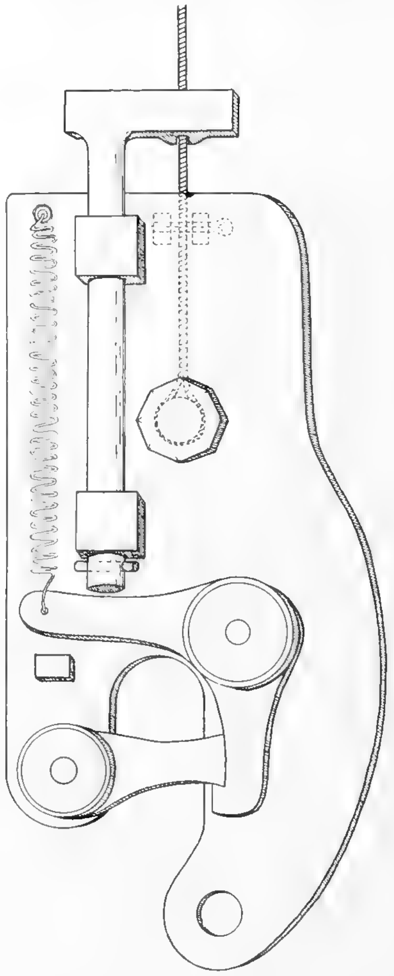


Fig. 17. Improved closing mechanism for vertical nets: $\times\frac{1}{2}$.

movement to have prevented release altogether. These difficulties were met by increasing the strength of the spring and by inserting a cotter pin through the ends of the forked lever to keep the wire in its proper place. With these alterations the apparatus worked well in smooth water, but in bad weather, with the ship rolling, premature releases were still liable to occur. If the wire strayed much from the vertical it would bear on the cotter pin and eventually effect release. During the second year of the commission a different pattern of closing mechanism was made by the engine-room staff and this has been found to be a great improvement on the former model, working

[1] Hjort, *Depths of the Ocean*, p. 48, fig. 31, London, 1912.

with certainty under all conditions. This type is illustrated about half size in Fig. 17 and does not call for detailed description.

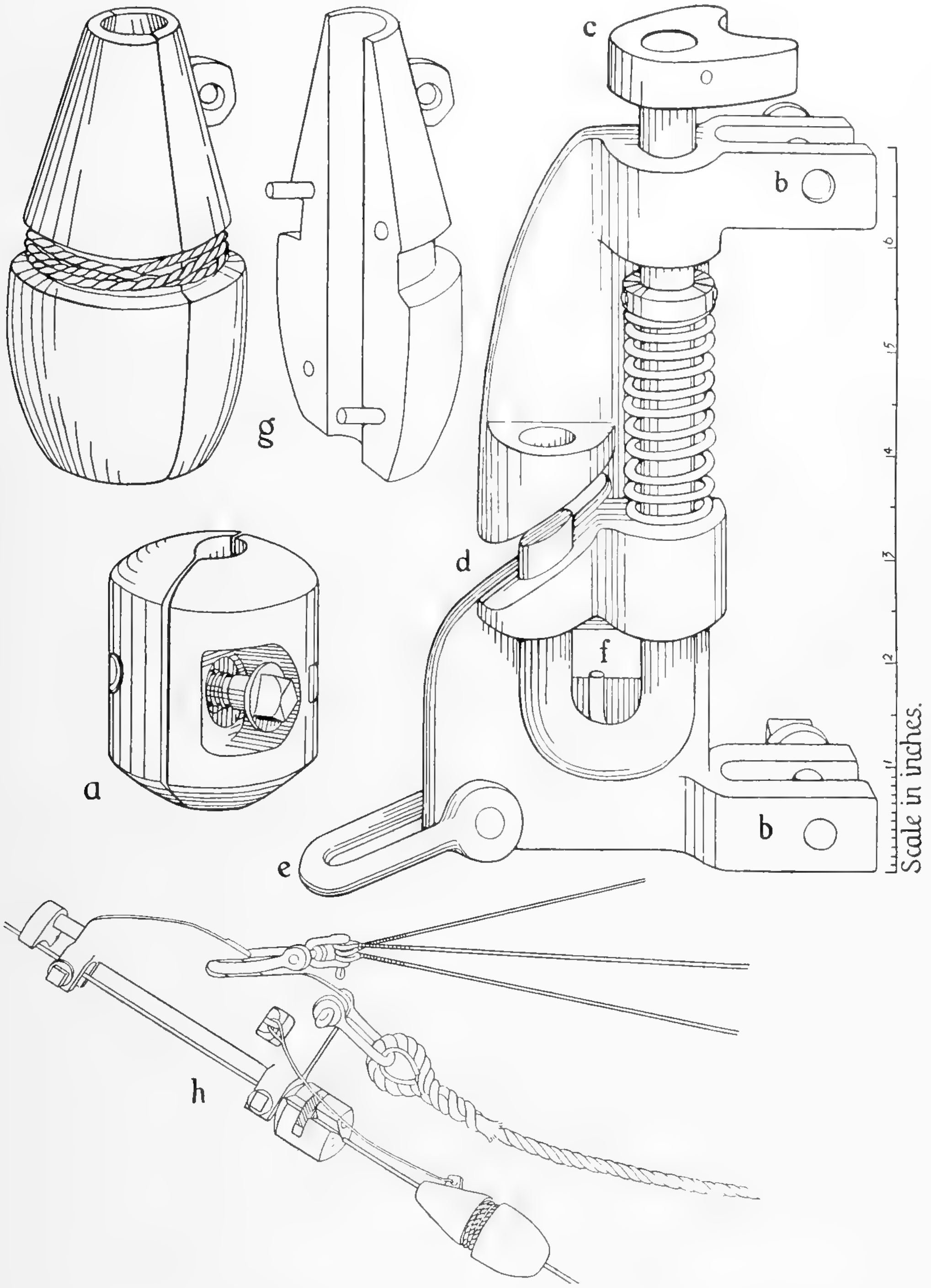


Fig. 18. Closing mechanism for small horizontal nets: for explanation see text.

Two kinds of messenger are ordinarily used with these mechanisms, both of the torpedo pattern described by Knudsen;[1] they weighed 405 and 615 grm. respectively.

[1] Knudsen, *Pub. Circ., Cons. Explor. Mer*, 77, p. 15, fig. 5, 1920.

Closing Mechanism for Small Horizontal Nets. The apparatus shown in Fig. 18 is used for closing 1 m. and 70 cm. nets towed horizontally. In attaching nets to the wire for horizontal work it is essential, as Hjort has pointed out, that the net should be free to revolve on the wire rope; for the rope is continually twisting, and the net, if clamped to it, will become wound round and will not tow properly. The closing mechanism is consequently made to swivel freely on the wire rope, and is supported by a brass screw stop *a* similar to those used by Hjort. The mode of action of the mechanism is evident from the figure. It is attached to the wire rope at the points marked *b* by two screw bolts. The messenger depresses the striking piece *c*, and the link which carries the bridles of the net is slipped from *d*. The throttling rope, by which the net is hauled to the surface, is attached at *e*. It will be noticed that a ring for the release of a messenger to a lower net can be passed through a slot *f* in the base plate and secured by a pin on the moving portion. The second messenger is thus released simultaneously with the closure of the net. In Fig. 18 *h* the apparatus is shown assembled on the wire rope, with a messenger for the release of a lower net.

This type of release gear has proved very satisfactory, but the heavy messengers that were used tend to bend or break the cast brass fork of the moving portion. Repairs were easily effected, but it would perhaps be better if this movable part were made of steel. The messengers (*g*) were of a very simple type, stream-line in form, 3 lb. in weight, and made in two halves seized together with a piece of twine. A still heavier messenger, that shown in Fig. 19 *m*, was also sometimes used with this apparatus. Both messengers took approximately half a minute to travel 100 m., the time varying somewhat with the angle of the warp. In serial work it was found best to attach the messenger for the lower net to the release of the upper by means of a length of stiff galvanized wire, rather than by cod-line and a ring: by this method all chance of the line fouling the stop was prevented.

Opening and Closing Mechanism for Large Horizontal Nets. The apparatus used with large nets is more elaborate and is shown in Figs. 19 and 20. Like the smaller mechanism described above, it is designed to swivel on the warp, to which it is attached by means of the two sliding clamps *a* and *b*. The primary release is at *c* and is opened by a small messenger striking the forked lever *d*. At the same time another small messenger for despatch to a lower net can be released from the catch *e*. The secondary release is at *f*. This link takes the whole towing weight of the net, and since it was anticipated that if the messenger acted directly (as with the primary release) the friction would be so great as to prevent movement, a double action was fitted by inserting the tumbler block *g*, the whole being arranged to give a leverage greatly in favour of the messenger. The rods effecting this release are attached above to the semi-circular striking piece *h*, which must of course be large and wide enough to permit free passage to the primary messenger; at the lower end they actuate another catch, by which the secondary messenger can be slipped to a net attached lower down the warp. We found in practice that with a net towing from the link *f* the apparatus was canted out of the straight line, and in order that the messenger may meet the striking piece *h* fairly, the latter is set at an angle of 20° to the horizontal. The apparatus is supported

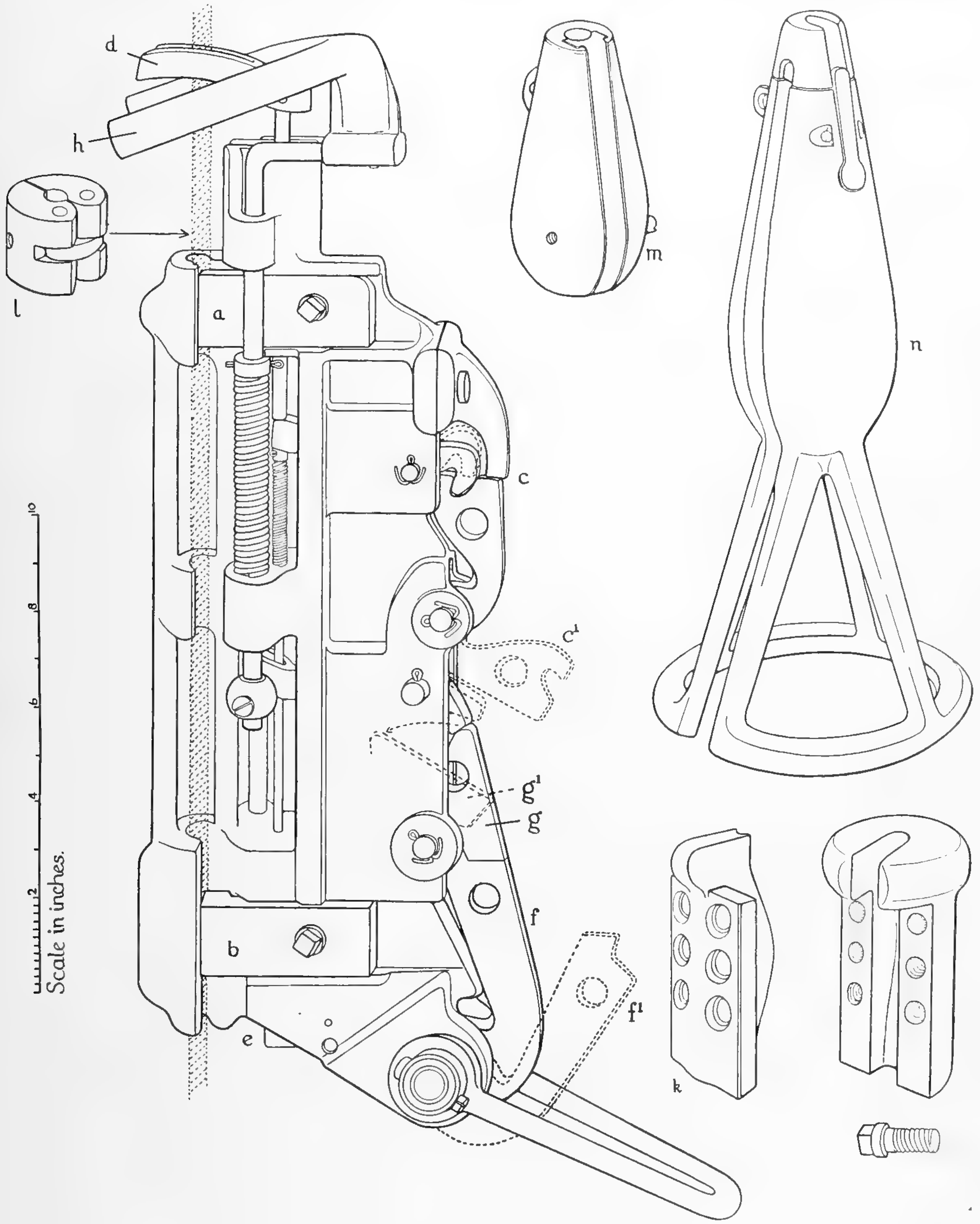


Fig. 19. Opening and closing mechanism for large horizontal nets: for explanation see text.

on the stop shown at *k*, which is attached to the warp by six bolts, and, with a view to obtaining a better grip, it is so made that it causes a slight bend in the warp. This stop proved unsatisfactory. It frequently slipped and it is almost certain that a simpler pattern, with two screws at most, would prove more efficient.

If a large net is lowered rapidly there is a tendency for both net and closing mechanism to slide up the warp, and if this happens the lines by which the messengers for the lower net are attached will break: it is also very likely that when the apparatus slides back to the stop the momentum consequent upon the impact will be sufficient to effect release. This possibility was foreseen when the apparatus was designed, and room is made for the insertion of a small stop *l* at the upper end to prevent any movement in an upward direction. The primary messenger is shown at *m* and the secondary

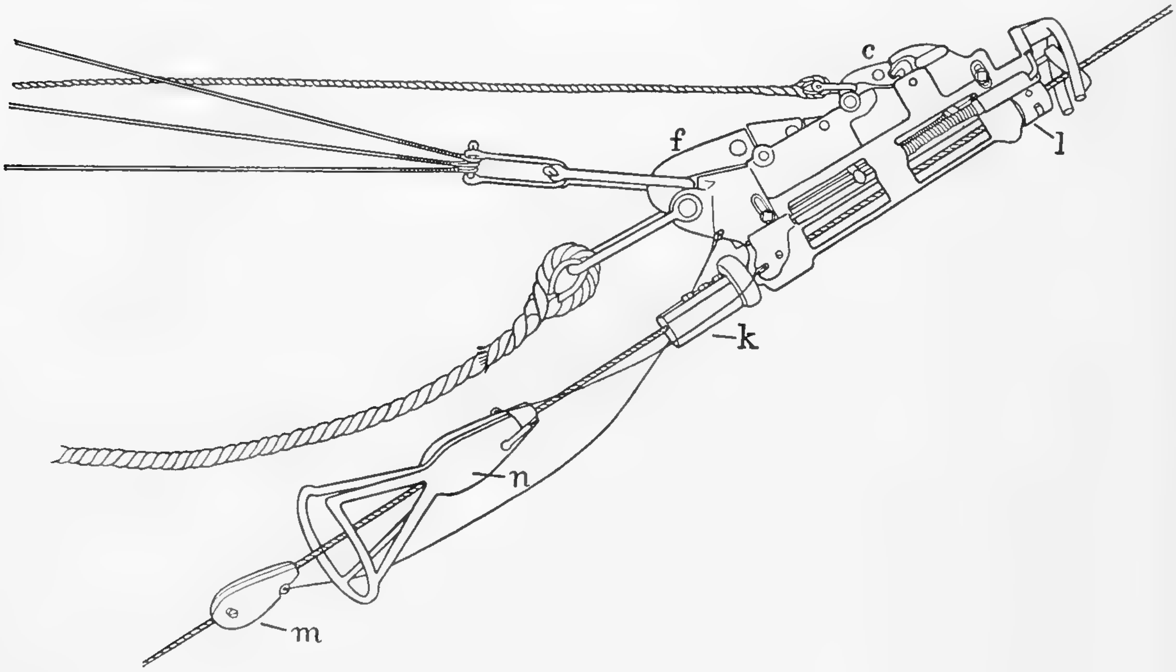


Fig. 20. Opening and closing mechanism for large horizontal nets, shown in use.

at *n*: the former is $5\frac{1}{2}$ lb. in weight and stream-lined in form, the latter is 22 lb. in weight and apart from the conical extension piece is similar in shape. The smaller messenger travels at a rate of $3\frac{1}{2}$–$4\frac{1}{2}$ min. and the larger at about 4–5 min. per 1000 m., the speed depending largely on the angle of the warp. The entire apparatus is made of phosphor bronze except for certain pins, at points where exceptional strength is required, which are of steel.

Apart from the defects shown in the stop this apparatus proved all that could be desired, but as is explained further on, the results obtained with these large horizontal nets were not always satisfactory.

Depth Gauges. To determine with any accuracy the depth at which mid-water nets are being towed is a matter of some difficulty. In most deep-water investigations the data on this point appear to be based mainly on guess-work, and in a recent expedition all attempts to determine the level are abandoned, and the only information given regarding depth is the number of metres of wire rope paid out. The depth at which a towed net is working is governed by a considerable number of factors, the most important being the length and size of the rope, the size and pattern of net, the weight of the lead and the speed of the ship, and since there must nearly always be some variation in one or more of these particulars it is hardly possible, even with the most carefully standardized system of hauls, to work out a table of calibration. The only reliable method is to use a depth-gauge with each haul, and unfortunately no perfect instrument for deep-water work has yet been invented.

In the 'Discovery' investigations a number of different types of gauge have been used: (i) the Admiralty pattern, recently employed with such good results by Mr F. S. Russell in his studies of vertical movements of plankton in the English Channel; (ii) the Kelvin tube, commonly used by seamen to determine shallow soundings from a moving ship; (iii) the Budenberg gauge, made by Schaffer and Budenberg and formerly used by the Prince of Monaco; and (iv) a pattern in which the depth is determined by the difference in the readings of protected and unprotected reversing thermometers. In addition a new pattern of gauge was tried, but proved unsatisfactory. The vibration of the warp caused the index to shift and the readings were unreliable.

It was unfortunately only possible to use the Admiralty pattern gauge to a very limited extent, for though it gives excellent results, it cannot be employed below depths of about 50 fathoms. With most of the shallow horizontal nets a Kelvin tube was used, inserted in a brass case lashed to the shaft of the stream-line lead. By this means a depth for the lower net is obtained without difficulty, but the method is, of course, open to the objection that only a single reading is taken and that the level at which the net is fishing may alter while it is being towed. The Kelvin tube was occasionally used to depths of 100 fathoms, but the scale above 75 fathoms becomes very small and cannot be read with any accuracy.

For work in deeper water the Budenberg gauge[1] was used on many occasions. The instrument is large and very heavy, and was attached to the end of the warp either with or without a stream-line lead. It works on the Bourdon principle, and gives a graph which can be read with reasonable accuracy to about 25 m.; but since its limit of depth is 1500 m., it can only be employed in the upper layers of the water. In certain series of hauls, when five nets were being towed simultaneously, this gauge was used at the bottom in conjunction with a Kelvin tube on the second net from the surface. The Budenberg gauge gave excellent results, but it has one serious defect which detracts greatly from its usefulness. The instrument is lenticular in shape, made in two halves with a large circular washer as a joint, and is held together by twelve steel bolts, all of which must be removed in order to open it. In practice it was found almost impossible to make the joint watertight. No matter what means were tried a small leakage occurred, and this, though insufficient to have any appreciable effect on the reading, made it necessary to dismantle the entire mechanism and clean it thoroughly

[1] Described in *Forschungsreise S.M.S. 'Planets'*, 1906–7, CXI, *Ozeanographie*, Berlin, p. 11, 1909.

after each operation. Parts of the clock-work were of steel and would rapidly have been destroyed if continual care had not been taken.

For depths below 1500 m. the only gauge used was of the reversing thermometer type[1]. If carefully calibrated beforehand a pair of thermometers, one protected against pressure and the other unprotected, will give a more reliable indication of depth than can be obtained by any other means. The thermometers were made by Richter and Wiese of Berlin, and were used at first in simple reversing frames supplied by the makers. These frames, though doubtless strong enough for vertical work, proved to

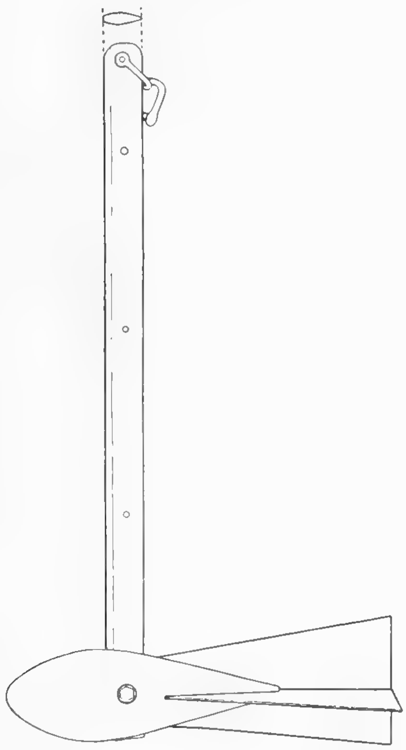


Fig. 21. 56-lb. stream-line lead, with bar attached.

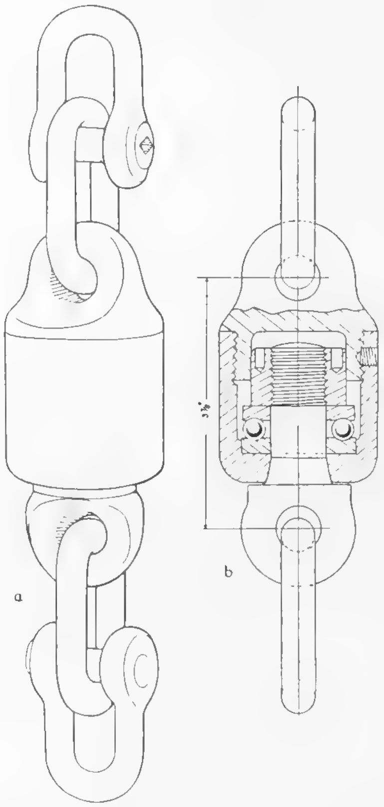


Fig. 22. Ball-bearing swivel for use with trawls, dredges and large tow-nets.

be too frail for our purpose and others of heavy cast gunmetal were substituted. These proved satisfactory, but later were replaced by an ordinary Ekman reversing bottle adapted to fit on wires of large calibre. The bottle serves equally well and has the added advantage that it provides a water sample as well as the temperature. In placing such instruments as these on a long length of towed wire rope, a stop should be used and the instrument attached above it with a loose-fitting clamp, so that it will not revolve as the rope twists and untwists. The thermometer type of gauge will, of course, only record the depth at the moment when the messenger arrives, and for biological work it

[1] For description of the method see Ruppin, *Wiss. Meeresuntersuch. Kiel, Helgoland, Abt. Kiel*, neue Folge, IX, p. 182, 1906, and Brennecke, *Ann. Hydrographie*, 41, p. 363, 1913, and 42, p. 34, 1914.

is thus less suitable than an instrument which provides a graph. In practice the reading of the gauge was taken as the mean depth, and an estimate of the levels in which the net was towing was arrived at by making an allowance (usually of about 50 m.) above and below the reading.

For all horizontal nets **Stream-line Leads**, as shown in Fig. 21, were used. These leads are an improvement on the ordinary pattern, offering less resistance to the water and giving a greater effect for the weight employed. Each lead is 56 lb. in weight, and the bar, which is 3 ft. long and also stream-lined in section, is bored with a series of holes so that any number of leads, up to four, can be attached to it.

In using stream-line leads and with every type of net **Swivels** are necessary. For the leads and light mid-water nets a simple galvanized swivel answers well enough, but with trawls, dredges and large plankton nets something better is required. For such purposes the ball-bearing pattern shown in Fig. 22 was used—made by Thos. and Wm. Smith, Ltd. These swivels with their links are tested to 2½ tons; they are compact and pass easily through the fair-leads, and in every way proved most satisfactory.

Methods of Handling Plankton Nets

The engines, reels, wire ropes, nets and fittings used in plankton work on board the 'Discovery' and 'William Scoresby' have now been described and figured. It remains to describe the method of working.

Vertical Nets. On ordinary routine stations one haul is made with the N 50 net from 100 m. to the surface, and a series of hauls with the N 70 net, soundings permitting, as follows: 50 m. to the surface, 100 to 50, 250 to 100, 500 to 250, 750 to 500 and 1000 to 750. When possible deeper hauls were taken from 1500 to 1000, 2000 to 1500, 2500 to 2000 or 3000 to 2500.

In the 'Discovery' three persons are required to work the plankton unit efficiently: two scientific officers and a deck hand. Of the two officers one is on the outboard platform to adjust the closing mechanism and net before descent, to despatch messengers and to wash down and take the sample at the end of the haul; the other, who is in charge of operations, is inboard to control the engine, the depth reached and speed of winding, and to time the despatch of the messenger. In the 'William Scoresby' outboard platforms were not necessary and only one scientific officer was required. The deck hand guides the wire on the drum, pulls up the weight and holds the net for washing down.

After an examination, when the closing rope is seen to be open to the full extent, the net is lowered to the surface and the hands on the dials of the recording sheave adjusted to zero. This being done, the net is lowered to the depth from which the haul is to be taken. When the ship is rolling heavily—a not infrequent occurrence in the vicinity of South Georgia—the wire must be let out with great care. As the ship rolls to starboard, that is, away from the side of operation, the wire must be allowed to run out easily; as it rolls to port the drum must be checked by the brake or the wire may become slack, over-ride a sheave and possibly kink. The danger of this happening becomes less the further the net goes out, because the strain on the wire is increasing with its own increasing weight; in hauling in the strain completely removes the danger. It has already been explained in a previous section (page 166) that modifications were made to the apparatus to prevent the wire from over-riding the sheaves when being paid out, and that the spring accumulators were of considerable assistance in mitigating this nuisance. But when all possible improvements had been made, the danger of kinking still existed and great care was always necessary in paying out the wire. If a hitch occurred the strain outboard was taken up by means of the brass clamp shown in Fig. 26.

Reference has already been made, on page 183, to the defects in the original design of the net which caused failure of operation. The fouling of the closing mechanism by the wire bridles or throttling rope was most likely to occur when the net was allowed to run out too fast. Even now that these difficulties have been overcome, and under favourable conditions of sea, a limit should be set to the speed of descent; for at great depths the wire by its increased total weight may fall faster than the net itself if allowed to run out at full speed. This, with the rolling of the ship, was another cause for premature releases with the old type of gear (see page 192).

As soon as the net reaches the required depth, the drum is stopped and put into gear, and the messenger, unless a haul to the surface is being made, is attached to the wire and held by a piece of line until the moment for despatch. The net is wound up at the speed of 1 m. per second. An even and exact rate of winding may be maintained, after a very little practice, by regulating the steam valve whilst watching the metre-recording sheave in conjunction with a stop watch. The times that the particular messenger in use takes to fall to the different depths required has been calculated from previous trials. Thus when the haul is (say) from 750 to 500 m., the messenger, which is known to fall 500 m. in 160 sec., is released from the surface when the metre wheel records that the net, in its upward passage, has reached 660 m. The upward haul is continued without a break, so that the net meets the messenger at 500 m. and is closed. After this the net, no longer fishing and offering less resistance, may be hauled more quickly, but never more than 4 or 5 m. per second if damage to the net is to be avoided. In the haul from 1000 to 750 m. the messenger, which takes 240 sec. to fall 750 m., must be released when the dial reads 990: i.e. 10 sec. after the haul is started. At greater depths it may be necessary to release the messenger and wait before starting the haul: thus from 3000 to 2500 m. one must wait 5 min. A table of dial readings and times is easily drawn up for any particular type of messenger. Careful winding should ensure accuracy of release to within 1 or 2 m. in the shallower hauls and not more than 10 m. in the 1000–750 m. haul. When the ship is drifting before a wind so that the wire is off the vertical a slightly longer time must be allowed for the falling of the messenger. It has already been explained (p. 166) that the spring accumulators afford a means of checking the accuracy of the haul, for they indicate by their sudden extension the exact moment when the closure of the net is effected.

On reaching the surface the weight is pulled up by its special rope and the net washed down on each side with water from a bucket. The brass net bucket is now detached, replaced by another, the net fully opened and the mechanism reset for the next descent.

When all is working properly the routine of N 50 and the six N 70 hauls takes 2 hours to complete.

Routine Horizontal Nets. On arrival at South Georgia it was necessary in the first place to find a method by which comparable hauls of *Euphausia superba* (whale-food) and associated organisms could be obtained. This Euphausian, which is the largest in the group to which it belongs, swims actively, and we soon discovered that it could not be caught in nets hauled vertically. It can escape even the N 200 hauled as quickly as possible, and though a vertical N 450 proved more successful, this net was too difficult to manipulate. Experience showed, however, that very good catches could be obtained in horizontal nets. Towed N 100 often yielded thousands of the species and it was frequently taken in abundance in the N 70. Horizontal N 100 and N 70 were therefore adopted as a routine method of investigation; they were used open at the surface and with a closing mechanism working on the Nansen principle at depths of about 60 and 120 m. At first both the N 100 and the N 70 were shot together and towed for 1 mile at a speed of 2 knots; but it was found that unduly large catches were then made in the finer net and subsequently the two sizes were towed separately, the N 100 for 1 mile and the N 70 for $\frac{1}{4}$ mile. The method proved very satisfactory: closure of the nets could be effected with reasonable certainty and none of the difficulties referred to below in connection with the larger nets was experienced. So far as can be ascertained the catch is not appreciably diminished if the net is closed, and the material was always in first-rate condition, with the majority of the organisms still alive. With nets worked on this principle hundreds of hauls have been made, both in the whaling areas of South Georgia and the South Shetlands and in other parts of the South Atlantic. During some special investigations off the African coast repeated hauls were made with a surface net and four closing nets used in series on the same wire rope, the total length of rope being 400 m.

One objection to the use of these flights of horizontal nets is that a patch of plankton may occur at a level which lies between those at which the nets are fishing. *Euphausia superba* lives in swarms or patches which are sometimes very strictly localized horizontally, and on more than one occasion the fore part of one of the nets (in front of the throttling rope) came to the surface covered with Euphausians, though few or none at all were found in the bucket. In June 1927 experiments were made with oblique hauls and these proved so satisfactory that in routine work they have been substituted for the horizontal hauls. It is thought that they give a better indication of the total plankton which is present, and for economic purposes this is a more important consideration than information, which the horizontal nets might yield, on the vertical distribution of the various species. For oblique hauls open N 100 and N 70 were attached to the warp close together and 3 or 4 m. above the lead. With the ship steaming at 2 knots 200 m. was paid away, and as soon as this had been done hauling commenced. The rate of hauling was 10 m. per minute; each haul thus took 20 min. and the distance covered was two-thirds of a mile.

In working **Large Horizontal Nets** attempts were made to effect some improvement in methods. As a general rule large horizontal nets are fished open and no matter how long they may have been towed at a particular level many organisms must necessarily be caught during the ascent of the net. As a result it is only by a careful comparative study of a large number of hauls that any good estimate can be formed of the horizons at which an abundant species lives, while with scarcer forms the data are nearly always insufficient. If the larger and more active planktonic animals are to be secured, a net of large dimensions is a necessity, and it appeared important to find out some method by which these large nets could be closed.

Originally it was hoped that it might be possible to send nets down closed, to open them when the full amount of warp had been paid out, and to close them again before hauling. In the arrangement suggested a number of rings were sewn to a canvas band some distance from the mouth and on the *inside* of the net. A short running line was passed through these rings and the whole fore part of the net drawn through the frame. The fore part thus took the form of a cone inside the bridles, and the running line at the apex of the cone was linked to the primary release of a mechanism attached to the wire rope (a description of this mechanism will be found on p. 194). The after part of the net tailed out in collapsed form from the inner apex of the cone, the bucket itself extending well behind the frame. When, by despatch of the first messenger, the running line was released, the net would be carried by the weight of water through the frame and would take up its normal form. To close the net when the haul was completed the Nansen method was employed. A link carrying the bridles was slipped from the secondary release, and the net was closed and hauled to the surface by a running line passing through another series of rings on the outer side of the canvas band and through a fair-lead on the frame of the net.

Experiments carried out on these lines resulted, in part at least, in failure. To shoot a large net, closed as described above, proved a matter of very great difficulty, due partly to the inherent inconvenience of the arrangement, and partly to the limited deck space and to the obstruction caused by the mizen rigging. Although on one or two occasions the N 450 has been successfully opened and closed by this method, the operation was far too awkward for routine work and the idea of shooting large nets closed was abandoned. This is perhaps not a matter of vital importance; for if horizontal nets are shot at a fair speed they catch practically nothing during the process, as has been shown by closing them immediately after they have been let out. To close the net before hauling is a much more important consideration: in this manœuvre greater success was attained, and with experience in manipulation it was found that large horizontal nets can be closed with a reasonable degree of certainty. But though almost all difficulties in the actual operation were overcome, the results fell much below expectation. Frequently the catch was disappointingly small and on a number of occasions the condition of the material left much to be desired. Throughout these hauls with large nets a speed of about 2 knots was maintained, and it is possible that the smallness of the catch when a net is closed indicates that an unexpectedly large proportion of the material obtained in an open net is caught on the way up, when the speed through the water is augmented by hauling. The poor condition of the material in some hauls is probably to be attributed to the surging movement of the net while being drawn to the surface. When a large horizontal net is hauled from deep water after having been closed on the Nansen principle, it appears sometimes to behave like an ill-constructed kite, the bucket lashing from side to side and causing serious damage to the contents. If the fair-lead on the edge of the frame is omitted the trouble is aggravated. On one occasion it was found, when the net had been hauled, that this fair-lead had carried away, and the condition of the material was far worse than anything previously seen. Except for the most heavily constructed organisms practically everything was destroyed: even the limbs of the larger Crustacea were broken up into their component segments.

In spite of these disadvantages a large amount of material has been obtained in good condition and with accurate data of the horizon at which it was caught, and this, though less in quantity than that obtained in large open nets, should prove of considerable biological interest. It is hoped in the future to conduct further experiments, with a view to finding some method of closing large midwater nets which obviates the disadvantages referred to above.

The N 450 was usually carried with the frame outboard, just abaft the mizen rigging. When shooting, the bucket and net were put overboard and the lashings were cast off, leaving the net suspended only from a slip-hook on the masthead tackle. When the frame had been lowered sufficiently the slip-hook was tripped. In hauling, the net was brought directly to its proper position on the port quarter, where it remained until it was next required. The N 200 and TYF could of course be handled very easily and no description of the procedure in shooting and hauling is necessary.

When these large tow-nets were fished open, the net was shackled to a ball-bearing swivel at the end of the wire rope, and a length of stray line, attached *behind* this swivel, was used to carry the weight. The swivel is an important part of the equipment. When any considerable length of rope is paid out, it is continually twisting and untwisting, and unless a swivel is used, the stray line and weight will become foul of the net and prevent it from fishing. Other nets can be employed at any desired point by fixing a stop on the wire and attaching the net above this point by a shackle in the manner recommended by Hjort (*Depths of the Ocean*, p. 49).

When the net was to be closed, the weight was attached directly to a swivel at the end of the wire rope and 20 or 30 m. paid out. The stop and large mechanism were now attached to the rope just inside the fair-lead on the after rail, and when a final inspection of bridles and throttling line had shown that all were clear and properly adjusted, a snatchblock was placed on the rope in front of the gear and the rope hauled up until the apparatus could pass clear of the fair-lead. The net was now put out, the frame lowered and tripped, and as soon as all was clear and well away the rope was slackened back into the fair-lead. On some occasions a second net and mechanism were added at an intermediate point on the wire, with messengers slung below the stop to operate the release of the lower net. It is no doubt possible to shoot a whole series of closing nets on the one warp, and, as explained above, this has been managed very successfully with small nets worked at shallow depths.

TRAWLS, DREDGES AND OTHER APPARATUS

The scientific programme for the 'Discovery' did not include trawling and dredging at great depths, and work on the bottom was for the most part limited to areas in the south where the depth did not exceed 600 m. Plankton and hydrography were, moreover, the subjects with which this vessel was more particularly concerned and investigation of the bottom fauna was only undertaken at irregular intervals. As has already been explained, a trawling survey of the grounds lying between the Falkland Islands and the South American coast formed part of the work of the 'William Scoresby'.

Trawls. The trawl in the 'William Scoresby' has a headline 80 ft. long and is made to the specification shown in Fig. 23: it was used with otter-boards 10 ft. long and 4 ft. 4 in.

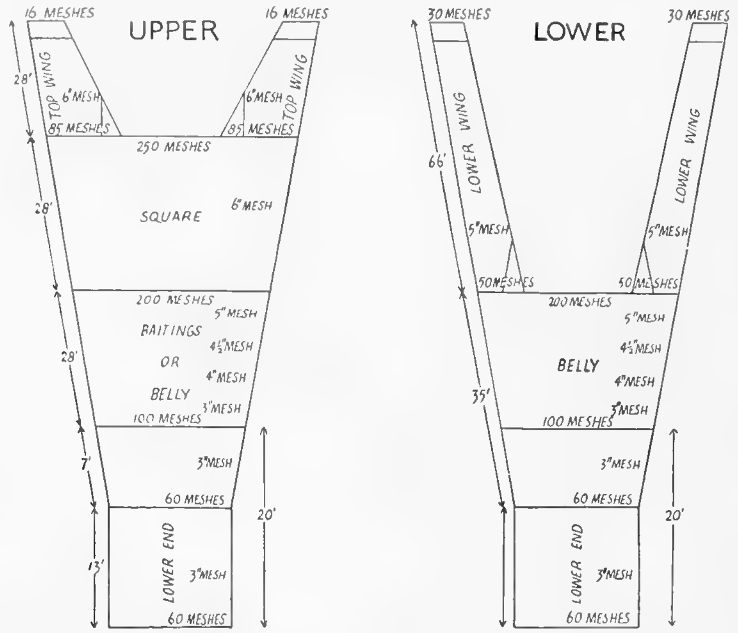


Fig. 23. Plan of otter trawl used in the R.S.S. 'William Scoresby'.

high, fitted with brackets. The trawl used in the 'Discovery' was a small one, with head-rope 40 ft. in length, made to the specification shown in Fig. 24; the otter-boards were 5 ft. long and 2 ft. 11 in. high, fitted with chains.

In the 'William Scoresby' the trawl was towed from two wire ropes in the manner usual in commercial vessels. In the 'Discovery', bridles, 25 fathoms in length, were used in conjunction with a single wire rope; in connecting them a ball-bearing swivel of the pattern shown in Fig. 22 (p. 198) was always used. In the south, and especially in the Palmer Archipelago, trawling is attended with some risk, for the bottom is frequently strewn with large stones and boulders, presumably ice-borne, which are very liable to damage the gear.

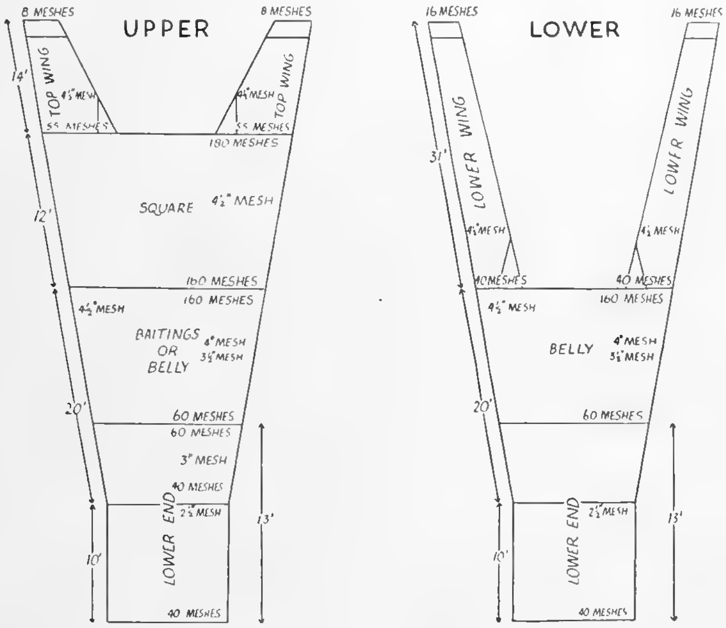


Fig. 24. Plan of otter trawl used in the R.R.S. 'Discovery'.

The trawls, which were made by the Gourock Ropework Company, proved very satisfactory and their catching power was greatly augmented by the addition of fine-meshed bags attached to the back. On several occasions when the cod-end of the trawl was so badly torn that it retained practically nothing, quantities of valuable material were taken in these fine nets and almost always they yielded large supplies of small

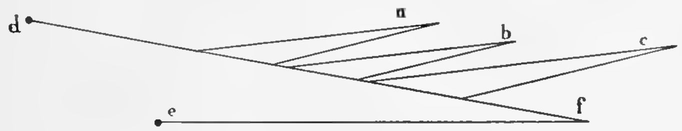


Fig. 25. Diagram of trawl, showing positions of fine-meshed nets: *a*, net of coarse silk; *b*, net of 4 mm. mesh; *c*, net of 7 mm. mesh; *d*, head-rope; *e*, foot-rope; *f*, cod-end.

organisms, particularly of Crustacea, which would inevitably have escaped through the meshes of the main net. Three sizes of fine-meshed net were used on the trawl, one made of coarse silk with 16 meshes to the inch, one of 4 mm. and one of 7 mm. mesh, and these were stitched to the baitings and lower end in the positions shown in Fig. 25. As the foot-rope passes over the bottom it disturbs small organisms, which are carried by the swirl of the water through the meshes of the back. The smaller and lighter organisms tend to be lifted most and consequently the silk net is placed in front and the 7 mm. net nearest the cod-end. The precise positions for obtaining the best results are easily found by experiment. It will be noticed that the nets must be specially shaped, with the upper side longer than the lower, so that they may stream out properly when the net is fishing. For the silk net an old tow-net may be used with the fore part cut away obliquely at an angle of about 40°. This system of attaching fine nets to a trawl was apparently first advocated by the late Dr E. W. L. Holt[1] and deserves to be more widely adopted. It can be employed equally well with beam trawls, but is of course impossible with an Agassiz trawl, which is fitted with two foot-ropes and is designed to fish either way up. Since Hjort has shown that a 40 ft. otter trawl can be worked successfully even in mid-ocean, little can be said in favour of the Agassiz pattern, and the impossibility of attaching fine nets is a very serious objection to its use.

On board the 'William Scoresby' the procedure in shooting the trawl is the same as that used on commercial vessels and does not require description. In the 'Discovery' the trawl was shot first of all from the port side of the ship, where, by swinging one of the life-boats on special davits, a length of clear rail had been provided between the main and mizen rigging. This position was, however, inconvenient and it was found better to shoot the net over the stern, with one board hanging on each quarter. If, when using the warp on the port side, the starboard board was slipped a few seconds later than the other, the trawl could always be shot clear.

A 30 ft. beam trawl was carried in the 'Discovery' in addition to the otter trawl, but the latter proved to work so well that it was not used. One of the 30 ft. nets was, however, adapted for use with otter boards and was employed on a few occasions. Small beam trawls, with beam 8 ft. in length and with $\frac{1}{2}$ in. mesh (knot to knot) at the cod-end, were carried on both vessels and were used mainly from boats in shallow water, generally with a coarse silk net attached to the back.

Rectangular Nets consist merely of a rectangular frame with a long bag of netting, towed by four bridles: for all practical purposes they are identical with what is usually called the D-net. Three sizes were taken: (i) with frame 8 ft. by $2\frac{1}{4}$ ft. with bag of $\frac{1}{2}$ in. mesh, (ii) with frame 4 ft. by $1\frac{1}{4}$ ft. with bag of 7 mm. mesh, and (iii) with frame 3 ft. by 1 ft. with bag of 4 mm. mesh. In the first of these the frame was made of flat steel, 2 in. broad and $\frac{1}{2}$ in. thick, with a series of holes along one edge for the attachment of the net. In the other sizes the frame was of $\frac{7}{16}$ in. round galvanized steel, which proved rather weak for the larger of the two. In these frames the ends were not welded, but were connected by means of an eye on the one part and a screw thread and nut on the other. The nets were attached to galvanized rings threaded on the frames. The two larger sizes were used from the 'Discovery' and coarse silk nets were sometimes attached to them: the smallest was for work from boats. Nets of these types are efficient on suitable ground, but were not used on many occasions.

[1] See Calman, *Fisheries, Ireland, Sci. Invest.*, 1904, I, p. 4 (1905).

Dredges. Two kinds of naturalists' dredge were used, both supplied by the Marine Biological Association and both of the double-sworded type. In working them the usual procedure was adopted: one arm only was shackled to the warp and the other was seized to it with several turns of trawl twine. If the dredge hitches, the seizing parts, and by this means the chances of loss or damage are lessened. Both dredges are galvanized, 4 ft. in length, 1 ft. in breadth, with arms $4\frac{1}{2}$ ft. long, and the only difference between them is that one is of much heavier material than the other. The lighter pattern proved much too weak for the very rough bottoms which were met and after one or two trials its use was discontinued. In the heavier type the frame is 3 in. wide and bevelled from $\frac{3}{4}$ to $1\frac{1}{4}$ in. in thickness; the double bars which form the arms are each $\frac{3}{4}$ in. in diameter. The weight is about 140 lb. For work in the south dredges of exceptional strength are required; bags, even of the heaviest netting, with plenty of chafing material attached to the outside, were not infrequently torn away, and we believe that they might more suitably be made of steel link.

The conical dredge, with mouth 18 in. in diameter and a canvas bag, is designed to bring up large samples of the bottom and for this purpose is a most efficient instrument. Its use was adopted as a routine in the trawling survey made by the 'William Scoresby'. This dredge has been described in detail by Borley.[1] Small naturalists' dredges and oyster dredges were also taken, the former for boat work.

Fish Traps of various sizes were constructed for use from the 'Discovery', and it was hoped that good results would be obtained with them in comparatively deep water. The largest was 10 ft. by 4 ft. by 4 ft., made of galvanized angle iron and netting; it was only used once and was then unfortunately lost. It had been buoyed in deep water off South Georgia, and with the onset of heavy weather two days elapsed before it could be picked up. The buoy was discovered far away from its proper position and the wire, though of over 2 tons breaking strain, was found to have parted. There is little doubt that its loss was due to an iceberg having drifted across the position. It is hoped that opportunity will be found for further experiments with large traps in deep water. Off the north-east coast of South Georgia the bottom between depths of 300 and 2000 m. is exceedingly rough and traps appear to afford the only means of obtaining those animals which can escape a dredge. Smaller traps were 4 ft. by 4 ft. by $2\frac{1}{2}$ ft., covered with $\frac{1}{2}$ in. wire netting, and three different sizes of a cylindrical pattern, covered with brass gauze. The latter were (i) 3 ft. by 1 ft. with $\frac{1}{8}$ in. mesh, (ii) $1\frac{1}{2}$ ft. by 6 in. with $\frac{1}{16}$ in. mesh, and (iii) 9 in. by 3 in. with $\frac{1}{34}$ in. mesh. These were used in shallow water, the largest sizes proving the most effective. They were generally baited with whale meat.

Nippers and Clamps. In trawling from the 'Discovery' a nipper was used to transfer the towing strain to a light rope stopper which broke at about 35 cwt., the arrangement being that shown in *Science of the Sea*.[2] If the trawl hitches the stopper breaks, the

[1] Borley, *Min. Agric. Fisheries: Fishery Invest.*, ser. ii, IV, no. 6, p. 5, 1923.

[2] *Science of the Sea*, p. 276, fig. 195, London, 1912; 2nd ed., p. 315, fig. 193, Oxford, 1928.

wire pays out from the drum of the winch, and the gear can often be recovered without serious damage. The nipper was made by Bullivant and Co. and is of the type illustrated in the figure quoted above. It has a double cam action and releasing plate, and the jaws have two grooves to suit $1\frac{1}{2}$ and $1\frac{1}{4}$ in. wire. Another type, with grooved brass wedges driving into a steel casing, was tried, but could not be made to grip the wire satisfactorily. A smaller nipper, also with cam action, and with brass interchangeable jaw plates, was occasionally used for the 4 mm. and 6 mm. wires; but the simple screw-clamp, shown in Fig. 26, was at least as easy to manipulate. With these light wires the nipper or clamp was for the most part only required when some misadventure made it necessary to take up the outboard strain.

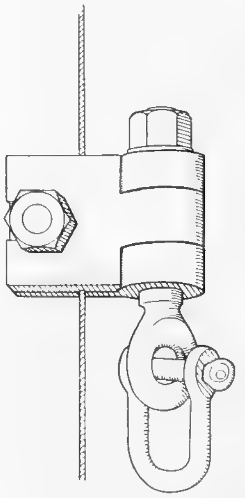


Fig. 26. Simple screw-clamp for light wire ropes.

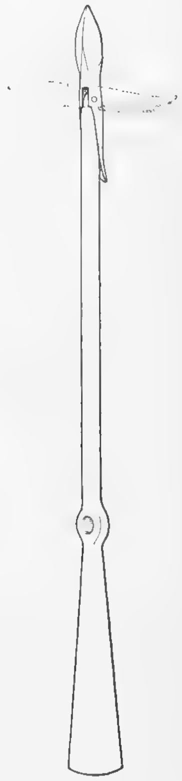


Fig. 27. Hand harpoon with swivel head.

Hand-Nets, Harpoons, etc. Hand-nets and lines were of course frequently employed and a sort of mussel rake, with heavy teeth and a triangle of wire netting extending from the cross-piece to the handle, was useful for collecting organic growth attached to hulks and to the piles of jetties. Equipment for obtaining porpoises and dolphins was taken, including a small harpoon gun of the type used in hunting the bottle-nose. The hand harpoons were provided with a swivel head, as shown in Fig. 27, which gives a very effective grip: in use one end of the head is tied back to the shaft with a piece of thin twine.

WHALE-MARKING

As already explained (p. 147), one of the objects for which the 'William Scoresby' was built was to undertake whale-marking—the only means by which the migrations of whales can be traced with any certainty. Preliminary experiments made in 1925 indicated that the best way of attempting to mark whales would be by shooting a mark into the blubber. An ordinary 12-bore gun was found suitable and trials were made on a shooting range with various patterns of mark. Portions of blubber obtained from whales stranded on the British coast were used as targets, and eventually the form of mark shown in Figs. 28 and 29 was evolved.

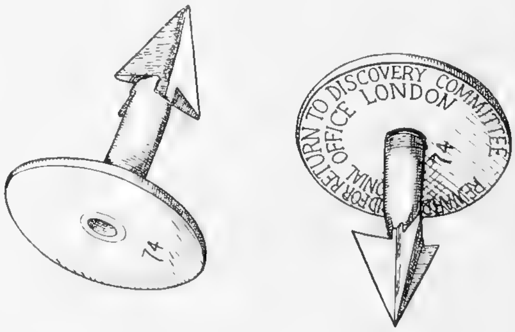


Fig. 28. Whale marks.

As will be seen the mark resembles a large drawing pin. The disc is $1\frac{3}{4}$ in. in diameter and the shank $2\frac{1}{2}$ in. long and $\frac{5}{16}$ in. in diameter, provided with three large barbs. The disc bears a serial number on both sides, and on its underside, where it is least likely to be affected by corrosion, the inscription "Reward for return to Discovery Committee, Colonial Office, London". The precise form of the barbs was the subject of prolonged experiment: a number of kinds were tried and it was found that quite small variations in form produced large differences in the amount of grip exerted on the blubber. In this respect barbs which folded back along the shank showed no superiority over those which were fixed, and the latter were to be preferred on the ground of expense. The selected pattern has a very powerful grip and can hardly be removed from the blubber by any means except cutting. The marks are made of annealed iron and silver-plated. Brass was rejected on account of the danger of copper poisoning in the wound, which might ultimately result in the mark dropping out.

The mark is used in conjunction with a light wooden shaft (Fig. 29), provided with three wads and sufficiently long to extend the whole length of the bore. The end of the rod fits into a small hole in the centre of the upper side of the disc, the mark itself lying just outside the muzzle when the gun is loaded for use. The wooden shaft breaks off short on impact, leaving the mark embedded in the blubber.[1] The guns are single-barrelled, with the sights heightened so as to give a clear view over the edge of the disc.

With this mark and gun and a cartridge containing 1 dram of black powder, the trajectory is reasonably flat at ranges up to about 75 yards, this being approximately the maximum distance at which whales are harpooned in commercial operations. It was found that when the target is hit obliquely the mark tends to straighten itself, coming to rest in nearly every experiment that was made with the disc flush with the surface of the blubber.

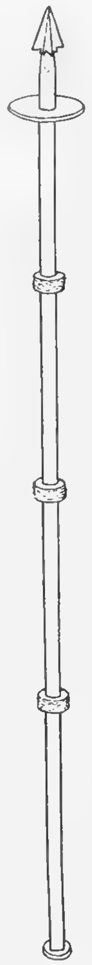


Fig. 29. Whale mark fitted to wooden shaft.

Marks and guns were supplied by Messrs Holland and Holland, Ltd., who gave expert technical advice and lent their shooting range for the experimental work.

First attempts at the use of this equipment on board the 'William Scoresby' were not very promising, one of the greatest difficulties being the amount of icy-cold spray taken over the bows in any but the smoothest water. This was overcome at the end of the first commission by the erection of a light forecastle head, as shown in Plates XIV and XV, and very satisfactory results were obtained in the early months of 1928 during the brief periods which could be allotted to this work. In the near future it is hoped to undertake

[1] It may be added that Capt. T. Sörrle, Manager of the whaling station at Stromness in South Georgia, has taken great interest in whale-marking experiments, and has devised a new form of mark with folding barbs designed to fit down the bore of the gun. Experiments with this mark are now being made.

marking on a more extensive scale. It will be understood that the method cannot be regarded as beyond the experimental stage until it has been demonstrated that the marks are retained in the blubber for at least some months.

HYDROLOGICAL INSTRUMENTS AND METHODS

Methods and apparatus in hydrology are more nearly standardized than those employed in biological work, and in consequence call for less detailed description.

Apparatus for Bottom Sampling. The apparatus used for obtaining bottom samples in routine work was supplied by the Admiralty. In shallow water, up to about 500 m., the sinker shown in Fig. 30 was employed. This sinker is 28 lb. in weight and the upper part is composed mainly of lead. At the lower end is a short cylinder, of $2\frac{3}{4}$ in. internal diameter, in which the bottom sample is collected. This cylinder has a pair of butterfly valves *a* at the lower end to prevent the sample from washing out during its passage to the surface, and a series of holes *b* at its upper end to allow the water to escape when it strikes the bottom.

In deep water greater weight is required, and with the very light wires used in sounding it is not possible to haul the weight back to the surface without risk of breaking the wire or damaging the sounding machine. The Baillie rod, which was used for deep-water soundings, is illustrated in Fig. 31; it is itself only 10 lb. in weight and is used in conjunction with separate cast-iron sinkers which are detached on striking the bottom. The rod itself is hollow throughout the greater part of its length; it has a pair of butterfly valves *a* at the lower end to retain the bottom sample, and a mushroom valve *b* at the upper end to allow the water to escape. The tube below the mushroom valve can be unscrewed from the upper part, and when this has been done, a long panel or shutter *c* can be removed, giving access to the bottom sample within. The shaft *d*, which bears the eye for the attachment of the sounding wire, is free to move vertically within the limits set by a cross-piece at its lower end, which engages in slots *e* cut in either side of the casing. To the shaft is attached a small projection *f*,

Fig. 30. 28 lb. sinker, Admiralty pattern: sectional view.

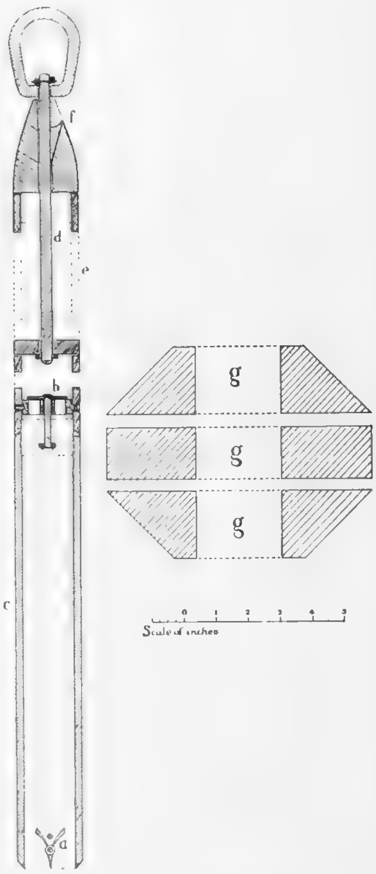


Fig. 31. Baillie rod for deep-water soundings: sectional view. For explanation see text.

and this, when the shaft is at its lowest, is housed within the conical upper part of the instrument. The cast-iron sinkers *g* each have a hole in the middle through which the rod passes and they are suspended by a bight of wire to the projection *f*. When the instrument strikes the bottom the rod is driven backwards, the wire is disengaged from *f* by the conical head-piece, and the sinkers are detached. As will be seen from the figure the sinkers are of two shapes, conical and flat, the former being 23 lb. and the latter 20 lb. in weight. For most deep-water soundings it was customary to use four sinkers—two cones with two flats between.

These two pieces of apparatus proved very reliable: except on rocky ground they rarely failed to provide a sample of the bottom.

Snapper leads, with both fixed and detachable weights, were also used on a few occasions, but appeared to be less certain in their action. The "Sondeur Leger",[1] a light form of grab originally constructed for the Prince of Monaco, was sometimes employed for obtaining larger samples of the bottom in shallow water, but as already stated the conical dredge was used for this purpose during the trawling operations of the 'William Scoresby'.

For obtaining cores of ooze in deep water an instrument similar to that described by Ekman[2] in 1905 was constructed. It is similar in principle to the Baillie rod, but is much longer and carries glass tubes inside which can be withdrawn without disturbing the enclosed bottom sample. This instrument, which is illustrated in Fig. 32, differs from the Ekman-Nansen pattern in that the weight is detachable—a necessity for deep-water work. As in the Baillie rod there is a mushroom valve at the top of the tube; closure at the bottom end is effected by two cup-shaped valves, actuated by a spring and similar to those used in snapper leads, which slide down the outside of the tube when the sinker is released. The rod is 5 ft. 2 in. in length and contains three 15 in. glass tubes separated by thin leather washers. The internal diameter of the glass tubes is about $1\frac{1}{4}$ in., and the pear-shaped cast-iron sinkers are 53 lb. in weight. The instrument was made by the Telegraph Construction and Maintenance Co. and with it cores up to 47 cm. in length have been obtained. Deeper penetration could perhaps be effected by using a heavier weight and a tube of smaller diameter.

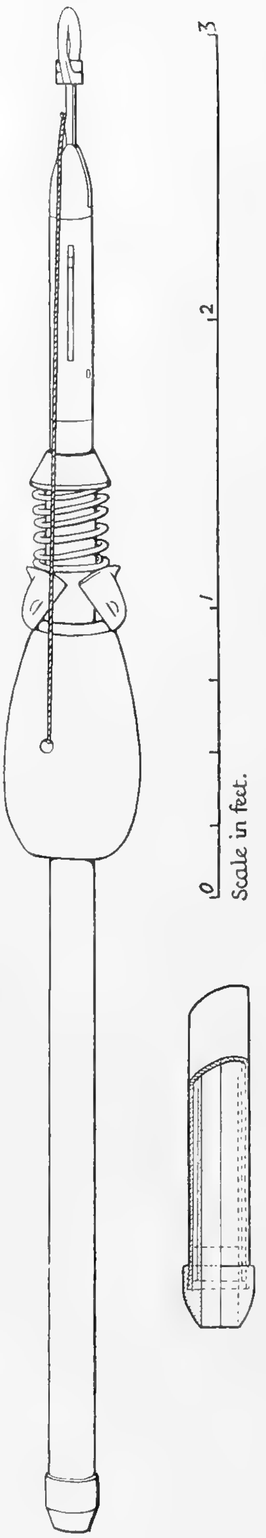


Fig. 32. Modified form of Ekman-Nansen sounding rod, for obtaining cores of ooze in deep water.

[1] Richard, *Les Campagnes scientifiques de S.A.S. le Prince de Monaco*, p. 17, figs. 12–14, Monaco, 1910.

[2] Ekman, *Pub. Circ., Cons. Explor. Mer*, 27, pp. 1–6, 1905.

Water Bottles and Thermometers. Water bottles were supplied by Dr Martin Knudsen from the Laboratoire Hydrographique at Copenhagen and are of three kinds: the Nansen-Pettersson insulating water bottle, the Ekman reversing water bottle and the Knudsen full speed water bottle.

In the Nansen-Pettersson instrument the water sample is insulated by a number of concentric jackets and the temperature is read by a thermometer of normal type inserted in the top of the water-chamber. This pattern is made for attachment to the end of the wire and in consequence only one instrument can be used at a time; it can, however, be shot and hauled very rapidly since the thermometer will take up the temperature while being hauled to the surface. If used in deep water the temperature is liable to rise, owing to the heat given off by the expansion of the water as the instrument is hauled to a higher level; it was, however, never used at greater depths than 400 m., the error arising from this cause being then negligible.

The water bottle is of the type described and figured by Knudsen in 1923.[1] The release mechanism in this pattern is effected by a messenger with a conical excavation in the bottom, which impinges on a small striking plate set in the conical headpiece of the bottle. This mechanism was not considered entirely satisfactory and a different form, in which a flat-bottomed messenger strikes a horizontal lever, was substituted. It is believed that a similar arrangement has been adopted in the latest models. The Nansen-Pettersson bottle proved most reliable on both vessels, thousands of temperatures and water-samples being taken without the smallest hitch.

For deeper water the Ekman reversing bottle was used, the model also being that described by Knudsen in 1923.[1] In this pattern the cylinder in which the water is collected capsizes when the messenger reaches the instrument, and the thermometers, two in number and carried in brass tubes attached to the cylinder, are capsized also. The thermometers are of a special type in which the mercury column is cut off at a particular point when they are reversed, and the only alteration in the reading while the instrument is being hauled to the surface is that due to the contraction or expansion of the cut-off column of mercury. In order to correct this error, which is always small, a secondary thermometer is sealed up in the same tube as the main thermometer, the correction being calculated from the two readings by means of a simple formula.

A single bottle of this type cannot be operated so quickly as one of the insulating pattern, for it must remain at the desired level until the thermometer has taken up the temperature. The bottles, however, are made so that they can be clamped on the wire at any point, and each is fitted with a device by which a messenger can be released on the wire below it. In consequence a series of bottles can be used at a single operation, and in deep-water work a great saving of time is effected.

The Ekman reversing bottle is a most reliable instrument. The only defect noted is that the cylinder is if anything too evenly balanced on its pivots, with the result that there were occasions when it failed to engage in the clip on the lower part of the frame

[1] Knudsen, *Pub. Circ., Cons. Explor. Mer*, 77, pp. 1–16, 1923.

when it was reversed. This was remedied by the addition of a small weight, after which no further difficulty was experienced.

The Knudsen full-speed water bottle[1] was tried on a number of occasions in the 'Discovery', but it was found that the manometers, which indicate the depth at which the samples are taken, failed to give accurate records. If this defect, which possibly does not exist in other instruments of the same pattern, can be overcome, this type of bottle should give valuable results.

The thermometers used with the water bottles were all made by the firm of Richter and Wiese of Berlin, who also supplied the unprotected thermometers which were used, as explained on p. 198, for determinations of depth. The simple thermometers used with the Nansen-Pettersson bottle are of two patterns, one having a range of -2° to $+32^\circ$ C., for use in tropical and sub-tropical waters, and one with a range of -2° to $+20^\circ$ C. for use in colder areas. The reversing thermometers have a range of -2° to $+16^\circ$ C. All the thermometers are scaled to 0·1° C. and provided with certificates from the Physikalisch-Teknische Reichsanstalt.

In all work at stations the Nansen-Pettersson bottle was used for taking surface samples. For observations between stations, when the ships were under way, a sample was taken in a leather bucket and the temperature read with thermometers made by Messrs S. and A. Calderara. These thermometers are scaled to 0·2° C. and have certificates from the National Physical Laboratory.

Transparency or Secchi Disc. This apparatus, which is used to determine the transparency of the water, consists merely of a circular disc, painted white and 50 cm. in diameter, which is lowered in a horizontal position to the depth at which it just ceases to be visible. It is extremely easy to manipulate, but recent investigations have unfortunately shown that the reliability of the method is open to doubt. In studying the penetration of light into sea water, Poole and Atkins[2] have endeavoured without success to correlate observations made with the Secchi disc with those obtained with their photo-electric apparatus.

Hydrological Methods.[3] Water samples and temperatures in routine work were usually taken at depths of 0, 10, 20, 30, 40, 50, 60, 80, 100, 150, 200, 300, 400, 600, 800 and 1000 m. and thence at 1000 m. intervals to the bottom. Samples of water for determination of salinity, hydrogen-ion concentration and phosphate-content were taken in 6 oz. swing top milk bottles, and tie-on labels were used giving particulars of station number, date and depth. Samples for oxygen work were preserved in numbered glass-stoppered bottles, each with a certificate of its volume, placed in a corked outer flask.

The analysis of water samples was for the most part carried out at the Marine Biological Station, South Georgia. In the 'William Scoresby' with her scanty accommodation it was not possible to do any of this work, but in the 'Discovery'

[1] Knudsen, *Pub. Circ., Cons. Explor. Mer*, 50, pp. 1–11, 1909.
[2] Poole and Atkins, *Journ. Marine Biol. Assoc.*, n.s., XV, p. 480, 1928.
[3] We are indebted to Mr H. F. P. Herdman for assistance in this section.

determinations of hydrogen-ion concentration were regularly made, and during a considerable part of the commission all samples were titrated on board for salinity. On certain occasions when the vessels were at Cape Town titrations for salinity were made in the physical and chemical laboratories of Cape Town University, while oxygen samples were worked up in the Government Chemical Laboratory. Thanks are due to Prof. E. Newbery and Dr Marchand for these facilities.

Salinity was determined by the method described in detail by Oxner and Knudsen,[1] in which the samples are titrated against a solution of silver nitrate of known strength, a solution of potassium chromate being used as an indicator. The strength of the silver nitrate is determined previously by titration against standard sea-water of a definite chlorine value supplied by the Laboratoire Hydrographique at Copenhagen. The special burette used in the work is graduated to give the chlorine value as a direct reading, and tables have been drawn up by Knudsen[2] from which the salinity can be quickly calculated from the titration. A special pipette for drawing off the required amount of water from the sample is also used, both burettes and pipettes being supplied by the Laboratoire Hydrographique.

Analysis of samples for dissolved oxygen was carried out by Winkler's method. The samples are fixed on board by the addition of small quantities of each of two solutions, manganous chloride and a mixture of sodium hydroxide and potassium iodide. Manganous hydroxide is immediately formed, and on absorbing the oxygen becomes manganic hydroxide. In order to prevent air from entering the sample bottle, it is placed in a flask filled with water from the same depth and corked until required for analysis. The fixed sample will keep for some considerable time. In the analysis the sample is well shaken after the addition of concentrated hydrochloric acid. The manganic hydroxide is broken up and manganic chloride formed, the latter immediately reacting with the potassium iodide present and setting free iodine. Titration against a standard solution of sodium thiosulphate, using starch as an indicator, will give the amount of iodine liberated, and hence, by a simple calculation, the percentage of oxygen in the sample.

Phosphate content was estimated by Atkins' application of Denigès' method,[3] in which the amount of phosphorus pentoxide is found by comparing the blue colour formed on the addition of two solutions to tubes containing (*a*) the sample of sea water and (*b*) a solution of potassium dihydrogen phosphate of known strength. By adjustment of the heights of the columns, which is easily done in Hehner tubes fitted with stopcocks, the intensity of colour in the lengths of the columns can be matched with accuracy. The solutions used are ammonium molybdate in 50 per cent sulphuric acid and tin dissolved in hydrochloric acid with the addition of a drop of copper sulphate.

[1] Oxner and Knudsen, *Bull. Comm. Internat. pour l'Explor. sci. de la Mer Méditerranéenne*, no. 3, pp. 1–36, 1920.

[2] Knudsen, *Hydrographische Tabellen*, Copenhagen, 1901, and *Pub. Circ., Cons. Explor. Mer*, 11, 1904.

[3] Atkins, *Journ. Marine Biol. Assoc.*, n.s., XIII, pp. 119–50, 1923, and Harvey, *Biol. Chem. and Physics of Sea Water*, p. 42, Cambridge, 1928.

Observations on hydrogen-ion concentration were made colorimetrically owing to the impossibility of setting up delicate electrical apparatus on board ship. Special sets of sealed standard tubes, made up from Palitzsch's buffer solutions[1] of borax and boric acid and a 0·02 per cent solution of phenol red as indicator, were supplied by British Drug Houses, Ltd., and renewed several times during the commission. These had a range of *p*H 6·8 to 8·4, ascending by 0·05. A thymol blue range was also used, giving a range of *p*H 8·0 to 9·0. The method employed in determining the *p*H value of a sample was to measure out 10 c.c. from an accurate pipette into a test tube of the same internal diameter as the tubes of the standard range. A fixed quantity of indicator (varying with each set of standard tubes) was then added, and the tube compared with the standards by the light of a "daylight" electric bulb shining indirectly from behind, with the rest of the laboratory in darkness.

SURVEY EQUIPMENT

Existing charts of the Dependencies of the Falkland Islands are deficient in many respects, and with a view to their improvement the services of a trained surveyor were placed at the disposal of the Discovery Committee by the Admiralty. This officer, Lieut-Comdr. J. M. Chaplin, R.N., was Navigator and (later) Chief Officer on the 'Discovery'.

Opportunities for hydrographic survey were necessarily limited by the fact that the vessel was almost continuously engaged in work on hydrography and plankton, but during the last commission useful work was done at various times in the 'Discovery', and on a number of occasions it was found possible to free the survey officer from his duties on board, thus enabling him to carry out coastal surveys in the Dependencies.

In South Georgia particular attention was paid to harbours, hitherto uncharted, which are habitually used by vessels of the whaling fleet, and since these are for the most part uninhabited it became necessary to establish temporary camps. Small tents, sleeping bags, stoves and other gear from the ship's sledging equipment were used in these operations, and provisions were worked out with a margin of at least 30 per cent above the full supply for the agreed period, in view of possible difficulties in affording relief. The personnel of these survey expeditions consisted of the survey officer, a cadet and one seaman, accompanied sometimes by the ship's doctor and by a member of the scientific staff. A light pulling boat—a Norwegian pram—was taken, fitted with a small Lucas sounding machine, together with an 8 ft. tide pole and poles and flags for beacons and marks.

The surveying instruments were supplied almost entirely by the Admiralty and most of them do not require description. We are indebted to Lieut.-Comdr. Chaplin for the following notes:

Of the theodolites the Zeiss 3 inch transit theodolite no. 1, with automatic mean reading, was used most extensively: it was found to possess great accuracy, and its light weight and compactness were important factors. Owing to the friable nature of the rock in South Georgia no attempt was

[1] W. Mansfield Clark, *Determination of Hydrogen-ions*, pp. 115, 117, Baltimore, 1923.

made to obtain heights by theodolite except at sea level. The pocket aneroids were therefore most useful for determining such heights and contours: the pocket sextant was also useful in similar circumstances.

The Dover compass was satisfactory, but was found after the first passage to have worn the pivot flat through the constant rolling of the ship.

The station pointers were the only instruments which gave any trouble. The brittleness of the metal owing to cold and the hardening of the lubricant caused the arc attached to the legs of one instrument to crack and rendered it useless until roughly repaired.

One notable point was the long life of the silvering on all the sextant mirrors, due partly to the very able work put into them and also partly to the dryness of the atmosphere.

The chronometers deserve special mention. All of them without exception worked extraordinarily satisfactorily and especially the chronometer marked *C*, which was taken on the first camping expedition as an experiment. So far as could be seen the rate hardly varied at all. Every precaution was taken to keep the temperature even, but it can be realized that under canvas the temperature is bound to conform to that in the open air even through blankets and padded cases. The chronometer was kept in the cooking tent and wound after cooking was finished in the morning, i.e. when the tent was at its warmest. The rate was compared twice or three times with Nauen or Lyons before leaving and again on returning, and was never found to have varied much: it was low to begin with, in the region of 0·1 sec. per day, which of course was good.

One point to be observed in this connection is that the W/T time signals in Schollaert Channel and generally in the Palmer Archipelago were heard with greater strength and clearness than anywhere else.

The tide readings were always a source of difficulty except in Leith Harbour, South Georgia, where the pole was secured to a wooden wharf. In other harbours it was erected with its foot below low-water mark and secured with stones tied round the foot and guys at suitable angles. Unfortunately the male elephant seals in South Georgia seemed to have a dislike for it and frequently we found the pole down in the morning, or waking up would find elephant seals in the act of pulling it down. This did not affect the reduction for soundings but rendered the readings useless for calculating tidal data even if we had been able to get a sufficient number.

During the course of the work it was never cold enough to make the use of the leather protection on eyepieces and screws necessary. For the latter a pair of washleather gloves afforded sufficient protection to the fingers; if leather was used it was found that it became dry and rendered round the screws, thus increasing the awkwardness of working with cold fingers.

The only improvement in the equipment that can be suggested is that a small W/T receiving set should be taken on any future expedition which will involve camping away from the parent ship or whaling station.

LABORATORY METHODS

On board ship laboratory accommodation is necessarily limited, and except in very fine weather the rolling of the vessel renders any elaboration of technique impossible. In intensive plankton work rapid disposal of the material is a first essential: the collections must be dealt with in bulk and even the most cursory examination of the material must frequently be postponed.

Sorting Collections. As a general rule the contents of 1 m., 70 cm. and 50 cm. tow-nets were preserved in bulk, sometimes with the subtraction of specimens of unusual interest, and often (more particularly with the 1 m. nets) with the omission of species, such as Salps, *Euphausia* and *Euthemisto*, which by their abundance swelled the volume of the catch beyond all reasonable dimensions. When specimens were subtracted from a tow-netting a note was made on the back of the label and in the biological log book. Hauls with the larger plankton nets and most of the bottom organisms obtained in dredges or trawl were usually sorted on board, specimens of different groups being placed in separate tubes or bottles and noted in the log book.

In plankton work in whaling areas, where it was necessary to form some idea of the contents of the nets without waiting for detailed analysis, a preliminary examination was made on board as soon as an opportunity presented itself. The variety of organisms in the 1 m. nets was generally not great, but one species or another frequently occurred in prodigious numbers and it was often difficult to arrive at a fair estimate of the quantity present. The procedure adopted was to find how many organisms were required to displace a given amount of water and then to determine the number of the remainder by a similar method of displacement. This system worked well, but the individuals of a particular species taken in one haul often differed considerably in size from those of the same species taken in another, so that it was usually necessary to repeat the initial count for each gathering examined. With tow-nettings made with the 70 cm. and 50 cm. nets the volume of plankton was measured after the larger organisms had been extracted and a rough estimate made of the proportionate abundance of the different organisms expressed in percentages of volume.

In the **Fixation and Preservation of Specimens** no novel methods were employed, but experiments were continually being made, and it will perhaps be useful to include some notes on the subject. The Antarctic fauna is exceedingly rich; a successful haul of the trawl entailed much heavy work and it was often difficult to find time for any but the simplest technique. On one occasion, off Clarence Island, a dredge was shot in 342 metres. It was only on the bottom for some five minutes, but yielded such a huge mass of material that three of the staff were kept fully occupied for over twenty-four hours.

The anaesthetic most commonly used was menthol. Crystals sprinkled on the surface of the water gave excellent results with many groups of animals, particularly with Actinians, Alcyonaria, Hydroids, Polychaetes and Holothurians. Generally it was found best to leave the bowls of animals on deck in a cool temperature, but Polychaetes react very slowly under these conditions. If brought into the laboratory they were always perfectly anaesthetized in about twelve hours.[1] For Pteropods a few drops of 1 per cent chloral hydrate gave splendid results and crystals of chloral hydrate often worked well with Nemertines. For Nudibranchs and Tectibranchs menthol proved reasonably efficient, but great difficulty was experienced in obtaining well-extended specimens of Gastropods in shells. On a few occasions moderate success was obtained by menthol, followed by a slow and careful addition of strong spirit to the surface of the water. This, however, could only be done on the swing table and in fine weather.

[1] By this method, however, the proboscis is rarely found extruded, a condition which facilitates systematic examination.

For fixation 10 per cent formalin and weak spirit were the reagents most commonly employed. Speaking generally the formalin was used for soft-bodied animals and those that had been anaesthetized, and the spirit for Sponges, Crustacea, Echinoderms and other animals in which delicacy in tissue fixation was not required. The hardening properties of formalin render it a most valuable reagent, and as a fixative it is to be recommended even for animals with calcareous spicules, such as Alcyonaria and Holothurians, which if permanently preserved in it would be ruined. Fish and all malacostracous Crustacea are best fixed in weak spirit, but even in these groups formalin has its uses: deep-water pelagic species are frequently very soft and are much improved by a preliminary hardening in formalin. For many delicate planktonic organisms a salt-water solution of formalin was employed. This proved very satisfactory with *Leptocephalus* larvae, which always blister if fresh water is used. With some of the transparent pelagic Polychaetes no success could be obtained with menthol, but they turned out well if a little weak formalin was added to the salt water. Other Polychaete worms, when fully anaesthetized, were straightened out with a brush on a filter paper saturated in formalin, more formalin being added as soon as they had acquired sufficient rigidity.

Special methods of fixation were adopted for certain animals and for those which seemed to possess particular anatomical interest. Of these Bouin's fluid was most frequently employed, and was very successful with a large range of organisms. It proved excellent for the polypides of *Cephalodiscus* and it gave such good results with Diphyids that it was adopted so far as possible as a routine method. Salps of soft consistency were frequently fixed in Bouin and afterwards preserved in formalin. For Crustacea and their larvae Bouin's formula was replaced by that of Duboscq, and for Turbellaria, Cestodes and Trematodes one of the corrosive mixtures (Schaudinn or Petrunkewitsch) was used. Hot 70 per cent spirit was used for the fixation of Nematodes. As recommended by Lo Bianco, Crinoids were fixed by quick immersion in strong spirit and, with some species at least, this appears to be the only method by which perfect specimens can be obtained. With most of the Ctenophores indifferent success was attained; some kinds could be fixed in formalin and transferred afterwards to spirit, while others, though they shrank greatly in the process, gave moderate results with Bouin's fluid; others, however, seemed to defy all attempts at preservation.

As permanent preservatives 10 per cent formalin and 75 per cent spirit were almost invariably employed. Most organisms were preserved in spirit, and those that had been fixed in formalin were usually placed for a time in weak spirit before being transferred to the stronger solution. To bring specimens through more gradations of spirit was usually impracticable and it was only attempted with those that were of special interest. Neutralized formalin was used as a permanent preservative for Medusae, Copepods, for transparent pelagic animals such as *Sagitta*, *Tomopteris* and *Carinaria*, and for bulk collections of plankton. The contents of large plankton nets were partially sorted on board and the Crustacea, Cephalopods, fish, etc., preserved in spirit.

The **Alcohol** used for making the 75 per cent solution was the ordinary commercial product from which methylated spirit is made, but without the addition of any methylating substances. In strength it varied from 94 to 95 per cent, and it was carried in 10 gallon drums. These drums gave a considerable amount of trouble, for in less than a year many of them rusted on the inside and the spirit became turbid with fine rust in suspension. At sea there was no opportunity for the rust to settle and for a time it was necessary to filter all supplies. Later, a galvanized tank was supplied to the 'Discovery' and filled with clear spirit whenever the ship was in port.

The **Formalin** was neutralized, as recommended by Atkins,[1] by the addition of 5 grm. of borax to every litre of undiluted solution. Experience showed that special care must be taken of formalin in the Antarctic. During the first season it was discovered that a large proportion of the formalin which had been stowed in carboys on the boat-skids of the 'Discovery' had become converted into paraformaldehyde, forming a white insoluble precipitate which cannot apparently be reconverted into its original form. It became necessary to filter the supplies, and with some carboys almost half the quantity was lost in the process. The same thing occurred with formalin which had been left in cases out-of-doors at the Marine Station, South Georgia. So far as can be ascertained the difficulty is due to low temperatures, for formalin kept in the ship's hold, or indoors at the Marine Station, did not deteriorate.

Storage of Specimens. All smaller organisms were preserved in tubes or bottles. Flat-bottomed tubes of all sizes from $1 \times \frac{1}{4}$ in. to $6\frac{1}{2} \times 1\frac{1}{2}$ in. were used and these tubes, when filled, were plugged with a ball of cotton-wool wrapped up in tissue paper and stored in bottles. The reason for wrapping the wool plug in tissue paper is that certain organisms entangle themselves in wool and cannot afterwards be freed from it without damage. This method is to be preferred to corks, which sometimes cause discoloration of specimens and are liable to shrink and allow the contents to dry up. If wool is placed at the bottom and top of the bottles in which the tubes are stored, the danger of breakage is very slight. These tubes were used for bulk plankton as well as for isolated specimens, but they are better adapted to the latter than the former. Plankton might more conveniently be stored in $\frac{1}{2}$ lb. screw top bottles, a method which would save a great deal of the labour involved in reducing samples to a small volume. Copper funnels with short and wide necks were found most useful in the reduction of plankton samples. Those used were 6 in. and 4 in. in diameter of mouth and $1\frac{1}{2}$ in. and $\frac{3}{4}$ in. respectively in diameter of neck. After the bulk of the fluid had been filtered off through fine silk the remainder of the sample was poured into a tube or jar through one or other of the funnels.

Extra long tubes, $1\frac{1}{2}$ in. in diameter and 12, 18 and 24 in. in length, were taken for the preservation of long and slender animals, and for these corks had to be used. These tubes were sealed by dipping the ends in melted wax, and they were specially packed

[1] Atkins, *Journ. Marine Biol. Assoc.*, n.s., XII, pp. 792–4, 1922.

in boxes which were always kept right end uppermost. The long tubes were used for many animals, but more particularly for Alcyonaria, Crinoids, large worms and deep-sea fishes.

Seven standard sizes of bottles were carried, the types being those shown in Fig. 33. Most in demand were the four kinds with screw tops (*a–d*), which have capacities respectively of 1 lb., 2 lb., 3 lb. and 5 lb. These have a rubber washer and glass lid kept tight by a screw ferrule and are similar to those used for preserving fruit. The ferrules,

Fig. 33. Bottles used for the storage of zoological material.

which are ordinarily made of lacquered tin plate and rust rapidly under sea-going conditions, were specially manufactured in copper. In the bottle shown in Fig. 33 *e*, which was used mainly for large samples of plankton and for the preservation of fine material obtained in small nets attached to the trawl, the glass lid is kept in position by a simple but very effective spring clip made of galvanized wire. This type, if made in a sufficient range of sizes, and with larger lids, would be ideal for biological purposes. Bottles *f* and *g* have glass lids and rubber washers like the others, and in the middle of the lid a recessed perforation covered by a circular glass disc resting on a small rubber washer. The bottle is made tight by means of a small exhaust pump *h* placed over the centre of the lid: when this pump is used the glass disc forms a non-return valve and a partial vacuum is created inside. These bottles were stocked not because the vacuum device was thought an advantage, but because their shapes rendered them particularly valuable for biological work. Fish nearly 10 in. in length can be put in one of them, while the other, with a mouth more than 5 in. in diameter, was very useful for echinoderms, sponges and other bulky organisms. The vacuum system appears to do no harm to zoological specimens—it may even assist in the penetration of the preserving fluid—but in practice it proved troublesome. When a bottle was first closed a slight leakage frequently occurred and this, in time, would break the vacuum and allow the lid to fall off. To seal the bottles properly required much care, but when once it had been done they remained tight indefinitely. All the bottles were stored in partitioned boxes lined with thick felt (see p. 170).

Larger specimens were preserved in stoneware jars and tanks. The jars were made by Messrs Price, Powell and Co. of Bristol and were of 3 gallon capacity, with mouth 6 in. in diameter. The stoneware lid was kept tight by means of a rubber washer and iron tri-radiate screw clamp. The tanks were of two sizes, some 30 × 18 × 18 in. and some 48 × 18 × 12 in.; they were mostly of cast iron, made by Messrs T. and C. Clark and Co. of Wolverhampton, but a few of the 30-in. size were of welded steel. The steel tank is preferable to the cast iron because of its greater lightness; it is, however, much more expensive. All the tanks were stove-enamelled inside; a flange round the upper edge matched a similar flange on the lid, and between the two there was a thick rubber washer cut in one piece. The lid was kept tight by a large number of bolts and fly-nuts passing through both flanges and the washer. Two large rings were attached to each side, and through these rings poles could be passed when it was necessary to move the tanks. The shorter tanks were each fitted with four trays, with sides made of teak, pegged together with wood, and with cane bottoms. They were provided in order that the upper layers of specimens should not crush those below and in this respect proved very useful. It was found, however, that teak, when soaked in spirit, gives out a dark brown colouring matter and that several changes are necessary before all has been extracted. Possibly some other wood is to be preferred, for there seem to be strong objections to the use of any form of metal in trays which are to be used with both spirit and formalin.

To accommodate the large number of specimens obtained during her trawling survey six of these tanks were installed in the 'William Scoresby'. In the 'Discovery' three were taken and spares were kept at the Marine Biological Station in South Georgia.

Heavy wooden boxes, 8 ft. in length, 2½ ft. in breadth and 2½ ft. in depth were carried on both vessels for salting porpoises. The seams were caulked and each had a plug in the bottom for drainage and a light lid.

Labels, Log Books, etc. Printed labels used for specimens were of 10 sizes, varying from 7 × 2½ in. to 1 × ⅜ in. They were of heavy paper of the best quality[1] and had spaces for station number, date, net and depth of net. The type of net was specified by means of the symbols shown at the beginning of the Station List (*supra*, p. 3). As a help in sorting, the name of the group, family or genus to which the specimens belonged was written in the lower left-hand corner, and occasionally a note was added

[1] The paper adopted after some preliminary experiment was that known as "Antique parchment, cream wove", supplied by Messrs Waterlow and Sons, Ltd.

on the method of fixation. All entries were made in soft pencil, B or BB, and the labels curled round inside the tube or bottle with the written side against the glass. Specimens in stoneware jars and tanks were more difficult to label permanently, for in a rolling ship paper labels sometimes get detached or become obliterated by friction. Fish stored in tanks were sewn up in cotton material with two labels, one of which was folded and placed in the mouth or behind the operculum. For other specimens serially numbered bone labels were sometimes employed and of these labels a special register was kept.

The more important log books were quarto and of two kinds. One of these, the General Scientific Log Book, contained all the particulars shown in the Station List, and, in addition, a record of all observations made between stations. In the Biological Log Book fuller details were given of all nets that were shot, with notes on the catch. Each of these books was in duplicate—a bound volume for use on board and loose sheets, punched for filing in suitable covers, which were posted periodically to London. For deck use smaller octavo books with similar ruling were employed, with pages punched on the left-hand side and perforated at the top. After the entries had been copied the sheets were torn out and filed in loose-leaf covers: they are thus readily available for reference if doubt arises regarding any particular observation. Other books on the loose-leaf principle were used for whale-measurements, whale observations, and for original records of salinity and phosphate determinations made at the Marine Biological Station.

Short notes on particular organisms were usually written on the back of the label. For longer notes, drawings, water-colour sketches and photographs a quarto loose-leaf "Note and Sketch" book was used. The entries in this book were numbered serially and a printed "Note" label, bearing the same number, was put in the tube or bottle with the specimen concerned.

Opportunities for making valuable sketches of living animals were numerous, and whenever possible advantage was taken of them. Unfortunately, interesting specimens were usually obtained at times when other work was very heavy. Ridgway's *Color Standards and Color Nomenclature*[1] was in frequent use for recording the colours of living animals. It appears to be much superior to any other book of the same kind and for marine biological work we recommend it very strongly. In spite of the great difficulties caused by the rolling of the ship, successful photographs of living specimens, up to magnifications of 6 diameters, were taken by Dr E. H. Marshall on the 'Discovery'. His apparatus consisted of a Leitz camera with 64 mm. "summar" lens and a Sanderson camera with Zeiss *f* 6·3 lens of 18 cm. focal length. Both cameras were generally used vertically and the illumination was by a mercury vapour lamp.

[1] Published by A. Hoen and Co., Baltimore, Md.

THE DISCOVERY INVESTIGATIONS
OBJECTS, EQUIPMENT AND METHODS

PART III. THE MARINE BIOLOGICAL STATION

By N. A. Mackintosh, A.R.C.S., M.Sc.

(Plate XVIII, text-figs. 34, 35.)

THE Marine Biological Station at South Georgia is situated at Grytviken, a small land-locked harbour in East Cumberland Bay, at the head of which lies the whaling station of the Cia Argentina de Pesca. The house, together with the Magistrate's house, Government quarters, wireless station and Argentine meteorological station, is built on a small spit of land known as King Edward Point, marking the entrance to the cove (see sketch map, Fig. 34), and was designed to accommodate seven persons—four officers and three men.

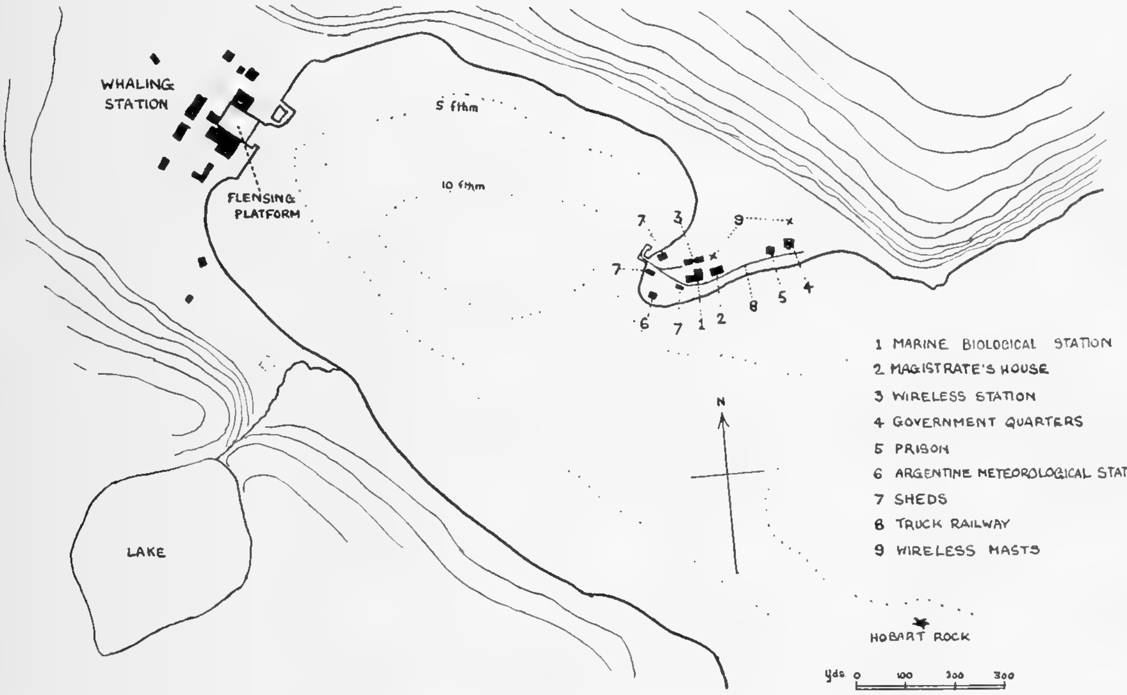


Fig. 34. Sketch map of Grytviken, South Georgia, showing positions of the whaling station, the marine biological station and other buildings.

The building (Plate XVIII, fig. 1) was constructed to designs supplied by Mr C. H. Rose, A.R.I.B.A.; it was completed in January 1925 and since then has been continuously occupied except during the winter seasons of 1926 and 1927. It is of the bungalow type, but has a large storage space under the roof. Full details of its architecture and construction need not be given here, but some remarks may be made on the general principles which were followed. In designing the house the severe climate of South Georgia, characterized by a heavy snowfall in winter and violent winds at all times of the year, was taken into special consideration. The building consists of a stout wooden framework bolted on to a concrete foundation, and the walls were constructed with the special object of insulating the house against cold. On the outside of the wooden framework there are two layers of boarding, enclosing a layer of felt and a layer of waterproof paper, and on the inside another layer of boarding and a layer of compressed cork finished with asbestos sheeting (poilite). The interior partitions consist simply of the wooden framework covered with poilite. The roof is of galvanized iron, with a layer of boarding and insulating material beneath, and all the windows are double, having an outer iron and an inner wooden framework. These arrangements serve admirably to insulate the walls. Brickwork was used for the chimneys and walls of the boiler house, coal cellar, etc., and for part of the outside store shed.

The arrangement of the rooms is shown on the accompanying plan (Fig. 35). The house is so placed that the windows of the laboratory face the beach, and the conservatory and windows of the living rooms, while having a restricted view, are on the sunny side of the house.

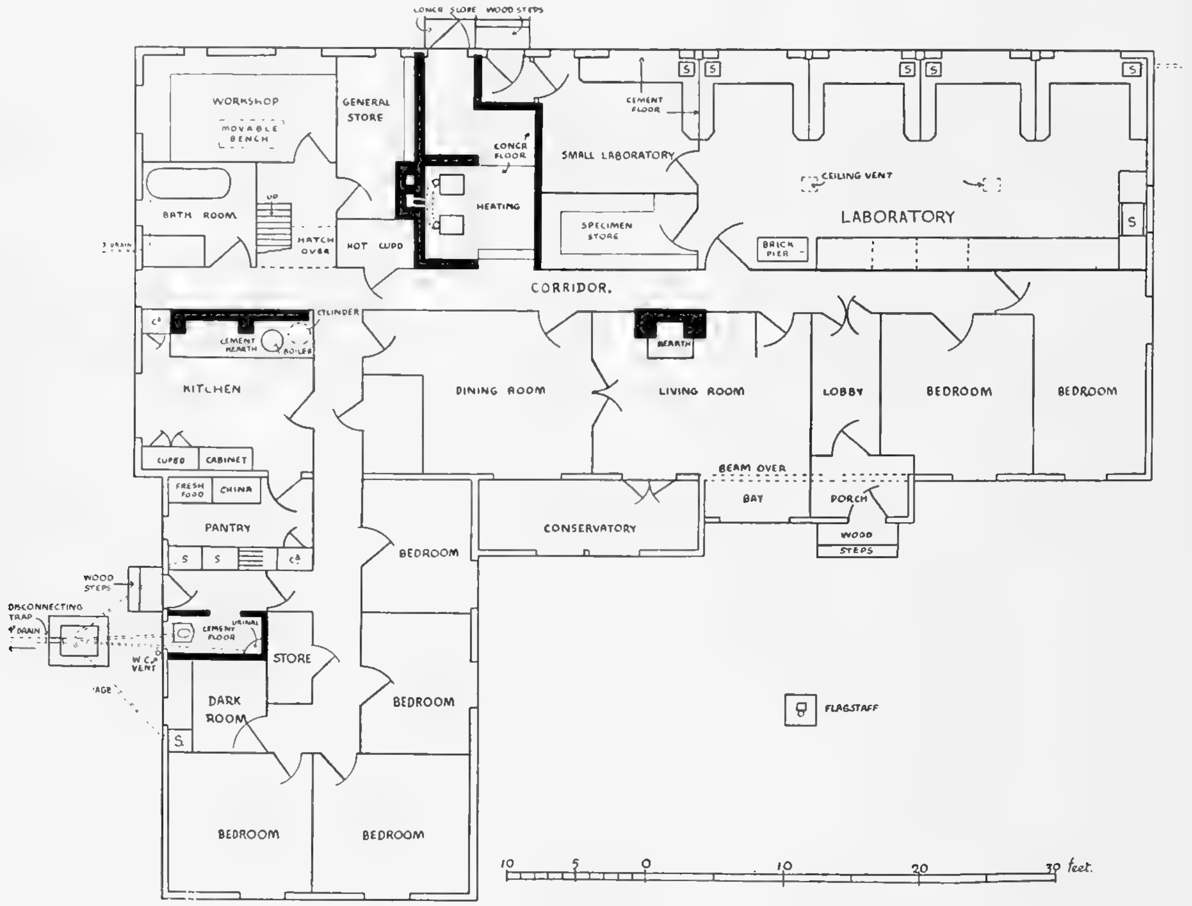


Fig. 35. Plan of Marine Biological Station, South Georgia.

In the construction of a house at South Georgia some attention needs to be paid to the accumulation of snow during the winter. Snow falls only occasionally in summer, but in winter it reaches an average depth of five or six feet, even round the coast line, and imposes a very considerable weight on the roofs of buildings. At the Biological Station the warmth of hot-water pipes in the loft prevented any very heavy accumulations of snow on the greater part of the roof, but a weak spot was found in the glass roof of the conservatory. This is situated in a corner of the house, where it catches the snow sliding down from more than one section of the iron roof. The snow frequently becomes partially converted to almost solid ice through alternate melting and freezing, and was found to crack and break the glass if it was not regularly scraped away. The snow sliding off the roof also forms large accumulations on the ground and if not removed will mount up to the eaves and obscure the windows.

The plan of the laboratories has been found very convenient. The large laboratory (Plate XVIII, fig. 2) measures 32 ft. by 15 ft. and has a series of bays along one side, each with benches, shelves, cupboards and sink. There is a long bench in the middle of the room and various shelves, drawers, cupboards, etc., on the side opposite the windows.

The main laboratory is connected with the exterior by a small laboratory. This has a concrete floor, a lead lined table and a bench with a sink. In connection with work carried on at the whaling station this small laboratory has proved indispensable. It is used mainly for handling large specimens and rough work generally. It also contains an apparatus for the preparation of distilled water, and has been used for miscellaneous operations, such as filtering formalin and preparing skins of birds and seals.

A small store room opens out of the main laboratory and is used for storing specimen bottles and chemicals.

Other rooms not included among the living rooms are the workshop and dark room. A workshop of some sort is of course essential for a station in such a place as South Georgia. That at the Biological Station is equipped with a small treadle lathe and sufficient tools for all ordinary purposes.

Little need be said of the living rooms as they do not differ much from those of an ordinary house at home. The walls of the laboratories, workshop and bathroom were painted with washable enamel, and this treatment would have been preferable throughout the building. The house is fitted with a central heating apparatus, burning coke, and there is a coal fire in the sitting room and kitchen.

The wireless station close by provides electricity for lighting purposes, and a power circuit is fitted, principally for use in the laboratory.

A pipe line from a dam a few hundred yards away on the mountain side provides water for the Biological Station, Magistrate's house and wireless station. Trouble is experienced with this from time to time during the winter. The water in the pipe will never freeze when there is plenty of snow on the ground, but in the early part of the winter, in May and June, there are often sharp frosts before the snow has accumulated to any great extent, and the ground becomes frozen down to a depth of about 3 ft. A water pipe therefore, unless it is buried at a considerable depth along the whole of its length, is very liable to become blocked with ice. The only remedy for this is to expose the pipe and melt out the obstruction, and since no tool except a pickaxe will make any impression on the frozen ground, the task may present considerable difficulties.

Drainage is effected by a 5 in. pipe running down to the beach.

In addition to the main building of the Biological Station an outside store shed measuring 32 ft. by 13 ft. was erected, the walls being mainly of brick. This is divided into three compartments and was planned principally for the storage of fuel. More recently a larger store shed has been built close to the jetty.

Owing to the heavy winter snowfall in South Georgia buildings cannot conveniently be constructed except during the summer months. To avoid delay in erection the framework of the buildings was cut to measure in England, so that the separate pieces had only to be fitted together in South Georgia.

The Marine Biological Station possesses two boats, a 30 ft. motor launch and an 18 ft. dinghy. The care of boats at South Georgia presents certain points of difficulty owing to the exceptional climatic conditions. Sudden storms with violent gusts commonly take place and necessitate strong and reliable moorings. The launch was usually moored to a buoy about 30 yards from the jetty. It was found that the only reliable method of attachment was by a length of strong flexible wire rope. Ordinary rope is quickly chafed through by the plunging of the boat in bad weather. The launch was also moored from time to time behind the projecting arm of the jetty. This had the advantage of accessibility, but a tendency for the bottom to silt up at this point resulted in a risk of the keel or stern frame being damaged. The dinghy was usually moored by a stout painter to the end of the arm of the jetty. In winter the boats must be taken out of the water, owing to the ice which is liable to accumulate in the harbour and to the heavy falls of snow. During the first winter the boats were housed at the whaling station, but accommodation for the motor boat is now available in the newly constructed shed.

The launch was originally intended as part of the equipment of the 'Discovery'. She is carvel built of teak, with copper fastenings, and has a 28 H.P. Parsons internal combustion engine giving a maximum speed of $10\frac{1}{2}$ knots. The engine runs on paraffin, but is started up with petrol. The launch is an open one, decked only at the bow, with a folding hood to shelter the engine and seating space. She has been used partly for scientific work in East Cumberland Bay (for plankton and hydrological investigations and for trawling and dredging), and partly for transport of personnel and stores between the Biological Station, the ships and the whaling station. In this work the launch has given constant and most valuable service, though she is not altogether suited to conditions at South Georgia. A boat with greater beam, to ensure steadiness in choppy water, and fully decked except for a small cockpit, would be more convenient.

The dinghy is built of teak and is equipped with a dipping lug sail. The design of the boat was entirely satisfactory, but the sail was not used much as there is rarely a steady moderate wind at South Georgia.

Owing to the difficulty of procuring supplies regularly, it is necessary to find space for sufficient food and other consumable stores to last over considerable periods. There must also be room for large quantities of scientific stores and miscellaneous articles, such as rope, canvas, benzine, timber, nets, boats' equipment, etc. As already mentioned, the original store shed was found to be insufficient.

Some difficulty was experienced in finding a suitable place to store provisions. These were at first kept in the roof space, but as many of the hot water pipes were led under the roof the heat was found to have an injurious effect on some of the tinned articles, and all the provisions were removed to a temporary shed outside. This was found more satisfactory, though some bottled provisions were broken by frost during the winter. Provisions are now kept in the new shed by the jetty.

Articles for which the greatest amount of storage accommodation is required are those which belong to the scientific equipment, especially as it is often necessary to keep at the Biological Station sufficient boxes of preserving bottles, drums of spirit, spare nets, etc., to form a reserve supply for the ships. The main part of the roof space was occupied by boxes of specimen bottles; the drums of preserving spirit, which it was unsafe to keep in the house, were stored in one compartment of the fuel shed together with benzine, paraffin, etc. Another part of the same shed was kept for such gear as nets, dredges, coils of rope and boats' equipment, and the third compartment for coal and coke. As the last provided insufficient accommodation, it was sometimes necessary to stock bags of fuel on the ground outside. This is an unsatisfactory procedure as the bags become frozen together in winter and extremely difficult to handle.

In regard to supplies of food it was at first considered advisable that the Biological Station should be equipped with a quantity sufficient to render it entirely independent of local resources. Facilities were, however, arranged for the purchase of fresh meat and vegetables from the whaling companies and the Falkland Islands. It has been found that a full supply of preserved food is unnecessary at South Georgia, for fresh meat and vegetables can be readily obtained from several sources during the summer. Salt meat was hardly used at all, being replaced by whale meat, frozen beef from the whaling station and mutton from the Falkland Islands. An unlimited supply of whale meat is of course available throughout the season, and, if cut from a fresh carcass and hung for some days, is very palatable. Chickens can be kept at South Georgia with little trouble, and fish are often easily caught in large numbers, though they are not to be depended on. In winter these supplies are necessarily much restricted, but can be supplemented if an occasional sea-leopard is killed. The flesh of this seal is dark and coarse, but the liver, brain and tongue can be recommended.

It remains now to consider some points in connection with the scientific equipment and methods of work at the Biological Station. The work is divided into three categories: (1) investigations on whales brought in to the whaling station, (2) the chemical analysis of water samples collected by the ships, (3) general work on the fauna of South Georgia.

As may be seen from the sketch map, the Biological Station is situated about 800 yards from the whaling station. There is a rough path leading round the north side of the cove, but the station is more easily reached by boat, especially as it is often necessary to carry various gear and specimens to and fro. It will not be necessary to give here a description of the process by which the whale's carcass is disposed of, or of the details of the observations which are made, as these things will be dealt with in the forthcoming report on the work at whaling stations; but some remarks may be made on the routine of work and the equipment used.

The whale boats usually bring in their catches during the night, and work on the flensing platform begins at 6 a.m. and continues with intervals for meals until 6 p.m., or until the day's catch has been disposed of. In order to carry out the programme of observations it is necessary for two people to be present on the flensing platform, and usually one officer and the laboratory assistant attended each day while the whales were being cut up.

This work at the whaling station consists in (i) taking a number of measurements including total length, bodily proportions, thickness of blubber, etc., of each whale; (ii) noting the external characters and variations; (iii) the examination of organs and tissues; and (iv) the collection of specimens. The equipment needed for all this is comparatively simple. The most important articles are rough note-books, measuring tapes, flensing and sheath knives, whale hooks, and tubes and bottles for preserving specimens. Everything used on the flensing platform becomes soiled in a short time and loose-leaf note books with a supply of spare covers are advisable. All measurements were made in metres, and the measuring tapes, reading to 30 m., were of the linen variety and wound on large fishing reels. This is much more satisfactory than a steel tape, or any kind which is rolled up in a case, but the actual tape lasts only a few weeks if detailed measurements are being taken and a good supply is therefore necessary. Flensing knives and whale hooks are important and can be obtained at any whaling station. They are used mainly in dissecting out the reproductive organs and foetuses. Smaller knives are also necessary for cutting off pieces of tissue and a variety of minor operations, and for this purpose sheath knives with blades 9 to 12 in. long are convenient. The kinds of specimens most frequently collected are small foetuses and parts of larger ones, ovaries, food specimens, parasites and external scars, pathological growths, etc., and small pieces of tissue for histological examination. These can mostly be accommodated in glass tubes and jars ranging from 1 lb. to 5 lb. capacity, but ovaries and foetuses are best stored in large enamelled iron tanks, of which four or five were available for this purpose at the Biological Station.

The records and data obtained at the whaling station are entered in large log books or ledgers kept at the Biological Station. These are of three types. In the first, or general log book, a double page (reading right across the book) is kept for each whale, and here all details referring to external characters, blubber, parasites, food, reproductive organs, occurrence of foetuses, etc., are entered. The second, or measurements log, is kept for the measurements of bodily proportions. In the third, or foetus log, a single page is kept for the details, including bodily measurements, external characters, etc., of each foetus.

Laboratory work in connection with the work at the whaling station (apart from the examination and analysis of the log-book data) consists in the detailed examination of such specimens as ovaries and foetuses, routine section cutting of pieces of testis, mammary gland and other tissues, and the examination of parasites, etc.

In the hydrological work undertaken at the Biological Station water samples from the ships were analysed for salinity and phosphate content, and occasionally for oxygen content. The methods used in this work are indicated on p. 213. In addition to the usual equipment required for work of this kind it is necessary to have an apparatus for the preparation of fairly large quantities of distilled water. It is also advisable to have a good supply of spare beakers, flasks and other glass ware. The chemical equipment of the laboratory includes apparatus for various other investigations to be carried out as opportunity arises: among these are the determination of the oil content of blubber and the analysis of whale's milk.

Work on the fauna of South Georgia consisted in shore collecting, trawling, plankton and hydrological work in East Cumberland Bay and some investigation of the local birds and seals. The gear most frequently used in Cumberland Bay has been an 8 ft. beam trawl towed from the launch, but owing to the great depth of the water (largely from 50 to 100 fathoms) this can only be used close to the shore. The fauna of Cumberland Bay, however, is very rich, and many interesting specimens may be obtained in this way. A small dredge was occasionally used, but better results were obtained with the beam trawl. The launch was fitted with a winder carrying 100 m. of 4 mm. wire, a small davit and a recording sheave. This outfit was used both for sounding and for working water bottles and vertical nets.

INDEX

PLATES VII—XVIII

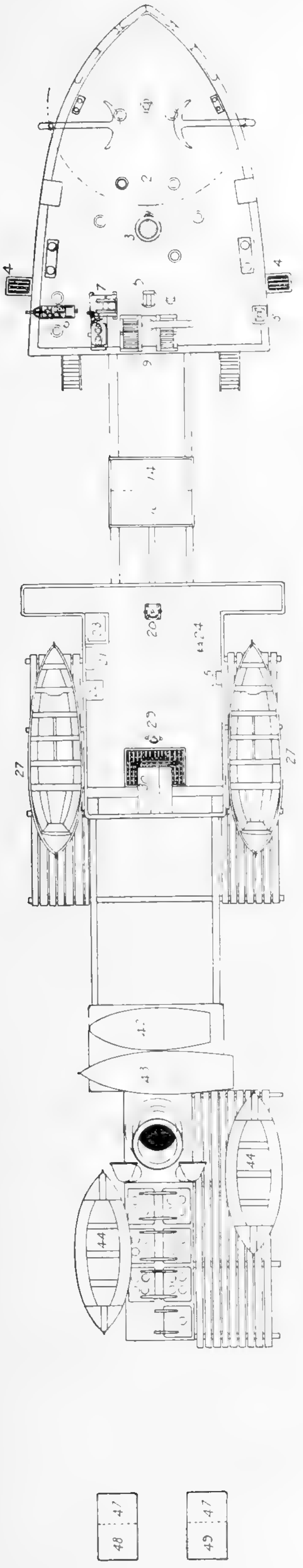
Royal Research Ship 'Discovery'

PLATE VIII

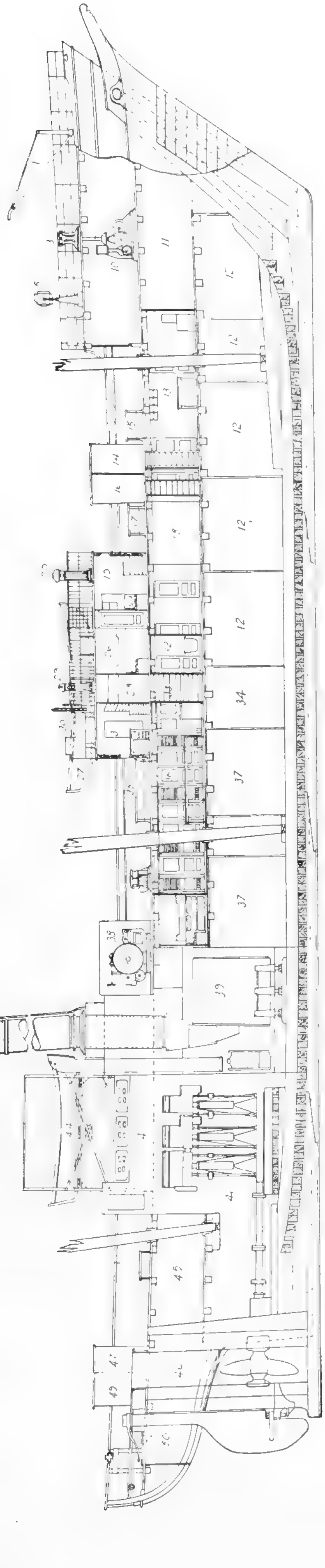
R.R.S. 'DISCOVERY'

Profile and plan of Forecastle and Bridge Deck

1. Anchor davit
2. Deck lights and mushroom ventilators
3. Capstan
4. Sounding platform
5. Searchlight
6. Lucas sounding machine
7. Deep-water hydrological machine
8. Pedestal for small harpoon gun
9. Galley skylight
10. Windlass
11. Chain locker
12. Stores
13. Galley and kitchen
14. Galley companion
15. Skylight to kitchen
16. Crew-space companion
17. Skylight to crew space
18. Quarters of crew and petty officers
19. Chart house
20. Standard compass
21. Flag locker
22. Wireless accumulator box
23. Chart table
24. Engine-room telegraph
25. Laryngaphone to engine room
26. Deck cabin
27. Whaler
28. Wardroom entrance
29. Steering compass
30. Steam and hand steering gear
31. Deck laboratory
32. Bathroom
33. Wardroom companion
34. Freshwater tank
35. Wardroom skylight
36. Wardroom
37. Main bunker
38. Winch house and winch
39. Main boiler
40. Engine-room casing and skylight
41. Engine room
42. Norwegian pram
43. Dinghy
44. Lifeboat
45. Sail locker
46. Propeller well
47. Officers' water-closet
48. Armoury
49. Lamp locker
50. Rudder well



FORECASTLE AND BRIDGE DECK



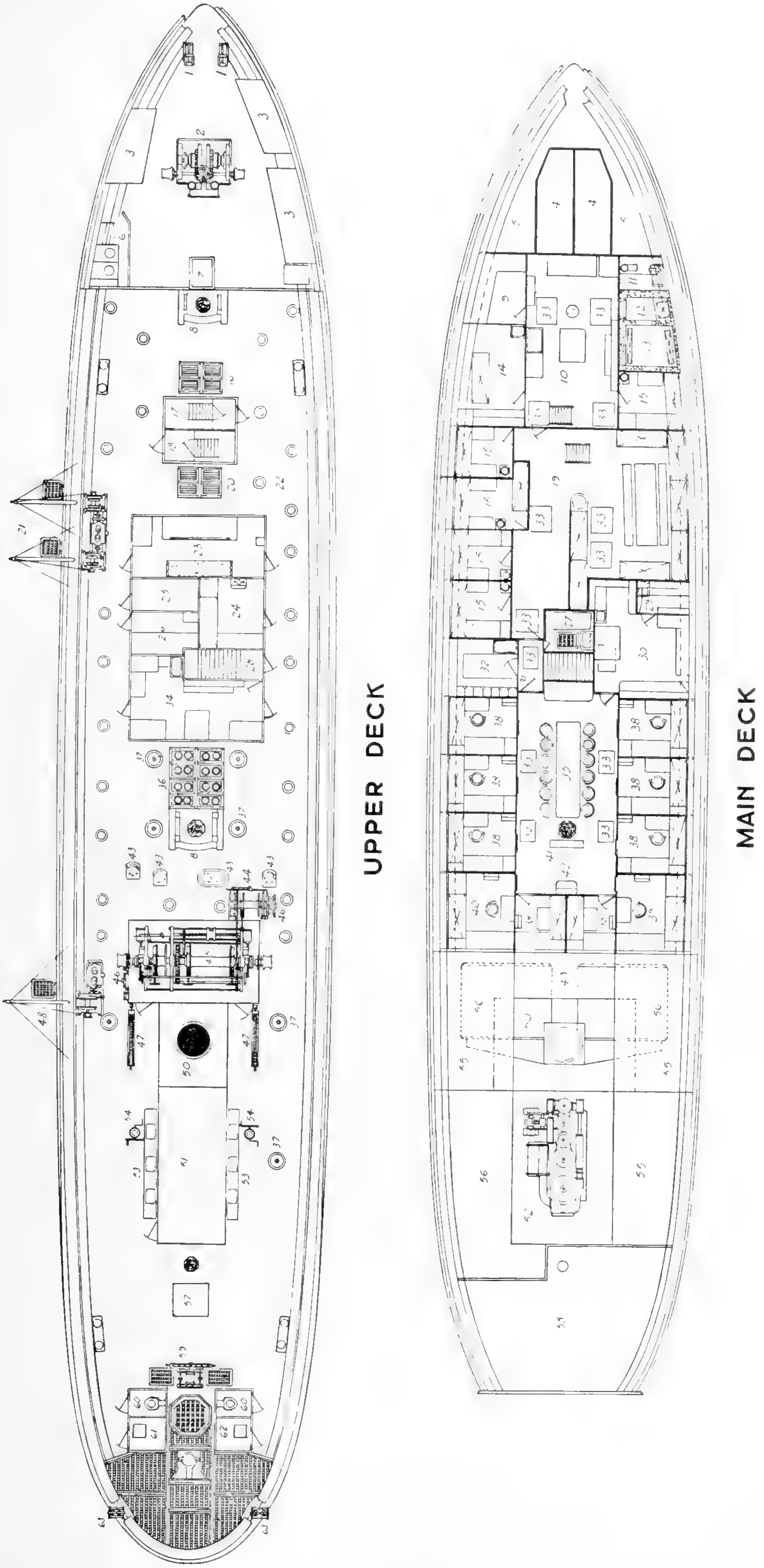
PROFILE

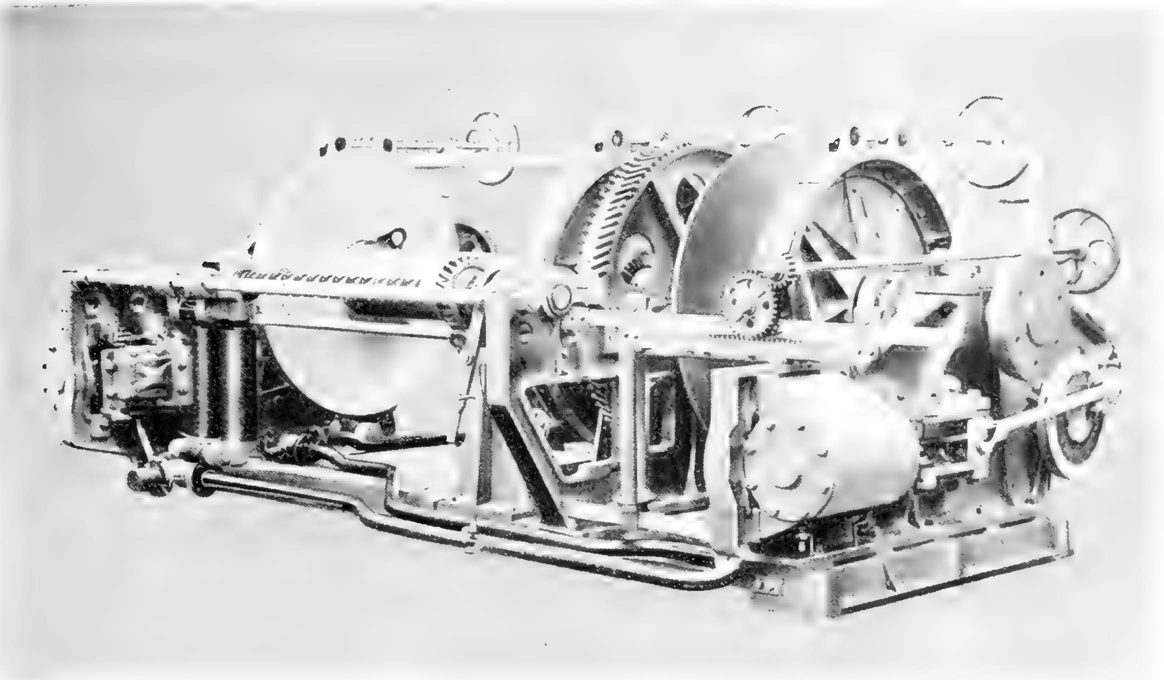
PLATE IX

R.R.S. 'DISCOVERY'

Plans of Upper and Main Decks

1. Bow stoppers for cables
2. Windlass
3. Lockers
4. Chain locker
5. Store
6. Crew's water-closet
7. Trunk to galley skylight
8. Fife rail round mast
9. Pantry store
10. Galley and kitchen
11. Refrigerator engine room
12. Refrigerator air-lock
13. Refrigerator cold chamber
14. Sick bay
15. Petty officers' cabin
16. Skylight to kitchen
17. Galley companion
18. Crew-space companion
19. Crew space
20. Skylight to crew space
21. Shallow water hydrographic machine with topping booms and platforms
22. Deck lights and mushroom ventilators
23. Chart house
24. Deck cabin
25. Survey store
26. Wireless cabin
27. Bathroom
28. Wardroom entrance
29. Dark room
30. Lower laboratory
31. Wardroom lobby
32. Wardroom pantry
33. Hatch to compartments below deck
34. Deck laboratory
35. Wardroom
36. Wardroom skylight
37. Coaling scuttle
38. Cabin
39. Captain's cabin
40. Cabin of Director of Research
41. Piano
42. Stove
43. Pedestal fair-lead for wire ropes
44. Winch auxiliary drum
45. Winch house and winch
46. Recording sheave
47. Accumulator spring
48. Plankton machine with davit and platform
49. Boiler room
50. Fiddley casing
51. Engine-room casing
52. Engine room
53. Ice tanks
54. Downton hand pump
55. Bunker
56. Workshop
57. Hatch to sail locker
58. Sail locker
59. Hand steering gear
60. Officers' water-closet
61. Armoury
62. Lamp locker
63. Stern fair-lead


UPPER DECK
MAIN DECK

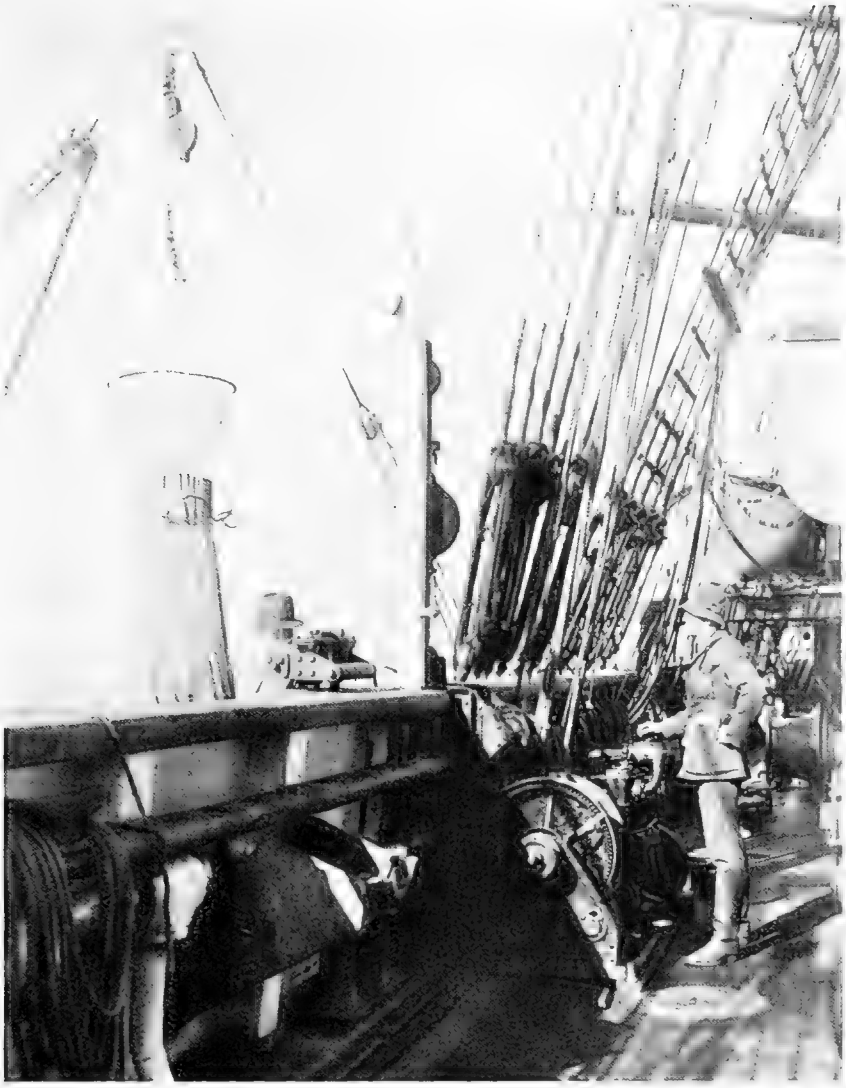


Clarke, Chapman & Co. phot.

Fig. 1. R.R.S. 'Discovery'. Main winch.

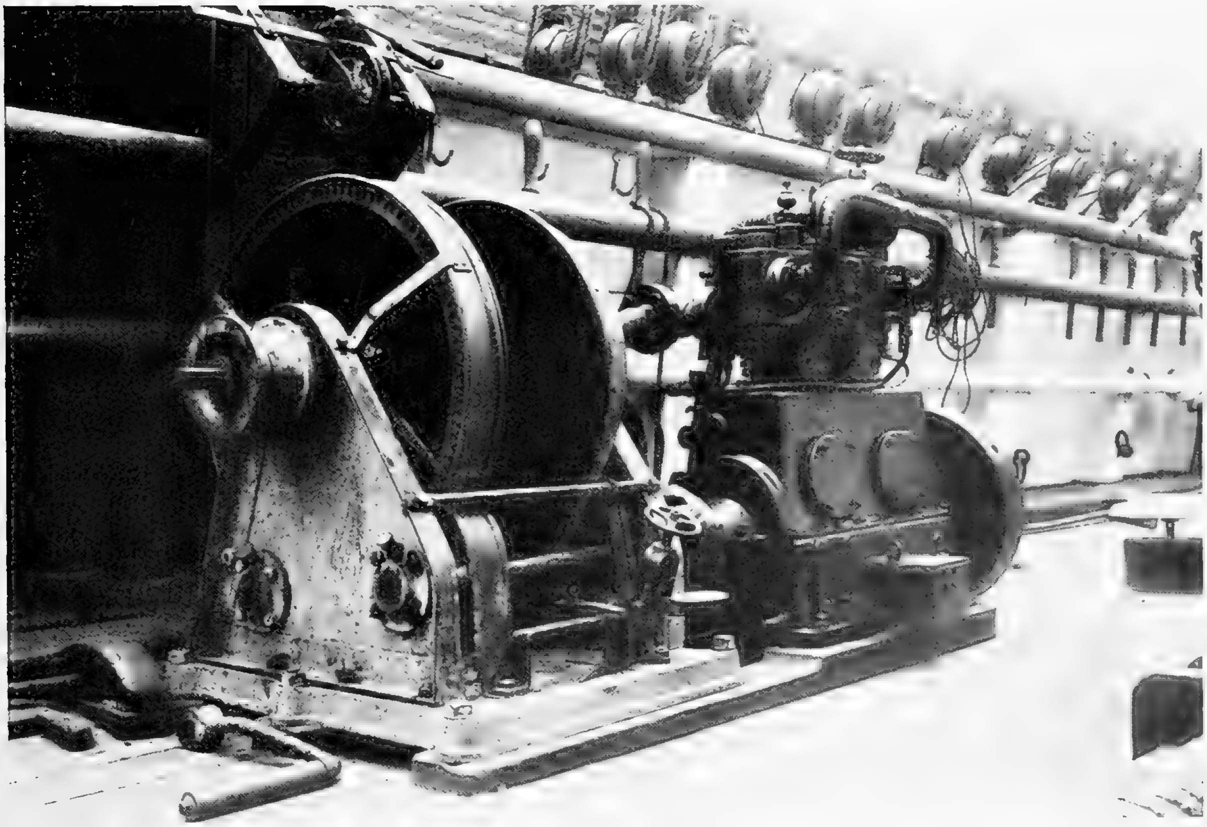
E. H. Marshall phot.

Fig. 2. R.R.S. 'Discovery'. View looking aft, showing winch house, auxiliary winch-drum, pedestal fair-leads and recording sheave.



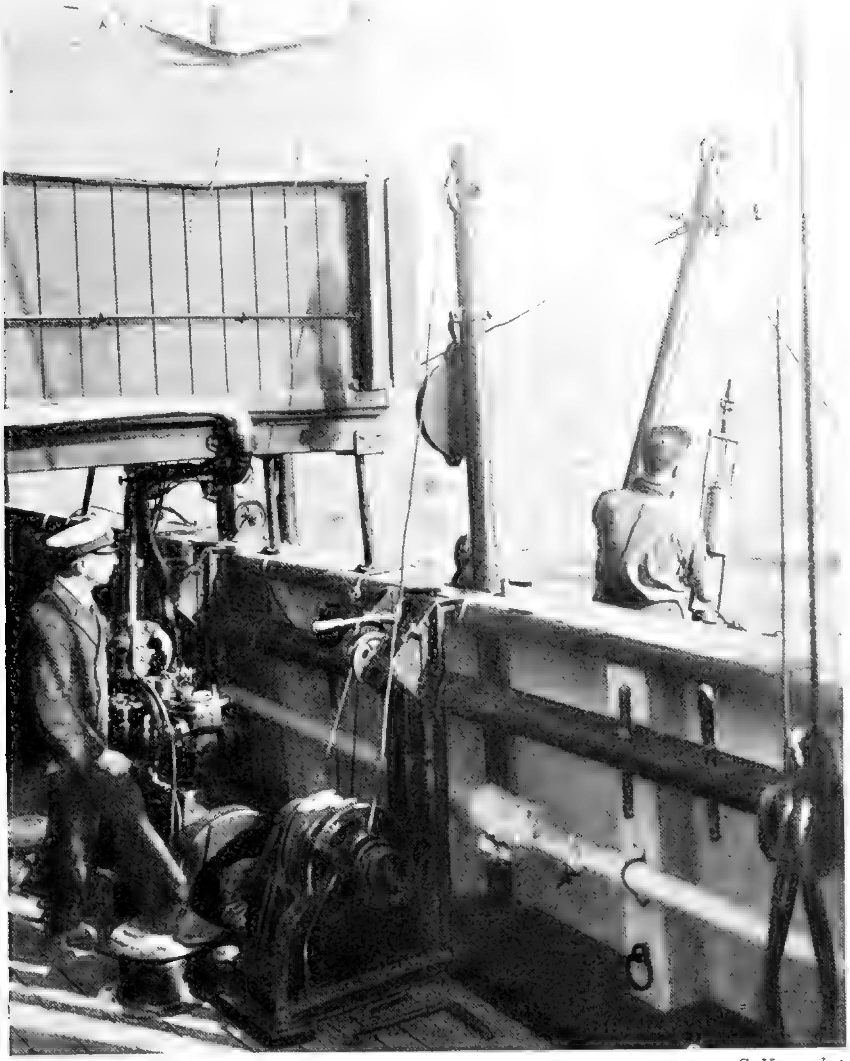
S. Kemp phot.

Fig. 1. R.R.S. 'Discovery'. Plankton machine.



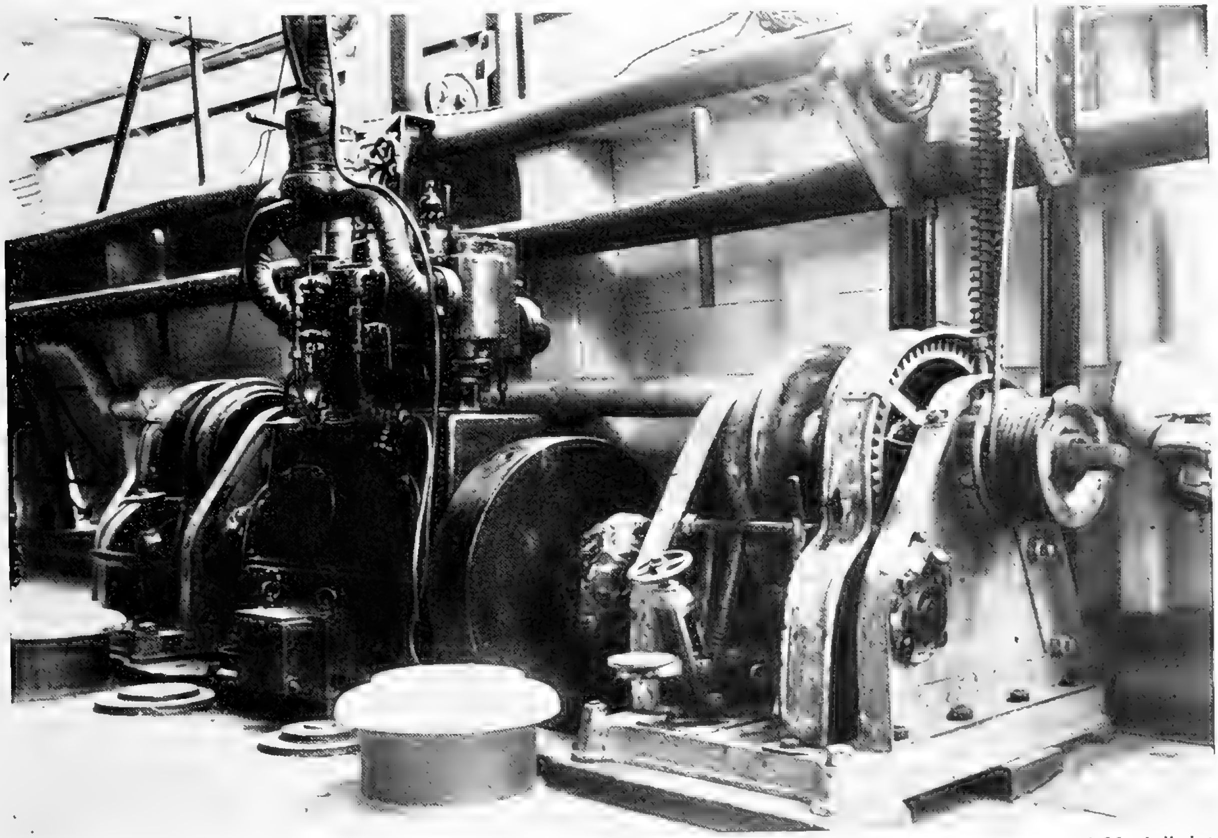
E. H. Marshall phot.

Fig. 2. R.R.S. 'Discovery'. Engine of plankton machine.



S. Kemp phot.

Fig. 1. R.R.S. 'Discovery'. Shallow water hydrological machine.

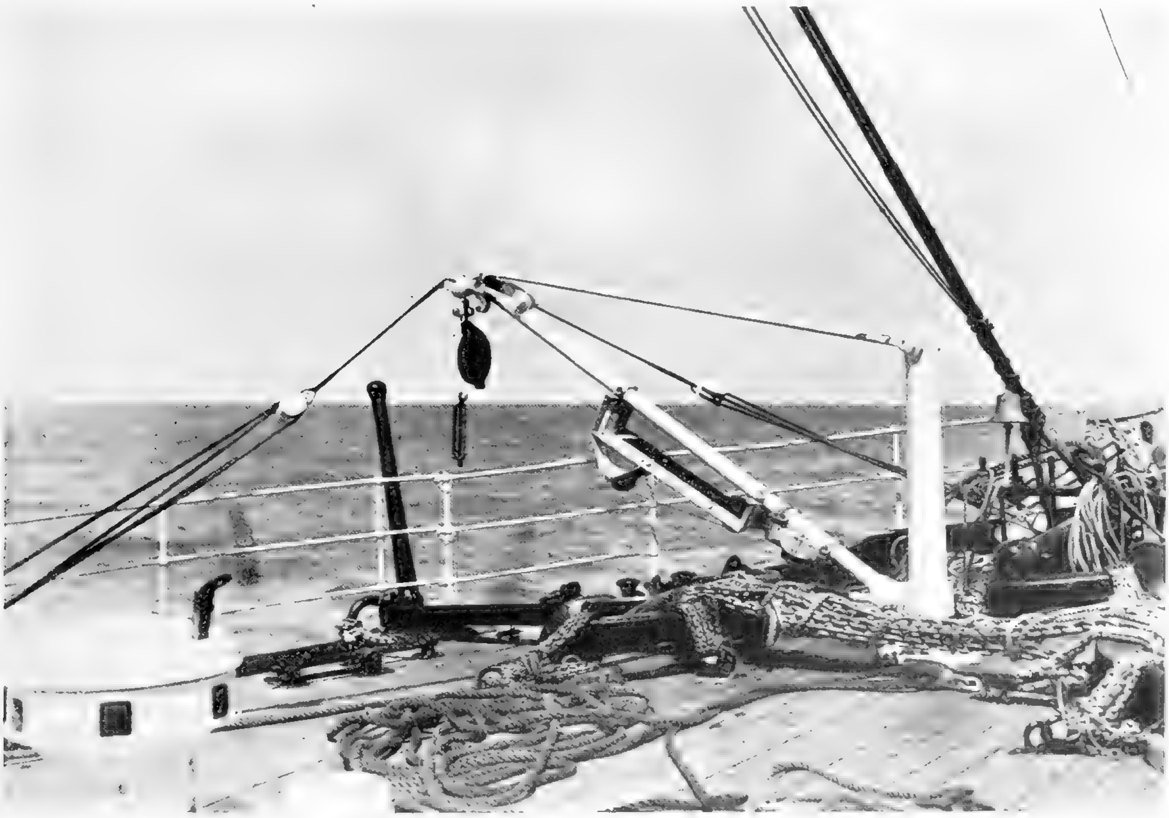


F. H. Marshall phot.

Fig. 2. R.R.S. 'Discovery'. Engine of shallow water hydrological machine.

E. H. Marshall phot.

Fig. 1. R.R.S. 'Discovery'. View on forecastle head, looking aft, showing Lucas sounding machine on right, and deep-water hydrological machine on left.



E. H. Marshall phot.

Fig. 2. R.R.S. 'Discovery'. View on forecastle head showing anchor davit rigged with accumulator and recording sheave for deep-water hydrological work.

A. Saunders phot.

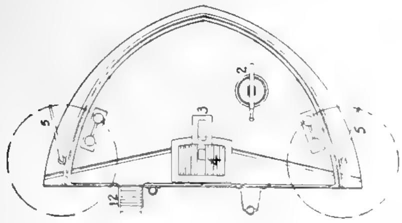
The Research Steamship 'William Scoresby'.

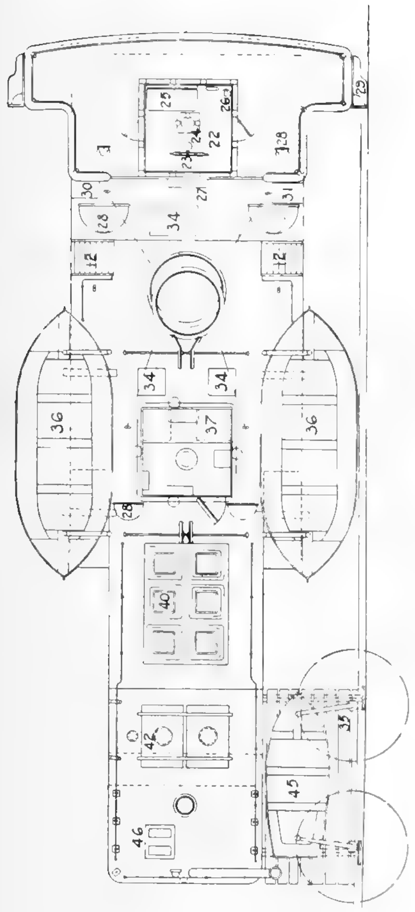
PLATE XV

R.S.S. 'WILLIAM SCORESBY'

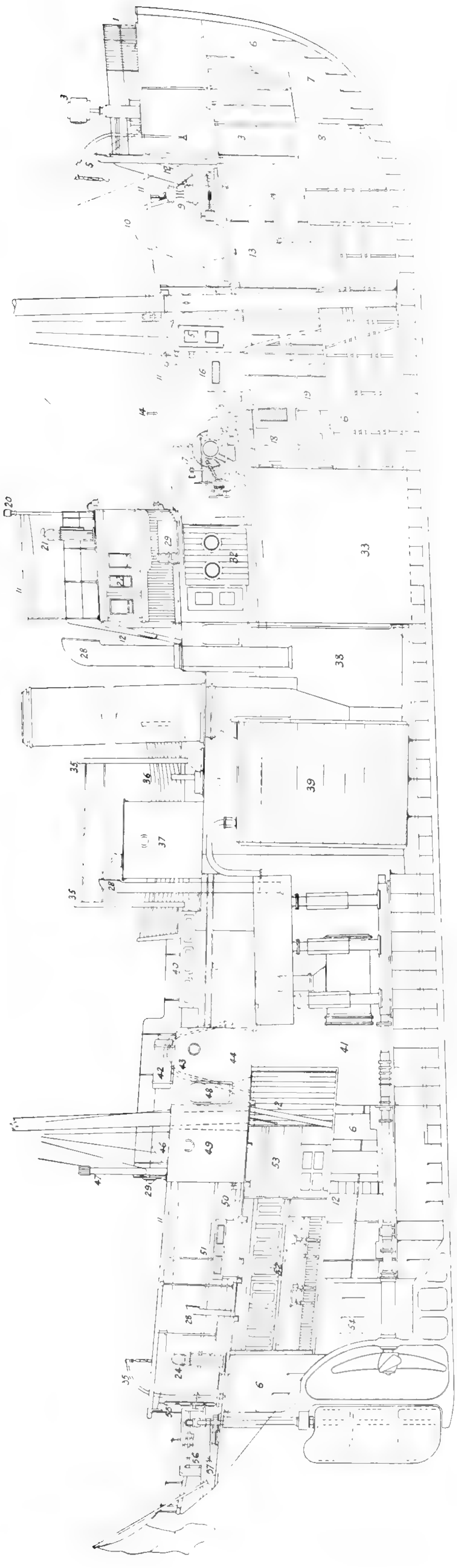
Profile and plan of Forecastle and Bridge Deck

1. Weather boarding as protection for whale marking
2. Light harpoon gun
3. Searchlight
4. Searchlight platform
5. Anchor davit
6. Store
7. Fore peak
8. Chain locker
9. Steam capstan
10. Fore gallows
11. Awning ridge pole
12. Ladder
13. Crew space
14. Derrick boom
15. Entrance to forward accommodation
16. Skylight
17. Trawling winch
18. Chart room
19. Chart table
20. Morse lamp
21. Standard compass
22. Wheel house
23. Steam steering wheel
24. Steering compass
25. Chart table
26. Engine-room telegraph
27. Flag locker
28. Ventilator
29. Navigation light
30. Spirit tank
31. Freshwater tank
32. Laboratory
33. Main bunker
34. Boiler room gratings
35. Davit
36. Lifeboat
37. Wireless room
38. Stokehold and wing bunkers
39. Boiler
40. Engine-room skylight
41. Engine room
42. Water tank
43. After gallows
44. Steering engine house
45. Dinghy
46. Galley skylight
47. Galley funnel
48. Passage giving access to after accommodation
49. Galley
50. Steering rod channels
51. Wardroom skylight
52. Wardroom
53. Cabin
54. After peak
55. Hand steering wheel
56. Hand steering gear
57. Quadrant





FORECASTLE AND BRIDGE DECK



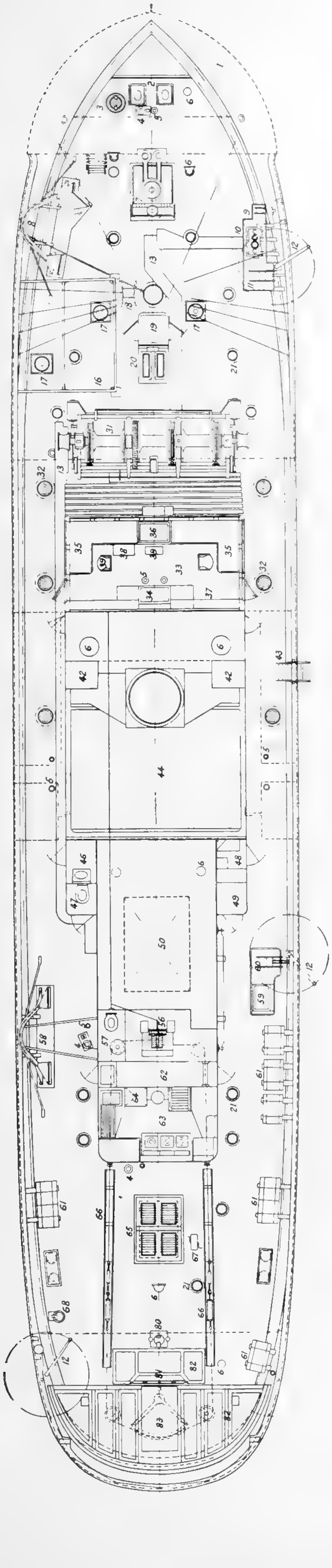
PROFILE

PLATE XVI

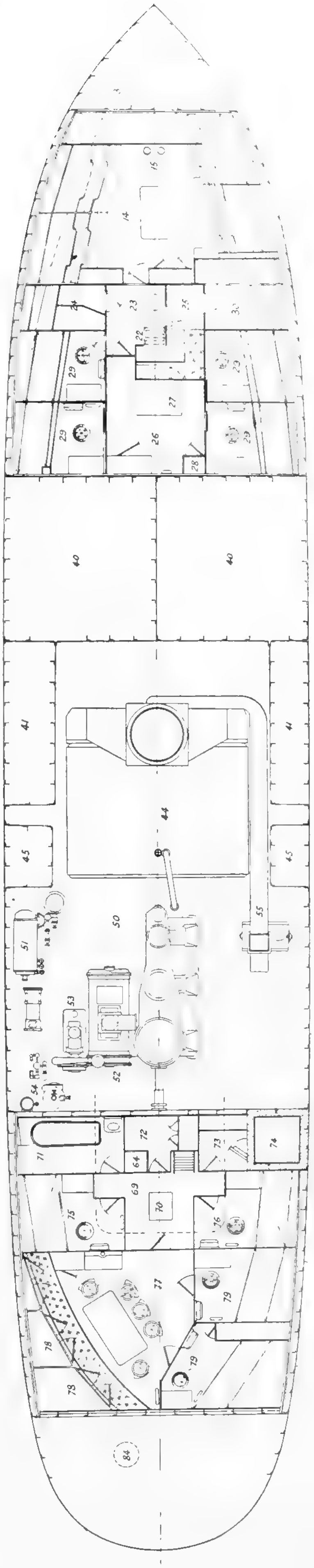
R.S.S. 'WILLIAM SCORESBY'

Plans of Upper and Lower Decks

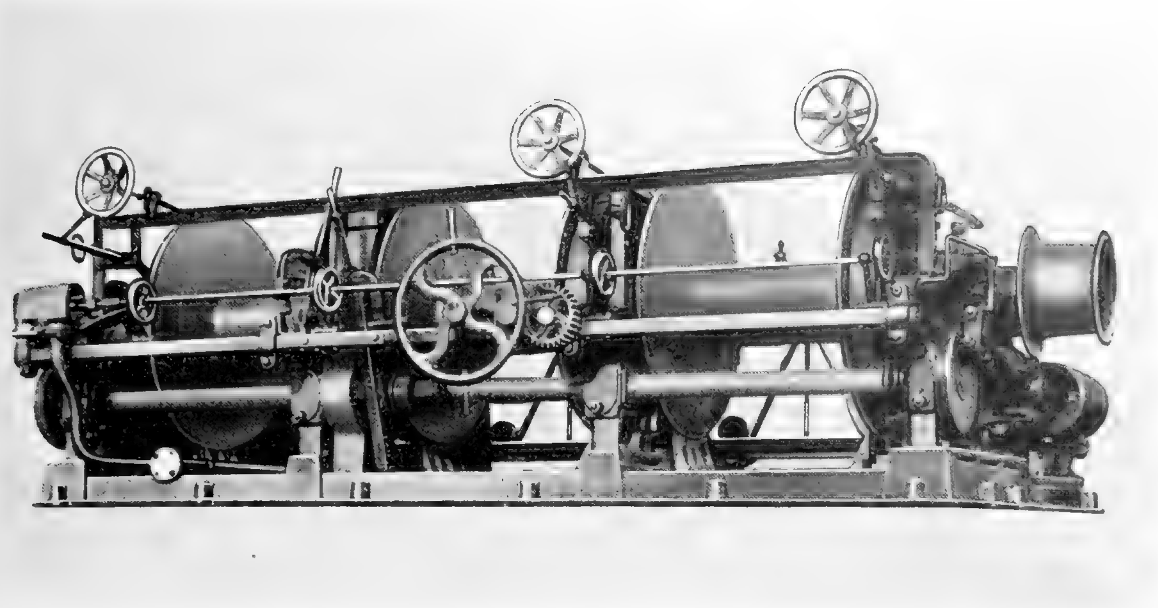
1. Flare of forecastle head
2. Hawse pipes
3. Scuttle to fore peak
4. Hand pump
5. Sounding pipe
6. Ventilator
7. Steam capstan
8. Fore gallows
9. Sounding machine
10. Engine coupled to sounding machine and hydrological drum
11. Hydrological drum
12. Davit
13. Steam pipe cover
14. Crew space
15. Chain pipes
16. Fish pound
17. Pedestal fair-lead
18. Drum for mooring wire
19. Companion to forward accommodation
20. Skylight
21. Deck lights
22. Ladder
23. Lobby
24. Scientific store
25. Petty officers' mess
26. Chart room
27. Chart table
28. Medicine chest
29. Cabin
30. Pantry
31. Trawling winch
32. Manhole door to bunker
33. Laboratory
34. Sink
35. Bench
36. Swing table
37. Bottle rack
38. Sliding desk
39. Seat
40. Main bunker
41. Wing bunker
42. Recess for ladder to bridge
43. Accommodation ladder
44. Boiler
45. Feed water tank
46. Crew's wash house
47. Crew's water-closet
48. Lamp room
49. Deck store
50. Engine room
51. Feed heater
52. Condenser
53. Main circulator
54. Evaporator and distiller
55. Forced draught fan and engine
56. Steering engine
57. Officers' water-closet
58. After gallows
59. Plankton engine
60. Plankton reel
61. Specimen tanks
62. Passage giving access to after accommodation
63. Galley
64. Lift
65. Skylight to wardroom
66. Steering rod channel
67. Kelvin sounding machine
68. Towing ring plate
69. Wardroom lobby
70. Hatch to store
71. Bathroom
72. Pantry
73. Store room
74. Cold store
75. Captain's cabin
76. Cabin of senior scientific officer
77. Wardroom
78. Cupboards
79. Cabin
80. Hand steering compass
81. Hand steering wheel
82. Grating support
83. Quadrant
84. Scuttle to after peak



UPPER DECK

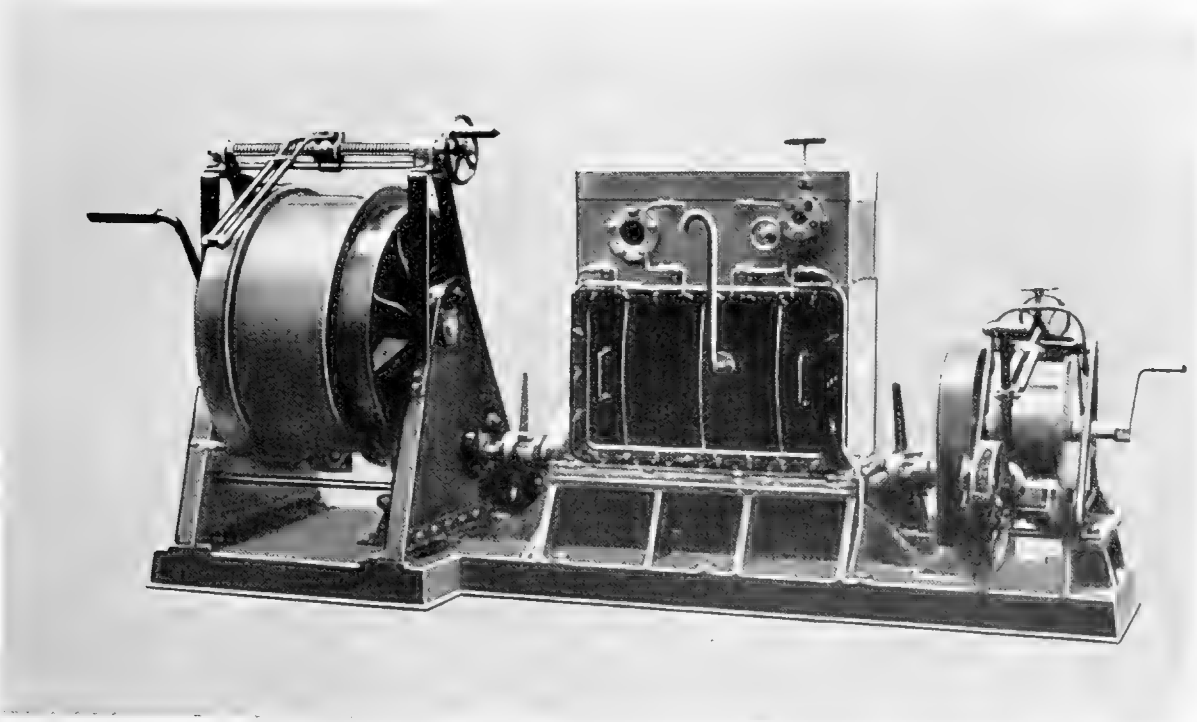


LOWER DECK



Strath Engineering Works phot.

Fig. 1. R.S.S. 'William Scoresby'. Three-barrelled trawling winch.



Philip & Son phot.

Fig. 2. R.S.S. 'William Scoresby'. Drum of wire for hydrological work (left) and Lucas sounding machine (right) coupled to the same engine.

N. A. Mackintosh phot.

Fig. 1. The Marine Biological Station, South Georgia.

N. A. Mackintosh phot.

Fig. 2. Part of the Laboratory of the Marine Biological Station, South Georgia.

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THE NATURAL HISTORY OF THE ELEPHANT SEAL

WITH NOTES ON OTHER SEALS FOUND AT SOUTH GEORGIA

by

L. Harrison Matthews, M.A.

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(Plates XIX–XXIV)

THE NATURAL HISTORY OF THE ELEPHANT SEAL, *MIROUNGA LEONINA*, LINN.

ELEPHANT seal, the largest of their race, in countless thousands make the shores of South Georgia their home during the southern summer. They are away at sea all the winter, and at the approach of spring they commence to haul out to breed on the beaches, where they congregate in rookeries, staying ashore for months on end (Plate XIX, figs. 1, 2). They are exceedingly slothful and unwieldy animals, the bulls being very much larger than the cows, and provided with a fleshy inflatable proboscis which hangs down over the mouth. The cows have no proboscis, but they are able to inflate the nostrils, producing a swelling and puckering of the skin of the nose. Elephant seals are polygamous, each bull gathering a harem of cows, which he jealously guards from his rivals. After the breeding season is over they return to the sea for several weeks, and then haul out again and spend two months on the land whilst the hair is shed and a new coat is grown.

Distribution. Beneath the skin of the elephant seal there is a layer of blubber so thick that when moving on the land "the whole body trembles like a bag of jelly." It is the presence of this blubber that has caused the elephant seal to be hunted nearly to extinction in many of its former haunts. At the end of the eighteenth century it was found on the coasts of Patagonia, Tierra del Fuego, and southern Chile, and was plentiful on the Falkland Islands, the South Shetland and South Orkney Islands, and at South Georgia. Further east it occurred in thousands at Tristan da Cunha and Gough Islands, Marion and Prince Edward Islands, the Crozet Islands, Kerguelen and Heard Islands and Macquarie Island, and it has also been seen on the coasts of South Africa. An allied race was formerly abundant on the coasts of California and Western Mexico and the nearby islands: a few still remain on Guadalupe Island. By the indiscriminate slaughter of young and old they have been exterminated or reduced to a mere remnant in most of these places, but they are still found in numbers sufficient for hunting in South Georgia, Kerguelen, Heard and Macquarie Islands. At South Georgia the hunting was formerly so intense that by 1885 elephant seals were practically extinct. After this date the island was not worked for some years, so that the seal increased in numbers till at the present time they are probably as numerous as ever. The hunting is now regulated by Government, so that there is no risk of them ever being exterminated again.

Annual "haul out". Seal commence to haul out on to the beaches in small numbers during the last part of August, but the times for the various parts of the island vary considerably. For example, in 1925 the seal had hauled out on the beaches from Cumberland Bay to Cape Disappointment and many pups were born by the end of August, but on the south side of the island hardly any were out until the first week in September.

From the middle of August onwards the cows haul out on the beaches and lie together in small parties awaiting the birth of their pups. These are born about a week after the mother hauls out, and the groups of cows form the beginning of the harems that the bulls collect later on. As soon as the cows arrive the bulls commence to haul out, though in smaller numbers. At first they lie by themselves on the beaches, keeping apart from the cows (Plate XIX, fig. 1), but soon after the first pups are born they join the cows, many of which have not yet given birth to their pups.

Birth of the Pups. The pups are born from the last week in August to the end of September and some even in October, so that the season lasts for six weeks or more. Most of the late pups are first ones, their mothers having been impregnated for the first time late in the last season. The virgin cows haul out much later than the mothers and join the harems already formed on the beaches. Twins were not observed, one pup to each cow being the rule. The cows are not impregnated at once after the pups are born, though the bulls attempt to cover them. The cow will not take the bull until a week or ten days after the birth of the pup.

At birth the pups are covered with a black woolly coat (Plate XX, fig. 1). This is shed, the change commencing about a fortnight after birth, and becoming complete in about five weeks. The black coat is first shed on the back, then on the belly and last on the head and face. The coat which is exposed when the black coat is shed is of soft hair, grey in colour, and lasts until the moult of the following season.

The umbilical cord, which is black and 2 ft. long, is sloughed off about three days after birth. The piece attached to the new-born pup is from 12 to 18 in. long (Plate XX, fig. 1). It was not ascertained if the cord is bitten asunder by the mother at birth, or if it is merely broken, but it is fair to assume that it is broken, first because of the ragged appearance presented by the free end, and secondly because the teeth of the mothers are capable of being used for seizing objects but not for cutting them. The foetal membranes and large fleshy placentas are a conspicuous feature of the rookeries at the beginning of the season when the pups are being born. Much of this rubbish is eaten by the Gulls, Skuas, Giant Petrels and Sheathbills. A discharge of mucus, at first discoloured with blood, continues to ooze from the vulvas of the cows for several days after the birth of the pups.

Suckling. In giving suck the cow lies on her side, and the pup sucks the area surrounding the teat, which is shortly protruded (Plate XX, fig. 2). The pups suck for five to ten minutes at a time, and must swallow a considerable amount of air as they make plenty of noise during the process. When hungry, the pup, lying alongside the mother, commences barking and nuzzling round the body of the mother in a feeble way until she turns on her side, when it soon finds the teats. There are two teats, one on each side of the middle line about one-quarter of the animal's length from the tail; they are kept retracted when the pup is not suckling. The flow of milk is small, as is shown by the long fine jets which squirt from the teat for a moment when the pup stops sucking. The pup takes milk from one teat only at each feed, when small usually from the lower one as the cow lies on her side, but when older from either indifferently.

Pups. At birth the cry of the pups is a shrill staccato barking, very much like that of a dog puppy, but this gradually changes, so that by the time they are a month old the cry is very much deeper and harsher. At this age they start to get the voice characteristic of the adult, and when excited raise up their heads and attempt to roar like their parents; but at first they are able to produce nothing but a hissing sound in the throat. When slightly older they can produce a rattle in the throat, which gradually deepens to the proper roar as they get larger, though even at the end of the season it is still comparatively feeble.

The pups grow very rapidly. At birth they are about 3 ft. long and at the end of the first month they are about 4 ft. long. The greatest increase, however, is in girth. At birth they are thin and have little blubber on them but the thickness of this very rapidly increases so that, by the time the coat changes, they are nearly as broad as they are long.

The pups do not have any very definite time for leaving their mothers, but roughly it is about the time that the coat change is half completed. When they leave them they congregate in batches of as many as twenty or more; many join these bands before the coat change is complete, yet on the other hand a number have been observed still suckling after the coat change was complete. When they leave the mothers they do not immediately take to the water but lie around sleeping on the beaches or playing in the streams of fresh water or in the shallow water near the shore (Plate XXI, fig. 2). By January they will take to the water much more readily if disturbed than when they are younger. Once they have taken to playing in the shallow water they soon learn to take longer excursions into deeper water, and it is then that they start feeding on their own account. From the time that they leave the mothers until they take to the water—about six weeks—they do not feed, but exist on their enormously thick blubber. At the end of December they are very noticeably thinner than they are when the coat is changed, being more fusiform and less nearly globular in shape. They do not finally leave the beaches and take to a pelagic life for some time longer. During the early part of the year they are continually hauling out to sleep, and finally leave in April and May when the adults also go.

Harems: Pugnacity of the Bulls. The harems are formed by the cows hauling out in bunches to give birth to their pups, as mentioned above, and later these groups are annexed by the bulls. When a number of harems lie close to each other on the beach they are collectively termed a "rookery" (Plate XIX, fig. 2). The number of cows in the harem depends on the strength and activity of the bull and his ability to keep away other bulls. As many as thirty cows have been observed in one harem but a smaller number is the rule, from a dozen to twenty, though some bulls have to content themselves with two or three only (Plate XXI, fig. 1[1]). The bulls in adjacent harems are continually fighting over the possession of the cows, and driving away the bachelor bulls which lie on the beach round the edge of the harem, and also loiter around in the water alongside. If one of these bulls outside the harem makes a move, the harem bull immediately raises up his head, and if the bachelor approaches his harem he starts roaring. In roaring the bull throws back the head and inflates the proboscis and, with the mouth widely open, produces a succession of loud expiratory bellows in the throat (Plate XXI, fig. 3). After three or four long ones, he gives a number of shorter ones and usually finishes off with another long one. The roar is not inspiratory, as has been stated by some writers, but expiratory. Between each roar there is a pause for breath, and during the roaring particles of saliva and phlegm can be seen to be forcibly ejected from the throat.

When the harem bull starts roaring at a bachelor bull, if the latter is a small one, he usually takes this as a warning and edges away, but if he is a big one he usually answers back, challenging the harem bull to fight, frequently approaching closer. This sets the harem bull beside himself with fury and immediately he blindly rushes at his rival in a direct line over his cows and pups. If this does not start the other in flight a fight ensues. Approaching each other closely face to face, each bull rears up as far as he can on the hind third of the body, and, with the mouth wide open and the proboscis inflated, falls forward against his rival, endeavouring to lacerate him with his upper canine teeth (Plate XXII, figs. 2, 3). They do not bite each other when fighting in this way, and most of the wounds are received on the head and sides of the neck. If, however, one of them makes an unsuccessful lunge and falls forward, the other wallops down on top of him with all his weight and bites his neck or back, sometimes tearing out a lump of skin and blubber nearly a foot square. If this happens the fight finishes at once, the vanquished making off as fast as he can, pursued for a short distance by the victor. If no bad wounds are given these fights do not last longer than four or five minutes; if the harem bull gets in a few good blows the other soon gives up.

When trying to drive a human intruder from the neighbourhood of the rookery, if roaring does not effect his purpose, the harem bull makes for the cause of his annoyance with all possible speed and regardless of obstacles. If he is in the middle of his harem he goes lolloping over his cows and pups, in spite of the disturbance that this causes, and it is astonishing that the pups manage to survive such rough treatment. One would expect to find them completely flattened by the passage of a large bull over them, yet one rarely sees them injured in this way. The bull, however, does not dare to leave his

[1] I am indebted to Lady Shackleton for permission to reproduce this photograph and those shown in Plate XXIII, figs. 1 and 2. They were taken at South Georgia during the Shackleton Antarctic Expedition of 1914–17.

harem unguarded and will only pursue the intruder a little way. When he wishes to return to the harem he stops by throwing forward his weight, without raising the fore part of the body on the fore flippers as he does in normal progression, so that he pitches forward on to his chest, raising the back part of the body and hind flippers high into the air. He then raises the fore quarters and swings round on the middle part of the body with both ends raised up in the air at the same time, and returns to his cows. He goes through the same process in chasing a rival bull, and will also suddenly swing round on the middle of the belly in this peculiar way to face an intruder if he is disturbed when asleep. If the disturbance is slight and behind him, to save himself the trouble of swinging round unnecessarily, he raises his head vertically and bends it back so far that he looks along his own back at the cause of his uneasiness. Cows and small bulls, if disturbed, will bite on a stick presented to them and wrench it forcibly from the hands; no doubt the big bulls would do so as well. The bachelor bulls fight considerably among themselves in the breeding season, when they are hanging round the outskirts of the rookeries. The fights between the bachelor bulls frequently last on and off for a long time, two of them lying near each other on the beach being engaged in bouts of fighting all day long.

The bulls very rarely, if ever, give each other mortal injuries; at least no case of this has ever come to the notice of the writer, but they often wound each other severely. Most of the wounds are lacerations and cuts on the sides of the neck, so that the skin of this region in an old bull becomes entirely hairless and covered with thick wrinkled and scarred skin (Plate XXI, fig. 1; Plate XXII, fig. 1; Plate XXIII, figs. 1, 2). Lacerations of the proboscis are also frequent, sometimes, though not commonly, the greater part of it is completely torn away; the usual wounds are cuts in the front overhanging portion, going right through into the nares. Wounds caused by biting are commonest on the back of the neck and body. The eyes, also, are commonly injured: in fighting, the canine tooth of one scratches the surface of the eyeball of the other sufficiently to cause an inflammation leading to a conjunctivitis. When the wound heals the conjunctiva becomes white and opaque. One-eyed seals with this injury are to be seen in all the big rookeries. Sometimes the eyes are completely torn out. It is noticeable that the body wounds do not heal readily and nearly always suppurate badly. This, in the opinion of the writer, is due to the dirty state of the rookeries and the indifference that the seal have to wallowing in filth.

The impression one gets from watching the elephant seal is that they would be extremely dangerous if they could move with any degree of agility on the land: it is only their cumbersome unwieldiness that makes them harmless.

Breeding Habits. The bulls are peculiarly jealous if they are disturbed in the rookery. When they return to their harem, after their warlike demonstration to the intruder, they invariably start pairing with their cows. In the large harems the bachelor bulls on the edges poach the outlying cows while the harem bull's attention is engaged with another cow. But the harem bull keeps a watchful eye on them and does not leave them long in peace as soon as he has finished with his own cow, though until he has, he will not leave her to drive the other away, merely contenting himself with roaring persistently at him.

From the above it will be seen that the cows take any bull that offers and show no fidelity to the harem bull. The bulls have an extremely strong sexual instinct and appear to be able to cover any number of cows in succession. In pairing, the bull embraces the cow with one of his fore flippers and lying on one side draws her to him. He takes hold by biting her neck and then brings his hind quarters round to the cow's tail and protrudes his penis. The process lasts from ten to fifteen minutes during which they both lie quiescent. This habit of the bull biting the cow is the cause of the many white spot-like scars to be seen on the necks of the cows (Plate XXI, fig. 1).

The period of gestation is eleven months.

Towards the end of the pairing season when the pups have changed their coats and are leaving their mothers, occasional bachelor bulls that have been unable to get a harem of their own persecute the pups and attempt to pair with them. The writer thinks that pups are sometimes killed by this misplaced affection. Though none were ever actually seen to be killed, dead pups have been found that showed no definite cause of death, but appeared to have been suffocated by the weight of a bull practising this habit.

Cows. The cows in the harems are very quarrelsome amongst themselves. If, in moving, one of them disturbs another they snap at each other, striking forwards and downwards with the upper canines after the manner of the bulls in fighting, though they do not rear up on the back part of the body so much as the bulls. They do not, however, have pitched battles like the bulls, these bouts of quarrelling being merely displays of bad temper. If they are disturbed by the presence of a human visitor to the rookery and are closely approached they rear up the front part of the body, supporting it with their fore flippers, and, opening the mouth widely, produce a harsh roaring noise in the back of the throat, and lunge out towards the cause of their annoyance. The voice of the cows when angry is similar to that of the bulls, but is not nearly so deep. When they have their pups the cows also produce another sound that is very characteristic of the rookeries at this period. It is a long drawn-out falsetto sound, almost a whine, produced with the head thrown up and the mouth widely open (Plate XXIV, fig. 2). This cry is used in calling to the young pups and if the rookery is disturbed so that the pups get separated from the cows an amazing volume of sound is produced until the mothers have found their young ones again.

After the pups are born the virgin cows begin to haul out and join the rookeries, most of them arriving in the last half of October and in the beginning of November. It is easy to recognize them in the rookeries by their small size and the absence of old scars on their necks. It is quite certain that none of the adult cows escapes impregnation, as there are too many spare bulls on the beaches for this to happen.

Growth. Elephant seal take two years to become adult. At the end of the first year they are $5\frac{1}{2}$ to $6\frac{1}{2}$ ft. long, judging from the few examples seen that had been branded, and by the numbers of this size, male and female, that are to be seen on the beaches away from the harems. At the end of the second year the cows are impregnated, being then from $7\frac{1}{2}$ to $8\frac{1}{2}$ ft. long. They continue growing after this and by the time that they are three years old, when they have their first pups, they are 9 to 10 ft. in length. The bulls at the end of their second year are 12 to 14 ft. long and have only a slight development of the proboscis. At this age they would breed, were they not kept away from the harems by the older and stronger bulls. After this age they grow gradually, up to 18 or 20 ft. long, with increasing girth and development of the proboscis (Plate XXIII, fig. 2). The writer believes that the bulls go on growing at least until they are five years old but he has no definite data to support this opinion.

Food. The writer has examined the stomachs of a large series of elephant seal to ascertain what their food is. The stomachs contain a large quantity—up to two gallons—of yellow watery fluid, usually pale but sometimes deep in colour, and several pounds of sand and shingle. In addition all the stomachs are heavily infected with nematode worms. In 35 per cent of the stomachs examined cephalopod beaks[1], some of large size, were found, though no soft parts were seen, and this is not to be wondered at, as all these specimens were killed in the rookeries where they had been fasting. No trace of any other food was found. Wilson, in the *Report of the National Antarctic Expedition of* 1901–1904, stated that he found no food in the stomachs of his specimens, but pointed out that the diet probably consisted of cephalopods, from a consideration of the dentition. It is probable that cephalopods are the sole food of the animal, and when one considers the number of seals on South Georgia and the large amount of food that they must consume to get so well covered with blubber, one realizes that the waters surrounding the island must be teeming with these molluscs. That this is so is also shown by an examination of the stomachs of the Albatross, Mollymauks, Cape Hens and Macaroni Penguins from the same locality, all of which are full of squid beaks. The squid are certainly there, and at times, if not always, near the surface, though no naturalist has yet invented gear which will catch them and prove their presence directly.

The writer has been unable to ascertain how the sand and shingle gets introduced into the stomachs of the elephant seal. It is most probable that the sand is deliberately swallowed, as it can be taken as certain that it is not swallowed with the food. A small amount may be swallowed accidentally when the seal are in the rookeries, but this would not account for such large quantities. Other species of seal are known constantly to have in their stomachs stones which are deliberately swallowed, so it is a fair assumption that the elephant seal get theirs in the same way, though no actual instance of the deliberate swallowing of sand and shingle has been observed. Sand was not only found in the stomachs of the adults, but also in the stomach of a young one that had only just completed the coat change and had not yet left the beach. Thus, if it is swallowed deliberately, the habit is a well-established instinct, since this young one had not yet

[1] Mr G. C. Robson has kindly examined these beaks and is of the opinion that they belong to a species of the family Architeuthidae. Any more precise identification is unfortunately impossible.

started independent feeding and the sand would therefore be quite useless to it. The function of the sand and shingle is presumably to triturate the food, which must be swallowed whole, as the teeth are only adapted for seizing and not for masticating.

First return to Sea. When the seal are in the rookeries they do not feed. During the breeding season the cows and bulls fast for two months, and then, when the harems break up, they go to sea in December and return to land in January and February to change their coats. They stop ashore for another six weeks to two months and then return to the water and do not haul out again until the next breeding season. It must not be supposed, however, that all the seal arrive and depart with any regularity. After the first haul out in the spring they all return to the water for a period after breeding, but the times vary individually. There are always adult seal of both sexes to be seen on the beaches right through the summer in addition to the young ones, though the above dates are correct for the majority. The bulls remain ashore later than the cows: by the first week in April very few cows are left, though there are plenty of bulls until the end of the month. The cows, however, haul out earlier than the bulls, arriving in January and early February, whilst the bulls do not come ashore till the latter part of February and the beginning of March.

Annual Moult. The moult occurs after the breeding season and after the seal have been to sea for a period. The actual time of the moult varies individually, but it is earlier with the cows and yearlings than with the bulls. With the former it starts about halfway through January and is in full swing during February. With the bulls it starts in February and lasts to the end of March. The process from the commencement of the shedding until the new coat is complete lasts from a month to five or six weeks. The hair comes off in patches, first on the back and shoulders, last on the belly, face and flippers. The patches peel off in sheets, the hair being held together by a layer of the epidermis which is shed, taking the hair with it (Plate XXIII, figs 1, 2). The hair projects about a quarter of an inch on the outside, and about one-eighth of an inch on the inside of this layer of epidermis when shed. In the cows and yearlings and the smaller bulls the new hair, soft, short and closely adpressed to the skin, is exposed when the old coat is shed, but in the older bulls the patches left where the old hair comes off are at first quite naked (Plate XXIII, fig. 2), and the new hair does not start sprouting for a week or ten days. During the shedding of the coat the seal get very out of condition and the thickness of the blubber is much diminished. In some cases also, the gums become congested and bleed at this season.

When they are shedding their coats the seal like to lie in wallows, which they make by lying and rolling in the pools of water amongst the clumps of tussac grass. They quickly produce a swampy quagmire, and as many as thirty or forty are sometimes to be seen lying closely packed together in these mud baths. The cows and bulls tend to keep apart at this time, each wallow being usually, though not invariably, packed with seal of the same sex. The writer has seen these wallows so deep in mud that only the heads of the seal were above the surface, and actually came across one instance in which the seal was completely immersed and was breathing through a hole about

9 in. deep that its breath kept open in the thick sticky mud. They still lie in the wallows and on the beaches after the moult is complete and are often to be seen bathing in the shallow water near the shore.

Final return to Sea. There is no definite time for all the elephant seal to return to the sea. The cows and young ones start leaving in March and are all gone by the middle of April, while the bulls follow them later, so that the beaches are practically deserted by May. Occasional seal, especially pups of the preceding season, haul out during the winter, but they do not stop ashore long. Whether the majority stay near the land during the winter or migrate far it is impossible to state. Occasionally adults are seen at sea in the neighbourhood of the island in the winter, but not nearly so frequently as in the summer. The National Antarctic Expedition of 1901–1904 found one at Cape Royds on the Antarctic continent in Lat. 77° 40′ S., more than a thousand miles from the nearest place where they are known to breed, and one was killed on the coast of South Africa during the visit of the 'Discovery' there in 1926. It is evident, therefore, that they can travel long distances at sea.

Mortality and Natural Enemies. The mortality of seals ashore is low. No fatal epidemics, such as the Uncinaria disease which afflicts the breeding rookeries of the northern fur seal, occur. A few dead pups are to be seen in most large rookeries; they are usually very young ones killed by being rolled on by one of the cows lying alongside the mother, or by the bull. Occasionally the very young pups die of starvation in the large rookeries, through wandering away from their mothers, for they are singularly unintelligent in finding their way back to them from even a short distance, and the cows are equally ineffective in finding their pups. The pups often lie so long in one spot that the heat of their bodies melts away the snow to such an extent that they sink down below the general level of the rookery (Plate XXIV, fig. 1). It sometimes happens when the season is late, so that the snow lies deep well into the spring, that they sink so far down that they cannot get out again to reach their mothers and are thus lost. It is extremely seldom that adult seals are found dead ashore. Several decomposed carcasses were observed, but only once was a fresh one seen, when circumstances did not allow of an examination as to the cause of death. No signs of disease were seen amongst them: two were seen with tumours in the blubber formed from old wounds; as stated above, their wounds often suppurate badly. No external skin parasites were found. The Killer Whale is the only natural enemy of the elephant seal of which the writer is aware. One of the gunners at Leith Harbour Whaling Station shot a killer whale off South Georgia in November 1926, and when it was struck by the harpoon it vomited up the heart, liver and a piece of blubber, about 4 ft. by 2 ft. in size, of an elephant seal. This gunner also told the writer he had previously seen killers attack elephant seal and cut them in two at one bite.

Branding Experiments. Some hundreds of pups have been branded yearly from 1921 to 1925, by the Magistrate's staff, but very few have been seen again. The island is divided into four divisions for purposes of administrating the sealing licences, and the brand used on the seal shows the division, and the year in which they are marked.

It has been found that the best time for branding is the beginning of November when most of the pups are completing the shedding of their first black woolly coat, and are leaving their mothers and congregating in small flocks by themselves on the beaches. If the branding is left till later the pups are so big that overcoming their struggles wastes a lot of time. They stand the branding very well and appear to be extremely insensible to pain. Only three branded seal have been seen, all in 1925, and all had been branded in the previous season. One hauled out on King Edward Point, Cumberland Bay, early in November 1925, bearing the brand of No. 3 Division, which includes Cumberland Bay. It was a female, $5\frac{1}{2}$ ft. long. The scar of the brand was incompletely healed, and was suppurating slightly at the angles of the figure "3". This was the only one seen by the writer.

Sand throwing Habit. When lying on the beach elephant seal have a peculiar habit of throwing sand and shingle on to their backs. It is, in fact, not only a habit but an instinct, as the very young pups cover themselves as do the adults (Plate XXI, fig. 1). They throw the sand up by bringing the fore flipper of one side round so that the tip is directed nearly forward, and then suddenly sweeping it round sideways and backwards, scooping up with the palmar surface a load of sand which is thrown upwards with considerable force; so much so that frequently most of it falls on the beach on the other side of the seal. It has been stated that they do this to keep off the direct rays of the sun, but this cannot be so, as they do it just as much on dull days as when the sun is shining. In the writer's opinion it is to keep the skin moist that the habit has been developed. The skin of the seal is always wet when it is in the water, as the hair is short and encloses no layer of air, so that, no doubt, a feeling of irritation is produced if the skin dries when the seal is on the beach. The eyes, too, appear to be irritated by the air when the seal leaves the water, for there is a copious secretion of tears which stream down the sides of the face and produce large wet patches round the eyes (Plate XXI, fig. 1; Plate XXIII, fig. 2).

An unexpected mobility of the fore limb is shown in thus reaching forward to scoop up sand, and it is further displayed when the seal use the limb for scratching themselves. The digits are provided with well-formed nails, and they can bring the fore flipper forward so as to scratch the chin or top of the head, or to wipe the nose with the back of it, and can bring it back so as to scratch the belly, hind flippers or back. The hind flippers, too, although unprovided with functional nails, are used for scratching each other, the hind portion of the body being raised in the air and the flippers vigorously rubbed together. When stretching themselves the hind flippers are also brought into play, the plantar surfaces being brought together and the webs widely stretched like a fan.

Breathing. When sleeping or lying undisturbed the breathing of the elephant seal is characteristic. Inspiration is deep, and then the nostrils are closed and the breath held for an average of forty seconds. This is followed by a rapid forcible expiration. Every few expirations one more forcible than usual is given, producing a loud snort, so that after the seal have been out of the water for some time their muzzles become very dirty with the expelled mucus. They also have a habit of keeping one nostril tightly closed and breathing only with the other (Plate XXIII, fig. 3).

Progress on Land. When travelling on the land elephant seal carry the head well raised, and always use the fore flippers, while the hind flippers are trailed uselessly on the ground. The fore flippers are spread out at the side with the palms on the ground and the fore part of the body is raised by them and hitched forward. At the same time that the fore part is being raised, the back is curved upwards, so that the hind flippers are drawn up slightly nearer, and as the front flippers hitch forward, the back is straightened, and the body is pushed forward from the pelvic region. When hurried, on a good surface, such as hard level snow, a big bull can do about five miles an hour —a man has to run to keep up with him—but he very soon becomes exhausted. When undisturbed they move forwards a few steps and then drop the head down and rest for a little, then move a few yards further and rest again, and so on. Nevertheless, they wander for considerable distances from the shore. In King Haakon Bay and the Bay of Isles the writer has seen them over a half a mile from the beach, and in spite of their unwieldiness they sometimes climb up on the tussac-covered hills, over uneven ground, to a height of 60 or 70 ft.

Swimming. In entering the sea the elephant seal go down the beach and into the water in the usual land-progression manner, but, before the water is deep enough to cover them completely, they duck their heads under and start swimming with powerful strokes of their hind flippers: this soon carries them off into deeper water. The hind flippers only are used for swimming, the plantar surfaces being opposed and the webs more or less expanded according to the amount of speed required. If they are hurried the webs are widely expanded and very vigorously sculled from side to side. When floating on the surface in still water in the bays they like to bring the head and hind flippers above the water at the same time, but at sea they have only been observed with the head alone out of the water. They are able to stay under water for twelve minutes at least, the writer having timed a dive of this length, and in his opinion they are able to stop below longer than this without undue inconvenience. On the occasion of this twelve-minute dive, which was the longest timed, the seal did not appear to be short of breath when it reappeared, and it soon dived again. On other occasions, when seals have been driven into the water to find the duration of the dive, they have not returned to the surface within sight at all.

Colour. The colour of the pups after they have shed their first black woolly coats is silvery grey, darker dorsally and lighter ventrally. The new coat of the cows and small bulls is slightly darker in colour, sometimes tinged with yellow, and it gradually becomes darker until it is a grey brown by the time it is shed. The new coat of the big bulls is light grey brown and becomes darker like that of the cows and small bulls. In all it is darker dorsally than ventrally, and there are no markings. The new coats of the seal soon become stained a yellowish or greenish brown by the mixture of mud and bright orange faeces in the wallows. The colour of the coat also appears much lighter when one looks at it with the lie of the hair than when one looks at it against the lie.

Numbers at South Georgia. As to the number of seal which annually haul out at South Georgia, it is impossible to make any definite statement. In the writer's opinion there are at least one hundred thousand, at a very moderate estimate. In all the large bays there are extensive rookeries totalling several thousand for each one: Cumberland, St Andrews, Royal and Sandwich Bays; Gold Harbour and Cooper Bay; Drygalski Fjord and Annenkov Island; King Haakon and Queen Maud Bays; Wilson Harbour and Ice Fjord; Right Whale Bay; Possession, Fortuna and Antarctic Bays all have many large rookeries, and the smaller bays all round the coasts are each plentifully supplied, probably exceeding in numbers those of the larger bays. In addition, there are hundreds of small inaccessible coves and beaches between the bays and harbours, which all give shelter to their complement of seal, altogether certainly equalling the numbers of those in the accessible parts. Sealers and whalers with whom the writer has discussed the probable numbers of seal on the island think that the estimate given above is exceedingly cautious, and that a quarter of a million would be short of the true number.

Elephant Seal Oil Industry. Elephant seal hunting is now carried on in a style different from that of the sailing-ship days. In the old style elephant hunting was combined with fur sealing, until the extinction of the fur seal confined the business to oil hunting alone. The trade was in full swing by 1800, in which year the seventeen vessels at work in the island took 112,000 fur seal skins between them. Weddell stated that in 1823 the fur seal and elephant seal were nearly extinct, "not less than 20,000 tons of elephant oil having been shipped to the London market alone, and not less than 1,200,000 fur seal killed since the reports by Captain Cook in 1775 which led sealers to this island". Since then the island has been worked at various times by a few vessels, mostly American, right down to the present century, the last "old-timer" working in the season 1912–13. In the palmy days of the hunting the vessels would anchor in some safe harbour and build on shore, from materials they brought with them, one or more "shallops" to collect the skins and blubber from the various rookeries. Some of these tenders, built in South Georgia more than a century ago, were decked, cutter-rigged vessels, as big as thirty tons. Gangs of men were also put ashore with try-pots and casks at good beaches, where they built huts, sometimes even wintering, and carried on their occupation of killing the elephant seal and boiling out the oil and collecting fur seal skins. When sufficient oil and skins had been accumulated they were rafted off to the ships. In many bays of the island the try-work bricks and cast-iron try-pots of the old sealers are to be seen on the beaches, and at Wilson Harbour the remains of the walls of one of their huts can still be traced. When they had killed the seal with lance, club, or musket, the skin was removed and the blubber flensed off and soaked in sea-water for twenty-four hours to cleanse it. It was then minced and boiled out in large iron pots, the try-works being so arranged that after the first boiling the oil flowed over into another pot in which it was boiled a second time before running off into the casks. The scraps of blubber after they had been boiled were used for fuel. In later days the building of "shallops" was given up and the sealers sent away their open boats to the various bays to carry and tow back the blubber for trying out on board the ship.

At the present day the hunting is carried on by one of the whaling companies, under a licence issued by the Government of the Falkland Islands. The first licence for taking seals was issued in 1910 and the same company has continued hunting until the present time. The coast of South Georgia is divided into four roughly equal divisions, of which only three are worked each year, the fourth forming an unmolested reserve. The licence allows the taking of adult bull seal only and stipulates that 10 per cent of the bulls shall be left on each beach. As the elephant seal is polygamous there are always many bachelor bulls on the beaches; further, it may be assumed that the proportions of the sexes born annually are about equal, so that the excess of bulls may well be exploited commercially without diminishing the numbers of the species; in fact the numbers may be increasing in spite of the hunting. The taking of seal is prohibited during the close season between November 1 and March 1. During the winter, from the beginning of May until the end of August sealing is impracticable owing to the absence of the seal, bad weather and the closing of the whaling station. Consequently the actual period during which the seal are taken is limited to the four months September and October, March and April. The licence requires the licensee to furnish an account of the number and kind of seals taken, and to report and locate on the chart where such seals were found in large numbers or rookeries, or where others were observed. The licence allowed also the taking of Weddell seal until 1916, since when this species has been protected. The taking of Leopard seal as well as Elephant seal is permitted, but the numbers taken annually are negligible, rarely exceeding one hundred.

Season	Elephant seals	Leopard seals	Weddell seals	Total	Barrels of oil
1910	2965	35	5	3005	3467
1911	1985	65	9	2059	4031
1912	2659	87	48	2794	5712
1913	4503	26	11	4540	7840
1914	3070	33	10	3113	4641
1915	2016	—	—	2016	2537
1916	2867	25	14	2906	5337
1917	2941	77	—	3018	5297
1918	2952	2	—	2954	6137
1919	1227	3	—	1230	1650
1920	1527	18	—	1545	2269
1921	1090	24	—	1114	1660
1922	2652	61	—	2713	5035
1923	2879	115	—	2994	6375
1924	3867	35	—	3902	7486
1925	3775	26	—	3801	6891
1926	4671	111	—	4782	8094
1927	5506	9	—	5515	10033

The above table shows the number of seal taken in the course of commercial operations since the year 1910.

For hunting an old whale-catcher is used, the crew being Norwegian and Russian. She visits the various beaches and anchors off them as near the shore as possible, and sends ashore a "pram" with the hunters (Plate XIX, fig. 1). The selected seal are driven down to the water's edge and there shot by rifle. The killing shots are the back of the head, or, if the seal stops to roar, as he frequently does, up through the palate into the brain while the mouth is widely open. When the seal is killed the iris of the eye relaxes so that the retina throws a green reflection. This fact was noted by Pernety in 1764, who says: "I remarked that when they were expiring their eyes changed colour, and their crystalline lens became of an admirable green". As the elephant seal, like all seals, is very tenacious of life, the sealers sever the carotids by gashing the side of the neck after the seal have been knocked down by the rifle shot. The quantity of blood that runs from a large elephant seal is very great, a fact which much impressed the early voyagers. The blubber is flensed off with the hide by cutting through it along each side just above the ground as the seal lies on his belly. These two cuts are joined by cuts across the head, and across the hind part of the body at the base of the hind flippers. A median cut is then made down the back, dividing the dorsal blubber into two equal parts. These are again divided by vertical cuts at the middle length of the body, and the four resulting flaps of blubber are quickly dissected off (Plate XXIV, fig. 3). The carcass is then rolled over on to its back and four similar pieces are flensed off the under surface. Long pointed knives are used for flensing: they are carried in locally made wooden sheaths hung from the belt and are kept very sharp by frequent application of the steel. The sealers take hold of the blubber by steel hooks similar to the stevedore's "cargo hooks". As the pieces of blubber are flensed off a cut is made in them so that they can be threaded on a rope, and then they are dragged into heaps at the water's edge. Whilst the killing and flensing are going on, the pram returns to the ship, and coils down a long rope, one end of which is made fast on board, whilst the other end is brought ashore, the coil in the pram being payed out the while. To the shore end of the rope a wire is made fast, having a number of smaller wires, each about a fathom long and ending in a wooden toggle, spliced into it at intervals. The toggles and wires are threaded through the pieces of blubber, which have cuts in them for the purpose, and when the wire is loaded the signal is given, and the rope is hove in to the ship by the steam winch, bringing with it the wire and its load of blubber. The flensed carcasses are left to rot on the beach and are soon reduced to clean picked skeletons by the birds, especially Giant Petrels, Gulls, Skuas and Sheathbills.

The shore gang return to the ship while the blubber is being hove on board and put in the hold; then the anchor is weighed and the next beach is visited. As the hold-space is not large on the whale-catchers the after rail is built in with planks and corrugated iron sheeting and a deck cargo is carried there as well. The blubber is brought back to the whaling station and is there minced and boiled out. During the best part of the season, given good weather, each whale-catcher employed brings in a full cargo, the blubber of a hundred to a hundred and thirty seals, every three days; but bad weather often delays them so that they cannot get home for a week or more.

The elephant seal are of extremely low intelligence, as the survivors take no notice at all of the slaughter of their companions. A slight disturbance is caused in the rookeries in driving the bulls out of the harems, which they are loth to leave, and down to the water; but as soon as the hunters have passed through the rookeries the seal all settle down again, and the spare bulls proceed to annex the harems and fight amongst themselves for them. The blood and carcasses, and the presence of the sealers cause no disturbance, nor does the sound of rifle fire, as it is possible to shoot many in succession right alongside each other. Sometimes the spare bulls get sufficiently scared to enter the water, but they do not go away and soon haul out again. The cows and pups take no notice whatever of the killing.

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NOTES ON OTHER SEALS FOUND AT SOUTH GEORGIA

The following notes comprise the observations made in South Georgia on seals other than the elephant seal. The species concerned are the Weddell and Crab-eater Seals, the Leopard Seal, and the Fur Seal. With the exception of the Leopard Seal the life histories of these seals have been thoroughly worked out by the members of previous antarctic expeditions[1], and these notes merely concern the occurrence of those species in South Georgia.

Weddell Seal, *Leptonychotes weddelli*, Less.

This seal, called by the Norwegian whalers and sealers "Fisk Sael", is found constantly, though in small numbers, at South Georgia. At Larsen Harbour, in Drygalski Fjord, at the southern extremity of the island, there is a small colony of them which make this place their home and they are always to be found there. In the other bays odd ones are occasionally seen. The headquarters of the species is amongst the ice further south.

There are between twenty and thirty Weddell seals in Larsen Harbour, and their pups are born in January. The sides of this harbour are very high and precipitous and the seals live on the narrow beaches at the water's edge. In November 1925 the writer found them lying about sleeping on the beaches and the level snow behind them, and the skeletons of several pups were found. One young one of the previous season hauled out at the whaling station in Grytviken in June 1925. It was about 5 ft. long. It came ashore one evening and spent the night asleep on the beach, returning to the sea early the next morning. It took no notice of the presence of men, but if touched it raised its head and snapped its jaws. In breathing it made a shrill whistling sound at each expiration: maybe it was sick. Another one, an old female in pup, was seen in Else Cove in September 1925. It was very fat and was lying on its back on the snow well back from the beach. When approached it made a whistling noise and snapped its jaws and then made a rattling sound by rapidly vibrating them. The Weddell seals are not molested by the sealers now, though until 1917 the sealing licences allowed the taking of this species, the catch of which averaged less than fourteen annually from 1910–1916 inclusive.

[1] For literature on these seals see Barrett-Hamilton, '*Southern Cross' Collections*, p. 1, pl. 1 (1902); Wilson, *ibid.* p. 67, pls. II–VI; Hansen, *ibid.* p. 84; Wilson, *Nat. Antarct. Exped.* 1901–4, II, p. 10, pls. I, II (1907); Tims, *ibid.* V, p. 1, pls. I, II (1907); Trouessart, *Expéd. Antarct. Française—Mammifères Pinnipèdes* (1907); *Scottish Nat. Antarct. Exped.* IV (1915); Barrett-Hamilton, *Expéd. Antarct. Belge*, IX, no. 4 (1901–4); Andersson, *Wiss. Ergebn. Schwedischen Sudpolar Exped.* V, no. 2 (1908).

Crab-eater Seal, *Lobodon carcinophagus*, Jaquinot & Pucheran.

Three or four were seen in Larsen Harbour near the Weddell seals in November 1925. They were lying on the snow near the water and were sluggish in their movements, but made for the sea when disturbed. The colour of their hair was reddish white. They were not heard to utter any sound when irritated, but they vibrated their jaws in the same manner as the Weddell seal. In December 1926 and January 1927 the skeletons of three Crab-eaters were found in Stromness Bay, one in Husvik Harbour and two in Stromness Harbour. They were all near the beach and had evidently hauled out and died during the previous winter. They were all adult. Though the true home of this species is among the ice-pack far to the south, it will thus be seen that occasional stragglers reach South Georgia, this island probably being at the northern limit of its range in these regions, though further west it has been recorded from Patagonia and Rio de la Plata[1].

Leopard Seal, *Hydrurga leptonyx*, Blain.

The Leopard Seal is a constant inhabitant of South Georgia, and though it is never found congregated in rookeries, it may be said to be common. Near the whaling station in Grytviken it is only found in the winter, but by taking a trip on one of the sealing boats one finds that odd ones are always to be seen in most of the bays and fjords. It is a solitary animal at all times, even when breeding; the largest number that was seen at once on a small stretch of beach was six, and in no sense could this collection be called a rookery as the seal were not lying close together. On the land they haul out on to the beaches, but do not go up on to the tussac-covered ground behind, as do the elephant seal. In moving on the land they wriggle along by arching the back and pushing themselves along from the pelvic region of the body; the fore flippers are not used and are kept closely pressed to the sides of the body. If they are approached while they are asleep, they wake up and menace the intruder by widely opening the jaws and snapping them. If they are further irritated they make a peculiar throbbing sound in the throat; this is not produced by the vocal cords, but by expelling the air in short jerks through the glottis. Frequently they will make for the intruder without provocation before he approaches closely, but if he steps back they will not follow him. They are surprisingly nimble in their movements on land and have a peculiar snake-like appearance. In spite of their ferocity when first approached, they soon get scared and make for the water, voiding the contents of the bladder and rectum as they go.

In the water they are extremely graceful, being lithe and active in all their movements. They are very inquisitive and will approach close to a boat to inspect it. If they are in the neighbourhood they can be attracted to a boat by gently hammering or tapping regularly on the gunwale or thwart.

Leopard seal are to be seen in Cumberland Bay much more commonly in the winter than in the summer. They come in especially when the bay is filled with ice from the

[1] Rudmose Brown, *Scottish Nat. Antarct. Exped.* IV, p. 194 (1915).

Nordenskjold glacier and can then be seen asleep on the floes. In the winter, too, they haunt the patch of kelp off the Marine Biological Station on King Edward Point, and can be seen bringing to the surface and devouring the fish which they catch there. In getting on to the ice floes they take astonishing leaps from the water, suddenly shooting out to a height of 6 ft., after first reconnoitring the place where they are going to land. In 1926 the Resident Magistrate, Mr E. Binney, showed the writer a photograph of a leopard seal that had jumped out of the water on to the back of a dead whale as it lay alongside the jetty of the whaling station.

The food of the leopard seal consists mainly of fish and penguins. As stated above, the members of the 'Discovery' staff often watched them catching fish off the Marine Biological Station during the winter. The stomach of one examined at Else Bay in September 1925 was full of small pieces of blubber, though digestion was too far advanced to be able to determine whether it was from seal or penguin. Leopard seal are always to be seen cruising about in the water at the places where the penguins land to go to their rookeries, and they take heavy toll of them. In eating a penguin the seal brings it to the surface and shakes it as a dog does a rat, and then, holding it by the belly, continues shaking until the skin is completely inverted. It then eats the carcass, discarding the skin and feathers. They have also been observed eating penguins at sea away from the rookeries. On one occasion one was seen to come up underneath a Giant Petrel that was swimming on the water and drag it down. The seal brought it to the surface when it was half drowned and devoured it after skinning it in the manner described above. When the sealers are rafting off the elephant-seal blubber to their ship a leopard seal will often follow them, biting large lumps out of the floating blubber and twisting and turning around in the water to detach them.

The young of the leopard seal are born in late August and early September. The females come ashore to give birth and are always strictly solitary. A foetus 3 ft. long was taken from a large female killed near King Edward Point in July 1925. In September 1925 a young one $3\frac{1}{2}$ ft. long was seen at Else Bay. It was lying on the beach near two females, neither of which appeared to take any interest in it. It was very tame, merely lifting up its head to look at us when we approached and not showing its teeth. It seemed to be very weak and feeble, having a thin body and disproportionately large head that appeared almost too heavy for its neck to support, for it wavered from side to side when it was raised. During November and December young ones from 6 to 7 ft. long are frequently to be seen on the beaches, having then left their parents. The young at this age make a loud shrill cry much like the noise of a ship's steam siren, and so remarkable is this likeness that on one occasion on hearing it during the night the people on King Edward Point turned out to see what ship was coming in. The young grow very rapidly, but are not mature for at least a year: the skull of one 9 ft. long, evidently born in the previous spring, killed at Grytviken in June 1925, still had the parietal foramen unclosed and $\frac{3}{8}$ in. in diameter.

The females are much bigger than the males, growing to 14 ft. long, whilst the length of a full-grown male is about 10 ft.

The flesh of the leopard seal is very good eating and was always a welcome addition to our larder during the winter. The brains, tongue, heart and liver are the best parts.

No information was collected as to the pairing habits or period of gestation of the leopard seal owing to its solitary and wandering mode of life.

The sealing licences allow the taking of leopard seal, and the annual catch is usually between fifty and one hundred. The blubber is not thick enough to produce much oil; neither does the price realised pay for preserving the skins, so that this species is not of particular interest to the sealer. It has been stated[1] that the leopard seal is a "ferocious pest, which preys on penguins as well as fish, and any diminution in its numbers may, perhaps, be viewed with equanimity". No reason is given for preferring penguins or fish to leopard seal.

Fur Seal, *Arctocephalus australis*, Zimm.

This species was formerly numerous in South Georgia, but is now practically extinct. In 1822 Weddell calculated that not less than 1,200,000 fur-seal skins had been taken there since 1775 and stated that they were then almost extinct. In 1874[2] 1450 skins were taken, 600 in 1875 and 110 in 1876. One fur seal was seen in 1885 or 1886 and three were taken in 1887. In 1892, 135 were taken. In 1905 a sealing-vessel could find none, but a few were taken in 1907. Larsen[3] states that 170 were caught in 1906, and 30 were seen together in 1911. Since then a few scattered examples have been seen, the latest being two on Willis Island in 1927.

[1] *Report of the Interdepartmental Committee on Research and Development in the Dependencies of the Falkland Islands*, Cmd. 657, p. 17, 1920.

[2] D. S. Jordan, *Fur Seals of the Pribilof Islands*, III, p. 307, Washington, 1899.

[3] *Loc. cit. supra*, 1920, p. 92.

PLATES XIX—XXIV

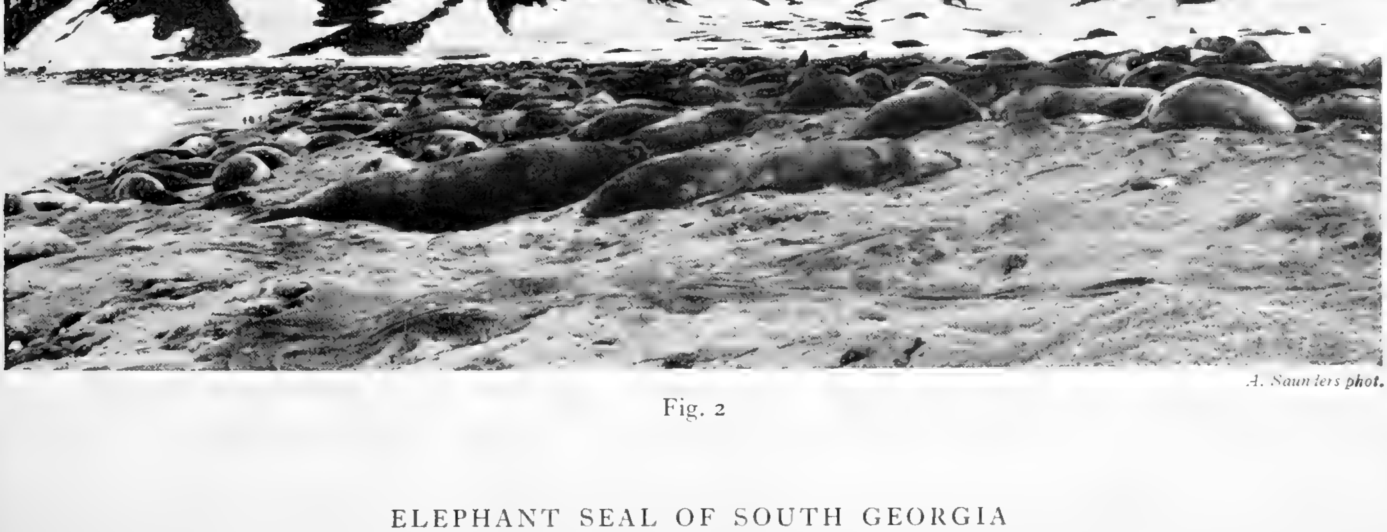
PLATE XIX

Fig. 1. General view of an Elephant seal rookery. Bachelor bulls are scattered on the landward side of the rookery. A sealing vessel lies in the bay and a group of sealers is flensing half-way along the beach.

Fig. 2. General view in an Elephant seal rookery, showing the crowded state of the beach.

A. Saunders phot.

Fig. 1.



A. Saunders phot.

Fig. 2

ELEPHANT SEAL OF SOUTH GEORGIA

[illegible]

[illegible]

PLATE XX

Fig. 1. A newly born Elephant seal pup and its mother. A portion of the attached umbilical cord can be seen below the abdomen of the pup.

Fig. 2. A cow suckling her pup. She is lying on her side while the pup suckles at the lower nipple; the upper one can be seen as a dark spot above the pup's nose.

A. Saunders phot.

Fig. 1.

A. Saunders phot.

Fig. 2.

ELEPHANT SEAL OF SOUTH GEORGIA

[illegible]

[illegible]
[illegible]

[illegible]

PLATE XXI

Fig. 1. A small harem of Elephant seal, a bull with four cows and their pups. A bachelor bull watches the harem from the water. The backs of the cows and pups are sprinkled with the sand thrown up. The head and neck of the central cow show well the light-coloured scars caused by the bites of the bull, while the neck and back of the bull are covered with the scars of wounds received in fighting. Notice the wet patch on the side of the bull's face, due to tears streaming from the eye.

Fig. 2. Elephant seal pups herding on the beach after leaving their mothers.

Fig. 3. A bull Elephant seal roaring, with the proboscis inflated. Compare with Plate XXII, fig. 1.

F. Hurley phot.

Fig. 1.

L. H. Matthews phot.

Fig. 2.

L. H. Matthews phot.

Fig. 3.

ELEPHANT SEAL OF SOUTH GEORGIA

PLATE XXII

Fig. 1. A sleepy bull Elephant seal, with the proboscis not inflated.

Fig. 2. An enraged bull Elephant seal roaring and rearing up on the hind part of the body.

Fig. 3. Two bull Elephant seal fighting.

A. Saunders phot.

Fig. 1.

A. Saunders phot.

Fig. 2.

A. Saunders phot.

Fig. 3.

ELEPHANT SEAL OF SOUTH GEORGIA

PLATE XXIII

Fig. 1. A moulting bull Elephant seal. Notice the old hair coming off in patches.

Fig. 2. A moulting bull Elephant seal. The proboscis is not yet fully developed, as this is a young full-grown bull, three or four years old. Notice the bare skin left where the sheets of old hair have peeled off, and the stream of tears flowing from the eye.

Fig. 3. A cow Elephant seal breathing through one nostril only.

F. Hurley phot.

Fig. 1.

F. Hurley phot.

Fig. 2.

A. Saunders phot.

Fig. 3.

ELEPHANT SEAL OF SOUTH GEORGIA

[illegible]

PLATE XXIV

Fig. 1. Elephant seal pups that have sunk into a depression in the snow, melted by the heat of their bodies.

Fig. 2. A cow Elephant seal calling to her pup.

Fig. 3. Sealers flensing an Elephant seal. The dorsal blubber has been divided into four pieces, of which the first is being peeled off. This photograph shows the thickness of the blubber. The sealing vessel lies at anchor off the beach.

A. Saunders phot.

Fig. 1.

L. H. Matthews phot.

Fig. 2.

L. H. Matthews phot.

Fig. 3.

ELEPHANT SEAL OF SOUTH GEORGIA

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SOUTHERN BLUE AND FIN WHALES

by

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(Plates XXV—XLIV, text-figs. 1–157)

INTRODUCTION

OBJECTS OF THE WHALING INVESTIGATIONS

The section of the Discovery investigations which consisted in direct observations on the whales brought into the whaling stations, required less elaborate preparations than were needed for the equipment of the ships, and it was therefore possible to start this branch of the work at a somewhat earlier date. The Marine Biological Station in South Georgia was opened in January 1925, and from the following February the observations were continued at South Georgia, and for a time at South Africa, until April 1927, during which period a total of 1683 whales were examined.

The present report is not to be regarded as final, for the investigations were reopened at South Georgia early in 1928, but in the meantime sufficient material has been gathered for a detailed examination of the results. There is still, of course, much to be done and the future prospects of the work are discussed towards the end of the report.

The procedure which has been followed in the work at whaling stations is based on the recommendations made in the *Report of the Interdepartmental Committee on Research and Development in the Dependencies of the Falkland Islands* (Cmd. 657, 1920). In this report the relation of the work on shore to the other investigations is explained, and a brief account is given of what was then known or conjectured of the distribution, migrations, breeding and other habits of the whales in question.

In discussing the problems which have to be studied it is necessary to remember that the main object of the work is to find out as much about the effect which whaling is having or is likely to have on the stock of whales as it is possible to discover by observations on the carcasses of whales which are brought into the whaling stations. The lines of investigation which may be expected to supply information bearing on this question may be roughly classified under the following headings: (1) a thorough examination of the specific characters (i.e. external features, bodily proportions, etc.[1]) of the various species, and the extent to which individual variation may occur; (2) an investigation of the reproductive processes and breeding habits, and the reproductive potentiality of the whole stock of whales; (3) the interrelations of breeding, migrations, feeding, etc.

[1] Osteological specimens are, of course, to be included in the examination of specific characters, but although some whale skeletons have been collected they are not ready for examination and cannot be reported on for some time.

Work under the first of these headings provides a basis upon which it will ultimately be possible to make a specific comparison between the whales of different localities (using this word in its broadest sense), and thus to ascertain whether there are, associated with different localities, any specific or sub-specific differences. From information of this kind one may be able to judge the possibility of the replenishment of the stock of whales in one locality from another, and to estimate within what limits it is possible for migrations to take place. The North and South Atlantic, for instance, must be regarded as two different localities in which both Blue and Fin whales commonly occur. They are rarely seen in equatorial waters as a general rule, but, as Harmer (1928) has pointed out, both species are caught off the coast of Ecuador, which is so near the equator that it is difficult to say whether they actually belong to the northern or southern hemisphere, or both. At any rate, the possibility of these whales crossing from one hemisphere to the other has to be considered. If it can be shown that there is even a slight racial distinction between the whales of the two hemispheres such a possibility is ruled out. Similarly, the whales found in South African waters must be compared in respect of their specific characters with those of the Dependencies of the Falkland Islands.

Perhaps the most important part of the work is concerned with the breeding of whales. This includes a study not only of their breeding habits, but also of their growth and life history. Information is needed on the seasons and localities at which pairing and parturition take place, the nature of the oestrous cycle, the frequency of the recurrence of pregnancy, the lengths of the periods of gestation and lactation, the rate of growth and the intervals between the various stages and events in the sexual life. With a knowledge of these processes it is possible to say in what circumstances hunting is liable to do the most damage and to judge the general ability of the stock of whales to withstand or recuperate from the effects of hunting on a large scale.

The study of breeding and growth is closely related to the problems of migration, distribution and feeding of the whales, many of which are, of course, beyond the scope of the work at whaling stations. It is here, however, that these direct observations on the whales may be made to supplement the work of the ships, which is concerned mainly with the whales' environment. The examination of the food in the stomachs of the whales, for example, is of value for comparison with the catches of plankton at sea, and by systematic measurements of the thickness of the blubber a check can be kept on the variations in the condition of the whales at different seasons.

Important information is to be had from a study of the different classes of whales which go to make up the populations of different localities. There is evidence of a certain amount of segregation of these classes (i.e. whales of different sexes, ages and stages in the reproductive cycle) and it is necessary to study their local movements and times of arrival and departure in different localities.

Since the breeding of whales is governed by a seasonal periodicity it is obviously desirable that observations should be made over the whole year, so that the whales can be studied at each stage in the reproductive cycle. The whaling season in the

Dependencies lasts only through the southern summer, but at South Africa it is conducted only during the winter. By visiting a whaling station at Saldanha Bay in Cape Colony for one season we were able to fulfil the double purpose of examining the whales in a different locality and of carrying the observations over a whole year.

On the South African coasts there are only two whaling centres of importance: at Saldanha Bay 60 miles north of Cape Town, and at Durban in Natal. A considerable number of whales are taken annually in these places, but the African coast as a whaling centre is hardly comparable with the Dependencies. At South Georgia, apart from the South Shetlands and South Orkneys, nearly 6000 whales were killed in the 1924–5 season. The two stations at Saldanha Bay took less than 1600 whales in 1925, and at Durban 1285 whales were taken in the same year. The average size of the whales at South African stations is also much smaller than at South Georgia and the South Shetlands.

It has already been explained that the work at South Georgia was conducted from the Marine Biological Station on King Edward's Point, at the whaling station of the Compaña Argentina de Pesca. Four whale boats operate from this station and the season lasts from October to May, as is also the case with the other companies at South Georgia. At South Africa the work was continued at Messrs Irvin and Johnson's station at Donkergat, Saldanha Bay. Here nine whale catchers were working during the season we were there, and the fact that with twice as many boats fewer and smaller whales were taken at this station than at South Georgia indicates the comparative richness of the latter locality from the point of view of the whaling industry.

We may take the opportunity here of acknowledging the courtesy we have received from the Norwegian community during the whole of our stay at South Georgia, particularly from Capt. V. Esbensen, the manager of the station at Grytviken, who has done much to facilitate our work.

THE SOUTHERN WHALING STATIONS

It is not within the scope of the present memoir to enter into an exhaustive description of the southern whaling industry, but a brief account of a southern whaling station and the routine of the whaler's operations will not be out of place.

The whale boats operate from one of two types of base. Either there is a shore station which is built at the water's edge in some cove or well-sheltered part of the coast, or there is a floating factory or factory ship which may be anchored throughout the season in a similar situation, or may operate at a distance from land. The central part of a shore station is the flensing platform, a wooden structure on which the dismemberment of the whale's carcass takes place, and which slopes gently down to the water. This platform may measure up to about 50 yards square and is fitted with a number of steam winches by means of which the flensing process is carried out. Built round the platform are sheds which house the various boilers in which the oil is extracted from the blubber, flesh, viscera and bones. Further back from the beach are a number of large tanks used for storing the oil. Various other buildings, such as living quarters, workshops, forges, store sheds, etc., bring the station up to the dimensions of a moderate-sized village. Altogether two or three hundred men are employed there.

Near the flensing platform is constructed a wharf or jetty for the accommodation of the whale boats and transport steamer. The latter is usually an oil tanker of about 8000 tons register which brings coal and other stores out to South Georgia and oil back to Europe. Two trips are generally made each year. The transport leaves South Georgia at the end of the season (usually the middle of May) with a full cargo of oil and with the majority of the men employed on the station. A few are left behind over the winter to take charge of the station and to prepare for the next season's work. In the following October the ship returns and within a few days whaling commences.

The floating factories are vessels of about 10,000 tons or more, and are equipped with all the necessary plant for the treatment of the carcasses. Their working expenses are less than those of a shore station, but their capacity is also less, and they are not able to utilize the carcass to the fullest advantage. The subject of floating factories, however, may be dimissed for the present as our own work has been conducted exclusively at land stations.

At King Edward's Cove four whale boats are employed by the Cia Argentina de Pesca. These boats spend nearly their whole time at sea, though they return to the station with their catches after an absence of from one to about three days. Usually they arrive during the night and are away again before dawn. Whales are generally to be found between ten and forty miles from the coast, and one or two at a time are usually brought in by the boats, though if they are only to be found a long way off the boats stay out longer and bring in a larger catch. It is desirable, however, that a whale should be brought back fairly soon after it is killed as decomposition sets in very rapidly, and, owing to the higher percentage of fatty acid which is formed, the value of the oil is seriously reduced in a whale which has been dead for several days. When whales are first brought in they are moored temporarily near the flensing platform, and when work starts in the morning they are hauled out of the water one by one and cut up with flensing knives aided by steam winches. By this means the biggest whale can be completely disposed of in little more than two hours. Work at the station commences at 6 a.m. and continues until 6 p.m. with intervals for meals. In the course of a day about twelve average sized whales can be dealt with, since work can be started on a second whale when the first is half finished.

The method of dealing with the carcass is as follows. A steel hawser connected with a powerful electric winch is attached to the whale's tail, and the body is drawn up until it is completely out of the water. It is now almost invariably lying half on its back and half on one side. Three long slits are cut in the blubber from the head to the tail, one from near the eye down the shoulder and flank (now the top of the whale) and the other two from the chin on one side and near the blowhole on the other side, along the body and as near the ground as possible. This virtually separates the blubber into three longitudinal strips, upon one of which the whale is resting. The two free strips are simultaneously peeled off from before backwards by wires from steam winches. By means of flensing knives the workers loosen enough blubber at the head end for the attachment of the wires, and separate it from the flesh as it is pulled away. After the tongue and a mass of filmy connective tissue beneath it have been removed from the lower jaw and thorax, the carcass is rolled over by means of a tackle passed over the shoulder and attached to the lower flipper, and the third strip of blubber is removed in the same way. The blubber is drawn away to a corner of the flensing platform, where it is cut into smaller pieces and put through a machine which slices it into yet smaller strips which are shot into the blubber boilers. A number of steam jets open into the boilers, and these rapidly melt out the oil.

Next the lower jaw is removed and the carcass is drawn over to another part of the platform so that a fresh whale can be taken up. The baleen plates, which are but lightly attached to the skull, are now removed *en bloc*. The head is separated from the body at the condyles and drawn up to the "bone platform" which is built immediately above a set of pressure boilers. Here it is cut up by a steam saw and the pieces are dropped into the boilers beneath.

The carcass is now opened up in the following manner. The whale is lying on its left side and a longitudinal cut is made down the mid-ventral line through the abdominal muscle wall and as far back as the anus. The wire from a winch is attached to the upper flipper and drawn tight enough to put considerable tension on the shoulder. Cuts are now made through the cartilaginous attachment of the ribs on this side to the backbone and when all these have been disarticulated the whole right shoulder, the right side of the abdominal wall and right side of the thorax come away with all the viscera attached. The shoulders and ribs are taken up to the bone platform, and there are separate boilers near by for the flesh and entrails. The remaining part of the carcass consists simply of the vertebral column with a considerable quantity of flesh. These are easily separated and taken to the appropriate boilers and the actual work of dismemberment is completed.

The best oil is obtained from the blubber, and with the least amount of trouble, but the bones provide a grade of oil which is very little inferior. From the meat, and especially the "guts", the oil contains a higher proportion of fatty acids and is thus of a poorer quality. The bonemeal and guano, consisting of the dried and powdered remains of the bones and flesh are sold as fertilisers. From the blubber there is hardly any residue left except a small quantity of fibrous material. The baleen is in fact the only part of the whole carcass which is not utilized.

METHODS OF WORK

Before an account is given of the routine observations made at the whaling stations and the methods by which conclusions can be drawn, something should be said of the investigations of this kind which have been made by previous workers.

The first attempt to carry out systematic observations on the whales brought into the whaling stations appears to be that of Cocks (1886–90), who published a series of papers on the catches at some Lapland whaling stations. He examined only a few whales personally, however, and most of his information was derived from the whalers.

Important work was done by True (1904), who examined some whales at a Newfoundland station in the course of his investigation of the specific identity of the whalebone whales of the western North Atlantic. True's observations were mostly confined to bodily measurements and the external characters, and were not so much concerned with the breeding and other habits of whales. The paper consists of an exhaustive examination of the specific characters of the Fin, Blue, Humpback, Little Piked whale, and North Atlantic Right whale, and is based to a large extent on the study of museum specimens. It contains excellent descriptions, however, of the external characters of these northern whales, and summarizes in many cases the descriptions given by other authors. The main object of the paper was to show that the whalebone whales of the western section of the North Atlantic are specifically identical with those of the eastern section.

Later, some observations were made by Haldane (1904–10) on whales brought into a Shetland whaling station. He published a series of brief papers dealing with various notes on the general biology of the whales he examined.

Lillie (1910) visited an Irish whaling station at Innishkea, Co. Mayo, and published a paper which was principally concerned with some anatomical details. The same author (1915) visited a whaling station and two floating factories at New Zealand and published some useful observations on the anatomy and habits of the Humpback.

Burfield (1912) and Hamilton (1914 and 1915) made some observations at the Bellmullet station in Ireland. The observations included the total length of the whale and twelve other measurements, notes on colour and some other external characters, and records of the stomach contents, external and internal parasites and various pathological specimens. A few foetuses also were measured.

At almost the same time (in the 1913–14 season) observations of the same kind were instituted, apparently for the first time in the southern hemisphere, by Major Barrett-Hamilton, who examined nearly 300 whales at Leith Harbour, South Georgia, between November 14, 1913, and January 16, 1914. His untimely death at South Georgia put an end to this work, and his notes were handed over to Mr M. A. C. Hinton of the British Museum (Natural History), who used them as the basis of an important paper (1925) on whales and whaling, in which also the results of various previous authors are summarized. In this paper all Barrett-Hamilton's observations are set out and various problems discussed, in particular those relating to the breeding and migrations of whales. Barrett-Hamilton's observations alone were not sufficiently extensive to lead to any very general conclusions as to the habits of whales, but the chief value of the paper lies in the fact that material from various other sources is brought together and considered as a whole. As an example of this, extensive lists of foetuses from the

North Atlantic are compiled from the records given by Collett (1911), Guldberg (1886), Cocks (1886–90), True (1904), Hamilton (1915) and others.

Several papers have been published by D'Arcy Thompson (1918, 1919 and 1928) which consist mainly of a general examination of the catches at Scottish whaling stations during the last twenty years, with notes on the various species and their habits, but these papers are not based on actual examination of the whales at the stations.

The routine of observations which has been carried out in our own work has consisted in making notes, in the case of each whale, on the following subjects: (1) Measurements of bodily proportions. (2) Description of the external characters. (3) Blubber, food, parasites, etc. (4) Genitalia. All measurements are recorded in metres or centimetres.

As the whale is drawn out of the water on to the flensing platform a note is made as to the date, species and sex, and the measurement series is commenced. The measurements are as follows:

1. *Total length.* This is measured in a straight line from the tip of the snout to the notch of the tail flukes. It is appreciably shorter than the overall length of the whale, but is the only reliable method of measuring the length.

2. *Lower jaw; projection beyond tip of snout.* This measurement is very rarely taken since, when the whale is lying on the flensing platform, the lower jaw is hardly ever in its natural position.

3. *Tip of snout to blowhole.* This is measured to the middle of the two slits of the blowhole.

4. *Tip of snout to angle of gape.* This is not a very reliable measurement and is often omitted when there is any difficulty in locating the angle of the gape.

5. *Tip of snout to centre of eye.*

6. *Tip of snout to tip of flipper.* This measurement must of course be taken only when the flipper lies in its natural position.

7. *Eye to ear, centres.*

8. *Notch of flukes to posterior emargination of dorsal fin.* This is the most reliable means of fixing the position of the dorsal fin.

9. *Flukes, width at insertion.* This is measured from the notch of the flukes to the nearest part of the anterior margin of the flukes.

10. *Notch of flukes to anus.*

11. *Notch of flukes to umbilicus.* This is taken to the centre of the umbilicus and can be done before or after flensing.

12. *Notch of flukes to end of ventral grooves.* The ventral grooves sometimes do not end evenly at a definite point, in which case this measurement cannot be taken.

13. *Anus to reproductive aperture, centres.* The centre of the reproductive aperture in females is taken as opposite the posterior end of the clitoris, and in males at the centre of the base of the penis when the latter is extruded.

14. *Dorsal fin, vertical height.*

15. *Dorsal fin, length of base.* This is a rather unsatisfactory measurement as it is very difficult, especially in the case of Blue whales, to say where the anterior part of the fin begins.

16. *Flipper, tip to axilla.* The axilla is taken as the most anterior point on the dorsal rim of the flipper.

17. *Flipper, tip to anterior end of lower border.*

18. *Flipper, length along curve of lower border.* Taken with the preceding measurement this gives the relative curvature of the flipper.

19. *Flipper, greatest width.*

20. *Severed head, condyle to tip.*

21. *Skull, greatest width.* This is not a very reliable measurement and can usually be taken only indirectly. The width of the head is measured from eye to eye, and that of the skull is determined by feeling for the bone behind the eye with the point of a knife.

22. *Skull length, condyle to tip of premaxilla.* To take this measurement it is necessary to cut down the tip of the snout until the premaxilla is found.

23. *Flipper, tip to head of humerus.* The head of the humerus is not often accessible, so that it is difficult to take this measurement systematically.

24. *Tail, depth at dorsal fin.* This is taken in a straight line from a point opposite the base of the dorsal fin.

25. *Flukes, notch to tip.* As the flukes are always cut off at sea this can only be taken in the case of foetuses.

26. *Flukes, total spread.* Taken only in the case of foetuses for the same reason.

Only measurements 1 to 16 can be taken when the whale is first drawn up. The rest are taken later on as opportunity permits.

Notes are made on the external characters as follows:

1. *Colour.* Routine notes are made only on features which are subject to variations. In Blue whales observations are made on such points as the number of white flecks over the posterior part of the ventral grooves, the size and degree of differentiation of the spots of pale colour over the back and flanks, the striations on the ventral surface of the tail flukes, etc. Among Fin whales there is some variation to be noted in the degree to which the dark pigment extends over the ventral surface, of which the greater part is white. In some also the dorsal pigment is lighter than in others.

2. *Baleen.* In the case of a large number of whales the number of baleen plates has been counted, and in still more cases the longest plates have been measured from base to tip. The spacing of the plates has also been measured. It does not appear, however, that these routine observations on the baleen lead to any very useful results, though measurement of the length of the plates in young whales has some bearing on the study of the whale's growth and feeding.

3. *Hair.* The hair which occurs on the mandibles and snout is subject to some variation, and routine notes as to the numbers and disposition of the hairs were made for some time. It does not appear, however, that differences were more than individual variations.

4. *Ventral Grooves*. Here again the numbers of grooves vary to some extent. They were counted in a number of cases, sufficient to show that the number depends only on individual variation. There is also some variation in the small grooves in the neighbourhood of the genital aperture in females.

5. *Palate and Tongue*. These show very little variation, and comparatively few notes were made under this heading.

As soon as the flensing process is commenced measurements can be made of the thickness of the blubber. The flensers make certain long cuts running longitudinally down the body of the whale in dorsal, lateral, and ventral positions, and piercing just to the depth of the blubber. A measurement was made regularly at two points on these cuts, the first at the apex of a V-shaped deflection of the dorsal cut near the shoulder, and the second at a point on the lateral cut opposite the dorsal fin. It is the latter rather than the former measurement which has been used in estimating the condition of the whales at different seasons.

Any external parasites are counted except when present in large numbers, and a note is made as to their position. Remarks are made also as to the number of healed or open scars which commonly occur on the flanks, and the appearance of a film of diatoms on the skin is noted.

Before flensing, observations are made on the external genitalia. In the case of males it has usually been noted whether the penis is extended or retracted, though this observation does not now appear to have much value. The penis is sometimes measured, but this should not be done unless one is certain that it is fully extruded. In the case of females records are made as to whether the genital aperture is open or closed and whether the vagina is congested or not. The mammary glands are best studied after the removal of the blubber, but if lactation is in progress it can usually (though not always) be observed as soon as the whale is out of the water. On one or two occasions milk has been found spouting out of the nipples as the whale was drawn up, and it was possible to collect a pure sample of it. By means of an incision into the gland after flensing, if the whale is fresh one can see at a glance whether lactation is taking place or not, or whether the whale is immature. In many cases the depth of the gland has been measured, and samples were occasionally preserved for histological examination.

At a later stage, when the longitudinal cut has been made down the abdominal muscles, one can draw out the internal genitalia by opening the peritoneum at the posterior end of the abdominal cavity. In males the testes are to be found against the coils of intestine just behind the bladder, and they can easily be pulled out and cut away. In females the uterus is found in the same way, but as it is often very large some trouble may be experienced in pulling it completely out, and it may be difficult to locate the ovaries which are often concealed in fold upon fold of the blanket-like uterine mesentery.

In the case of males the length, breadth and depth of the testis are measured, and if it is sufficiently fresh a small piece is preserved for histological examination. In the case of adult females (in immature females there is little object in systematically examining the genitalia) the ovaries are examined, and if a functional corpus luteum is present the uterus is searched from end to end for signs of a foetus. Before being opened, however, if there is not a large foetus present, the width of the uterus is measured across one cornu as it lies on the platform. After it is opened a note is made if there is congestion of the internal wall, and in some cases a piece is preserved for histological examination.

The ovaries are examined in some detail. A full series of observations consists in measurements of size and weight, counting all the corpora lutea, fresh and old, and measuring each in three dimensions, and describing the condition of the Graafian follicles and measuring the larger ones. It appears now, however, that if the presence of a functional corpus luteum, the number of corpora lutea and the size of the largest follicles are noted, the rest is not of much importance.

Shortly after the internal genitalia become accessible the stomach is exposed by the opening up of the carcass, and can be split with the touch of a knife. The possibility of the stomach being damaged by the harpoon, and the contents thus escaping, has to be borne in mind when it sometimes appears to be empty.

The series of observations is usually brought to a close by a brief examination of the intestines for internal parasites. Very occasionally it is possible in the final stages of the dismemberment of the carcass to examine the degree to which the vertebral epiphyses have fused with the centra.

When work is finished at the whaling station any specimens are taken back to the Biological Station and the notes are entered up in log-books. These are in the form of large ledgers of which three patterns are kept. The first, for general notes, has a double page for each whale, the pages being divided into a number of sections in which notes can be made under the various headings such as colour, food, internal genitalia, etc. In the second book all the measurements of bodily proportions are entered, and in the third particulars of every foetus found, including bodily measurements, external characters, etc.

The primary difficulty of investigating the habits of whales is that it is almost impossible to make direct observations on them. It is for instance impossible to keep one whale or a group of whales under observation for any length of time and direct observations on their breeding habits have been few and far between. Indirect methods must therefore be employed. By observations at whaling stations information is mainly gained (apart from questions regarding specific identity) by studying the seasonal changes which take place through the year in whales of the same species and sex and in the whale population as a whole. For instance the changes which take place through the year in the lengths of foetuses provide information on the seasons of pairing and parturition and the rate of growth of the foetus; the seasonal changes in the condition of the reproductive organs give rather more direct evidence on the breeding season; the times of year at which ovulating and lactating females and young calves are most abundant are to be examined in connection with the general sexual cycle; and the movements and migrations of the whales are to some extent reflected in the seasonal variations of the food and thickness of the blubber.

Perhaps the greatest difficulty in investigating the habits of whales lies in the fact that they do not conform to any definite rules. For instance there is an unmistakable pairing season in winter, but it is only the season at which the maximum number of pairings takes place. It appears that breeding can go on exceptionally through most, though probably not all, of the year. Again, the majority of whales leave the Dependencies in autumn on their northward migration, but there are always some to be found there throughout the year. Such examples could be extended indefinitely, and it is in consequence of this general irregularity that it is necessary to have a fairly large bulk of material on which to base inferences about the breeding and other habits of whales. The most that can be done in fact is to frame general rules about the behaviour of the majority, based on the average of a large number of individuals.

Through the courtesy of the Director of the British Museum (Natural History) we have received much assistance in some cases where a specially large number of whales has been required, from an examination of the Museum's statistics of the catches at whaling stations. These have been compiled by Sir Sidney Harmer from the returns of the whaling companies and give the date, species, sex, length and foetuses of many thousands of whales caught in various localities over a number of years. Much useful information is to be derived from these statistics, but their value is impaired by the fact that the figures cannot always be regarded as necessarily quite accurate, especially those relating to the sizes of the whales and the occurrence and lengths of the foetuses. Sir Sidney Harmer has, however, made an analysis of some of these figures in several reports by the British Museum to the Colonial Office on the progress of the whaling industry, and further reference to his work will be made later.

MATERIAL AND DATA

The whales examined in the course of the work at South Georgia and South Africa may be tabulated as follows:

		South Georgia			S. Africa	Total	
		Feb. to May 1925	Season 1925–6	Season 1926–7	Season 1926		
Blue	Males	50	58	155	120	383	
	Females	58	71	146	127	402	
	Total	**108**	**129**	**301**	**247**		**785**
Fin	Males	56	210	61	114	441	
	Females	75	139	62	75	351	
	Total	**131**	**349**	**123**	**189**		**792**
Sei	Males	—	—	14	4	18	
	Females	—	—	49	6	55	
	Total	—	—	**63**	**10**		**73**
Humpback	Males	1	5	—	2	8	
	Females	1	13	—	2	16	
	Total	**2**	**18**	—	**4**		**24**
Right	Males	—	1	—	1	2	
	Females	—	—	—	1	1	
	Total	—	**1**	—	**2**		**3**
Sperm	Males	—	—	4	1	5	
	Females	—	—	—	1	1	
	Total	—	—	**4**	**2**		**6**
				Total for all species			**1683**

The British Museum statistics available up to date are as follows:

Locality	Period covered	Number of whales
South Georgia	1913–25	37,462
South Shetlands	1918–24	17,291
South Orkneys	1922–26	1,749
Cape Colony	1920–25	3,650
Natal	1922–26	4,845
Angola	1924–25	781

Work was started at Grytviken, South Georgia, on February 5, 1925. By this date, the South Georgia whaling season was half finished, but both Blue and Fin whales were fairly plentiful and 241 whales were examined up to May 11 before the stations closed for the winter. Among these Blue and Fin whales were fairly equally represented and both large and small specimens were plentiful. The average size of the Blue whales, however, was small, more than half being actually immature. The catching was fairly regular during February, but few whales were taken in March until towards the end of the month. There was no special feature about the catches in April and May, except that fewer whales were caught as the season advanced.

The 1925–6 season opened in the middle of October, the first whale being examined on October 15. Up to Christmas the whales were phenomenally scarce, and of both species those which were taken were on the average very large. At the end of December there was a sudden and enormous increase in the numbers of whales, due to the unexpected appearance of an immense quantity of male Fin whales about 70 miles off the north-east coast of South Georgia. Later on they approached closer to the island and began to feed, and more females were caught with them. Blue whales remained scarce until the latter part of February and the beginning of March when a fair number of small ones were caught. The average size of the whales of both species declined considerably during the last two months of the season. The greatest number was caught in January and February, and of these the vast majority were Fin whales. The season continued into May, but we were unable to examine any more whales after the end of March owing to our departure for South Africa early in April. The total number of whales measured at South Georgia from February 1925 until Christmas was 296, but by March 29, 1926, the figure had risen to 738.

The work was resumed at Messrs Irvin and Johnson's whaling station at Saldanha Bay, Cape Colony, on June 15, 1926. Saldanha Bay lies about 60 miles north of Cape Town, and the whales are mostly caught from 20 to 30 miles off this part of the coast. Four hundred and fifty-four whales were examined between June 15 and October 11. The catches here are quite different from those at South Georgia except in the fact that the great majority are Blue and Fin whales. The majority of the whales are small and immature, only 10–20 per cent being adult. At South Georgia again there is a great deal of variation in the numbers of whales caught at different times, whereas at Saldanha Bay they are brought in in moderate numbers with great regularity throughout the season. This is partly due to the more settled weather off the African coast, but there is no doubt at all that the local whale population is subject to far less fluctuation off the south-west African coast than in the neighbourhood of South Georgia.

We left the Cape in October 1926, arriving again in South Georgia in November. Work was recommenced on November 15 and continued from then to April 25, 1927. This season's catch showed certain points of special interest. A feature of the first part of the 1925–6 season was the great scarcity of whales, especially of Blue whales. The 1926–7 season was characterized by a great abundance of Blue whales which was maintained right on to March, and a scarcity of Fin whales in the earlier part of the season. From the whaling industry's point of view the season was even more successful than the preceding one, for although whales were at no time quite so abundant as in January and February 1926, the supply was plentiful throughout the season. As in the last season the whales caught in November and December were on the average very large. During the second half of the season smaller whales began to appear and the average size became considerably less. A peculiar feature of this season's catch was the appearance towards the end of February of Sei whales. These were the first which had been caught at South Georgia during the whole of our stay, and through March and April they became very plentiful, 63 being examined before the end of the season.

It should be mentioned that the 1926–7 season was characterized by the phenomenal amount of ice which had drifted as far north as, and even farther than, South Georgia. There is little doubt that this was correlated in some way with the exceptional abundance of Blue whales throughout the season.

In May 1927 the Marine Biological Station was closed and the staff returned to England. It was reopened early in 1928 and work on the same lines was started again at the whaling station on February 15 by Messrs Fraser and Rayner.

EXTERNAL CHARACTERS

Among all the whales examined six distinct species are included, and representatives of each of these have occurred both at South Georgia and at Saldanha Bay. Not many whales have been examined apart from Blue and Fin whales, and the present memoir is really concerned only with the two latter species. The other species will no doubt be dealt with in due course when more material has been collected.

The following are the names now generally adopted for the six species mentioned above:

MYSTACOCOETI (Baleen whales)

BALAENOPTERIDAE (Rorquals)

Blue	*Balaenoptera musculus*
Fin	*B. physalus*
Sei	*B. borealis*
Humpback	*Megaptera nodosa*

BALAENIDAE (Right whales)

Southern Right ... ... *Balaena australis*

ODONTOCOETI (Toothed whales)

PHYSETERIDAE

Sperm ... ... *Physeter catodon*

Several other species not included in the above list have been taken from time to time in the Dependencies, but their value is negligible from the point of view of the whaling industry. Among these are the Bottlenose (*Hyperoödon*), the Killer or Grampus (*Orcinus orca*), the Lesser Rorqual (*Balaenoptera acutorostrata*) and the Ca'aing whale (*Globicephala melaena*). The Killer, though of little value, may be said to have some economic importance owing to its habit of occasionally attacking the larger whales and their calves.

At South African stations one other species is frequently taken, namely Bryde's whale (*Balaenoptera brydei*). This whale is not very well known, but it resembles the Sei whale and has been described by Olsen (1913, 1914/15 and 1926). Unfortunately none was brought in to the station at Saldanha Bay during our work there.

A general account of the bodily proportions and external and specific characters of Blue and Fin whales can best be given separately under each species.

BLUE WHALES

GENERAL REMARKS

This species together with the Fin whale constitutes over 90 per cent of the catches of most southern whaling stations. The two are caught nearly everywhere in roughly equal numbers, but the value of the Blue whale is greater owing not only to its greater size, but also to the fact that even allowing for its size, the yield of oil is slightly greater. The average yield of oil from a Blue whale is 70 to 80 barrels, but as many as 305 barrels were once obtained from a Blue whale at Walvis Bay, West Africa (see Risting, 1928, p. 41). A higher bonus is paid to the whalers for the capture of a Blue whale than for any other species, so that when more than one species is open to attack it is usually the Blue whale which suffers.

This species is widely distributed in temperate and arctic and antarctic waters, and it has been hunted more or less regularly since the invention of the harpoon gun, though during the period when the Humpback formed the main prey of the whalers, the largest specimens were sometimes avoided owing to the comparative lightness of the gear then used. At South Georgia it was caught in comparatively small numbers from 1904, when the industry started there, until about 1913 when the Humpback fishery began to decline. With some fluctuations a great increase in the catches of Blue whales took place during and after the war, and in the recent 1926–7 season greater numbers of this species were taken than ever before.

The largest Blue whale measured by us was No. 667. This was a female 28·5 m. long, or 93 ft. 6 in. Only two others measured 28·0 m. or over (No. 1281, 28·2 m., and No. 1417, 28·0 m.), but there were ten measuring between 27·0 m. and 28·0 m. All these were females. The method of measuring the total length from the tip of the snout to the notch of the flukes is the shortest measurement which could be called the total length, and it has already been explained that this is appreciably shorter than the overall length. One would therefore hardly expect to find a whale measuring 100 ft. (30·48 m.) according to this method, but if the projection of the lower jaw beyond the snout, and the tips of the flukes beyond the notch are included in the measurement, 100 ft. is not at all an improbable length for a Blue whale. The largest whale measured by Barrett-Hamilton at South Georgia was 95 ft. long, but this was taken from the notch of the flukes to the tip of the mandible. The length to the tip of the snout was 92 ft. This appears to be the longest measurement ever made up till now which can really be regarded as authentic. In a recent paper based on the statistics of the Norwegian Whalers' Association, Risting (1928) quotes five instances of whales measuring 100 ft. or more. The measurements, however, appear to be unreliable, for according to Risting's data the smallest pregnant Blue whale measured 63 ft. or 20 m. (allowance being made for Norwegian feet) and 11·4 per cent of the 71 ft. (22·5 m.) whales were pregnant. Now Blue whales are rarely adult at a length of less than 23·5 m. and it is in our opinion extremely improbable that 11·4 per cent of those measuring 22·5 m. were pregnant, or that a 20·0 m. Blue whale could be pregnant, and it must be supposed that some of the measurements were inaccurate.

The size of the Blue whale is also discussed at some length by True (1904) who concludes that the maximum authentic measurement of a Blue whale from the North Atlantic is 88 ft. 7 in. or 27·0 m. Authentic measurements from the South Atlantic were not to be had at that time and it appears that in the North Atlantic the whales in general do not attain to so great a size as in the south. More recently, however, a huge Blue whale, said to measure 98 ft., was killed in the Panama Canal, and Harmer (1923), from an examination of the cervical vertebrae, estimates that the reputed length was not exaggerated. The fact that the average size of the Blue whales of South Georgia is considerably greater than that of the corresponding form in the North Atlantic is commented on by Hinton, who suggests that if it could be shown that the Blue whales of the two regions do not mingle in equatorial waters, the difference in size might be regarded as sufficient ground for recognizing the two forms as distinct sub-species. In the same paper, however, Hinton mentions that the small size of the whales examined by True at Newfoundland suggests that during the whaling season the herds in that region consist principally of adolescent individuals with a few young adults. In view of the fact that at south-west African stations the average size of the whales is extremely low, solely on account of the high percentage of immature whales which are caught there, it does not seem impossible that a similar factor may operate in more than one part of the North Atlantic and that the comparatively small average size of the whales taken there may be due to a high percentage of immature whales in the catches.

Before going on to an analysis of the systematic measurements of bodily proportions it will be convenient here to examine the sex ratio and the differences which exist between the two sexes.

In investigating the proportions between the numbers of existing male and female whales certain difficulties arise which make it impossible to estimate the ratio with accuracy. It is certain that Rorquals of one sex sometimes associate in large herds, and it may be assumed that members of one sex may move to some extent (though perhaps a limited extent) in different places or at different times from members of the other sex. Consequently one sex might actually exist in smaller numbers than the other and yet be caught in greater numbers in some particular locality.

The ratio of the numbers of each sex which are born could be estimated from the sex ratio of foetuses, but the number of foetal records is hardly great enough for this purpose. Some good material, however, is to be found in the statistics of the catches at various whaling stations, for here there are records of the numbers of each sex taken through a considerable number of seasons and at several different localities, and the number of whales recorded is so large that it might be expected to some extent to swamp any differences due to local movements of the whales.

The British Museum statistics cover the following localities and seasons:

(*a*) *Dependencies of the Falkland Islands.*

South Georgia, 1913–25	18,484	Blue whales
South Shetlands, 1918–24	7,625	,,
South Orkneys, 1922–26	519	,,

(*b*) *South Africa.*

Cape Colony, 1920–25	2,667	,,
Natal, 1922–26	927	,,

Analysis of these figures gives the following results:

(*a*) *Dependencies of the Falkland Islands.*

Of all whales recorded 53 per cent were males.

Of 22 seasons in different localities there were five with from 51 to 57 per cent of females. One season had equal numbers of males and females. The remaining 16 seasons all showed a majority of males. Of these, 14 seasons showed 50 to 60 per cent of males and two seasons showed between 60 and 70 per cent of males.

(*b*) *South Africa.*

Of all whales recorded 53 per cent were females.

Of 14 seasons in different localities 10 showed a majority of females, all between 50 and 60 per cent. In the four remaining seasons there were 51 to 58 per cent males.

From the above we see that while males have been found to be more numerous at South Georgia and the other Dependencies, at South African stations larger numbers of females have been taken. Among the Blue whales examined by us at both localities there was a slight majority of females. 51 per cent of the whales and 60 per cent of the foetuses were female. The results are therefore rather inconclusive though the total of all Blue whales, of which there are records, consists of 48 per cent females and 52 per cent males. Any attempt to explain these differences must, however, be very speculative. The main fact is that in general there is very little difference in the abundance of the two sexes.

It is well known that among the Rorquals the female reaches a greater size than the male, and it will be interesting to examine briefly the extent of the difference which exists. The largest recorded specimen of each sex hardly provides a fair comparison in itself. Perhaps the best criterion of the difference in size is to be found in a comparison of the lengths at which each sex becomes adult. It will be shown later that up to a point the rate of growth of the two sexes is probably equal, but that the female appears to begin growing faster than the male some time after it is weaned, and that when sexual maturity is reached there is a definite difference between the two. The mean length at which sexual maturity is reached in the female Blue whale can be fairly accurately estimated at 23·7 m. and the corresponding length in the male at 22·6 m. Thus there is approximately 1 m. difference between the two or the length of the male is 95·4 per cent of that of the female. The largest female measured was 28·5 m. and the largest male only 26·45 m. Thus although the largest specimen met with of either sex is perhaps a matter of chance, this seems to show that there must be an increased divergence in size after maturity is reached. The difference between these two specimens was 2·05 m., and the length of the male was 92·5 per cent of the female.

Besides the difference in size there are one or two differences between the sexes in respect of the bodily proportions, but these will be considered in the general analysis of the measurement records.

EXTERNAL PROPORTIONS

It has already been explained that an essential part of the work at whaling stations is to establish as thoroughly as possible the external characters of the southern whales and the limits of the ordinary individual variations which may occur. There has been no evidence to show that the southern whales differ specifically from the corresponding northern forms, or that there are racial distinctions among the southern species themselves, but the equatorial regions appear to constitute something of a natural barrier between the whales of the two hemispheres (so far at least as the genus *Balaenoptera* is concerned) and the circumstances are therefore not unfavourable to the development of separate sub-species. Similarly, it is not proved that the whales of the Dependencies are the same whales which are found at a different time of year in South African waters, so that here again some distinction may exist. Consequently a basis is required for the comparison of the whales of different localities, and the first step will be to quote the average condition (in respect of the external characters) of a large number of whales in each region.

The bodily proportions, recorded by the system of measurements described on p. 265, are of course included in this connection among the external characters. The entire series of measurements has hardly ever been carried out on any one whale, for some of them, such as the length of the flipper measured from the head of the humerus, are difficult to obtain and have been performed only on a small number of whales. However, a more or less complete series has been recorded in some 783 Blue whales and 692 Fin whales.

The actual measurements of each whale are of course of little value for purposes of comparison, and they have therefore been reduced in the case of each whale to percentages of the total length.

As a preliminary analysis of the measurements the following table shows the mean value of all the measurements taken for male and female Blue whales, expressed as percentages of the total length:

Measurement	South Georgia				South Africa				Total			
	Males		Females		Males		Females		Males		Females	
	Mean value	No. of measurements	Mean value	No. of measurements	Mean value	No. of measurements	Mean value	No. of measurements	Mean value	No. of measurements	Mean value	No. of measurements
1 Total length	100	—	100	—	100	—	100	—	100	—	100	—
2 Lower jaw, projection beyond tip of snout	1·53	8	1·72	10	—	—	1·00	2	1·53	8	1·52	12
3 Tip of snout to blowhole	17·93	238	18·03	243	16·90	116	17·07	123	17·59	354	17·71	366
4 Tip of snout to angle of gape	19·36	105	19·05	107	18·88	102	18·75	91	19·12	207	18·91	198
5 Tip of snout to centre of eye	20·53	255	20·40	266	19·52	119	19·60	126	20·21	374	20·14	392
6 Tip of snout to tip of flipper	42·99	229	43·00	230	42·20	106	42·18	110	42·74	335	42·73	340
7 Eye to ear (centres)	5·49	215	5·35	218	5·36	115	5·31	116	5·44	330	5·34	334
8 Notch of flukes to posterior emargination of dorsal fin	24·46	169	24·56	184	25·01	101	25·28	101	24·67	270	24·82	285
9 Flukes, width at insertion	5·17	245	5·24	249	5·24	120	5·26	126	5·20	365	5·25	375
10 Notch of flukes to anus	28·98	256	29·19	268	29·85	116	30·34	123	29·25	372	29·55	391
11 Notch of flukes to umbilicus	45·50	252	45·49	259	46·93	115	46·95	124	45·94	367	45·96	383
12 Notch of flukes to end of ventral grooves	42·52	157	42·82	163	44·20	91	45·40	99	43·13	248	43·79	262
13 Anus to reproductive aperture (centres)	6·13	239	2·57	268	6·90	107	2·67	118	6·37	346	2·60	386
14 Dorsal fin, vertical height	1·28	154	1·23	183	1·35	96	1·23	101	1·30	250	1·23	284
15 Dorsal fin, length of base	4·49	173	4·19	195	4·53	108	4·38	105	4·51	281	4·26	300
16 Flipper, tip to axilla	9·84	224	9·85	223	9·98	109	9·74	114	9·89	333	9·81	337
17 Flipper, tip to anterior end of lower border	13·20	159	13·13	175	13·10	90	12·90	101	13·17	249	13·05	276
18 Flipper length along curve of lower border	13·88	152	13·85	171	13·81	88	13·64	98	13·85	240	13·77	269
19 Flipper, greatest width	3·66	171	3·65	181	3·68	87	3·64	98	3·67	258	3·65	279
20 Severed head, condyle to tip	24·81	170	24·93	183	23·82	66	24·26	67	24·53	236	24·75	250
21 Skull, greatest width	11·53	156	11·53	174	10·45	64	11·30	55	11·21	220	11·48	229
22 Skull length, condyle to tip of premaxilla	26·99	1	23·81	2	23·02	3	22·10	2	24·01	4	22·93	4
23 Flipper, tip to head of humerus	14·71	1	15·24	2	14·59	2	13·86	3	14·63	3	14·41	5
24 Tail, depth at dorsal fin	9·57	142	9·37	129	8·61	96	8·64	91	9·18	238	9·07	220

The number of measurements actually made under each heading is quoted to show the reliability of each mean result. The majority are based on over a hundred readings and are therefore very reliable, but measurements Nos. 2, 22 and 23 are based on two or three readings only and owing to the individual variation which naturally occurs, are not to be depended on for purposes of accurate comparison.

It is seen from the table that the only marked difference in bodily proportion between the sexes is that shown by measurement No. 13, in which the mean distance between the anus and reproductive aperture works out at more than twice as great in the male as in the female. In the other measurements the differences are comparatively insignificant, though there is a very slight indication that in males the head is relatively slightly larger than in females, while in the latter the tail measurements are slightly greater. It will be shown below, however, that as a whale grows larger the head becomes slightly larger in proportion to the tail and the slight difference in these measurements is very probably due to the fact that females are on the average a little larger than males.

As a result of this comparison between the sexes it may be said that no distinction is apparent in respect of the bodily proportions except in the case of the interval between the anus and reproductive aperture. This distinction of course is simply due to the fact that the penis occupies a more anterior position than the vulva.

A comparison between the general average measurements from South Georgia and South Africa shows a corresponding difference between the relative sizes of the head and tail which in this case is much more marked. The mean value of all the anterior measurements is distinctly greater in the South Georgia whales, while the posterior measurements are, with one exception, greater in the South African whales. This exception is found in No. 24—"Depth of tail at dorsal fin"—which is, on the average, greater for South Georgia whales. A possible explanation of this is that, in general, the blubber of whales taken at South Georgia tends to be relatively thicker than at South Africa, and since the blubber is very massive in the mid-dorsal and ventral lines on the tail, the effect of an increase in thickness would be quite likely to exaggerate this particular measurement.

The fact that the tail is, on the average, relatively large in South African whales, and the head relatively large in South Georgia whales, is undoubtedly due to the difference in the average sizes of the whales from the two localities.

The manner in which the bodily proportions vary according to the size of the whale may now be considered. It has been found that there is a very definite variation of this description, and it follows that the value of the general average measurements, which include whales of any and every size, is much reduced for purposes of comparison.

In the following tables the mean value of each (percentage) measurement has been worked out as far as possible for each metre of whale-length, foetuses being included.

Male Blue Whales: South Georgia

Measurements expressed as percentages of total length.

	Metre lengths	2. Lower jaw, projection beyond tip of snout			3. Tip of snout to blowhole			4. Tip of snout to angle of gape			5. Tip of snout to centre of eye		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	1–2	—	—	—	5	12·80–16·67	14·45	4	14·40–18·82	17·24	5	16·00–19·84	18·33
,,	2–3	—	—	—	7	13·86–16·74	14·76	8	16·52–19·07	17·58	8	17·62–20·93	18·66
,,	3–4	—	—	—	3	14·51–16·38	15·36	3	16·00–17·81	17·16	3	17·87–20·11	18·65
,,	4–5	—	—	—	1	—	15·16	1	—	18·32	1	—	18·74
Whale	16–17	—	—	—	—	—	—	1	—	15·90	2	16·85–17·52	17·18
,,	17–18	—	—	—	13	13·88–16·90	15·81	8	16·85–18·75	17·93	15	16·20–19·77	18·42
,,	18–19	1	—	1·39	14	14·21–17·95	16·04	13	17·47–20·11	18·53	21	15·72–20·33	18·63
,,	19–20	2	1·36–1·54	1·45	18	14·92–20·94	16·58	13	17·69–22·88	19·06	22	17·53–23·04	19·12
,,	20–21	1	—	1·57	14	15·21–19·18	17·16	10	16·96–20·09	18·55	17	17·76–20·49	19·53
,,	21–22	2	1·24–1·61	1·43	16	15·72–18·60	17·49	14	16·90–21·71	19·52	22	16·90–20·93	19·71
,,	22–23	1	—	1·18	21	14·00–19·98	17·72	10	17·82–21·43	19·44	23	16·22–22·14	20·05
,,	23–24	—	—	—	38	16·46–21·24	18·44	14	18·57–22·45	20·08	43	19·41–23·01	20·36
,,	24–25	—	—	—	56	17·00–21·02	19·06	15	19·47–21·30	20·54	59	19·29–24·79	21·25
,,	25–26	1	—	2·35	25	16·47–20·62	18·72	5	19·39–21·33	20·61	32	19·41–22·84	21·04
,,	26–27	—	—	—	3	18·13–20·38	19·01	2	19·47–19·66	19·56	3	20·53–21·92	21·03

	Metre lengths	10. Notch of flukes to anus			11. Notch of flukes to umbilicus			12. Notch of flukes to end of ventral grooves			13. Anus to reproductive aperture, centres		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	1–2	5	28·80–32·92	30·67	5	44·74–49·69	46·44	5	41·93–51·32	45·67	5	3·11–6·58	5·66
,,	2–3	7	29·50–34·17	31·71	8	44·55–52·38	46·67	8	38·13–50·00	44·06	8	3·72–7·39	5·88
,,	3–4	3	28·74–33·07	31·43	3	41·09–48·00	45·47	3	38·22–45·87	43·28	3	5·17–6·62	5·97
,,	4–5	1	—	30·11	1	—	45·68	1	—	43·79	1	—	6·11
Whale	16–17	2	30·38–32·05	31·22	2	47·20–48·66	47·93	—	—	—	2	4·42–4·75	4·59
,,	17–18	15	28·61–32·11	30·56	14	45·89–48·86	47·56	9	40·46–47·43	44·95	15	3·67–8·01	6·14
,,	18–19	20	27·69–32·24	30·24	20	45·21–51·32	47·79	12	41·64–48·15	44·85	21	3·50–8·31	6·37
,,	19–20	21	28·39–32·99	30·20	22	44·79–50·00	47·11	13	41·97–49·61	45·09	19	3·66–7·93	5·81
,,	20–21	16	27·82–32·35	30·13	15	44·36–47·83	46·52	8	42·19–44·83	43·81	16	3·12–8·79	5·78
,,	21–22	22	27·79–31·29	29·56	21	43·66–47·80	46·14	15	40·00–45·97	43·32	21	3·72–7·85	6·08
,,	22–23	23	27·43–31·63	28·91	23	41·33–47·66	45·19	18	40·44–48·01	43·43	22	4·25–8·63	6·45
,,	23–24	42	26·61–30·34	28·35	41	41·63–47·86	44·75	26	39·49–47·86	42·91	40	4·10–8·39	6·23
,,	24–25	60	25·00–30·96	28·13	59	41·04–47·98	44·50	39	34·44–45·82	41·24	52	3·84–7·89	6·14
,,	25–26	31	25·84–29·30	27·92	32	41·70–47·20	44·17	19	38·54–45·47	41·85	28	3·37–7·66	6·10
,,	26–27	3	27·50–29·11	28·20	3	42·41–44·80	43·81	3	40·92–42·72	41·98	3	5·16–7·50	6·30

	Metre lengths	18. Flipper, length along curve of lower border			19. Flipper, greatest width			20. Severed head, condyle to tip			21. Skull, greatest width		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	1–2	4	13·60–18·82	15·78	4	3·20–4·30	3·71	—	—	—	2	13·82–14·40	14·11
,,	2–3	5	14·00–18·60	17·25	7	3·75–5·12	4·30	—	—	—	—	—	—
,,	3–4	3	17·24–18·60	17·81	3	4·53–4·73	4·62	—	—	—	—	—	—
,,	4–5	1	—	17·26	1	—	4·42	—	—	—	—	—	—
Whale	16–17	—	—	—	2	3·56–4·01	3·78	2	20·77–22·42	21·60	1	—	11·50
,,	17–18	5	13·29–14·40	13·95	7	2·86–4·03	3·53	7	20·96–23·45	22·59	8	8·89–12·78	11·35
,,	18–19	12	12·59–17·76	14·22	17	2·93–4·37	3·70	17	19·78–25·80	23·26	17	9·76–13·26	11·37
,,	19–20	13	12·21–15·00	13·74	16	3·09–4·17	3·61	12	21·13–24·87	23·27	12	10·59–12·04	11·26
,,	20–21	12	13·12–14·68	13·73	11	3·36–3·88	3·59	9	22·77–25·49	24·39	8	10·31–12·10	11·18
,,	21–22	16	11·27–14·60	13·20	16	3·19–3·97	3·55	17	21·13–25·81	24·37	15	10·28–12·27	11·09
,,	22–23	12	10·67–16·56	14·15	13	3·18–4·27	3·68	20	20·00–27·20	24·68	15	9·98–12·38	11·54
,,	23–24	21	12·99–15·79	14·19	26	3·11–4·15	3·74	30	22·91–27·47	25·61	29	10·21–12·82	11·80
,,	24–25	37	12·50–14·84	13·71	40	3·11–4·16	3·68	35	23·63–28·48	25·85	33	10·55–13·30	11·72
,,	25–26	21	12·60–14·75	13·82	21	3·09–3·93	3·65	20	23·93–28·01	25·80	17	10·86–12·60	11·71
,,	26–27	2	13·61–13·69	13·65	2	3·33–3·89	3·61	1	—	24·89	1	—	10·86

Male Blue Whales: South Georgia

Measurements expressed as percentages of total length.

	Metre lengths	6. Tip of snout to tip of flipper			7. Eye to ear, centres			8. Notch of flukes to posterior emargination of dorsal fin			9. Flukes, width at insertion		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	1–2	5	40·00–46·77	43·46	4	6·40–7·14	6·91	5	25·20–29·19	27·30	5	6·30–8·55	7·25
,,	2–3	8	41·30–48·84	44·33	8	6·44–8·09	6·95	6	25·00–29·77	27·26	8	6·67–8·37	7·39
,,	3–4	3	44·16–47·13	45·45	3	6·40–6·94	6·65	3	25·86–27·76	26·76	3	5·67–8·27	6·75
,,	4–5	1	—	43·16	1	—	6·53	1	—	26·74	1	—	7·16
Whale	16–17	1	—	38·87	1	—	5·43	—	—	—	1	—	5·22
,,	17–18	12	40·00–42·25	40·90	13	4·91–6·63	5·40	11	24·44–28·35	26·04	13	4·86–5·97	5·37
,,	18–19	17	38·56–44·56	41·58	16	4·53–6·22	5·28	15	22·22–27·03	25·17	17	4·57–6·19	5·30
,,	19–20	20	38·92–43·49	41·32	17	5·01–6·00	5·28	11	23·67–27·39	25·25	21	4·71–5·74	5·21
,,	20–21	16	39·16–43·87	41·71	14	4·29–5·63	5·22	7	24·78–26·96	26·01	16	4·68–5·88	5·28
,,	21–22	20	40·84–45·03	42·63	17	4·79–5·77	5·34	14	23·51–28·89	25·18	22	4·64–6·07	5·32
,,	22–23	20	39·42–46·30	42·81	20	4·67–6·07	5·50	19	22·60–26·73	24·39	23	4·67–5·88	5·18
,,	23–24	37	39·74–49·15	44·06	35	4·94–6·91	5·57	31	22·08–26·29	23·89	38	4·76–5·86	5·27
,,	24–25	55	38·02–47·85	44·36	52	4·04–6·25	5·55	39	21·23–26·45	23·87	59	4·32–6·02	5·11
,,	25–26	27	40·48–46·32	43·69	27	4·88–6·10	5·38	20	21·93–26·00	23·73	32	3·92–5·88	5·05
,,	26–27	2	43·86–44·59	44·22	3	5·22–5·77	5·49	2	22·69–25·33	24·01	3	4·69–5·09	4·86

	Metre lengths	14. Dorsal fin, vertical height			15. Dorsal fin, length of base			16. Flipper, tip to axilla			17. Flipper, tip to anterior end of lower border		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	1–2	5	1·18–1·86	1·58	5	3·94–5·59	4·73	4	10·56–11·29	11·01	5	12·80–17·31	14·73
,,	2–3	6	1·25–2·33	1·81	6	4·50–5·84	5·36	8	9·50–12·56	11·43	7	13·00–16·74	15·68
,,	3–4	3	1·72–2·31	1·86	3	4·02–4·42	4·24	3	11·67–12·07	11·91	3	16·00–16·09	16·06
,,	4–5	1	—	2·11	1	—	5·47	1	—	12·21	1	—	16·21
Whale	16–17	—	—	—	—	—	—	2	10·03–12·75	11·39	1	—	14·83
,,	17–18	13	1·16–1·59	1·33	12	3·30–6·24	4·11	15	8·22–10·17	9·39	7	11·16–13·77	13·03
,,	18–19	15	0·85–1·61	1·28	13	2·93–7·05	4·61	17	8·24–11·47	9·89	13	12·21–16·72	13·48
,,	19–20	13	1·09–1·83	1·28	13	2·79–6·65	4·03	21	8·42–11·03	9·83	14	11·60–14·40	13·22
,,	20–21	9	0·94–1·59	1·24	10	2·95–5·76	4·27	15	8·13–10·19	9·21	12	12·37–13·93	13·03
,,	21–22	14	0·60–1·98	1·24	14	3·02–6·77	4·22	19	7·91–11·55	9·74	17	11·26–14·01	12·78
,,	22–23	17	0·98–1·79	1·32	19	3·54–7·14	4·64	17	8·22–12·08	9·71	12	10·22–15·25	13·35
,,	23–24	24	0·34–1·84	1·18	30	2·51–6·05	4·45	36	8·74–11·92	10·14	22	12·51–14·95	13·46
,,	24–25	31	0·65–1·76	1·26	40	2·45–7·57	4·90	51	7·66–12·16	9·94	38	11·89–14·27	13·19
,,	25–26	15	0·59–1·60	1·33	20	2·91–7·47	4·88	28	8·51–12·20	9·99	21	12·04–14·26	12·56
,,	26–27	2	1·04–1·59	1·31	2	4·23–4·63	4·43	3	9·26–9·81	9·62	2	12·96–13·04	13·00

	Metre lengths	22. Skull length, condyle to tip of premaxilla			23. Flipper, tip to head of humerus			24. Tail, depth at dorsal fin			25. Flukes, notch to tip		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	1–2	—	—	—	—	—	—	5	9·60–11·18	10·46	3	9·47–12·37	11·01
,,	2–3	—	—	—	—	—	—	6	10·40–13·02	11·46	6	12·38–15·81	13·77
,,	3–4	—	—	—	—	—	—	3	10·09–11·21	10·74	3	12·33–13·07	12·58
,,	4–5	—	—	—	—	—	—	1	—	11·16	1	—	12·63
Whale	16–17	—	—	—	—	—	—	—	—	—	—	—	—
,,	17–18	—	—	—	—	—	—	10	8·15–12·18	9·87	—	—	—
,,	18–19	—	—	—	—	—	—	9	8·87–10·01	9·36	—	—	—
,,	19–20	—	—	—	—	—	—	8	8·29–10·95	9·60	—	—	—
,,	20–21	—	—	—	—	—	—	7	9·36–10·78	10·00	—	—	—
,,	21–22	—	—	—	—	—	—	11	9·07–10·92	9·99	—	—	—
,,	22–23	—	—	—	—	—	—	13	7·11–11·15	9·34	—	—	—
,,	23–24	1	—	26·99	—	—	—	26	8·13–10·85	9·35	—	—	—
,,	24–25	—	—	—	—	—	—	38	8·10–11·45	9·52	—	—	—
,,	25–26	—	—	—	—	—	—	18	8·57–10·20	9·38	—	—	—
,,	26–27	—	—	—	—	—	—	1	—	8·32	—	—	—

Male Blue Whales: South Africa

Measurements expressed as percentages of total length.

	Metre lengths	2. Lower jaw, projection beyond tip of snout			3. Tip of snout to blowhole			4. Tip of snout to angle of gape			5. Tip of snout to centre of eye		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	—	—	—	2	12·36–13·13	12·75	2	17·50–17·98	17·74	2	18·00–18·75	18·38
Whale	15–16	—	—	—	1	—	17·06	—	—	—	1	—	20·09
,,	16–17	—	—	—	2	16·09–16·99	16·54	2	18·34–19·76	19·05	2	18·82–19·88	19·35
,,	17–18	—	—	—	20	15·20–17·68	16·22	17	17·71–19·71	18·27	19	16·96–20·29	18·70
,,	18–19	—	—	—	33	14·84–18·31	16·63	31	16·94–19·95	18·44	33	17·58–20·38	19·08
,,	19–20	—	—	—	23	14·95–18·25	16·49	21	17·10–19·59	18·48	23	17·72–20·68	19·12
,,	20–21	—	—	—	13	15·98–18·91	17·00	12	18·16–19·75	18·92	14	18·76–20·25	19·51
,,	21–22	—	—	—	1	—	17·16	1	—	19·45	1	—	20·23
,,	22–23	—	—	—	7	16·80–19·13	17·78	5	19·26–20·45	19·72	7	20·00–21·11	20·53
,,	23–24	—	—	—	6	17·06–19·67	18·35	3	19·61–22·01	20·54	7	19·49–22·18	20·86
,,	24–25	—	—	—	7	17·74–19·63	18·67	6	19·79–20·85	20·26	7	20·41–21·51	21·01
,,	25–26	—	—	—	1	—	17·72	1	—	21·63	2	20·54–22·62	21·58
,,	26–27	—	—	—	2	16·73–19·70	18·22	2	19·15–21·29	20·22	2	19·62–22·24	20·93

	Metre lengths	10. Notch of flukes to anus			11. Notch of flukes to umbilicus			12. Notch of flukes to end of ventral grooves			13. Anus to reproductive aperture, centres		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	2	28·54–31·25	29·90	2	43·82–46·25	45·03	—	—	—	2	6·25–6·74	6·50
Whale	15–16	1	—	29·37	1	—	45·80	1	—	43·27	1	—	7·58
,,	16–17	2	30·09–30·47	30·28	2	47·20–47·34	47·27	2	42·49–44·84	43·67	2	7·51–7·67	7·59
,,	17–18	18	28·20–32·17	30·22	18	45·62–51·76	47·76	14	43·19–50·00	45·29	18	3·99–8·41	7·17
,,	18–19	33	28·23–32·11	30·32	32	45·22–49·31	47·53	27	40·27–47·55	44·64	29	3·17–8·60	6·78
,,	19–20	22	27·96–32·49	30·40	23	45·34–49·74	47·30	17	42·93–46·43	44·72	18	4·15–8·42	6·82
,,	20–21	14	27·55–31·75	29·83	14	44·71–48·50	46·68	10	39·90–46·89	43·92	13	4·35–8·13	6·97
,,	21–22	1	—	31·12	1	—	46·68	1	—	42·11	1	—	7·32
,,	22–23	7	27·73–29·60	29·01	6	44·98–46·46	45·99	5	42·14–45·23	43·49	7	4·62–7·42	6·78
,,	23–24	7	26·60–29·76	28·55	7	39·96–45·69	44·24	3	39·75–43·78	41·95	7	6·03–7·51	6·76
,,	24–25	7	27·46–29·96	29·10	7	44·47–46·77	45·71	7	40·08–45·15	43·00	7	4·95–7·79	6·80
,,	25–26	2	27·38–29·27	28·33	2	44·25–45·56	44·91	2	40·48–43·24	41·86	2	6·94–7·14	7·04
,,	26–27	2	28·52–29·23	28·88	2	44·81–44·87	44·84	2	40·30–41·54	40·92	2	6·15–6·84	6·50

	Metre lengths	18. Flipper, length along curve of lower border			19. Flipper, greatest width			20. Severed head, condyle to tip			21. Skull, greatest width		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	2	12·58–14·00	13·29	2	3·75–3·82	3·78	—	—	—	—	—	—
Whale	15–16	—	—	—	—	—	—	—	—	—	—	—	—
,,	16–17	2	13·96–13·98	13·97	2	3·79–3·83	3·81	2	23·37–23·60	23·49	2	11·54–11·92	11·73
,,	17–18	12	12·89–14·32	13·72	9	3·35–3·77	3·57	10	20·45–23·88	22·79	9	9·83–11·29	10·48
,,	18–19	25	12·91–15·83	13·86	26	3·27–3·91	3·68	19	21·33–25·52	23·42	19	9·78–12·68	11·02
,,	19–20	14	12·93–14·86	13·81	14	3·22–4·01	3·65	10	22·14–24·68	23·08	9	10·53–11·86	11·05
,,	20–21	12	12·60–14·69	13·79	14	3·29–3·93	3·67	10	22·40–25·62	23·85	10	10·21–12·44	11·27
,,	21–22	1	—	14·65	1	—	3·75	1	—	24·71	1	—	11·44
,,	22–23	7	13·50–14·86	14·12	6	3·32–3·96	3·75	3	24·67–25·41	24·92	3	11·05–11·22	11·15
,,	23–24	6	13·43–15·11	13·88	6	3·42–4·04	3·69	4	25·21–27·06	26·23	4	10·26–11·30	10·96
,,	24–25	5	12·83–14·78	13·46	5	3·38–3·87	3·64	4	25·25–26·80	25·78	4	11·00–11·70	11·46
,,	25–26	2	13·10–13·82	13·46	2	3·78–3·89	3·80	1	—	25·10	1	—	11·74
,,	26–27	2	12·96–13·19	13·08	2	3·46–3·80	3·63	2	23·54–27·00	25·27	2	11·00–11·41	11·21

Male Blue Whales: South Africa

Measurements expressed as percentages of total length.

	Metre lengths	6. Tip of snout to tip of flipper			7. Eye to ear, centres			8. Notch of flukes to posterior emargination of dorsal fin			9. Flukes, width at insertion		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	2	42·70–43·75	43·23	—	—	—	2	27·50–28·09	27·80	—	—	—
Whale	15–16	1	—	43·27	1	—	5·94	1	—	24·00	1	—	5·05
,,	16–17	2	41·66–41·89	41·78	2	5·55–7·10	6·33	2	25·44–26·08	25·76	2	4·73–6·31	5·52
,,	17–18	16	40·28–42·90	41·60	20	4·99–5·85	5·34	15	22·86–28·11	24·96	21	4·70–5·97	5·34
,,	18–19	30	37·00–44·06	41·64	33	4·95–5·99	5·36	28	23·48–28·00	25·71	33	4·70–5·80	5·32
,,	19–20	21	36·20–45·03	41·62	21	4·74–5·62	5·27	17	23·82–29·95	25·38	23	4·31–5·88	5·23
,,	20–21	13	37·29–44·38	42·16	14	4·77–5·57	5·25	13	23·56–27·12	24·86	14	4·65–5·50	5·14
,,	21–22	1	—	43·71	1	—	5·22	1	—	25·17	1	—	4·94
,,	22–23	7	42·57–47·05	44·01	6	4·22–6·03	5·26	7	22·71–25·98	24·51	7	4·66–5·72	5·23
,,	23–24	5	41·49–45·53	43·68	6	5·25–5·82	5·46	6	22·84–25·63	24·99	7	5·02–5·49	5·21
,,	24–25	6	41·96–44·67	43·69	7	5·10–5·69	5·40	7	22·24–25·74	24·39	7	4·67–5·07	4·95
,,	25–26	2	44·79–46·83	45·81	2	5·56–6·15	5·86	2	22·06–23·94	23·00	2	4·40–5·08	4·74
,,	26–27	2	41·54–44·68	43·11	2	5·12–5·86	5·49	2	23·19–23·85	23·52	2	4·62–5·02	4·82

	Metre lengths	14. Dorsal fin, vertical height			15. Dorsal fin, length of base			16. Flipper, tip to axilla			17. Flipper, tip to anterior end of lower border		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	2	0·45–0·63	0·54	2	2·70–3·75	3·23	2	10·00–10·11	10·06	2	12·36–13·75	13·06
Whale	15–16	—	—	—	1	—	1·26	—	—	—	—	—	—
,,	16–17	2	0·88–1·24	1·06	2	3·83–6·75	5·29	2	9·76–10·03	9·90	2	13·20–13·33	13·27
,,	17–18	16	1·03–1·80	1·34	17	2·86–6·98	4·86	16	9·12–11·11	9·80	12	12·36–13·62	13·04
,,	18–19	30	0·70–1·87	1·34	30	2·43–6·65	4·52	31	8·86–11·09	9·83	25	11·98–14·78	13·14
,,	19–20	18	0·73–1·78	1·24	19	2·63–6·05	4·34	21	9·32–10·97	10·05	14	12·47–13·68	13·17
,,	20–21	13	0·79–1·84	1·42	13	3·90–6·25	4·90	14	8·99–10·92	9·94	14	12·21–13·90	13·05
,,	21–22	1	—	1·65	1	—	5·49	—	—	—	1	—	13·64
,,	22–23	6	1·02–1·55	1·29	7	2·88–4·50	3·87	7	8·85–10·77	10·13	7	12·39–14·07	13·36
,,	23–24	5	1·07–1·59	1·25	7	3·43–6·28	4·84	7	9·22–10·68	10·15	6	12·76–14·04	13·19
,,	24–25	3	0·92–1·43	1·14	7	3·28–5·44	4·08	6	8·55–11·07	9·86	5	11·98–13·25	12·65
,,	25–26	—	—	—	2	3·47–6·55	5·01	2	10·42–10·52	10·47	2	12·54–13·20	12·87
,,	26–27	1	—	1·71	2	4·23–4·94	4·59	2	9·38–10·27	9·83	2	12·27–12·74	12·50

	Metre lengths	22. Skull length, condyle to tip of premaxilla			23. Flipper, tip to head of humerus			24. Tail, depth at dorsal fin			25. Flukes, notch to tip		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	—	—	—	—	—	—	2	8·99–10·00	9·50	2	8·09–10·00	9·05
Whale	15–16	—	—	—	—	—	—	1	—	8·84	—	—	—
,,	16–17	—	—	—	—	—	—	2	8·46–8·85	8·65	—	—	—
,,	17–18	1	—	23·43	—	—	—	15	7·82–11·14	8·68	—	—	—
,,	18–19	1	—	22·50	1	—	14·47	26	7·57–9·74	8·55	—	—	—
,,	19–20	—	—	—	1	—	14·71	17	7·83–9·11	8·52	—	—	—
,,	20–21	1	—	23·12	—	—	—	13	8·03–9·98	8·88	—	—	—
,,	21–22	—	—	—	—	—	—	1	—	9·15	—	—	—
,,	22–23	—	—	—	—	—	—	6	8·30–9·77	8·80	—	—	—
,,	23–24	—	—	—	—	—	—	5	8·12–10·09	8·99	—	—	—
,,	24–25	—	—	—	—	—	—	6	7·36–8·96	8·22	—	—	—
,,	25–26	—	—	—	—	—	—	2	7·22–8·21	7·71	—	—	—
,,	26–27	—	—	—	—	—	—	2	8·65–9·01	8·83	—	—	—

Female Blue Whales: South Georgia

Measurements expressed as percentages of total length.

	Metre lengths	2. Lower jaw, projection beyond tip of snout			3. Tip of snout to blowhole			4. Tip of snout to angle of gape			5. Tip of snout to centre of eye		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	1	—	1·10	5	11·61–13·40	12·69	5	14·06–16·56	15·99	5	16·48–18·18	17·49
,,	1–2	—	—	—	4	13·93–15·96	14·90	4	16·92–18·62	17·58	4	18·46–20·21	19·03
,,	2–3	—	—	—	6	13·94–15·71	15·00	7	17·31–18·20	17·64	7	18·01–19·62	18·52
,,	3–4	—	—	—	—	—	—	—	—	—	—	—	—
,,	4–5	—	—	—	6	14·77–17·54	15·52	4	17·51–18·12	17·77	6	17·27–19·06	18·26
,,	5–6	—	—	—	1	—	13·46	1	—	16·73	1	—	16·23
,,	6–7	—	—	—	1	—	14·30	1	—	18·10	1	—	17·78
Whale	16–17	—	—	—	3	14·58–17·42	16·17	3	14·03–18·35	16·55	4	15·20–19·52	17·86
,,	17–18	1	—	1·85	6	14·61–17·21	15·99	3	16·85–18·54	17·90	6	17·25–19·55	18·51
,,	18–19	2	1·48–1·59	1·54	18	13·70–19·34	16·43	16	15·38–20·44	18·11	21	16·43–21·21	18·81
,,	19–20	1	—	1·38	18	13·95–19·49	16·24	16	15·31–22·56	18·28	22	16·53–24·12	19·05
,,	20–21	1	—	1·46	15	15·44–18·75	17·24	13	16·38–20·53	19·05	18	17·37–20·90	19·59
,,	21–22	—	—	—	12	14·65–19·38	17·30	10	16·84–20·85	19·08	12	17·44–22·86	19·91
,,	22–23	1	—	1·77	15	16·63–19·65	17·85	9	18·90–20·66	19·56	16	19·56–21·83	20·28
,,	23–24	—	—	—	20	16·48–20·96	18·38	6	19·06–21·37	20·09	22	18·53–21·80	20·70
,,	24–25	1	—	1·57	25	15·94–20·45	18·29	4	19·67–20·52	20·07	27	19·20–22·67	20·82
,,	25–26	2	1·82–2·48	2·15	49	16·43–21·60	19·16	7	18·38–21·18	20·12	53	19·21–22·87	21·18
,,	26–27	1	—	1·63	49	16·54–20·65	18·89	8	19·01–21·44	20·38	53	19·43–23·67	21·16
,,	27–28	—	—	—	8	16·21–19·56	18·41	1	—	19·93	9	20·04–21·08	20·58
,,	28–29	—	—	—	2	18·75–19·68	19·22	1	—	21·81	2	20·54–22·09	21·32

	Metre lengths	10. Notch of flukes to anus			11. Notch of flukes to umbilicus			12. Notch of flukes to end of ventral grooves			13. Anus to reproductive aperture, centres		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	5	29·09–31·25	30·47	5	46·02–46·88	46·36	—	—	—	5	1·65–3·09	2·34
,,	1–2	4	28·19–33·85	31·62	4	44·15–49·23	47·58	4	42·55–53·85	48·20	4	2·01–2·31	2·13
,,	2–3	7	29·37–33·65	31·26	7	44·66–53·55	47·61	7	40·78–50·71	44·92	7	1·94–3·40	2·67
,,	3–4	—	—	—	—	—	—	—	—	—	—	—	—
,,	4–5	6	29·55–32·70	31·52	6	41·24–48·96	46·33	6	42·59–46·01	44·39	6	2·27–3·15	2·69
,,	5–6	1	—	34·03	1	—	50·00	1	—	50·00	1	—	3·08
,,	6–7	1	—	29·84	1	—	43·65	1	—	41·90	1	—	1·90
Whale	16–17	4	28·75–33·84	31·29	4	46·60–51·69	49·12	1	—	45·26	4	2·08–3·12	2·56
,,	17–18	7	29·80–32·87	31·56	7	46·54–49·58	48·19	3	42·74–48·19	45·51	7	2·02–3·37	2·38
,,	18–19	21	28·57–32·95	31·09	21	45·50–49·15	47·35	16	42·41–47·85	44·43	21	1·37–3·99	2·77
,,	19–20	22	27·75–32·37	30·67	22	45·13–50·79	47·70	12	43·81–47·74	45·67	22	1·72–3·51	2·63
,,	20–21	19	25·75–32·25	29·65	16	45·32–48·54	46·34	10	41·79–47·14	44·09	17	1·74–3·15	2·50
,,	21–22	13	28·57–31·79	29·54	12	43·60–46·91	45·63	7	40·71–45·47	43·36	13	1·90–3·29	2·55
,,	22–23	15	27·97–30·77	29·55	15	44·35–49·09	45·90	10	41·85–46·15	43·69	15	2·22–3·12	2·64
,,	23–24	21	27·97–31·43	29·64	20	43·88–49·57	45·99	10	41·29–46·54	43·22	22	1·48–3·04	2·34
,,	24–25	28	25·51–30·53	28·53	27	41·90–46·99	44·64	19	38·66–44·17	42·18	28	2·01–3·07	2·48
,,	25–26	54	25·78–31·20	28·16	52	41·80–47·52	44·37	35	37·98–44·75	41·78	54	1·56–3·17	2·47
,,	26–27	54	24·23–31·23	28·25	53	40·90–47·60	44·28	34	39·70–44·10	41·68	54	1·69–3·73	2·56
,,	27–28	9	27·57–30·50	28·75	9	42·73–46·04	44·21	3	41·29–43·24	42·26	9	1·92–3·63	2·55
,,	28–29	2	27·27–27·86	27·57	2	43·62–45·00	44·31	1	—	40·78	2	2·13–2·68	2·41

	Metre lengths	18. Flipper, length along curve of lower border			19. Flipper, greatest width			20. Severed head, condyle to tip			21. Skull, greatest width		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	5	10·91–14·29	12·74	5	3·09–4·40	3·78	—	—	—	1	—	15·46
,,	1–2	4	15·00–17·09	16·07	4	3·77–4·10	3·93	—	—	—	3	14·73–15·43	15·18
,,	2–3	6	15·49–16·94	16·16	6	2·82–4·29	3·90	—	—	—	1	—	14·55
,,	3–4	—	—	—	—	—	—	—	—	—	—	—	—
,,	4–5	5	17·71–19·06	18·45	6	4·24–4·85	4·50	—	—	—	—	—	—
,,	5–6	1	—	16·73	1	—	4·62	—	—	—	—	—	—
,,	6–7	1	—	19·52	1	—	4·76	—	—	—	—	—	—
Whale	16–17	2	14·15–14·46	14·31	2	3·63–3·69	3·66	2	23·09–24·02	23·56	3	9·85–11·11	10·67
,,	17–18	5	13·41–15·32	14·13	4	3·37–3·93	3·63	5	21·07–24·30	23·31	5	10·50–12·92	11·74
,,	18–19	13	13·06–15·30	13·97	13	3·30–4·10	3·60	9	21·50–26·24	23·33	9	10·90–12·29	11·45
,,	19–20	14	12·42–15·11	13·64	16	2·91–3·98	3·63	15	21·99–25·34	23·28	14	10·71–12·41	11·60
,,	20–21	14	12·77–14·98	13·77	16	2·25–3·97	3·52	15	21·84–26·42	24·05	13	10·58–12·40	11·49
,,	21–22	9	12·12–15·08	13·85	9	3·04–3·93	3·61	11	23·70–26·43	24·58	9	11·03–12·71	11·89
,,	22–23	9	13·02–15·06	14·33	10	3·35–4·04	3·74	11	24·12–26·20	24·96	10	11·10–12·23	11·65
,,	23–24	14	12·72–14·96	14·13	16	3·17–3·97	3·63	13	23·93–27·23	25·51	15	10·43–12·55	11·65
,,	24–25	18	12·09–16·19	14·14	20	2·99–4·13	3·62	20	23·68–27·35	25·15	17	10·39–12·85	11·55
,,	25–26	33	12·01–15·94	13·87	35	3·32–4·19	3·67	40	23·81–27·98	25·79	37	10·16–13·56	11·75
,,	26–27	31	12·22–15·17	13·75	32	3·32–4·18	3·74	33	23·18–28·03	25·62	32	9·47–12·97	11·60
,,	27–28	6	11·44–15·86	13·17	7	3·25–4·00	3·59	6	24·19–25·91	25·15	6	10·33–11·66	11·06
,,	28–29	2	13·65–14·18	13·92	1	—	3·71	2	25·36–26·42	25·89	2	11·74–11·79	11·77

Female Blue Whales: South Georgia

Measurements expressed as percentages of total length.

	Metre lengths	6. Tip of snout to tip of flipper			7. Eye to ear, centres			8. Notch of flukes to posterior emargination of dorsal fin			9. Flukes, width at insertion		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	5	40·63–43·64	41·71	2	7·53–7·69	7·61	5	25·77–29·69	27·37	5	6·59–9·38	8·26
,,	1–2	4	43·08–46·28	44·21	4	6·53–7·79	7·23	4	24·12–28·46	26·69	4	7·54–8·20	7·39
,,	2–3	7	42·79–45·28	44·51	5	5·10–7·14	6·45	7	26·21–29·86	27·21	7	6·25–9·06	7·71
,,	3–4	—	—	—	—	—	—	—	—	—	—	—	—
,,	4–5	5	43·04–44·94	44·46	6	6·00–6·82	6·42	5	23·86–28·81	26·80	5	6·54–8·26	7·42
,,	5–6	1	—	43·27	1	—	5·96	1	—	25·00	1	—	6·15
,,	6–7	1	—	46·03	1	—	5·87	1	—	27·46	1	—	8·89
Whale	16–17	4	37·78–42·45	40·54	3	4·61–5·26	4·99	1	—	23·73	4	5·54–5·71	5·61
,,	17–18	6	38·44–42·74	40·70	6	4·66–5·95	5·29	4	23·95–27·24	25·23	7	4·46–5·90	5·27
,,	18–19	17	38·44–42·55	40·91	19	4·92–6·20	5·24	20	22·31–27·46	25·27	19	4·86–6·43	5·38
,,	19–20	18	38·86–44·61	41·71	20	4·65–6·87	5·26	17	23·66–27·95	26·03	20	4·69–6·30	5·42
,,	20–21	17	39·45–44·40	42·37	13	4·68–5·91	5·38	11	23·74–27·54	25·25	17	4·90–5·96	5·45
,,	21–22	12	38·05–44·29	42·34	10	4·88–5·85	5·37	7	24·14–25·89	25·11	13	4·76–5·79	5·29
,,	22–23	13	41·08–44·28	42·46	14	4·98–5·88	5·39	12	22·67–26·40	24·84	14	4·67–5·87	5·20
,,	23–24	19	41·84–45·73	43·63	15	4·85–6·03	5·42	13	22·55–25·80	24·28	18	4·69–5·93	5·30
,,	24–25	24	38·84–46·56	43·61	21	4·91–6·20	5·54	18	22·27–25·69	24·18	25	4·78–6·07	5·23
,,	25–26	49	41·38–46·00	43·90	46	4·84–6·06	5·38	37	20·51–26·94	23·87	50	4·26–5·62	5·10
,,	26–27	43	40·92–46·96	43·91	41	4·77–5·77	5·37	37	21·72–25·97	23·76	52	4·52–6·06	5·17
,,	27–28	6	41·87–44·28	42·64	8	4·96–5·91	5·33	6	23·25–24·80	24·11	6	4·49–5·54	4·91
,,	28–29	2	40·71–44·82	42·77	2	5·21–5·46	5·33	1	—	23·05	3	4·60–4·82	4·74

	Metre lengths	14. Dorsal fin, vertical height			15. Dorsal fin, length of base			16. Flipper, tip to axilla			17. Flipper, tip to anterior end of lower border		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	5	0·55–1·03	0·83	4	4·12–4·67	4·47	5	8·79–10·31	9·48	5	10·91–13·19	12·18
,,	1–2	4	0·82–1·33	1·14	4	3·02–4·92	4·20	4	10·00–12·02	10·81	4	14·62–15·96	15·22
,,	2–3	7	1·17–2·64	1·67	6	3·85–4·85	4·44	7	10·10–15·38	11·65	6	14·42–16·23	15·30
,,	3–4	—	—	—	—	—	—	—	—	—	—	—	—
,,	4–5	5	1·53–2·06	1·78	5	2·91–5·57	4·40	5	12·50–14·12	13·09	5	16·67–17·88	17·40
,,	5–6	1	—	2·33	1	—	6·54	—	—	—	1	—	14·42
,,	6–7	1	—	1·43	1	—	4·44	1	—	13·02	1	—	18·73
Whale	16–17	2	1·23–1·47	1·35	2	3·69–3·79	3·74	3	9·61–10·70	10·05	2	13·54–13·81	13·68
,,	17–18	4	0·95–1·57	1·22	6	3·35–5·25	4·14	6	8·91– 9·89	9·48	5	12·92–14·45	13·41
,,	18–19	17	0·77–1·80	1·23	19	1·18–6·54	3·67	18	7·98–11·75	9·83	13	12·20–14·36	13·20
,,	19–20	16	0·87–2·55	1·40	18	2·98–5·67	4·18	21	7·32–11·08	9·71	14	11·65–14·21	12·87
,,	20–21	14	0·70–1·84	1·29	14	2·60–6·22	4·04	17	8·93–12·27	9·82	15	12·40–14·23	13·04
,,	21–22	9	1·05–1·86	1·40	9	3·02–4·57	4·02	12	8·53–11·04	9·67	9	11·89–14·20	13·26
,,	22–23	12	0·67–1·75	1·25	13	2·94–7·40	4·34	12	8·81–10·83	9·79	9	12·00–14·61	13·56
,,	23–24	14	0·63–2·07	1·27	16	1·92–5·56	4·17	18	8·85–11·52	10·13	14	11·92–14·23	13·37
,,	24–25	19	0·62–1·62	1·18	20	2·35–6·02	4·09	19	8·21–11·29	9·94	18	11·80–14·84	13·46
,,	25–26	37	0·66–1·53	1·20	33	3·10–6·32	4·46	42	8·69–12·55	10·14	34	11·12–14·80	13·11
,,	26–27	33	0·61–1·68	1·17	35	3·05–6·69	4·56	42	8·02–11·79	9·80	33	11·43–14·75	13·01
,,	27–28	6	0·54–1·39	1·04	6	2·44–6·62	3·91	8	8·30–11·27	9·67	6	10·83–15·68	12·57
,,	28–29	1	—	1·17	2	4·18–4·62	4·40	2	9·64–10·11	9·88	2	12·86–13·05	12·96

	Metre lengths	22. Skull length, condyle to tip of premaxilla			23. Flipper, tip to head of humerus			24. Tail, depth at dorsal fin			25. Flukes, notch to tip		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	—	—	—	—	—	—	5	9·09–10·94	10·01	3	9·09– 9·89	9·45
,,	1–2	—	—	—	—	—	—	4	9·02–11·17	9·81	4	10·77–12·29	11·57
,,	2–3	—	—	—	—	—	—	6	9·61–12·32	10·95	5	11·55–14·72	13·26
,,	3–4	—	—	—	—	—	—	—	—	—	—	—	—
,,	4–5	—	—	—	—	—	—	6	9·65–12·78	10·93	3	12·11–14·77	13·43
,,	5–6	—	—	—	—	—	—	—	—	—	1	—	11·55
,,	6–7	—	—	—	—	—	—	—	—	—	1	—	10·79
Whale	16–17	—	—	—	—	—	—	1	—	8·87	—	—	—
,,	17–18	—	—	—	—	—	—	2	9·39– 9·94	9·67	—	—	—
,,	18–19	—	—	—	—	—	—	13	8·23–10·07	8·95	—	—	—
,,	19–20	1	—	22·67	1	—	15·71	11	8·16–10·31	9·39	—	—	—
,,	20–21	—	—	—	—	—	—	4	8·74– 9·85	9·20	—	—	—
,,	21–22	—	—	—	—	—	—	4	7·98–10·07	9·13	—	—	—
,,	22–23	—	—	—	—	—	—	8	8·57–10·18	9·33	—	—	—
,,	23–24	—	—	—	—	—	—	9	7·89–11·00	9·77	—	—	—
,,	24–25	1	—	24·95	—	—	—	14	8·25–11·06	9·54	—	—	—
,,	25–26	—	—	—	—	—	—	30	7·78–11·37	9·65	—	—	—
,,	26–27	—	—	—	—	—	—	28	7·84–10·65	9·23	—	—	—
,,	27–28	—	—	—	—	—	—	4	7·47– 9·07	8·32	—	—	—
,,	28–29	—	—	—	—	—	—	1	—	10·71	—	—	—

Female Blue Whales: South Africa

Measurements expressed as percentages of total length.

	Metre lengths	2. Lower jaw, projection beyond tip of snout			3. Tip of snout to blowhole			4. Tip of snout to angle of gape			5. Tip of snout to centre of eye		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	—	—	—	1	—	12·50	1	—	16·07	1	—	17·86
Whale	13–14	—	—	—	2	13·11–13·84	13·48	2	14·61–14·84	14·73	2	14·98–15·63	15·30
,,	14–15	—	—	—	—	—	—	—	—	—	—	—	—
,,	15–16	—	—	—	—	—	—	—	—	—	—	—	—
,,	16–17	—	—	—	7	14·49–16·86	16·04	7	16·86–19·56	18·16	7	16·92–19·68	18·65
,,	17–18	—	—	—	16	15·47–17·61	16·53	15	17·13–19·52	18·47	16	18·04–20·55	18·98
,,	18–19	1	—	1·04	25	15·28–18·08	16·47	22	17·47–19·14	18·25	28	17·89–19·94	18·88
,,	19–20	—	—	—	23	15·26–18·14	16·63	19	17·10–20·25	18·60	23	17·78–20·66	19·17
,,	20–21	1	—	0·95	11	15·19–18·20	17·17	8	18·13–20·00	19·26	12	17·93–21·49	20·02
,,	21–22	—	—	—	8	16·58 19·02	17·82	7	18·43–20·66	19·63	8	19·21–21·27	20·33
,,	22–23	—	—	—	5	17·18–19·55	17·92	2	19·64–20·22	19·93	5	20·23–21·79	20·74
,,	23–24		—	—	2	17·55–19·28	18·42	1	—	20·75	2	20·21–21·38	20·79
,,	24–25	—	—	—	6	16·23–20·16	18·45	2	18·47–20·96	19·72	6	18·88–22·37	20·92
,,	25–26	—	—		7	17·73–19·84	19·63	3	20·12–21·67	20·99	7	20·43–22·29	21·09
,,	26–27	—	—	—	9	18·25–19·73	18·96	3	20·60–21·02	20·75	9	21·17–22·98	21·49
,,	27–28	—	—	—	1	—	18·19	—	—	—	1	—	20·07

	Metre lengths	10. Notch of flukes to anus			11. Notch of flukes to umbilicus			12. Notch of flukes to end of ventral grooves			13. Anus to reproductive aperture, centres		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	1	—	30·36	1	—	44·64	—	—	—	1	—	1·79
Whale	13–14	2	32·62–33·93	33·28	2	50·54–52·28	51·41	2	48·75–50·19	49·97	2	2·02–2·87	2·45
,,	14–15	—	—	—	—	—	—	—	—	—	—	—	—
,,	15–16	—	—	—	—	—	—	—	—	—	—	—	—
,,	16–17	7	30·92–33·93	31·76	7	47·33–49·70	48·59	6	45·56–48·03	46·44	7	2·50–3·27	2·91
,,	17–18	15	29·66–33·23	31·39	16	42·29–50·38	47·80	11	43·50–46·59	45·09	14	1·97–3·75	2·62
,,	18–19	27	28·95–32·25	30·79	26	46·13–50·26	47·77	20	42·89–48·05	45·20	26	2·05–3·14	2·69
,,	19–20	23	24·12–33·07	30·56	24	40·67–49·37	47·09	18	40·52–46·98	44·57	22	1·95–3·12	2·65
,,	20–21	11	26·98–31·95	29·61	11	43·84–48·50	46·68	9	42·23–46·33	44·06	10	2·39–2·98	2·71
,,	21–22	8	28·77-31·05	29·74	8	45·47–47·46	46·53	6	42·69–45·21	44·05	8	1·87–3·05	2·62
,,	22–23	5	28·19–31·13	29·55	5	44·19–46·81	45·54	4	38·93–45·14	42·63	5	2·24–2·58	2·39
,,	23–24	2	29·18 30·18	29·65	2	45·91–46·23	46·07	2	42·30–42·55	42·43	2	2·72–2·96	2·84
,,	24–25	6	27·57–30·17	28·62	6	44·15–47·62	45·60	4	41·73–45·55	43·66	5	2·01–3·29	2·87
,,	25–26	7	28·40–31·13	28·30	7	42·80–47·10	44·81	7	39·30–44·31	42·74	7	2·33–2·89	2·60
,,	26–27	9	27·35–30·07	28·27	9	43·20–46·24	44·73	9	40·61–45·48	42·37	9	2·29–3·04	2·69
,,	27–28	1	—	28·84	1	—	46·50	1	—	44·11	1	—	2·75

	Metre lengths	18. Flipper, length along curve of lower border			19. Flipper, greatest width			20. Severed head, condyle to tip			21. Skull, greatest width		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	—	—	—	1	—	3·57	—	—	—	—	—	—
Whale	13–14	2	13·91–14·98	14·45	2	3·66–4·49	4·07	—	—	—	—	—	—
,,	14–15	—	—	—	—	—	—	—	—	—	—	—	—
,,	15–16	—	—	—	—	—	—	—	—	—	—	—	—
,,	16–17	2	14·62–14·63	14·63	2	3·63–3·66	3·65	3	21·30–24·75	22·84	2	10·71–10·87	10·79
,,	17–18	15	12·62–14·60	13·56	13	3·31–4·04	3·74	8	23·18–25·72	24·13	7	10·33–13·50	11·24
,,	18–19	22	12·43–14·45	13·72	22	3·22–3·87	3·64	16	22·37–24·49	23·14	12	9·89–11·58	10·79
,,	19–20	18	12·84–15·72	13·84	17	3·18–3·95	3·68	11	22·52–25·29	23·58	8	10·31–11·59	11·00
,,	20–21	8	12·75–14·27	13·53	9	3·28–3·72	3·55	7	23·10–25·95	24·29	7	10·99–12·20	11·53
,,	21–22	8	12·80–13·95	13·42	8	3·29–3·78	3·56	4	23·11–24·76	24·05	2	11·44–11·71	11·58
,,	22–23	4	12·45–14·06	13·03	4	3·41–3·83	3·62	2	25·22–25·80	25·51	1	—	11·36
,,	23 24	2	13·53–13·66	13·60	2	3·56–3·59	3·58	1	—	26·41	1	—	10·90
,,	24–25	5	11·88–14·31	13·19	5	3·44–3·90	3·68	3	22·57–27·21	25·65	3	10·88–12·75	11·88
,,	25–26	6	12·85–14·41	13·58	6	3·39–3·70	3·59	5	24·16–27·08	25·96	5	10·60–12·37	11·68
,,	26–27	6	12·33–14·85	13·72	7	3·18–3·75	3·60	6	25·75–28·35	26·48	6	11·11–15·91	12·08
,,	27–28	—	—	—	1	—	3·41	1	—	25·00	1	—	10·66

Female Blue Whales: South Africa

Measurements expressed as percentages of total length.

	Metre lengths	6. Tip of snout to tip of flipper			7. Eye to ear, centres			8. Notch of flukes to posterior emargination of dorsal fin			9. Flukes, width at insertion		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	1	—	41·07	—	—	—	1	—	26·80	1	—	8·93
Whale	13–14	2	37·53–37·83	37·73	2	5·02–5·23	5·12	2	27·46–27·49	27·48	2	6·13–6·29	6·23
,,	14–15	—	—	—	—	—	—	—	—	—	—	—	—
,,	15–16	—	—	-	—	—	—	—	—	—	-	—	—
,,	16–17	6	39·88–42·60	41·19	7	4·14–5·67	5·29	6	24·32–26·68	25·74	7	4·76–5·86	5·25
,,	17–18	13	39·54–42·94	41·38	14	5·04–5·67	5·34	12	23·89–27·97	25·55	15	4·80–5·87	5·36
,,	18–19	22	39·45–43·27	41·44	25	4·78–5·68	5·27	22	23·11–27·39	25·49	28	5·05–6·02	5·35
,,	19–20	23	39·21–45·18	41·45	22	4·67–5·47	5·22	17	24·50–28·35	25·95	24	4·68–5·97	5·27
,,	20–21	11	39·75–44·22	42·13	10	5·12–5·87	5·41	9	23·26–26·75	25·29	12	4·78–5·59	5·31
,,	21–22	8	40·55–43·52	42·87	8	5·23–5·67	5·41	6	23·96–26·16	25·04	8	4·66–5·53	5·10
,,	22–23	3	42·27–43·18	42·80	4	4·54–5·85	5·37	4	23·78–24·16	24·00	5	4·86–5·50	5·19
,,	23–24	2	42·93–44·44	43·69	1	—	5·45	2	23·98–25·50	24·74	2	5·07–5·66	5·37
,,	24–25	6	39·96–45·67	43·53	6	5·17–5·60	5·40	4	23·58–25·46	24·74	6	4·98–5·34	5·19
,,	25–26	6	42·51–46·24	44·11	7	5·10–5·82	5·39	7	23·24–27·02	24·69	7	4·63–5·27	5·09
,,	26–27	8	42·48–45·59	44·48	9	5·00–5·93	5·35	9	21·82–24·81	23·82	9	4·41–5·26	5·05
,,	27–28	1	—	42·68	1	—	5·22	1	—	25·18	1	—	4·96

	Metre lengths	14. Dorsal fin, vertical height			15. Dorsal fin, length of base			16. Flipper, tip to axilla			17. Flipper, tip to anterior end of lower border		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	1	—	0·89	1	—	3·57	1	—	10·71	1	—	12·50
Whale	13–14	2	1·22–2·32	1·97	2	3·58–6·37	4·98	2	10·19–10·61	10·40	2	12·90–13·86	13·38
,,	14–15	—	—	—	—	—	—	—	—	—	—	—	—
,,	15–16	—	—	—	—	—	—	—	—	—	—	—	—
,,	16–17	6	1·00–1·42	1·18	5	2·95–4·06	3·48	6	8·92–10·59	9·86	2	13·49–13·60	13·55
,,	17–18	12	0·89–1·62	1·25	12	3·44–5·90	5·18	15	8·88–10·39	9·54	16	12·01–13·48	12·86
,,	18–19	21	0·84–2·09	1·26	23	2·76–7·49	4·74	26	8·81–10·86	9·96	22	11·78–13·84	13·06
,,	19–20	19	0·94–1·85	1·25	19	2·54–6·70	4·26	21	8·57–11·25	9·69	19	10·99–14·55	13·04
,,	20–21	10	0·79–1·90	1·34	10	2·23–5·74	3·96	10	8·28–10·15	9·41	9	11·50–13·45	12·67
,,	21–22	5	0·99–1·24	1·11	7	2·84–4·76	3·93	8	8·83–10·67	9·65	8	12·21–13·48	12·84
,,	22–23	5	1·09–1·52	1·24	5	3·08–6·71	4·41	4	9·03–10·04	9·51	4	12·04–13·12	12·38
,,	23–24	1	—	1·31	1	—	4·73	2	8·64– 9·72	9·18	2	12·15–12·98	12·57
,,	24–25	3	0·91–1·65	1·35	4	4·14–6·65	5·24	5	8·82–10·28	9·55	5	11·39–13·58	12·59
,,	25–26	7	0·54–1·47	1·02	7	2·79–4·71	3·72	7	8·59–10·94	9·53	5	12·39–13·23	12·80
,,	26–27	9	0·85–1·76	1·26	9	3·22–4·69	3·93	7	9·20–10·91	10·03	6	11·65–13·94	12·85
,,	27–28	1	—	0·91	1	—	4·22	1	—	11·02	1	—	13·89

	Metre lengths	22. Skull length, condyle to tip of premaxilla			23. Flipper, tip to head of humerus			24. Tail, depth at dorsal fin			25. Flukes, notch to tip		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	—	—	—	—	—	—	1	—	8·93	1	—	9·82
Whale	13–14	—	—	—	—	—	—	2	10·71–10·75	10·73	—	—	—
,,	14–15	—	—	—	—	—	—	—	—	—	—	—	—
,,	15–16	—	—	—	—	—	—	—	—	—	—	—	—
,,	16–17	—	—	—	—	—	—	5	7·37– 8·87	8·24	—	—	—
,,	17–18	—	—	—	—	—	—	11	7·97– 9·44	8·66	—	—	—
,,	18–19	2	22·00–22·10	22·05	—	—	—	18	7·45– 9·57	8·45	—	—	—
,,	19–20	—	—	—	2	13·82–15·10	14·46	17	6·58– 8·89	8·21	—	—	—
,,	20–21	—	—	—	1	—	12·65	8	7·31– 9·61	8·70	—	—	—
,,	21–22	—	—	—	—	—	—	6	8·06– 9·52	8·78	—	—	—
,,	22–23	—	—	—	—	—	—	3	7·27– 9·62	8·60	—	—	—
,,	23–24	—	—	—	—	—	—	2	9·01–10·57	9·79	—	—	—
,,	24–25	—	—	—	—	—	—	4	8·68–10·08	9·36	—	—	—
,,	25–26	—	—	—	—	—	-	7	7·78–10·23	8·78	—	—	—
,,	26–27	—	—	—	—	—	—	7	8·06– 9·86	8·90	—	—	—
,,	27–28	—	—	—	—	—	—	1	—	7·72	—	—	—

The above tables have been drawn up for two purposes: (*a*) As a criterion of the alterations in bodily proportions which occur as the total length of the whale increases. (*b*) To provide a standard of comparison between the whales of South Georgia or South Africa and the whales of any other localities.

The first object is considered below. As regards the second, the tables have been prepared to provide for such cases as that of an investigator who, having procured a number of measurements of Blue whales from a locality in some other part of the world, wishes to ascertain whether these whales differ in any way from those of the South Georgia or South African region. Such measurements would be compared with averages given in the table under the appropriate whale-lengths, but it would also be required to know how much deviation could be allowed for individual variation. For this reason the maximum and minimum readings of the measurements from which each average is calculated are quoted in the table in addition to the average figure itself. The value for this purpose of these maxima and minima is of course dependent on the number of readings from which they are taken and the number of readings is therefore also quoted in each case. Under some whale-lengths the number of readings is insufficient to show the extent of deviation which might occur, but by reference to other columns there would be no difficulty in forming an idea of how much margin should be allowed for individual variation. In this way a series of measurements of even a single whale from some other locality could be profitably compared with the averages given in the tables.

Comparisons of bodily proportions are in general best made by reference to the tables themselves, but the variations of the bodily proportions according to the length of the whale are more conveniently shown by means of charts. In Figs. 1 to 23 the averages shown in the table are plotted for each metre of whale-length in the case of measurements 3, 4, 5, 6, 8, 10, 11, 12, 13, 18, 20 and 24. The other measurements do not show any definite variation with the whale-length or other points of interest.

The figures show in the first place no significant difference in the shapes of the curves for the two sexes except in the case of No. 13 (anus to reproductive aperture) to which reference has already been made. In the second place no distinction can be drawn in respect of these curves between whales of South Georgia and South Africa, at least so far as the majority of the graphs are concerned. There are some slight differences between the whales of the two localities in respect of the interval between the anus and reproductive aperture in males (Fig. 19), the length of the flipper (Figs. 20 and 21) and the depth of the tail (Figs. 22 and 23), but these are really very slight and need not be regarded as of any significance.

With the exception then of the genito-anal measurements the averages for male and female Blue whales may be considered together. The averages for foetuses have not been included in the graphs as there are not yet sufficient data upon which to base sound conclusions so far as they are concerned.

It will be seen that in both sexes the percentage measurements referring to the anterior end of the whale (see Figs. 1 to 10) show a more or less regular proportional

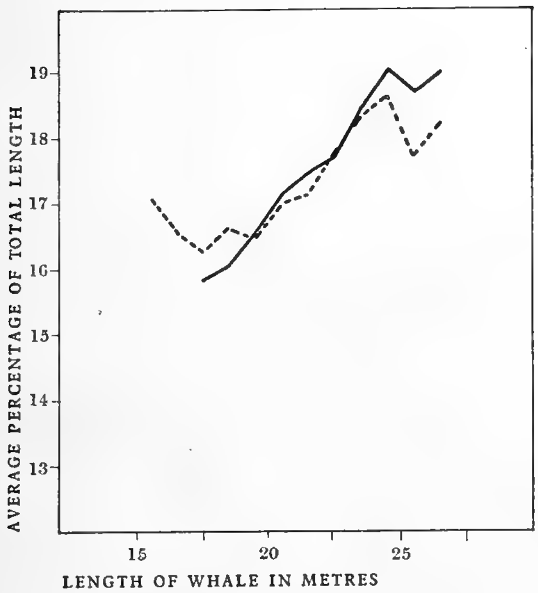

Fig. 1. Male Blue whales. Measurement No. 3. Tip of snout to blowhole.

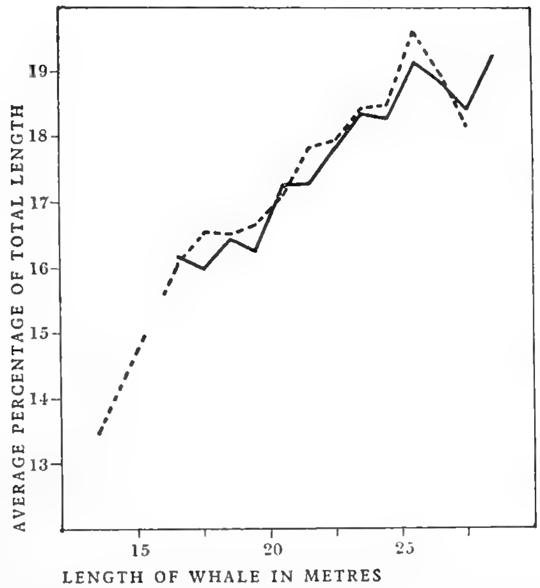

Fig. 2. Female Blue whales. Measurement No. 3. Tip of snout to blowhole.

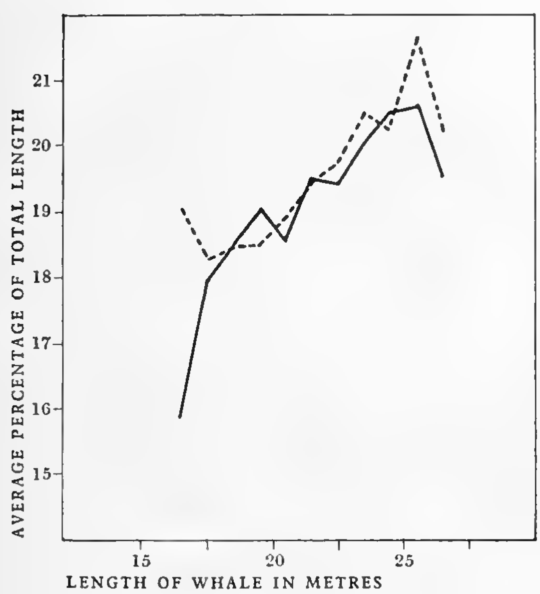

Fig. 3. Male Blue whales. Measurement No. 4. Tip of snout to angle of gape.

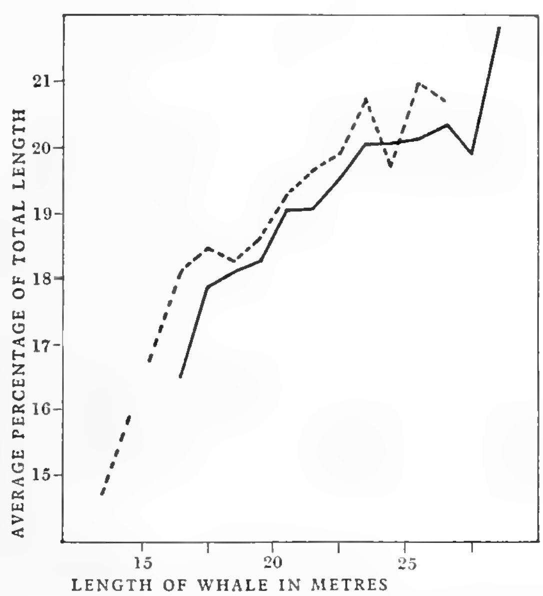

Fig. 4. Female Blue whales. Measurement No. 4. Tip of snout to angle of gape.

——— South Georgia whales. - - - - South African whales.

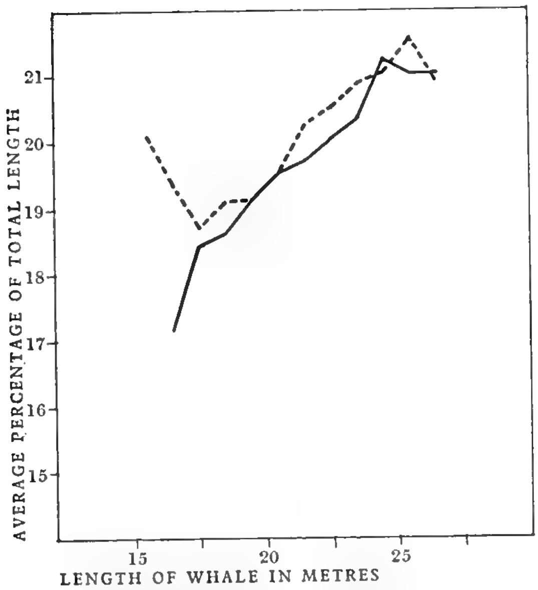

Fig. 5. Male Blue whales. Measurement No. 5. Tip of snout to centre of eye.

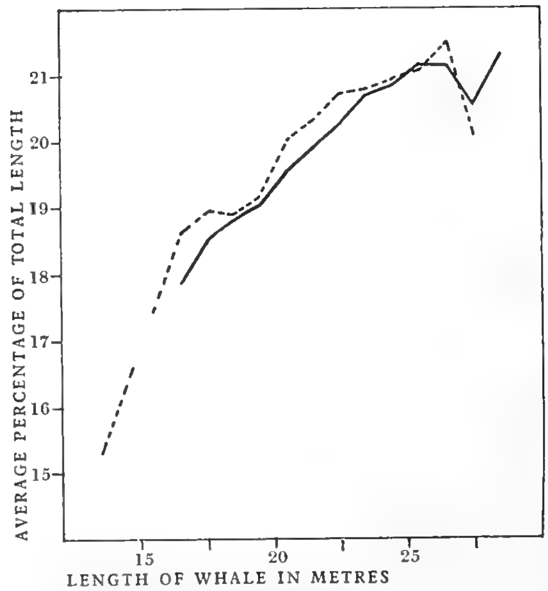

Fig. 6. Female Blue whales. Measurement No. 5. Tip of snout to centre of eye.

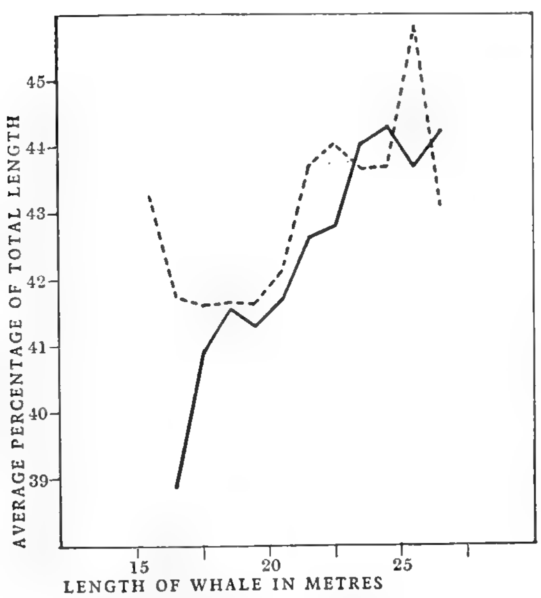

Fig. 7. Male Blue whales. Measurement No. 6. Tip of snout to tip of flipper.

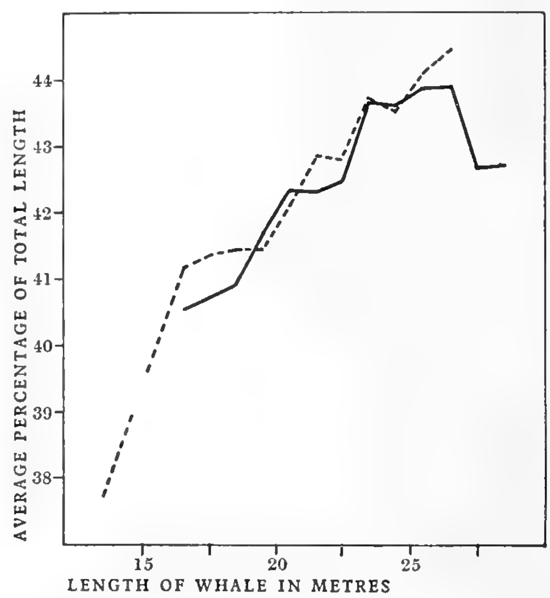

Fig. 8. Female Blue whales. Measurement No. 6. Tip of snout to tip of flipper.

——— South Georgia whales. - - - - South African whales.

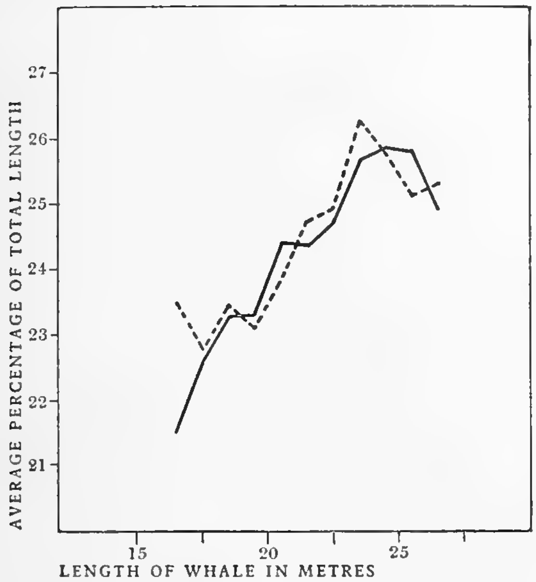

Fig. 9. Male Blue whales. Measurement No. 20. Severed head, condyle to tip.

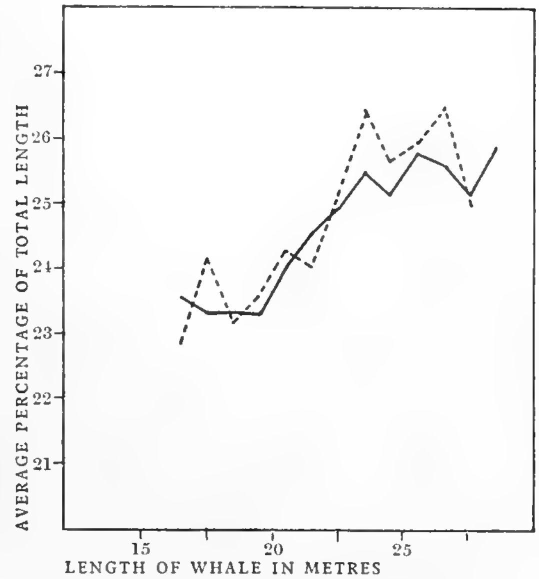

Fig. 10. Female Blue whales. Measurement No. 20. Severed head, condyle to tip.

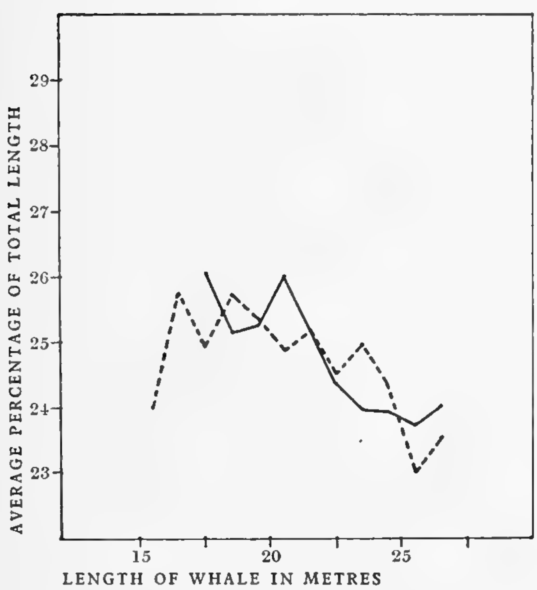

Fig. 11. Male Blue whales. Measurement No. 8. Notch of flukes to posterior emargination of dorsal fin.

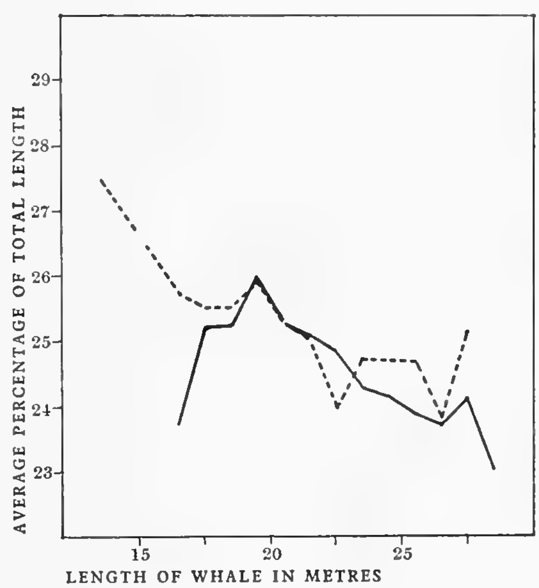

Fig. 12. Female Blue whales. Measurement No. 8. Notch of flukes to posterior emargination of dorsal fin.

——— South Georgia whales. - - - - South African whales.

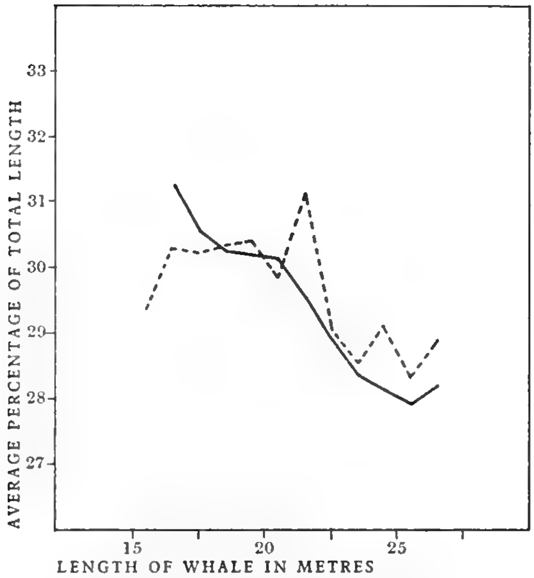

Fig. 13. Male Blue whales. Measurement No. 10. Notch of flukes to anus.

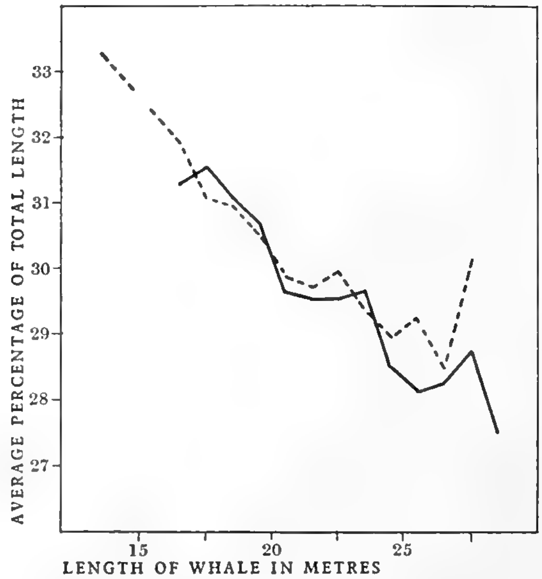

Fig. 14. Female Blue whales. Measurement No. 10. Notch of flukes to anus.

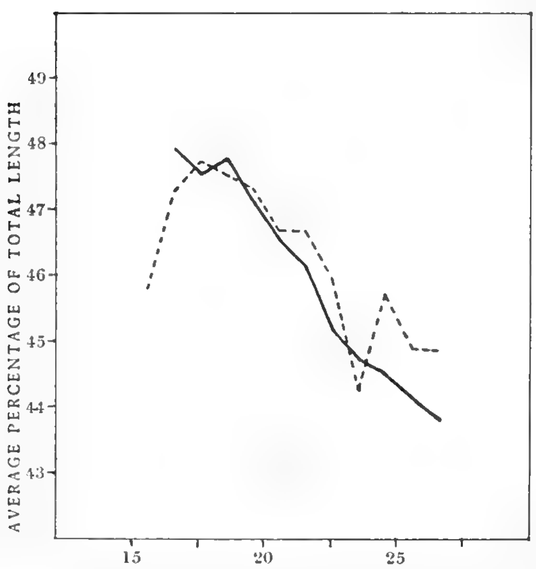

Fig. 15. Male Blue whales. Measurement No. 11. Notch of flukes to umbilicus.

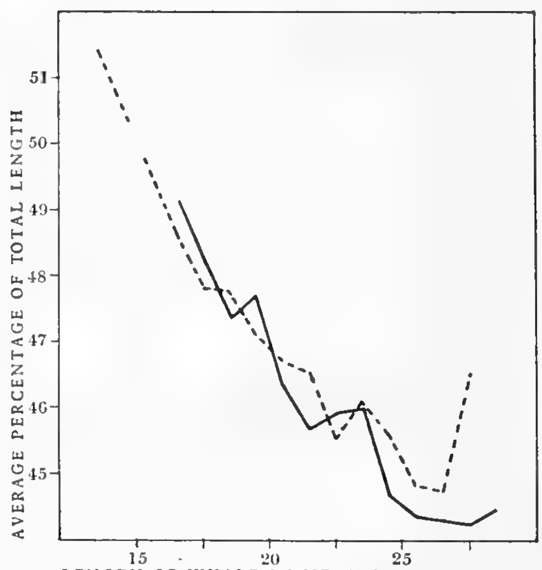

Fig. 16. Female Blue whales. Measurement No. 11. Notch of flukes to umbilicus.

——— South Georgia whales. - - - - South African whales.

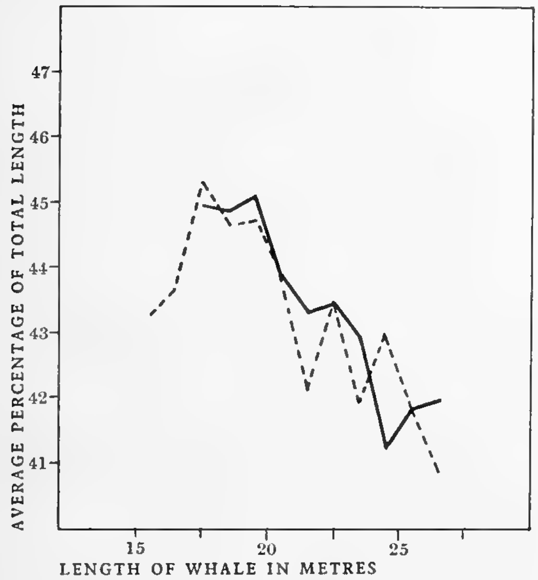

Fig. 17. Male Blue whales. Measurement No. 12. Notch of flukes to end of ventral grooves.

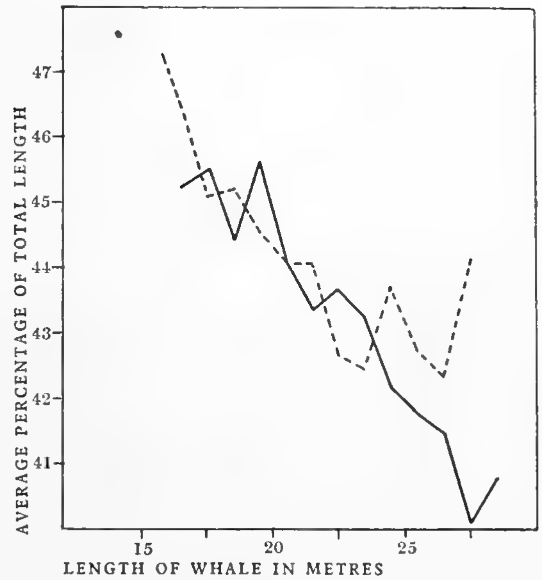

Fig. 18. Female Blue whales. Measurement No. 12. Notch of flukes to end of ventral grooves.

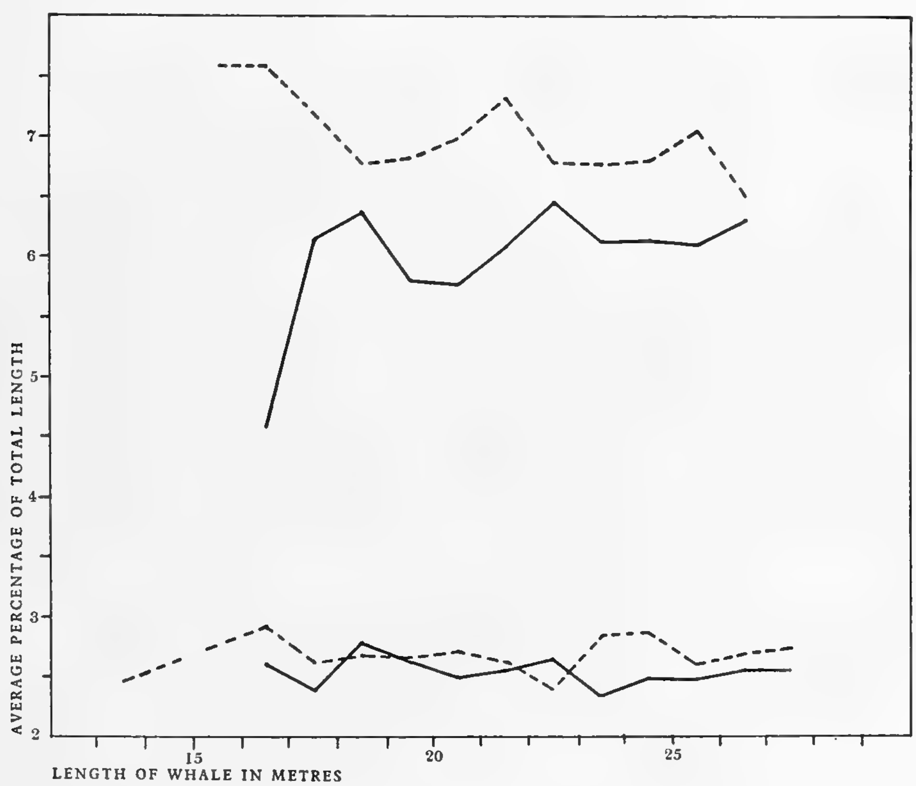

Fig. 19. Blue whales (upper curves males, lower curves females). Measurement No. 13. Anus to reproductive aperture.

——— South Georgia whales. - - - - South African whales.

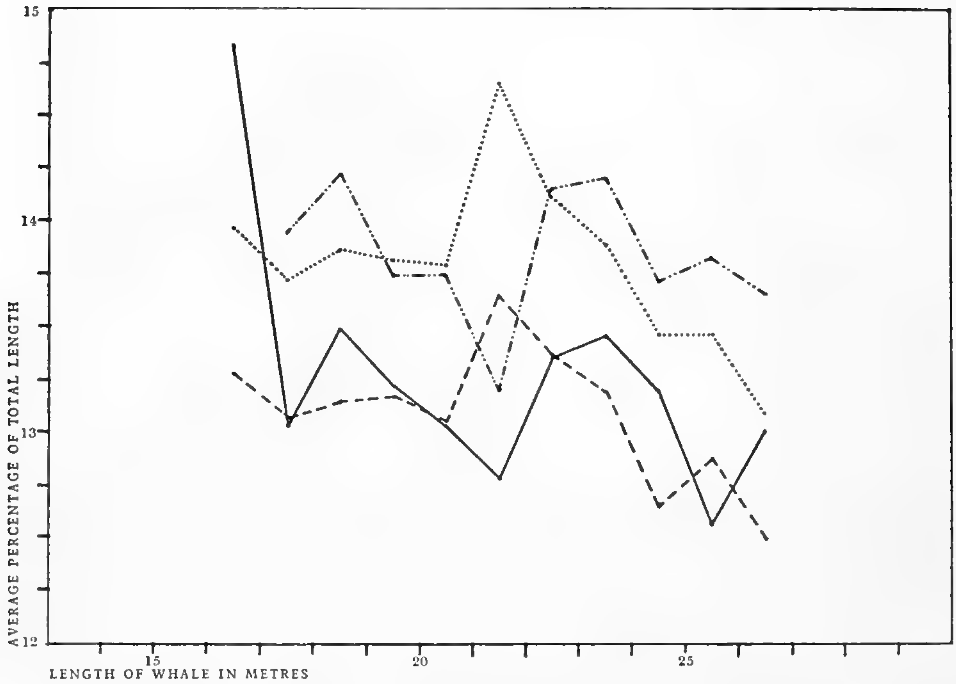

Fig. 20. Male Blue whales. Measurement No. 17. Flipper, tip to anterior end of lower border. Measurement No. 18. Flipper, length along curve of lower border. (See below.)

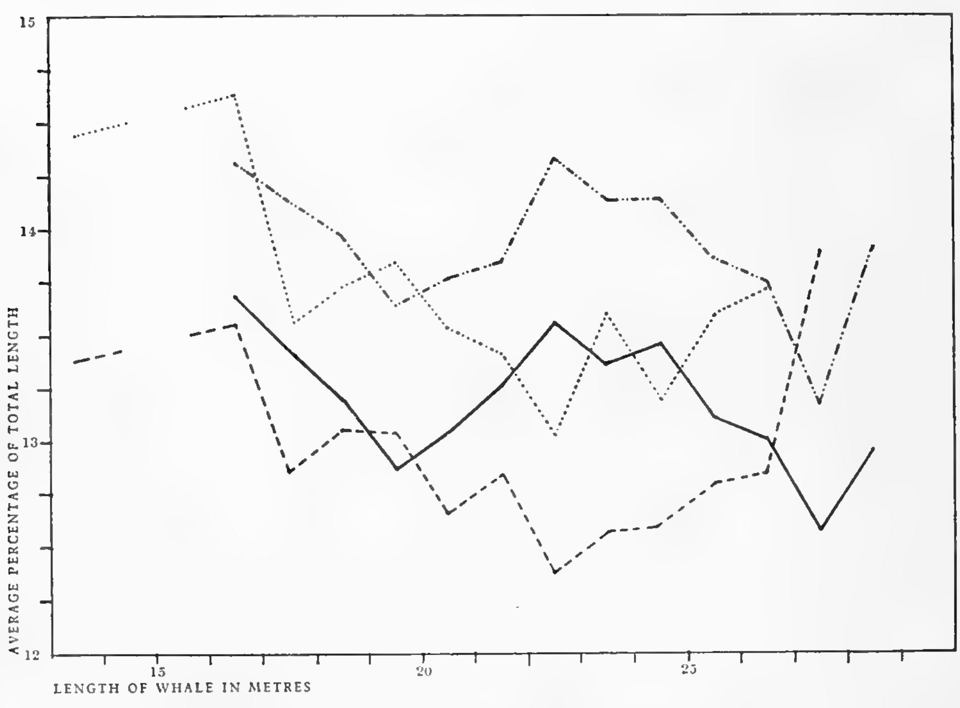

Fig. 21. Female Blue whales. Measurement No. 17. Flipper, tip to anterior end of lower border. Measurement No. 18. Flipper, length along curve of lower border.

——— S. Georgia, - - - - - S. Africa } Measurement No. 17. —··—··—·· S. Georgia, ··········· S. Africa } Measurement No. 18.

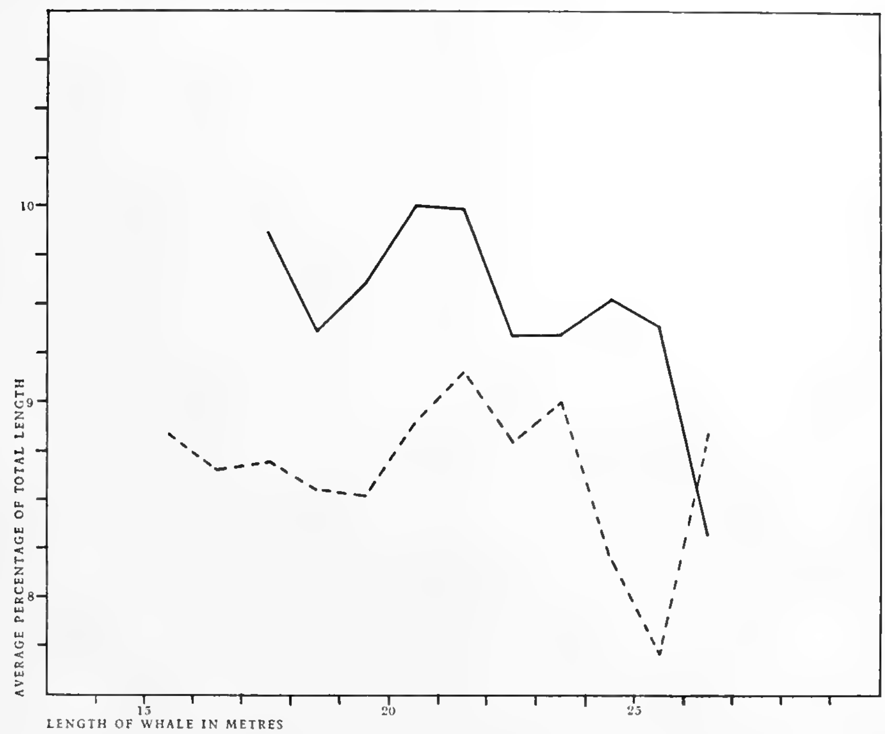

Fig. 22. Male Blue whales. Measurement No. 24. Depth of tail at dorsal fin.

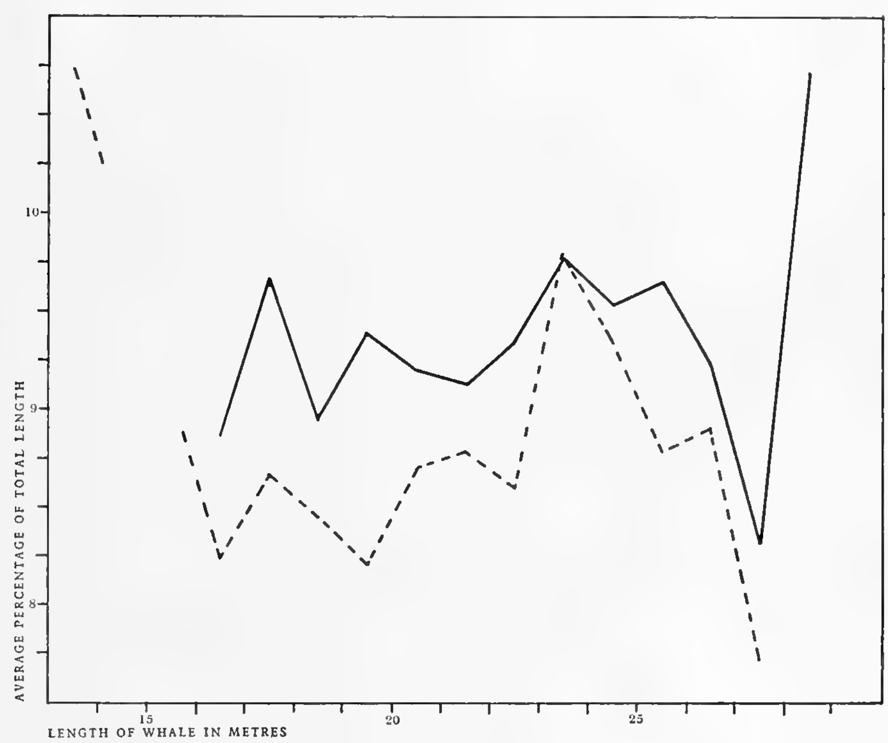

Fig. 23. Female Blue whales. Measurement No. 24. Depth of tail at dorsal fin.

——— South Georgia whales. - - - - - South African whales.

increase as the total length of the whale increases from 16 to 26 m. At about 26 m. in females and 25 m. in males a change occurs in this process and the size of the head begins to decrease in proportion to the rest of the body, as is shown by a sudden turning down of the curve when the greater lengths are reached.

Contrasting strongly with this we find a lag in growth of the tail region. The curves for measurements of the posterior part of the body (Figs. 11 to 18) are almost mirror images of those for the anterior part. In the graphs of the first two or shorter measurements (notch of flukes to dorsal fin, and to anus, Figs. 11 to 14) the lag is less marked than in the two longer measurements (notch of flukes to umbilicus and to ventral grooves, Figs. 15 to 18), so that although the whole tail region undergoes a proportional decrease to compensate for the increase of the head and shoulders, the greatest lag in growth occurs in the region between the anus and the umbilicus. Corresponding

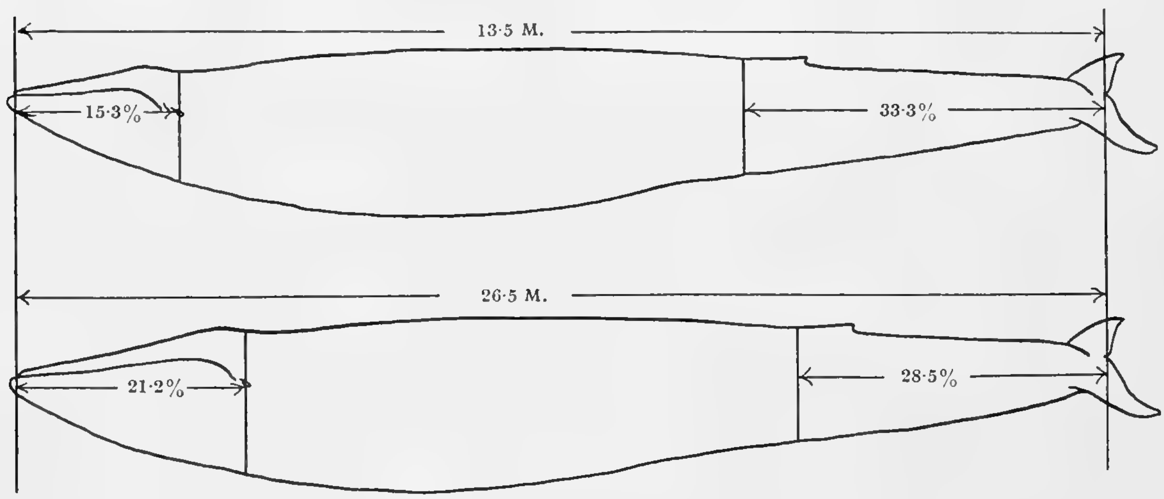

Fig. 24. Greatest difference in average relative sizes of the head and tail in small and large female Blue whales.

to the slight reduction in the size of the head at 25 or 26 m., there is a tendency for a slight increase in the size of the tail at about these lengths.

The proportions of the head and tail in 13·5 m. and 26·5 m. whales are contrasted in the outline sketches in Fig. 24.

Hinton (1915, p. 75), dealing with twenty male Humpbacks examined by Barrett-Hamilton, found that measurements of (*a*) snout to axilla, (*b*) notch of flukes to penis, (*c*) notch of flukes to navel, (*d*) notch of flukes to posterior insertion of the dorsal fin, become relatively shorter as growth proceeds, and concluded that, during adolescence, the thoracic region was the principal seat of growth in the Humpback bull. An examination of the percentage measurements of immature and mature Fin and Blue whales listed by Hinton (pp. 104 and 134) reveals a proportional increase anteriorly and a decrease posteriorly similar to that which has been described above.

The general conclusion is that with increasing total length, up to a point, the anterior part of the body up to the axilla becomes relatively larger and the posterior part correspondingly smaller. It may reasonably be inferred that so long as these steady changes in bodily proportions are taking place full physical maturity has not yet been reached. It is possible, however, that the rather profound change indicated after 25 m. in males and 26 m. in females is concerned with physical maturity, but more measurements of these very large whales are needed before one can ascertain whether the relative proportions of the body alter at this period or whether perhaps abnormally large whales are abnormal in their proportions as well as in their size.

So far only the mean values of the measurements have been considered. The individual variations which occur are best examined by the method of frequency curves; that is, the range of values over which each measurement varies may be divided into groups and the number of individual measurements for each group may be plotted out to form a curve. Owing to the fact that a certain amount of variation depends on the length of the whale it is not permissible to draw curves which include all the measurements which have been made. There are relatively large numbers of measurements for males about 23 and 24 m. and females about 25 and 26 m. Thus by using the bodily measurements of males measuring from 23·00 m. to 24·99 m. and all females from 25·00 m. to 26·99 m. we have enough material for the construction of curves which will at least show the nature and approximate extent of the individual variations which occur. One could perhaps apply a correction for length, but the value of the result would hardly be sufficient to make such an enormous task worth while.

In the following tables and in Figs. 25 to 44 this plan is carried out. In the tables the range of values obtained for each measurement (still of course expressed as percentages of the total length) is divided into an arbitrary number of groups. The individual readings of each measurement for male Blue whales from South Georgia measuring from 23·00 m. to 24·99 m. and females from 25·00 m. to 26·99 m. are sorted out, and the number which fall into each of the groups are shown.

VARIATION OF MEASUREMENTS

Blue Whales: South Georgia

Males, 23–25 m.; females 25–27 m.

3. Tip of snout to blowhole

Range of values (% of total length)	Number of readings ♂	♀
16·0–16·5	1	1
16·5–17·0	3	1
17·0–17·5	8	4
17·5–18·0	6	11
18·0–18·5	14	14
18·5–19·0	17	19
19·0–19·5	18	22
19·5–20·0	18	17
20·0–20·5	5	5
20·5–21·0	2	3
21·0–21·5	2	—
21·5–22·0	—	1

4. Tip of snout to angle of gape

Range of values (% of total length)	Number of readings ♂	♀
18·0–18·5	—	1
18·5–19·0	1	—
19·0–19·5	3	2
19·5–20·0	5	1
20·0–20·5	7	5
20·5–21·0	10	2
21·0–21·5	2	4
21·5–22·0	—	—
22·0–22·5	1	—

5. Tip of snout to centre of eye

Range of values (% of total length)	Number of readings ♂	♀
19·0–19·5	3	3
19·5–20·0	8	6
20·0–20·5	16	12
20·5–21·0	21	19
21·0–21·5	23	31
21·5–22·0	21	20
22·0–22·5	4	10
22·5–23·0	3	4
23·0–23·5	2	—
23·5–24·0	—	1
24·0–24·5	—	—
24·5–25·0	1	—

6. Tip of snout to tip of flipper

Range of values (% of total length)	Number of readings ♂	♀
38–39	1	—
39–40	1	—
40–41	2	1
41–42	2	7
42–43	8	14
43–44	21	26
44–45	29	22
45–46	20	16
46–47	5	6
47–48	2	—
48–49	—	—
49–50	1	—

7. Eye to ear (centres)

Range of values (% of total length)	Number of readings ♂	♀
3·75–4·00	—	1
4·00–4·25	1	—
4·25–4·50	—	—
4·50–4·75	—	—
4·75–5·00	2	5
5·00–5·25	7	18
5·25–5·50	29	29
5·50–5·75	24	27
5·75–6·00	19	6
6·00–6·25	3	1
6·25–6·50	1	—
6·50–6·75	—	—
6·75–7·00	1	—

13. Anus to reproductive aperture (centres)

Range of values (% of total length)	Number of readings ♂	♀
1·5–2·0	—	10
2·0–2·5	—	42
2·5–3·0	—	48
3·0–3·5	—	7
3·5–4·0	1	1
4·0–4·5	9	—
4·5–5·0	19	—
5·0–5·5	—	—
5·5–6·0	4	—
6·0–6·5	9	—
6·5–7·0	22	—
7·0–7·5	19	—
7·5–8·0	7	—
8·0–8·5	2	—

14. Dorsal fin, vertical height

Range of values (% of total length)	Number of readings ♂	♀
0·2–0·4	1	—
0·4–0·6	1	—
0·6–0·8	3	6
0·8–1·0	10	8
1·0–1·2	9	18
1·2–1·4	14	23
1·4–1·6	9	13
1·6–1·8	7	2
1·8–2·0	1	1

15. Dorsal fin, length of base

Range of values (% of total length)	Number of readings ♂	♀
2·0–2·5	1	—
2·5–3·0	2	—
3·0–3·5	11	7
3·5–4·0	10	15
4·0–4·5	8	13
4·5–5·0	10	16
5·0–5·5	16	8
5·5–6·0	5	6
6·0–6·5	4	2
6·5–7·0	1	1
7·0–7·5	1	—
7·5–8·0	1	—

16. Flipper, tip to axilla

Range of values (% of total length)	Number of readings ♂	♀
7·5–8·0	1	—
8·0–8·5	1	2
8·5–9·0	5	9
9·0–9·5	11	14
9·5–10·0	18	19
10·0–10·5	33	21
10·5–11·0	12	9
11·0–11·5	2	4
11·5–12·0	3	5
12·0–12·5	1	—
12·5–13·0	—	1

17. Flipper, tip to anterior end of lower border

Range of values (% of total length)	Number of readings ♂	♀
11·0–11·5	—	2
11·5–12·0	1	4
12·0–12·5	4	14
12·5–13·0	16	8
13·0–13·5	16	19
13·5–14·0	18	11
14·0–14·5	4	6
14·5–15·0	1	3

VARIATION OF MEASUREMENTS

Blue Whales: South Georgia

Males, 23–25 m.; females 25–27 m.

8. Notch of flukes to posterior emargination of dorsal fin			9. Flukes, width at insertion			10. Notch of flukes to anus			11. Notch of flukes to umbilicus			12. Notch of flukes to end of ventral grooves		
Range of values (% of total length)	Number of readings ♂	♀	Range of values (% of total length)	Number of readings ♂	♀	Range of values (% of total length)	Number of readings ♂	♀	Range of values (% of total length)	Number of readings ♂	♀	Range of values (% of total length)	Number of readings ♂	♀
20·5–21·0	—	1	4·25–4·50	2	1	22·5–23·0	—	1	39·0–39·5	—	1	33–34	—	1
21·0–21·5	2	1	4·50–4·75	7	9	23·0–23·5	—	—	39·5–40·0	—	—	34–35	2	—
21·5–22·0	1	5	4·75–5·00	23	28	23·5–24·0	—	—	40·0–40·5	—	—	35–36	—	—
22·0–22·5	7	3	5·00–5·25	24	31	24·0–24·5	—	1	40·5–41·0	—	1	36–37	—	—
22·5–23·0	6	10	5·25–5·50	22	20	24·5–25·0	—	—	41·0–41·5	1	—	37–38	1	1
23·0–23·5	11	10	5·50–5·75	12	9	25·0–25·5	1	—	41·5–42·0	3	3	38–39	—	—
23·5–24·0	9	10	5·75–6·00	6	2	25·5–26·0	1	2	42·0–42·5	2	5	39–40	7	6
24·0–24·5	15	11	6·00–6·25	1	2	26·0–26·5	3	4	42·5–43·0	4	7	40–41	12	14
24·5–25·0	6	11				26·5–27·0	9	5	43·0–43·5	4	11	41–42	12	20
25·0–25·5	8	6				27·0–27·5	10	11	43·5–44·0	14	15	42–43	13	13
25·5–26·0	1	2				27·5–28·0	19	22	44·0–44·5	18	17	43–44	7	11
26·0–26·5	4	2				28·0–28·5	18	23	44·5–45·0	17	10	44–45	7	4
26·5–27·0	—	2				28·5–29·0	18	13	45·0–45·5	18	14	45–46	2	—
						29·0–29·5	13	14	45·5–46·0	7	5	46–47	1	—
						29·5–30·0	7	5	46·0–46·5	6	9	47–48	1	—
						30·0–30·5	2	5	46·5–47·0	1	5			
						30·5–31·0	1	—	47·0–47·5	3	—			
						31·0–31·5	—	2	47·5–48·0	2	2			

18. Flipper, length along curve of lower border			19. Flipper, greatest width			20. Severed head, condyle to tip			21. Skull, greatest width			24. Tail, depth at dorsal fin		
Range of values (% of total length)	Number of readings ♂	♀	Range of values (% of total length)	Number of readings ♂	♀	Range of values (% of total length)	Number of readings ♂	♀	Range of values (% of total length)	Number of readings ♂	♀	Range of values (% of total length)	Number of readings ♂	♀
12·0–12·5	—	4	3·1–3·2	3	—	22·5–23·0	1	—	9·0– 9·5	—	1	6·0– 6·5	1	—
12·5–13·0	7	9	3·2–3·3	2	—	23·0–23·5	—	1	9·5–10·0	—	—	6·5– 7·0	—	—
13·0–13·5	10	10	3·3–3·4	1	5	23·5–24·0	2	4	10·0–10·5	1	1	7·0– 7·5	—	—
13·5–14·0	15	10	3·4–3·5	6	9	24·0–24·5	3	5	10·5–11·0	5	8	7·5– 8·0	—	3
14·0–14·5	15	15	3·5–3·6	6	12	24·5–25·0	8	7	11·0–11·5	15	18	8·0– 8·5	3	6
14·5–15·0	9	10	3·6–3·7	11	10	25·0–25·5	9	15	11·5–12·0	18	19	8·5– 9·0	10	7
15·0–15·5	1	5	3·7–3·8	10	8	25·5–26·0	17	6	12·0–12·5	15	16	9·0– 9·5	16	11
15·5–16·0	1	1	3·8–3·9	10	6	26·0–26·5	10	20	12·5–13·0	7	5	9·5–10·0	17	14
			3·9–4·0	9	8	26·5–27·0	10	10	13·0–13·5	1	—	10·0–10·5	6	13
			4·0–4·1	6	5	27·0–27·5	4	3	13·5–14·0	—	1	10·5–11·0	9	3
			4·1–4·2	2	4	27·5–28·0	—	1				11·0–11·5	2	1
						28·0–28·5	1	1						

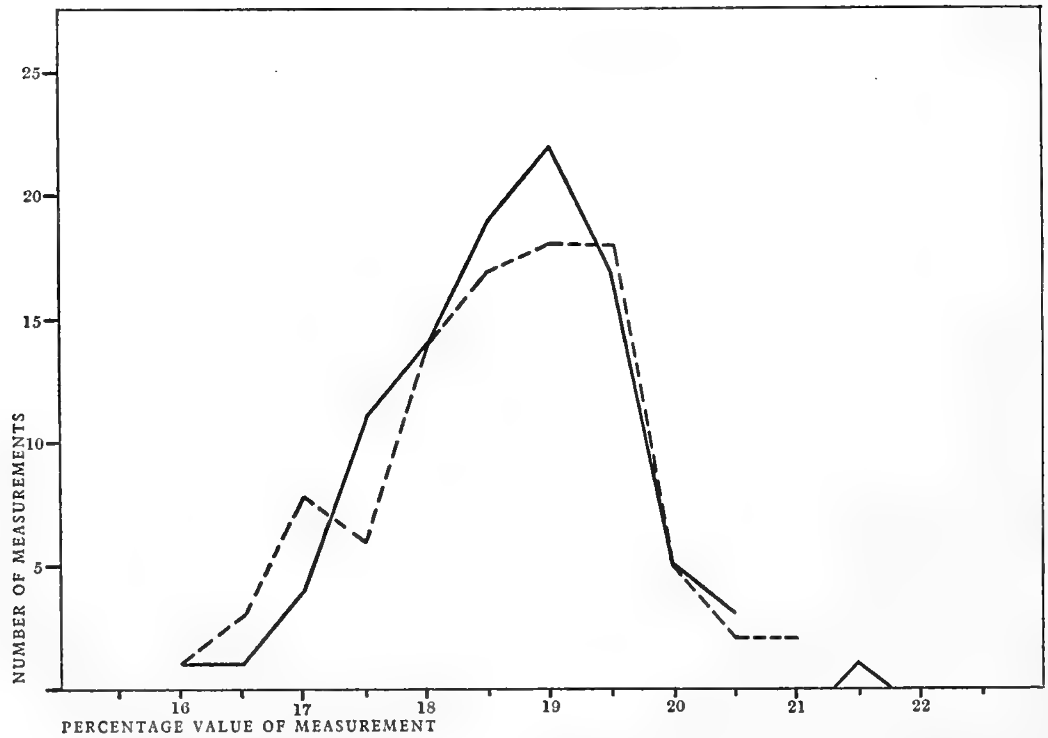

Fig. 25. Blue whales. Variations of measurement No. 3. Tip of snout to blowhole.

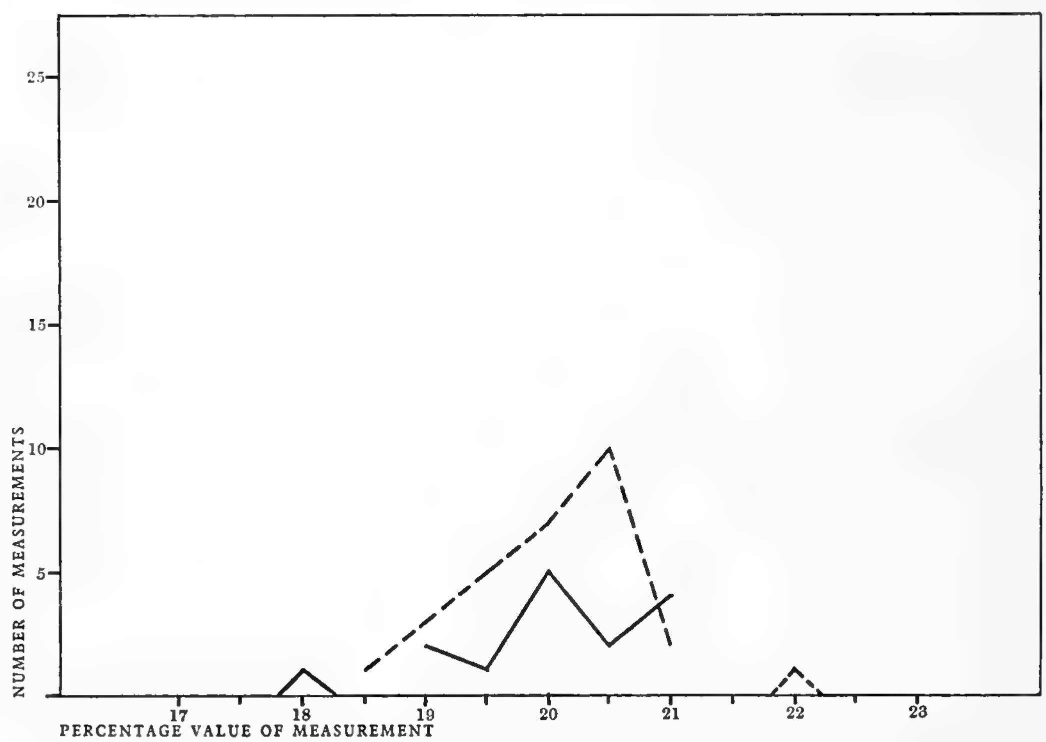

Fig. 26. Blue whales. Variations of measurement No. 4. Tip of snout to angle of gape.

- - - - - Males. ——— Females.

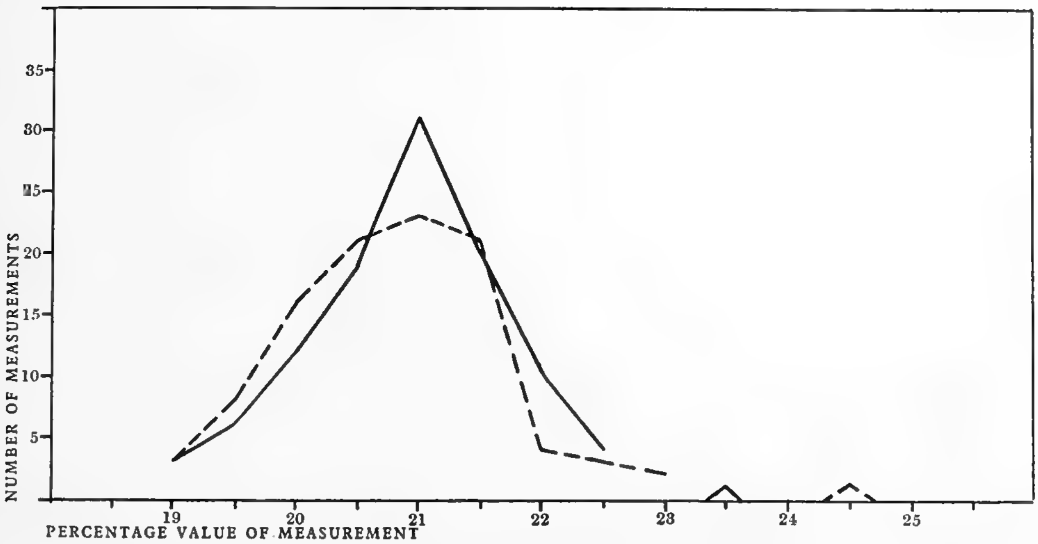

Fig. 27. Blue whales. Variations of measurement No. 5. Tip of snout to centre of eye.

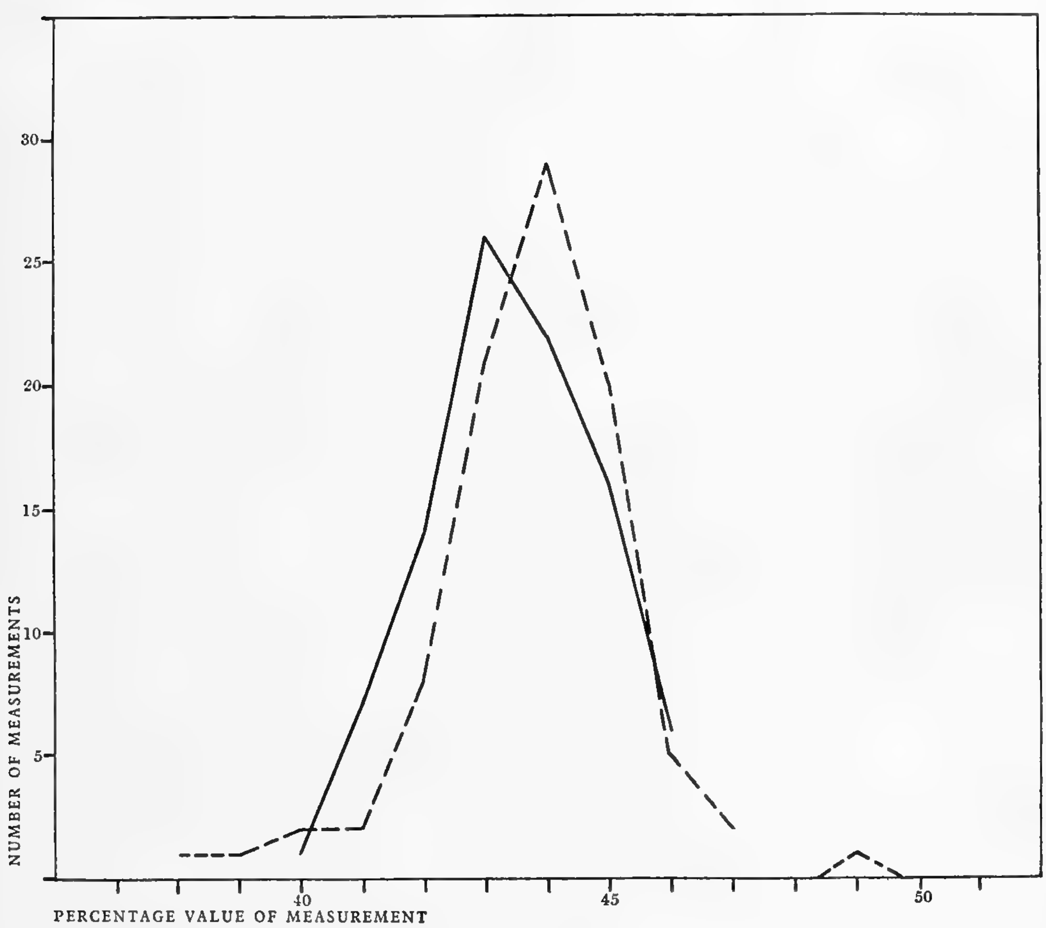

Fig. 28. Blue whales. Variations of measurement No. 6. Tip of snout to tip of flipper.

- - - - - Males. ——— Females.

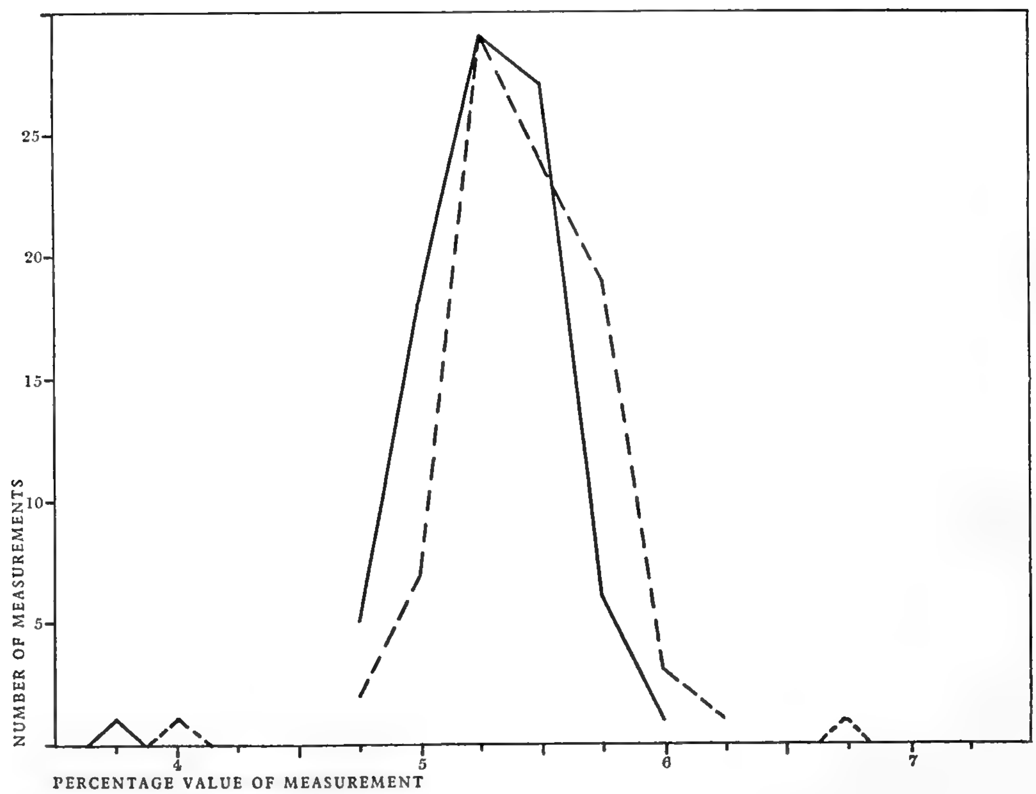

Fig. 29. Blue whales. Variations of measurement No. 7. Eye to ear, centres.

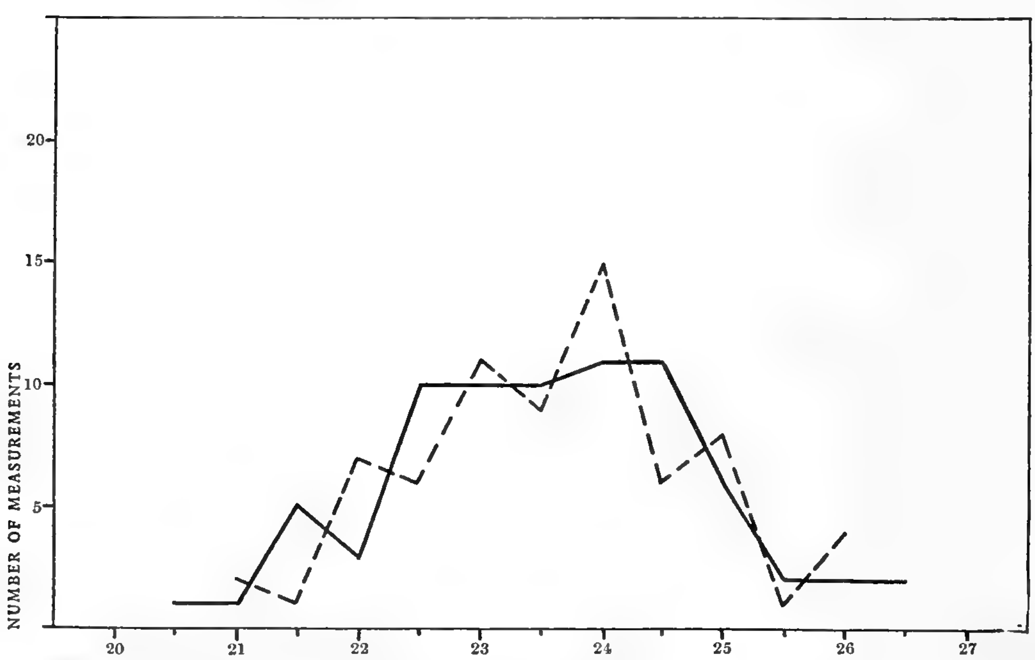

Fig. 30. Blue whales. Variations of measurement No. 8. Notch of flukes to posterior emargination of dorsal fin.

- - - - - Males. ——— Females.

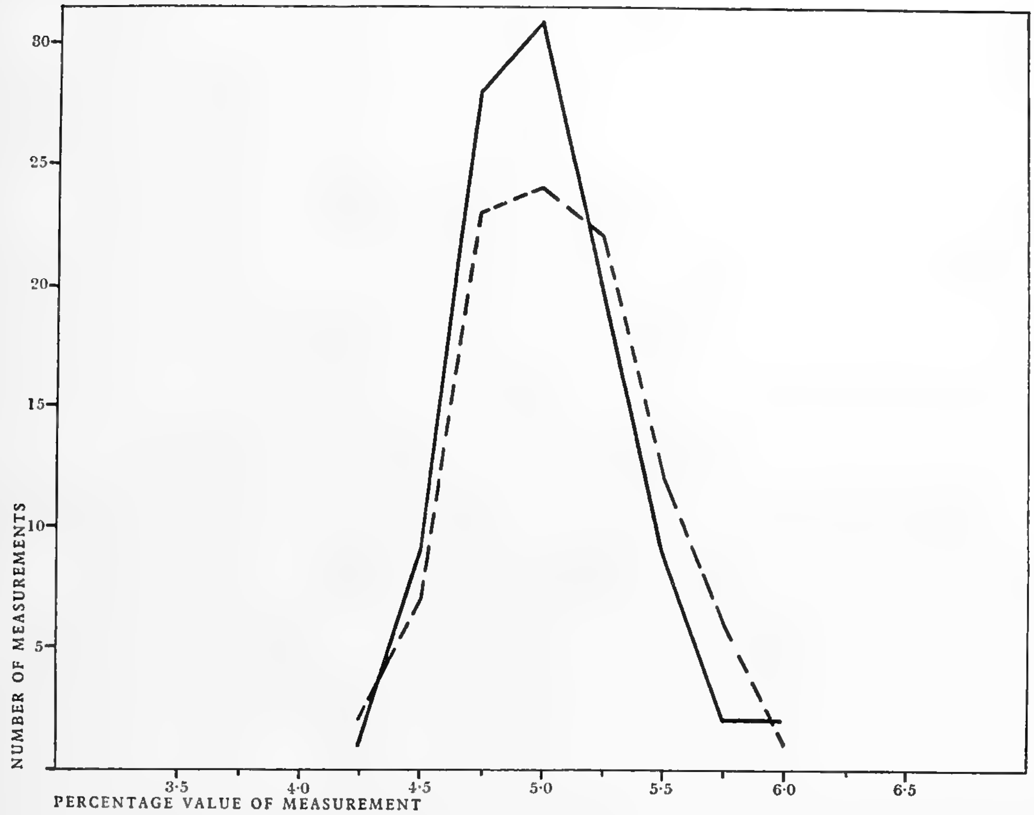

Fig. 31. Blue whales. Variations of measurement No. 9. Flukes, width at insertion.

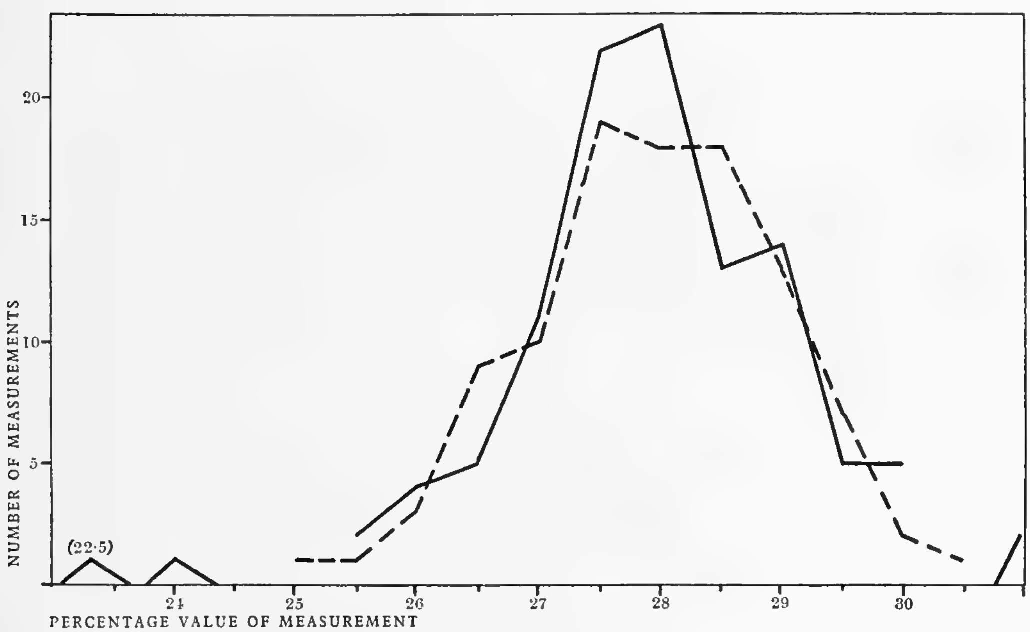

Fig. 32. Blue whales. Variations of measurement No. 10. Notch of flukes to anus.

- - - - - Males. ——— Females.

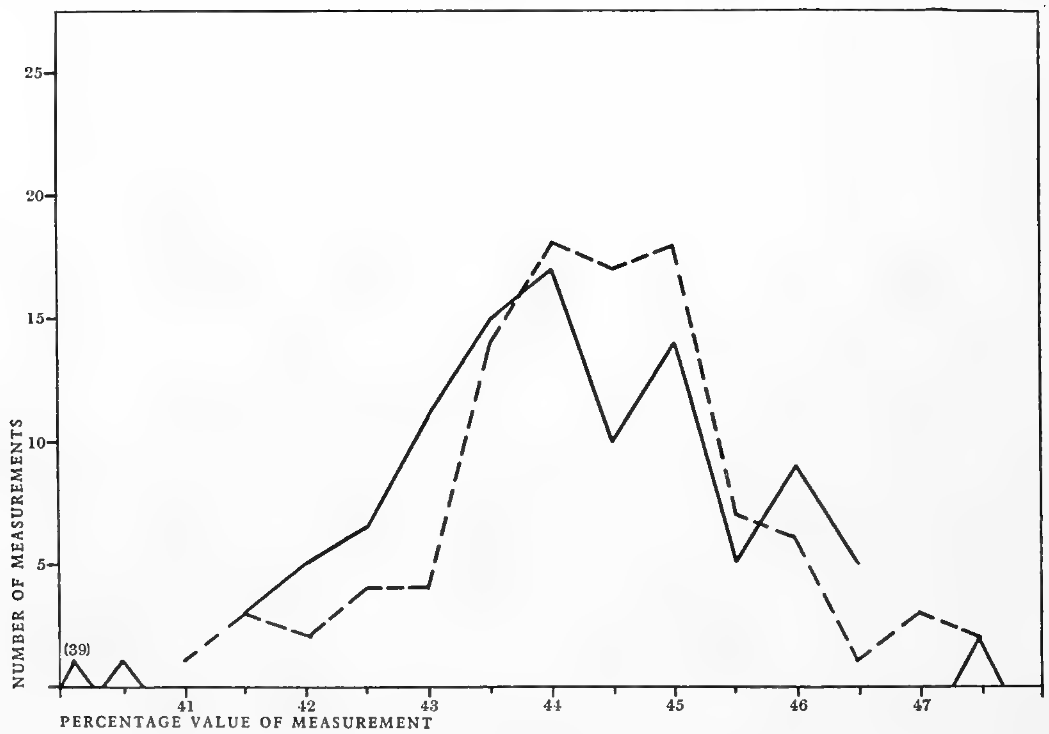

Fig. 33. Blue whales. Variations of measurement No. 11. Notch of flukes to umbilicus.

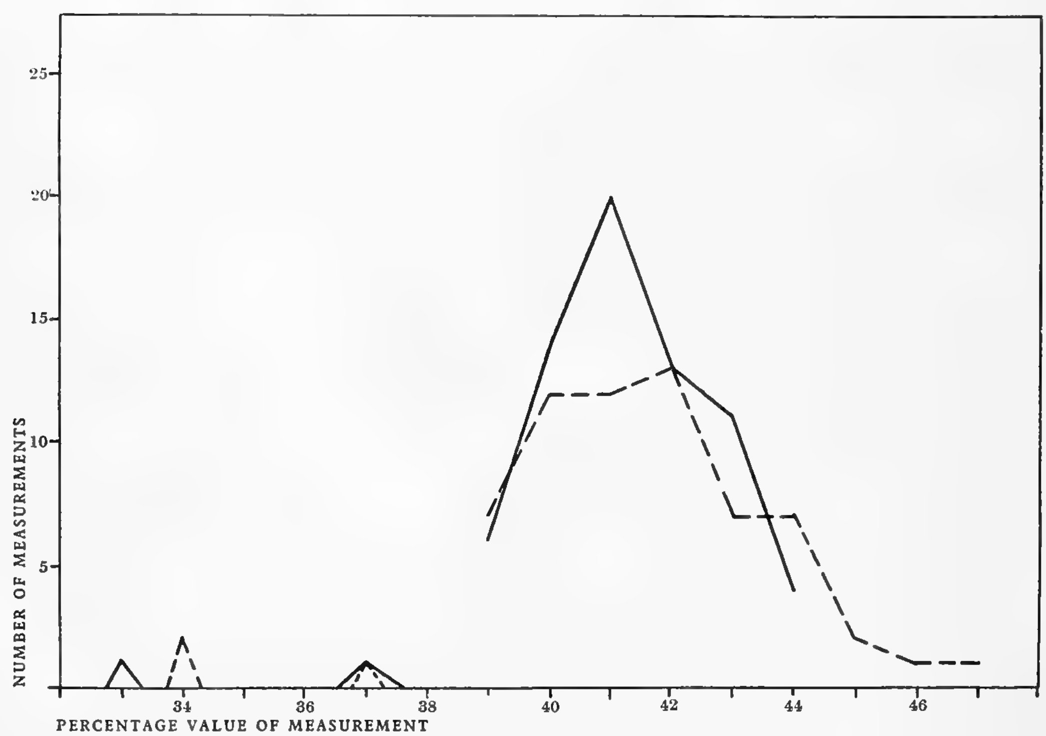

Fig. 34. Blue whales. Variations of measurement No. 12. Notch of flukes to end of ventral grooves.

- - - - - Males. ——— Females.

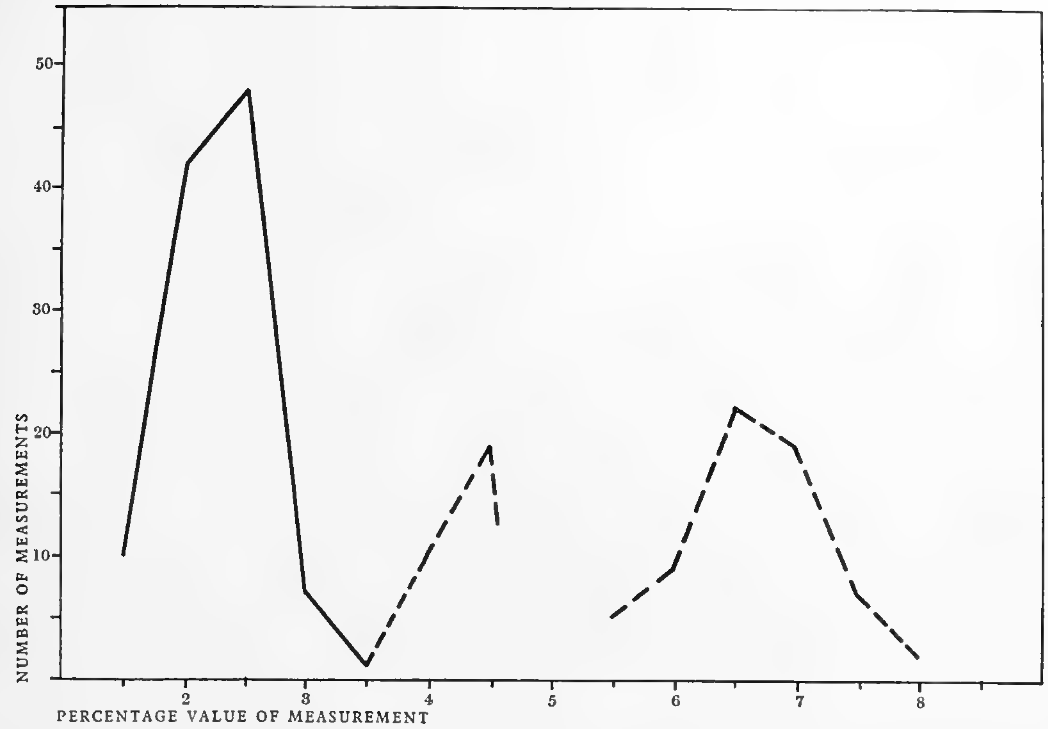

Fig. 35. Blue whales. Variations of measurement No. 13. Anus to reproductive aperture, centres.

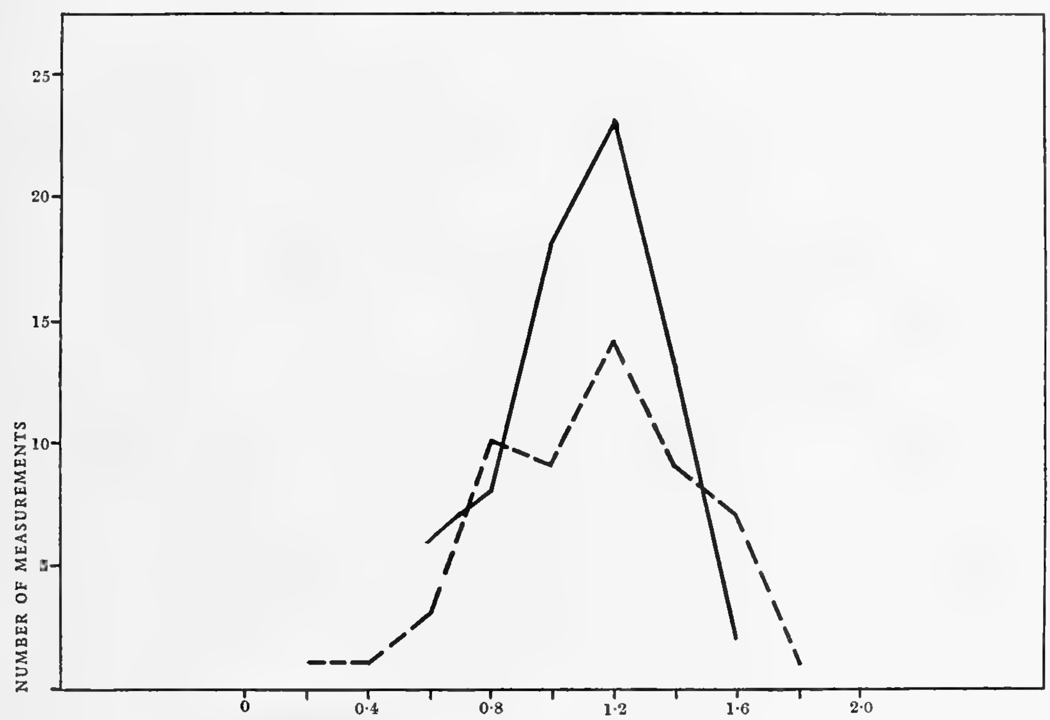

Fig. 36. Blue whales. Variations of measurement No. 14. Dorsal fin, vertical height.

- - - - - Males. ——— Females.

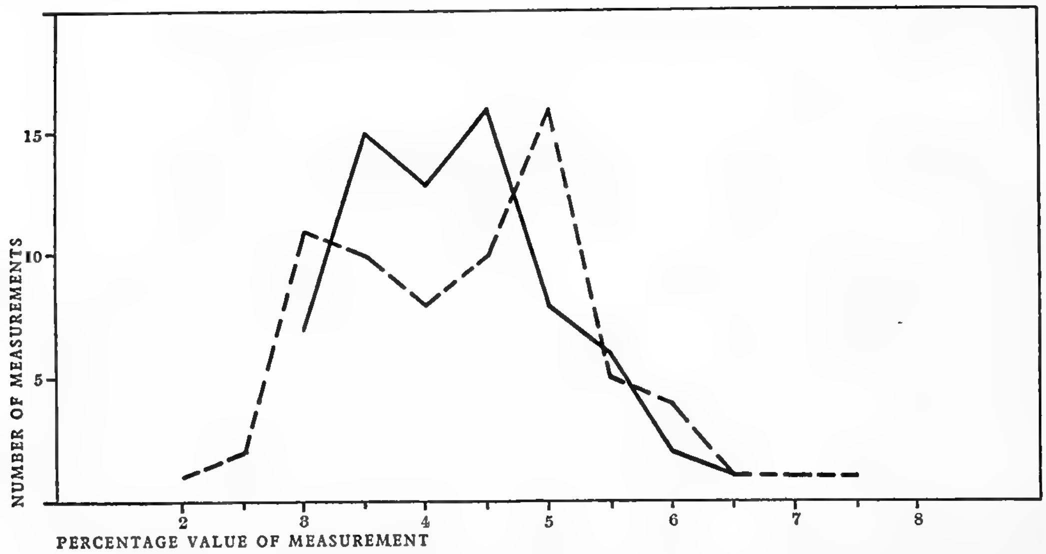

Fig. 37. Blue whales. Variations of measurement No. 15. Dorsal fin, length of base.

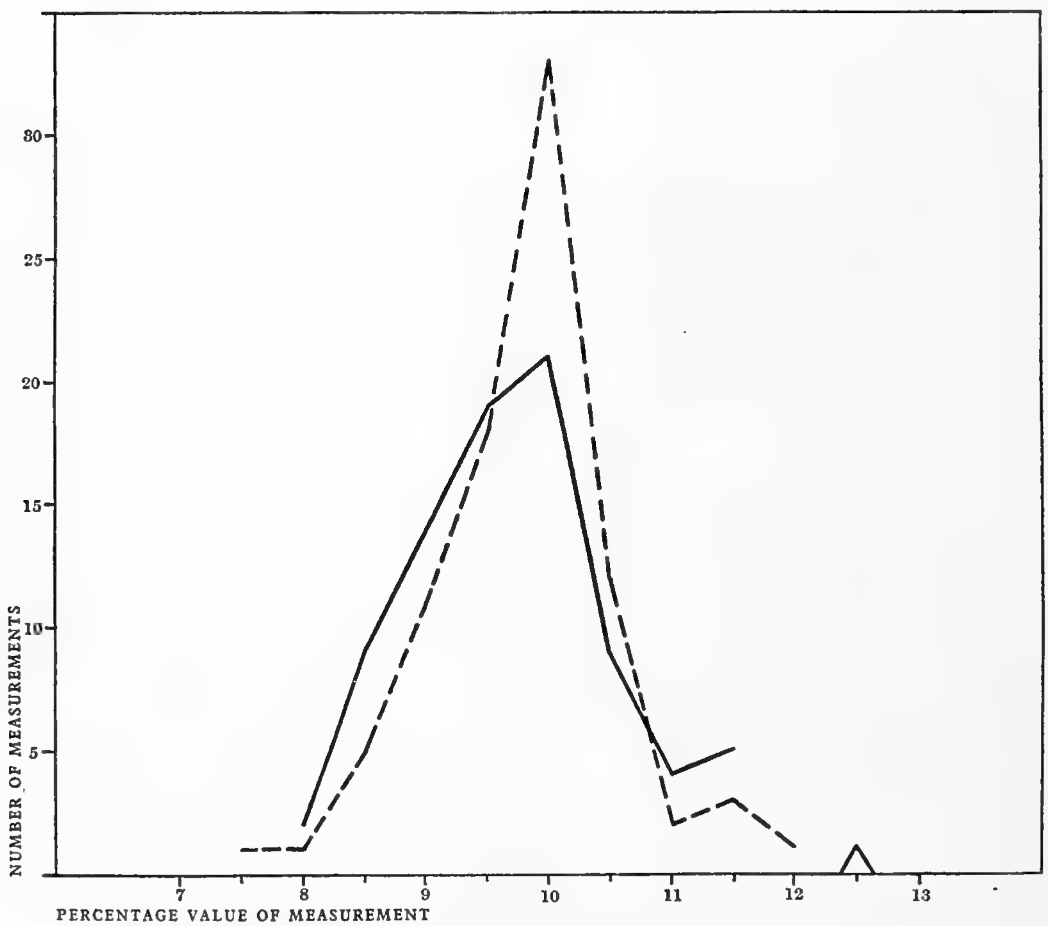

Fig. 38. Blue whales. Variations of measurement No. 16. Flipper, tip to axilla.

- - - - - Males. ——— Females.

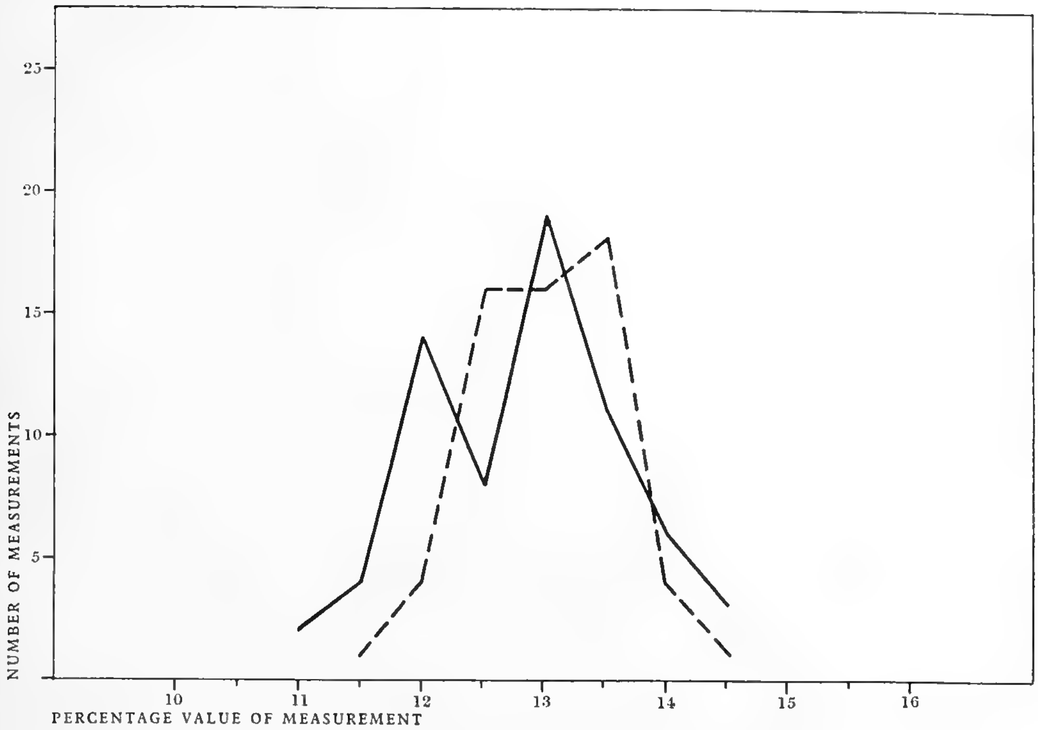

Fig. 39. Blue whales. Variations of measurement No. 17. Flipper, tip to anterior end of lower border.

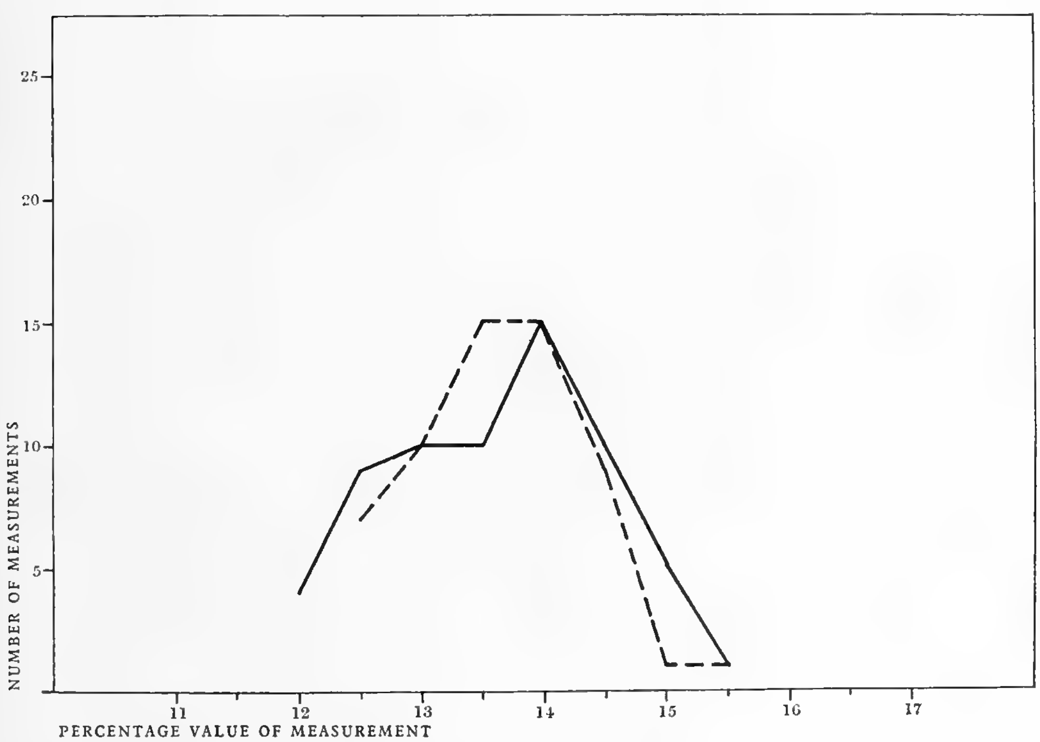

Fig. 40. Blue whales. Variations of measurement No. 18. Flipper, length along curve of lower border.

- - - - - Males. ——— Females.

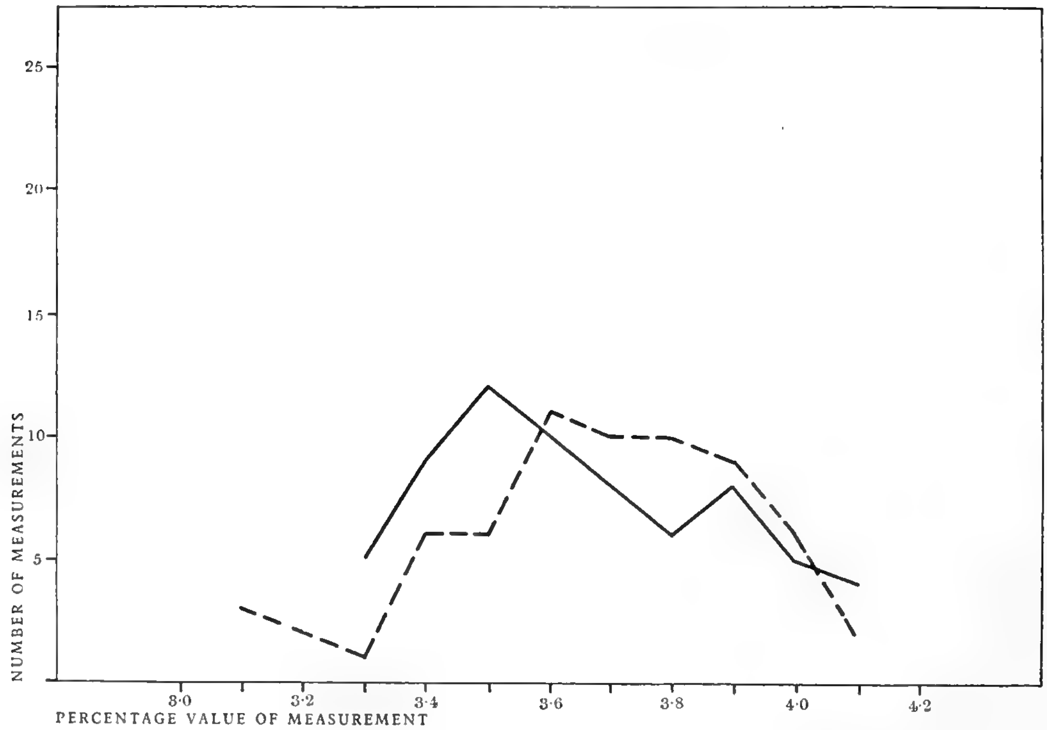

Fig. 41. Blue whales. Variations of measurement No. 19. Flipper, greatest width.

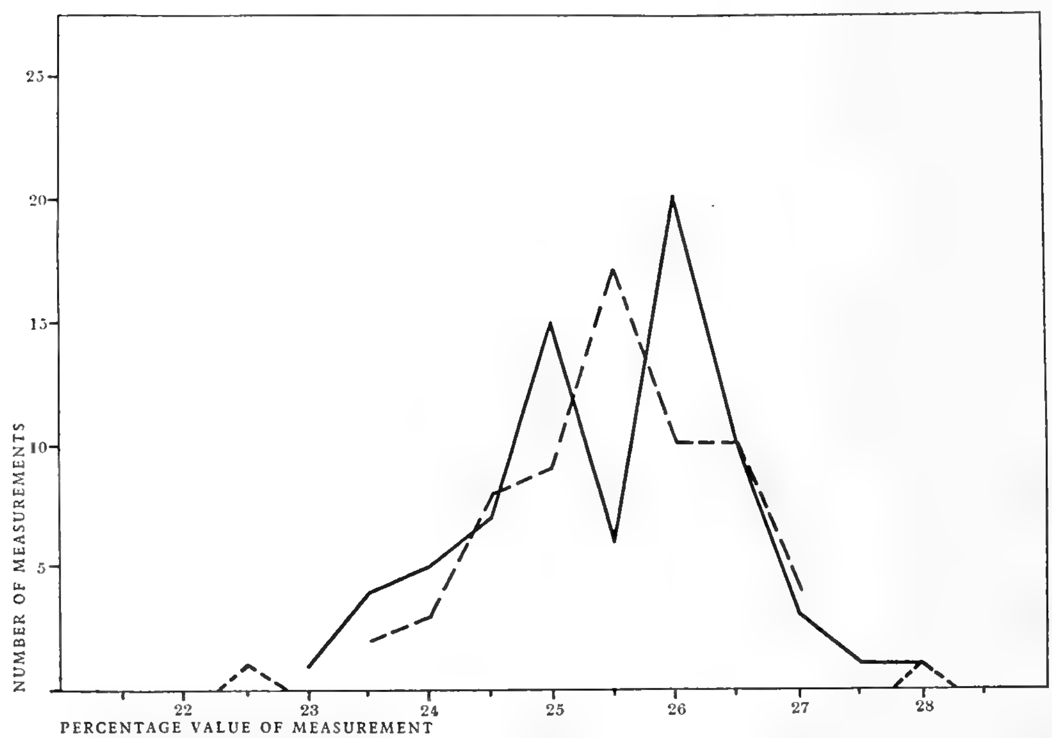

Fig. 42. Blue whales. Variations of measurement No. 20. Severed head, condyle to tip.

- - - - - Males. ——— Females.

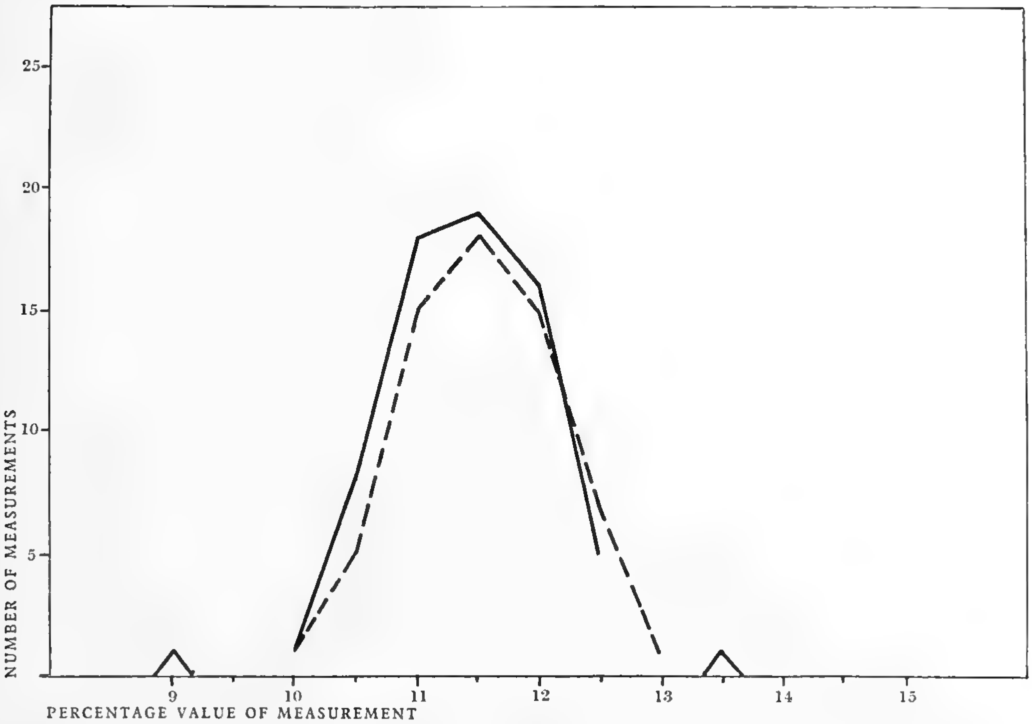

Fig. 43. Blue whales. Variations of measurement No. 21. Skull, greatest width.

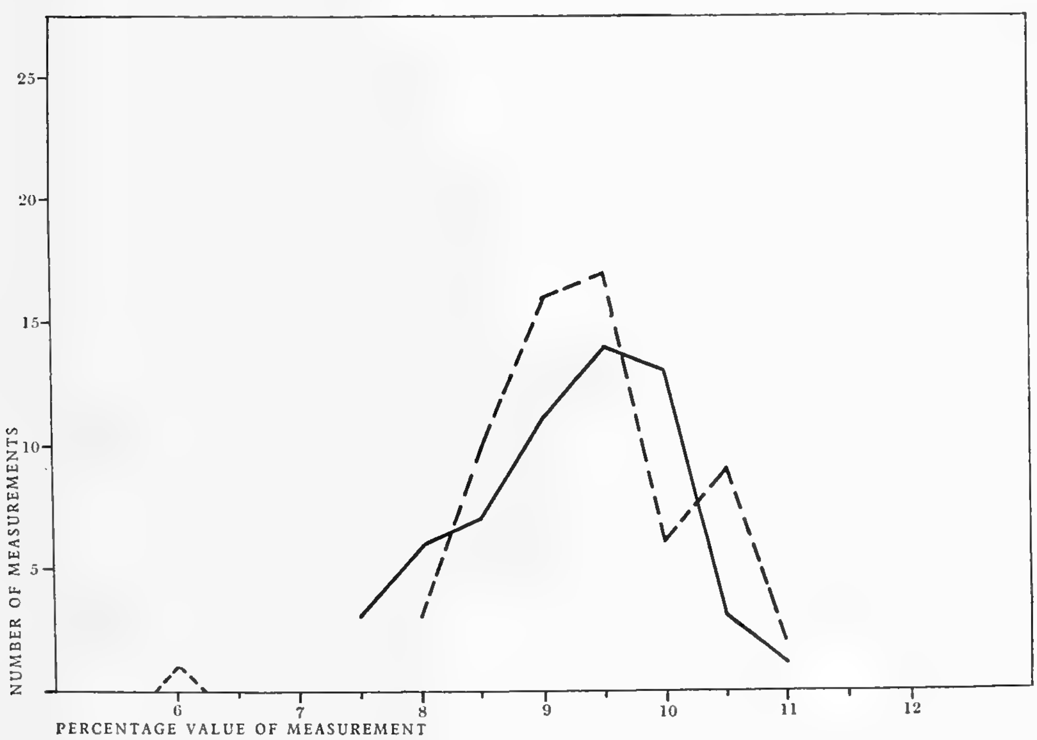

Fig. 44. Blue whales. Variations of measurement No. 24. Tail, depth at dorsal fin.

- - - - - Males. ——— Females.

We may consider first the degree of variation shown by each measurement. In this respect the actual spread of the curve is not to be relied on, for the range of percentage measurement values (shown as abscissae) is not on the same scale in all the charts. Perhaps the best idea of the amount of variation is to be had by dividing the largest reading by the smallest. Thus, in No. 21, "Greatest width of skull," except for two "outsize" measurements, the largest reading is only 1·3 times as great as the smallest, indicating a narrow range of variation, while in No. 14, "Vertical height of dorsal fin," the largest reading is nine times as great as the smallest, indicating a very wide range of variation. It should be mentioned, however, that No. 14 (like Nos. 12 and 15) is a bad measurement in the sense that it is difficult to take it each time in a uniform manner, and the wide range of the readings may be due, to a limited extent, to this cause.

It will be unnecessary to discuss the range of variation of each measurement, as this can be seen at a glance from the tables, and the information may be supplemented by reference to the charts on pp. 298–307.

Normal variation should give normal frequency curves from data treated in this way, and with one or two exceptions the curves are undoubtedly of this type. Minor irregularities can be attributed to the comparatively limited data from which they are constructed.

Of the curves which do not conform to the normal frequency type measurement No. 4 (males) may be quickly disposed of since its lack of shape is simply due to paucity of data. Measurement No. 8 is somewhat erratic, but would probably resolve itself into a normal curve with more data. The curves which need more careful examination are those of measurements Nos. 13, 15, 17 and 20, for either in one or both sexes these curves show a tendency to resolve themselves into two peaks. One object of studying the variations of the external characters is to find whether by any chance more than one race is to be distinguished among the whales examined, and if any measurement constituted a distinguishing feature between two such races the probable effect would be two separate maxima in the frequency curve. On the other hand, two peaks in this curve, if not very marked, might be due to chance (unless constructed from a great number of readings) or to faults in the actual taking of the measurements, for there are one or two cases in which there is always some doubt as to the exact point to which the measurement should be taken.

Although measurement No. 20 increases relatively as the whale length becomes greater, the variations of measurements Nos. 13, 15 and 17 are independent of the length of the whale. Thus for these three measurements we may compare the curves already obtained with curves constructed from the whole of the data relating to Blue whales instead of only those between certain lengths. In other words, we may see whether these double-peaked curves can be shown to be in reality single when a larger amount of data is used. In measurement No. 20 this irregularity appears only in the curve for females. Now the length of the head is very little affected by the length of the body between about 23 and 28 m. (see table on p. 282), so that we may at least draw

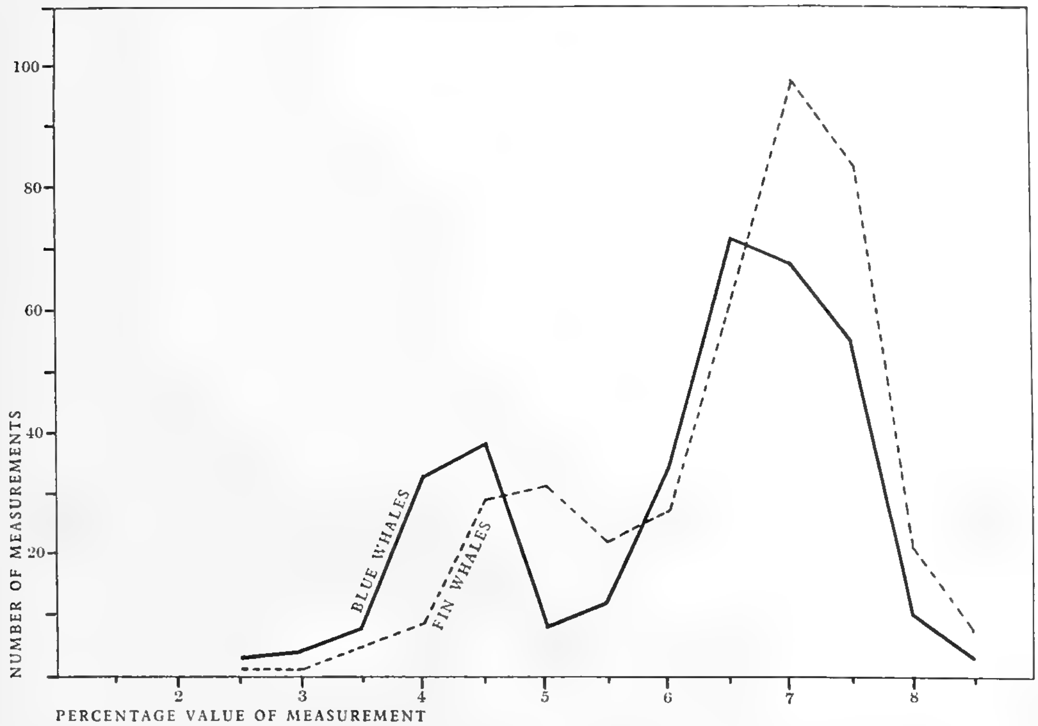

Fig. 45. Male Blue and Fin whales. Variations of measurement No. 13. Anus to reproductive aperture. (Whales of all sizes.)

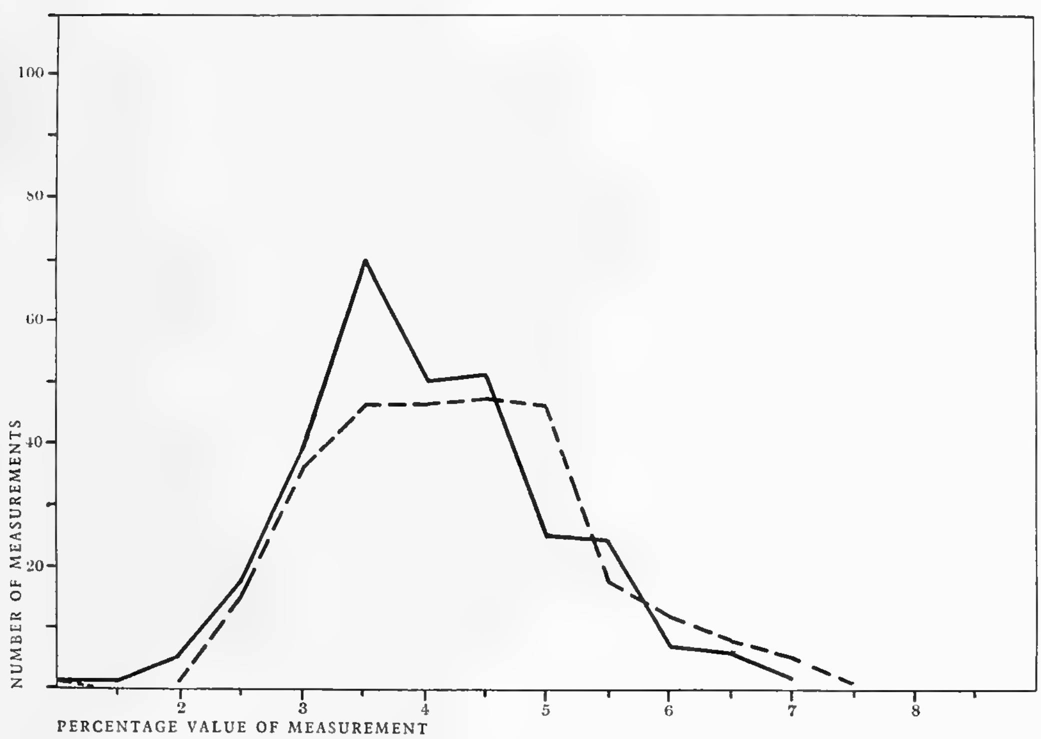

Fig. 46. Blue whales. Variations of measurement No. 15. Dorsal fin, length at base. (Whales of all sizes.)

- - - - - Males. ——— Females.

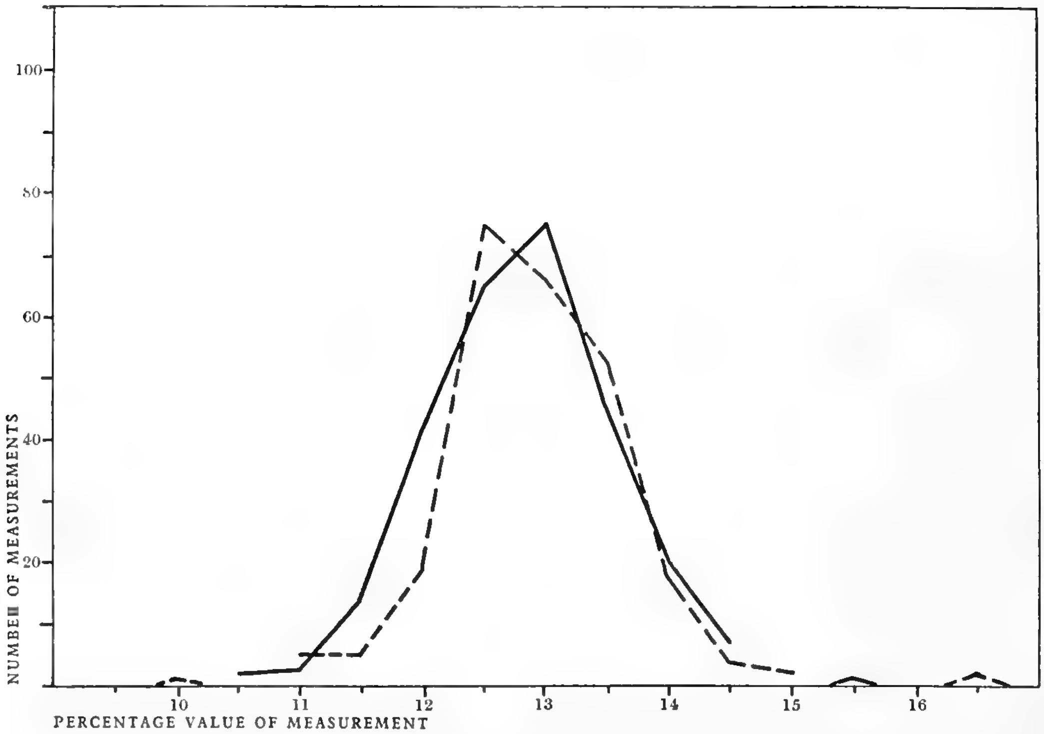

Fig. 47. Blue whales. Variations of measurement No. 17. Flipper, tip to anterior end of lower border. (Whales of all sizes.)

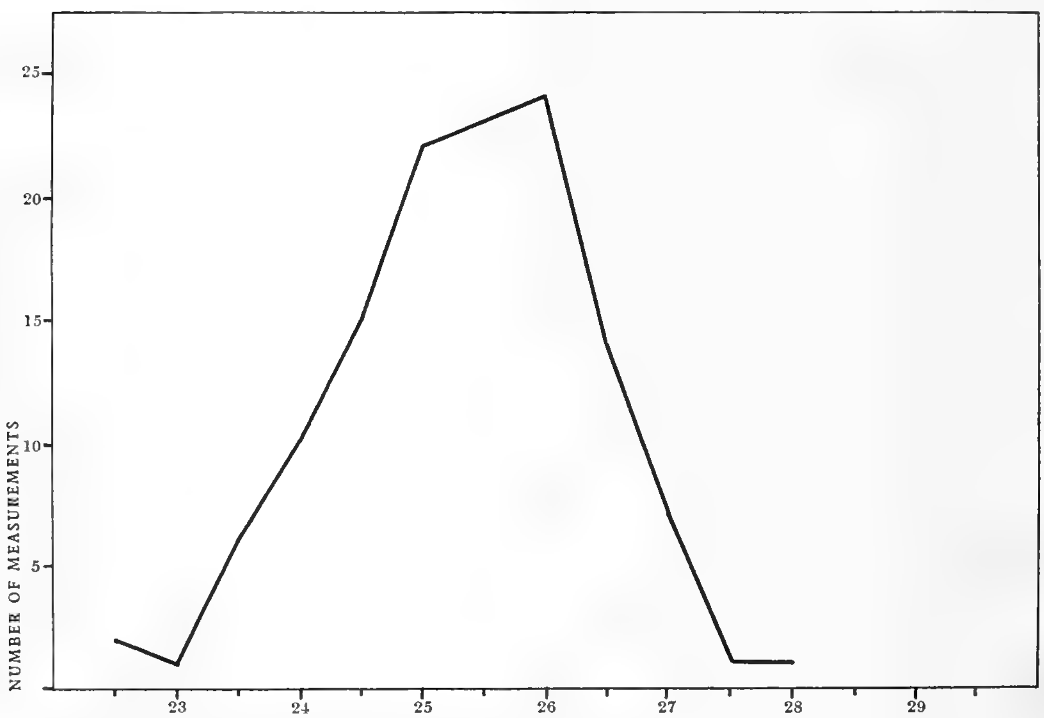

Fig. 48. Blue whales. Variations of measurement No. 20. Severed head, condyle to tip. (Whales of 23·00 to 27·99 metres.)

- - - - - Males. ——— Females.

a curve for this measurement from a somewhat larger number of readings by taking all Blue females between 23 m. and 28 m. instead of, as before, between 25 m. and 27 m.

In Figs. 45, 46, 47 and 48 these revised curves are shown. Those for measurements Nos. 13, 15 and 17 are constructed on readings from whales of all sizes, while that for No. 20 is on readings from whales between 23 m. and 28 m.

It is now seen that the curves of Nos. 15, 17 and 20 have resolved themselves into more or less normal frequency curves, and that the two peaks which appeared previously were therefore due only to insufficient data. As to measurement No. 13 it has been found on further investigation and from information recently received from Mr Fraser at South Georgia, that the two peaks in the curves result from the fact that the measurement has been taken sometimes before and sometimes after flensing, and it appears that this process displaces the penis so as to shorten the distance between it and the anus. The same phenomenon occurs in Fin whales and for purposes of comparison the curve for this species is also shown in Fig. 45.

COLOUR

Various descriptions have from time to time been given of the colouring of Blue whales from the North Atlantic. Of these the best seems to be that of True (1904), who gives an exhaustive general description and detailed notes of the nature and variations of the pigmentation of twenty-two Blue whales examined by himself. Barrett-Hamilton made brief notes on some half-dozen of the Blue whales he examined, but it appears that no thorough account of the colouring of these whales from the southern hemisphere has yet been given.

The following is based on our own observations on whales of the South Atlantic:

The pigmentation of Blue whales is subject to considerable individual variation, and the majority of the records we have made in respect of this character have dealt simply with the more variable features.

Except on the under surface of the flippers the Blue whale's body is covered nearly all over with a groundwork of dark blue-grey which varies to some extent in depth of colour in different individuals. Most of the body is covered with a pale mottling which consists of small, roughly oval marks of a colour which is similar to, but lighter than the blue-grey background. Typical examples of these spots are shown in Plate XXVII, figs. 1 and 2. Plate XXXVII, fig. 4, gives a close-up view of part of the back of the whale shown in Plate XXVII, fig. 1, taken at a point just opposite the reflexed flipper. These pale spots show a good deal of individual variation in respect of their size, number and sharpness of contrast with the darker background. They rarely appear on the head (see Plate XXVIII, fig. 1) and are not commonly present on the mandible, flippers or tail flukes. They are most thickly distributed along the flanks from the eye back to the tail and are often very numerous in the shoulder region. Their normal arrangement here is shown in Plate XXVIII, fig. 1. These marks are on the average about 4 in. long by about 3 in. wide, but vary in different individuals and on different parts of the body. For instance, they are generally very small just behind the eye and relatively larger along the posterior part of the flanks. In individuals in which these marks are in general small they are usually relatively sharply defined, while in other individuals they are bigger and more diffuse, in which case they often coalesce to a large extent and may occupy actually more space than the dark background. In others again they may be of medium size and if very numerous run together so as almost to obliterate the darker colour. Plate XXVIII, fig. 2, gives an example of a whale in which the spots are moderately large, very numerous and coalescing to an unusual extent.

These pale spots may also be seen here and there on the ventral grooves, where, however, they are less noticeable than on other parts of the body. On the ventral grooves there are almost invariably a number of white flecks more or less similar in size and shape to the pale bluish spots. The numbers in which these spots occur constitutes the most marked feature of the variations in the pigmentation of Blue whales. A typical or average condition is shown in Plate XXX, fig. 1, but Figs. 1, 2 and 3 in Plate XXIX and Figs. 1, 2 and 3 in Plate XXX form a series which illustrate the range of variation. These white flecks tend to be grouped on each side towards the posterior end of the ventral grooves. They are usually also fairly numerous beneath the flipper on each side and are sometimes even more plentiful here than at the posterior end of the ventral grooves. In extreme cases there may be hardly a white fleck anywhere, as in Plate XXIX, fig. 1, or the whole grooved area behind the flipper region may be a mass of white as in Plate XXX, fig. 3. On the whale illustrated in this photograph the flecks, though very numerous, were not very sharply defined and had to some extent coalesced so as to produce a cloudy white effect. Plate XXIX, fig. 3, and Plate XXX, figs. 1 and 2, show intermediate conditions. The flecks shown in Plate XXIX, fig. 3, are mostly grouped further forward than usual, whilst these shown in Plate XXX, fig. 2, are concentrated well back and to each side. Not infrequently there is a white splash over the umbilicus as in Plate XXX, fig. 3. The white flecks sometimes extend behind the umbilicus, and cases have been recorded in which the white has coalesced on each side of the umbilicus to form a pair of transversely placed, elongated white patches which are usually, but not always, symmetrical (see Plate XXXI, fig. 1).

Slightly pitted white spots occur frequently on the flanks and tail region, but these are healed scars and will be considered separately in another section (p. 373).

The flippers are pigmented over the greater part of the outer surface, but have little and sometimes no pigment on the inner, or ventral, surface. There is a certain amount of individual variation here. A common condition is that shown in Plate XXX, fig. 1, where there is a streak of pigment running from a point near the apex of the flipper, forwards to about the middle of the inner surface and a small patch curving over the anterior part of the lower border from the outer surface of the flipper. Frequently, however, the inner surface is pure white. An example of this is shown in Plate XXVII, fig. 1. In this whale the flipper has been almost cut in half and the distal part turned forward so that the inner surface is shown. In other cases, which are not very common, almost the whole of the inner surface is covered with streaky pigment (see Plate XXXI, fig. 2). Though the outer surface of the flipper is nearly all pigmented the tip is usually white.

One other variable feature in the pigmentation of Blue whales appears on the under surface of the flukes. The upper surface is normally of a uniform blue-grey. The under surface is rather paler and in most cases shows a number of fine whitish striations which run in an antero-posterior direction (Plate XXXI, fig. 3). These are not usually very noticeable and sometimes are not to be seen at all. In other individuals they are strongly marked, and in one case (whale No. 819) they were so pronounced that the anterior half of the ventral surface of the flukes was practically white. It is a fairly general rule that well-marked fluke striations are associated with a lack of pigment under the flippers.

From the photographs and description given by True of the pigmentation of Blue whales from the North Atlantic it is certain that there is no important difference in this respect between the Blue whales of the North and South Atlantic. In fact, so far as the pattern of the pigmentation is concerned, his account might be applied in almost every detail to the whales we have examined in the south.

In the foetus the first signs of external pigmentation appear when it measures about 0·5 m. Up to this stage the body has a uniform pinkish or greyish appearance. Now, however, there is a faint darkening on the head, round the jaws and inside the mouth. The pigment seems to appear first on the extremities and to spread over the dorsal surface from the head backwards. At about 1·5 m. pigment can be recognized on the head, rostrum and mandible, along the anterior part of the back, and on the dorsal surface of the flukes. At about 2·0 m. it becomes general over the dorsal surface but remains rather thin except on the head and extremities. From about 2·5 to 3·0 m. all the markings of the adult pigmentation become distinguishable except on the ventral surface. It is not until the length increases to 4 or 5 m. that the whole pattern is completed and even the large foetuses of 5 or 6 m. remain paler than the adult with less sharply defined spots and flecks.

BALEEN

As in the case of the colour of whales, observations have been made on the baleen with the main object of studying the variations which may occur. There are also points of interest in a comparison of the development of the baleen with the rate of growth of the young whale.

Routine observations included the counting of the numbers of plates, measuring the length of the longest plates from base to tip (excluding the terminal bristles) and the spacing of the longest plates (by measuring the average spacing of ten). A few measurements were made of the width of the plates at the base, but this is an awkward measurement to make and difficult to perform accurately.

The baleen is of great importance from the systematic point of view, for the species of a whale can almost always be recognized from a single whalebone plate. In Blue whales it is rather coarse and short and is of a uniform blue-black colour not differing much except in tone from the colour of the skin. The bristles on the inner edges of the plates are of the same dark colour.

It will be convenient first to consider certain features of the development and growth of the baleen. The body of the foetus is practically perfected while the latter still measures only about half a metre, but although in essential features it differs little at this length from the adult whale, no trace of baleen appears until considerable

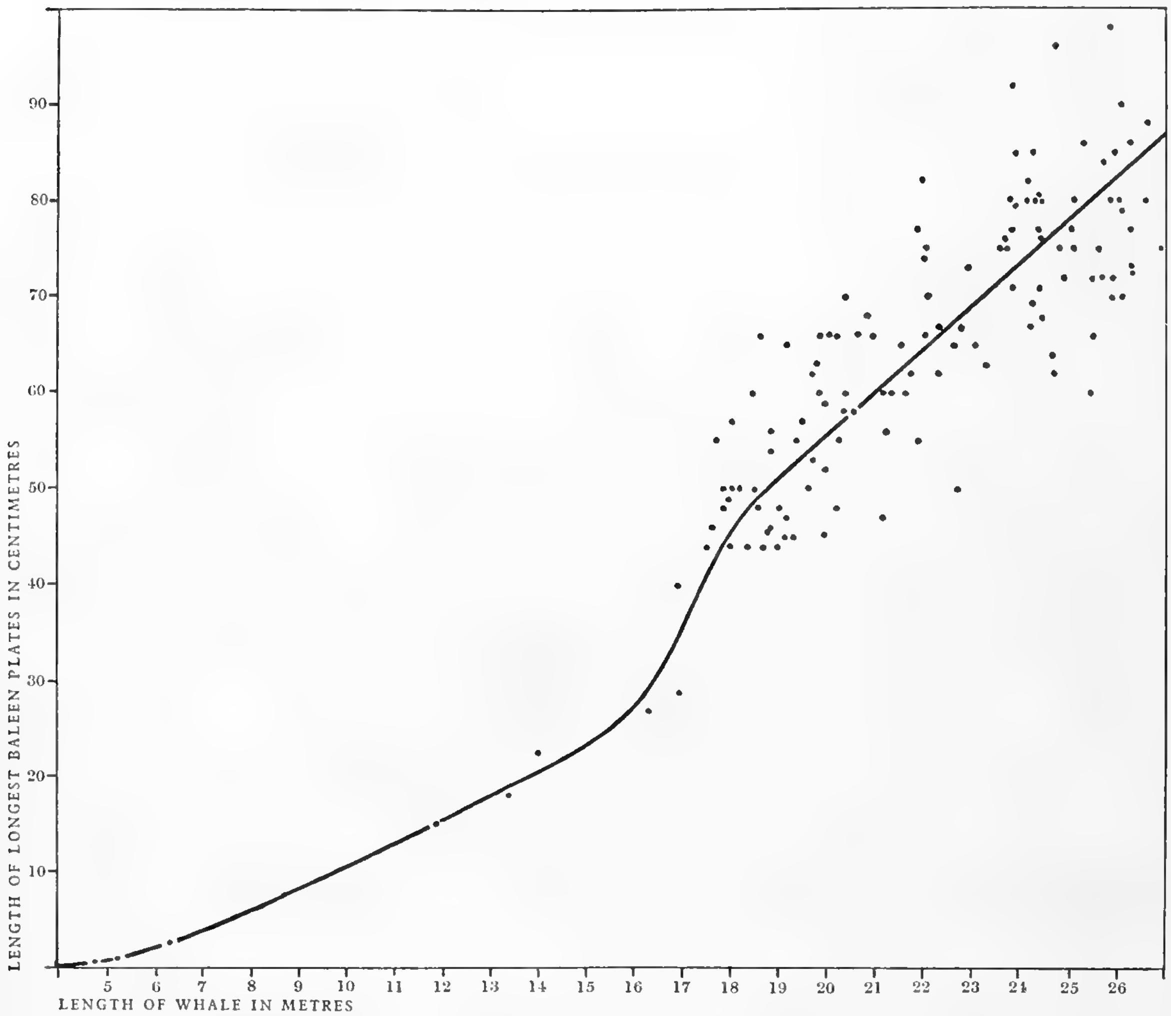

Fig. 49. Mean curve of growth of baleen in Blue whales. The plotted points represent the length of the baleen in individual whales.

further growth has taken place. Details of the development and histology of the baleen of Blue whales are given in an important memoir by Tullberg (1883) and the matter need therefore be dealt with only very briefly here. The first rudiments of the two blocks of plates are found after the foetus reaches a length of 2 m. or more. Then two plain strips of a soft whitish material appear, one on each side of the upper jaw. At 2·5 to 3 m. minute transverse ridges appear on these strips and later develop into whalebone plates. The two rudimentary strips appear first along the outer edges of the mouth leaving a broad, more or less flat palate between. As the plates grow the basic strips spread inwards until, when they are fully developed, no part of the palate remains except a narrow ridge in the median line. This condition, however, is not reached until long after the whale is born. Even when the foetus is ready for birth the longest plates measure only about 2·5 to 3·0 cm. and are arranged along the outer edge of the jaw, leaving a wide area of uncovered palate.

The rate of growth of the baleen in relation to the rate of growth of the whale can be examined in quite a simple manner by plotting the recorded lengths of the longest plates against the length of the whale. There are unfortunately very few baleen measurements for whales between 7·0 and 17·0 m., but there are just enough to indicate the course taken by the curve of growth. In Fig. 49 all the records of the lengths of the longest baleen plates are shown, and it will be seen that the plotted points may be divided in a sense into two groups. The first of these consists of the points derived from whales measuring 17·0 m. or more and forms a wide but regular series sloping upwards from baleen lengths of about 40 cm. to lengths of 70 to 100 cm. for the largest whales. This must mean that though there is some little individual variation in the length of the baleen, the plates must grow by about 5 cm. for every increase of 1 m. in the length of the whale. The second group consists of only a very few points derived from foetuses and young whales of less than 17·0 m. These points fall into a comparatively well-defined line which indicates a rate of growth appreciably slower than in the larger whales. The important feature of the graph, however, is that if a line is drawn to represent the average slope of the plotted points, or in other words the mean rate of growth of the baleen, the part built on the smaller group of points is not directly continuous with the part built on the larger group, and one must conclude that there is a sudden spurt in the growth of the plates during the whale's growth from about 16 to 18 m. The possibility arises that this is some functional development. The question, however, will be dealt with when the growth of the calf is considered and it will be shown that the sudden increase in size of the baleen plates is in fact almost certainly associated with a change from a diet of milk to a diet of krill.

As to other features of the chart we see that considerable individual variation occurs, but that there is no particular grouping which might suggest any racial distinction. Taken as a whole, the plotted points show that in general the length of the plates varies fairly uniformly with the length of the whale.

Observations on the numbers of baleen plates (excluding some subsidiary inner plates which are not seen from the outside) show that they vary from about 250 to 400 on each side. A sufficiently thorough analysis of the records is given by the table of frequencies given at top of page 316.

This gives an idea of the numbers of baleen plates normally present in southern Blue whales and the extent to which the numbers may vary. It also shows that there is no significant difference in this respect between males and females or between the Blue whales of South Georgia and South Africa.

As regards the width of the baleen at the base only twelve measurements were made

Blue Whales

Number of plates on one side	Males		Females	
	S. Georgia	S. Africa	S. Georgia	S. Africa
240–260	—	—	—	—
260–280	2	—	—	—
280–300	1	—	5	—
300–320	10	1	8	2
320–340	10	1	9	3
340–360	1	1	2	2
360–380	1	—	2	—
380–400	1	—	2	—
Total	26	3	28	7
Average No. of plates	318	327	324	326
Maximum ,, ,,	395	347	380	354
Minimum ,, ,,	270	310	280	306

in the case of Blue whales, and as the number is so small they are shown individually in the following table:

Males			Females		
Whale length	Baleen width	Width as percentage of baleen length	Whale length	Baleen width	Width as percentage of baleen length
*17·80	38	79·0	18·80	43	93·5
*18·55	55	89·0	*22·00	56	74·7
*18·80	45	83·5	22·75	48	71·7
23·10	53	94·7	24·25	55	80·0
23·30	67	106·0	*26·10	61	67·8
24·10	63	77·0	26·30	75	87·5

Those marked with an asterisk are South African whales. There are few enough data here for any comparisons to be made, but it can be said that there is no indication of any difference in the width of the baleen between either males and females or South Georgian and South African whales.

Measurements of the spacing of the largest baleen plates similarly give only negative results. The distance separating these plates varies from about 1·0 cm. in 16·0 m. whales to about 2·5 cm. in 27·0 m. whales. The readings are plotted in Fig. 50 from which it will be seen that no particular distinction exists between males and females or between whales of South Georgia and South Africa.

VENTRAL GROOVES

The presence of ventral grooves is common to all the Balaenopteridae and their arrangement in Blue, Fin and Sei whales is very similar. In Blue whales they run from a point slightly behind the tip of the mandible back to a point rather behind the umbilicus (see Plate XXX, fig. 3). Laterally they extend round to the shoulders and up to the level of the eye (Plate XXVIII, fig. 1) or slightly below it. Here they are very short and one or two run forwards into the corner of the mouth. A few grooves immediately below this run forwards for a short distance along the side of the mandible, but the rest stop short on the lower edge leaving the side of the mandible smooth. The longest grooves are those in the mid-ventral line and it is only these that

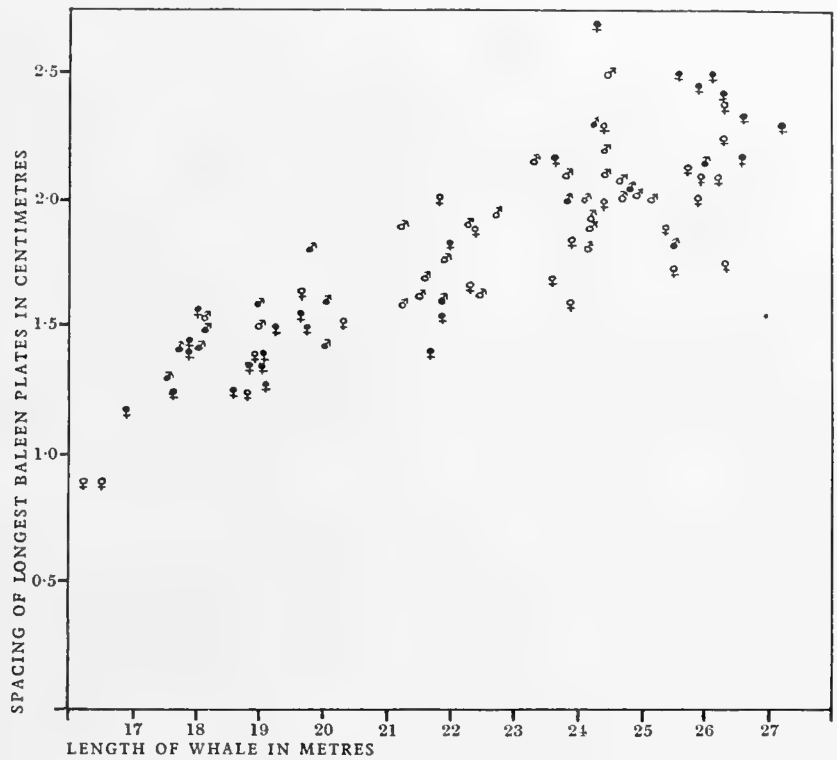

Fig. 50. Spacing of the baleen in Blue whales. The plotted points represent the spacing of the baleen in individual whales. (Black symbols represent South African whales, and circular ones South Georgia whales.)

run back as far as the umbilicus. The rest become progressively shorter so that their posterior ends form a line which curves forwards to the axilla. Posteriorly the median grooves may end evenly behind the umbilicus, as in Plate XXX, fig. 3, but there is a certain amount of variation here, for some grooves may extend further back than others, or the posterior ends may be broken up and very indefinite, and sometimes in males there is a median groove continuous with the umbilicus and genital aperture (see Plate XXIX, fig. 3, Plate XXX, figs. 1 and 2, and Plate XXXI, fig. 4).

On each side of the genital aperture in females there is often, in addition to the mammary grooves, a varying number of small grooves not more than a foot or two long which may be mentioned here though they are quite separate from the main mass of grooves. These are to be seen in Plate XXX, figs. 1 and 3. The four rough sketches in Fig. 51 show some typical examples and give an idea of the kind of variations which occur.

The best method of estimating the number of the main ventral grooves is to count their anterior terminations, beginning at the middle of the chin and counting along the mandible past the angle of the gape up to the last groove near the eye, and doubling the result.

The estimation of the number of grooves is of no particular value except (as in the case of other characters) for the purpose of fixing the normal condition and range of variation of this character for purposes of general comparison. Differences which occur in the numbers of ventral grooves of whales from South Georgia are evidently due simply to individual variation, for the differences between parent and foetus (in cases where the ventral grooves of the foetus are fully developed) are of the same order as the differences between adults. Whale No. 54 for instance had 94 grooves and its foetus had 78, while whale No. 154 had 80 grooves and its foetus 96.

The variations in the numbers of grooves is best shown by the following table, in which the records are analysed on the same principle as the table for numbers of baleen plates given on p. 316.

Blue Whales

Number of ventral grooves	Males		Females	
	S. Georgia	S. Africa	S. Georgia	S. Africa
70–80	4	4	2	2
80–90	7	6	8	5
90–100	8	1	8	5
100–110	1	3	7	1
110–120	1	—	4	1
Total	21	14	29	14
Average	90	85	95	89
Maximum	118	102	116	112
Minimum	70	70	76	70

An inspection of the above table shows again that no distinction exists between the sexes, and the fact that the averages for South African whales are slightly lower than for South Georgia is more likely due to the small number of records than to the existence of any real distinction.

The ventral grooves appear in the foetus earlier than the baleen plates. The first traces are to be found when the foetus measures from about 1·0 to 1·25 m. The anterior ends appear to materialize first and then spread backwards, and by the time the foetus reaches 2·0 m. they are usually sufficiently complete and well defined to be counted.

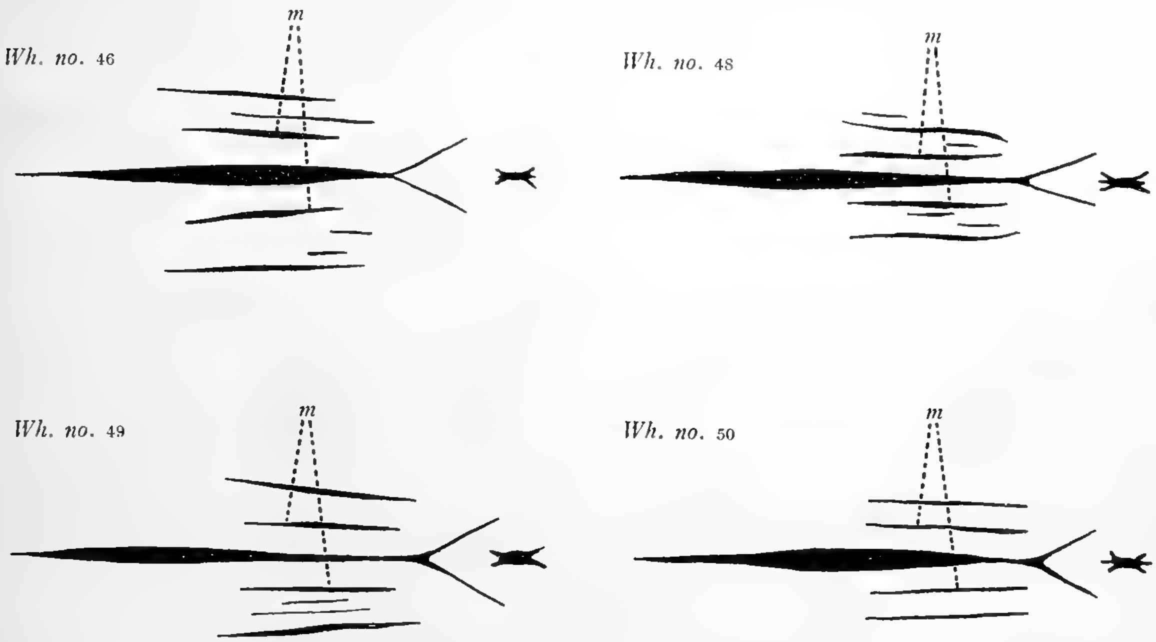

Fig. 51. Mammary grooves, genital aperture, etc., of female Blue whales (semi-diagrammatic); to show variation of the extra grooves in this region. *m*, mammary grooves.

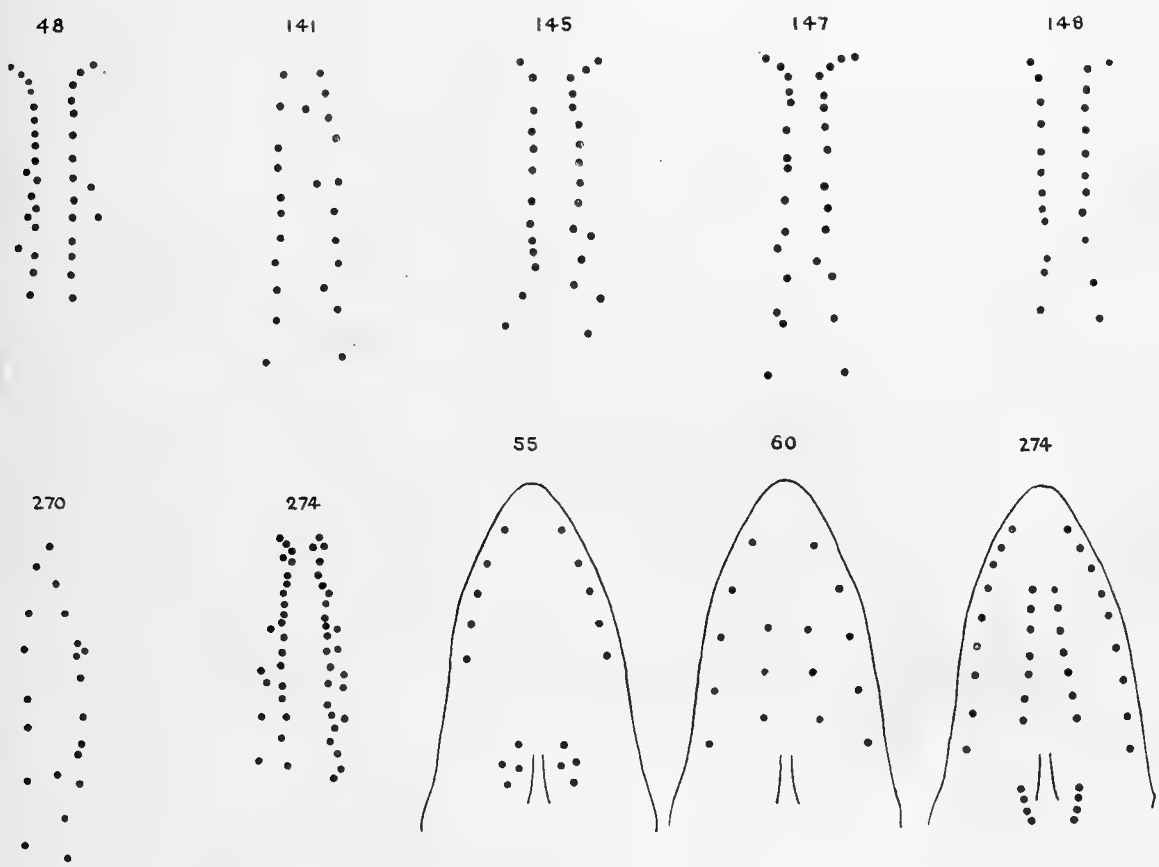

Fig. 52. Diagrams showing different arrangement of the hairs on the chin of seven and the rostrum of three Blue whales. The beard in each case is sketched from a view immediately in front of the mouth, and the rostral hairs from a dorsal aspect. The numerals refer to individual whales.

HAIR

In both Blue and Fin whales hairs occur (*a*) at the symphysis of the mandibles, (*b*) along each ramus of the lower jaw, (*c*) on the dorsal surface of the rostrum. They are best developed in young whales and foetuses, for in old whales they tend to become rather short and reduced in number.

Previous descriptions of the hairs have been given by Lillie (1910) and Japha (1911). The latter gives an account of the structure and histology of the hairs in five species of whalebone whales and six species of toothed whales.

The "beard" consists, in most whales, of between twenty and forty hairs arranged in two vertical rows which are often a little asymmetrical, and which tend to diverge slightly. The actual length of the rows is about 1 ft. in medium sized whales. In Fig. 52 the arrangement of the chin hairs of seven Blue whales and the hairs on the rostrum of three are shown.

Along each mandible there is normally a row of a few hairs varying in number from about two to a dozen. In Fin and Sei whales two rows on each side are occasionally found, but this does not seem to occur in Blue whales.

Blue Whales

Number of hairs on chin	Males		Females	
	S. Georgia	S. Africa	S. Georgia	S. Africa
8–11	1	—	1	—
12–15	—	—	—	—
16–19	—	—	—	—
20–23	2	—	5	—
24–27	11	—	9	1
28–31	8	—	14	—
32–35	5	—	4	—
36–39	2	3	1	1
40–43	2	1	1	—
44–47	—	—	2	—
48–51	1	—	—	—
Total	32	4	37	2
Average	29	38	29	31
Maximum	50	43	44	37
Minimum	9	36	10	25

On the rostrum also the number of hairs is very variable. It is practically impossible to examine the hairs on both sides since on the flensing platform the whale lies with the dorsal surface of the head resting on the ground, but usually there are between ten and twenty on one side. There is usually a row along the edge of the rostrum, a small group near the blowhole, and a few odd hairs in other positions.

The hairs of the chin have been counted more systematically than those of the mandible and rostrum, and a table of the type used for the numbers of baleen plates and ventral grooves may be drawn up to show the extent of variation.

Here, as usual, no difference is found between males and females. There are only half a dozen records from South African whales, but these fall well within the limits of variation shown by South Georgian whales, and we may therefore suppose that the whales of the two localities do not differ in this respect.

In the foetus, hairs are numerous and well developed at an early stage. In the foetus of No. 270, which measured 0·55 m., the hairs were represented by small white spots in the positions where they would later have grown out, but in No. 1151 which measured 0·445 m. the incipient hairs were already distinct.

FIN WHALES

GENERAL REMARKS

The characters of the Fin whale may be dealt with in the same manner and in the same order as those of the Blue whale. Since each step is fully explained in the section on the Blue whale much repetition may be avoided here, and though the Fin whale is of at least as great commercial importance as the Blue, less space need be devoted to it.

The average yield of oil from a Fin whale is 35 to 50 barrels, as compared with 70 to 80 from a Blue whale[1]. The distribution and history of the hunting of the Fin whale is very similar to that of the Blue whale. It was caught only in small numbers at South Georgia and the other Dependencies up to about 1912, but during and since the war it has been taken regularly in great quantities.

The largest Fin whale we examined measured 24·53 m., or 80 ft. 5 in. This was a female, No. 478. There were altogether four females measuring over 24·0 m. (Nos. 478, 200, 263 and 463). As No. 478 was the largest out of nearly 800 Fin whales one would expect that the limit for this species is somewhere about 25·0 m. (or 82 ft.), so far at least as the length is measured from the tip of the snout to the notch of the flukes. The largest Fin whale measured by Barrett-Hamilton was 82 ft. long, measured from the tip of the mandible, or 80 ft. 3 in. from the tip of the snout. Risting (1928) mentions that the largest Fin whale among his records measured 27·3 m. or 89 ft. 6 in. This is one from a great number of records, but it has already been pointed out that we are unable to put entire confidence in the accuracy of Risting's data.

As to the Fin whales of the North Atlantic, a female of 24·55 m. or 80 ft. 6 in. has been recorded by Cocks (1887), but it is uncertain how this was measured. The largest whale examined by True was 21·5 m. or 70 ft. 8 in.

In order to examine the sex ratio of Fin whales we may, as in the case of Blue whales, use the British Museum statistics of catches at the southern whaling stations during previous years. These include the following:

[1] It appears that, owing to improved methods, a somewhat higher yield has been obtained in recent seasons.

(*a*) *Dependencies of the Falkland Islands.*

South Georgia, 1913–25	15,535	Fin whales
South Shetlands, 1918–24	9,153	,,
South Orkneys, 1922–26	1,208	,,

(*b*) *South Africa.*

Cape Colony, 1920–25...	2,131	,,
Natal, 1922–26	1,439	,,

Analysis of the figures gives the following results:

(*a*) *Dependencies of the Falkland Islands.*

Of all whales examined 54 per cent were males.

Of 22 seasons in different localities there were six with from 51 per cent to 55 per cent of females. The remaining sixteen seasons all showed a majority of males. Of these, 12 seasons showed 50 to 60 per cent of males, three seasons showed 60 to 70 per cent of males and one exceptional season (1924–5 at the South Orkneys) showed as much as 82 per cent of males.

(*b*) *South Africa.*

Of all whales recorded 56 per cent were males.

Of 14 seasons in different localities only one showed a majority of females (54 per cent). The other 13 seasons all showed a majority of males of which eleven fell between 50 and 60 per cent and two between 60 and 70 per cent.

Here we have a more decisive result than in the case of Blue whales, males being in an all-round majority both in the Dependencies and in South African waters. Our own records agree with this, for 56 per cent of the whales examined and 54 per cent of the foetuses were males. It seems difficult, therefore, to avoid the conclusion that among Fin whales males are in a slight majority. Of all the Fin whales of which we have records 45 per cent are females and 55 per cent males.

As to the differences which exist between the sexes the male Fin whale becomes mature on the average at 19·4 m., and the female on the average at just 20·0 m. Thus there is approximately 0·6 m. difference between the two, or the length of the male is 97 per cent of that of the female. As in Blue whales the difference between the largest specimen of each sex is even more marked, for the largest female measured 24·53 m. and the largest male only 22·40 m., giving a difference of 2·13 m., the length of the male being 91·3 per cent of that of the female. Thus it is on the whole probable that there is an increased divergence in size after sexual maturity is reached.

EXTERNAL PROPORTIONS

A more or less complete series of measurements has been carried out on some 692 Fin whales, and the following table shows the average value of all the measurements taken for male and female Fin whales, expressed as percentages of the total length.

	Measurement	South Georgia				South Africa				Total			
		Males		Females		Males		Females		Males		Females	
		Average value	No. of measurements	Average value	No. of measurements	Average value	No. of measurements	Average value	No. of measurements	Average value	No. of measurements	Average value	No. of measurements
1	Total length	100		100		100		100		100		100	
2	Lower jaw, projection beyond tip of snout	1·18	4	1·07	8	—	—	—	—	1·18	4	1·07	8
3	Tip of snout to blowhole	19·18	269	19·26	216	18·06	105	18·01	74	18·86	374	18·94	290
4	Tip of snout to angle of gape	20·28	190	20·52	145	19·44	88	19·63	68	20·01	278	20·24	213
5	Tip of snout to centre of eye	21·12	314	21·23	257	20·18	111	20·24	75	20·87	425	21·00	332
6	Tip of snout to tip of flipper	41·79	256	41·67	205	40·55	100	40·51	71	41·44	356	41·37	276
7	Eye to ear (centres)	4·96	280	4·84	207	4·87	101	4·83	70	4·93	381	4·84	277
8	Notch of flukes to posterior emargination of dorsal fin	24·27	240	24·65	179	24·97	84	25·40	59	24·45	324	24·83	238
9	Flukes, width at insertion	5·01	272	4·98	223	5·21	114	5·10	75	5·07	386	5·01	298
10	Notch of flukes to anus	28·07	306	28·42	252	29·75	108	29·69	75	28·51	414	28·71	327
11	Notch of flukes to umbilicus	45·34	288	45·20	247	47·10	107	46·92	71	45·82	395	45·59	318
12	Notch of flukes to end of ventral grooves	44·23	204	43·87	146	45·44	80	45·57	57	44·57	284	44·35	203
13	Anus to reproductive aperture (centres)	6·89	290	2·85	246	6·84	100	2·79	72	6·88	390	2·83	318
14	Dorsal fin, vertical height	2·49	243	2·36	185	2·51	88	2·47	65	2·50	331	2·39	250
15	Dorsal fin, length of base	6·04	231	5·64	169	5·96	91	5·66	64	6·02	322	5·65	233
16	Flipper, tip to axilla	8·31	284	8·26	217	8·14	102	8·14	73	8·27	386	8·23	290
17	Flipper, tip to anterior end of lower border	11·28	191	11·07	144	11·13	85	11·04	66	11·23	276	11·06	210
18	Flipper, length along curve of lower border	11·61	175	11·43	125	11·44	82	11·49	66	11·56	257	11·45	191
19	Flipper, greatest width	2·83	203	2·77	159	2·80	76	2·71	60	2·82	279	2·75	219
20	Severed head, condyle to tip	25·63	222	25·85	180	24·69	67	24·87	48	25·41	289	25·64	228
21	Skull, greatest width	10·96	204	11·19	144	10·31	64	10·52	46	10·80	268	11·03	190
22	Skull length, condyle to tip of premaxilla	25·80	2	25·54	2	23·03	1	23·91	3	24·88	3	24·39	5
23	Flipper, tip to head of humerus	13·19	4	12·23	3	10·87	1	12·49	4	12·73	5	12·38	7
24	Tail, depth at dorsal fin	9·29	188	9·39	128	8·38	79	8·54	58	9·02	267	9·13	186

The results shown in this table are much the same as those which appear in the table for Blue whales. Apart from measurement No. 13 (anus to reproductive aperture) there is no particular difference between the sexes. There appears to be no sexual difference in respect of the relative sizes of the head and tail, for some of the measurements are a shade bigger in one sex, while others are a shade smaller.

The only difference between the Fin whales of South Georgia and South Africa lies in the relative sizes of the head and tail, the head measurements being consistently larger in South Georgian whales, and the tail measurements in South African whales, except in the case of No. 24 (depth of tail at dorsal fin) which, as in Blue whales, is slightly greater among the South Georgian whales. As has already been explained, these differences in the relative sizes of the head and tail are simply due to the greater average size of the whales at South Georgia.

In the following tables the average value of each measurement is shown for Fin whales at each metre of whale-length.

Male Fin Whales: South Georgia

Measurements expressed as percentages of total length

	Metre lengths	2. Lower jaw, projection beyond tip of snout			3. Tip of snout to blowhole			4. Tip of snout to angle of gape			5. Tip of snout to centre of eye		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	2	1·02–1·23	1·13	4	12·86–14·29	13·86	4	16·43–17·90	16·99	4	17·14–19·75	17·89
,,	1–2	2	0·55–0·98	0·77	16	13·73–15·83	15·09	16	16·18–20·33	17·93	16	16·67–20·66	19·02
,,	2–3	3	0·93–1·89	1·27	10	13·96–16·67	15·73	10	16·98–19·63	18·55	10	17·92–20·37	19·57
,,	3–4	—	—	—	6	13·71–18·67	15·51	6	16·29–18·93	18·14	6	18·00–20·33	19·29
,,	4–5	1	—	0·68	3	15·37–16·09	15·79	2	17·73–19·54	18·64	3	18·11–19·54	18·91
Whale	13–14	—	—	—	1	—	13·65	—	—	—	—	—	—
,,	14–15	—	—	—	2	15·14–16·67	15·91	2	16·55–18·84	17·70	3	16·90–19·18	18·38
,,	15–16	—	—	—	2	16·67–19·05	17·86	1	—	18·24	5	18·01–22·88	19·91
,,	16–17	—	—	—	4	17·75–18·51	18·16	4	18·51–20·00	19·42	5	18·20–21·21	19·67
,,	17–18	—	—	—	7	16·91–19·31	17·76	6	18·02–20·46	19·14	11	18·71–21·46	20·20
,,	18–19	—	—	—	18	17·39–20·27	18·80	16	18·86–21·39	20·19	23	18·32–22·20	20·90
,,	19–20	2	1·28–1·51	1·40	57	17·21–21·94	19·19	44	19·01–21·99	20·45	69	16·24–24·03	21·10
,,	20–21	2	0·73–1·20	0·97	110	17·50–21·74	19·30	78	17·80–22·28	20·41	121	19·02–23·28	21·33
,,	21–22	—	—	—	62	17·46–21·80	19·45	36	18·20–22·05	20·29	71	19·12–23·25	21·29
,,	22–23	—	—	—	5	17·11–21·29	19·90	3	18·27–21·61	20·45	5	18·89–22·32	21·31
,,	23–24	—	—	—	1	—	19·49	—	—	—	1	—	21·40

	Metre lengths	10. Notch of flukes to anus			11. Notch of flukes to umbilicus			12. Notch of flukes to end of ventral grooves			13. Anus to reproductive aperture, centres		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	4	29·63–33·34	30·89	4	45·92–48·72	47·17	—	—	—	4	6·17–7·86	6·93
,,	1–2	16	29·41–32·81	30·95	16	44·04–53·12	48·15	11	44·92–55·00	49·40	16	6·42–7·94	7·11
,,	2–3	10	29·63–31·76	30·79	10	45·56–48·30	46·97	10	43·33–47·99	46·06	10	6·47–7·78	7·06
,,	3–4	5	27·81–33·23	31·02	4	44·57–49·87	47·93	4	45·33–51·08	48·14	6	6·00–7·20	6·63
,,	4–5	3	28·42–29·89	28·98	3	44·00–45·98	45·14	2	43·18–43·68	43·43	3	6·95–8·05	7·65
Whale	13–14	1	—	31·73	1	—	51·29	—	—	—	1	—	6·27
,,	14–15	3	29·93–31·34	30·40	3	47·96–49·30	48·75	1	—	46·60	3	4·58–8·50	6·17
,,	15–16	6	28·57–30·89	29·52	5	46·03–48·87	47·81	2	46·54–46·67	46·61	6	4·65–8·67	7·34
,,	16–17	5	27·27–30·15	28·81	3	44·85–47·38	46·23	3	45·56–46·43	45·99	5	4·29–8·48	6·67
,,	17–18	11	27·49–30·84	29·31	10	45·03–49·28	46·90	5	45·19–48·41	46·92	8	4·97–7·78	6·56
,,	18–19	22	27·25–31·05	28·49	23	43·80–49·05	45·50	11	42·78–47·41	44·22	20	3·58–8·52	6·39
,,	19–20	64	25·61–29·90	27·98	59	42·78–49·24	45·18	42	41·02–46·73	44·15	66	3·87–9·39	6·83
,,	20–21	120	22·81–30·52	27·94	110	40·87–49·00	45·33	83	41·22–47·58	43·99	119	3·88–8·40	6·61
,,	21–22	69	24·76–29·48	27·77	68	40·92–46·98	44·86	52	40·61–46·76	43·48	66	4·03–8·57	6·64
,,	22–23	5	25·82–28·26	27·20	5	42·19–46·14	44·12	5	41·20–44·81	42·77	5	6·22–7·95	7·16
,,	23–24	1	—	26·06	1	—	44·07	1	—	44·07	1	—	4·87

	Metre lengths	18. Flipper, length along curve of lower border			19. Flipper, greatest width			20. Severed head, condyle to tip			21. Skull, greatest width		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	1	—	10·71	4	2·86–3·46	3·10	—	—	—	3	14·29–17·14	16·03
,,	1–2	13	11·76–14·69	13·37	16	2·94–3·91	3·39	—	—	—	11	13·51–17·50	14·35
,,	2–3	8	13·33–15·56	14·75	8	3·30–3·77	3·59	—	—	—	5	10·98–15·51	13·62
,,	3–4	6	13·30–16·00	14·65	6	3·09–4·00	3·53	—	—	—	2	12·10–12·92	12·51
,,	4–5	2	15·45–15·63	15·54	2	3·37–3·64	3·51	1	—	24·60	—	—	—
Whale	13–14	1	—	11·07	1	—	3·32	1	—	22·14	1	—	9·00
,,	14–15	2	11·20–11·56	11·38	3	2·86–3·10	2·98	2	23·47–24·35	23·91	2	8·16–10·48	9·32
,,	15–16	2	10·57–12·06	11·32	5	2·47–3·02	2·84	6	21·86–26·03	23·35	6	10·06–12·00	11·05
,,	16–17	3	10·32–12·31	11·31	4	2·58–2·74	2·68	3	21·49–25·94	23·60	3	9·97–11·15	10·53
,,	17–18	3	11·49–11·98	11·75	6	2·33–2·96	2·63	7	23·39–26·73	25·00	7	10·38–11·96	11·20
,,	18–19	8	10·67–12·67	11·73	13	2·40–3·05	2·80	15	23·98–26·74	25·31	13	10·78–12·30	11·41
,,	19–20	38	10·23–12·73	11·63	44	2·35–3·40	2·86	49	23·56–30·10	25·73	45	9·11–12·82	11·02
,,	20–21	72	9·76–13·17	11·62	77	2·35–3·15	2·81	85	23·17–27·55	25·84	78	9·86–12·94	10·99
,,	21–22	43	9·74–12·86	11·57	47	2·33–3·29	2·85	50	23·78–27·64	25·78	45	9·81–11·75	10·82
,,	22–23	3	11·75–12·72	12·14	3	2·83–3·08	2·94	3	26·63–27·46	27·15	3	10·62–11·78	11·20
,,	23–24	—	—	—	—	—	—	1	—	25·64	1	—	10·04

Male Fin Whales: South Georgia

Measurements expressed as percentages of total length

	Metre lengths	6. Tip of snout to tip of flipper			7. Eye to ear, centres			8. Notch of flukes to posterior emargination of dorsal fin			9. Flukes, width at insertion		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	4	39·74–41·98	40·81	—	—	—	4	25·93–27·35	26·84	4	7·14–8·64	7·65
„	1–2	15	39·22–44·53	41·91	14	5·88–7·50	6·82	16	24·77–28·33	26·48	16	6·30–9·09	7·47
„	2–3	10	39·62–46·67	42·55	10	5·86–6·67	6·28	10	25·18–27·78	26·92	10	6·30–8·15	7·25
„	3–4	6	40·00–44·00	42·15	6	5·71–6·67	6·23	6	27·07–31·46	29·00	6	6·18–8·00	7·15
„	4–5	2	42·50–45·98	44·24	2	5·47–6·14	5·81	3	25·23–26·95	25·98	2	5·95–6·82	6·39
Whale	13–14	1	—	36·16	1	—	7·01	—	—	—	1	—	6·64
„	14–15	2	36·97–40·82	38·90	3	4·58–5·24	5·00	2	24·69–25·17	24·93	2	5·37–5·63	5·50
„	15–16	2	37·74–44·44	41·09	5	4·53–6·03	4·99	4	25·16–27·87	26·35	2	4·72–6·86	5·79
„	16–17	4	38·99–41·42	39·72	4	4·49–4·94	4·77	4	23·39–26·46	24·44	4	5·03–5·67	5·32
„	17–18	7	38·01–41·50	40·02	9	4·58–6·06	5·00	9	24·28–26·60	23·96	7	4·74–5·26	5·02
„	18–19	18	39·24–44·29	41·70	17	4·57–5·35	4·86	17	22·28–25·99	24·19	18	4·50–5·33	5·03
„	19–20	59	38·94–45·69	41·78	62	4·42–5·64	4·92	51	21·32–26·23	24·47	60	4·59–6·03	5·02
„	20–21	99	37·22–45·95	41·86	109	4·23–6·37	5·02	91	21·87–28·92	24·25	109	4·11–6·08	5·04
„	21–22	59	37·44–45·41	42·11	64	4·38–5·49	4·89	57	21·68–26·25	24·11	63	4·34–5·61	4·97
„	22–23	4	42·69–44·64	43·66	5	4·04–5·18	4·85	5	22·71–23·66	23·37	5	4·27–5·09	4·69
„	23–24	1	—	42·80	1	—	4·49	—	—	—	1	—	4·45

	Metre lengths	14. Dorsal fin, vertical height			15. Dorsal fin, length of base			16. Flipper, tip to axilla			17. Flipper, tip to anterior end of lower border		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	4	1·92–2·55	2·27	4	3·70–5·13	4·61	4	8·58– 9·18	8·84	4	10·71–12·56	11·87
„	1–2	16	2·10–4·32	2·80	16	4·59–6·61	5·51	16	8·24–10·16	9·26	16	11·74–14·12	12·79
„	2–3	9	2·26–3·67	2·71	9	3·77–7·78	5·75	10	9·43–11·48	10·30	10	12·94–14·81	14·27
„	3–4	6	2·53–3·47	3·07	6	5·62–7·38	6·66	6	9·87–11·73	10·62	6	12·64–15·08	13·94
„	4–5	3	2·95–4·14	3·58	2	6·82–6·90	6·86	3	10·11–12·64	11·14	2	14·71–14·77	14·74
Whale	13–14	—	—	—	—	—	—	—	—	—	1	—	10·33
„	14–15	3	2·59–3·17	2·83	2	5·10–5·63	5·37	3	7·75– 8·30	8·07	2	11·13–11·43	11·28
„	15–16	5	1·87–2·79	2·28	2	6·48–6·92	6·70	5	6·80– 9·33	7·91	2	10·50–11·75	11·13
„	16–17	4	2·07–3·15	2·55	3	5·92–6·25	6·11	5	7·46– 9·09	8·34	3	10·14–11·07	10·50
„	17–18	9	2·12–3·04	2·43	6	4·68–7·58	5·83	10	7·25– 8·82	8·02	6	10·20–11·73	11·23
„	18–19	17	1·96–2·78	2·55	13	5·27–7·48	6·07	23	7·20– 9·52	8·29	11	9·62–12·30	11·12
„	19–20	51	1·33–3·08	2·47	47	4·39–9·35	6·04	63	6·64–10·80	8·32	41	10·12–12·50	11·36
„	20–21	94	1·86–3·36	2·53	96	4·35–8·11	6·15	105	6·84– 9·86	8·42	76	9·61–12·78	11·31
„	21–22	56	1·39–3·47	2·43	57	3·33–7·62	5·90	64	6·60–10·24	8·39	46	8·37–12·52	11·26
„	22–23	4	2·30–2·60	2·47	5	4·75–6·62	5·95	5	7·42– 8·75	8·36	3	11·43–12·50	11·83
„	23–24	—	—	—	—	—	—	1	—	8·90	—	—	—

	Metre lengths	22. Skull length, condyle to tip of premaxilla			23. Flipper, tip to head of humerus			24. Tail, depth at dorsal fin			25. Flukes, notch to tip		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	—	—	—	—	—	—	4	9·18–11·11	9·98	3	7·69–10·20	9·06
„	1–2	—	—	—	—	—	—	14	8·82–11·35	10·31	15	10·08–13·75	11·35
„	2–3	—	—	—	—	—	—	10	8·68–11·72	10·43	9	10·85–13·47	12·65
„	3–4	—	—	—	—	—	—	6	8·28–15·47	10·87	6	10·96–13·67	12·50
„	4–5	—	—	—	—	—	—	2	8·42– 9·09	8·76	2	12·50–12·63	12·57
Whale	13–14	—	—	—	—	—	—	—	—	—	—	—	—
„	14–15	—	—	—	—	—	—	1	—	8·84	—	—	—
„	15–16	—	—	—	—	—	—	4	8·18–11·00	9·39	—	—	—
„	16–17	—	—	—	—	—	—	3	8·88– 9·11	8·97	—	—	—
„	17–18	—	—	—	1	—	12·81	4	8·07–10·23	9·10	—	—	—
„	18–19	—	—	—	—	—	—	12	8·56–10·75	9·83	—	—	—
„	19–20	—	—	—	—	—	—	38	8·21–11·42	9·50	—	—	—
„	20–21	2	25·42–26·18	25·80	1	—	13·29	75	8·01–11·35	9·26	—	—	—
„	21–22	—	—	—	2	13·33–13·35	13·34	46	7·82–11·20	9·13	—	—	—
„	22–23	—	—	—	—	—	—	5	8·39– 9·87	8·80	—	—	—
„	23–24	—	—	—	—	—	—	—	—	—	—	—	—

Male Fin Whales: South Africa

Measurements expressed as percentages of total length

	Metre lengths	2. Lower jaw, projection beyond tip of snout			3. Tip of snout to blowhole			4. Tip of snout to angle of gape			5. Tip of snout to centre of eye		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Whale	12–13	—	—	—	1	—	18·05	—	—	—	1	—	19·47
,,	13–14	—	—	—	4	16·19–18·20	16·88	3	17·91–18·73	18·45	5	18·54–19·33	18·86
,,	14–15	—	—	—	20	15·36–19·31	17·23	17	17·45–20·44	18·82	22	17·34–20·95	19·34
,,	15–16	—	—	—	27	15·45–19·23	17·48	23	17·21–20·53	19·00	29	17·73–22·15	19·87
,,	16–17	—	—	—	18	16·76–19·10	17·91	19	17·64–20·48	19·32	19	18·82–20·84	19·99
,,	17–18	—	—	—	8	16·96–19·24	18·34	8	19·29–21·57	20·14	8	20·00–21·98	20·78
,,	18–19	—	—	—	2	18·89–19·36	19·13	1	—	20·28	1	—	21·11
,,	19–20	—	—	—	9	17·71–21·38	19·75	7	19·27–21·68	20·92	9	20·00–22·53	21·65
,,	20–21	—	—	—	12	18·18–20·88	19·41	9	19·66–21·22	20·35	13	20·49–22·74	21·37
,,	21–22	—	—	—	4	18·43–19·95	19·19	1	—	19·81	4	19·82–21·93	21·12

	Metre lengths	10. Notch of flukes to anus			11. Notch of flukes to umbilicus			12. Notch of flukes to end of ventral grooves			13. Anus to reproductive aperture, centres		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Whale	12–13	1	—	31·14	1	—	52·03	—	—	—	1	—	4·07
,,	13–14	5	29·64–30·79	30·31	5	47·27–48·20	47·83	4	46·04–47·48	46·89	5	5·53–7·84	7·15
,,	14–15	21	28·24–33·00	30·23	21	44·59–51·52	47·93	11	43·58–48·48	46·14	16	3·34–8·22	6·83
,,	15–16	26	27·38–32·89	30·05	26	45·25–52·37	47·73	18	43·53–50·03	46·44	23	4·10–8·67	7·00
,,	16–17	19	27·73–31·49	29·64	18	45·76–49·48	47·13	15	41·74–46·73	45·50	19	2·73–8·08	6·44
,,	17–18	8	28·49–30·99	29·65	8	45·35–48·88	47·03	6	44·61–46·47	45·93	7	4·52–7·82	6·91
,,	18–19	3	28·61–29·48	29·18	3	45·28–47·75	46·62	3	44·63–46·68	45·34	3	6·67–7·69	7·12
,,	19–20	9	27·07–28·68	28·06	9	44·44–46·87	45·77	7	42·86–45·26	44·09	8	6·84–7·81	7·27
,,	20–21	13	27·23–29·71	28·04	12	42·89–48·31	45·26	12	40·90–45·89	43·75	13	5·84–8·31	7·34
,,	21–22	4	26·42–28·05	27·29	4	44·58–45·85	45·31	4	42·92–44·93	44·09	4	5·42–8·11	7·10

	Metre lengths	18. Flipper, length along curve of lower border			19. Flipper, greatest width			20. Severed head, condyle to tip			21. Skull, greatest width		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Whale	12–13	1	—	11·79	1	—	2·85	1	—	24·39	1	—	10·24
,,	13–14	4	11·99–12·64	12·24	4	2·73–3·06	2·88	4	22·84–23·97	23·32	4	9·89–10·40	10·12
,,	14–15	20	10·36–12·57	11·30	18	2·56–2·99	2·80	12	21·82–25·69	23·38	14	9·09–11·11	10·38
,,	15–16	24	10·48–13·38	11·52	23	2·52–3·16	2·78	16	22·73–26·90	24·32	15	9·09–10·64	10·08
,,	16–17	12	10·19–12·12	11·40	11	2·11–3·03	2·73	14	23·27–25·72	24·52	11	9·27–11·37	10·21
,,	17–18	4	11·03–12·21	11·61	6	2·70–2·92	2·81	6	24·74–26·82	25·41	6	9·65–10·73	10·29
,,	18–19	3	11·24–11·78	11·43	2	2·59–3·02	2·81	2	25·83–25·89	25·86	2	10·00–10·93	10·47
,,	19–20	5	9·17–13·02	11·24	4	2·55–3·00	2·84	5	25·32–26·95	25·91	5	10·10–12·11	10·91
,,	20–21	8	9·63–12·17	11·20	5	2·70–2·93	2·84	5	24·77–26·32	25·51	4	10·02–11·63	10·63
,,	21–22	1	—	11·04	2	3·02–3·03	3·03	2	25·28–26·65	25·97	2	10·38–10·38	10·38

Male Fin Whales: South Africa

Measurements expressed as percentages of total length

	Metre lengths	6. Tip of snout to tip of flipper			7. Eye to ear, centres			8. Notch of flukes to posterior emargination of dorsal fin			9. Flukes, width at insertion		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Whale	12–13	1	—	40·65	—	—	—	—	—	—	1	—	4·88
,,	13–14	4	37·99–41·09	39·69	4	4·75–5·18	4·98	4	24·78–25·76	25·13	5	5·32–5·61	5·45
,,	14–15	21	37·25–41·55	39·51	17	4·68–5·26	4·91	12	24·19–26·85	25·47	23	4·83–5·77	5·30
,,	15–16	25	37·99–44·30	40·48	23	4·53–5·33	4·89	21	24·19–27·48	25·34	29	4·79–5·83	5·22
,,	16–17	19	37·95–41·76	40·12	19	4·30–5·36	4·90	14	24·30–27·83	25·60	19	4·55–5·65	5·14
,,	17–18	8	40·00–42·86	41·38	8	4·71–5·06	4·87	6	24·53–25·36	24·99	8	4·63–5·23	4·92
,,	18–19	3	40·05–41·67	40·83	3	4·63–5·33	5·02	3	24·24–25·31	24·85	3	4·96–5·41	5·12
,,	19–20	6	40·10–44·05	42·10	9	4·79–5·27	5·01	8	22·31–25·26	24·02	9	4·59–5·31	4·90
,,	20–21	10	40·39–44·30	41·99	13	4·59–5·13	4·92	12	22·71–24·88	24·07	13	4·47–5·29	4·91
,,	21–22	3	41·04–42·30	41·85	4	4·51–4·91	4·70	4	23·04–24·37	23·88	4	4·15–5·20	4·66

	Metre lengths	14. Dorsal fin, vertical height			15. Dorsal fin, length of base			16. Flipper, tip to axilla			17. Flipper, tip to anterior end of lower border		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Whale	12–13	—	—	—	—	—	—	1	—	8·54	1	—	11·54
,,	13–14	4	1·87–2·47	2·27	4	4·68–6·74	5·95	5	7·64–9·20	8·17	4	11·24–12·36	11·78
,,	14–15	16	1·93–2·94	2·61	16	3·80 7·17	5·84	21	7·38–9·00	8·19	20	9·82–12·16	10·96
,,	15–16	22	1·81–3·05	2·48	21	5·03–7·78	6·14	25	7·07–9·06	8·11	25	10·22–12·58	11·25
,,	16–17	15	2·16–3·07	2·55	15	4·49–7·27	5·70	19	7·29–8·67	8·02	12	9·81–11·82	11·10
,,	17–18	7	2·10–2·79	2·37	7	4·52–7·02	5·64	8	7·35–8·66	8·06	5	10·75–11·74	11·31
,,	18–19	3	2·83–3·29	3·03	3	4·77–7·50	6·11	3	7·72–8·81	8·17	3	10·83–11·51	11·12
,,	19 20	7	1·48–2·76	2·35	8	5·36 7·49	6·39	6	7·60–9·18	8·66	5	8·96–12·24	10·84
,,	20–21	11	1·89–3·07	2·57	13	4·95–8·37	6·31	11	7·08–8·94	8·10	8	9·58–11·88	10·90
,,	21–22	3	2·22–2·41	2·31	4	4·25–5·53	5·07	3	6·98–8·28	7·84	2	10·80–11·49	11·15

	Metre lengths	22. Skull length, condyle to tip of premaxilla			23. Flipper, tip to head of humerus			24. Tail, depth at dorsal fin			25. Flukes, notch to tip		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Whale	12–13	—	—	—	—	—	—	1	—	7·49	—	—	—
,,	13–14	1	—	23·03	—	—	—	3	8·63– 9·34	8·87	—	—	—
,,	14–15	—	—	—	1	—	10·87	11	7·18–10·10	8·64	—	—	—
,,	15–16	—	—	—	—	—	—	19	7·27– 9·21	8·21	—	—	—
,,	16–17	—	—	—	—	—	—	14	7·66– 9·12	8·30	—	—	—
,,	17–18	—	—	—	—	—	—	5	8·14– 8·77	8·46	—	—	—
,,	18–19	—	—	—	—	—	—	3	7·44– 8·91	8·23	—	—	—
,,	19–20	—	—	—	—	—	—	8	8·02– 9·49	8·73	—	—	—
,,	20–21	—	—	—	—	—	—	11	7·89– 9·78	8·53	—	—	—
,,	21–22	—	—	—	—	—	—	4	7·26– 8·49	7·62	—	—	—

Female Fin Whales: South Georgia

Measurements expressed as percentages of total length

	Metre lengths	2. Lower jaw, projection beyond tip of snout			3. Tip of snout to blowhole			4. Tip of snout to angle of gape			5. Tip of snout to centre of eye		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	—	—	—	3	13·53–15·79	14·94	3	16·20–17·54	16·74	3	16·90–19·30	17·95
,,	1–2	2	0·82–1·23	1·03	12	13·64–17·44	15·53	12	15·46–19·66	18·28	12	17·27–20·44	19·21
,,	2–3	1	—	0·93	10	14·03–17·44	15·39	7	17·28–19·25	17·91	10	18·12–19·53	18·98
,,	3–4	—	—	—	6	14·95–16·67	15·66	6	17·66–19·18	18·41	6	18·48–20·00	19·26
,,	4–5	—	—	—	—	—	—	1	—	15·93	1	—	18·03
,,	5–6	—	—	—	—	—	—	—	—	—	—	—	—
,,	6–7	—	—	—	1	—	11·24	1	—	17·85	1	—	19·01
Whale	14–15	—	—	—	1	—	16·22	—	—	—	2	16·74–18·92	17·83
,,	15–16	1	–	0·65	4	15·03–17·76	16·45	2	18·95–19·15	19·05	7	16·12–20·07	17·93
,,	16–17	—	—	—	8	12·99–19·44	16·66	6	17·43–20·74	18·70	9	18·04–21·60	19·33
,,	17–18	—	—	—	8	15·57–19·88	18·04	7	18·37–20·59	19·76	10	19·03–21·59	20·42
,,	18–19	2	0·83–1·10	0·96	17	17·03–20·05	18·47	15	18·36–21·61	19·68	22	19·19–22·28	20·56
,,	19–20	2	1·09–1·53	1·31	16	17·10–20·46	18·93	13	19·43–21·48	20·43	20	19·58–22·25	21·12
,,	20–21	2	0·96–1·15	1·05	29	17·63–21·35	19·21	19	19·08–22·34	20·47	37	20·04–23·81	21·22
,,	21–22	1	—	1·24	59	17·62–21·84	19·79	34	18·84–22·93	20·89	66	19·68–24·52	21·67
,,	22–23	—	—	—	59	17·58–22·22	19·67	40	18·95–22·67	20·91	68	19·54–23·77	21·70
,,	23–24	—	—		12	17·32–21·07	19·92	7	19·78–22·37	21·20	13	20·78–22·77	21·89
,,	24–25	—	—	—	3	18·63–20·25	19·63	2	20·78–22·00	21·39	3	20·78–22·50	21·88

	Metre lengths	10. Notch of flukes to anus			11. Notch of flukes to umbilicus			12. Notch of flukes to end of ventral grooves			13. Anus to reproductive aperture, centres		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	3	30·98–32·46	31·73	3	47·37–50·70	49·55	—	—	—	3	1·75–2·82	2·31
,,	1–2	11	29·23–32·33	30·89	12	45·76–49·55	47·62	8	43·26–51·35	47·17	12	1·84–3·37	2·74
,,	2–3	10	29·05–32·17	30·82	10	44·83–49·61	47·19	9	44·91–48·20	46·73	10	2·33–3·73	2·74
,,	3–4	6	29·13–33·16	31·06	4	46·03–51·52	49·12	5	45·20–50·00	47·13	6	2·10–3·83	3·08
,,	4–5	1	—	32·79	1	—	48·01	1	—	48·01	1	—	2·81
,,	5–6	—	—	—	—	—	—	—	—	—	—	—	—
,,	6–7	1	—	30·58	1	—	47·44	1	—	46·28	1	—	2·81
Whale	14–15	2	31·76–32·06	31·91	2	47·97–48·94	48·46	1	—	46·62	2	2·70–3·12	2·91
,,	15–16	7	30·26–32·89	31·01	7	46·38–50·00	48·04	2	46·05–48·16	47·11	7	1·49–3·83	2·87
,,	16–17	9	28·75–30·37	29·69	9	45·06–48·18	46·75	5	45·06–48·34	46·29	9	1·82–3·31	2·61
,,	17–18	10	27·45–31·32	29·20	9	44·51–47·76	46·39	6	41·08–46·59	44·34	9	2·30–4·08	3·05
,,	18–19	21	27·12–31·22	29·16	19	43·50–49·57	46·24	11	42·44–47·30	44·96	22	1·85–3·84	2·75
,,	19–20	20	26·73–30·05	28·37	20	41·48–47·31	45·18	12	41·22–46·04	44·05	19	1·82–3·28	2·56
,,	20–21	36	27·39–29·80	28·63	39	42·80–47·12	45·37	17	41·72–46·20	44·00	36	1·73–3·50	2·84
,,	21–22	67	26·04–30·00	28·00	65	42·40–47·52	44·89	41	39·53–46·30	43·41	66	1·84–3·95	2·89
,,	22–23	64	24·62–30·40	27·95	64	40·88–48·89	44·52	40	40·89–46·44	43·51	61	1·98–3·93	2·81
,,	23–24	13	26·69–28·99	27·70	10	42·16–46·52	44·30	9	41·52–44·81	43·33	12	2·17–3·13	2·68
,,	24–25	3	27·95–28·75	28·48	3	43·06–45·42	44·15	2	42·50–42·92	42·71	3	1·69–2·92	2·43

	Metre lengths	18. Flipper, length along curve of lower border			19. Flipper, greatest width			20. Severed head, condyle to tip			21. Skull, greatest width		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	3	12·35–14·91	13·31	3	3·50–3·53	3·52	—	—	—	2	15·29–17·54	16·42
,,	1–2	11	11·70–14·87	13·21	12	2·73–3·77	3·37	—	—	—	9	13·90–16·37	14·90
,,	2–3	9	12·86–14·03	13·48	10	3·10–3·72	3·43	—	—	—	2	13·58–14·16	13·87
,,	3–4	6	13·51–16·84	15·42	5	3·56–3·80	3·66	—	—	—	2	13·21–13·67	13·44
,,	4–5	1	—	15·93	1	—	3·98	—	-	—	—	—	—
,,	5–6	—	—	—	—	—	—	—	—	—	—	—	—
,,	6–7	1	—	14·88	1	—	3·64	—		—	—	—	—
Whale	14–15	—	—	—	1	—	2·62	—		—	—	—	—
,,	15–16	4	11·03–11·58	11·34	7	2·57–3·24	2·74	4	21·85–23·10	22·48	4	10·73–11·60	11·10
,,	16–17	4	10·56–11·23	10·75	6	2·42–3·12	2·73	6	23·94–24·59	24·25	5	10·61–11·87	11·21
,,	17–18	4	10·79–11·49	11·15	7	2·62–2·94	2·81	7	23·58–26·20	25·08	6	10·61–12·24	11·07
,,	18–19	5	10·52–11·94	11·17	7	2·38–3·11	2·69	11	23·73–26·39	25·34	11	9·79–12·37	10·70
,,	19–20	9	10·41–12·16	11·40	12	2·39–2·92	2·78	14	23·83–29·09	26·18	9	9·58–11·26	10·73
,,	20–21	22	10·48–13·60	11·54	31	2·42–3·14	2·76	35	24·15–27·50	25·77	30	10·25–12·50	11·03
,,	21–22	34	10·37–12·86	11·48	40	2·32–3·19	2·78	45	23·73–29·28	26·31	36	10·08–12·38	10·96
,,	22–23	34	9·73–12·65	11·54	38	2·46–3·21	2·80	44	23·79–30·52	26·18	38	9·46–11·50	10·76
,,	23–24	6	9·91–12·29	11·20	7	2·57–3·03	2·71	10	21·72–27·27	25·78	8	10·00–11·69	10·81
,,	24–25	3	10·83–11·96	11·23	3	2·61–2·79	2·68	4	22·83–27·08	25·45	1	—	10·42

Female Fin Whales: South Georgia

Measurements expressed as percentages of total length

	Metre lengths	6. Tip of snout to tip of flipper			7. Eye to ear, centres			8. Notch of flukes to posterior emargination of dorsal fin			9. Flukes, width at insertion		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	3	39·44–42·11	40·52	2	7·06–8·75	7·91	3	27·06–28·92	28·05	3	7·02–7·06	7·04
,,	1–2	11	37·08–43·22	41·45	9	6·15–7·49	6·65	12	23·93–28·21	26·33	12	6·49–8·98	7·50
,,	2–3	9	40·09–44·81	42·49	10	5·52–6·88	6·26	9	20·69–31·12	26·47	9	6·05–8·30	6·96
,,	3–4	6	43·33–45·38	44·09	5	6·06–6·58	6·31	6	25·83–28·95	27·47	6	6·79–8·42	7·52
,,	4–5	—	—	—	1	—	6·09	2	20·73–27·40	24·07	2	6·05–7·26	6·66
,,	5–6	—	—	—	—	—	—	—	—	—	—	—	—
,,	6–7	1	—	42·48	1	—	5·45	1	—	29·09	1	—	6·94
Whale	14–15	1	—	39·66	1	—	4·75	2	28·01–28·72	28·36	1	—	5·18
,,	15–16	3	35·16–40·13	38·30	5	4·39–5·05	4·76	4	25·66–28·29	26·49	4	4·61–6·13	5·32
,,	16–17	8	38·23–41·98	39·64	6	4·50–5·13	4·89	5	23·75–26·25	24·78	8	4·79–6·65	5·37
,,	17–18	8	37·35–42·61	40·92	9	4·60–5·10	4·96	8	24·85–27·84	26·06	8	4·91–5·31	5·17
,,	18–19	16	38·92–42·59	40·83	16	4·18–5·28	4·80	14	23·56–26·49	25·07	17	4·55–5·36	4·98
,,	19–20	16	39·38–42·75	41·35	14	4·42–5·52	4·71	14	23·47–26·34	24·85	17	4·37–5·53	4·97
,,	20–21	27	38·61–45·00	41·36	32	4·21–5·40	4·82	26	20·33–29·12	24·86	30	4·48–5·89	5·03
,,	21–22	58	38·94–46·81	42·09	59	4·49–6·32	4·90	50	19·08–26·48	24·38	63	4·40–5·72	5·00
,,	22–23	55	38·68–44·54	42·18	54	4·04–5·33	4·83	45	20·27–25·92	24·24	60	4·24–5·66	4·92
,,	23–24	10	40·48–43·10	42·54	9	4·52–5·13	4·83	9	22·76–24·59	23·90	12	4·29–5·13	4·73
,,	24–25	3	40·83–43·21	42·16	2	4·83–4·87	4·85	2	22·83–23·54	23·18	3	4·33–4·55	4·46

	Metre lengths	14. Dorsal fin, vertical height			15. Dorsal fin, length of base			16. Flipper, tip to axilla			17. Flipper, tip to anterior end of lower border		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	3	2·35–2·82	2·60	3	4·23–7·06	5·51	3	9·40–10·53	9·93	3	11·76–14·04	12·83
,,	1–2	12	2·24–3·77	2·91	12	4·18–6·18	5·07	12	8·18–10·77	9·58	12	11·70–15·17	12·81
,,	2–3	10	1·89–3·73	2·93	10	4·53–7·05	5·08	10	8·91–10·29	9·72	9	12·03–13·41	12·91
,,	3–4	6	3·00–4·33	3·45	6	6·01–7·67	6·63	6	9·31–12·12	10·54	6	13·21–15·76	14·66
,,	4–5	1	—	3·04	—	—	—	2	9·50–10·54	10·02	1	—	14·99
,,	5–6	—	—	—	—	—	—	—	—	—	—	—	—
,,	6–7	1	—	3·97	1	—	7·77	1	—	11·24	1	—	14·55
Whale	14–15	2	2·34–2·84	2·59	1	—	6·08	1	—	8·30	1	—	11·84
,,	15–16	4	2·12–2·76	2·47	3	4·93–5·81	5·33	7	7·15–8·58	8·00	5	10·32–11·18	10·72
,,	16–17	5	2·18–3·67	2·64	5	4·89–6·88	6·29	6	6·79–8·64	7·86	5	9·91–11·04	10·42
,,	17–18	7	2·24–3·02	2·56	6	4·37–7·93	5·82	9	7·47–9·78	8·33	7	9·25–11·82	10·80
,,	18–19	14	1·93–2·67	2·37	13	4·32–6·42	5·36	18	7·00–9·89	8·39	5	10·14–11·56	10·74
,,	19–20	16	1·94–3·45	2·57	13	4·27–6·43	5·47	17	7·27–9·33	8·35	11	10·15–11·91	11·30
,,	20–21	27	1·69–2·93	2·38	19	4·21–7·12	5·55	32	6·53–10·81	8·30	27	9·90–13·16	11·20
,,	21–22	50	1·74–3·20	2·30	50	4·28–7·78	5·66	58	6·86–10·70	8·26	37	9·41–12·38	10·97
,,	22–23	49	1·69–2·83	2·30	48	4·24–7·62	5·70	56	6·67–9·76	8·27	36	9·64–13·15	11·27
,,	23–24	9	1·97–2·71	2·24	9	4·18–7·52	5·74	10	7·58–9·12	8·00	7	9·48–12·03	11·01
,,	24–25	2	1·96–1·96	1·96	2	5·00–5·21	5·11	3	8·04–9·37	8·49	3	10·42–11·75	10·95

	Metre lengths	22. Skull length, condyle to tip of premaxilla			23. Flipper, tip to head of humerus			24. Tail, depth at dorsal fin			25. Flukes, notch to tip		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Foetus	0–1	—	—	—	—	—	—	3	9·40–11·28	10·40	3	9·40–10·53	9·93
,,	1–2	—	—	—	—	—	—	9	10·11–11·24	10·49	11	8·64–13·51	11·68
,,	2–3	—	—	—	—	—	—	9	9·30–10·94	10·04	9	8·62–14·34	12·42
,,	3–4	—	—	—	—	—	—	6	10·33–11·51	10·81	6	11·14–14·47	13·15
,,	4–5	—	—	—	—	—	—	2	8·42–10·54	9·48	2	11·66–12·88	12·27
,,	5–6	—	—	—	—	—	—	—	—	—	—	—	—
,,	6–7	—	—	—	—	—	—	1	—	8·93	1	—	12·23
Whale	14–15	—	—	—	—	—	—	1	—	10·43	—	—	—
,,	15–16	—	—	—	—	—	—	2	9·21–9·21	9·21	—	—	—
,,	16–17	—	—	—	—	—	—	4	8·56–10·31	9·38	—	—	—
,,	17–18	—	—	—	—	—	—	4	9·40–10·05	9·69	—	—	—
,,	18–19	—	—	—	—	—	—	10	8·77–10·46	9·70	—	—	—
,,	19–20	1	—	25·78	—	—	—	10	8·59–11·06	9·56	—	—	—
,,	20–21	—	—	—	—	—	—	15	8·71–10·59	9·32	—	—	—
,,	21–22	—	—	—	2	11·66–12·79	12·23	38	7·91–11·36	9·43	—	—	—
,,	22–23	1	—	25·30	1	—	12·25	34	7·51–10·77	9·38	—	—	—
,,	23–24	—	—	—	—	—	—	8	7·88–10·34	8·76	—	—	—
,,	24–25	—	—	—	—	—	—	2	8·33–8·96	8·65	—	—	—

Female Fin Whales: South Africa

Measurements expressed as percentages of total length

	Metre lengths	2. Lower jaw, projection beyond tip of snout			3. Tip of snout to blowhole			4. Tip of snout to angle of gape			5. Tip of snout to centre of eye		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Whale	12–13	—	—	—	1	—	15·76	1	—	18·27	1	—	18·51
,,	13–14	—	—	—	1	—	16·24	1	—	18·30	1	—	18·97
,,	14–15	—	—	—	14	15·88–18·70	17·27	13	17·57–19·97	18·17	14	18·18–20·87	19·04
,,	15–16	—	—	—	24	16·58–19·05	17·87	20	18·10–21·00	19·41	25	18·82–21·32	20·08
,,	16–17	—	—	—	14	17·33–19·45	17·64	13	18·77–21·09	19·81	14	19·40–21·33	20·27
,,	17–18	—	—	—	9	17·84–19·59	18·86	9	20·00–21·05	20·47	9	20·73–22·11	21·19
,,	18–19	—	—	—	2	18·35–20·81	19·58	2	20·48–22·70	21·59	2	20·74–22·86	21·80
,,	19–20	—	—	—	1	—	19·53	1	—	21·46	1	—	21·87
,,	20–21	—	—	—	4	17·60–20·45	19·34	4	19·90–22·08	21·30	4	20·38–22·13	21·63
,,	21–22	—	—	—	4	18·98–20·28	19·44	4	20·14–21·42	20·54	4	20·83–22·31	21·37

	Metre lengths	10. Notch of flukes to anus			11. Notch of flukes to umbilicus			12. Notch of flukes to end of ventral grooves			13. Anus to reproductive aperture, centres		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Whale	12–13	1	—	30·59	1	—	49·02	1	—	50·20	1	—	3·29
,,	13–14	1	—	29·89	—	—	—	1	—	45·39	1	—	3·69
,,	14–15	14	27·99–32·33	30·49	13	46·98–49·66	48·41	11	45·55–49·66	47·24	14	2·05–3·26	2·72
,,	15–16	25	28·30–31·76	30·11	25	45·04–51·48	47·55	19	44·06–48·43	45·69	23	1·90–3·79	2·86
,,	16–17	14	26·59–30·40	29·39	13	43·03–49·09	46·41	11	41·54–47·30	44·78	13	2·46–3·07	2·71
,,	17–18	9	27·19–32·39	29·19	8	43·86–48·42	45·54	6	43·27–47·59	44·96	9	1·69–3·31	2·50
,,	18–19	2	28·72–28·92	28·82	2	44·68–45·41	45·04	—	—	—	2	1·89–2·39	2·14
,,	19–20	1	—	28·39	1	—	44·27	1	—	43·75	1	—	3·39
,,	20–21	4	27·16–29·02	28·21	4	43·95–47·96	45·32	3	42·47–46·04	43·75	4	2·43–3·82	3·08
,,	21–22	4	27·12–29·95	28·44	4	43·87–47·22	45·30	4	42·45–46·30	44·24	4	3·06–3·24	3·15

	Metre lengths	18. Flipper, length along curve of lower border			19. Flipper, greatest width			20. Severed head, condyle to tip			21. Skull, greatest width		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Whale	12–13	1	—	12·71	1	—	2·75	—	—	—	—	—	—
,,	13–14	1	—	11·00	1	—	2·58	—	—	—	—	—	—
,,	14–15	10	10·68–12·05	11·30	10	2·59–3·01	2·74	7	22·97–25·48	24·24	7	9·59–11·10	10·30
,,	15–16	24	10·23–13·29	11·34	23	2·40–2·89	2·69	16	23·38–25·57	24·36	15	9·72–10·79	10·24
,,	16–17	14	10·39–13·04	11·32	12	2·52–3·01	2·70	9	23·95–25·68	24·67	9	9·63–10·49	10·92
,,	17–18	6	10·70–12·06	11·53	5	2·54–2·92	2·73	7	25·07–26·32	25·68	7	9·46–11·27	10·45
,,	18–19	1	—	12·23	1	—	2·77	2	25·00–27·68	26·34	2	10·64–11·62	11·13
,,	19–20	1	—	10·94	1	—	2·76	—	—	—	1	—	10·68
,,	20–21	4	10·52–11·61	11·07	3	2·59–2·77	2·69	3	23·98–26·90	25·82	2	10·53–10·55	10·54
,,	21–22	4	10·40–11·47	11·07	3	2·69–2·92	2·81	4	24·77–26·56	25·59	3	10·42–11·32	10·95

Female Fin Whales: South Africa

Measurements expressed as percentages of total length

	Metre lengths	6. Tip of snout to tip of flipper			7. Eye to ear, centres			8. Notch of flukes to posterior emargination of dorsal fin			9. Flukes, width at insertion		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Whale	12–13	1	—	37·65	1	—	4·78	1	—	27·37	1	—	5·25
,,	13–14	1	—	39·78	1	—	4·87	1	—	25·68	1	—	5·02
,,	14–15	12	37·92–41·74	39·52	13	4·63–5·21	4·86	11	24·83–27·70	26·28	14	4·79–5·61	5·28
,,	15–16	24	38·46–43·35	40·47	22	4·45–5·34	4·83	20	24·33–27·67	25·52	25	4·57–5·77	5·15
,,	16–17	12	38·62–42·34	40·46	13	4·43–5·03	4·80	11	24·02–27·20	25·14	14	4·56–5·69	5·16
,,	17–18	9	41·13–42·46	41·81	9	4·50–5·00	4·79	6	23·68–25·33	24·62	9	4·56–5·34	4·88
,,	18–19	2	41·49–43·78	42·63	2	4·95–5·30	5·12	1	—	24·79	2	5·00–5·03	5·01
,,	19–20	1	—	42·19	1	—	5·21	1	—	24·64	1	—	5·00
,,	20–21	4	41·25–42·22	41·60	4	4·54–4·78	4·65	3	23·56–24·70	23·94	4	4·67–4·84	4·78
,,	21–22	4	40·74–42·45	41·33	4	4·54–5·08	4·80	4	24·06–25·83	25·16	4	4·62–4·86	4·71

	Metre lengths	14. Dorsal fin, vertical height			15. Dorsal fin, length of base			16. Flipper, tip to axilla			17. Flipper, tip to anterior end of lower border		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Whale	12–13	1	—	2·51	1	—	5·49	1	—	7·84	1	—	12·47
,,	13–14	1	—	2·29	1	—	6·64	1	—	8·12	1	—	10·63
,,	14–15	12	2·03–2·92	2·46	11	4·39–6·85	5·77	12	7·74–8·77	8·08	10	10·34–11·85	10·99
,,	15–16	21	1·90–3·74	2·50	21	4·57–7·72	5·89	25	7·17–9·90	8·16	24	9·64–12·89	11·05
,,	16–17	13	2·22–2·97	2·50	13	4·37–6·85	5·75	14	7·72–8·64	8·14	14	10·09–12·50	11·02
,,	17–18	7	2·08–2·69	2·34	7	4·39–6·88	5·72	9	7·44–8·85	8·26	6	10·59–11·83	11·19
,,	18–19	1	—	2·87	1	—	6·91	2	8·51–9·03	8·77	1	—	11·76
,,	19–20	1	—	2·97	1	—	6·51	1	—	8·12	1	—	10·68
,,	20–21	4	1·87–2·72	2·29	4	3·97–6·42	5·13	4	7·44–8·21	7·87	4	10·32–11·11	10·72
,,	21–22	4	2·12–2·59	2·40	4	4·61–6·02	5·13	4	7·53–8·25	7·98	4	10·21–11·34	10·83

	Metre lengths	22. Skull length, condyle to tip of premaxilla			23. Flipper, tip to head of humerus			24. Tail, depth at dorsal fin		
		No. of measurements	Range	Mean	No. of measurements	Range	Mean	No. of measurements	Range	Mean
Whale	12–13	—	—	—	—	—	—	1	—	8·24
,,	13–14	—	—	—	1	—	11·96	1	—	9·00
,,	14–15	—	—	—	—	—	—	11	7·45–9·45	8·51
,,	15–16	1	—	22·86	1	—	12·99	19	7·81–9·09	8·44
,,	16–17	1	—	23·47	1	—	12·16	11	7·87–8·99	8·32
,,	17–18	—	—	—	—	—	—	6	8·48–8·84	8·68
,,	18–19	1	—	24·52	1	—	12·87	1	—	8·62
,,	19–20	—	—	—	—	—	—	1	—	9·79
,,	20–21	—	—	—	—	—	—	3	8·63–8·94	8·74
,,	21–22	—	—	—	—	—	—	4	8·40–9·95	8·92

Graphical representations of selected measurements from the foregoing tables are shown in Figs. 53 to 75, and it will be seen that in general the results are very similar to those which appear in the case of Blue whales. There is no important difference between the curves for the two sexes, except of course in the case of measurement No. 13, and though a slight distinction appears between Fin whales of South Georgia and South Africa, which will be dealt with immediately, there is no difference between the shapes of the curves.

As in Blue whales, the anterior measurements (Figs. 53 to 62) show a relative increase as the whale-length increases. The increase is about 0·45 per cent per metre of whale-length as the whale-length increases from 14 to 22 m. The measurements referring to the posterior part of the body show a corresponding decrease.

A feature of the anterior measurement which is very noticeable in female Fin whales and is distinguishable in males (and, incidentally, in Blue whales of both sexes), is that the curves for South African whales fall in advance of the curves for South Georgian whales, to which, however, they correspond in shape. This means that the South African whales have relatively larger heads than those of the same total length at South Georgia. In Fin males the difference is about 0·7 per cent of the whale-length and in females about 0·8 per cent of the whale-length.

Among the posterior measurements we find that the female Fin whales again show a South African curve in advance of the South Georgian curve, which means that the South African whale has a relatively smaller tail than the South Georgian whale of the same size. In male Fin whales and Blue whales of both sexes this difference is not noticeable.

As growth is accompanied by a relative increase in the size of the head and a relative decrease in the length of the tail, one may say that the South African whales (female Fin whales especially) have heads and tails whose proportions correspond with whales 1 to 2 m. longer at South Georgia.

If the attainment of physical proportions goes on to some extent independently of growth in length, whales of the African coast would appear to be stunted and their smaller size accentuates the relatively increased size of the head and decreased size of the tail, while at South Georgia exactly the opposite happens. In support of this interpretation it may be pointed out that in the graphs of the anterior measurements a maximum head size is reached in Fin whales of South Africa at about 19 to 20 m. and the curve then drops to the level of the South Georgian whales which reach the maximum at about 23 m.

It is possible that this difference in the bodily proportions of South Georgian and South African whales is due to a slightly emaciated condition among the latter, caused by the relative scarcity of food.

As to the other measurements illustrated in Figs. 71 to 75, we find no difference between the whales of the two localities in respect of measurement No. 13 (Fig. 71) or of measurements Nos. 17 and 18 (Figs. 72 and 73), but the depth of the tail (Figs. 74 and 75) is again slightly greater in South Georgian whales. The size of the whale appears to make no difference to this measurement.

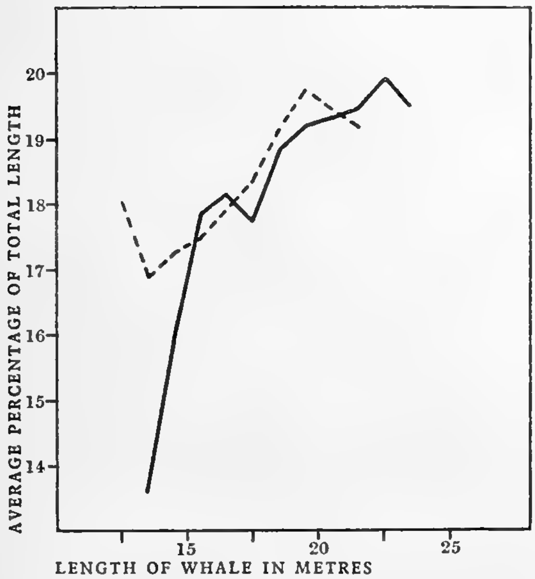

Fig. 53. Male Fin whales. Measurement No. 3. Tip of snout to blowhole.

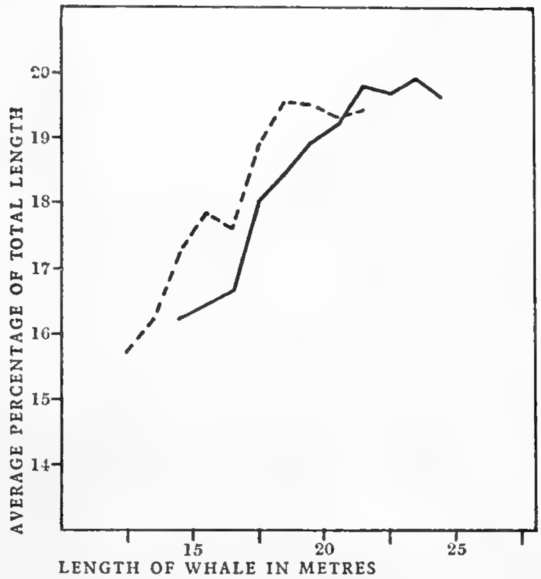

Fig. 54. Female Fin whales. Measurement No. 3. Tip of snout to blowhole.

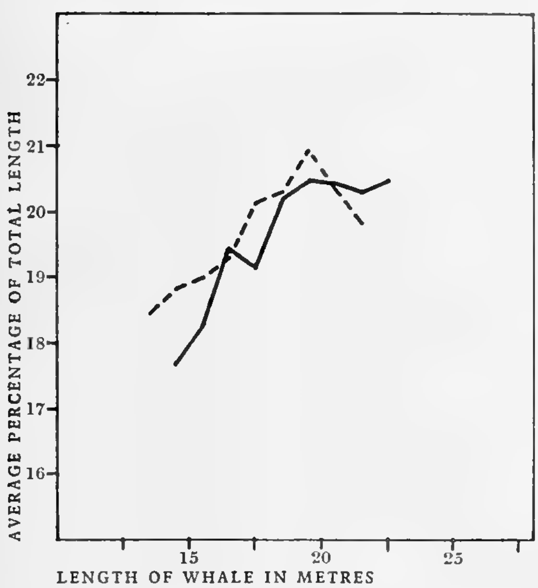

Fig. 55. Male Fin whales. Measurement No. 4. Tip of snout to angle of gape.

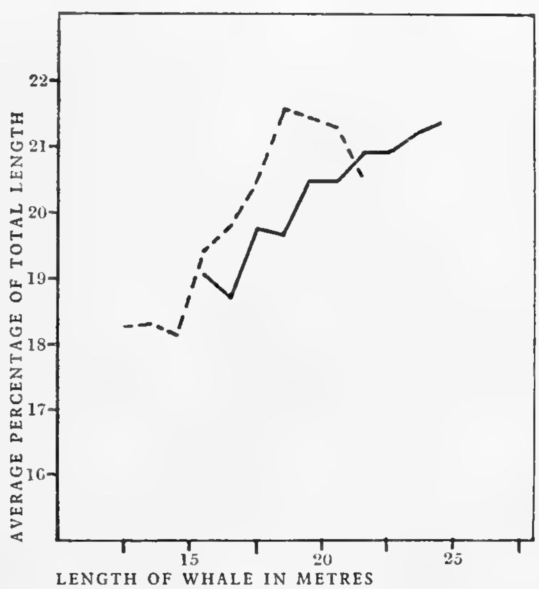

Fig. 56. Female Fin whales. Measurement No. 4. Tip of snout to angle of gape.

——— South Georgia whales. - - - - - South African whales.

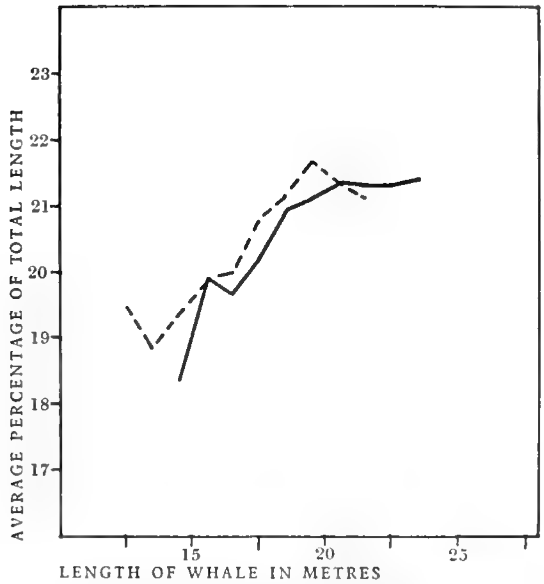

Fig. 57. Male Fin whales. Measurement No. 5. Tip of snout to centre of eye.

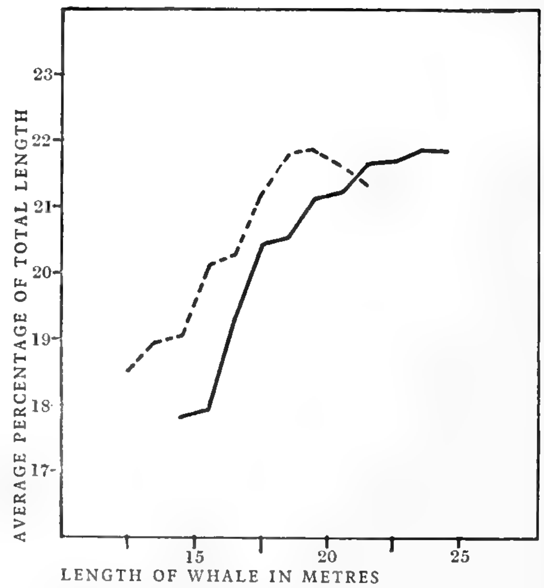

Fig. 58. Female Fin whales. Measurement No. 5. Tip of snout to centre of eye.

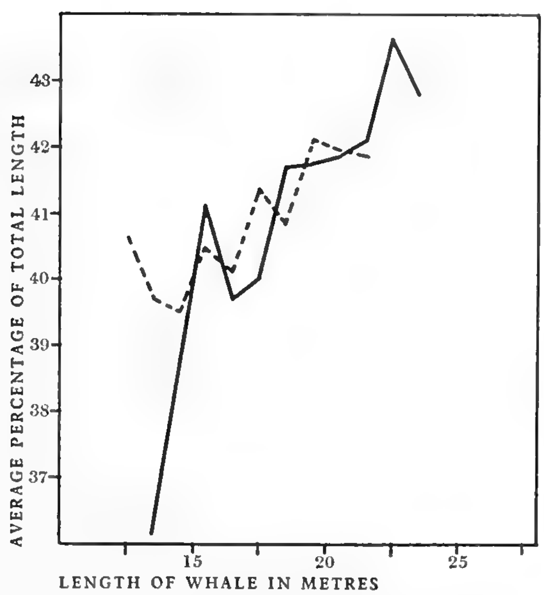

Fig. 59. Male Fin whales. Measurement No. 6. Tip of snout to tip of flipper.

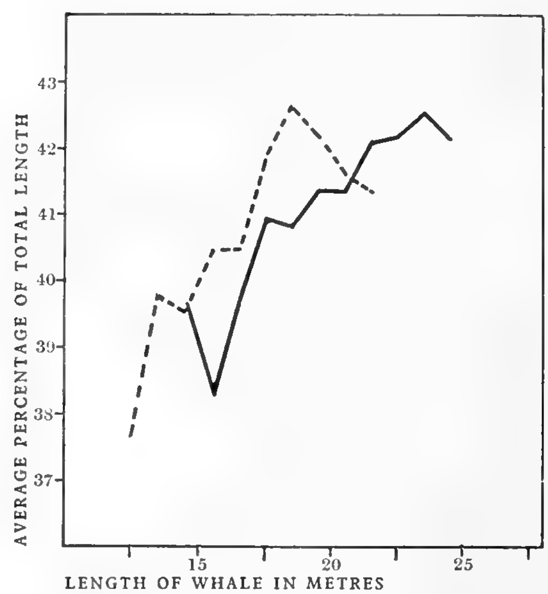

Fig. 60. Female Fin whales. Measurement No. 6. Tip of snout to tip of flipper.

——— South Georgia whales. - - - - - South African whales.

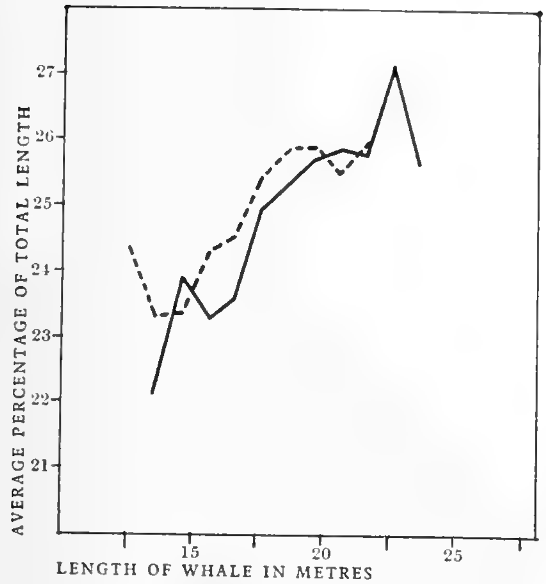

Fig. 61. Male Fin whales. Measurement No. 20. Severed head, condyle to tip.

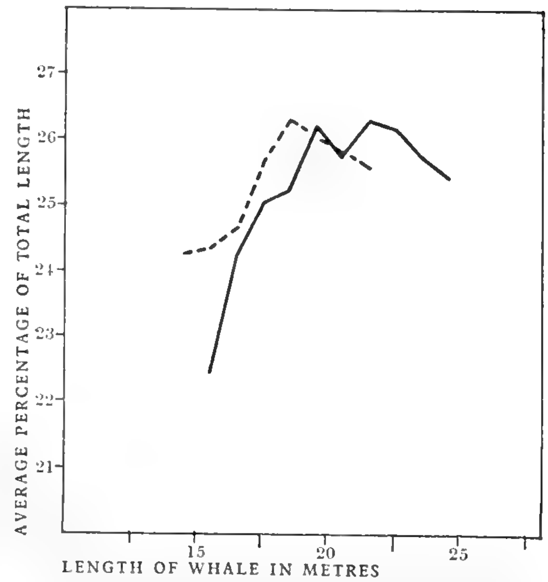

Fig. 62. Female Fin whales. Measurement No. 20. Severed head, condyle to tip.

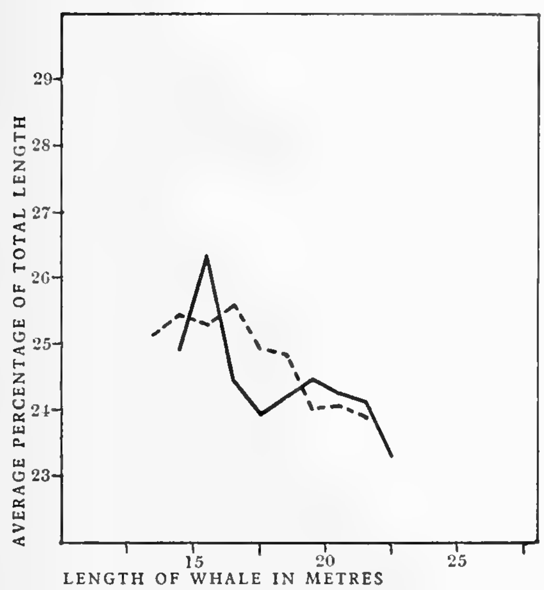

Fig. 63. Male Fin whales. Measurement No. 8. Notch of flukes to posterior emargination of dorsal fin.

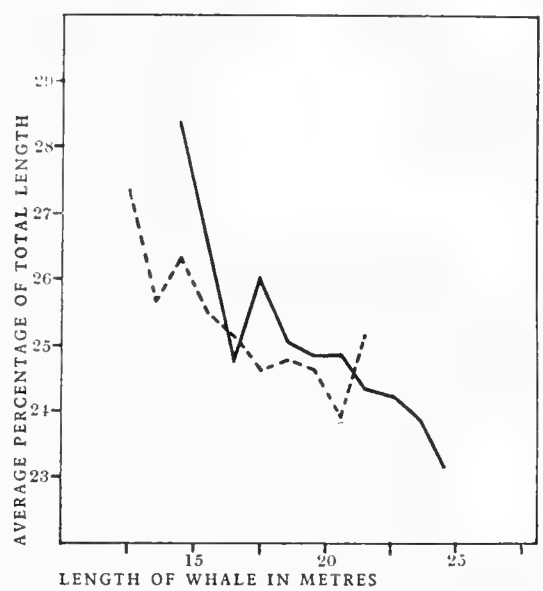

Fig. 64. Female Fin whales. Measurement No. 8. Notch of flukes to posterior emargination of dorsal fin.

——— South Georgia whales. - - - - - South African whales.

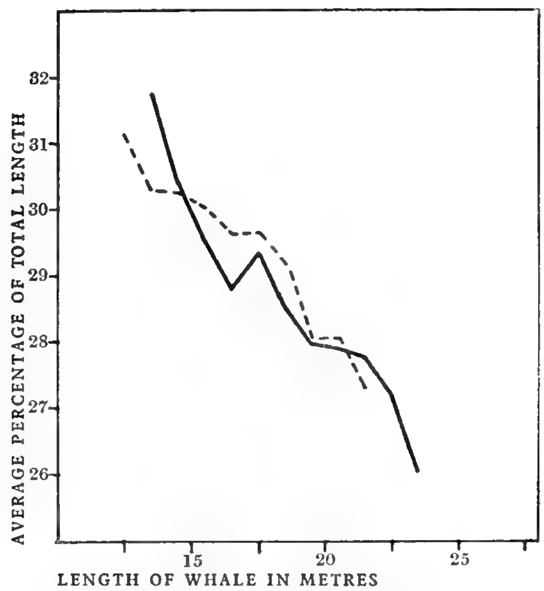

Fig. 65. Male Fin whales. Measurement No. 10. Notch of flukes to anus.

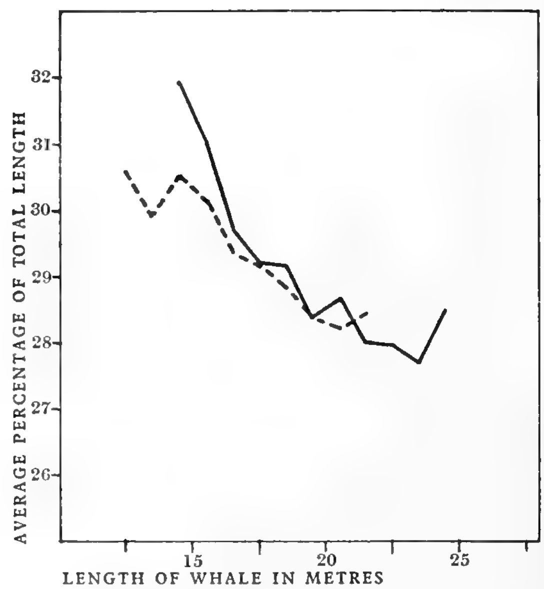

Fig. 66. Female Fin whales. Measurement No. 10. Notch of flukes to anus.

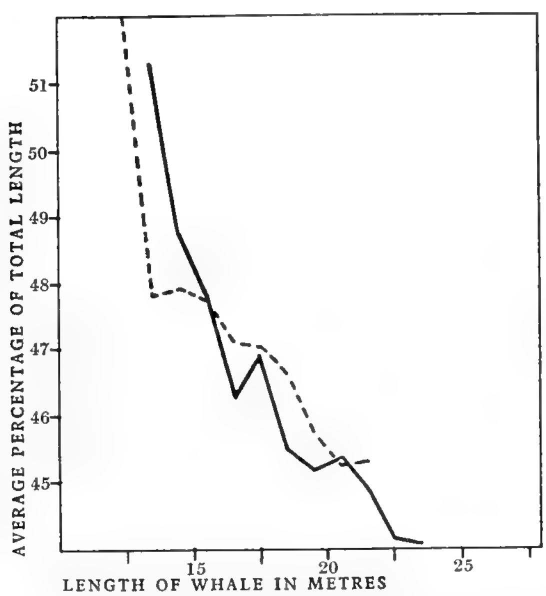

Fig. 67. Male Fin whales. Measurement No. 11. Notch of flukes to umbilicus.

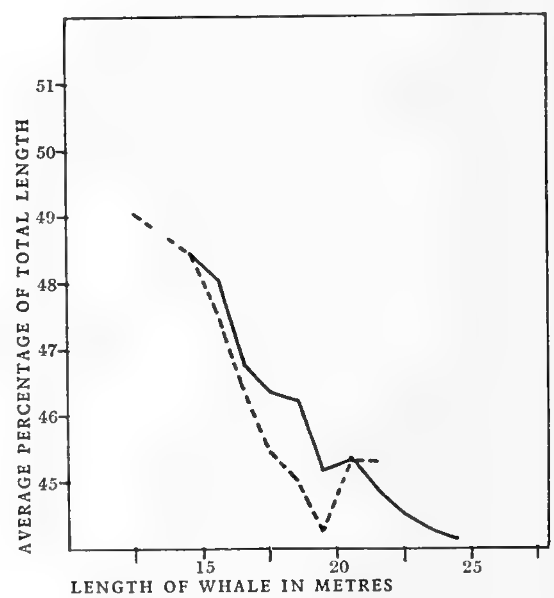

Fig. 68. Female Fin whales. Measurement No. 11. Notch of flukes to umbilicus.

——— South Georgia whales. - - - - South African whales.

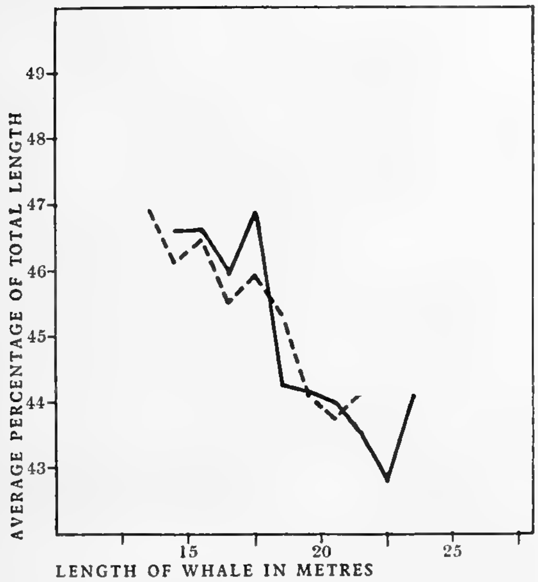

Fig. 69. Male Fin whales. Measurement No. 12. Notch of flukes to end of ventral grooves.

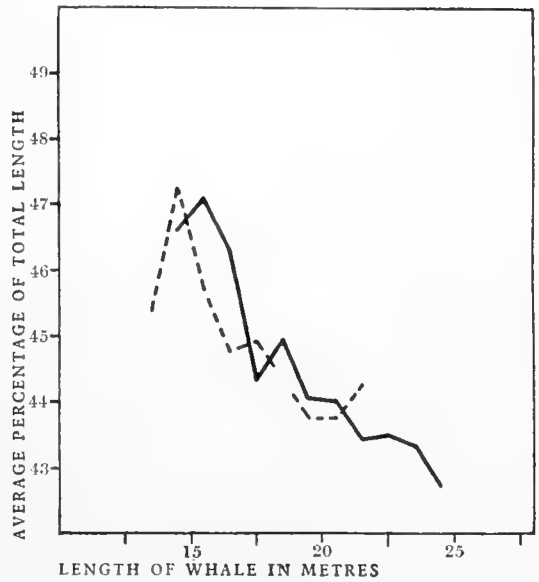

Fig. 70. Female Fin whales. Measurement No. 12. Notch of flukes to end of ventral grooves.

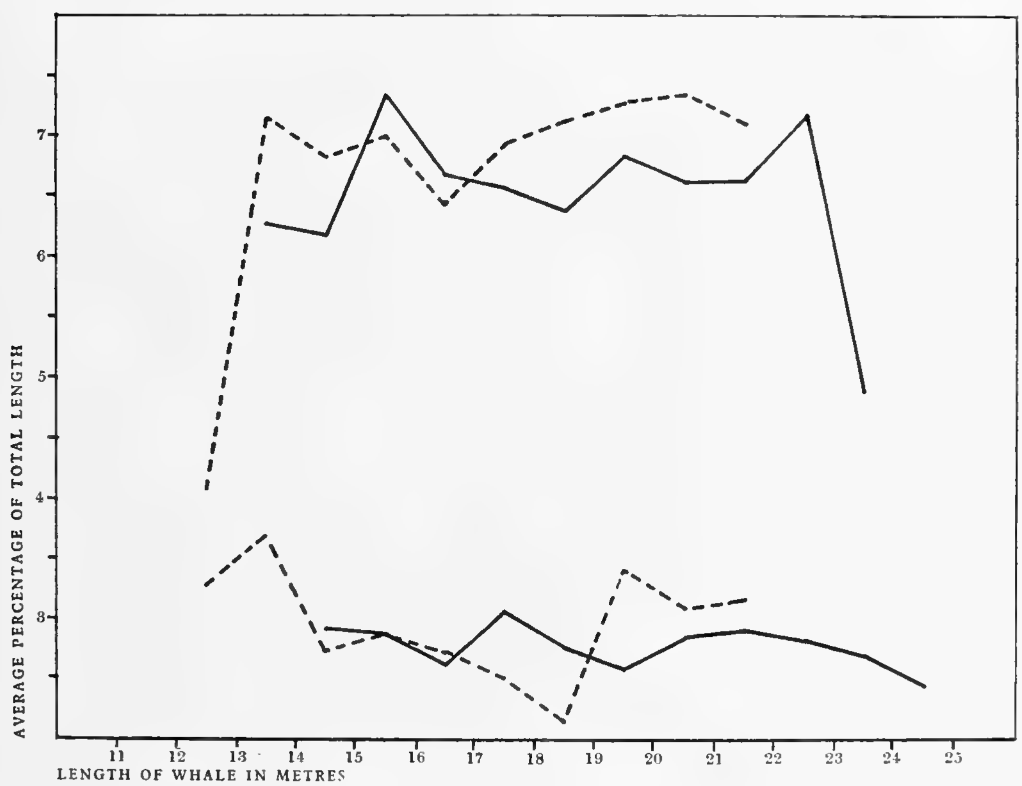

Fig. 71. Fin whales (upper curves males, lower curves females). Measurement No. 13. Anus to reproductive aperture.

——— South Georgia whales. - - - - - South African whales.

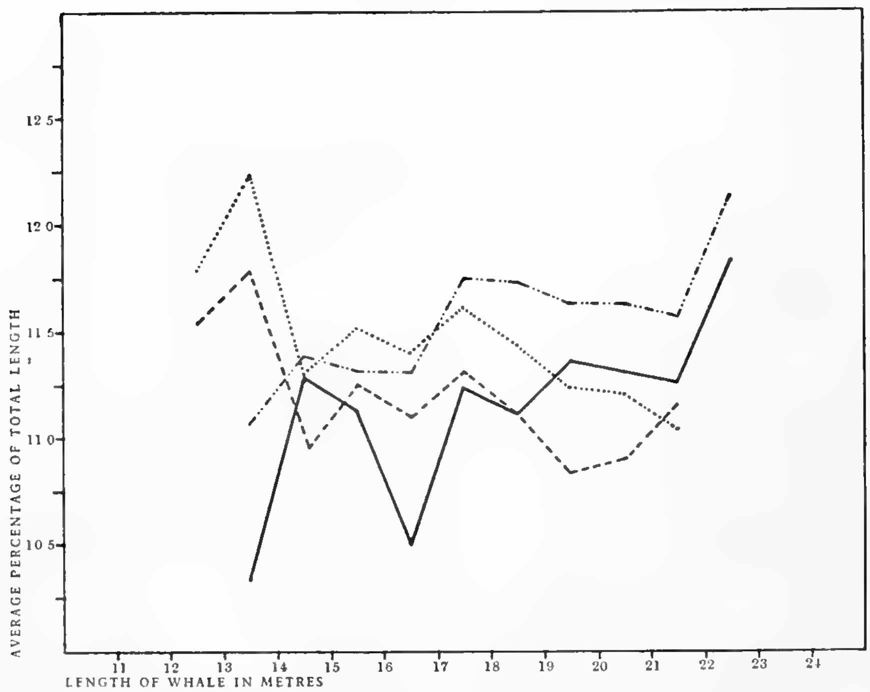

Fig. 72. Male Fin whales. Measurement No. 17. Flipper, tip to anterior end of lower border. No. 18. Flipper, length along curve of lower border. (See below.)

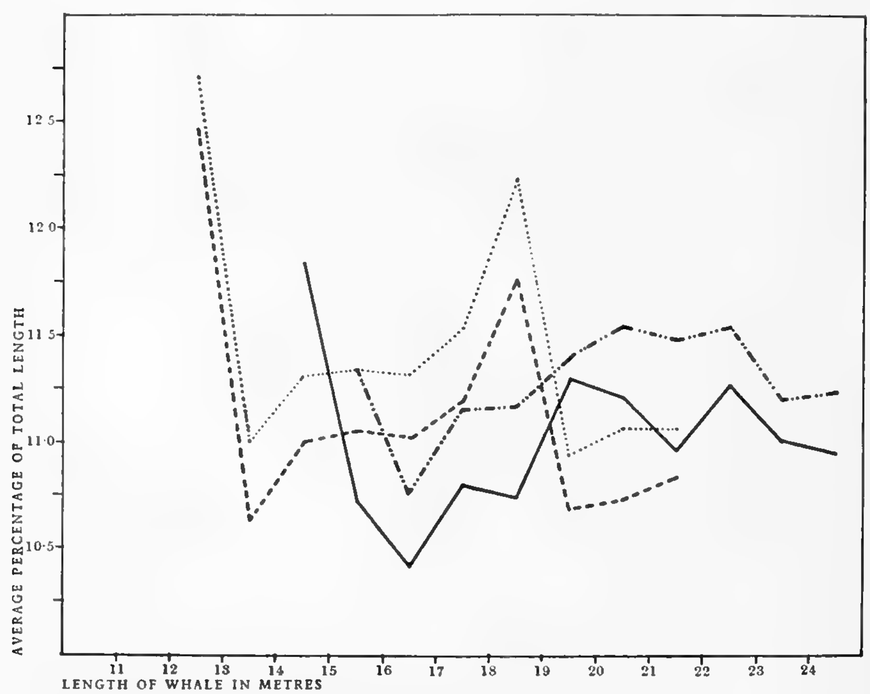

Fig. 73. Female Fin whales. Measurement No. 17. Flipper, tip to anterior end of lower border. No. 18. Flipper, length along curve of lower border.

———— S. Georgia, - - - - - S. Africa } Measurement No. 17. —··—··— S. Georgia, ·········· S. Africa } Measurement No. 18.

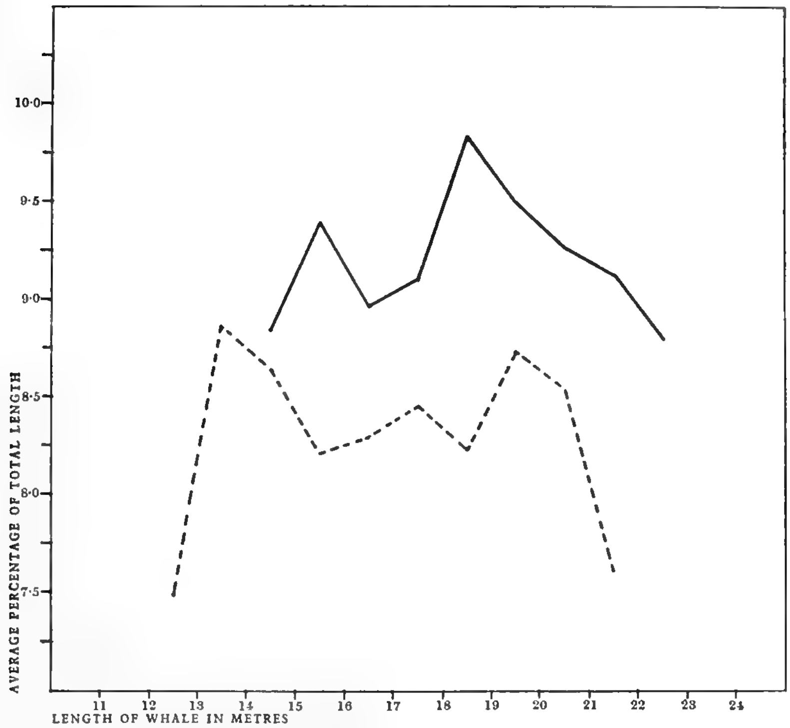

Fig. 74. Male Fin whales. Measurement No. 24. Tail, depth at dorsal fin.

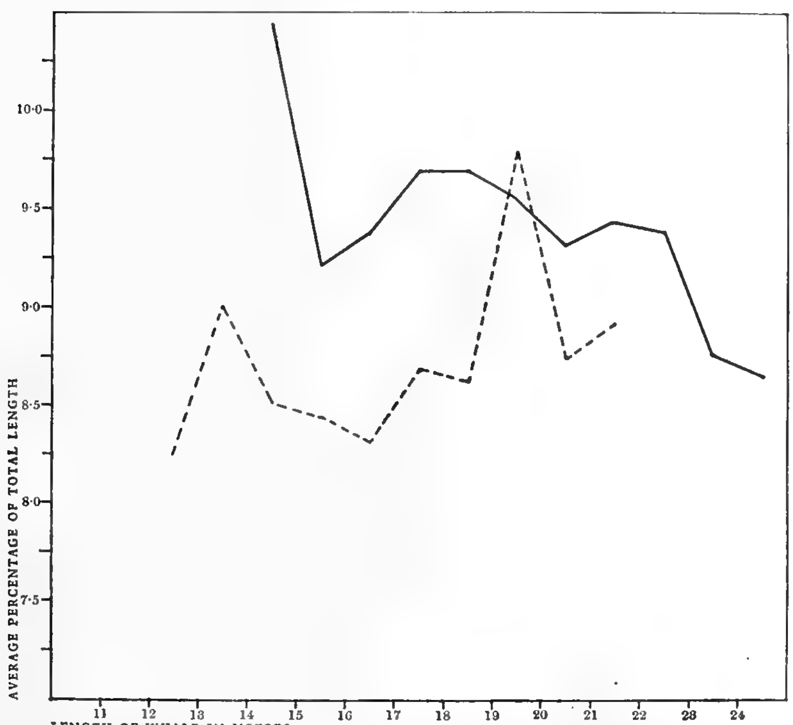

Fig. 75. Female Fin whales. Measurement No. 24. Tail, depth at dorsal fin.
——— South Georgia whales. - - - - - South African whales.

VARIATION OF MEASUREMENTS

Fin males (S. Georgia), 20 to 22 m. Fin females (S. Georgia), 21 to 23 m.

3. Tip of snout to blowhole

Range of values (% of total length)	Number of readings ♂	♀
17·0–17·5	1	—
17·5–18·0	12	5
18·0–18·5	15	4
18·5–19·0	28	16
19·0–19·5	49	25
19·5–20·0	28	20
20·0–20·5	22	28
20·5–21·0	13	10
21·0–21·5	2	5
21·5–22·0	2	3
22·0–22·5	—	1
22·5–23·0	—	1

4. Tip of snout to angle of gape

Range of values (% of total length)	Number of readings ♂	♀
17·5–18·0	1	—
18·0–18·5	2	—
18·5–19·0	2	2
19·0–19·5	14	4
19·5–20·0	17	7
20·0–20·5	26	10
20·5–21·0	27	15
21·0–21·5	11	17
21·5–22·0	10	10
22·0–22·5	4	4
22·5–23·0	—	5

5. Tip of snout to centre of eye

Range of values (% of total length)	Number of readings ♂	♀
19·0–19·5	2	—
19·5–20·0	7	4
20·0–20·5	17	7
20·5–21·0	46	18
21·0–21·5	39	31
21·5–22·0	42	28
22·0–22·5	24	24
22·5–23·0	13	11
23·0–23·5	2	6
23·5–24·0	—	3
24·0–24·5	—	1
24·5–25·0	—	1

6. Tip of snout to tip of flipper

Range of values (% of total length)	Number of readings ♂	♀
37–38	2	—
38–39	2	2
39–40	9	5
40–41	21	13
41–42	47	29
42–43	38	36
43–44	29	18
44–45	7	8
45–46	3	—
46–47	—	2

7. Eye to ear (centres)

Range of values (% of total length)	Number of readings ♂	♀
4·00–4·25	1	1
4·25–4·50	7	5
4·50–4·75	31	33
4·75–5·00	59	48
5·00–5·25	53	17
5·25–5·50	16	8
5·50–5·75	4	—
5·75–6·00	1	—
6·00–6·25	—	—
6·25–6·50	1	1

13. Anus to reproductive aperture (centres)

Range of values (% of total length)	Number of readings ♂	♀
1·5–2·0	—	3
2·0–2·5	—	23
2·5–3·0	—	56
3·0–3·5	—	35
3·5–4·0	1	—
4·0–4·5	1	—
4·5–5·0	14	—
5·0–5·5	19	—
5·5–6·0	13	—
6·0–6·5	12	—
6·5–7·0	41	—
7·0–7·5	52	—
7·5–8·0	27	—
8·0–8·5	4	—
8·5–9·0	1	—

14. Dorsal fin (vertical height)

Range of values (% of total length)	Number of readings ♂	♀
1·2–1·4	1	—
1·4–1·6	—	—
1·6–1·8	2	3
1·8–2·0	4	9
2·0–2·2	14	19
2·2–2·4	34	32
2·4–2·6	39	20
2·6–2·8	35	12
2·8–3·0	13	2
3·0–3·2	4	1
3·2–3·4	3	1
3·4–3·6	1	—

15. Dorsal fin, length of base

Range of values (% of total length)	Number of readings ♂	♀
3·0–3·5	1	—
3·5–4·0	2	2
4·0–4·5	1	6
4·5–5·0	12	13
5·0–5·5	23	26
5·5–6·0	39	19
6·0–6·5	27	13
6·5–7·0	24	10
7·0–7·5	20	4
7·5–8·0	3	5
8·0–8·5	1	—

16. Flipper, tip to axilla

Range of values (% of total length)	Number of readings ♂	♀
6·5–7·0	5	3
7·0–7·5	10	12
7·5–8·0	21	24
8·0–8·5	55	35
8·5–9·0	54	25
9·0–9·5	14	10
9·5–10·0	8	3
10·0–10·5	2	1
10·5–11·0	—	1

17. Flipper, tip to anterior end of lower border

Range of values (% of total length)	Number of readings ♂	♀
8·0–8·5	1	—
8·5–9·0	—	—
9·0–9·5	1	1
9·5–10·0	1	2
10·0–10·5	7	13
10·5–11·0	24	19
11·0–11·5	42	15
11·5–12·0	31	15
12·0–12·5	10	7
12·5–13·0	5	—
13·0–13·5	—	1

VARIATION OF MEASUREMENTS

Fin males (S. Georgia), 20 to 22 m. Fin females (S. Georgia), 21 to 23 m.

8. Notch of flukes to posterior emargination of dorsal fin			9. Flukes, width at insertion			10. Notch of flukes to anus			11. Notch of flukes to umbilicus			12. Notch of flukes to end of ventral grooves		
Range of values (% of total length)	Number of readings ♂	♀	Range of values (% of total length)	Number of readings ♂	♀	Range of values (% of total length)	Number of readings ♂	♀	Range of values (% of total length)	Number of readings ♂	♀	Range of values (% of total length)	Number of readings ♂	♀
19·0–19·5	—	1	4·00–4·25	2	1	22·5–23·0	1	—	39–40	—	—	39–40	—	1
19·5–20·0	—	—	4·25–4·50	3	7	23·0–23·5	—	—	40–41	2	1	40–41	2	5
20·0–20·5	—	1	4·50–4·75	23	22	23·5–24·0	1	—	41–42	—	3	41–42	12	8
20·5–21·0	—	—	4·75–5·00	51	38	24·0–24·5	—	—	42–43	5	8	42–43	26	17
21·0–21·5	—	—	5·00–5·25	60	36	24·5–25·0	1	1	43–44	22	27	43–44	32	19
21·5–22·0	2	1	5·25–5·50	22	14	25·0–25·5	2	—	44–45	46	32	44–45	29	17
22·0–22·5	4	1	5·50–5·75	9	5	25·5–26·0	2	1	45–46	67	36	45–46	24	9
22·5–23·0	9	8	5·75–6·00	1	—	26·0–26·5	13	6	46–47	26	19	46–47	6	5
23·0–23·5	23	6	6·00–6·25	1	—	26·5–27·0	12	9	47–48	8	2	47–48	1	—
23·5–24·0	26	15				27·0–27·5	23	17	48–49	1	1			
24·0–24·5	29	17				27·5–28·0	36	32	49–50	1	—			
24·5–25·0	21	20				28·0–28·5	49	31						
25·0–25·5	19	12				28·5–29·0	31	20						
25·5–26·0	8	9				29·0–29·5	10	4						
26·0–26·5	5	3				29·5–30·0	5	6						
26·5–27·0	—	—				30·0–30·5	2	4						
27·0–27·5	—	—				30·5–31·0	1	—						
27·5–28·0	1	—												
28·0–28·5	—	—												
28·5–29·0	1	—												

18. Flipper, length along curve of lower border			19. Flipper, greatest width			20. Severed head, condyle to tip			21. Skull, greatest width			24. Tail, depth at dorsal fin		
Range of values (% of total length)	Number of readings ♂	♀	Range of values (% of total length)	Number of readings ♂	♀	Range of values (% of total length)	Number of readings ♂	♀	Range of values (% of total length)	Number of readings ♂	♀	Range of values (% of total length)	Number of readings ♂	♀
8·5– 9·0	1	—	2·3–2·4	3	1	23·0–23·5	3	—	9·0– 9·5	—	1	6·5– 7·0	—	1
9·0– 9·5	—	—	2·4–2·5	1	2	23·5–24·0	1	2	9·5–10·0	6	—	7·0– 7·5	—	—
9·5–10·0	2	1	2·5–2·6	2	6	24·0–24·5	3	4	10·0–10·5	17	14	7·5– 8·0	3	2
10·0–10·5	1	2	2·6–2·7	11	12	24·5–25·0	14	6	10·5–11·0	48	32	8·0– 8·5	17	7
10·5–11·0	9	16	2·7–2·8	21	20	25·0–25·5	30	9	11·0–11·5	35	22	8·5– 9·0	24	15
11·0–11·5	37	17	2·8–2·9	42	17	25·5–26·0	29	19	11·5–12·0	11	4	9·0– 9·5	34	19
11·5–12·0	32	14	2·9–3·0	26	11	26·0–26·5	24	16	12·0–12·5	2	1	9·5–10·0	28	10
12·0–12·5	27	13	3·0–3·1	13	7	26·5 27·0	14	13	12·5–13·0	4	—	10·0–10·5	12	8
12·5–13·0	4	4	3·1–3·2	3	1	27·0–27·5	15	9				10·5 11·0	—	8
13·0–13·5	2	—	3·2–3·3	2	1	27·5–28·0	2	5				11·0–11·5	3	1
13·5–14·0	—	—				28·0–28·5	—	2						
14·0–14·5	—	1				28·5–29·0	—	2						
						29·0–29·5	—	1						
						29·5–30·0	—	—						
						30·0–30·5	—	—						
						30·5–40·0	—	1						

To illustrate the variations likely to occur in the bodily proportions the tables on pp. 340, 341 are drawn up in the same way as for Blue whales. The range of percentage values for each measurement is divided into an arbitrary number of groups, and the individual readings for each measurement for male Fin whales from South Georgia, measuring from 20·00 to 21·99 m., and females from 21·00 to 22·99 m., are sorted out, and the number which fall into each group are shown.

The results are plotted in Figs. 76 to 95.

A comparison between the charts illustrating the above tables with the corresponding charts for Blue whales shows that the range of variation for each measurement corresponds closely in the two species, and it will not be necessary to comment on the separate measurements.

It may also be said that, with the exception of No. 13 (anus to reproductive aperture), all the curves approach as closely to the normal frequency type as one would expect with the amount of data on which they are constructed, and it may therefore be concluded that only normal variation occurs in these measurements.

The explanation of the two maxima in the curve of measurement No. 13 for males has been dealt with in the section on Blue whales.

COLOUR

The best description of the colouring of Fin whales from the North Atlantic, as of Blue whales, appears to be that of True (1904), who gives a general account of the features of the pigmentation of northern Fin whales and details of the colouring of ten specimens examined by himself. Of southern Fin whales Barrett-Hamilton made some brief notes on the colouring of thirty-nine whales examined by him at South Georgia.

The pattern of the pigmentation of southern Fin whales is perhaps more complex than that of Blue whales, but there is probably less individual variation. The most obvious feature is that pigment covers the whole of the back and flanks, while the ventral surface remains unpigmented. This pigment is of a bluish slate-grey, varying to some extent in tone and not at all unlike the groundwork colour of the skin of Blue whales. As was pointed out by True and others, the tone rapidly deepens on exposure to light and air until the skin becomes practically black.

The flippers are in general pigmented on the outer and white on the inner surface (though there may be a little pigment on the inner surface of the left flipper). The white of the inner surface reaches round the rim of the lower border of the flipper, and sometimes the tip is white dorsally. The upper surface of the tail flukes is entirely pigmented, and the under surface is white except at the anterior and posterior borders, where there is a margin of pigment.

The most remarkable feature of the colouring of Fin whales is that the pigment is arranged asymmetrically. This asymmetry is to be noticed on the outer ventral grooves, the side of the head and shoulders, the under surface of the flippers, the upper and lower jaws, the baleen, and inside the mouth. In reality it consists of a shifting of the

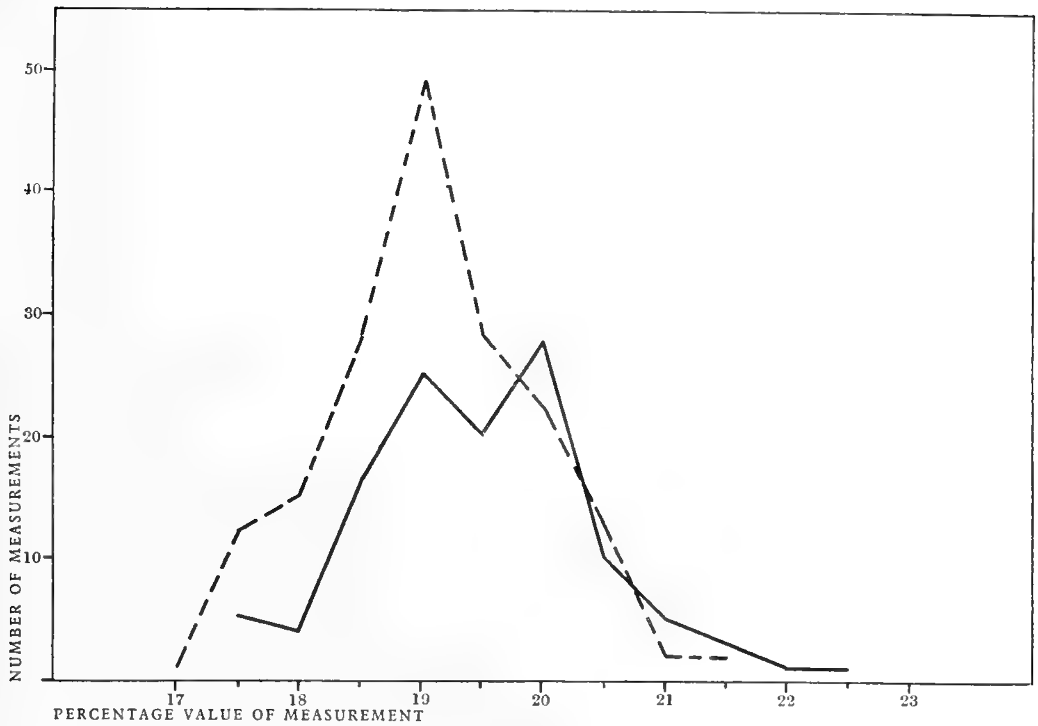

Fig. 76. Fin whales. Variations of measurement No. 3. Tip of snout to blowhole.

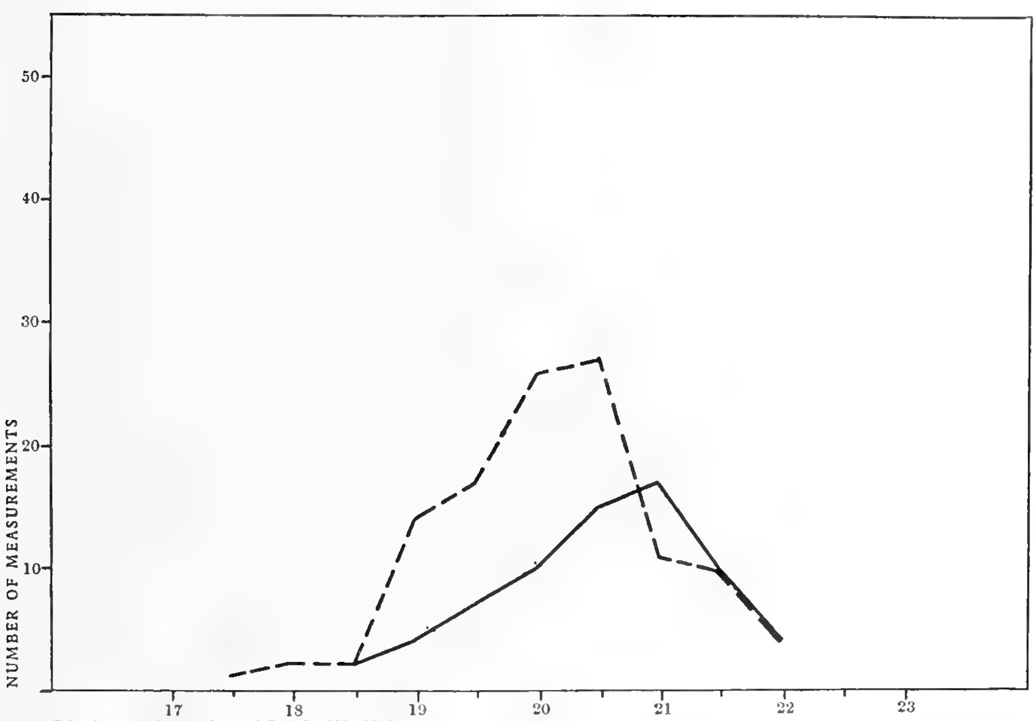

Fig. 77. Fin whales. Variations of measurement No. 4. Tip of snout to angle of gape.

- - - - - Males. ——— Females.

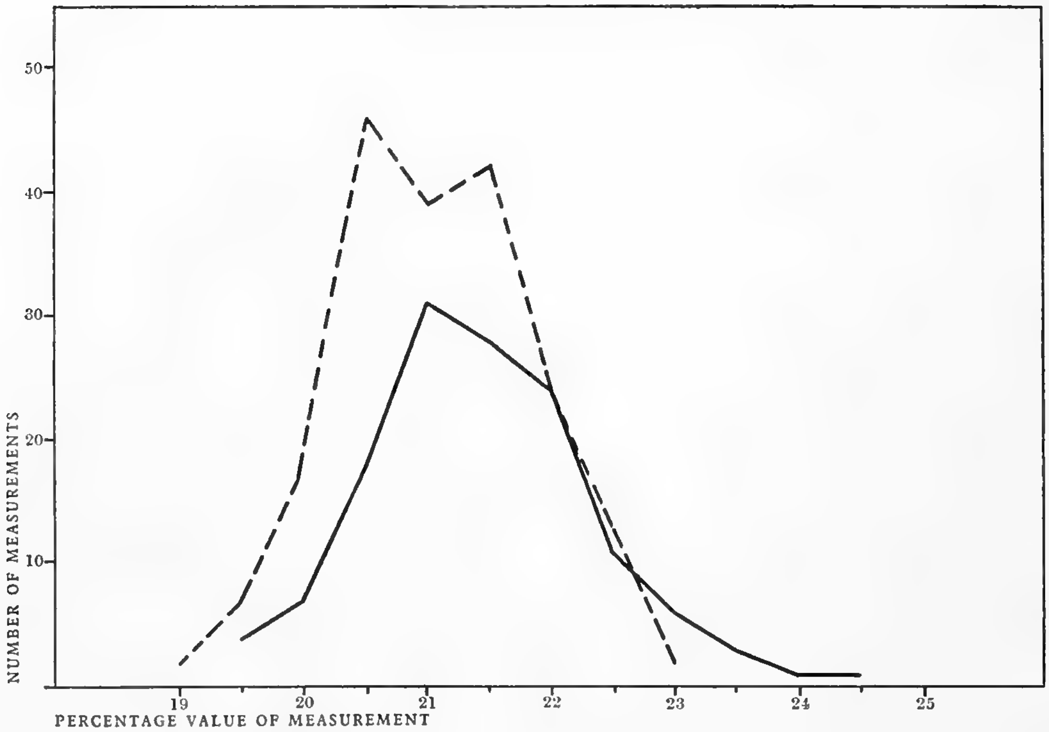

Fig. 78. Fin whales. Variations of measurement No. 5. Tip of snout to eye.

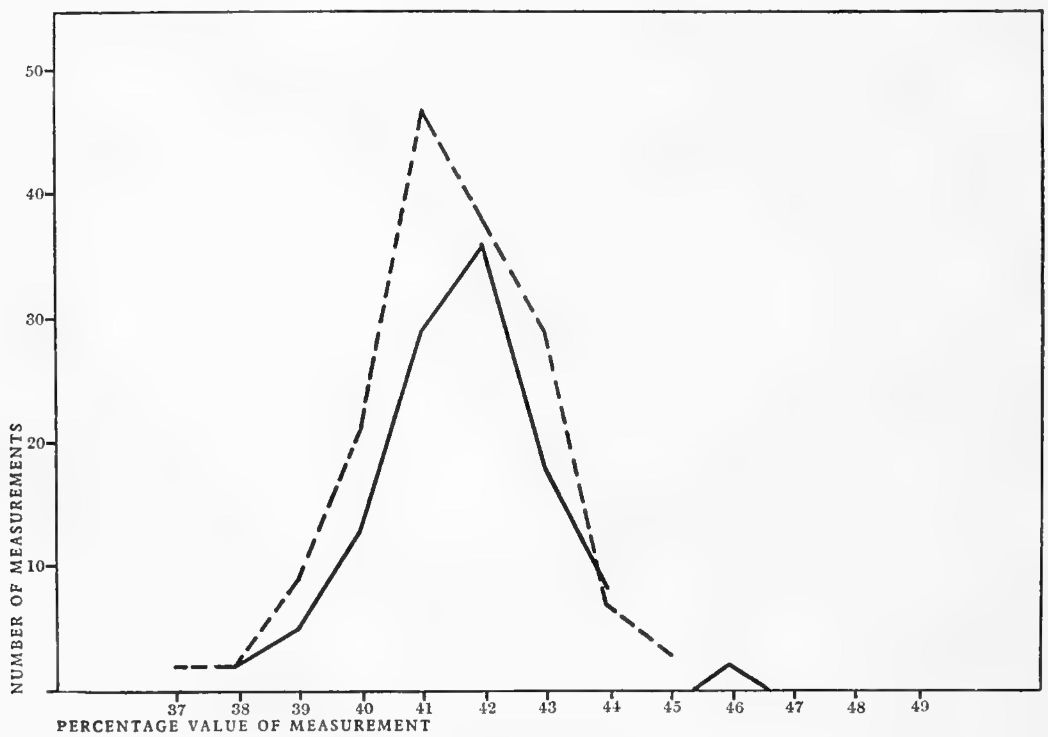

Fig. 79. Fin whales. Variations of measurement No. 6. Tip of snout to tip of flipper.

- - - - - Males. ——— Females.

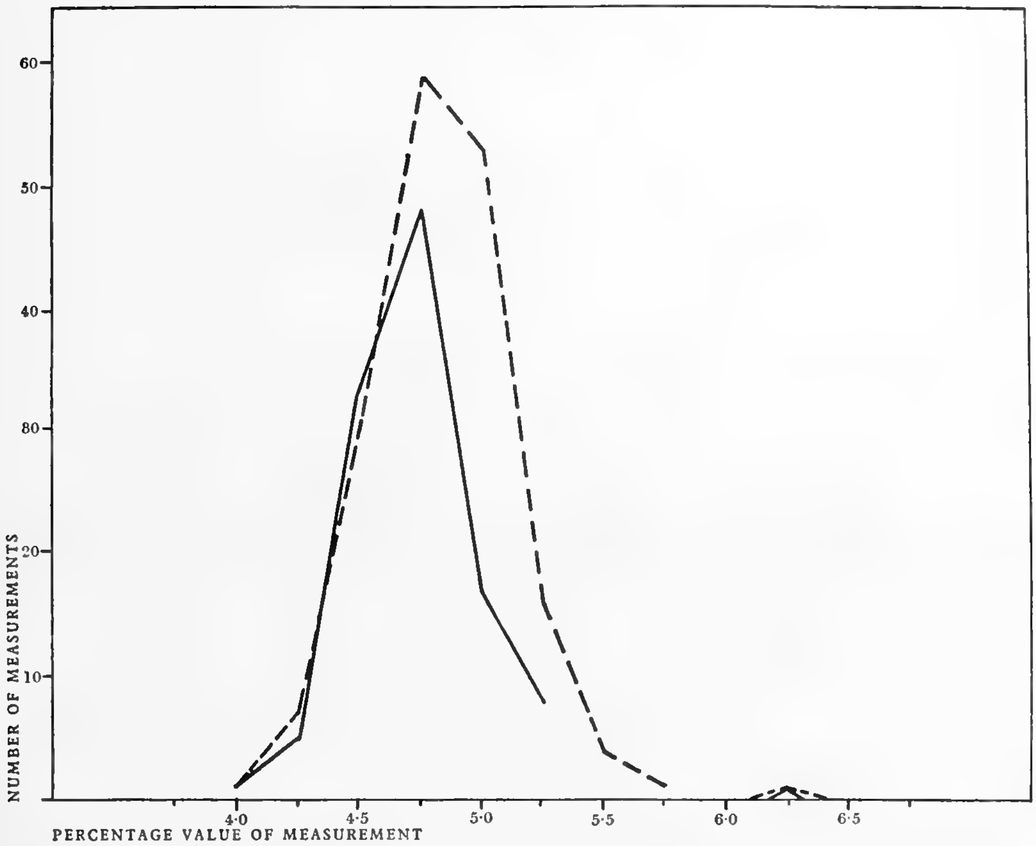

Fig. 80. Fin whales. Variations of measurement No. 7. Eye to ear, centres.

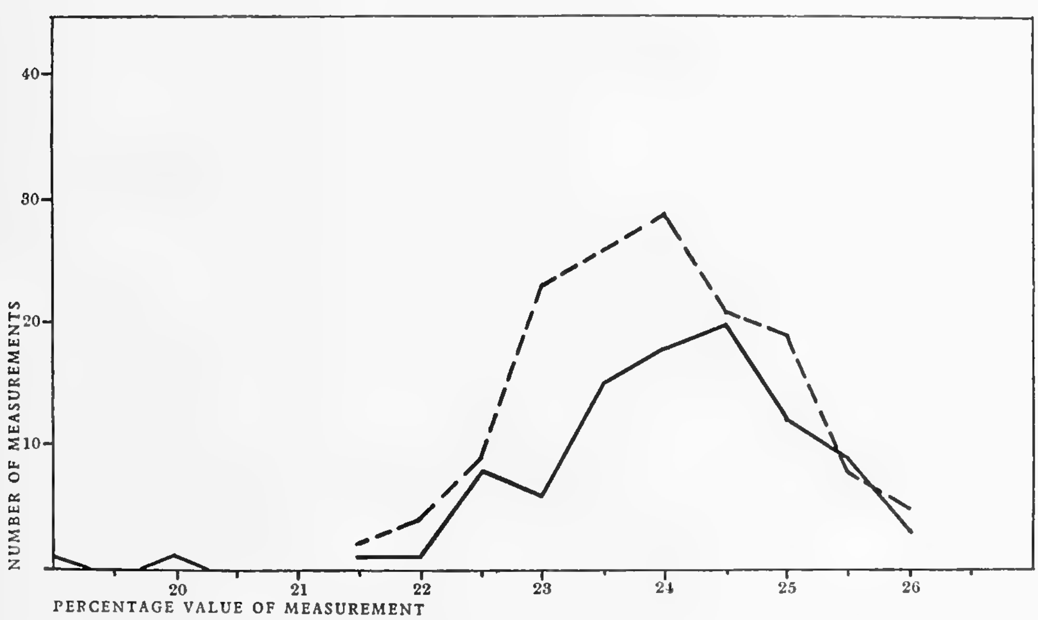

Fig. 81. Fin whales. Variations of measurement No. 8. Notch of flukes to posterior emargination of dorsal fin.

- - - - - Males. ——— Females.

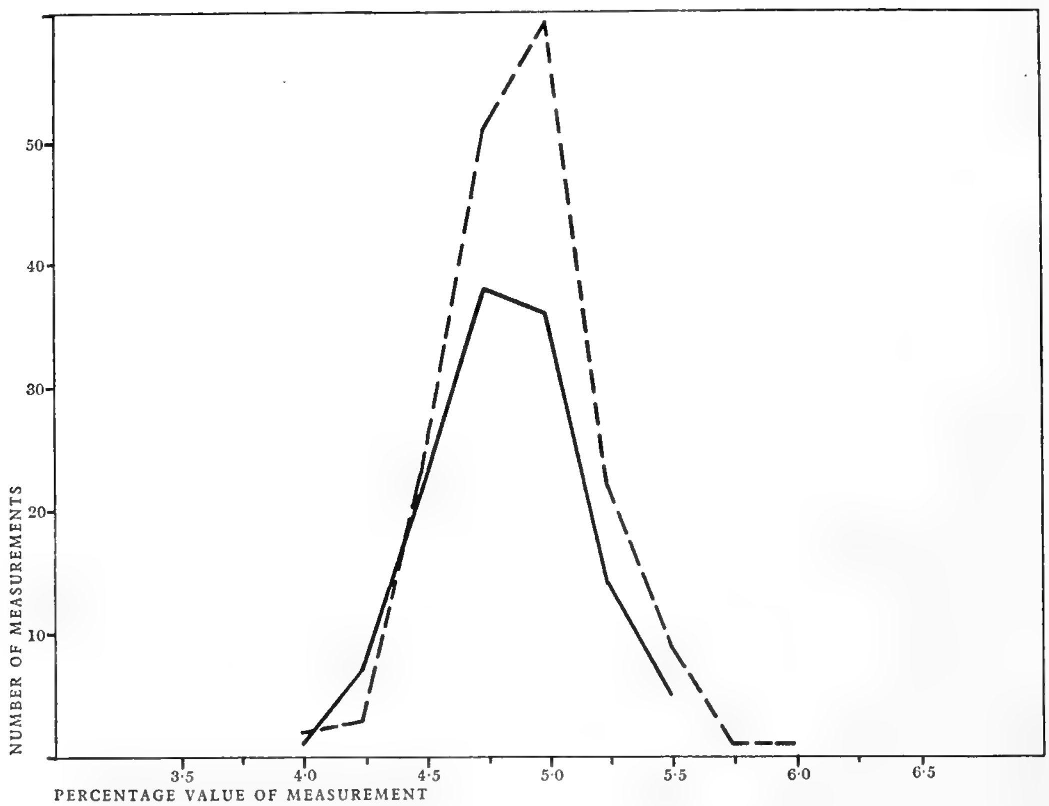

Fig. 82. Fin whales. Variations of measurement No. 9. Flukes, width at insertion.

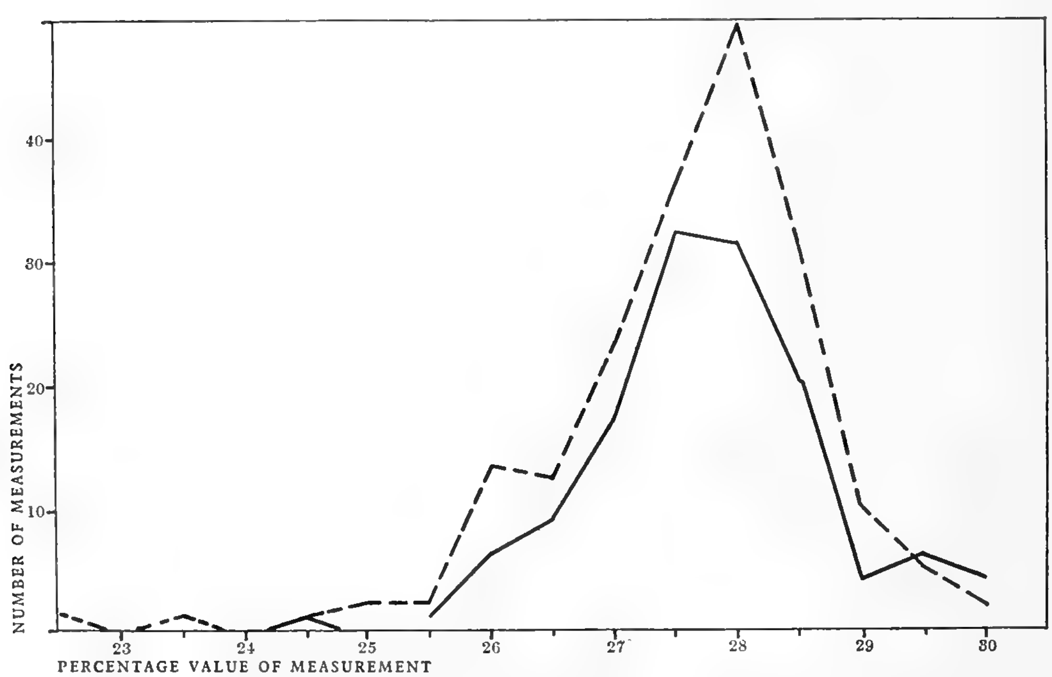

Fig. 83. Fin whales. Variations of measurement No. 10. Notch of flukes to anus.

- - - - - Males. ——— Females.

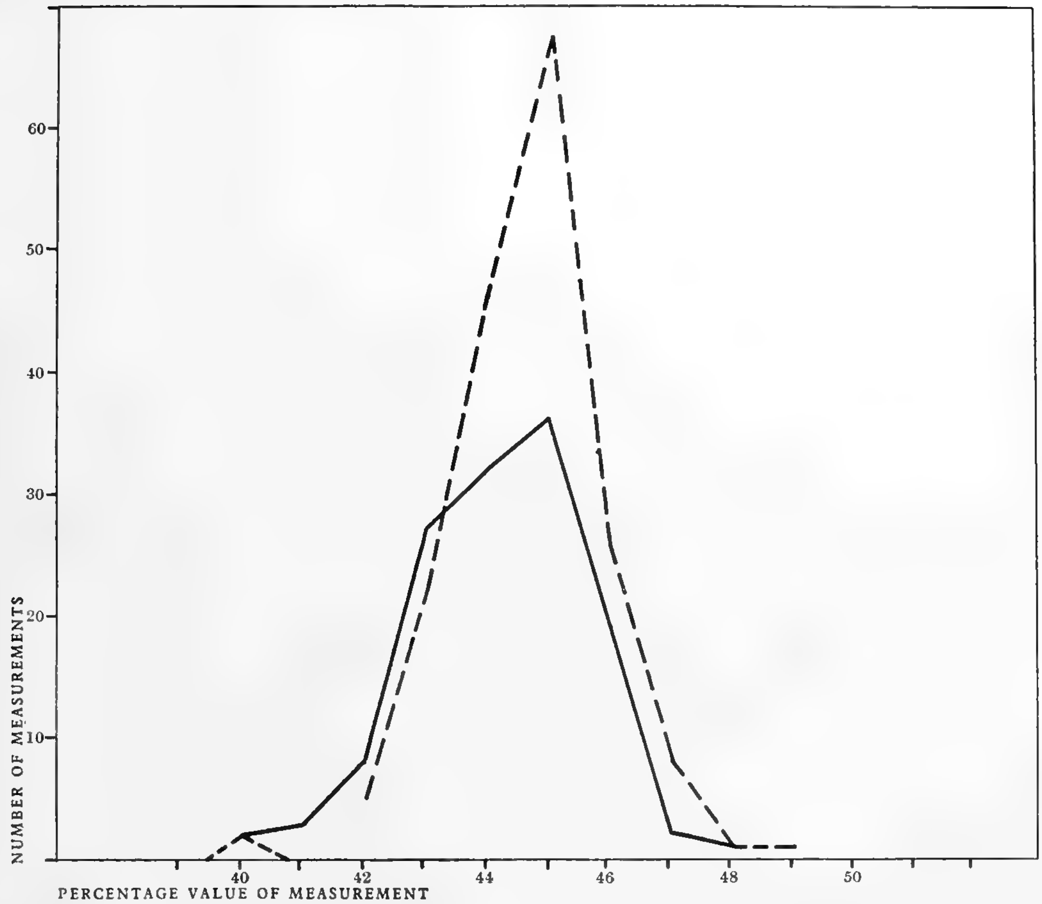

Fig. 84. Fin whales. Variations of measurement No. 11. Notch of flukes to umbilicus.

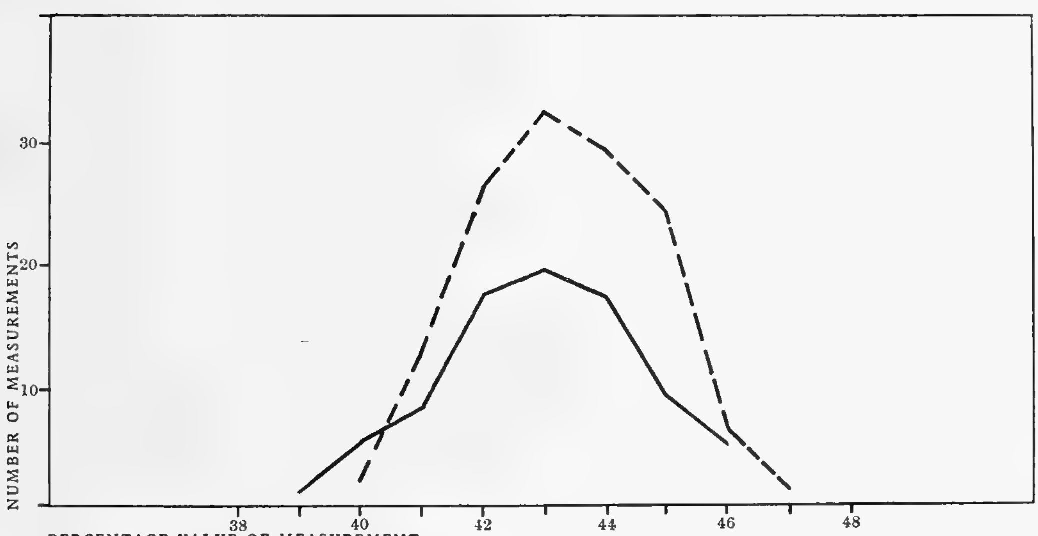

Fig. 85. Fin whales. Variations of measurement No. 12. Notch of flukes to end of ventral grooves.

- - - - - Males. ——— Females.

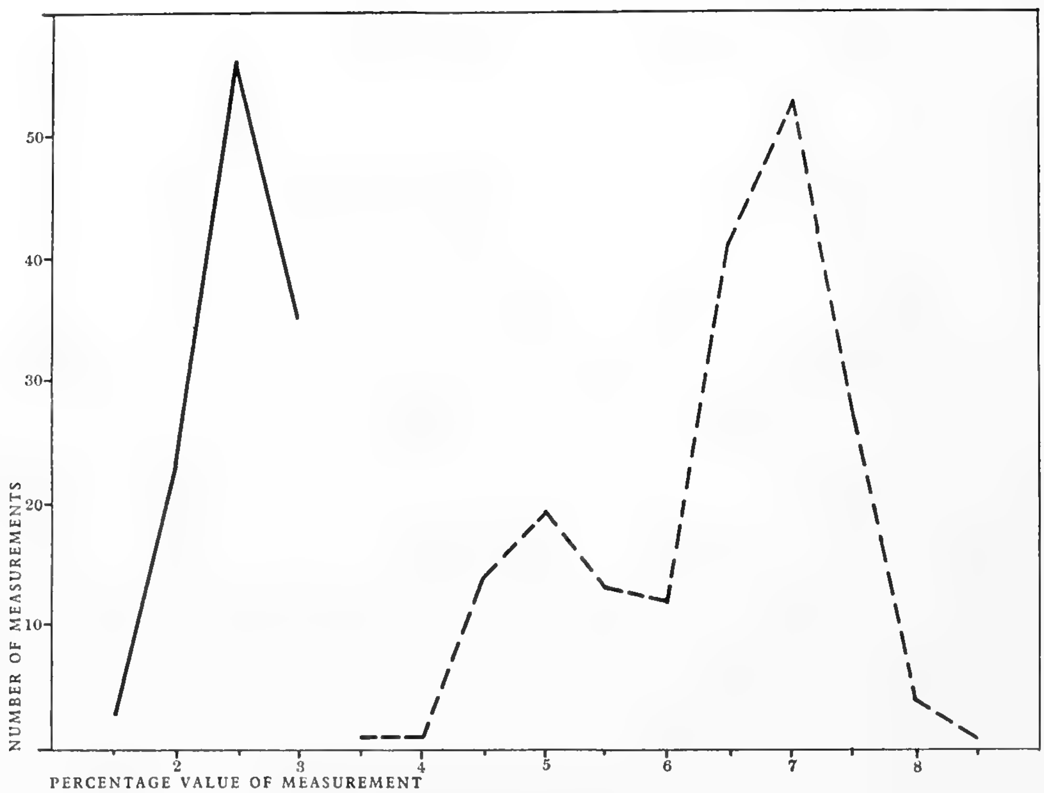

Fig. 86. Fin whales. Variations of measurement No. 13. Anus to reproductive aperture, centres.

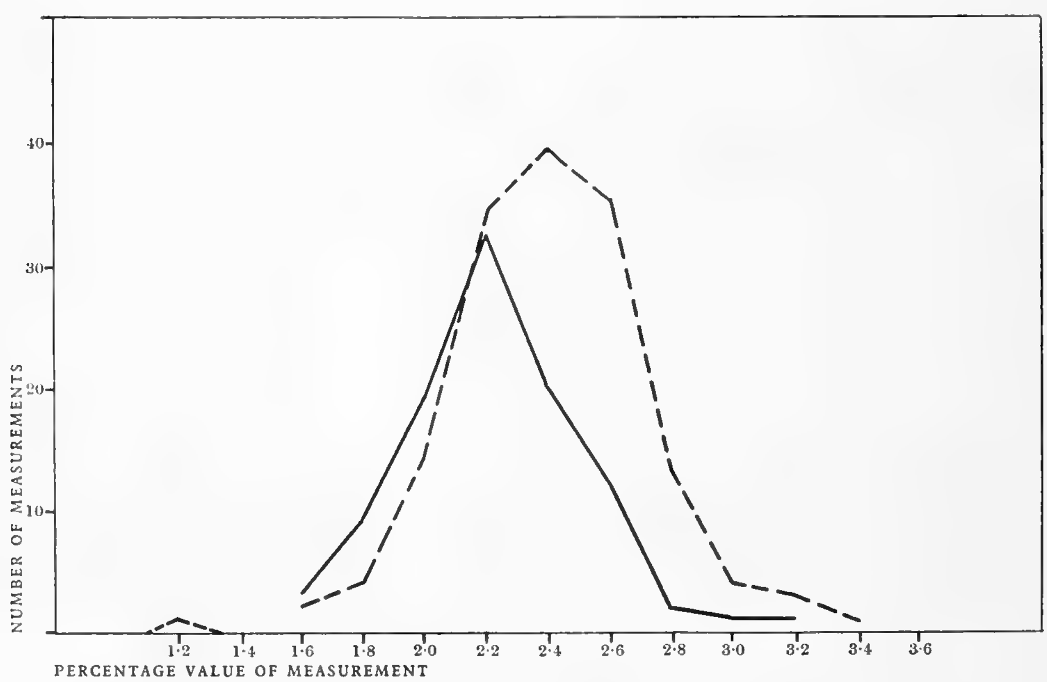

Fig. 87. Fin whales. Variations of measurement No. 14. Dorsal fin, vertical height.

- - - - - Males. ——— Females.

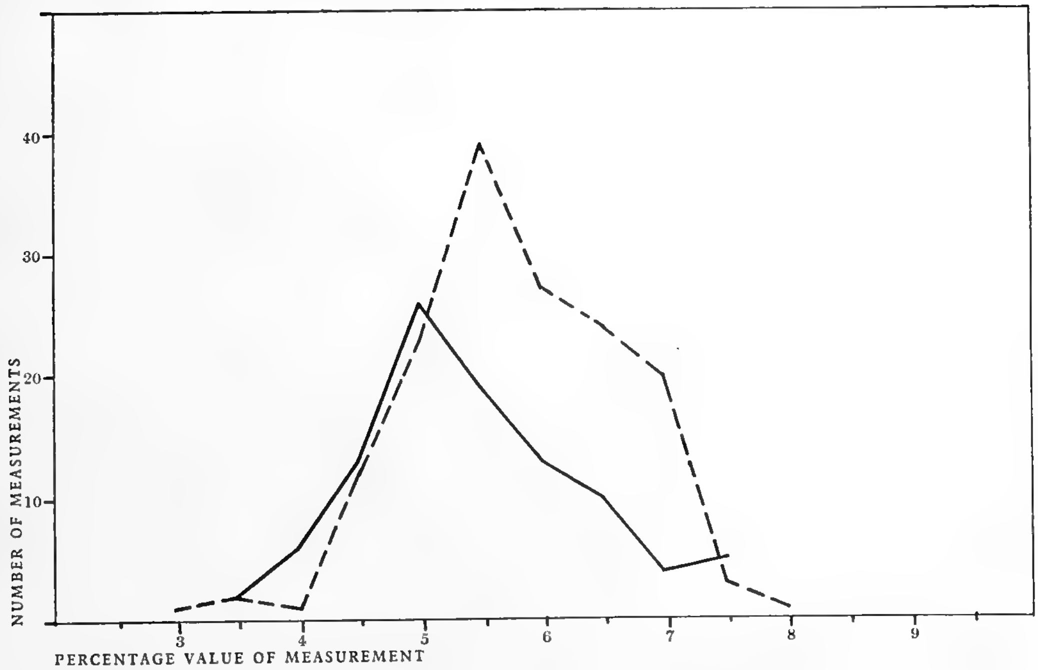

Fig. 88. Fin whales. Variations of measurement No. 15. Dorsal fin, length of base.

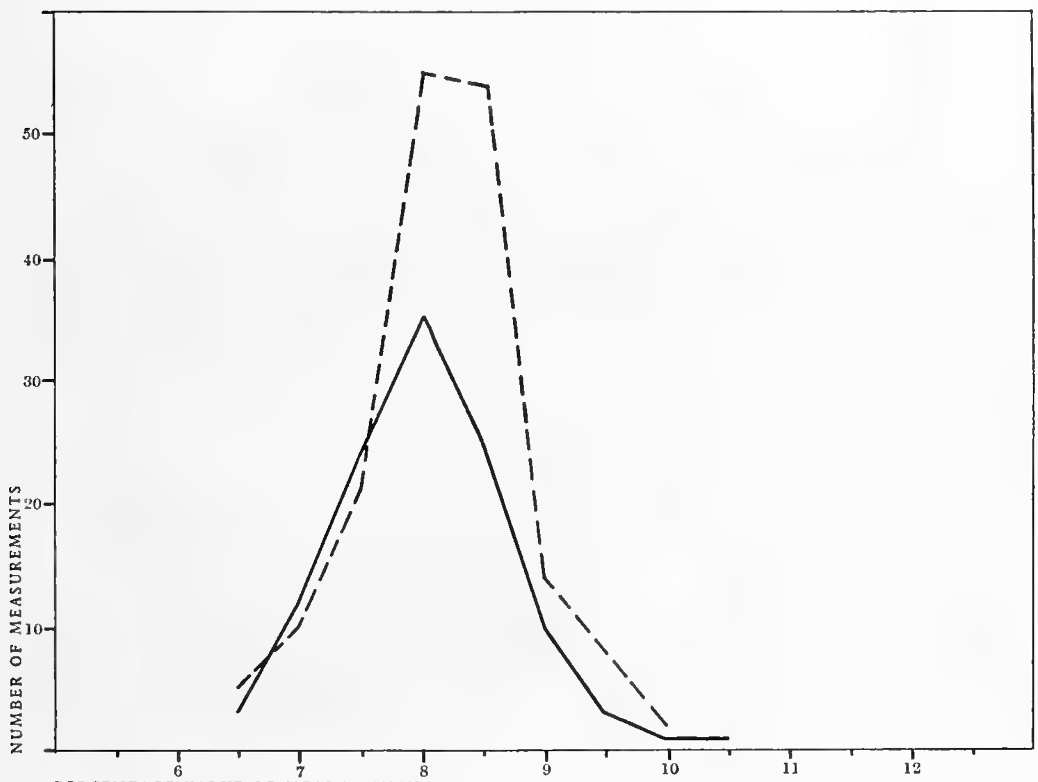

Fig. 89. Fin whales. Variations of measurement No. 16. Flipper, tip to axilla.

- - - - - Males. ——— Females.

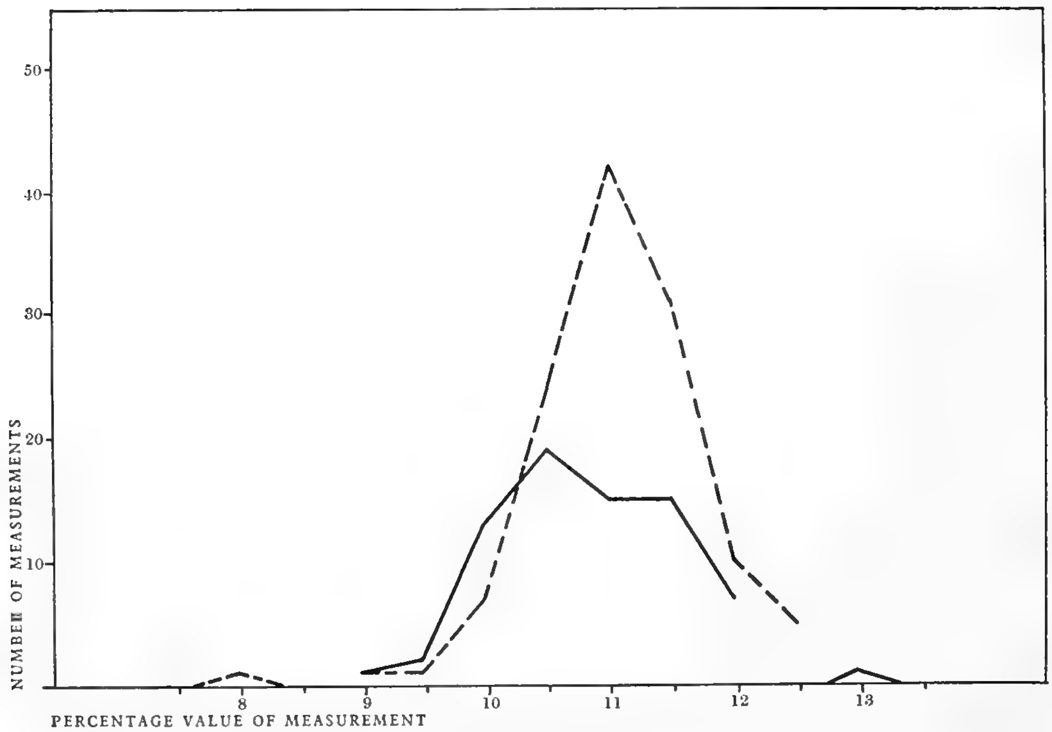

Fig. 90. Fin whales. Variations of measurement No. 17. Flipper, tip to anterior end of lower border.

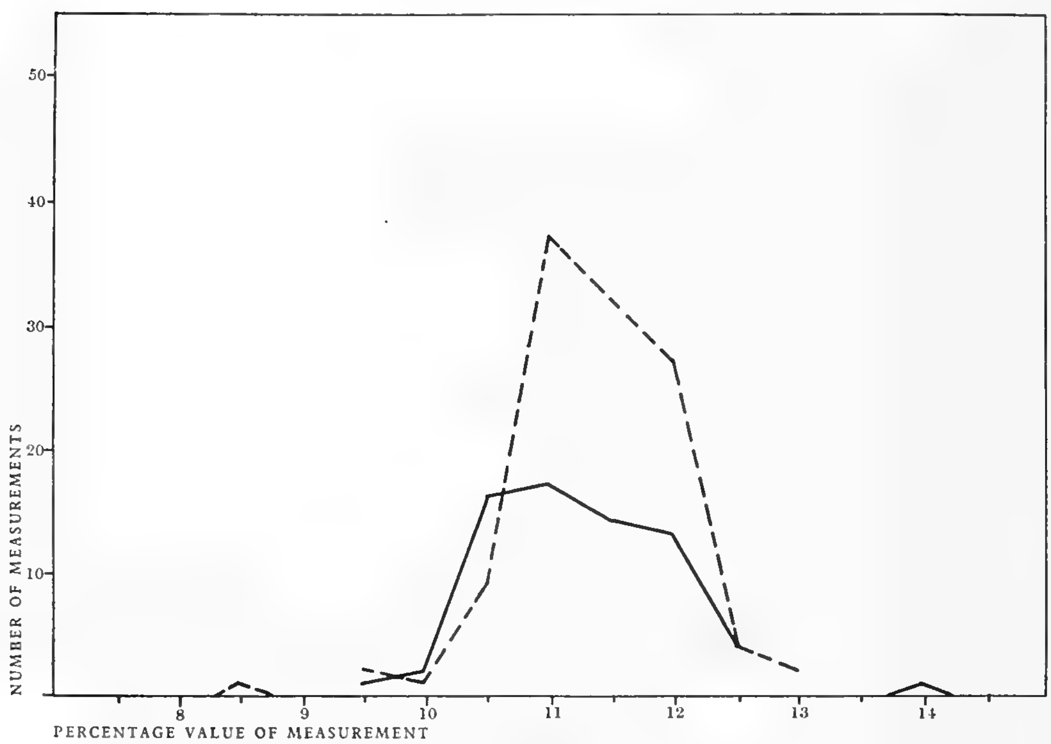

Fig. 91. Fin whales. Variations of measurement No. 18. Flipper, length along curve of lower border.

- - - - - Males. ——— Females.

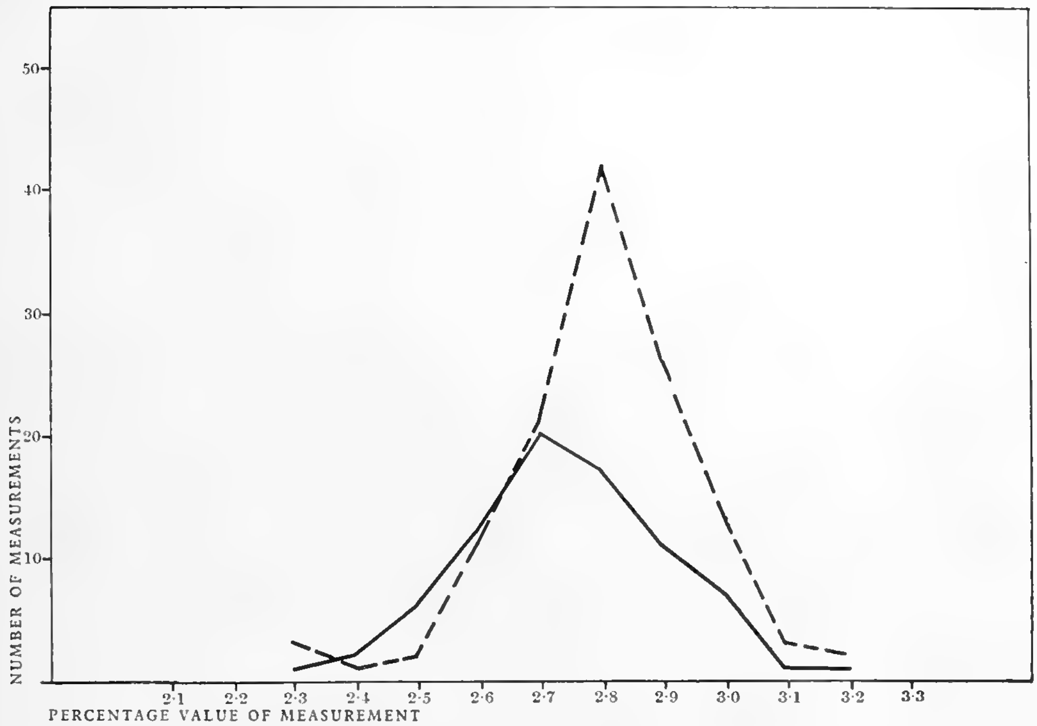

Fig. 92. Fin whales. Variations of measurement No. 19. Flipper, greatest width.

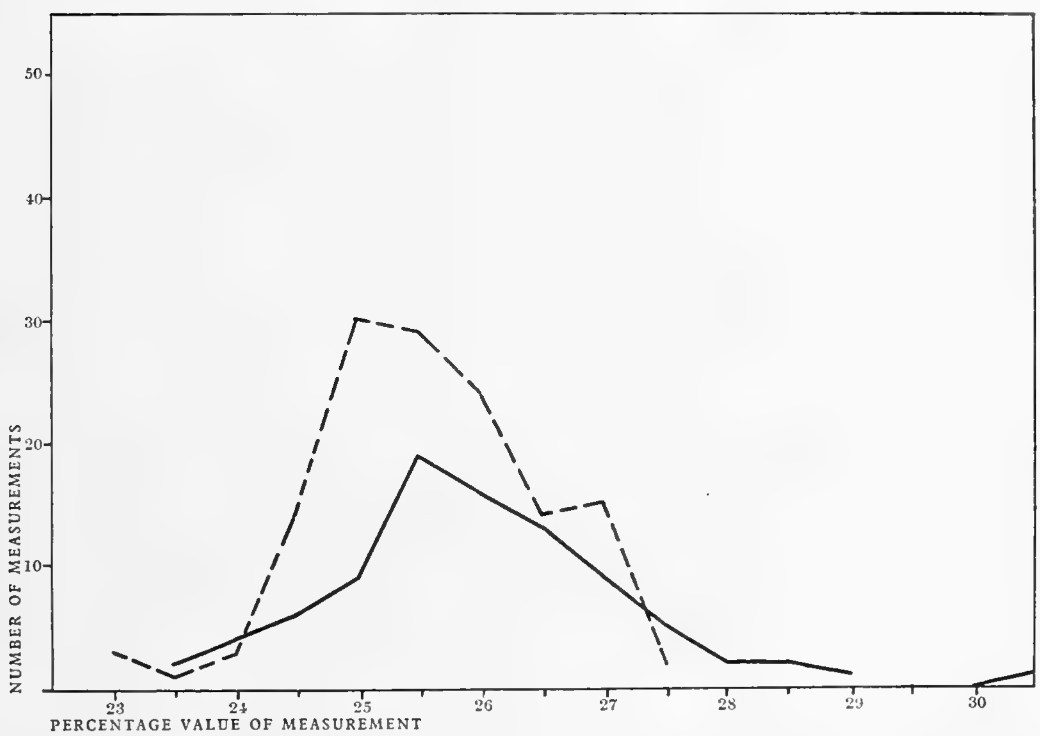

Fig. 93. Fin whales. Variations of measurement No. 20. Severed head, condyle to tip.

- - - - - Males. ——— Females.

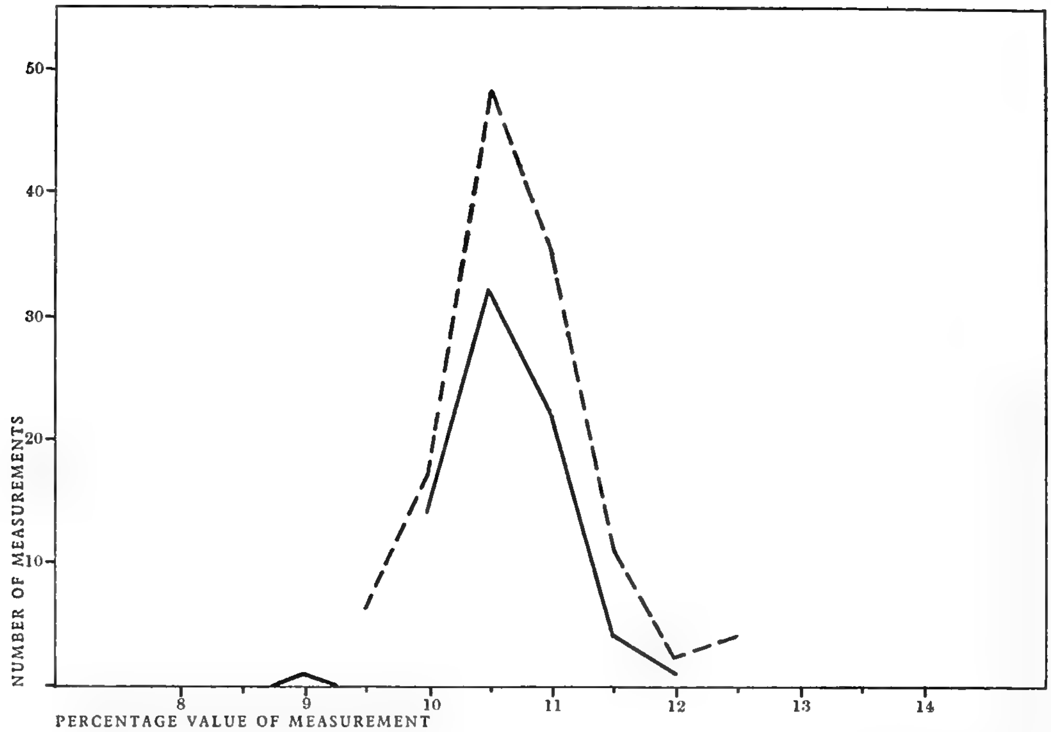

Fig. 94. Fin whales. Variations of measurement No. 21. Skull, greatest width.

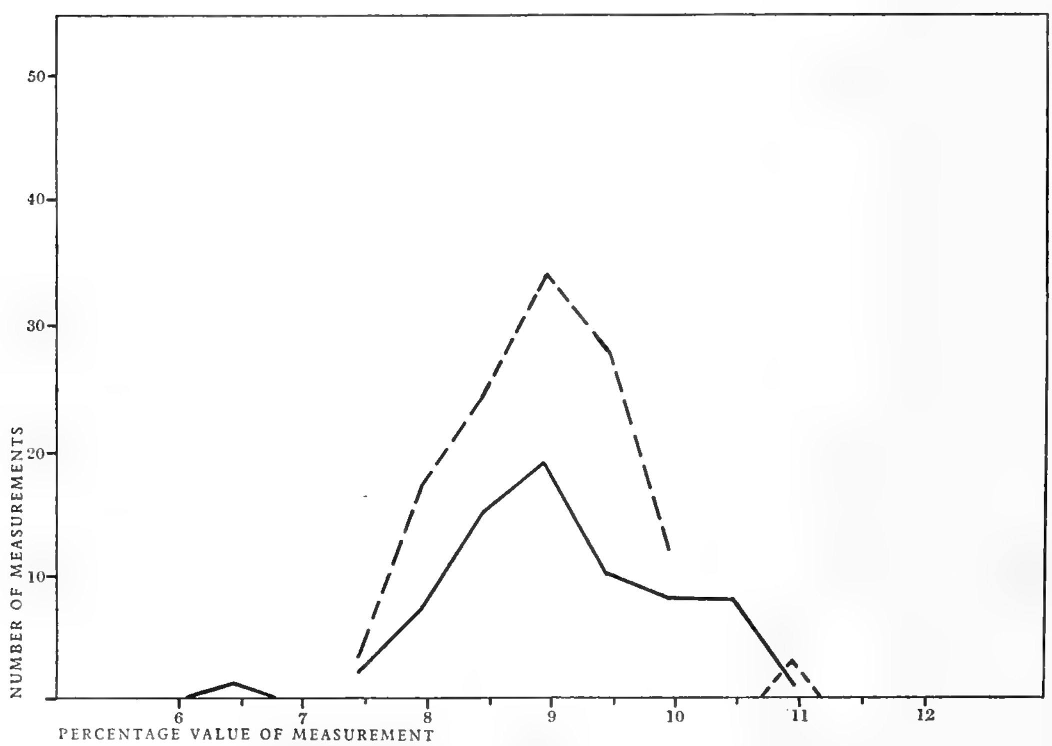

Fig. 95. Fin whales. Variations of measurement No. 24. Tail, depth at dorsal fin.

- - - - - Males. ——— Females.

whole mass of pigment slightly to the left side of the body, except inside the mouth, where it predominates on the right.

The junction of the ventral white area with the dorsal pigment is rather irregular, and in places without any very definite line of demarcation. In the thoracic region the pigment reaches down on each side in irregular projections over the outer ventral grooves (see Plate XXXII, fig. 2, and Plate XXXIV, fig. 1), which in places may be pigmented in the actual grooves but white on the ridges. The degree to which it extends over the grooves is variable, but the pigment on the left-hand side always reaches farther down than on the right. The ventral white area may reach without interruption to the ventral surface of the tail flukes, but frequently the pigmented area of the tail reaches farther down behind the anus to meet in the mid-ventral line and cut off the white area just in front of the flukes. At a point a short distance behind the anus there is on each side a narrow projection of pigment which reaches downwards and forwards towards the anus. These promontories may be so ill-marked as to be almost indistinguishable, or they may be about a yard long and meet at the anus. In Plate XXXIII, fig. 2, one of these promontories can be seen, but the other is obscured by high lights on the whale's skin. In this whale the white ventral area extended well back to the tail flukes, while in Plate XXXIII, fig. 1, which was a heavily pigmented whale, almost the whole of the white area behind the anus was obliterated by pigment. The rim of the pigment on each side, from about the region of the genital aperture (or sometimes farther forward) back to the tail flukes, may be fairly regular or may be broken up by a kind of mottled condition suggestive of galvanized iron.

In the head region the left mandible is pigmented externally while the right is white. The outer edges of the baleen plates are all pigmented on the left side except for a few at the extreme anterior end, which may or may not be white. On the right side the anterior baleen plates, more than a third of the total number on that side, are white. The rest are pigmented, and the demarcation is always sharp. The right upper jaw is pigmented opposite the dark plates and is white opposite the unpigmented plates. The left upper jaw is pigmented along the whole of its length. All these details are illustrated in Plate XXXII, figs. 1 and 2, which show the right and left sides of the head of the same whale. Inside the mouth the asymmetry of the pigmentation is reversed. The inner side of the right mandible is pigmented while that of the left is whitish, and on the tongue pigment is predominant on the right. Very little pigment is present on the palate though a few pale streaks are usually visible at the posterior end and the extreme anterior tip is sometimes pigmented. The bristles on the inside of the baleen plates are all unpigmented.

Certain light and dark streaks occur about the head and shoulders. There is always a well-marked narrow pale streak reaching backwards from the ear, which is well seen in Plate XXXII, fig. 2. It takes a slightly upward course at first and then turns down, becoming more diffuse and fading near the insertion of the flipper. There may also be an indefinite and not very pronounced pale streak running upwards and backwards from the axilla. There is regularly a V-shaped pale streak on the back. The apex of the V is opposite the insertion of the flippers and lies in the mid-dorsal line pointing forwards towards the snout. This mark is very noticeable in foetuses in which the dorsal pigment has started to develop.

A long black band, 2 to 3 in. wide at first but increasing in width, runs backwards and upwards from the eye (see Plate XXXIV, fig. 3). The asymmetry of the pigmentation is very noticeable here, for the right shoulder and right side of the head are very much paler than the left, and in consequence the black band stands out in great contrast on the right side, while on the left it can hardly be said to exist, since almost the whole shoulder region is pigmented.

On the whole, there is little individual variation in the pigmentation of Fin whales except around the ventral region posterior to the anus, and perhaps in the degree to which the pigment of the flanks extends over the ventral thoracic region. The restriction of the ventral white area and the prominence of the projecting strips of pigment behind the anus seem to go largely together and there is not really very much to say of the variation of an individual Fin whale, apart from the tone of the pigment, except that it is a heavily or lightly pigmented whale.

From the descriptions given by Sars (1865) and True (1904) of the colouring of Fin whales from the North Atlantic one must suppose that the whales of the North and South Atlantic are very similar if not identical in colour and arrangement of the pigment.

Pigment appears at a fairly early stage in the foetus. When the latter measures 0·5 m. to 1·0 m. it is present as a darkening of the skin on the top of the head, the anterior part of the back, the tip of the dorsal fin, the dorsal surface of the flukes and the outer surface of the flippers. At this stage the pigment is of a faint grey colour, confined apparently only to the superficial layer of skin, while the rest of the body is of a pinkish colour. As the pigment spreads backwards from the neck over the dorsal surface, the pale dorsal V-mark makes its appearance. The development of the colouring from now on through gestation consists in the deepening of the colour on the dorsal surface and the spreading of the pigment downwards over the flanks. The dorsal V-mark appears soon after the foetus measures 1·0 m. and it soon becomes even more prominent than in the adult whale. At 1·5 m. the lower jaw is well pigmented and the asymmetry of the colouring is already distinguishable. Before 3 m. is reached the pigmentation is similar to that of the adult except that the colour is still rather paler and the pigment has not reached so far down the flanks.

The asymmetry of the pigment appears to be an invariable feature of the colouring of Fin whales. Among northern Fin whales this asymmetry may on rare occasions be reversed, as described by Collett (1912), the right instead of the left being the darker side. No such case, however, has appeared among all the whales we have examined, and if such a reversal does occur in the south it must certainly be extremely rare.

It may be suggested, as a possible explanation of the shifting of the pigment over to the left side, that Fin whales swim slightly on their right side while under the water. Such a habit would seem rather peculiar, though perhaps not more so than the displacement of the pigment. We have made attempts to test this possibility by observations on whales at sea. While actually on the surface the Fin whales swim on an even keel. When they sound the last part of the body to disappear is the dorsal rim of the tail just above the insertion of the flukes. Our impression is that at the last moment there is a slight rotation to the right, but it is difficult to say for certain and more observations will be needed before the point can be confirmed.

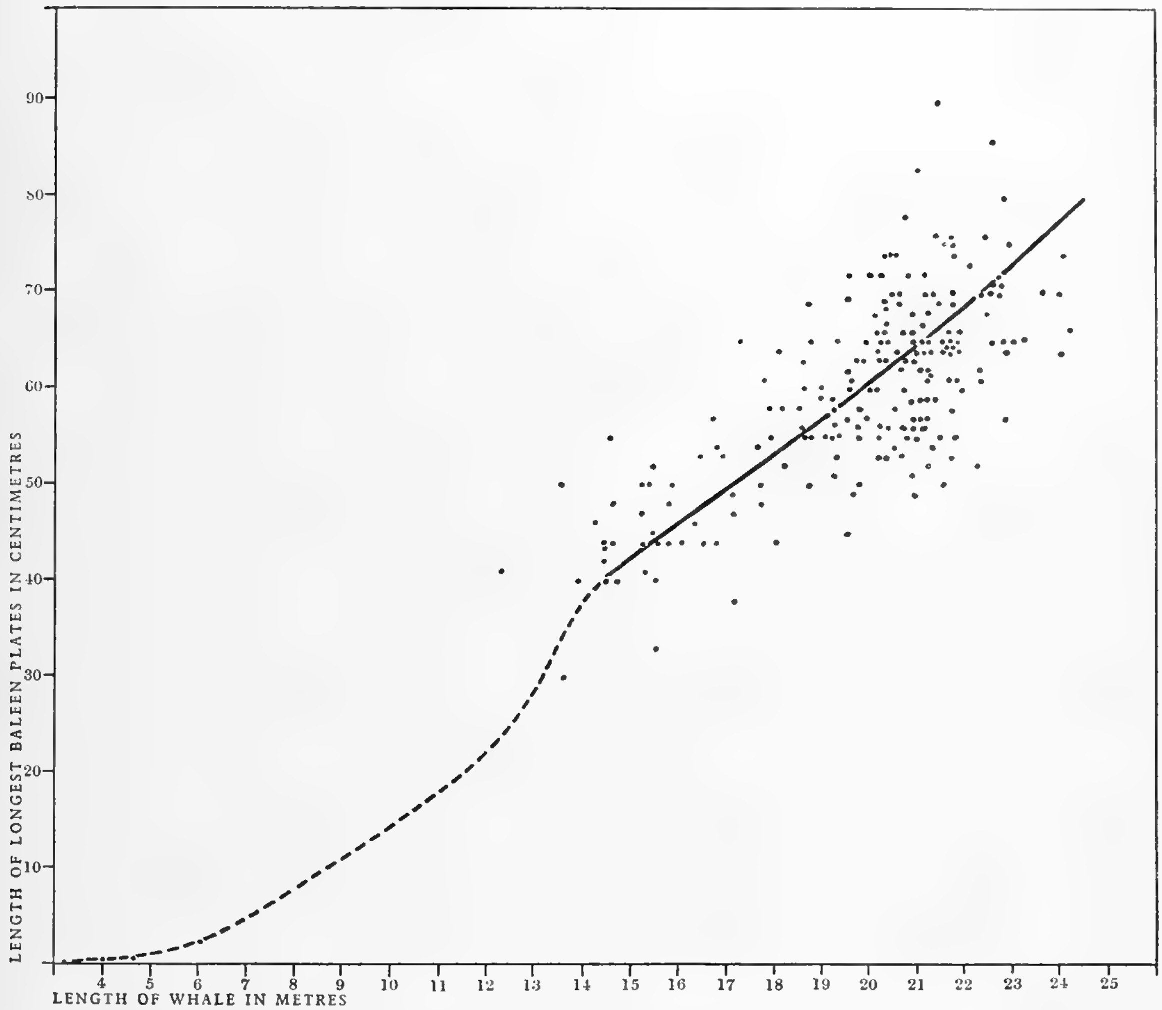

Fig. 96. Mean curve of growth of baleen in Fin whales. The plotted points represent the length of the baleen in individual whales.

BALEEN

The description already given of the development of the baleen in the Blue whale foetus applies equally to its development in the Fin whale foetus, and we may proceed with the growth of the baleen in relation to the growth of the whale.

The recorded lengths of the longest plates are plotted against the length of the whale in Fig. 96. Except for the records of baleen in foetuses there are in the case of Fin whales, no measurements of the length of the baleen in individuals of less than 12·0 m.

It is evident again that considerable individual variation takes place, but in this case the path of the plotted points indicates that the plates increase in length quite uniformly, at any rate from 14 m. onwards. Therefore if there is any sudden spurt in the rate of growth of the baleen in young Fin whales it must be supposed that it takes place before the whale reaches 14 m. It is fairly certain that this spurt in growth takes place in Blue whales and it is consequently very probable that something of the same sort occurs in Fin whales. The curve representing the mean rate of growth of the baleen plates is therefore drawn as a continuous line for whales of more than 14 m. and as a dotted line for the smaller whales where its shape depends rather on analogy with Blue whales. This dotted line is intended to represent the most probable course of the rate of growth, the suggestion being that the rate suddenly increases when the whale measures about 13 m.

The numbers of baleen plates in Fin whales are on the average greater than in Blue whales. The records may be tabulated as follows:

Fin Whales

Number of plates on one side	Males		Females	
	S. Georgia	S. Africa	S. Georgia	S. Africa
260–280	3	—	1	—
280–300	1	—	1	—
300–320	1	1	1	—
320–340	—	—	4	—
340–360	7	—	9	1
360–380	6	1	12	1
380–400	4	—	5	—
400–420	2	—	4	1
420–440	—	—	—	—
440–460	—	—	1	1
460–480	1	—	1	—
Total	25	2	39	4
Average	356	340	365	392
Maximum	460	366	473	440
Minimum	268	314	262	352

The above table gives an idea of the limits within which the numbers of baleen plates may be expected to vary and shows that there are no grounds for drawing any distinction between males and females, or between the whales of South Georgia and South Africa in respect of this particular character.

Observations on the baleen of Fin whales have also included the counting of the numbers of white plates (i.e. plates whose outer edges are white) on the right-hand side of the mouth. The results, analysed in the same way, are as follows:

Number of white plates	Males		Females	
	S. Georgia	S. Africa	S. Georgia	S. Africa
60–80	2	—	1	—
80–100	—	—	—	—
100–120	—	—	1	1
120–140	6	4	12	2
140–160	15	2	17	4
160–180	8	3	13	1
180–200	3	3	3	1
200–220	1	—	—	—
Total	35	12	47	9
Average	152	157	155	146
Maximum	200	190	190	184
Minimum	68	120	77	118

Here again very similar results appear for the different sexes and localities. The two males from South Georgia with less than 80 white plates are rather aberrant, but need not be regarded as of any particular significance as the number of whales in which these white plates were counted is not very great.

Only seven measurements were made of the width of the baleen of Fin whales. These were as follows:

Males			Females		
Whale length	Baleen width	Width as a percentage of baleen length	Whale length	Baleen width	Width as a percentage of baleen length
*14·45	32	68·0	*15·35	34	68·0
19·75	40	71·5	*15·47	32	61·5
21·10	42	73·8	22·40	46	60·5
			23·00	46	71·0

Those marked with an asterisk are South African whales. Here again there are not sufficient data for a valid comparison to be made, but there is no suggestion of any difference between the sexes or the two localities.

Measurements of the spacing of the longest baleen plates also give negative results. The distance separating them varies from about 1·0 cm. in 14 m. whales to about 1·8 cm. in 23 m. whales, the increase varying uniformly with the length of the whale. The readings are plotted in Fig. 97 from which it will be seen that no special distinction exists between males and females, or between whales of South Georgia and South Africa.

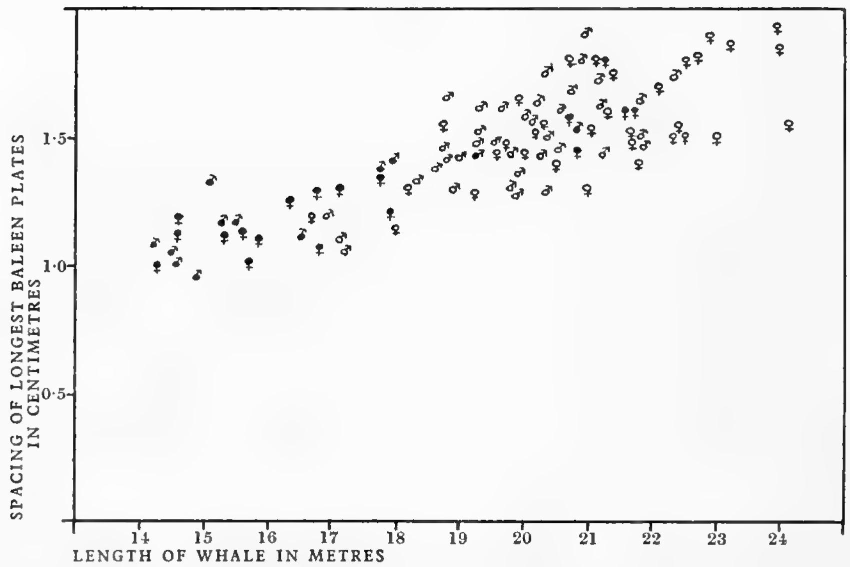

Fig. 97. Spacing of baleen plates in Fin whales. The plotted points represent the spacing of the baleen plates in individual whales. (Black symbols represent South African whales and circular ones South Georgia whales.)

VENTRAL GROOVES

The description already given of the ventral grooves in Blue whales may be taken as applying also, in almost every particular, to Fin whales. A minor distinction perhaps is to be found in the posterior endings of the grooves. In Blue whales they may end evenly in the neighbourhood of the umbilicus but in many cases may be continued beyond this point in the form of irregular or broken up extra grooves and there may be a median groove joining the umbilicus and genital aperture. In Fin whales, on the other hand, the grooves always end very evenly near the umbilicus, and the median

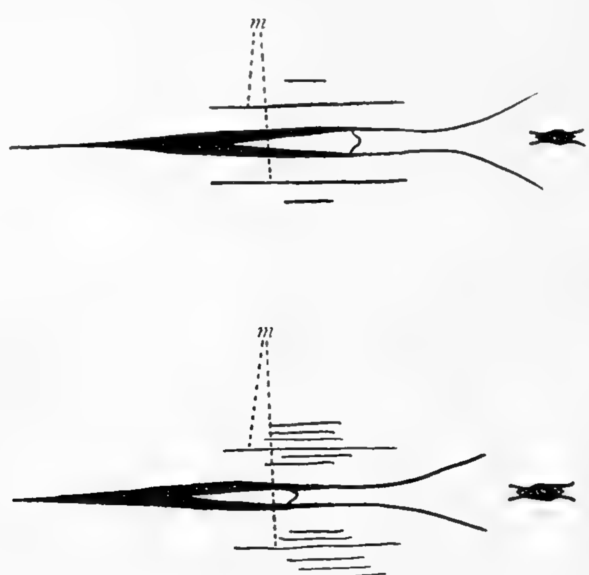

Fig. 98. Mammary grooves, genital aperture, etc., in female Fin whales (semi-diagrammatic); to show variations of the extra grooves in this region. *m*, mammary grooves.

Number of ventral grooves	Males		Females	
	S. Georgia	S. Africa	S. Georgia	S. Africa
60–70	1	—	—	—
70–80	10	2	5	1
80–90	7	3	12	10
90–100	4	3	8	2
100–110	3	—	6	—
110–120	—	—	3	—
Total	25	8	34	13
Average	84	85	91	85
Maximum	106	94	114	98
Minimum	68	76	72	78

grooves do not show a very marked apex to the grooved area. The endings of the grooves are shown in Plate XXXIII, figs. 1 and 3. Other illustrations of the ventral grooves of Fin whales are Plate XXXII, fig. 2, and Plate XXXIV, fig. 1. As in Blue whales there are some small extra grooves on each side of the reproductive aperture of the female. Examples of these are illustrated in Fig. 98.

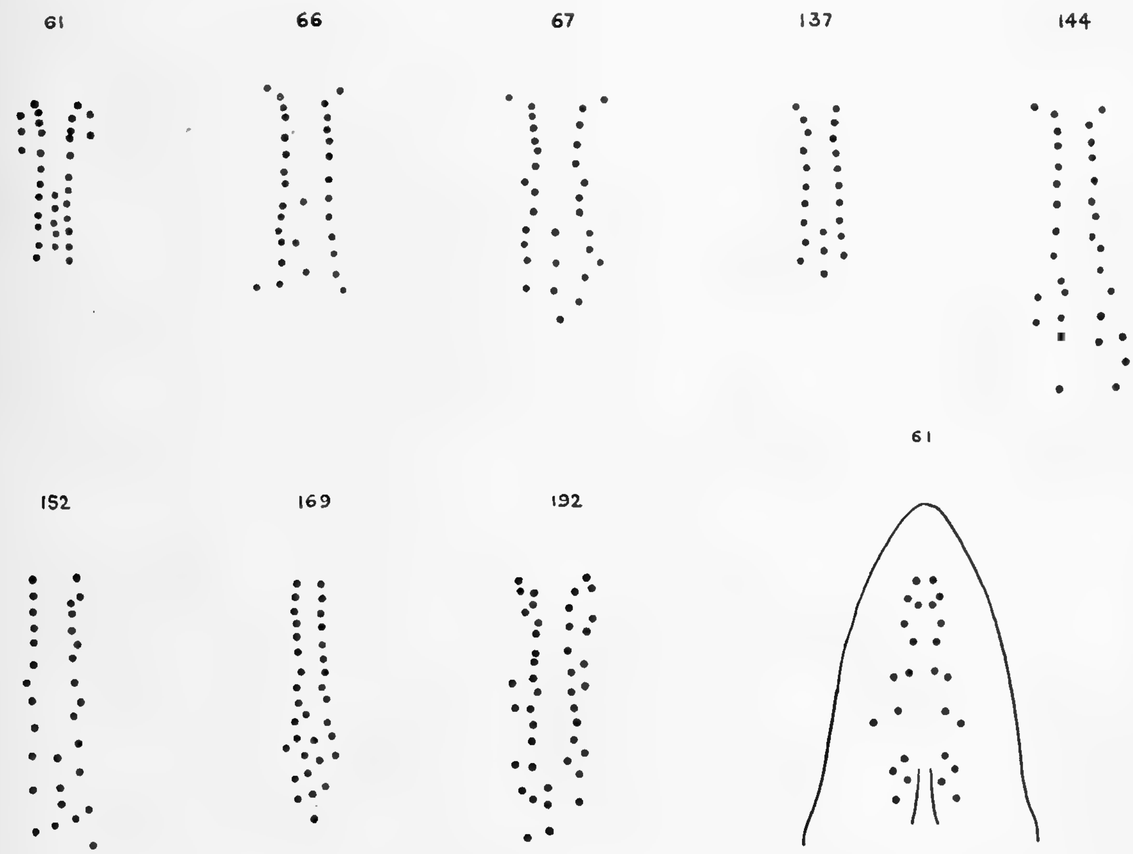

Fig. 99. Diagrams showing different arrangement of the hairs on the chin of eight and the rostrum of one Fin whale. The beard in each case is sketched from a position immediately in front of the mouth and the rostral hairs from a dorsal aspect. The numbers refer to individual whales.

In Fin whales again the number of ventral grooves which occur seems to be purely a matter of individual variation. Whale No. 67, for instance, had 72 grooves and its foetus 96; No. 179 had 92 and the foetus 88; and No. 186 had 100 grooves and the foetus 90.

The numbers of grooves recorded and the variations which occur are shown in the table at top of page 359.

Here again there is no particular distinction between the sexes and localities.

In development the ventral grooves have usually appeared by the time the foetus reaches 1 m., and the full number is present at about 2·0 m.

HAIR

The positions at which the hairs are found have already been described in the section on Blue whales. In Fig. 99 diagrams are shown of the arrangement of the hairs on the chin of eight Fin whales and the rostrum of one. The arrangement on the chin in Nos. 137 and 169 is very typical of Fin whales.

The hairs on the chin occur in about the same numbers as on Blue whales. The following is an analysis of the records made:

Number of hairs on chin	Males		Females	
	S. Georgia	S. Africa	S. Georgia	S. Africa
16–19	2	—	1	—
20–23	4	—	6	—
24–27	3	—	5	—
28–31	13	1	20	2
32–35	6	—	8	—
36–39	4	—	6	1
40–43	2	—	5	—
44–47	—	—	1	—
Total	34	1	52	3
Average	30	30	31	37
Maximum	40	30	44	39
Minimum	17	30	19	31

Thus the figures for males and females correspond very closely and the few readings from South Africa fall close to the averages for South Georgia.

FOOD, BLUBBER, AND EXTERNAL PARASITES

It will be convenient to consider the food of whales together with the blubber and parasites in this section. The three subjects are not so disconnected as they first appear to be, for variations in the condition of the blubber are directly dependent on the whale's feeding, and the study of certain parasites involves investigations into the structure, and normal and pathological conditions of the blubber.

FOOD

The food of whales is principally the concern of the ships employed in the investigations, for it is only by operations at sea that it can be effectively studied. A certain amount of information, however, is to be had from the examination of the stomach contents of the whales at the whaling stations. The species which constitute the whale's food can be determined, and a rough idea can be formed of the fluctuations in abundance and types of "krill" which occur on the whaling grounds.

The whales caught at South Georgia (excluding the Sperm whale) feed exclusively on *Euphausia superba* (Fig. 100) and have no other food whatever in their stomachs apart from a few specimens of the Amphipod *Euthemisto*, which is so abundant in the plankton round South Georgia that the whales can hardly help swallowing a certain quantity.

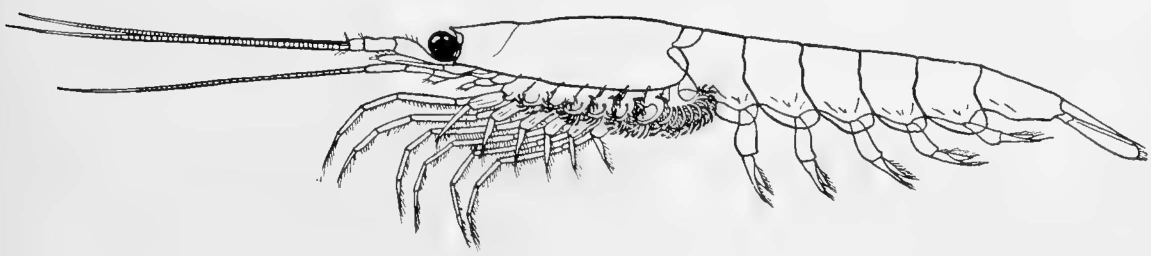

Fig. 100. Outline sketch of *Euphausia superba* (× $1\frac{2}{3}$ approx.).

Off the South African coast the little food in the stomachs was found to include *Euphausia recurva*, *E. lucens* and *Nyctiphanes africanus*, species which grow to a length of less than 1 in. Doubtless all species of Euphausian occurring in the locality are consumed without discrimination. One or two Humpbacks and one of the Fin whales examined at Saldanha Bay had fish in their stomachs. Sperm whales were feeding on cuttlefish, some of which appeared to have been of considerable size.

The question of the migrations of whales has not yet been referred to, but it may be mentioned here that there is a general movement northwards into warmer waters for breeding during the southern winter and southwards for feeding during the southern summer. Little food is available in the lower latitudes, but in certain parts of the Antarctic and sub-Antarctic waters *Euphausia superba* flourishes in immense quantities. It is to be found in dense shoals usually in the neighbourhood of land, and thus the great feeding grounds of the southern whales are situated in such places as the vicinity of South Georgia and the other Dependencies. The enormous abundance of the krill round South Georgia is revealed by an examination of the stomach contents of the whales caught there. Normally the stomach was found to be well filled with comparatively fresh Euphausiids and an empty stomach was at most times an uncommon occurrence. Plate XXXV, fig. 1, illustrates a typical case of the appearance of the stomach after a slight opening in it had been made.

The whales examined at Saldanha Bay showed a marked contrast. Here the stomach was normally found to be empty or to contain a very small quantity of food and the whales were correspondingly lean and ill-fed, except in cases where they appeared to have recently come north from the Antarctic.

One may sometimes receive a false impression of the amount of food in the stomach when a small cut is made in some part of its wall. Part of the stomach may be isolated from the rest by the weight of some mass of flesh for instance, when the whale has been partly cut up, and most of the food may have been pushed into or away from this particular part. Further, the whale's stomach is separated into several different compartments and one cannot always be certain which of these one is examining. It frequently happens that the stomach is torn or damaged in some way by the harpoon, so that much of its contents is lost in the body cavity. Allowance, however, can always be made for such an occurrence, as it can be detected by the presence of blood inside the stomach. Again, there is no doubt that a whale occasionally vomits when it is shot and the whole of the stomach contents may be lost. There has been more than one occasion on which we have noticed partly digested shrimps entangled in the bristles of the baleen, or inside the blowhole of a whale whose stomach was practically empty.

Allowing for these occasionally deceptive conditions, however, one can in many cases say whether the stomach is empty or whether there is much, a moderate amount of, or little food in it. Occasionally it is also worth while examining the contents of the intestines. This is always of a reddish-brown colour in whales which have been feeding on the ordinary krill. The whales examined at South Georgia usually had very well-filled intestines, while in those at Saldanha Bay the intestines rarely contained more than thin patches of food, those in which the stomach was empty often having only a little greenish substance.

In order to give an account of the fluctuations in abundance and type of the krill on which the whales examined were feeding it will be convenient to draw up a table showing for each half-month (*a*) the number of whales recorded as having empty stomachs or as having at least some food in the stomach, (*b*) the amount of food present in those cases where an opinion could be expressed, and (*c*) the dominant type of krill present. There are of course many more records of the actual presence of krill than there are of the amount of krill present. The "dominant type of krill" refers to the size of the individuals and the following symbols are used in the table:

L = *E. superba*. Large, from 5·5 cm. to 6·5 cm. (rostrum to tail).
M = ,, Medium sizes, from about 4·0 cm. to 5·0 cm.
S = ,, Small, up to about 4 cm.
X = ,, Mixtures of conspicuously different sizes.
R = *E. recurva*, etc., which do not show much variation in size.

This classification is very rough and is not to be regarded as referring to definite instars of *Euphausia* (which can, indeed, be determined only with very great difficulty); but it will serve to give a general idea of the kind of fluctuations which take place.

All krill-feeding species are included in the table.

Locality	Half-months	1925								1926								1927							
		No. of stomachs examined	,, ,, with krill	,, ,, empty	% ,, with krill	No. with much krill	,, ,, mod. krill	,, ,, little krill	Predominating type of krill	No. of stomachs examined	,, ,, with krill	,, ,, empty	% ,, with krill	No. with much krill	,, ,, mod. krill	,, ,, little krill	Predominating type of krill	No. of stomachs examined	,, ,, with krill	,, ,, empty	% ,, with krill	No. with much krill	,, ,, mod. krill	,, ,, little krill	Predominating type of krill
South Georgia	January	—	—	—	—	—	—	—	—	24	12	12	50	1	1	5	M	15	14	1	93	1	1	4	X
	,,	—	—	—	—	—	—	—	—	52	44	8	85	21	10	10	M	22	20	2	91	3	—	4	M
	February	1	1	—	(100)	1	—	—	M	65	59	6	91	26	17	10	M	10	8	2	80	2	2	—	X
	,,	8	8	—	100	2	—	2	L	29	25	4	86	12	4	8	M	28	25	3	89	2	2	2	X
	March	11	10	1	91	8	—	—	L	21	21	—	100	11	5	5	M	26	22	4	85	3	—	3	X
	,,	20	20	—	100	8	2	—	L	15	14	1	93	8	3	—	M	20	19	1	95	—	—	1	X
	April	10	9	1	90	3	1	1	L	—	—	—	—	—	—	—	—	18	14	4	78	—	—	3	X
	,,	15	13	2	87	3	2	3	L	—	—	—	—	—	—	—	—	15	12	3	80	—	—	2	X
	May	5	5	—	100	1	—	3	L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
South Africa	June																								
	,,	—	—	—	—	—	—	—	—	36	13	23	36	—	2	9	R								
	July	—	—	—	—	—	—	—	—	20	12	8	60	1	2	9	R								
	,,	—	—	—	—	—	—	—	—	10	4	6	40	—	—	4	R								
	August	—	—	—	—	—	—	—	—	19	4	15	47	—	1	3	R								
	,,	—	—	—	—	—	—	—	—	54	30	24	56	3	6	19	R								
	September	—	—	—	—	—	—	—	—	15	4	11	27	—	—	4	R								
	,,	—	—	—	—	—	—	—	—	37	12	16	57	3	2	16	R								
	October	—	—	—	—	—	—	—	—	14	10	4	40	1	1	7	R								
South Georgia	October	8	7	1	87	5	—	2	L	—	—	—	—	—	—	—	—								
	November	7	7	—	100	5	2	—	L	—	—	—	—	—	—	—	—								
	,,	5	2	3	40	1	—	1	L	21	20	1	95	9	—	4	S								
	December	6	4	2	66	2	1	1	L	28	27	1	96	2	5	1	X								
	,,	—	—	—	—	—	—	—	—	14	9	5	64	1	1	—	X								

The table suggests that fluctuations of the following nature took place in the food supply during the periods in which the whales were examined:

South Georgia, February to May 1925. Large krill were abundant and the whales well fed during February and March, but the supply seems to have been slightly reduced during April and May.

South Georgia, 1925–6 *Season.* Plenty of large krill were present in October and the first part of November, but they became scarcer later in November and in the first part of December. No whales were examined in the second half of December, but in January the large krill appear to have been suddenly replaced by a smaller type, scarce at first (unless the whales had difficulty in finding it) and then eaten in fair quantities. This krill seems to have become most plentiful in the earlier part of March. It is an interesting fact that the new type of krill which appeared in January was accompanied by a striking change in the whale population round South Georgia, for whales were very scarce during October, November and December, especially during December. But at about the new year immense numbers of Fin whales appeared. They were found first about 70 miles from the island and seemed to be finding very little food. Later they came closer to the coast and larger quantities of food were found in their stomachs.

Saldanha Bay, 1926. Food was extremely scarce here compared with South Georgia, as may be seen from the high proportion of empty stomachs. Even of those in which food was present the vast majority are noted as containing only a few very small Euphausiids.

South Georgia, 1926–7 *Season*. Food appears to have been fairly plentiful during the second part of November and first part of December, but to have fallen off a little in the second part of December. It was fairly plentiful again during January and February, but less abundant in March and April. The krill differed from that of other seasons in the fact that there was in most cases a noticeable mixing of Euphausiids of different sizes. These were not always mixed indiscriminately in the stomach. Large or small individuals might be found together in different parts of the mass of stomach contents, or patches of large ones might occur in a mass of smaller forms, suggesting that the whale had been feeding on separate shoals which differed in respect of the sizes of the individuals. During this season there was a high proportion of unusually small Euphausiids, though fully grown forms were also found from time to time.

BLUBBER

The highest grade of whale oil comes chiefly from the blubber, and the quantity and quality of the blubber is therefore a matter of direct importance to the whaler. If blubber were always of the same thickness and contained an invariable percentage of oil, the size of the whale would be the determining factor in the total yield of oil from the blubber. Other factors are present, however, which have an appreciable effect on the yield, although the size of the whale must of course be the predominant factor.

It is already known that differences of a regular nature occur in the thickness of the blubber. Risting (1912), speaking of the Humpback, says that on the average it is very fat in proportion to its size, and the blubber thickness varies according to the season and food. In a later work (1928) the same author states that the quantity of oil produced from a whale depends upon a number of factors, especially the size of the animal, thickness of the blubber and the content of fat in the blubber and carcass. Again, speaking of the stock of whales off the coast of South Africa, Risting mentions the extreme fatness of pregnant whales—a fact which is noticeable at South Georgia as well as at South Africa. Olsen (1914–15), reporting on the whales of South Africa, notes that Fin whales caught from March to June were nearly all small and lean. The fattest whales were females with foetuses. If accompanied by young the females were leaner.

Risting has used the total oil output of the whaling stations with the total number of whales caught to give a figure for the "fatness" of each season's catch in barrels of oil per "Blue whale unit." This unit is based upon the assumption that a Blue whale gives twice as much oil as a Fin whale, two and a half times as much as a Humpback, and six times as much as a Sei whale from the same field of operations. Calculated on these lines the results show that whales in the south (South Georgia and South Shetlands) are far more productive than those occurring further north, say at Saldanha Bay or Durban.

Other differences in the thickness of the blubber are recognized by the flensers at the whaling stations in South Georgia. Thus whales covered with the brownish-yellow film of diatoms are fatter than those without it, and the large Blue whales taken at the end of the season are fatter than those taken earlier.

During our three seasons' work at South Georgia and one at South Africa a large number of blubber measurements were obtained. It is not suggested that the work done in these areas is complete, for many more measurements must be collected before more than good general indications of the changes in the blubber can be shown. Further, it is unfortunate that the data in any year must be broken by a period of several months owing to the closing of the stations. Our measurements, however, are sufficient for tracing the effect of differences in the length of the whale, changes taking place during the year, the effect of pregnancy and lactation, and so on.

As explained on p. 267, the thickness of the blubber was generally measured at a point opposite the dorsal fin and on the flank midway between the mid-dorsal and mid-ventral lines.

Changes in blubber thickness with length of whale. The Blue and Fin whales taken at the whaling stations have a fairly definite range of size. Nearly all Blue whales measure from 17 m. to 26 m. and nearly all Fin whales from 15 m. to 23 m. By comparing the averages of blubber thickness for metre length differences between these limits it is possible to find whether the thickness of the blubber is correlated with the size of the whale. The results for each species and sex are shown graphically in Figs. 101 to 104. It is seen from these that in addition to differences in the volume of blubber present, due to the different sizes (i.e. areas) of the whales, there is a relative general increase in thickness with increasing whale length. The average difference in actual thickness of the blubber of the smallest and largest whales is about 2·5 cm.

The large whales captured off Saldanha Bay are relatively fat. The graphs show that they were actually fatter than whales of corresponding length at South Georgia, while South African whales at the average length at which sexual maturity is reached were leaner than those of South Georgia. The explanation of the differences in the average thickness will be apparent later when the thickness of the blubber in relation to the size of the whale is considered and the nature of the stock of whales off the South African coast is examined.

By calculation of the thickness of the blubber as a percentage of the total length of the whale, comparison is possible between the thickness of the blubber of all whales of the same species and sex apart from the changes due to differences in length. This method shows whether any seasonal increase or decrease in thickness occurs and —in the females—how much the blubber is affected by pregnancy and lactation.

Before considering the results it should be pointed out that at the station in Saldanha Bay the catch was almost entirely composed of immature animals giving a decided impression of leanness which contrasted strongly with the extra fatness of the few large whales captured there. This fact suggested that a separation of the measurements in both areas into two groups might show changes in the blubber of the immature

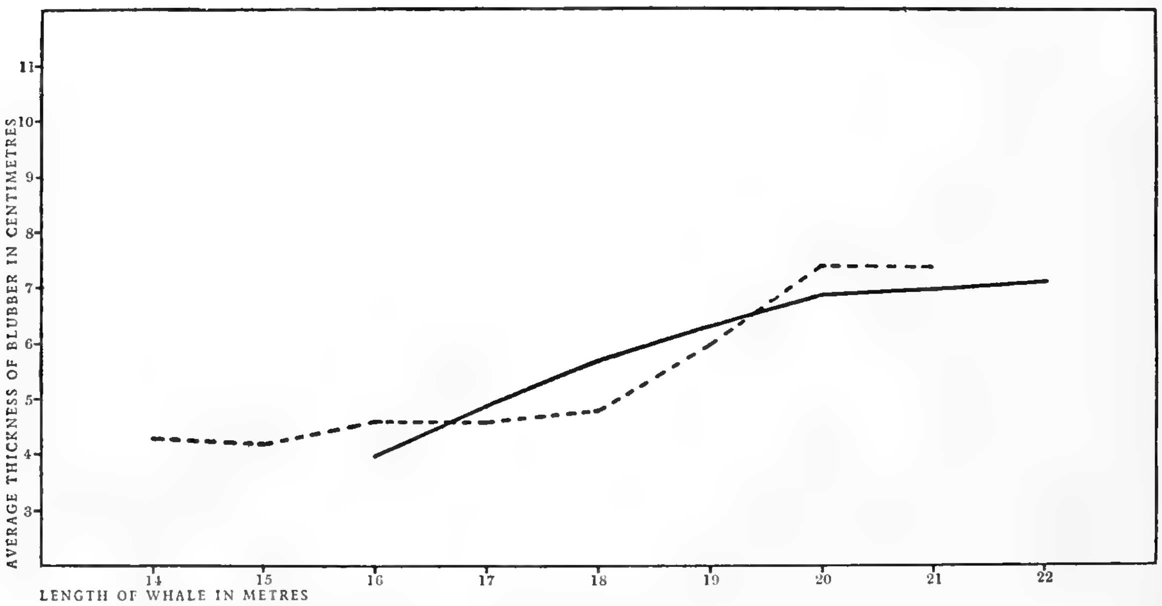

Fig. 101. Male Fin whales. Variations of thickness of blubber with length of whale.

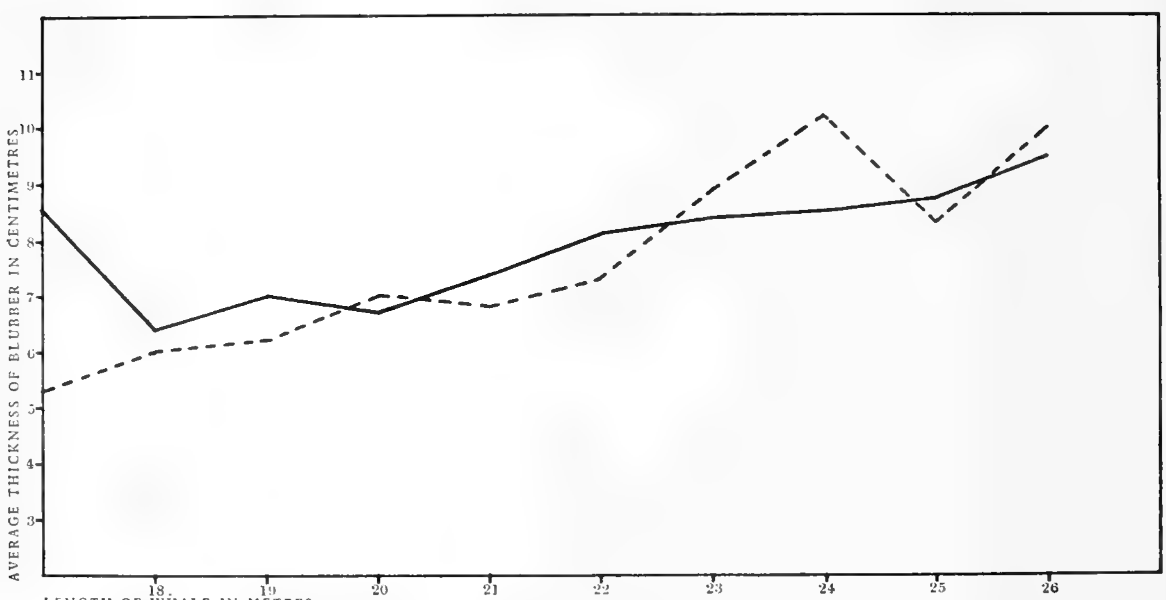

Fig. 102. Male Blue whales. Variations of thickness of blubber with length of whale.

——— South Georgia whales. - - - - - South African whales

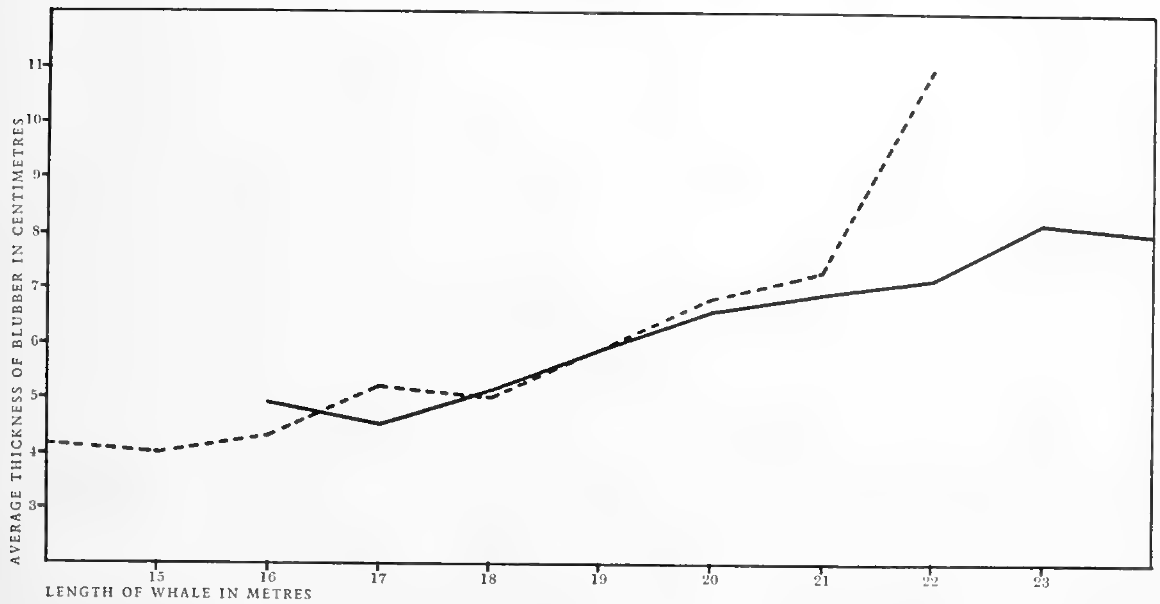

Fig. 103. Female Fin whales. Variations of thickness of blubber with length of whale.

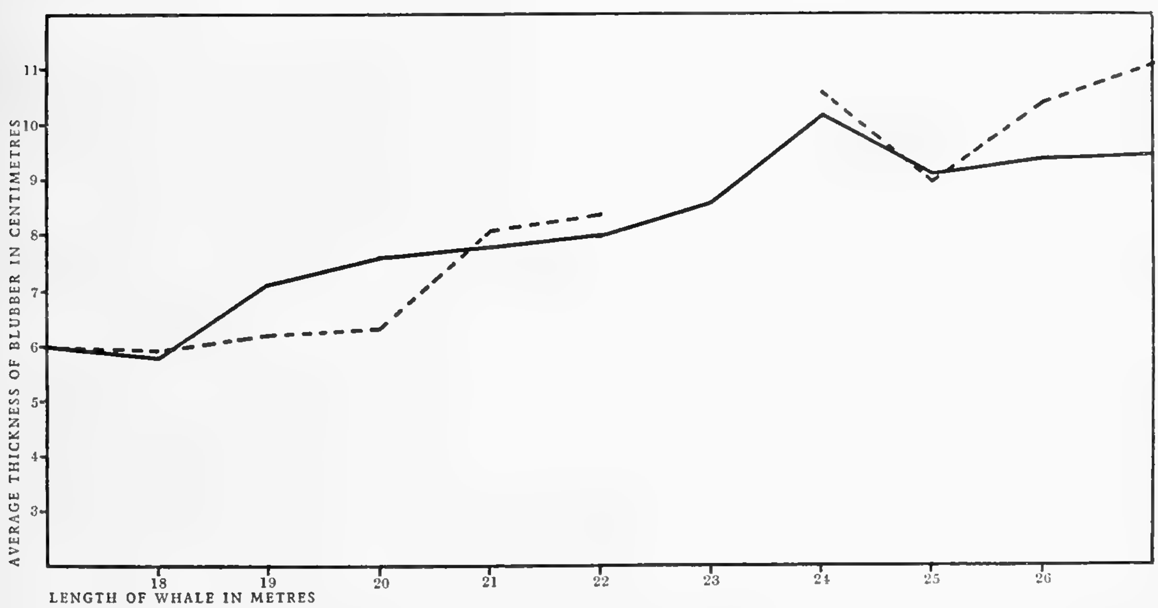

Fig. 104. Female Blue whales. Variations of thickness of blubber with length of whale.

——— South Georgia whales. - - - - - South African whales.

whales which did not occur among the large adults. It was felt that although the number of percentage measurements on which averages were based would be lessened by doing this, the large and small whales had evidently very different histories and must on that account be separated from one another.

The averages for each month of the thickness measurements (each measurement having been expressed as a percentage of the whale length) are shown in Figs. 105 to 110. Small whales certainly immature have been separated from the large adult whales. Thus Fin whales shorter than 18 m. and Blue whales shorter than 19 m. represent the immature group, while Fin whales longer than 20·0 m. and Blue whales longer than 23·0 m. are considered mature.

The average blubber thickness for all Fin whales is about 0·3 per cent of the total length. This represents a whale of normal fatness. For example, a 20 m. Fin whale should have blubber 6 cm. thick. The corresponding average for Blue whales is 0·35 per cent, which means that a Blue whale of 20 m. is fat or lean according as to whether its blubber is thicker or thinner than 7·0 cm. We will now consider each sex of the two species in turn.

Male Fin Whales (Fig. 105). In this graph the 1925–6 season is separated from that of 1926–7, but the results are very similar. An evident increase in thickness takes place among mature whales during the season at South Georgia.

It will be noticed that the immature whales appeared at the island in February and March, i.e. towards the end of the season, and that they were far less fat than the adults.

At Saldanha Bay the lean immature whales contrast well with the few fat mature whales of August and September. There is a hint of a decrease in blubber thickness here which is more evident in the other groups.

Male Blue Whales (Fig. 106). In the case of male Blue whales the increase in the thickness of the blubber in adults from below normal in November to above normal in March is seen. A rapid fattening of immature whales in the second half of the season is also evident.

At Saldanha Bay the fatness of the large whales and leanness of the small ones is apparent, as it was among male Fin whales. Here again is a suggestion of a decrease in thickness as the season advances.

Female Fin and Blue Whales. Among the female whales complications arise due to pregnancy and lactation. Pregnancy is known to have a profound effect on the blubber, the fatness of pregnant whales being noticeable at the whaling stations as soon as the blubber is cut.

Lactating whales, characterized by leanness at South Georgia, have been found at Saldanha Bay to be extraordinarily fat. To deal with these differences pregnant, lactating and resting females have been separated.

The resting females of both species (i.e. those neither pregnant nor lactating) may be taken first (Figs. 107 and 108). The mature whales at South Georgia, of normal fatness from November to February, show a rather sudden increase in blubber thickness at the end of the season. The immature females, like the immature males, arrived for the second half of the season, and on arrival were normal or rather lean.

At Saldanha Bay a decrease in blubber thickness among the mature whales balances the increase shown at South Georgia in both species. The immature whales are again thinner than the normal.

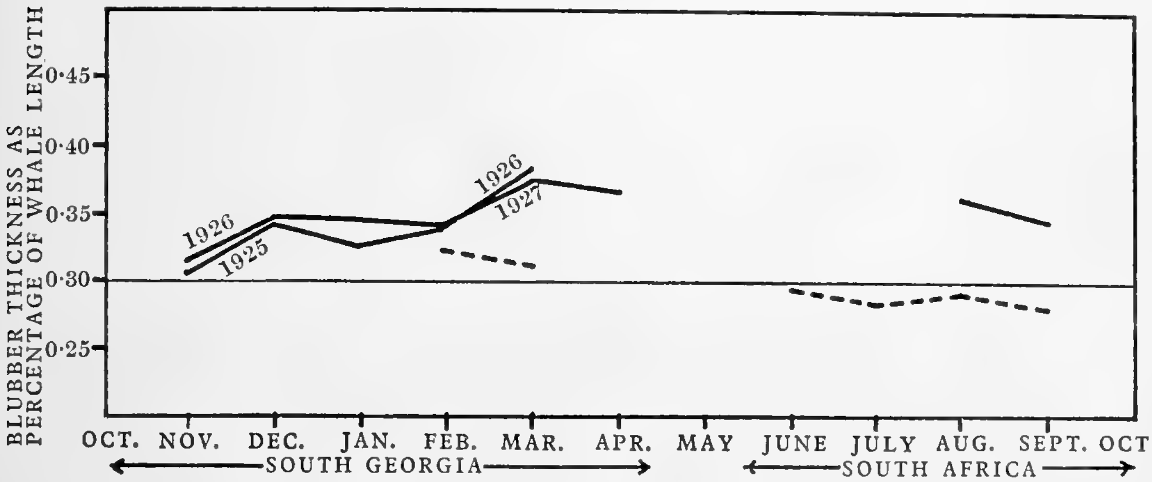

Fig. 105. Male Fin whales. Monthly average thickness of blubber. (Separate curves for 1925–6 and 1926–7 seasons.)

——— Whales more than 20·0 m. long. - - - - - Whales less than 18·0 m. long.

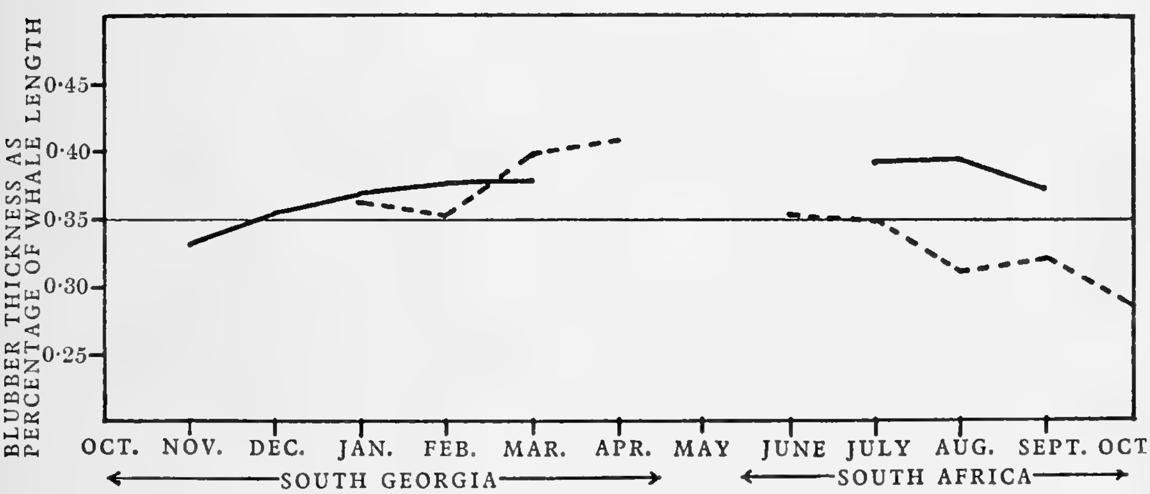

Fig. 106. Male Blue whales. Monthly average thickness of blubber.

——— Whales more than 23·0 m. long. - - - - - Whales less than 19·0 m. long.

The similarity of the results obtained for the males and resting females indicates the general conclusion that whales are fatter at the end of the season at South Georgia than they are at the beginning and that a decrease in blubber thickness takes place in South African waters. The increase in average blubber thickness of adult whales at South Georgia should be due to good feeding and fattening in that neighbourhood, where the food, as already explained, is available in abundance. The possibility might be suggested that the increase in fatness may be due to increasing numbers of fat whales arriving in South Georgian waters from other, apparently richer, feeding grounds as the season advances. If the small whales that appear about January have come from northern waters, as their leanness, size, and frequently parasitized condition very strongly suggest, the upward trend of their average blubber thickness shown in Figs. 106 and 107 favours the theory that fattening actually takes place on the local feeding ground.

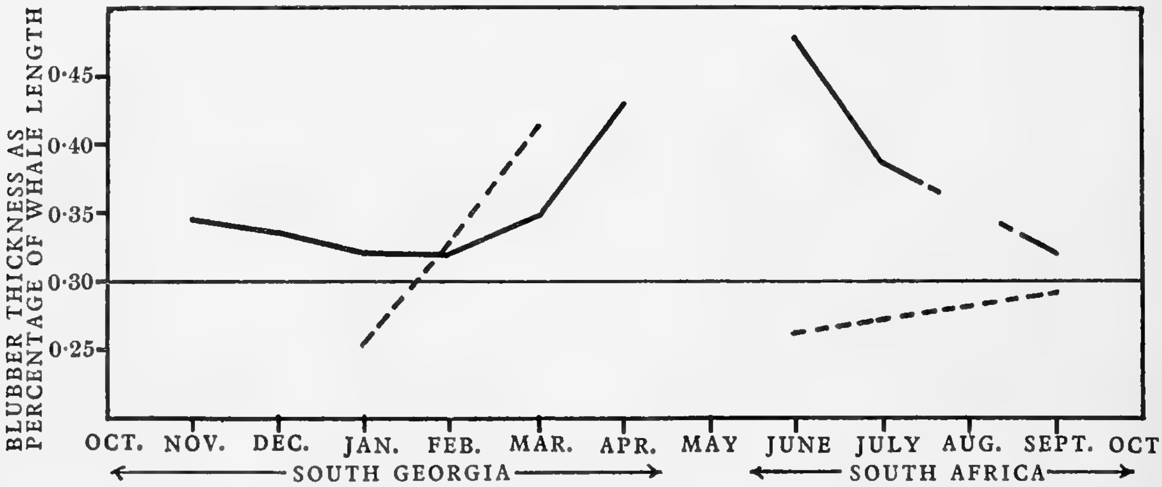

Fig. 107. Female Fin whales. Monthly average thickness of blubber.

——— Whales more than 20·0 m. long (excluding pregnant and lactating whales).
- - - - - Whales less than 18·0 m. long.

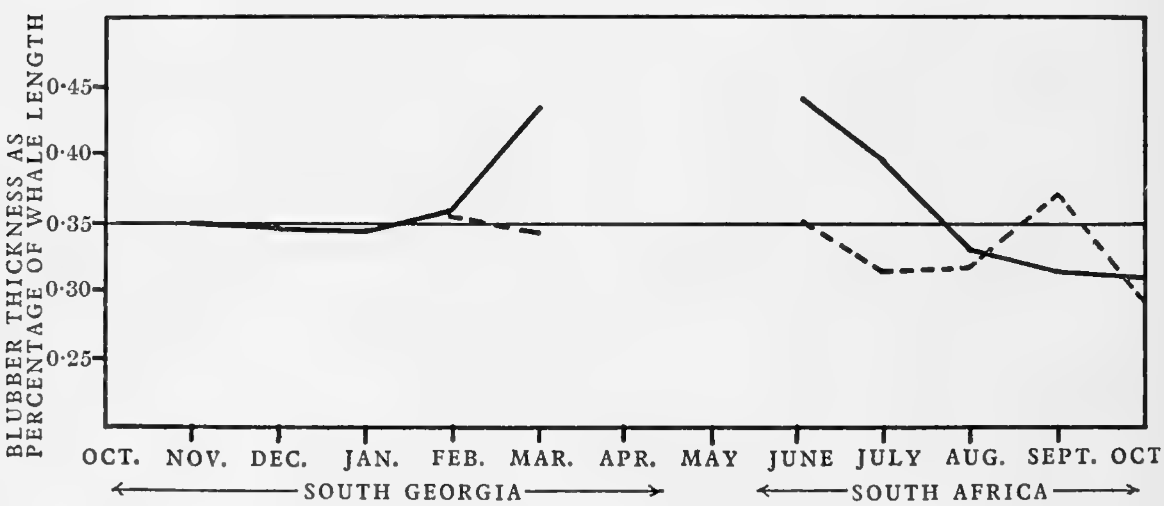

Fig. 108. Female Blue whales. Monthly average thickness of blubber.

——— Whales more than 23·0 m. long (excluding pregnant and lactating whales).
- - - - - Whales less than 19·0 m. long.

Turning now to the South African whales we see that the adult Fin whales make a late appearance in the catch at Saldanha Bay. Both Fin and Blue whales are very fat at the beginning of the season, as fat indeed as the end-of-season whales at South Georgia. This points to a migration to the African coast from rich feeding grounds, though not necessarily from the Dependencies of the Falkland Islands. Certainly they have not been staying for long off the coast of South Africa, for the majority of their stomachs were empty in spite of their fatness. Further, the average thickness of blubber shows

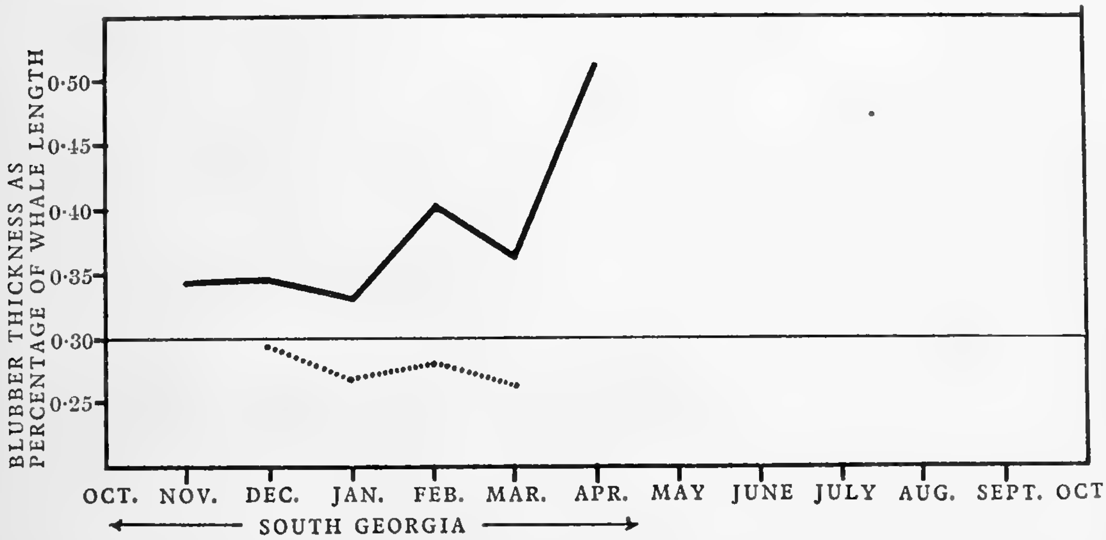

Fig. 109. Pregnant and lactating Fin whales. Monthly average thickness of blubber.

——— Pregnant. - - - - - Lactating.

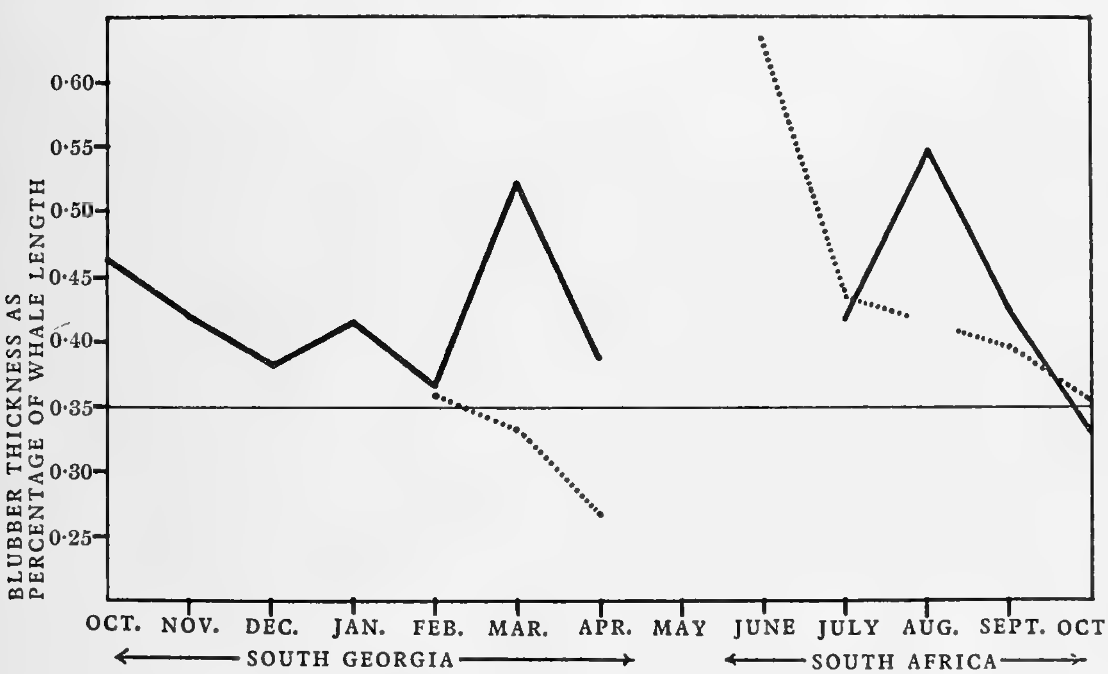

Fig. 110. Pregnant and lactating Blue whales. Monthly average thickness of blubber.

——— Pregnant. - - - - - Lactating.

a decided tendency to fall as the season advances. In other words the longer the whales stay the leaner they become.

The reason now appears why the large whales at South Africa have a higher average thickness than those of the same length at South Georgia as shown in Figs. 101 to 104.

In these figures the actual thickness of the blubber is shown. The large whales of South Georgia are a mixture of thin and fat individuals occurring during the season, while at South Africa the large whales are all fat.

The outstanding feature of the catches at Saldanha Bay is the high proportion of immature whales taken, and it is to be noted that they had a very low average thickness of blubber all through the season.

The west coast of Africa seems to be a sort of nursery area for young whales and it does not seem unreasonable to connect them in some way with the thin immature whales which arrive in southern waters usually late in the season.

Pregnancy and Lactation. The blubber is always thick during pregnancy. A glance at Figs. 109 and 110 will show that the average thickness is always above the normal. They appear to follow the general rule that the whales of South Georgia become fatter towards the end of the season.

Many more measurements of blubber thickness are needed for both pregnant and lactating whales, but the few records available for the latter are very interesting. The thinness of the blubber of these whales at South Georgia, and its thickness at South Africa have already been mentioned. In Fig. 110 the results are shown for Blue whales. There is a decrease in thickness from June to October (South Africa). At South Georgia lactating whales were lean and those taken in February, March and April were apparently rapidly becoming leaner. Of the Fin whales there were no records for lactating females at Saldanha Bay. Those captured at South Georgia from December to March were, like the Blue whales, very lean.

There seems to be no doubt of the significance of the great difference in the measurements at the two places. The blubber is very thick at Saldanha Bay because the whales have not long given birth. From the fact that the blubber during pregnancy is at all times above the normal thickness one would expect that at the onset of lactation the whales would be fat. This explanation covers also the fact of the leanness of the whales at South Georgia which are thus very near the end of the lactation period.

Diatom film. Little can be said with regard to the correlation of the diatom films with fatness in whales. Small patches of film occur on some whales at South Georgia throughout the season. From February onwards thick films covering a large part of the body were sometimes recorded. The immature whales were usually free but patches were found occasionally in the later months. Two immature Blue whales in March and April 1927 had thick and extensive films.

Small spots of diatoms were seen on a few immature whales at Saldanha Bay in August and September, but all the mature whales at this station appeared to be free. Conditions favouring the rapid growth of diatoms occur in southern waters in February, March and April, and as has been shown, at this time the whales are rapidly becoming fatter.

EXTERNAL PARASITES

The species of external and internal parasites of whales will be dealt with in separate papers. They have not been thoroughly examined at the time of writing and are therefore dealt with only very briefly here. The greater part of this section is devoted to an account of certain scars, of which the origin is rather obscure, but which are probably to be attributed to a parasite or parasites of some kind.

The external parasites of whales are mostly crustaceans, and the commonest internal parasites are tapeworms and Acanthocephala.

The following external parasites have been collected from Blue and Fin whales (apart from certain more or less minute forms found on the baleen):

Cirripedia.
- *Coronula regina.*
- *Conchoderma auritum.*
- *C. virgatum.*
- *Xenobalanus globicipitis.*

Copepoda.
- *Pennella* sp.

Amphipoda.
- *Cyamus* sp.

Diatoms.

Ectoparasites in general are rarely found on Blue and Fin whales at South Georgia. Infection seems to take place more easily in the warmer waters of the South African coast, where *Pennella* is particularly common. At South Georgia such external parasites as do occur are generally fully grown, while those observed at South Africa included, at any rate in the case of *Coronula* and *Pennella*, young ones in all stages besides the fully grown individuals. It appears that whales become infected with these external parasites during their stay in the warmer waters, but lose them on migrating to the colder waters of the south. The film of diatoms is the only exception to this, for it is undoubtedly contracted in the summer in the Antarctic or sub-Antarctic waters. Early in the season it may be seen in its initial stages in the form of little round green patches on the skin, an inch or so in diameter. These patches appear to be growing colonies, which gradually expand from numerous centres and eventually cover perhaps the whole body within a few months. These diatoms were described by Bennett (1920) and identified by Nelson (1920) as a species of *Cocconeis*.

The ability of a whale to throw off the *Pennella* which most commonly attack Blue and Fin whales, seems to have some physiological significance, for it is often found that a whale taken at South Georgia with a number of these parasites in its blubber is suffering from some internal growth or disease.

Internal parasites are to be found more commonly than the external Crustacea, and they are often present in great numbers in whales from both South Georgia and South Africa. Blue whales are more often parasitized than Fin whales, in fact more than half the individuals of the former species from both localities contain tapeworms or Acanthocephala or both in their intestines. In both species the younger whales are normally more heavily infected than the older ones.

We may now turn to an account of a kind of disease to which all southern Blue and Fin whales seem to be subject. All the whales of these species caught at South Georgia are marked by numbers of whitish scars which are very different in appearance from the irregular white or grey flecks scattered over the skin in Blue whales which are due, apparently, simply to incomplete pigmentation of the epidermis. The scars are obviously the result of wounds or sores. They occur mainly on the posterior end of the body, sometimes in such numbers that the colour of the animal is distinctly paler on the sides above the anus than at the head or in the flipper region. The scars are normally more numerous on the larger whales than on the smaller ones. They are usually of an oval shape with the long axis of the oval parallel with the long axis of the animal's body (Plate XXXVI, fig. 10). Sometimes they are quite white and sometimes composed of radiating white streaks. The centre line is an elongated cicatrix generally somewhat sunk below the level of the epidermis. Occasionally the scars take the form of a white crescent (Plate XXXVI, fig. 5).

At Saldanha Bay nearly all the whales captured had open wounds or pits on the flanks and tail, as well as various healing stages of these pits and white scars like those found on the whales at South Georgia. The open, unhealed pits of the South African whales were not seen at South Georgia and only rarely were the partly healed pits to be found there.

The open pits of the South African whales are very remarkable (Plate XXXVI, fig. 6). They are oval, scooped-out wounds in the skin and blubber about 7 cm. long, 4–5 cm. broad and 3 cm. deep. The long axis is usually parallel to the long axis of the whale's body.

From the appearance of the wounds one might think that a lump of blubber had been scooped out at a single stroke by some sharp spoon-shaped instrument, but a close examination shows that a fringe of minute processes arise at the edge of the pit just beneath the border of the epithelium (Plate XXXVI, fig. 6). No marks suggestive of teeth outside the lip or inside the pit can be seen, and the fringed edge does not give the impression that it has been caused by say a sucking mouth. The surface of these pits is naked, unaltered blubber.

Of almost equal frequency are pits of similar shape with a flabby disc of greyish tissue attached by its centre to the middle of the base of the pit (Plate XXX, fig. 8). This disc, apparently, is thrown off during the process of healing of the pit.

Sometimes crescent-shaped wounds were found. The appearance of this kind of pit suggests that the scooping action which might have gouged out the open pits had been arrested so that a free flap of tissue remained attached to one side of the pit (Plate XXXVI,

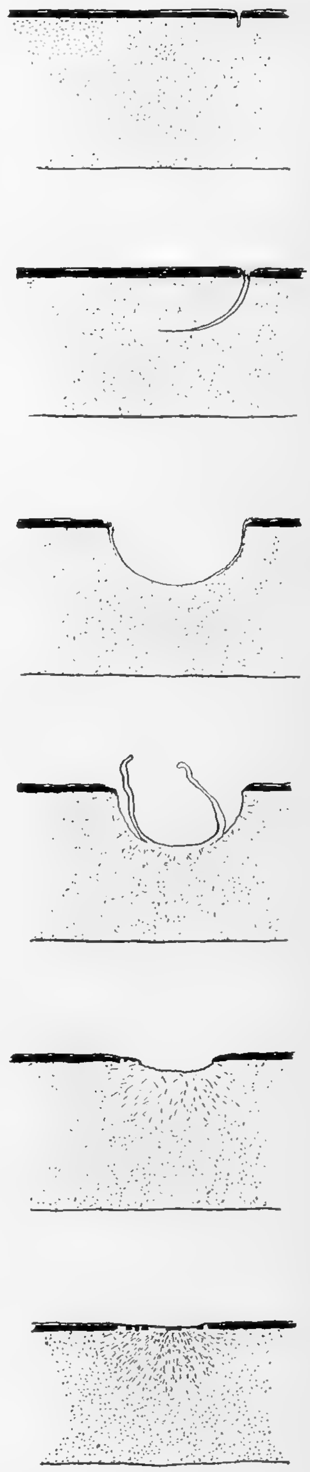

Fig. 111. Successive stages in the formation and healing of a pit in the blubber.

figs. 2 and 4). Sometimes the crescent is short, as though only slight penetration had occurred, at other times the scooping action seems almost to have been completed so that the free flap of blubber and skin remains attached by a thread as it were to the edge of the pit. A kind of scar tissue covers the blubber surfaces within the crescent pit, and this peels at the edges during healing.

In the healing stages the epidermal layer loses its sharp edges and grows gradually inwards, while the blubber fibres grow up and draw together (Plate XXXVI, fig. 9). Pigment is not present in the later stages so that when the wound is completely healed the scar is white. In sections the scar tissue shows up as a mass of converging fibres (Plate XXXVII, fig. 3). White crescent scars, formed probably by prompt healing of a wound which never got beyond the initial stages, are found sometimes, but they are not numerous.

Careful examination of the whales at Saldanha Bay led to the discovery of occasional crescentic grooves with a few minute slots in the course of the groove (Plate XXXVI, fig. 1). The slots led into a subcutaneous crescentic canal following the arc of the surface depression. Microscopic examination of the contents showed nothing in the canal but numerous bacteria.

Specimens of all the stages observed have been collected from whales at Saldanha Bay and South Georgia, and examined from the histological point of view. Sections show a number of interesting points connected with the earlier stages and a possible causative agent. As the primary cause of the pits remains in some doubt it is of course not certain that the stage of the curved groove with its minute punctures is connected with the pits. It seems logical, however, to connect this stage with the crescent-shaped incisions. If one imagines a continuation of the process forming the crescent flap and the final throwing off of the latter, an open pit will be formed. Thus the stages fall into a natural order, beginning with the arc-shaped groove and the epidermal canal followed by the crescent pit. Occasionally this heals, to form the crescentic scar, but more frequently the whole centre is thrown off leaving scar tissue over the surface of the exposed blubber. This is sloughed off as the flabby disc referred to above, and leaves the clean open pit (Fig. 111).

It is quite probable that the initial stages are more frequent in regions further north than Saldanha Bay. This is suggested by the difficulty of obtaining evidence as to the primary cause of the pits and by the fact that whales in the colder waters of the south show only scars and a few late healing stages. It is reported by Olsen (1913) that wounds "filled with mortifying fat" were very numerous in the few old and apparently diseased specimens (of Bryde's whale, *B. brydei*) taken at Port Alexander, which is over 1000 miles north of Saldanha Bay. Similarly, the blubber of whales off the coast of Ecuador is, according to Risting, often more or less covered with deep holes filled with matter.

Sections of the arc-shaped groove show a deep cleft in the pigmented epidermal layer. In the blubber beneath is a wedge-shaped mass of tissue with deeply staining nuclei (Fig. 112). In this area the blubber has been completely replaced by this nucleated tissue. At the edge of the wedge of blubber cells are to be seen in process of destruction and some are filled with small brownish needle-shaped crystals. These are probably blood-crystals (Fig. 113).

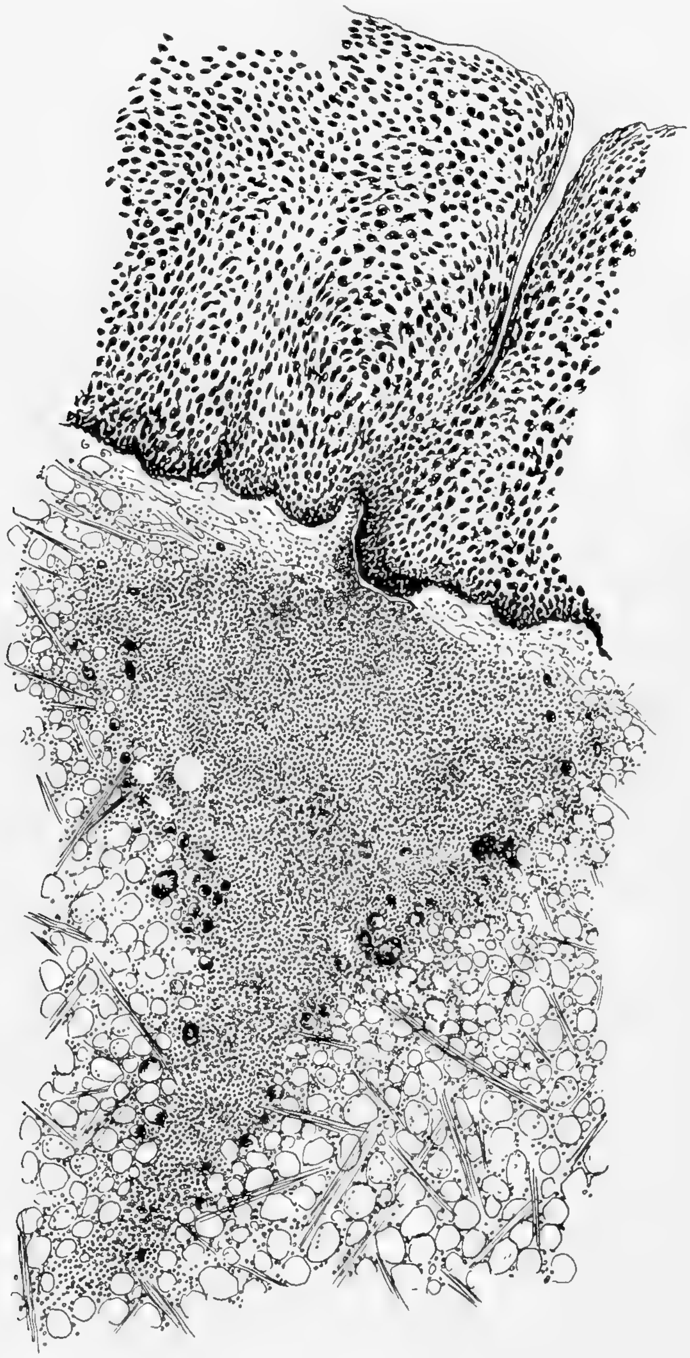

Fig. 112. Transverse section of an arc-shaped wound in the epidermis and the blubber beneath.

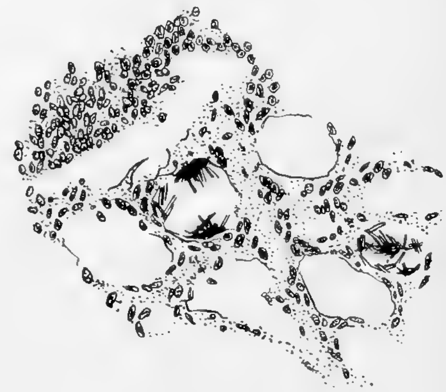

Fig. 113. Blubber cells with blood crystals at the edge of the inflammatory tissue of a wound. (Part of section shown in Fig. 112 enlarged.)

Dr John Taylor, pathologist at St Thomas's Hospital, kindly undertook to examine some of the specimens. He found that at all the exposed surfaces inflammatory tissue was present. The wedge-shaped mass of nucleated tissue was inflammatory in character and might result from a wound or abrasion of some kind. In sections of the flabby disc (Fig. 114) he found a number of ciliated protozoa (Fig. 115) embedded in the tissue by which the base of the disc was attached to the bottom of the pit. He considered that these might quite likely be the cause of wounds if the epidermis had been damaged slightly to allow their entry.

On the under surface of the free edge of the flabby disc there are matted ribbons of what look like rod-shaped bacteria (Fig. 116). From their position one would suppose that these are a secondary infection. The flabby disc itself consists of an outer zone of disintegrated cells. Farther in are dead blubber cells. Beneath these is a zone of inflammatory tissue and then come the fibres already mentioned in which the protozoa were found.

In seeking the cause of these pits we must consider a number of possible agents. The balance of probability indicates that they are primarily the work of micro-organisms, but this cannot be regarded as proved. On the other hand, it does not seem possible to explain the various stages by any of the theories previously advanced. *Coronula* (Goodall, 1913), *Pennella* (Olsen, 1913), and sucking fishes (Olsen, 1913) have all been blamed, and biting fishes have been suggested. Lillie (1915) supposed that open wounds of evidently the same nature in Humpbacks at New Zealand had been caused by damage from sharp rocks.

Fig. 114. Section of the "flabby disc." *a*, dead cells of surface disc; *b*, heavily nucleated tissue; *c*, protozoa; *d*, base of attachment to centre of pit.

Taking these in turn it can be shown first that *Coronula* can hardly be responsible. This parasite leaves a surface impression, but even when somewhat

Fig. 115. Ciliated protozoa in scar tissue.

embedded in the skin it does not penetrate below the pigmented epidermis (Plate XXXVII, fig. 1). When the furrows and ridges of the impression have flattened out after the disappearance, from one or other cause, of the barnacle, there is left a greyish symmetrical pattern on the epidermis that cannot be mistaken for the scars caused by healed pits (Plate XXXVII, fig. 2).

Pennella grows very deeply into the blubber—much further than the depth of the pits—and affects the skin and blubber only immediately around its narrow "stalk." Secondary infection of the open pits with *Pennella* often takes place, but there seems no possibility that this parasite is responsible for the formation of the pits either by its own activities or as a reaction on the part of the whale to these activities. It is true that *Pennella* may leave a scar of its own, but this is smaller and quite distinct from the scars left by the pits.

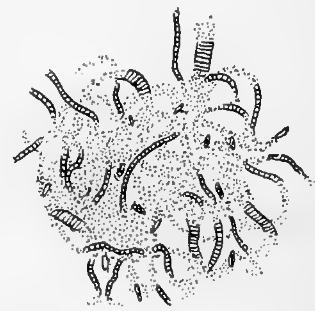

Fig. 116. Rod-shaped bacteria in scar tissue.

There have been reports from the whalers at Saldanha Bay of fishes (apparently Myxinoids) occasionally attached to the whales at sea. Soon after the capture of the whales the fishes were said to loosen their hold so that specimens were never taken. Myxinoid fishes can in fact be caught by hook and line in Saldanha Bay, though these are far too small to have caused the pits. In this connection Olsen (1913) remarks as follows: "A species of Myxinoid makes similar wounds in Bryde's whale, but I did not obtain specimens because they always leave the whale when it is dragged out of the water. I do not know whether they are to be found on the whale when alive or only after its death". There is no doubt that the wounds noted by Olsen at Durban are the "pits" under discussion. A very good illustration of them is given in his paper. He describes them as "fresh wounds with a length of as much as 10 cms. and 3–4 cms. deep, caused by parasites, generally *Pennella*". It is probable that wounds caused by a sucking fish would show signs of the method by which they had been made, and such fishes cannot be imagined to make the crescentic pits. The same objection applies to biting fishes, although certain species might possibly manage to make the open pit in one bite. It is in fact the partially cut pit shown in Plate XXXVI, fig. 4, with its free flap of practically unaffected blubber which constitutes the great objection to any kind of bite, gash or macro-parasite, as a possible cause of the open pits and the scars, for there seems to be no conceivable process by which such agents could cause this particular stage. One can only suppose that there is some micro-organism which, having penetrated the skin, propagates itself through a peculiar kind of curving plane, undermining a piece of blubber which finally drops out and leaves an open pit.

It should be mentioned that instances of fishes biting into the blubber of whales have been known. Scoresby (1820) describes how the Greenland Shark (*Laemargus borealis*) bites "hemispherical pieces", "nearly as big as a person's head", out of the blubber of the living Greenland whale. *Laemargus* does not occur, however, in the south, and if it did it could hardly be the cause of the pits in question. It is conceivable that the whale's epidermis might be pierced by a bite of some kind and that infection by some micro-organism then sets in, resulting eventually in the formation of the pit. *Callorhynchus*, for instance, is a fish with remarkable projecting teeth, but there is still the difficulty that the walls of the pit are normally absolutely vertical at the edge (i.e. at right angles to the surface of the blubber), and it is difficult to imagine any kind of teeth even starting such a wound.

The presence of pits and scars on whales from widely separated localities such as New Zealand, Ecuador, South Georgia and South Africa, gives a kind of unity to the southern whales. It shows a common experience confined to whales in the warmer water of the ocean, leaving its mark on the whales that migrate. It strengthens the theory of a north and south migration between the temperate or sub-tropical waters and the Antarctic and sub-Antarctic regions.

The open pits seem never to have been described in whales of the northern hemisphere. They are mentioned neither by True (1904) nor by Sars (1878, 1880) and they do not appear to be present on the whales of which True shows photographs. Irregular grey patches on the flanks and white patches on the ventral grooves are mentioned by these authors, but this is probably concerned with the normal colouring of the whales. White scars are mentioned by Collett (1912) on Sei whales from West Finmark and by Burfield and Hamilton on Fin whales from Bellmullet, Ireland. From Burfield's description of "large oval grey spots with radiating dark lines $2\frac{1}{2}$ in. × $1\frac{1}{2}$ in.", one would perhaps suppose that these whales had at some time suffered from open pits. More than one kind of scar, however, is liable to appear on the skin of whales, and further observations are needed from northern stations before the point can be settled.

IV. THE REPRODUCTIVE ORGANS

The systematic examination of the genitalia includes some of the most important observations in the work at whaling stations, and certain aspects of the physiology of the reproductive organs must be examined in considerable detail.

Previous descriptions of the genitalia of Cetacea have been few, and for the most part, not very helpful. Turner (1871) describes the uterus and foetal membranes of *Orcinus*, but the paper by Meek (1918) on the reproductive organs of the porpoise and some other species is probably the most useful general description though this does not include any account of Blue and Fin whales.

Since there is no difference of any importance between the genitalia of Blue and Fin whales the following account may be considered to have a general application except where otherwise indicated.

THE EXTERNAL GENITALIA

There is not very much to be said with regard to the external genitalia, but systematic notes have been made on them and their appearance sometimes gives a little information on the sexual condition of the whale. In the female the vulva is situated in a deep groove immediately in front of the anus (Plate XXIX, fig. 2, and Plate XXXIII, fig. 3). In immature whales this groove is usually tightly closed, but in mature whales it is generally slightly open so that the clitoris is just visible. On each side of the genital groove are the slits which contain the nipples of the mammary glands. As stated on p. 276, the average distance between the anus and reproductive aperture in, for instance, female Blue whales is 2·6 per cent of the total length, or 0·65 m. in a 25·0 m. whale. The most important observations to be made are probably those concerned with indications of "heat" in females, but we have met with only one case in which a whale appeared to be in this condition. In No. 775 the genital groove was rather more open than usual and the clitoris was pushed outwards by a slight eversion of the vagina. The latter was noticeably congested and contained some clear mucus. The actual presence of mucus appears to mean little, for it is present in most whales and is often found to be issuing in considerable quantities from the vagina, but instead of being clear it is normally cloudy and viscous.

The condition of the external genitalia may also occasionally be useful in indicating the approach of parturition in pregnant whales. In Nos. 154 and 175 the vulva was greatly swollen and the genital groove stretched open to a remarkable extent as though from considerable internal pressure. These two whales were found to contain foetuses measuring 6·3 and 6·05 m. respectively, and it is to be supposed that parturition was to take place very shortly.

In the male, the penis is retractile and is normally completely withdrawn into the cavity within the genital groove. The exterior then presents a long groove which differs from that of the female in its shape and in its more forward position (Plate XXX, fig. 2). Whereas in the female the anus lies immediately at the posterior end of the genital groove, in the male there is a considerable distance between the two. The average distance between the anus and genital aperture in this sex is 6 to 7 per cent of the total length, and this measurement gives in fact the most obvious distinction between the sexes. The shape and proportions of the penis are illustrated in Plate XXXIII, fig. 1. In the carcasses of males brought to the whaling station the penis is frequently fully extruded, but this takes place gradually, after the whale has been killed, during the period when it is being towed back to the whaling station. In fully grown Blue and Fin whales the penis measures usually from 2 m. to 2·5 m., but adult specimens (e.g. No. 1229) have been recorded in which the penis measured considerably less than 2 m.

Observations on the size of the penis may be useful as a means of deciding at a glance whether a whale is sexually mature or not, for this organ undergoes considerable growth at maturity. This method, however, is unreliable in the case of whales which have recently been or are about to become mature.

THE VAGINAL BAND

The vaginal band is a unique structure which is of sufficient interest to be considered separately from the other external genitalia. It was first noticed in a specimen of the external genitalia of a Fin whale sent to England from the South Shetlands by Mr J. E. Hamilton. It was then thought to be an abnormality of an interesting type, but the examination of whales at South Georgia and Saldanha Bay shows that it is by no means a rare occurrence among Fin whales and so should be included in any description of their structure.

In most immature female Fin whales, as already mentioned, the genital groove is closed so that little or nothing can be seen of the genitalia; and when the blubber is removed the vulva is frequently removed with it. This probably accounts for the fact that no mention of a vaginal band appears previously to have been made.

The clitoris is an incurved, keeled structure about 8·0 cm. long, with a trilobed apex directed backwards. Under the clitoris are the openings of a pair of small glands; and immediately behind these, between a pair of fleshy lobes, opens a larger unpaired duct which is the urethra. Behind the urethra and nearly covered by the apex of the clitoris is a small projecting mass of tissue with papilliform appendages. From the posterior side of this mass stretches a thick strand 7 or 8 cm. long and not less than 1 cm. in diameter, across the large, somewhat star-shaped entrance to the vagina, to the posterior border of which it is attached (Plate XXXIX, figs. 1, 2 and 3).

In mature Fin whales one end of this band was sometimes found as a tag 5 or 6 cm. long usually attached anteriorly, but signs of recent rupture of a complete band were not found.

The band is composed mainly of fibrous connective tissue with a few small blood-vessels. Many minute convoluted ducts course through the tissue, which also contains a few droplets of oil. Transverse sections show that the character of the band is not similar throughout. That part—about one-third—which faces the opening of the vagina is covered with papillae. At each side the papillae give place to a typical epidermis which covers the remaining two-thirds of surface and resembles the epidermis covering the blubber (Fig. 117). Sections give the impression that the outer surface epidermis has grown in round a solid strand of the underlying tissue but has not completely covered the inner surface.

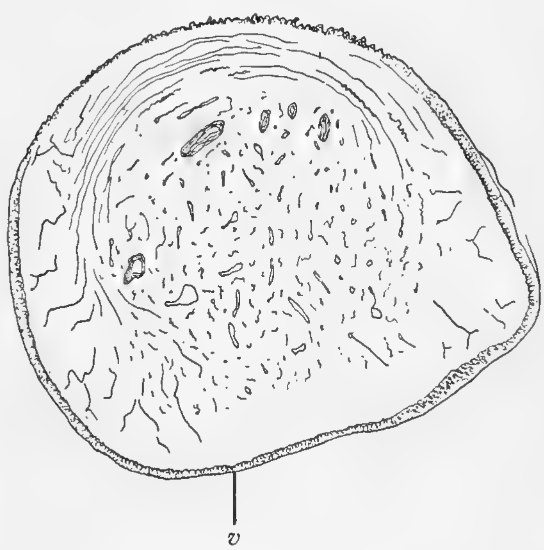

Fig. 117. Section of the vaginal band. *v*, ventral, or outer surface.

Of the total of 145 immature female Fin whales, the band was present in 31 (21·4 per cent) and in the total of 206 mature Fin whales the tag was observed in 14 (6·8 per cent). Not all these whales were examined for this structure, but it was definitely not present in 40 immature Fin whales.

Of 36 female Fin whale foetuses 5 (14 per cent) possessed the band while 2 definitely did not. Again in some cases observations could not be made.

There is some evidence that this peculiarity is not hereditary. In Fin whales Nos. 173 and 289 vaginal bands occurred in the foetuses but there was no sign of a tag in the adults. The broken ends, however, may possibly have been reabsorbed so far as to be inconspicuous. In Nos. 286 and 332 there was a tag in each of the parent whales and no band in either of the foetuses. One foetus, however, was very rotten and it is just possible that a band may have been missed.

Whale No. 1494, a Blue female, possessed a tag attached anteriorly. This was the only case where evidence of the vaginal band was found in any species other than Fin whales.

The presence of an unbroken vaginal band usually denotes sexual immaturity, for it is difficult to see how coition could occur without rupture of the band, and coition probably occurs quite shortly after the female becomes adult. In this way it appears to be somewhat analogous to the hymen in the human subject.

There are two cases, however, of vaginal bands occurring in whales, one of which appeared to be on the threshold of maturity, and the other just passed maturity. In the former, whale No. 139, one of the ovaries showed a large vesicle 6·5 cm. in diameter which was apparently an enlarged Graafian follicle. The ovaries appeared otherwise to be immature. They were small, weighed comparatively little (8 and 13 oz.) and the other follicles present were minute. The whale was smaller than the smallest certainly mature female Fin whale, and it was captured at the end of March. Whale No. 76 appeared to have just reached maturity, for it measured 20·2 m. (the mean size at which maturity is reached is 20·0 m. in female Fin whales) and although a vaginal band was present a body was found in the ovaries which appeared to be an old corpus luteum. In this whale, which is referred to again on a later page, either an ovulation had taken place or an ovum had ripened and become atretic. The second possibility is the more likely as no path could be traced from the capsule to the exterior of the corpus luteum.

The vaginal band appears not to have been previously described, and it is difficult at present to put forward any explanation of its occurrence. It has been found in too large a percentage of Fin whales to be dismissed as an abnormality, yet no correlation has been noticed with the measurements or other features of these whales to distinguish them from whales in which the band is absent.

THE OVARIES

The ovaries are, from our point of view, the most important of the reproductive organs, for they are an unfailing index of the sexual condition, and to some extent of the sexual history of the whale. They are elongated bodies measuring usually between 20 and 40 cm., and differ from the ovaries of most other mammals in their highly convoluted condition and the prominence of the frequently numerous corpora lutea and follicles, which give the surface a very irregular appearance.

(*a*) *Growth of the Ovaries*

In discussing the physiology of the ovaries it will be convenient to start with an account of their growth in the foetus and the young whale. In Blue and Fin whale foetuses measuring about 1 m. they are small elongated bodies whose flattened surfaces are marked by a number of furrows (Fig. 118). The whole genital tract of the young foetus at this stage is engorged with blood so that the ovaries are of a deep red colour. In larger foetuses the furrows are more pronounced and more numerous (Plate XXXIX, figs. 3 and 4). After the calf is born the majority of the furrows are smoothed out by the growth of the ovaries, but some remain to mark the convolutions of the adult ovary which are referred to above, and some of the minor furrows occasionally persist to give the surface of the ovaries a curious appearance which has been described in notes on the internal genitalia as "bramble-marking." This is illustrated in Fig 119 and Plate XXXIX, fig. 4.

Fig. 118. Ovary of foetus measuring 1·13 m. (Natural size.)

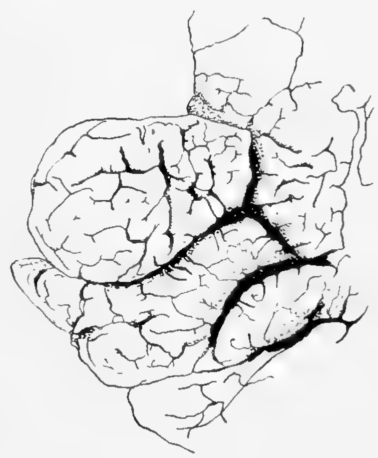

Fig. 119. Small portion of ovary of immature whale, showing "bramble markings." × 1·5.

Although the ovaries do not grow very much from birth to sexual maturity, considerable changes take place. From rather rounded, soft structures they become pale, flat, compact organs (Plate XL, fig. 1). They remain, however, small up to this stage, for in Fin whales measuring less than 18 m. and in Blue whales under 20 m. the two ovaries together weigh less than 1 lb. The ovaries of immature Fin whales practically never weigh more than 2 lb., nor those of Blue whales more than 3 lb. After sexual maturity is reached the weight of the ovaries, as shown in Figs. 120 and 121, appears to increase up to a point with the increasing length of the whale. Although the ovaries of large whales are as a rule bigger than those of smaller whales, the increases illustrated in these graphs are in reality due more to the presence of a larger number of old corpora lutea than to an increase in the actual size of the ovary. When a corpus luteum of pregnancy is present the weight of the ovary may be nearly doubled, so that in connection with the growth of the ovary, only those of non-pregnant females can be taken into consideration.

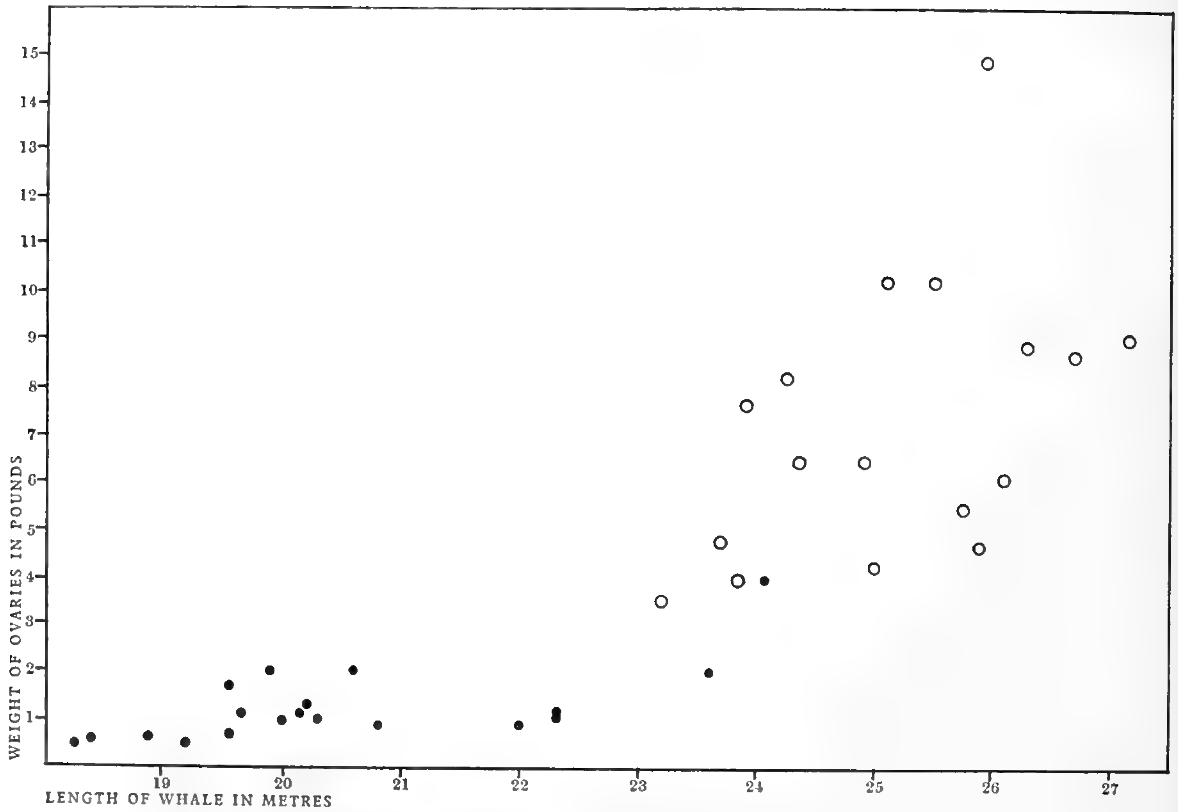

Fig. 120. Blue whales. Weight of ovaries in whales of different lengths.
● Immature whales. ○ Mature whales (not pregnant).

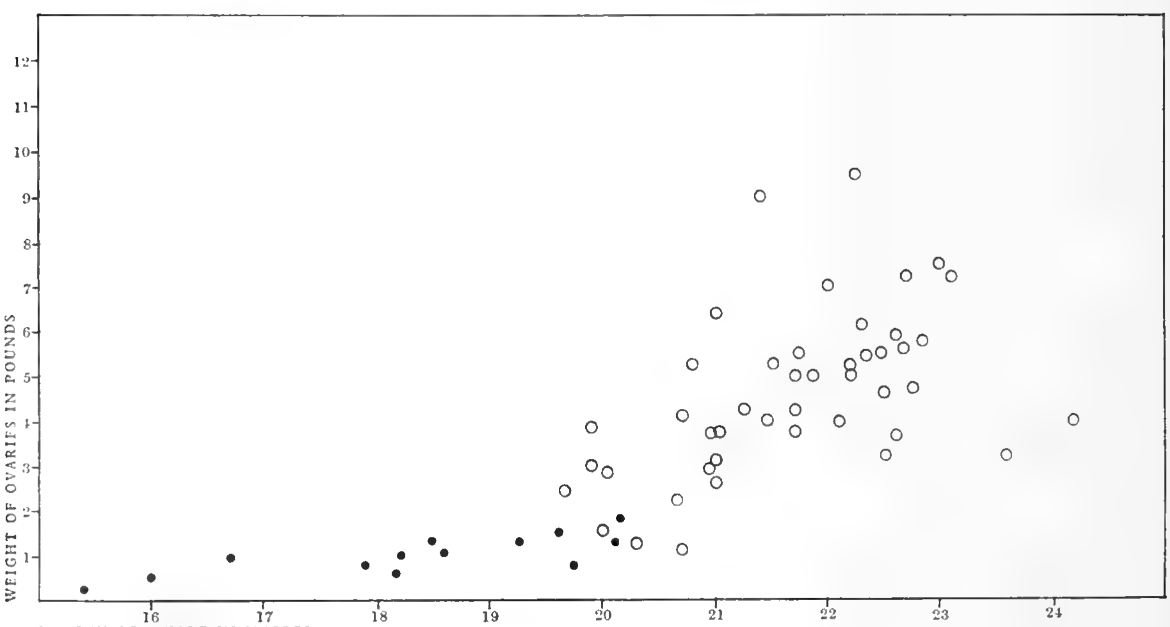

Fig. 121. Fin whales. Weight of ovaries in whales of different lengths.
● Immature whales. ○ Mature whales (not pregnant).

The positions of the plotted points in Figs. 120 and 121 suggest that at least in the case of Fin whales there is a general increase in the weight of the ovary from 20 m. (at about which length sexual maturity is reached) up to 22 m., that a maximum is reached here, and that there is subsequently some regression. This apparent regression may be a coincidence or it may be an indication of actually different conditions in the very large whales. The two whales of 23·6 and 24·15 m., plotted in Fig. 121, had thirteen and twenty corpora lutea respectively, and the fact that in spite of this their ovaries weighed so little, supports the suggestion that the ovaries do become lighter in the largest whales.

(*b*) *Growth of the Ova*

It will be convenient next to trace the growth of the ovum and development of the Graafian follicles. Sections of the ovary in young foetuses show large numbers of deeply-staining nuclei towards the surface. In a 2·76 m. foetus the germinal nuclei

Fig. 122. Section through ovary of a 2·76 m. foetus of a Fin whale. *g.n.*, germinal nuclei; *p.*, Pflüger's tubes.

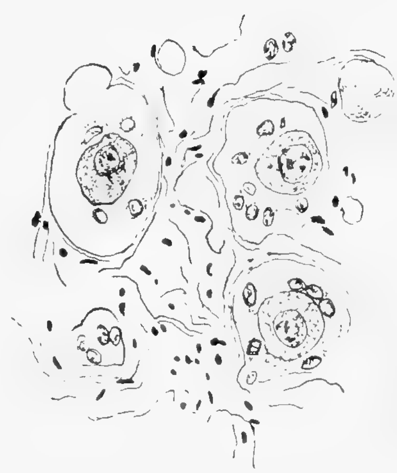

Fig. 123. Early Graafian follicles in 6·05 m. foetus of a Fin whale.

were collected in cavities (Pflüger's tubes), the intervening tissue being connective tissue and large blood spaces (Fig. 122). In a 6·05 m. foetus definite Graafian follicles are present some distance in from the surface (Fig. 123), while near the surface the conditions remain as they were in the smaller foetuses. In the follicles shown in the figure, the ovum is seen as a large cell round which several nuclei (often showing signs of division) are grouped.

In small immature whales the follicles are less than 1 mm. in diameter, and it is necessary to section the ovaries before they can be seen. In larger whales they become evident as dark round blurrs beneath the surface; and when ripening they project from the surface as thin-walled vesicles 30–50 mm. in diameter (Plate XL, fig. 2).

The ovum can be obtained from a large follicle by examination of the squeezed-out follicular liquor. It is usually surrounded by follicular nuclei and can just be picked out against a dark background without magnification. An ovum from one of the largest follicles (of a Fin whale) was 0·0165 mm. (0·00065 in.) in diameter. The follicle was about 40 mm. in diameter and probably was not fully ripe.

Among Blue whales follicles measuring as much as 10 cm. in diameter have been found. In one of this size no ovum could be found, but the cloudiness and bad smell of the *liquor folliculi* suggested that this large size might be a pathological condition.

In ripening ovaries there are many follicles visible, but usually there is only one of large size. This implies that one ovum is shed at a time, and further that if fertilization does not take place, another follicle ripens and is shed, or in other words that the whale is polyoestrous.

If more than one ovum were shed at one ovulation, records of two or more foetuses should be more frequent than they are. Only two instances of twins were recorded among the whales examined, and it is possible that these were identical twins, i.e. two foetuses from the same ovum, or from two ova from the same follicle. In one case there was only one corpus luteum of pregnancy, and the six old corpora lutea which were also present were shrunken, hard and small and did not appear to have been concerned in the twin pregnancy. In the other case the internal organs were too decomposed for examination. There are, however, the following records, among the statistics from South Georgia stations, which seem to show that occasionally several ova are shed at once, viz. seven foetuses in one Blue whale, six in one Fin whale and three in a Sei whale (see *Norsk Hvalfangst Tidende*, Sept. 1925, p. 99). Unfortunately, of course, no notes were taken of the condition of the ovaries of these whales, but it seems hardly likely that six or seven twins could develop other than from the discharge of several ova.

Enlarged follicles are found in a few ovaries during most of the year. Enlargement is sometimes general, both ovaries containing bulging follicles which give a decided impression of coming ripeness. Sometimes one or two follicles of about 20 mm. diameter are visible, while the remainder are very small and hidden beneath the ovarian epithelium.

In Fig. 124 the diameters of the largest follicles in Fin whale ovaries throughout the year are shown, all records for the seasons 1925, 1926 and 1927 are included. Although the numbers of ovaries examined in different months vary considerably, it will be seen that the "resting" ovaries, in which only small follicles are present, are commonest in the early months of the year, i.e. the latter part of the southern summer. The very few mature whales taken at Saldanha Bay had large follicles, and three whales which, though exceeding 19·0 m. in length, were still immature (female Fin whales become adult at about 20·0 m.) also had large follicles. This predominance of ripening follicles during the southern winter argues in itself a period of sexual activity, and the increase in size of the follicles of the three whales exceeding 19·0 m. suggests the approach of sexual maturity.

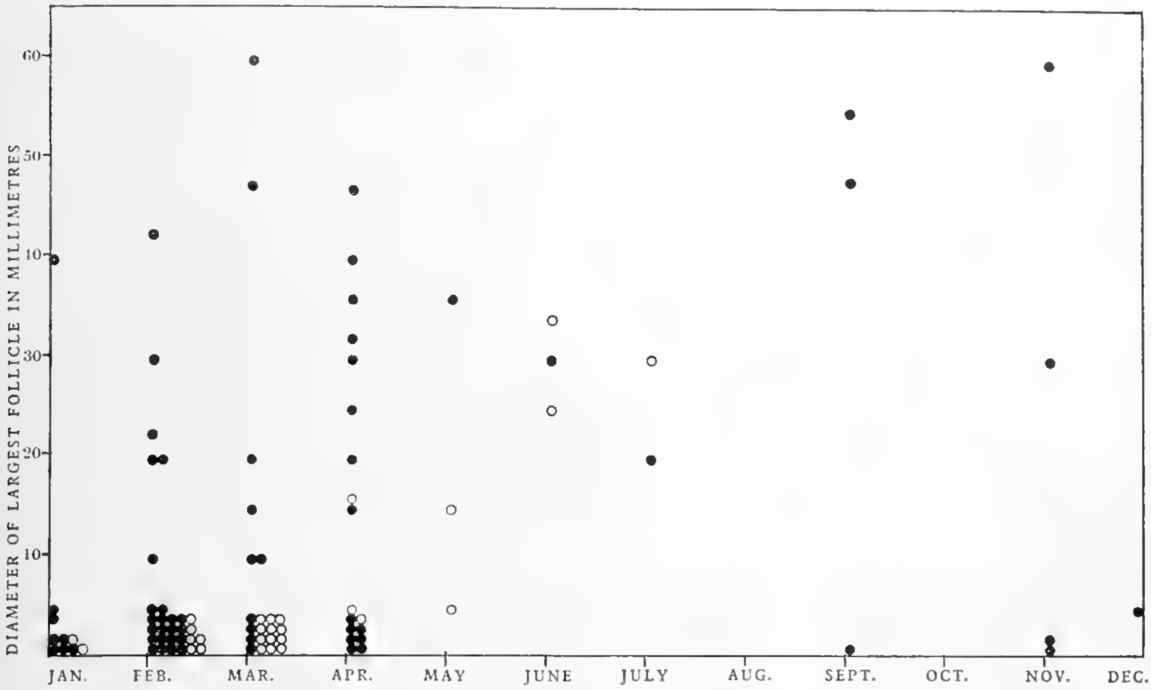

Fig. 124. Fin whales. Size of the largest ovarian follicles during the year.
● Mature females neither pregnant nor lactating. ○ Immature females longer than 19·0 m.

(c) *The Corpus Luteum of Pregnancy*

It is from the condition of the corpora lutea that the most important conclusions can be drawn as to the sexual condition and history of the whale. It will be convenient to start with an account of the corpus luteum of pregnancy.

When an ovum is shed the follicle from which it was liberated becomes a corpus luteum by inward growth and hypertrophy of the follicular epithelium, carrying with it blood-vessels from the surrounding tissue (see Marshall, 1922, who discusses in detail the physiology of the ovaries and gives references to original work on the subject). If fertilization occurs, the corpus luteum persists to all intents and purposes in its original condition throughout the period of gestation, but if pregnancy does not supervene it persists for a comparatively short time and then begins to undergo involution. In whales of all the species examined the corpus luteum of pregnancy is a very large and conspicuous body (Plate XL, figs. 3 and 4) with a scar marking the point of rupture of the follicle. The scar, which is sometimes of considerable size, consists of a dimple about 5 mm. in diameter surrounded by a raised area which may be called the "corona" and which may measure as much as 6·0 cm. in diameter. Internally the corpus luteum shows fine connective tissue strands radiating from the centre and dividing up the soft pale buff luteal tissue. In young luteal tissue the cells are vacuolated. This is illustrated in Fig. 125 from a section of the corpus luteum of a whale containing a 30 mm. foetus, and may be compared with the older tissue shown in Fig. 126. The mean diameter of the young corpus luteum is 10·5 cm. in Fin whales and 12·7 cm. in Blue whales. There is some indication that in both species it increases slightly in size up to the stage when the foetus measures about 1 m., and then gradually becomes slightly smaller. This is shown in Fig. 128 in which the sizes of the corpora lutea are plotted according to the length of the foetus. It will be seen that in general the smallest corpora lutea

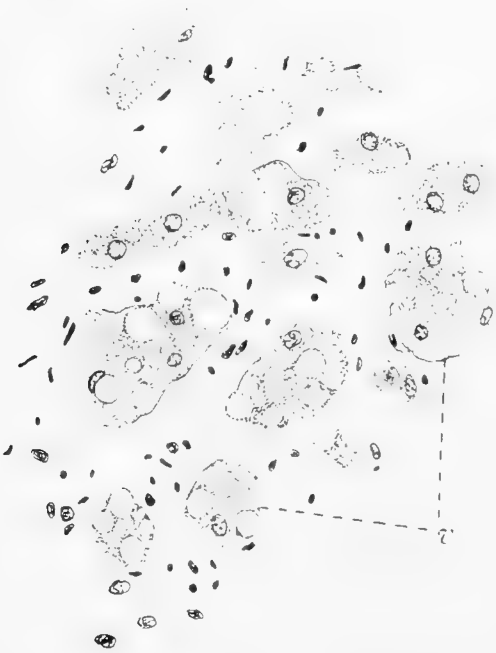

Fig. 125. Young luteal tissue from ovary of Blue whale with 30 mm. foetus. *v.*, vacuolated cells.

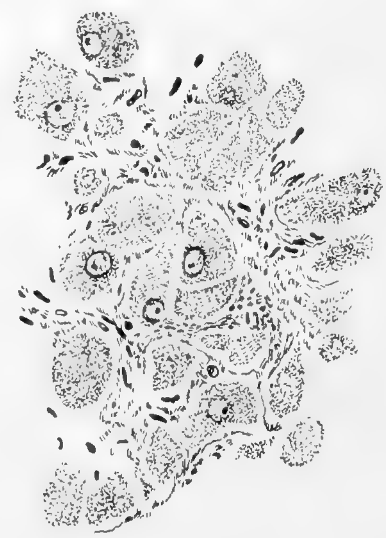

Fig. 126. Older luteal tissue from ovary of Blue whale with 6·3 m. foetus.

of this kind were those with which no foetus was found and which were therefore either corpora lutea of ovulation or corpora lutea of pregnancy which accompanied foetuses so minute that they were missed. It appears that the regression in size of the corpus luteum is accompanied by the disappearance of the vacuoles in the luteal cells. The luteal tissue now stains intensely with Nile Blue, indicating the presence of plenty of fat.

It is difficult to say whether the size of the corpus luteum continues to decrease up to the end of gestation owing to the small number of large foetuses which have been recorded, but in Fin whales there seems to be a slight decrease.

It may be mentioned here that there are invariably many enlarged follicles in the ovaries of pregnant whales, and these range in magnitude from 40 mm. to 50 mm. in diameter to 10 mm. and less. During lactation one or two large follicles are found but the smaller ones are no longer visible. It is known that a functional corpus luteum inhibits the growth of ova and the incidence of ovulation, so that the follicles seen in pregnant ovaries are those that would later have discharged their ova had not fertilization occurred. During lactation the larger follicles, having apparently attained a size that is beyond retrogression, remain large but lose the turgidity they had before and during pregnancy, while the smaller follicles retrogress to become again hidden beneath the surface of the ovary.

(*d*) *The Corpus Luteum of Ovulation*

In certain whales no foetus was found in the uterus yet a corpus luteum similar to the corpus luteum of pregnancy was present in the ovaries. Assuming that no foetus was missed in these cases, it may be said that these were corpora lutea of ovulation, i.e. representing an ovum which had been shed quite recently. There are, in such circumstances, two occasions on which a foetus may be missed. It may be lost at sea through premature birth when the whale is killed, or it may be so minute that it cannot be found. The former could hardly occur except when the foetus is fully large enough to leave unmistakable evidence of its presence in the uterus. There have in fact been two clear cases in which it has occurred, for in No. 373 (Fin) and No. 1602 (Sei), although no foetus was present, some of the membranes were still in the uterus, and even had these been lost the swelling and congestion of one cornu of the uterus could not have been missed. With regard to the second possibility it may be said that the smallest foetus can hardly be missed if searched for in the proper manner. When a functional corpus luteum is present in the ovaries the uterus is at once spread out and slit open from end to end. The foetal membranes of even a 2 mm. embryo form an object about the size of a thrush's egg and can readily be seen. It may be said then that those functional corpora lutea which were not found to be accompanied by a foetus, were corpora lutea of ovulation or were accompanied by a foetus not exceeding 1 or 2 mm. in length. It is in any case certain that in all the whales in question ovulation had occurred relatively very recently. Of these whales there were nine Blue and four Fin whales. None had any sign of a foetus and the copora lutea were on the average smaller than the corpus luteum of pregnancy except in No. 250 (Blue) in which the corpus luteum had a mean diameter of 14·7 cm. This contained an enormous cavity and was obviously a very young structure.

Corpora lutea of ovulation in Fin whales occurred at South Georgia once in February among fifty-two mature females, and at Saldanha Bay once in June (the only adult female), once in July (also the only adult female) and once in September (among three mature females). Very small embryos were found twice at South Georgia in January (one in 1926 and one in 1927) and once at Saldanha Bay in the only mature female taken in August. Now only 8 per cent of the female Fin whales taken at Saldanha Bay were adult, whereas at South Georgia over 60 per cent were adult. Thus the ratio of ovulating females to other mature females is overwhelmingly greater at Saldanha Bay than at South Georgia. That is to say, a far greater percentage of Fin whales are ovulating during the southern winter than during the southern summer.

Among Blue whales again at South Georgia one corpus luteum of ovulation was recorded in February among twenty mature whales taken in this month, two in March among thirty-six mature whales, one in May from among four adults, and one in October among seven adults. At Saldanha Bay there were three such corpora lutea in June among six mature females, and one in July among five adults. Early foetuses were found in July and August. Thus in the case of Blue whales also ovulation takes place to the greatest extent during the southern winter.

It is not known for certain whether ovulation takes place spontaneously, but there is evidence besides that furnished by the corpora lutea of ovulation to show that the ovum is shed at oestrus whether coition occurs or not. The corpora lutea simply show that fertilization of the ovum probably does not always occur, but this does not necessarily mean that copulation had not taken place. In a Fin whale (No. 76) of 20·2 m., the "vaginal band" was found intact, showing that coition almost certainly had not taken place. A small body like an old corpus luteum was however found in one of the ovaries which otherwise appeared to be immature. Luteal tissue was present in this structure surrounding a tough capsule with viscid contents. It is to be supposed that the follicle had matured early (the whale was captured at South Georgia in March) and formed a corpus luteum of ovulation following spontaneous rupture. The condition of the corpus luteum appears to have been abnormal, and it is not entirely certain that an ovum was actually shed, but the formation of luteal tissue shows that the follicle had at least attained a size ripe for shedding.

(*e*) *The Corpus Luteum subsequent to Parturition*

It is reasonably certain that ovulation does not normally take place after pregnancy until the end of lactation. Among all the whales examined no lactating whale was pregnant or showed any indication of ovulation. There have been reports of lactating whales which were pregnant (see Hinton, pp. 97 and 98), and one may suppose that though ovulation and fertilization may possibly occur during lactation, such an occurrence is extremely rare.

In the ovaries of whales captured during lactation there are normally several old corpora lutea, one of which is still conspicuously bigger than the others (Plate XLI, fig. 1). This is the former corpus luteum of pregnancy persisting after the birth of the foetus. It is much smaller and tougher than it was during gestation and the change appears to have taken place comparatively abruptly. In Fin whales the size varies from 4 cm. to 8 cm. diameter, with an average of 5·3 cm. In Blue whales the average is 7·0 cm. diameter. The changes in size and consistency are due to shrinkage of the luteal cells and growth of the connective tissue which take place rapidly after parturition. Sections of these corpora lutea stain faintly and generally with Nile Blue.

It remains now to consider the old corpora lutea which are often present in considerable numbers in the ovaries, and in various stages of degeneration (Plate XLI, figs. 2 and 3). More than one functional corpus luteum (i.e. corpus luteum of ovulation or of pregnancy) has never been known to occur at one time in the ovaries, but over thirty old corpora lutea have sometimes been counted in the two ovaries together.

The structure of these corpora lutea is similar to that which the corpus luteum of pregnancy assumes after parturition and the beginning of lactation, but they are smaller and still more compact and tough. Sometimes little more is seen than a scar at the apex of a hard and inconspicuous knob on the surface of the ovary. This, when cut open, shows radial white connective tissue strands with a small amount of whitish yellow tissue between them. Careful slicing of the ovaries reveals no traces of older corpora lutea which are not to be distinguished on the surface. The staining with Nile Blue is again faint and general.

It will be seen that two quite different types of corpus luteum are to be found in the ovaries of these whales. In the first place there is the functional corpus luteum of ovulation or pregnancy which is a large and conspicuous structure composed mainly of soft luteal cells. One cannot say how long the corpus luteum of ovulation (i.e. where pregnancy does not supervene) remains unchanged, though this is presumably for a comparatively short period. The corpus luteum of pregnancy persists as such only until the end of gestation. In the second place there is the old functionless corpus luteum formed by a kind of metamorphosis of the functional corpus luteum of ovulation or pregnancy. This body remains essentially the same during its earlier stages in the period of lactation and in its later stages of gradual absorption. The two types may for purposes of convenience be referred to as corpus luteum *a* and corpus luteum *b*.

There are several reasons for inferring that the retrogression of the corpus luteum after gestation and lactation is extremely slow, so much so in fact that it is probably never completely absorbed. The co-existence of a corpus luteum of pregnancy with several of these corpora lutea *b*, some at least of which must have persisted since a previous breeding season, is in itself evidence that this is the case. It is at least quite certain that the corpus luteum persists for more than a year since, although there is an annual breeding season among whales which falls only in a certain season, no mature female is ever found, except those which have evidently only just become mature, which has not several corpora lutea *b* in the ovaries no matter at what time of year it is captured. A slight indication of the rate of absorption of the corpus luteum *b* is shown in Figs. 127 and 128 in which are plotted the mean diameters of the largest (and therefore presumably the most recent) corpus luteum *b* in either of the ovaries where a corpus luteum of pregnancy was present. The plotted points show in general in the case of Fin whales a gradual reduction in size of the corpus luteum *b* during gestation, but there are insufficient data referring to the latter part of the period of gestation to allow of any quantitative estimation of the average rate of regression. The data in the case of Blue whales are insufficient to show any very definite results.

In any pair of ovaries containing fairly numerous corpora lutea *b*, it is found that the smaller corpora lutea are more numerous than the larger, and since the size is a rough indication of the age, it follows that the older the corpus luteum the slower becomes its rate of decrease in size. Fig. 128 suggests that in the case of Fin whales the youngest corpus luteum *b* shrinks from about 5 cm. diameter to 3 or 4 cm. during a period of about 10 months (i.e. the period of gestation). Thus one might say on a

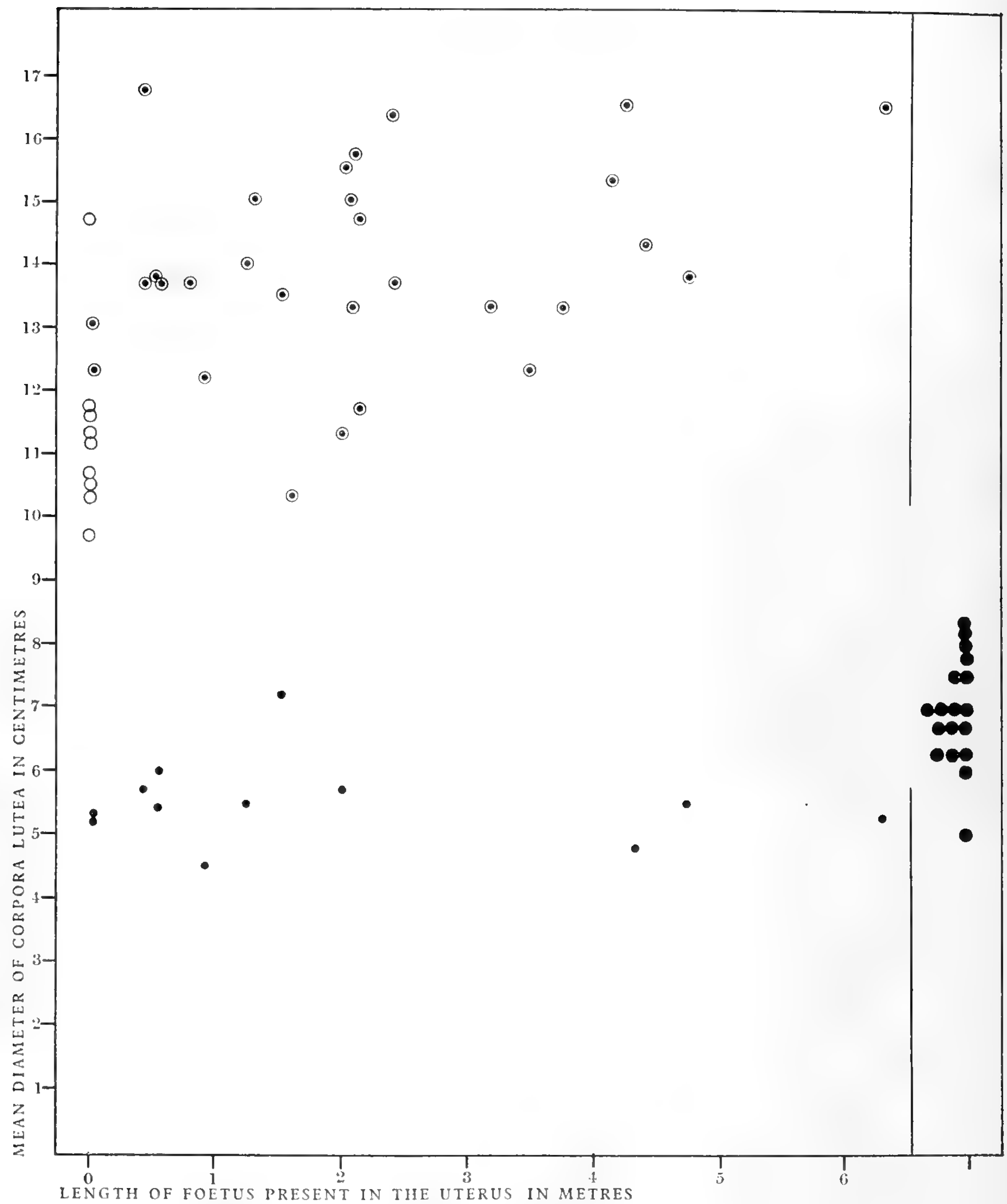

Fig. 127. Blue whales. Mean diameter of corpora lutea in ovaries of pregnant females, and length of foetus.

○ Corpus luteum of ovulation. ⊙ Corpus luteum of pregnancy. ● Former corpus luteum of pregnancy persisting during lactation. • Largest old corpus luteum co-existent in the ovaries with a corpus luteum of ovulation or pregnancy.

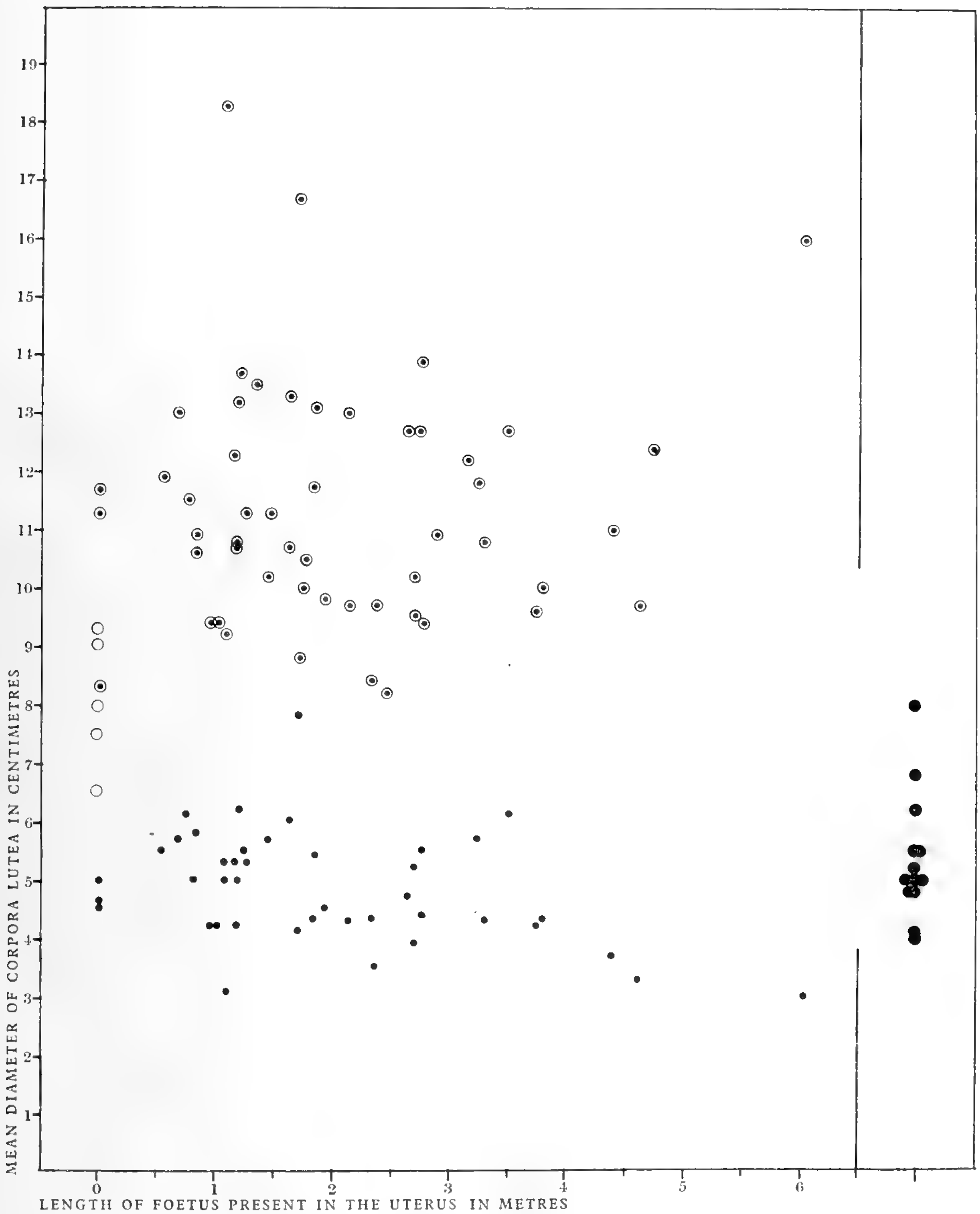

Fig. 128. Fin whales. Mean diameter of corpora lutea in ovaries of pregnant females, and length of foetus.

(For meaning of symbols see Fig. 127.)

rough estimation that in its first year the diameter of the corpus luteum *b* probably becomes reduced by about 40 per cent, and since this is the period during which reduction is most rapid it is to be supposed that many years must pass before it could completely vanish if indeed the last traces of it ever do disappear. It seems that this much may be inferred, even though a quantitative estimation of the average rate of regression is inadmissible.

Further evidence of the longevity of the corpora lutea *b* may be obtained by comparing their numbers in the ovaries with the lengths of the whales from which they were taken. This comparison is shown in Figs. 129 and 130. It will be seen that there is a great diversity in the numbers of corpora lutea at any given whale length, but the important fact emerges that in general the smaller whales have fewer corpora lutea than the larger whales, the correlation being better defined in the smaller than in the larger whales. Now up to a point the length of a whale is obviously some indication of its age, and it must be supposed that the correlation existing between the number of corpora lutea and the length of the whale is in fact a correlation of some kind between the number of corpora lutea and the age of the whale. Female Fin whales become adult when they reach a length between 19·5 and 20·5 m. (see p. 417) and one would expect that they would normally continue subsequently to grow a metre or two beyond this length, some ceasing to grow at about 22·0 m. others going on to 23·0 or 24·0 m. On the supposition that the number of corpora lutea are an indication of the age of the whale this fits in well with the fact that in Fig. 130 there is a more obvious correlation in the case of whales measuring 19·5 to 21·5 m. than in the case of the larger whales, many of which will have ceased to grow and whose length is thus little indication of their age.

If all the corpora lutea in the ovaries were those of the previous season (as was suggested by Barrett-Hamilton) this correlation with the length of the whale should not exist as there is no reason why large whales should ovulate without the occurrence of fertilization more times than small whales. Persistence and accumulation of the corpora lutea, however, explains the correlation at once.

It has already been pointed out that although the number of corpora lutea varies to some extent with the length of the whale, there is still a great diversity in the number occurring at any particular whale length. This can be set down to one of two causes. The first of these is the differences in length attained by the whales at and after sexual maturity, and has already been discussed in certain particulars. Although female Fin whales become mature mostly at about 20·0 m. and Blue whales at about 23·7 m. the difference actually between the smallest mature and the largest immature whale is relatively large. Then where for instance two whales differ slightly in length, the difference may be due to age, the rates of growth having been equal, or it may be due to differences in the rate of growth, the ages being equal.

The second cause for the variation in the numbers of corpora lutea is due to the difference between the number of pregnancies and the number of ovulations which may have occurred. From evidence already given it may be taken that ovulation

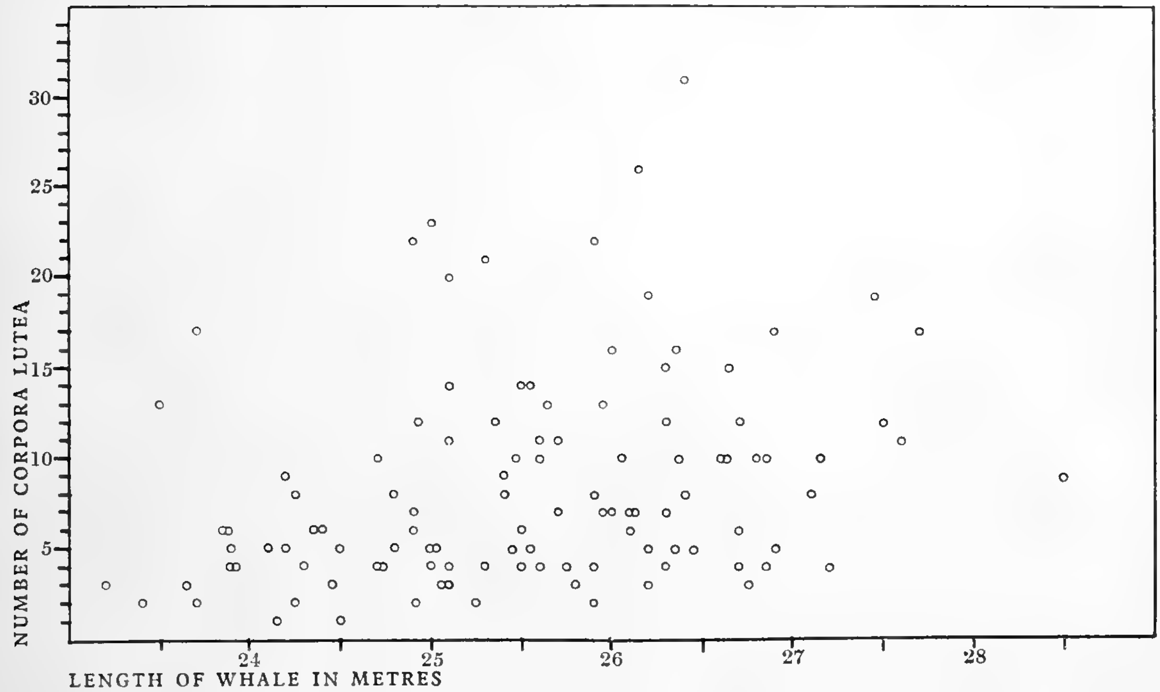

Fig. 129. Blue whales. Length of female and number of corpora lutea in the ovaries.

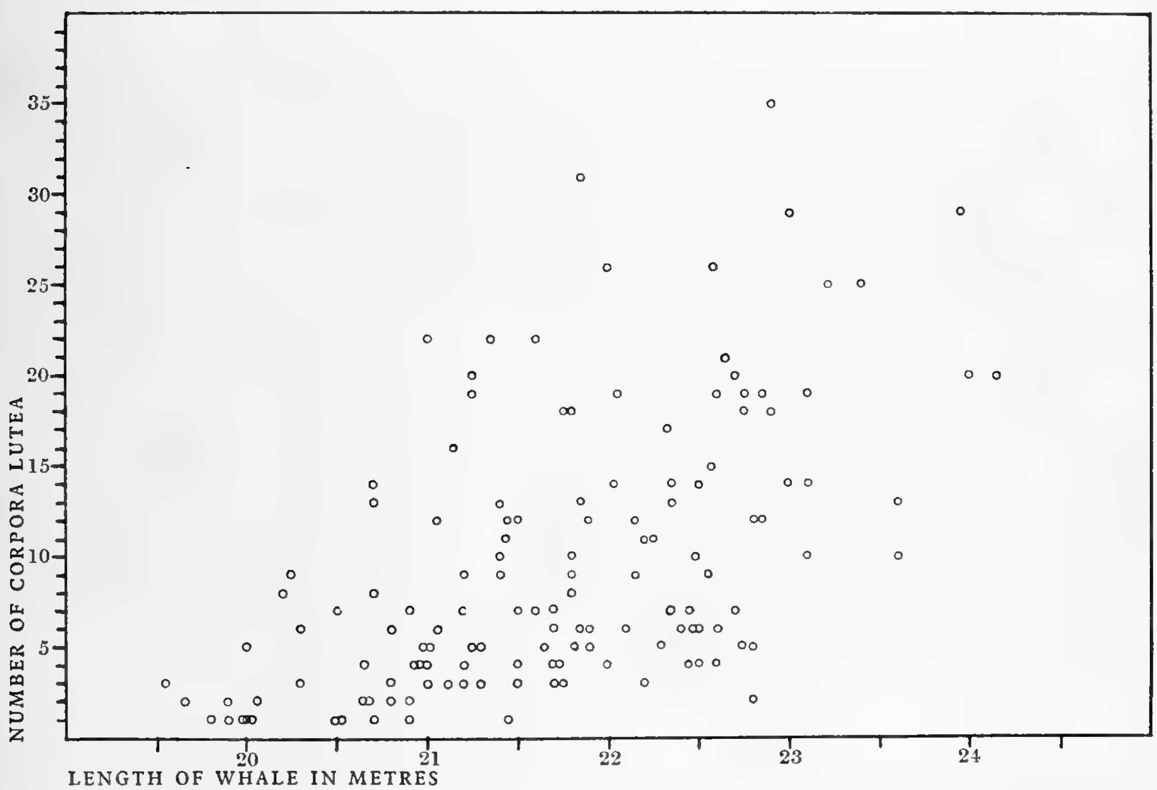

Fig. 130. Fin whales. Length of female and number of corpora lutea in the ovaries.

can take place without fertilization, and that many follicles are ready for subsequent ovulation should fertilization not occur. Now if fertilization occurs at the first ovulation every season the number of corpora lutea represents the number of pregnancies which have taken place and the number of years since sexual maturity was reached (except possibly in the case of the oldest whales in which the oldest corpora lutea might have finally vanished). With ovulation, however, taking place spontaneously and no method of distinguishing the corpora lutea formed from those of pregnancy it is evident that there will be great differences in the numbers of corpora lutea present among whales of similar length, differences depending on the number of dioestrous cycles which may have taken place each season before pregnancy supervened.

Finally, a few words may be said in recapitulation of the more important facts which emerge from the study of the ovaries. There are two specially characteristic features of the ovaries of the Balaenopteridae. These are the abundance of ripening follicles which are so often present and the curious longevity of the old corpora lutea. The number of follicles implies a capacity for producing numerous ova in quick succession, and this favours the supposition that these whales are polyoestrous. The suggestion is further supported by other evidence. There are several cases for instance in which over thirty old corpora lutea have been counted in a single pair of ovaries, and if whales are monoestrous it follows that some of these have persisted for not less than thirty years. It seems much more reasonable to suppose that the large number is the result of several unsuccessful ovulations in a comparatively few seasons. Again, it will be shown later that the breeding season is a protracted period covering several months. This in itself suggests that a succession of dioestrous cycles may occur and that in some cases conception occurs after the first ovulation and in other cases not until several ovulations have occurred and the season is well advanced.

The longevity of the corpora lutea provides a useful indication of the history of the whale in which they occur. The weak point here, however, lies in the fact that the number of corpora lutea depends partly on the number of years which have elapsed since sexual maturity and partly on the number of ovulations which have occurred in each sexual season, and there is no means of knowing how much each factor has contributed to the number of corpora lutea which are found. However, one would not suppose that more than a very few ovulations would occur before pregnancy supervened among animals living in a state of nature, even though it is likely that ovulation may occasionally take place at times of year outside the season at which breeding activities become general. It follows from this that a whale having twenty or thirty corpora lutea *b* in the ovaries can hardly have been adult for less than five or six years, and has more probably been adult for say twelve or fifteen years. On the other hand, a whale having only three or four corpora lutea will probably be not more than two or three years old.

THE UTERUS

The uterus consists of a relatively short corpus and two long cornua which are generally to be found close to the ventral wall of the abdominal cavity. There is no particular feature of its gross anatomy which needs any special consideration but an account of its growth in the young whales and the alterations in size which it undergoes at different stages may be given. The routine observations which have been made on the uterus consist in the measurement of the width of one cornu

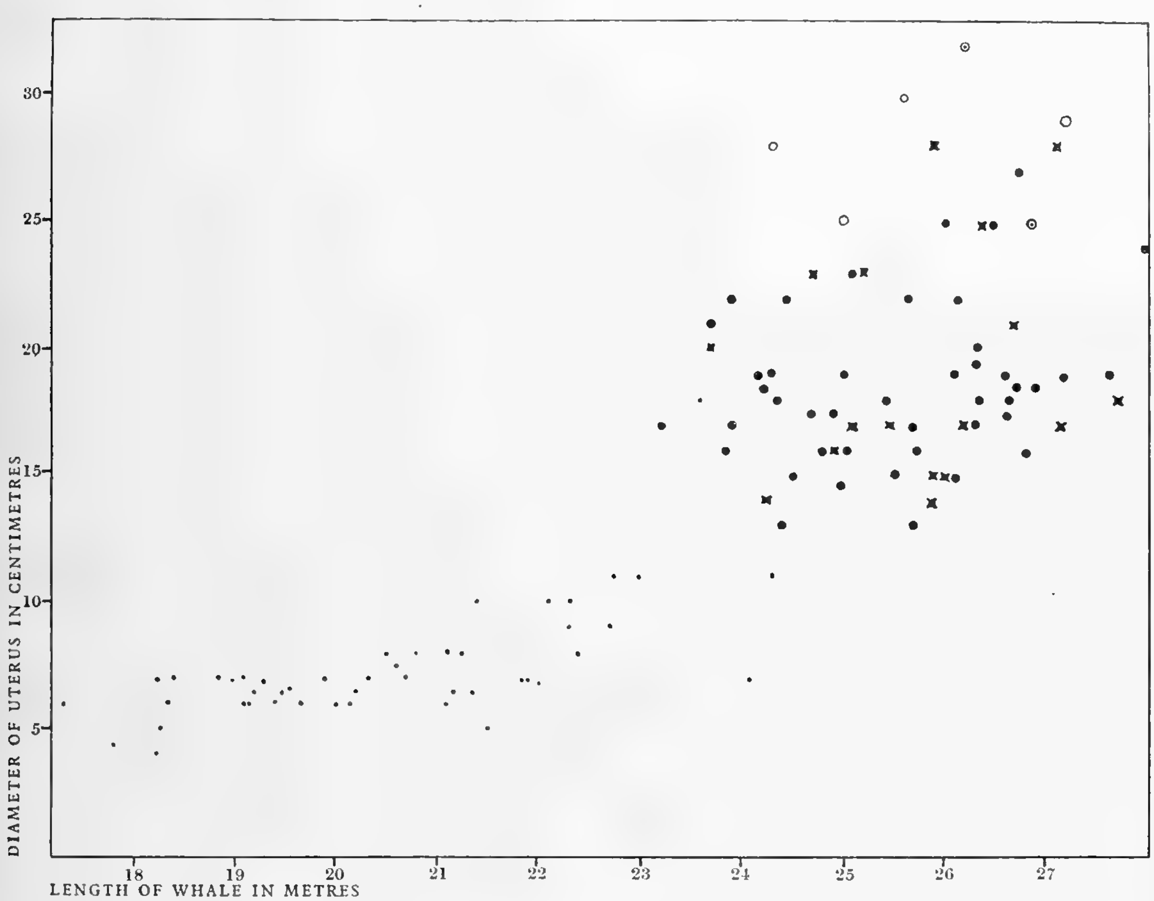

Fig. 131. Blue whales. Size of uterus in whales of different classes and different sizes.

• Immature. ● Resting. ○ Recently ovulated. ⊙ With very small foetus. × Lactating.

as it lies in the collapsed condition on the flensing platform, and records of any congestion observed when it has been slit open. Histological examination has also been undertaken in many cases.

During the period between birth and sexual maturity the uterus undergoes no important change other than a gradual increase in size to keep pace with the growth of the body. The sizes of the uterus in immature whales of various lengths is shown in Figs. 131 and 132 and it is seen that it does not much exceed 8 cm. in Blue whales measuring less than 22·0 m., or 7 cm. in Fin whales measuring less than 19·0 m.

Maturity is reached in Blue females at about 23·7 m. and in Fin females at about 20·0 m. and it will be noticed that just before these lengths are reached the still immature uterus undergoes an acceleration in its growth, and by the time maturity is reached it has become conspicuously bigger, measuring not less than 13 cm. in Blue whales, or (with one exception) less than 11 cm. in Fin whales. Fluctuations of course take place subsequently in the size of the uterus, but once the functional enlargement has taken place it never returns to its original size.

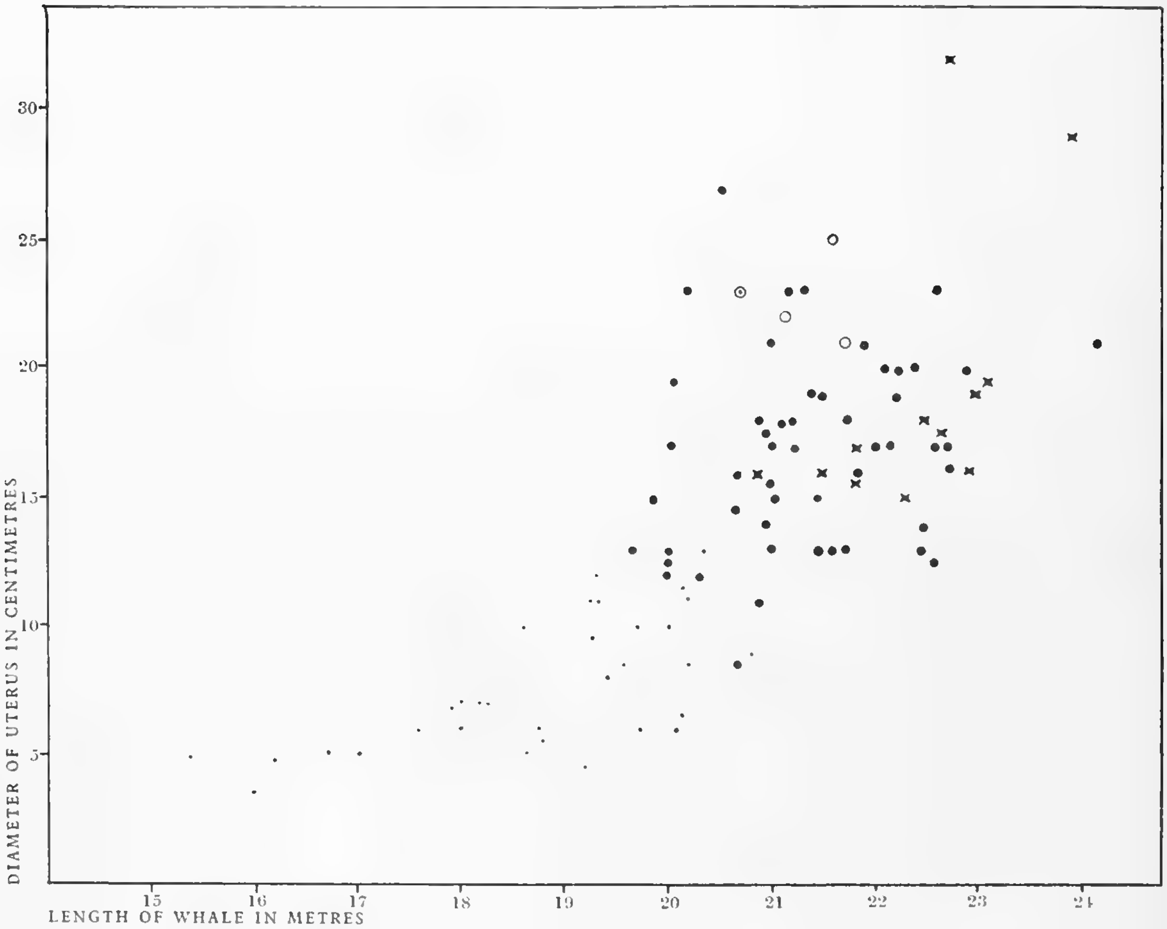

Fig. 132. Fin whales. Size of uterus in whales of different classes and different sizes.
• Immature. ● Resting. ○ Recently ovulated. ⊙ With very small foetus. × Lactating.

In "resting" whales (i.e. those mature females which are neither ovulating, pregnant nor lactating) the average size of the uterus is about 17 cm., but, as will be seen in Figs. 131 and 132, it may range from less than 10 cm. to over 25 cm. A new increase in size, however, takes place at ovulation for it will be seen that the size of the uterus is clearly above the average in those whales in which a corpus luteum of ovulation or an early foetus not yet big enough to necessitate an increased size, has been found.

In pregnancy the uterus grows to an enormous size, for the foetus reaches a length of 6 or 7 m. before it is born, but after parturition involution takes place with surprising rapidity. In almost all the lactating whales examined involution has been complete.

In a few cases the size of the uterus has been still above the average for resting females, but in the majority of cases it has been as low as, if not lower than, the average. This may be seen in Figs. 131 and 132. In the latter figure attention may be drawn to two Fin whales having remarkably large uteri in which involution was evidently not complete. In only one case (not included in the above figures) did the uterus appear to have actually been in an early stage of involution. This was in a Blue whale, No. 770, caught at Saldanha Bay on June 21. One cornu of the uterus measured 48 cm. and was thin walled. The other measured only 21 cm. The congestion of the large cornu was evident before it was opened, and the corpus of the uterus, which measured 30·0 cm., was also congested. This whale had evidently given birth to a calf quite recently, and it is interesting to note that though involution of the uterus had hardly begun, the corpus luteum had completely changed from the *a* to the *b* type.

Although only this one whale has been met with in which the uterus had not recovered from pregnancy, it must be remembered, in discussing the rate of involution, that the majority of lactating whales killed are those accompanied by large rather than small calves. This is partly because the waters which come within the sphere of the whaling operations appear to be frequented less by the whales which have recently given birth than by those accompanied by large calves, and partly because the whaling regulation in force in the Falkland Island Dependencies, against the killing of mothers with calves, is probably applied more to the small calves than to the large ones which may be very difficult to recognize as such at sea.

Since it conveys some idea as to whether parturition has occurred recently or not, the involution of the uterus is the most important point for observation so far as this organ is concerned.

The changes in the size of the uterus are mainly caused by alterations in the blood content of the uterine mucous membrane, and accompanying them are changes in the mucous exudation from the vagina.

For the histological study of the uterine mucosa small pieces of the uterus were occasionally taken from the cornu about half-way between the uterine end of the Fallopian tube and the junction of the cornua. They were fixed in Bouin or formol-saline, and after sectioning were stained in haematoxylin and eosin.

The mucous membrane of the uterus is typical, but the ciliated epithelium is rarely intact over the surface. Even in immature whales (Plate XLII, fig. 1) it is usually lost except in the openings of the glands.

In sections of the mucosa no very striking difference is apparent between immature and mature "resting" whales, though the latter may or may not show some congestion. In two Fin whales, Nos. 111 and 193, for instance, there was a considerable amount of blood in the capillaries, and in some other whales taken in the same months as these (March and April) some congestion at the edge of the mucosa was found.

During early pregnancy blood is present in large quantities throughout the mucosa and is especially evident at its edge (Plate XLII, fig. 3). Extravasation of blood takes place, but it is possible that the extra blood supply is kept up until after parturition, since during early lactation more blood appears to break away (Plate XLII, fig. 4). The material collected did not cover the later stages of gestation. Sections were cut of the uteri of six pregnant whales, and the foetuses present were all in comparatively young stages, viz. Blue whales 0·55, 0·91 and 1·52 m.; Fin whales 0·81, 1·09 and 1·63 m. Later in lactation the uterus returns to the resting stage shown in Plate XLII, fig. 5.

Fig. 137 shows the uterus of a whale (Fin, No. 877, 13. vii. 26) in which ovulation had taken place, i.e. there was a corpus luteum *a* in the ovary but no sign of a foetus in the uterus. The capillaries at the edge of the mucous membrane appeared to be dilated—they were more evident in this section than in any of the others—but they contained no blood corpuscles, while vessels in the deep mucosa were full of blood.

The change in size of the uterus at ovulation is due to the increasing supply of blood and the congestion of the uterine tissue. If ovulation passes without fertilization the uterus tends to return to the normal. If, however, pregnancy supervenes the congestion remains, at least for a time. At parturition also it is congested and presumably it has remained so throughout gestation. During lactation the uterus returns again to normal, both in size and in condition of the mucosa.

A number of smears of vaginal mucus from different whales were collected and stained in an endeavour to trace the course of the generative processes. This method was used with some success by Long and Evans (1922) in their work on the oestrous cycle in the rat. Care was taken that no apparent injury had been done to the internal organs in the whales from which the smears were taken, for blood for instance may sometimes be present in the vagina as a result of injury by the harpoon.

The whales examined were as follows: four immature (Nos. 191, 203, 187 and 192), five mature "resting" (Nos. 184, 185, 208, 260 and 264), one recently ovulated (No. 250), two pregnant (No. 253, foetus 1·52 m., and No. 186, foetus 2·65 m.), and two lactating (No. 244, uterus 22·0 cm., and No. 271, uterus 17·0 cm.).

The results were constant although in this small number of cases only the obvious differences in the cells occurring in the mucus can be pointed out.

In immature (Fig. 133) and resting mature whales the mucus contains small clumps of epithelial cells (portions of epithelium) and many isolated cells, some from the surface of the mucosa, others from the epithelium of the glands. In immature whales a few red blood corpuscles occur. The presence of epithelial cells may account in part for the absence of much of the uterine epithelium in sections of the mucosa.

Fig. 133. Cells from vaginal mucus of immature whale. *ep.c.*, epithelial cells; *c.gl.*, cells from glands; *r.b.c.*, red blood corpuscles.

In regard to pregnancy a smear from a whale containing a foetus of 1·52 m. showed that the dominant cells were red blood corpuscles with a few polymorphonuclear leucocytes. In a whale with a larger foetus (2·65 m.) the mucus was very thick and few cells could be seen. Epithelial cells together with blood corpuscles were, however, present. If this second case is typical it suggests that extravasation of blood may not continue throughout pregnancy.

The smear from the ovulating whale differed entirely from those from the pregnant whales. There were many isolated epithelial cells present, with many other cells with smaller nuclei of doubtful origin. As one would expect from observations on sections of the uterine mucosa, no blood corpuscles could be seen.

In lactating whales the epithelial cells and red blood corpuscles were few. In No. 271, which had a uterus of 17·0 cm., more epithelial cells were present than in No. 244. In these whales apparently the extravasation of blood had almost ceased.

THE MAMMARY GLANDS

The mammary slits are situated on either side of the genital groove, and lie parallel to it. The teats are normally completely withdrawn and invisible, but in lactating whales drawn on to the flensing platform they are more or less everted, though not always

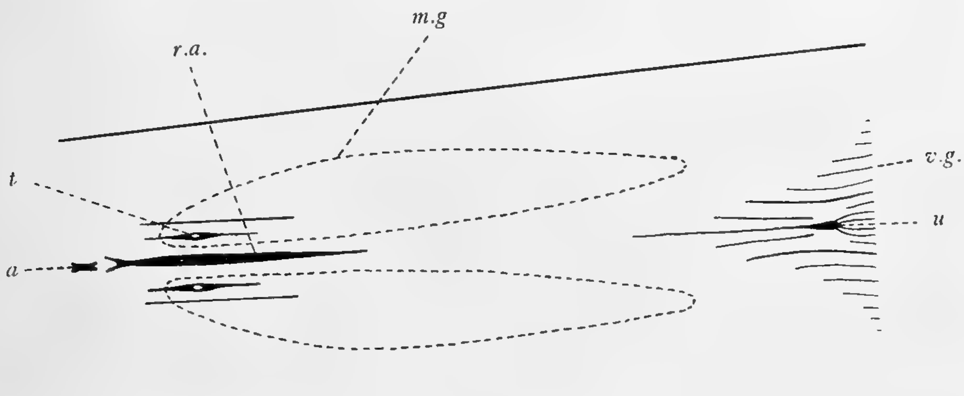

Fig. 134. Diagram of ventral view of whale to show position of mammary glands. *m.g.*, outline of mammary glands; *r.a.*, reproductive aperture; *t.*, teat in mammary groove; *a.*, anus; *u.*, umbilicus; *v.g.*, endings of ventral grooves.

completely. Sometimes when plenty of milk is present the pressure of the carcass on the edge of the platform causes it to spout from the teat in such a way that a sample can be collected sufficiently pure for chemical analysis. An account of the composition of whale's milk appears in Appendix I.

A good description of the mammary glands of the Humpback is given by Lillie (1915, p. 101). This however deals mainly with the gross anatomy of the gland and the process of suckling, while we are concerned more with the changes which take place in the gland in the different phases of the sexual cycle.

In Blue and Fin whales the mammary glands lie between the blubber and flesh and are situated almost entirely anterior to the teats. They are of an elongated pear-shape, the apex of the pear being anterior to and remote from the teats (Fig. 134). The length of the gland is about 2 m. and its depth varies according as to whether the whale is sexually mature or immature and whether milk is being secreted or not. In an immature whale the gland is usually not more than 2 cm. deep at the widest part. In a mature whale it is usually 5 to 6 cm. deep, and in a lactating whale 15 to 30 cm. deep. When the gland is in full activity the swelling is usually distinguishable externally (Plate XXX, fig. 1), and is very evident after the blubber has been removed from it (Plate XXXV, fig. 3). When milk is not being secreted the outline may be almost indistinguishable even after flensing.

Several large ducts run longitudinally through the gland. These are fed by numerous smaller ducts and become enlarged posteriorly to form sinuses or reservoirs for the milk. They join finally in one large sinus which communicates with the teat.

If the gland of a sexually mature whale which is not lactating is cut across, it is seen to consist of numerous lobes subdivided into small pinkish lobules, with ducts of all sizes and blood-vessels. There may be some variation in the amount of blood which is present. These pink lobules are not seen in immature whales, but the connective tissue in which they subsequently develop can be distinguished quite easily.

When examined histologically the gland in whales does not appear to differ in any essential from that of other mammals. The greater size of the gland appears to be allowed for by increased numbers of the alveoli in a lobule, and multiple subdivision of the lobes of the gland, rather than by any different structure.

It will be convenient to describe first the immature gland. This shows the same structure both in the foetus and in large though still sexually immature whales. When examined histologically it is found to consist mainly of connective tissue in which a few ducts and blood-vessels are seen, of which the former are surrounded by clusters of cells forming imperfect alveoli grouped together in small lobules (Fig. 135). In some cases (such as adult whales which have not yet been pregnant) the distinction between the immature and mature condition is not very sharp, but as a rule there is no difficulty in recognizing the immature type.

Among sexually mature whales the gland may be found in no less than four different conditions. These are as follows:

1. *Lactating*, in which milk is being actively secreted.

2. *Intermediate*, in which the lobules of the gland are better developed than in the resting condition, but less than in the lactating condition. This condition appears to occur immediately before lactation and again in the apparently prolonged involution of the gland afterwards.

3. *Resting*, in which complete involution appears to have taken place.

4. *Virgin*, which occurs in a few young adults which have probably never been pregnant.

In the lactating gland (Fig. 136) the lobules are greatly swollen, and the space between them which is occupied by connective tissue is considerably restricted. The alveoli are distended and their outline is rounded and relatively distinct. Droplets of secretion are clearly seen in the lumen of the alveolar cells which are noticeably swollen and have small, densely staining nuclei. The lumen of the alveoli is filled with larger droplets, the size of which, however, may vary. This variation might possibly depend on the freshness of the whale when the tissue was fixed, or it might be correlated with the rate at which the secretion is being drawn off, or with variations in the constitution of the milk. Sometimes the outlines of these droplets is in the form of a complete circle; at other times (possibly when the gland has been emptied by suckling) the outlines are broken up or fragmentary. Where an osmic acid fixative is used the droplets are densely blackened, no doubt owing to the very high percentage of fat which is present in whale's milk. In such cases the droplets within the lumen of the cells are similarly blackened.

The depth of the mammary gland during the secretion of milk varies in Blue and Fin whales between about 15 and 30 cm.

Fig. 135. Section of the immature mammary gland.

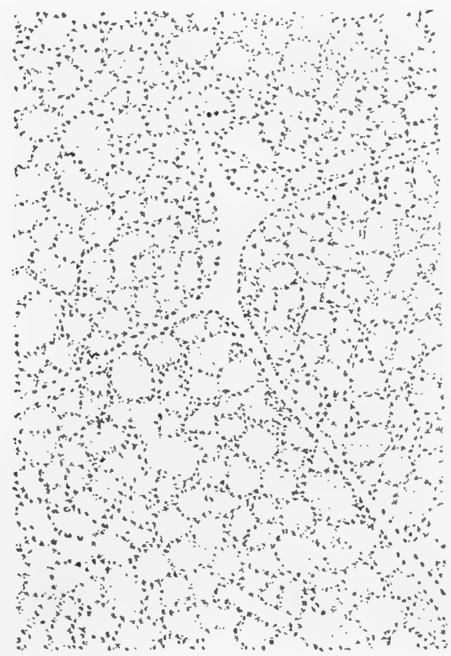

Fig. 136. Section of mammary gland in functional activity.

The intermediate stage occurs in certain sexually mature whales in which the mammary glands are not functionally enlarged. It has been seen that during lactation the lobules become greatly swollen and compress the intervening connective tissue into the smallest possible space. In the intermediate stage the lobules appear either to have started swelling in preparation for lactation, or, more often, are in the process of contracting after the end of lactation. This condition is never found in pregnant whales except at the very end of gestation, but it is curious that it occurs more often in "resting" whales than the normal resting condition which is almost always present in pregnant whales. The lobules are still large (Fig. 137), and, though noticeably smaller than in lactating whales, they are considerably better developed than in the resting stage. The connective tissue space is still restricted, but the alveoli are shrivelled and smaller than in the lactating gland, their outline is less easily traced, and their lumen, at least in haematoxylin-eosin preparations, is not easy to distinguish. Droplets are practically absent from the alveoli, though one or two may sometimes be visible here and there. The nuclei of the cells lining the alveoli are larger than in the lactating gland, and stain less densely.

The thickness of the gland during this stage rarely exceeds 10 cm.

The resting stage occurs in a certain number of whales which are neither pregnant nor lactating and has been found with one exception in the case of all pregnant whales in which the gland has been histologically examined in this respect. It differs from the intermediate stage principally in the size of the lobules (Fig. 138) which are definitely

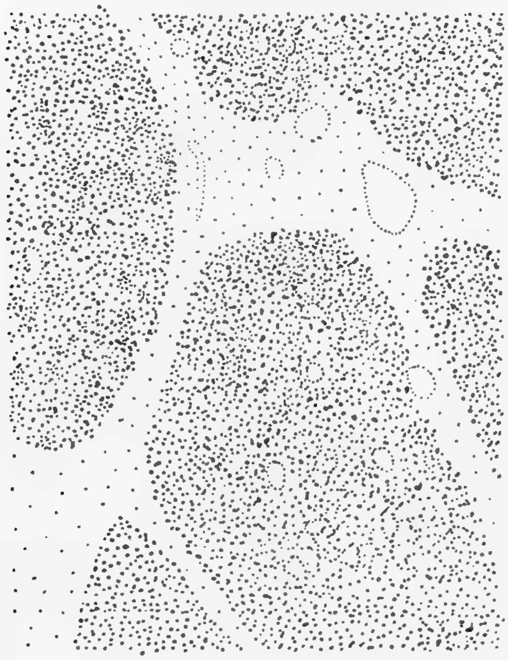

Fig. 137. Section of mammary gland not completely returned to the normal condition.

Fig. 138. Section of mammary gland after complete involution.

smaller and more numerous in a given area of section. The nuclei are usually more numerous in a given space but are similar in individual appearance. The alveoli have shrivelled to such an extent that they cannot now be distinguished. Usually the lobules are flattened or elongated in cross-section, perhaps owing to collapse of the gland as a whole. This is not an invariable rule, however, and the appearance of the lobules no doubt depends to some extent on the plane in which the section was cut.

The thickness of the resting gland is usually between about 4 and 8 cm. and is only a little less than that of the intermediate gland.

The fourth condition of the mammary glands, which is found in young whales which in all probability have never been pregnant, or are pregnant for the first time, differs from the state of the gland in immature whales only in a slightly better development of the lobules which are still less developed than in the resting gland. This condition has been found in several whales with only one or two corpora lutea.

The thickness of the gland here is of course intermediate between that of the resting and that of the immature gland. The latter is usually about 2 cm. deep.

Excluding lactating and immature whales the number of Fin whales of which the mammary glands have been sectioned is thirty-three and of Blue whales eight. The numbers of these occurring in each condition are as follows:

	Fin	Blue
"Resting" whales:		
Intermediate	7	3
Resting	3	1
Virgin	3	—
Doubtful	4	—
Pregnant whales:		
Intermediate	1	—
Resting	14	4
First pregnancy	1	—
Total	33	8

Taking pregnant whales first it is found that only in one case was there a mammary gland in the intermediate condition. This whale, No. 175, had a foetus measuring over 6·0 m. which was evidently about to be born, and there is no doubt that the lobules of the glands were beginning to develop in preparation for active secretion. Now, where the gland is found in this condition in whales which are not pregnant it must be supposed that, lactation having ceased, the gland is now reverting to the normal resting condition, and since the ratio of the intermediate to the resting conditions is 7 to 3 among Fin whales and 3 to 1 among Blue whales it can only be supposed that though the development of the gland is rapid at the end of pregnancy, its involution after the period of secretion is very slow. It seems improbable that the majority of "intermediate" non-pregnant whales had only just finished lactation, since the resting whales are caught in far greater numbers than the lactating whales—a fact which argues that the resting period is correspondingly longer than the lactating period or at least as long, even if the nursing mothers lead a more secluded life less open to the attacks of whale boats.

Since the intermediate stage is never found in pregnant whales except at the approach of parturition it follows that the involution of the gland is always completed before pregnancy again takes place, but since in some young but clearly adult whales the gland is sometimes found in a state far less developed than the normal resting condition, it is to be supposed that it becomes permanently altered after the first pregnancy.

THE TESTES

It is well known that in Cetacea the testes remain permanently in the abdominal cavity. In the whalebone whales, as explained on p. 267, they can be found without difficulty near the abdominal wall at the posterior end of the cavity. The testis is a rounded cylindrical organ, the size of which is subject to considerable variations which are very difficult to correlate with any particular factor. However, it is worth while to examine the matter as closely as possible. It should be explained first that for convenience the size of the testis may be represented by a number obtained by multiplying together the length, breadth and depth measured in centimetres. This gives a rough approximation to (actually rather more than) the volume of the testis in cubic centimetres. The size of the smallest testis of a Blue whale recorded in this way was 330 (No. 594) and of a Fin whale 300 (No. 705). The largest testes were of a Blue whale 58,000 (No. 1331) and of a Fin whale 56,000 (No. 51). As an accurate representation of the size of the testis is unnecessary a figure may be used giving the number of thousands of cubic centimetres in the approximate volume. Thus the largest Blue whale testis may be considered to measure 58, and the smallest 0·3.

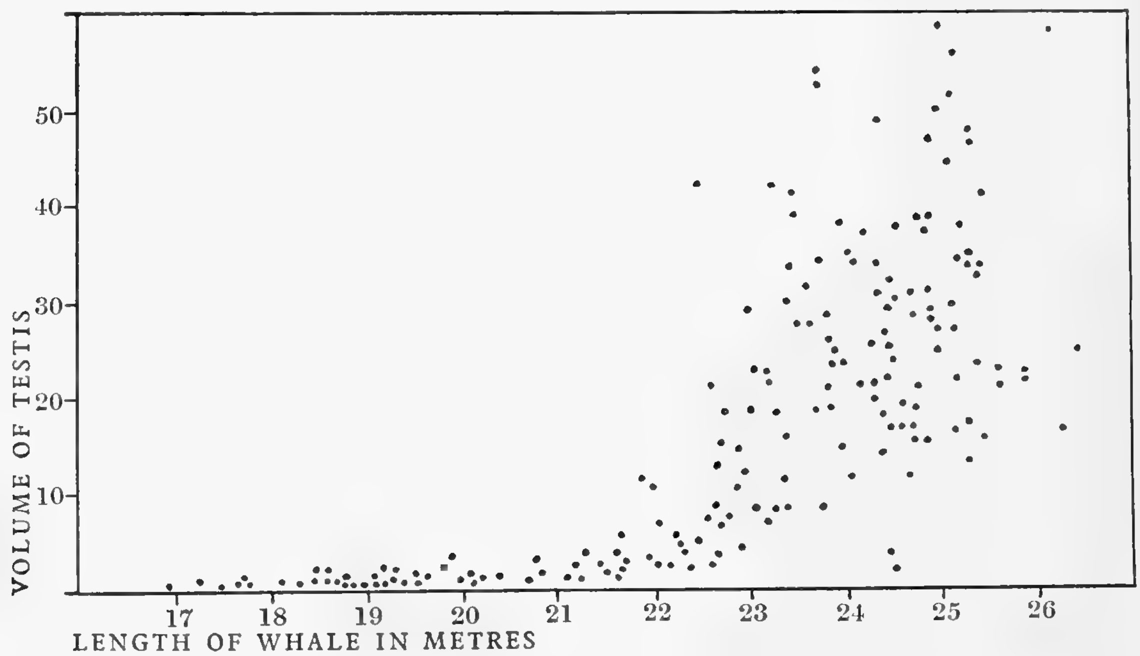

Fig. 139. Size of the testis in Blue whales of different lengths.

As was to be expected, the size of the testis up to a point varies with the size of the whale, this being in part due to the fact that the former becomes much larger at the advent of sexual maturity. Fig. 139 shows the testes of 180 Blue whales plotted according to the size of the testis and the length of the whale. It will be seen that up to a length of about 23·5 m. there is a general tendency for the size of the testis to increase, but from 23·5 m. onwards it cannot be said that there is any correlation between its size and the length of the whale. The plotted points represent all the Blue whale testis measurements which have been taken (in large numbers of immature whales of course the testes were not examined) and are plotted therefore quite irrespectively of the time of year. It is to be supposed from Fig. 139 that during immaturity the testis increases its size very slowly, but that when sexual maturity is reached (around 22·5 m.) it rapidly increases in size, and continues to increase over the period during which the whale increases its length by one or more metres. Among whales over 23·5 m.

in length, the age or size of the whale evidently ceases to be the factor which dominates the size of the testis, and other factors must be sought in order to explain the great variations in its size in large whales. In the porpoise the testis is described by Meek (1918) as undergoing an enormous development in the summer (northern hemisphere), the breeding season being in July and August, and it is natural to suppose that something similar might occur in the Balaenopteridae. If this were so the size of the testis might provide a valuable clue to the period and duration of the breeding season. Unfortunately, however, there is no evidence that this is the case. If the testes of all the sexually mature whales are plotted, according to the time of year and volume of the testis, there is no indication of any correspondence between the two. The great diversity in the size of the testis in different whales might be accounted for if there is considerable individual variation and at the same time a slight increase in size in answer to a stimulus associated with breeding.

The most instructive observations on the testis are those made from the histological point of view. One of the most striking features of the testis is the extraordinarily small number of spermatozoa which are normally to be seen in sections, and it may be said at once that the examination of sections gives no support to the supposition that the testis might undergo any important increase in size when breeding takes place, for the largest testes appear to contain no more spermatozoa than the smaller.

Sections of the immature testis (Fig. 140) show small tubules, of which the wall consists of a layer of small cells with small, strongly staining nuclei. The lumen of each tubule is completely filled by a comparatively small number of large cells with large nuclei which do not stain very strongly and of which only about half a dozen appear in transverse sections of tubules. There is often plenty of interstitial tissue, but the spacing of the tubules varies considerably. In immature Blue whales the tubules appear often to be rather more tightly packed and slightly larger than in Fin whales. The histological appearances of the testis in the foetus do not appear to differ in any way from those of the large immature whale.

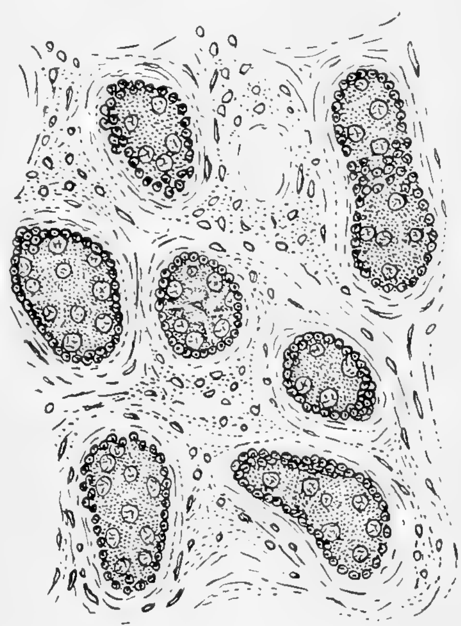
Fig. 140. Section of testis tubules of an immature Fin whale.

At the approach of maturity the first indication of a change is the appearance here and there of division stages in the nuclei of the large cells in the lumen of the tubules. After this the tubules become greatly enlarged and various other changes take place. The general appearance of sections of the mature testis is subject to considerable variation in any particular species, and this is only in part due to the different degrees of freshness in which the material is fixed. For good fixation of mammalian testis the material should be fixed within a very few minutes of death. In the case of whales, one is fortunate if the tissue has been dead less than three or four hours. However, surprisingly good fixation can sometimes be achieved and, the nuclei being very large, even some cytological observations can be made.

The mature testis can of course be distinguished at a glance from the immature. The tubules are much larger and may be filled with nuclei in various degrees of abundance. In some cases the lumen is packed with a dense mass of cells, and in others the latter may be loosely scattered, or clustered only round the rim of the tubule, leaving an empty space in the middle. In extreme cases the tubule appears to be practically empty. It is difficult to say whether these spaces are in part due to bad preservation, but in the testis of No. 114 (Fin), in which the fixation was probably better than in any other, the tubules showed large spaces (Fig. 141).

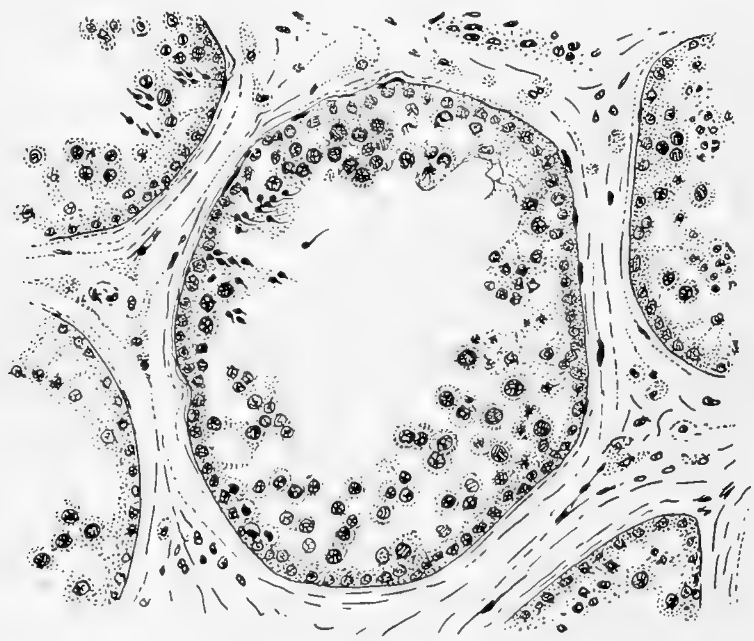

Fig. 141. Section of normal testis of an adult Fin whale.

Germ cells may be seen in various stages of development, but it is difficult to follow out much of the process of spermatogenesis. Figs. 142 and 143 illustrate some of the stages most commonly seen. (Both are from the same specimen as Fig. 141.) Among all the testes, of which sections have been cut, the conditions are found to vary at different times of year. In the majority of cases spermatozoa are present in very small numbers. They appear to be produced all the year round, but only in very small quantities, except at one particular season. Sections have been prepared from whales killed in every month except June, and it is found that in April and May, and in the case of one whale in July, the testis assumes a different histological appearance from that of whales killed in other months. The difference is noticeable partly in the relative abundance of spermatozoa throughout the tubules, but mostly in the enormous quantity of nuclei which appear in the tubules. In other months the tubules show considerable empty spaces or may be loosely filled with cells. In some cases large quantities of cells may be present, but the densely packed tubules which are found in the testis in May for example are practically never seen. In April and May spermatozoa are also present in much increased quantities, and the appearance of the sections

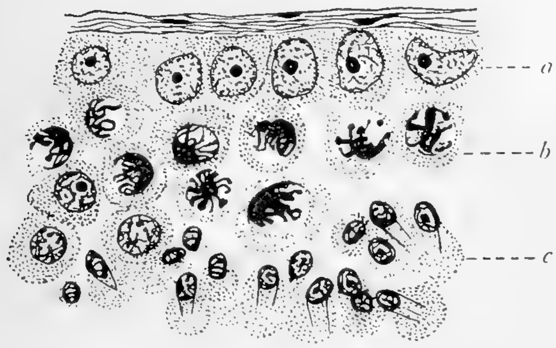

Fig. 142. Germ cells in normal testis. *a.*, spermatogonia; *b.*, spermatocytes; *c.*, spermatids.

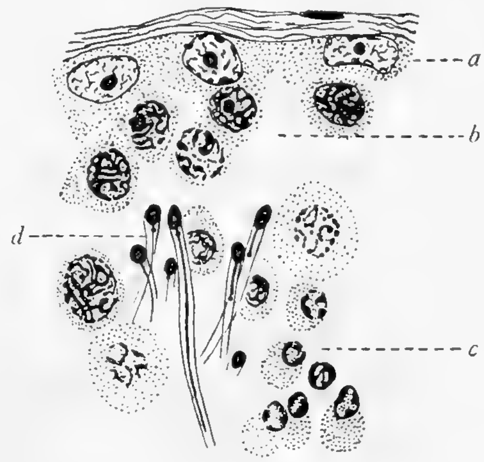

Fig. 143. Germ cells in normal testis. *a.*, spermatogonia; *b.*, spermatocytes; *c.*, spermatids; *d.*, spermatozoa.

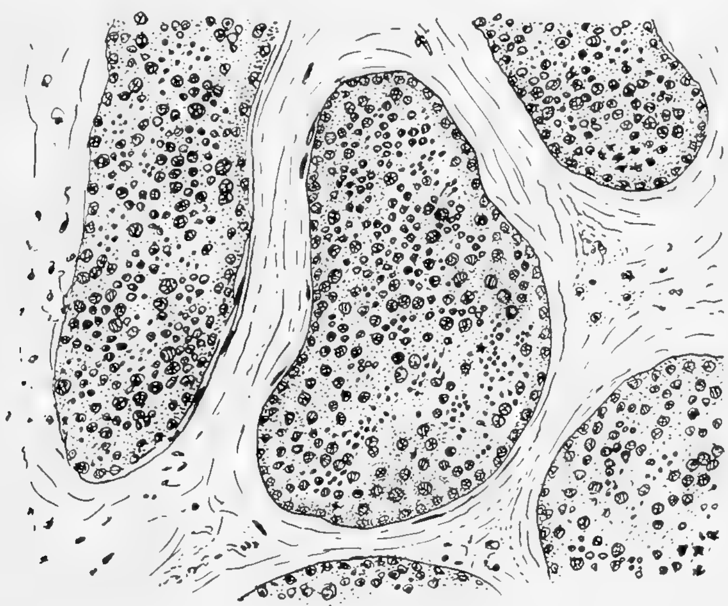

Fig. 144. Section of active testis of Fin whale during the male sexual season.

indicates unmistakably an active proliferation of germ cells, and a speeding-up in the production of spermatozoa. In Figs. 144 and 141 this active condition of the testis can be compared with the relatively passive condition. It happens rather often in a testis in the latter condition that the section of a tubule shows numerous spermatozoa which may be as abundant as in the active testis, but the distinction lies in the fact that the numerous spermatozoa are to be seen only in one tubule out of half a dozen or more, whereas in the active testis they are uniformly distributed as a result of active proliferation throughout the tubules.

Since this indication of a male sexual season is of considerable importance in its relation to the problem of the breeding season of whales, it will be worth while to make a systematic examination of the data. The following is an account of the testes of whales taken in different months, which have been examined histologically.

(*a*) *Blue Whales*

January. Two specimens. Both with tubules lightly filled with cells, but with rather few spermatozoa.

February. Four specimens. In three of these the tubules were mostly still in a practically immature condition. In the fourth there were few spermatozoa and there were empty spaces in some of the tubules.

March. One specimen. Empty spaces in the tubules and few spermatozoa.

April. Six specimens. In two of these the spermatozoa were not many and in one there were empty spaces in the tubules. In the other four the tubules were packed with nuclei and spermatozoa were numerous—not appearing in small groups here and there in an odd section of a tubule, but everywhere. The appearance of the sections suggested a general and uniform proliferation of germ cells, and a production of spermatozoa all along the tubules.

May. Two specimens. In one of these the spermatozoa were numerous, and the tubules, though small and distorted, seemed well filled with cells. In the other, part of the section was similar to the most active specimens, but the rest of the tubules were emptier.

June. No specimens.

July. Four specimens. One of these had a moderate number of spermatozoa, but there were few in the others, and none of the tubules contained a noticeably large quantity of cells. These testes seemed to have reverted to the more passive condition.

August. Two specimens. Both with few spermatozoa and with rather empty tubules.

September. Four specimens. One with a moderate number of spermatozoa and the rest with few. All had rather empty tubules.

October. Three specimens. Few spermatozoa in any. In one most of the tubules were immature, in another they were small and distorted, and in the third they were loosely filled with cells.

November. Five specimens. A moderate number of spermatozoa in one but very few in the rest. In the former the tubules were lightly filled with cells. One of the others was similar in this respect, but in the remaining three there were empty spaces in the tubules.

December. Three specimens. All with very few spermatozoa and with empty spaces in the tubules.

(*b*) *Fin Whales*

January. Twenty-two specimens. One of these was too rotten to be studied. Of the remaining twenty-one, all except five had few spermatozoa. In two of these five the spermatozoa could be described as numerous, and the tubules were well filled, though not thickly packed with cells. In the third the spermatozoa were not numerous, but seemed uniformly distributed along the tubules. In the fourth and fifth a number of spermatozoa were present, but the tubules showed empty spaces or were loosely filled with cells. In the remaining sixteen the testes all had few spermatozoa and the tubules showed empty spaces or were loosely filled with cells. In spite of the one or two exceptions the testes for January do not suggest much activity in this month.

February. Thirty-five specimens. In two of these spermatozoa were comparatively numerous, but the tubules, though well filled, were not thickly packed. There were one or two cases where a moderate number of spermatozoa were present, but in the great majority they were few and the tubules had empty spaces or were only loosely filled with cells.

March. Three specimens. One of these (early in March) had few spermatozoa. The tubules, however, were distorted and it was difficult to interpret their condition. The second (No. 114) at the end of March had fairly numerous spermatozoa. The tubules were large and rather empty. The third specimen was rotten.

April. Five specimens. One of these was hardly mature. Of the others spermatozoa were very numerous only in one, but in all four the tubules were becoming thickly packed with cells. In general, the sections for this month suggest that the activity of the testes was well started.

May. Three specimens. These three were all alike in the presence of very numerous spermatozoa and tubules thickly packed with nuclei.

June. No specimens.

July. One specimen. Here again the spermatozoa were numerous and the tubules thickly packed with nuclei.

August. Four specimens. In these a moderate number of spermatozoa were present, but the tubules were only loosely filled with cells.

September. Five specimens. One had numerous and the other four from rather few to moderate numbers with loosely packed tubules.

October. Three specimens. There were rather few spermatozoa in all these. In two cases the tubules were loosely filled with cells, and in the third they were practically empty.

November. Five specimens. In two of these (early in the month) there was a moderate number of spermatozoa and the tubules were loosely packed with cells. In the other three there were few spermatozoa and in two the tubules were rather empty.

December. Three specimens. In one there was a moderate quantity of spermatozoa but there were few in the other two. There was a tendency towards empty spaces in the tubules of all three.

From the foregoing material one may conclude that through the greater part of the year the testis is in a comparatively quiescent condition. As will be shown later pairing may take place exceptionally at almost any time of year, and this may account for the slow but steady production of spermatozoa during the other months.

It is true that there are one or two cases of whales in which the testis appeared to be producing spermatozoa comparatively rapidly at times when the majority are quiescent, e.g. Nos. 374 (January), 471 (January), and 552 (February), but the activity of the testis in April and May, in comparison with its condition in other months, is quite unmistakable. No material is available for June, but no doubt the conditions in this month are similar to those for May.

The bearing of these observations on the question of the season at which pairing takes place will be considered in a later section.

BREEDING AND GROWTH

SOURCES OF INFORMATION ON BREEDING

The study of the reproductive processes and breeding habits of whales constitutes probably the most important part of the work concerned with direct observations on whales. The sources from which information may be obtained on this subject are included mainly among (1) the examination of the reproductive organs themselves, (2) the study of the occurrence of foetuses, and (3) the correlation of the seasonal movements and other habits of whales, with the reproductive processes.

The difficulty of obtaining any direct evidence on the breeding of whales has already been pointed out, and it may be said that the investigation of evidence from one source alone, such as the lengths of foetuses at different times, does not provide quite adequate information. It is necessary to put together the evidence from all sources in an endeavour to build up, so to speak, as much as possible of the life history and reproductive cycle of the whales under consideration.

In the first place, it must be explained that nearly all the conclusions which are to be drawn on the breeding habits of whales ultimately rest on the assumption that there is an annual migration of these whales towards the equator in winter into warmer waters for purposes of breeding, and southwards in summer into colder waters where food is more plentiful. It is not necessary to assume that this rule is rigidly adhered to by all the whalebone whales, but it is sufficient if it can be shown that there is at least a general tendency in the south for a northward breeding movement in winter and a southward feeding movement in summer. This annual migration has been fairly well established by other investigators, but as it is of considerable importance here it will be best at this point to give some attention to the evidence supporting it.

To begin with, there is the evidence from the quantities of whales caught at whaling stations in different latitudes at different seasons. Briefly it may be said that at the southern stations, such as those in South Georgia, which is a relatively cold region, the numbers of whales are altogether greater in summer than in winter, whereas at the northerly stations the reverse is the case. This fluctuation is described in detail by Risting (1928) and is in itself strong evidence for a northern migration in winter and a southern migration in summer. Harmer has gone into this question in even greater detail, and his analysis of the returns from whaling stations in the Dependencies and on the west and east African coasts puts the fact of the north and south migration of Blue, Fin and Humpback whales practically beyond all question. Of these three species the most rigidly defined migration appears to be that of the Humpback.

Observations on whales of the North Atlantic have also led to the supposition of a north and south migration, and descriptions of the migrations of these species in that region have been given by Collett (1912), Risting (1928), Hinton (1925) and others. In fact it may be considered that this annual movement is a universal rule among the Balaenopteridae.

The existing knowledge of the reproductive processes and breeding habits is rather meagre, but a brief account must be given here of the more important previous work which has been done on the subject.

Work on the breeding of whales which had been published up to 1915 is mostly summarized by Hinton (1925). It may be mentioned that probably the most important early work on the subject is that of Guldberg (1886), to whom reference has already been made on p. 265. Hinton's paper is based on the records of 294 whales examined by Barrett-Hamilton at South Georgia over a period of two months. The value of the material is, of course, restricted by the shortness of the period, for the composition of the local whale population is liable to vary so much from month to month and year to year that conclusions cannot be drawn from a quantitative analysis of the data. In the "Preliminary Memorandum" a scheme of the rate of propagation is given, which summarizes some of the more important conclusions. In this, gestation (in Fin whales) is taken as lasting for 10 to 12 months and the length of the calf at birth as 20 to 25 ft. (i.e. approximately 6 or 7 metres); during the next year it is suckling and grows to 45 or 50 ft. (15 metres) and, after weaning, it grows in its second year to 61 ft. and is then ready to breed in the next sexual season. The estimation of the period of gestation and length of the calf at birth appear to be well founded, for there was a considerable number of foetal records and previous work (mostly from the North Atlantic) on which to base the former, and the latter can easily be fixed with sufficient precision from the lengths of the largest foetuses and smallest calves recorded. We have, however, been unable to find any mention of the evidence on which the supposed subsequent rate of growth is based, except a remark on p. 126 that the whalers believe that the calf grows very rapidly and accompanies the mother for a full year.

According to Haldane (1905) also, the whalers consider that the young Fin whale cow is mature at two to three years.

Of the Fin whale foetuses noted by Barrett-Hamilton, Hinton estimates the majority to have been conceived in July and August. The majority of pairings for the North Atlantic are estimated to fall between January and April. The Blue whale records for

South Georgia are not very useful as there are only seven, but for the North Atlantic the majority of pairings is estimated to fall in December, February and March, but they are spread over a longer period and are much less conclusive than in the case of Fin whales.

The next paper to be mentioned is that of Andrews (1916) on the Pacific Grey whale, *Rhachianectes glaucus*. It has been possible to make some direct observations on the migrations and breeding of this whale, and these observations provide by analogy some useful evidence on the breeding of the other whalebone whales. The period of gestation in this species is clearly about one year, and it has been shown that subsequent growth is remarkably rapid.

It has already been mentioned that a detailed examination of some of the whalers' statistics has been made by Harmer, special attention having been paid to an analysis of the records of foetuses with a view to calculating the pairing dates and ascertaining the limits of the breeding season and the months in which the breeding activities reach a maximum. The more important results are incorporated in an account of the southern whaling industry in the *Report of the Interdepartmental Committee on Research and Development in the Dependencies of the Falkland Islands*. The analyses of the foetal records suggest that the maximum time of pairing for Fin whales falls in about July, for Blue whales between June and October, and for Humpbacks about September. It is shown that though the existence of a definite pairing season is a clearly established fact, it is prolonged over several months at least. It is inferred that parturition takes place normally not later than July.

These inferences, which are concerned with the breeding season of whales and drawn from the whalers' records of foetuses, are subject to two weaknesses. In the first place, the accuracy of the material is not wholly to be relied on. However, such inaccuracy as exists does not seem to be sufficiently serious to affect the main conclusion that pairing mostly occurs between about June and September, for this agrees well with similar estimations from other sources, such as those of Hinton from the North Atlantic. The more serious difficulty in fixing the maximum pairing season is due to the uncertainty as to the rate of growth in the earlier stages of gestation, the uncertainty being due to the fact that the information is derived only from records of foetuses measuring from about 1 ft. upwards and is unchecked by observations on the ovaries and testes and the evidence of minute foetuses.

An exhaustive paper has recently been published by Risting (1928) in which an analysis has been made of the statistics supplied by various whaling companies over a number of years and assembled by the Norwegian Whalers' Association. This is carried out on very much the same lines as Harmer's work described above. The paper serves in general to confirm the supposition that the period of gestation in Blue and Fin whales is in the neighbourhood of a year, that pairing takes place during the southern winter and that the pairing season is itself somewhat indefinite and prolonged. It is estimated that among Blue whales pairing takes place mostly in June, July and August, and among Fin whales in June, July, August and September. Risting's results are, of course, liable to the same two weaknesses which are mentioned in connection with Harmer's work. Risting (1929) has further published a brief paper on the same subject in *Den Norske Hvalfangst Tidende.*

Among the sources of information on breeding mentioned above are the reproductive organs and the occurrence of foetuses. The latter, which are perhaps the most important of all, are comparatively simple to deal with, for, by plotting out the foetuses found according to their length and the date on which they occurred, we have important evidence at once as to the rate of growth and the probable seasons of pairing and parturition.

Owing to the fact that the pairing season is prolonged over a considerable period, the points so plotted are very much scattered, so that the best one can do is to construct a curve which seems to represent as accurately as possible the mean rate of growth throughout gestation. This, however, is not a serious difficulty. The main weakness of this method (at least of fixing the pairing season) lies, as already mentioned, in the uncertainty of the rate of growth in the early stages of development. It is here that observations on the genitalia of whales are needed, to fix, for example, the exact season at which pairing takes place, and to investigate the details of the oestrous cycle, the sexual season of the male, etc. In this connection the most important whales to examine are the adult females, and naturally the most important observations are to be made at the period when pairing and parturition mostly take place. One of the most serious obstacles to the work on whales at whaling stations has been the difficulty of finding adult females at this particular time of year. As will be explained later, the seasons of pairing and parturition fall in the southern winter or autumn, when whaling closes in the Dependencies and opens at South African stations. It is at the latter, therefore, that the most important observations on the breeding processes are to be sought. It has already been mentioned that at Saldanha Bay the number of adult whales caught is unfortunately small and the conditions appear to be much the same at other African stations, though the percentage of mature whales appears to be somewhat higher at the Durban stations. At present it is impossible to say what becomes in winter of the numerous adult whales which frequent the neighbourhood of South Georgia in summer. This question, however, will be considered again later on.

SEXUAL MATURITY

In an investigation of the breeding of whales, the first fact to be sought, if possible, for every whale is whether or not it is sexually mature. Sexual maturity is to be distinguished from full (physical) maturity. The latter may take place long after the former is attained, and it can sometimes, though with difficulty, be distinguished by the degree of ossification of the vertebral epiphyses.

An accurate diagnosis of sexual maturity is of special importance for several reasons. In the first place, the proportion of immature whales among those which are killed is of fundamental importance in any consideration of the effect of whaling on the stock of whales; and, in the second place, the determination of the proportion of mature and immature whales is a necessary preliminary to the estimation of various other ratios, such as the percentage of adult females pregnant or lactating.

The amount of data collected during the work makes it possible to fix with considerable accuracy the mean length at which Blue and Fin whales become mature, and, among all the whales examined, there have been very few cases in which maturity or immaturity cannot be determined with confidence. The only doubtful cases are those of whales whose length, being near to that at which maturity takes place, gives no clue, and in which there are not sufficiently definite records of the condition of the genitalia.

It is easy to determine whether a female is mature or not, but there is much more difficulty in the case of males.

Among females, information can be obtained from the following points:

1. *Presence of a foetus.* This, of course, determines maturity, but it is of little value in itself for estimating the mean length at which members of a species become mature.

2. *Presence of corpora lutea in the ovary.* This is the most valuable means of ascertaining whether a female is mature or not. If corpora lutea (including the scars of very old ones) are present in the ovary, the whale must, of course, be mature, and it can be said that, with negligible exceptions, a whale without any sign of corpora lutea in the ovaries is immature. As was explained in the section on the reproductive organs, it appears that the old corpora lutea persist for several years, so that once ovulation has taken place there will always be corpora lutea, or traces of them, in the ovaries. Instances of whales which have just become mature without having yet ovulated are extremely rare, and it might indeed be argued that a female need not be regarded as mature until it has actually ovulated. In no case has a whale been examined which for other reasons was obviously mature, but which had no traces of corpora lutea in the ovaries.

3. *Size of the uterus.* There is, of course, an increase in the size of the uterus when maturity is reached but it is not sufficiently sudden to constitute an infallible distinction between the mature and immature. Among Fin whales an immature individual would very rarely have a uterus measuring more than 11·0 cm. across the cornu (i.e. the transverse diameter of the collapsed cornu), and the uterus of mature whales would rarely measure less. Among Blue whales the corresponding figure would be about 12·0 cm. (see Figs. 131 and 132).

4. *Size of the ovaries.* In a number of cases a figure has been used representing roughly the volume of the ovaries and obtained by multiplying together the length, breadth and depth expressed in centimetres. Among Fin whales a figure exceeding about 800 generally indicates a mature whale. Among Blue whales a corresponding figure would be about 900, but this is less certain.

5. *Weight of the ovaries.* This is more convenient than measuring the size of the ovaries. As stated in the section dealing with the reproductive organs, among Fin

whales a pair of ovaries weighing less than 2 lb. generally indicates immaturity, the corresponding figure for Blue whales being slightly higher (see Figs. 120 and 121).

6. *Condition of the mammary glands.* The appearance of the mammary gland after flensing, and to some extent its thickness, form a useful quick method of determining whether or not a whale is mature. There are only occasionally intermediate cases where the method cannot be applied and most of these can be settled by a histological examination of the gland.

7. *Condition of the ovarian follicles.* These are not of great importance except where they serve as an indication in immature whales of the approach of maturity.

Among males there is very much less to go on, but information can be obtained from the following points:

1. *Size of the penis.* This is perhaps the readiest method of distinguishing mature from immature males, but it can be used only to distinguish definitely mature from definitely immature whales, for the growth of the penis at maturity is not conspicuously sudden. Among Fin whales a penis exceeding about 1·5 m. would usually indicate maturity, and about the same figure would apply to Blue whales.

2. *Size of the testis.* This is more convenient than taking the weight, as there is a great range in size. If the size, measured in the manner explained on p. 406, exceeds about 4 in the case of Fin whales, and say 5 in the case of Blue whales, the whale is generally mature (see Fig. 139).

3. *Histology of the testis.* This is the most reliable method of distinguishing maturity, but it is naturally laborious. The distinction between the mature and immature testis, as seen in sections, is fully explained in the section on the reproductive organs.

According to calculations based on a large number of individuals distinguished as mature or immature by the above methods, the following figures may be taken as accurate estimations of the mean lengths at which Blue and Fin whales become sexually mature:

Blue females	...	...	23·7 m. or 77 ft. 9 in.
Blue males	...	...	22·6 m. or 74 ft. 2 in.
Fin females	...	...	20·0 m. or 65 ft. 7 in.
Fin males	...	...	19·5 m. or 63 ft. 8 in.

The corresponding figures calculated by Hinton and based on the records left by Barrett-Hamilton are according to these results mostly a little too low. He gives 75–80 ft., 70 ft., 61 ft. and 60 ft. respectively.

The value of establishing the mean length at which maturity is reached lies in the fact that it enables one to calculate the percentage of mature whales in lists of catches in which only the sex and length are given. The following notes will give some idea of the degree of accuracy with which maturity can be gauged by the length alone:

Blue females. Of 402 female Blue whales there were three clearly mature measuring less than 23·7 m. and three clearly immature measuring more than 23·7 m. The smallest mature whale measured 23·2 m. and the largest immature whale measured 24·3 m. Five other whales measuring 23·0 m. to 23·4 m. were doubtful but probably immature (Nos. 209, 1267, 1408, 1436 and 1482) and three measuring 23·7 m. to 24·2 m. were doubtful but probably mature.

Blue males. Of 383 male Blue whales two certainly mature and one probably mature measured less than 22·6 m., three certainly mature whales measured 22·6 m., and two certainly and one probably immature whale measured more than 22·6 m. The smallest certainly mature whale was 22·4 m. and the largest certainly immature whale measured 22·74 m. There were, however, nine whales between 22·0 m. and 22·95 m. of which the records did not provide evidence as to maturity.

Fin females. Of 351 female Fin whales, five clearly mature whales measured less than 20·0 m., four mature and one immature whale measured exactly 20·0 m. and nine clearly immature whales measured more than 20·0 m. The smallest certainly mature whale measured 19·55 m. and the largest certainly immature whale measured 20·85 m. There were also five doubtful whales and two just verging on maturity between 19·5 m. and 21·2 m.

Fin males. Of 441 male Fin whales, fourteen mature whales measured less than 19·4 m., two mature whales measured exactly 19·4 m. and eleven immature whales measured more than 19·4 m. The smallest certainly mature whale measured 19·1 m. and the largest certainly immature whale measured 20·0 m. There were also twenty-nine doubtful cases between 19·0 m. and 20·1 m.

The ratios of mature and immature whales which have been examined at different times and places may now be considered. In the following table the percentages of immature whales are shown separately for the whales examined at South Georgia and Saldanha Bay, and for the separate seasons and half-seasons at South Georgia. (The end of January is taken as the middle of the South Georgia season, which lasts from October to May.)

	Blue whales						Fin whales					
	Females			Males			Females			Males		
	Total number	Number immature	% immature	Total number	Number immature	% immature	Total number	Number immature	% immature	Total number	Number immature	% immature
South Georgia												
Feb. to May 1925 ...	58	34	58·6	50	34	68·0	75	26	34·7	56	23	41·0
Oct. 1925 to Jan. 1926	20	5	25·0	17	6	35·3	72	7	9·7	115	7	6·1
Feb. to Mar. 1926 ...	51	37	72·5	41	32	78·0	67	23	34·3	95	21	22·1
Total for season 1925–6	71	42	59·2	58	38	65·5	139	30	21·6	210	28	13·3
Nov. 1926 to Jan. 1927	102	23	22·6	114	17	14·9	25	2	8·0	18	4	22·2
Feb. to Apr. 1927 ...	44	17	38·6	41	22	53·7	37	18	48·6	43	20	46·5
Total for season 1926–7	146	40	27·4	155	39	25·2	62	20	32·3	61	24	39·4
Total for South Georgia	275	116	42·2	263	111	42·2	276	76	27·5	327	75	22·3
South Africa												
Saldanha Bay 1926 ...	127	102	80·3	120	99	82·5	75	69	92·0	114	90	79·0

The most striking result shown by this table is the generally high percentage of immature whales. The figures for males and females correspond fairly closely in both species, but the percentage of immature Blue whales is usually higher than in the case of Fin whales.

At South Georgia, perhaps the most important fact is that there is always a higher percentage of immature whales in the second half of the season than in the first. Included above are three second-half seasons and two first-half seasons. Among Blue whales the percentage of immature whales in the first half of the season is about 20 per cent or 30 per cent, but in the second half of the season usually more than half, and in one case 78 per cent, of the whales are immature.

The same phenomenon is to be seen in the case of Fin whales. Here the immature whales are mostly under 10 per cent of the total in the earlier part of the season, but rise to 30 per cent or 40 per cent in the second half of the season.

These figures are, of course, a reflection of certain features of the migrations and movements of the whales, and it appears that there is a general tendency for the large whales to visit the coasts of South Georgia first, and for the smaller whales to come on later. The significance of this will be discussed in a later section.

One other feature may be pointed out in the figures for South Georgia and that is that there is a definitely lower percentage of immature Blue whales in the 1926–7 season than in the two preceding seasons. This is due to the exceptional nature of the catches of Blue whales, which were present in very large numbers throughout most of the season, and which were of a large average size. This again is dealt with more fully later on.

Of the figures for Saldanha Bay there is little to be said beyond the fact that almost the entire catch (from 80 per cent to 90 per cent) consists of immature whales. The catches at Saldanha Bay are fairly uniform throughout the season and there seems little to be gained by a comparison here between the first and second halves of the season.

The proportion of immature whales in the catches needs careful scrutiny from the economic point of view. As has been pointed out on various occasions, the killing of immature whales is economically undesirable, as it means that these whales have no chance of reproducing. To express in a different way what is perhaps the same thing, one may say that a high percentage of immature whales in the catches is a reflection of a general decrease in the average length of the whales. Now it is known that one of the first effects of the depletion of a community of animals is a general decrease in size, which results from the likelihood that an individual is killed before it has time to grow to its full size. Thus, where an unnaturally high percentage of immature whales is found, excessive hunting may be suspected. At Saldanha Bay, however, the high proportion of immature whales is not due to this cause but to the segregation of young whales in that particular region. The whole question will be examined, however, when the movements and distribution of the whales come to be considered.

THE BREEDING SEASON

The term "breeding season" is not very explicit and needs to be used with a certain amount of caution, for it does not clearly differentiate between the pairing season and the season at which the young are born. The term "breeding season" will probably convey to most people the season at which pairing takes place, but in any case it so happens that the two fall very close together and certainly overlap to some extent. In many cases, however, it will be better to speak separately of the "pairing season" and the "season of parturition".

The fact that whales actually have a breeding season has been clearly established by various previous authors. It is pointed out by Hinton that the first attempt to deduce the time of the breeding season from a study of the lengths of foetuses at different times was made by Guldberg (1886), who found from an examination of foetuses from the North Atlantic that there was at least such a thing as a definite pairing season. More data were subsequently collected by Cocks (1886–90) and Collett (1912) and the question was re-examined by Hinton in 1925. Similar work has been done, as already explained, by Harmer (unpublished) and Risting (1928), and the results of these investigators' work are mainly in agreement.

The position from which we now have to start is as follows. From a study of the recorded lengths of a considerable number of foetuses of Blue and Fin whales, several authors have arrived at the conclusion that (1) the pairing season is very protracted and lasts as such over two or three months, while pairing may exceptionally take place at almost any time of year, (2) the maximum amount of pairing takes place about July in the case of Blue and Fin whales.

That pairing is spread over a considerable period is obvious from the diversity in the lengths of the foetuses which may be taken at any one time, but these authors do not claim to have proved that, say, July is the month in which the maximum numbers of Blue and Fin foetuses were conceived. It is merely stated that, as far as the available data goes, July appears to be the most likely month, the doubt lying mainly in the rate of linear growth during the earliest stages of development. Perhaps the only way in which it is possible to ascertain the length of this preliminary period, apart from guess-work, is to compare the mean curve of foetal growth with the dates at which the greatest numbers of whales show signs of active breeding, such as the occurrence of minute foetuses, heat and ovulation among females, and the increased activity of the testis among males.

It will be convenient to start with the more direct evidence concerning the time of the breeding season and to go on later to the foetal growth curve.

In the first place, some information on the female sexual season is to be had from the ovarian follicles. The fact that many follicles are to be seen in ripening ovaries is a sign that many ova may be shed, but the rule is that one ovum is shed at a time, for, in the first place, one follicle appears always to be definitely larger than any others in the ovaries, and, in the second place, twins and multiple births are not common occurrences.

It has already been shown that large follicles *may* be present at any season of the year in whales which are neither pregnant nor lactating, but there is definite evidence that in the majority of such whales the follicles are small during January, February and March, but increase in size in April and May, i.e. the growth of the follicles eases up in the summer but becomes active at the commencement of the southern winter (see Fig. 124, p. 387).

Perhaps the most important sign of breeding activity is the occurrence of functional corpora lutea in the ovaries without the presence of a foetus. This, of course, indicates recent ovulation. It is observed so seldom at South Georgia that the occurrence of a recent corpus luteum in the ovaries almost invariably means a foetus in the uterus. At Saldanha Bay, however, such corpora lutea occurred comparatively frequently in proportion to the number of adult whales.

Although these corpora lutea of ovulation have been discussed in the section on the reproductive organs it will be convenient to recapitulate here some of the details of their occurrence. Among Blue whales they were found on March 14 and 18 (1926 and 1927), May 4 (1925), and October 24 (1925) at South Georgia; while among the few mature whales at Saldanha Bay they occurred on June 17, 22 and 29 and on July 19. Among Fin whales they were found on February 16 and 28 (1925) at South Georgia, and June 22, July 13 and September 15 at South Africa. It must be emphasized again that the numbers of adult females taken at South African stations is very small and that the percentage of ovulations is therefore very high.

Further light is thrown on the breeding season by the occurrence of several minute foetuses in an early stage of development. Two of these were of Blue whales and occurred in July and August. They measured 21 mm. and 30 mm. respectively. It is difficult to say how old such foetuses are but probably conception took place not less than several weeks previously. Among Fin whales there were three small embryos. One of these was found in August and the other two both occurred in January. Judging from the appearance of one of the latter when it was found (in whale No. 331) it seems possible that it was abortive, but the occurrence of the other one so late as January is surprising, though not very exceptional when compared with the irregular occurrence of many of the larger Fin whale foetuses (see Fig. 146, p. 425). Photographs of some of these foetuses appear on Plate XXXVIII, together with that of a Sei whale (No. 1074) which measured only 2 mm. and is probably the smallest foetus of a whalebone whale which has ever been found. These small foetuses are not described in detail in the present report but will doubtless form the subject of a separate paper in due course.

It has already been explained that through the greater part of the year the testis is in a comparatively quiescent condition but that from about April to July it shows signs of increasing activity in the production of spermatozoa (see p. 408). Seen as it is in sections of the testis, this activity takes place perhaps rather earlier than one would expect, comparing it with, say, the time at which corpora lutea of ovulation occur most plentifully, but a proliferation of germ cells in the testis does not, after all, necessarily mean that the spermatozoa will be put to immediate use.

It is now seen that the time of ripening of the ovarian follicles, the occurrence of corpora lutea resulting from recent ovulations, the occurrence of minute foetuses, and the season at which the testis shows an increased activity, all point to the earlier part of the southern winter as the season at which the breeding processes become general. The next step will be to examine the records of the lengths of the foetuses at different times of year and to construct curves to represent the growth of the foetus. The pairing season, as indicated by these curves, may then be compared with information provided by the reproductive organs.

The total number of foetuses examined at South Georgia and Saldanha Bay is as follows:

	Males	Females	Sex not determined	Total
Blue ...	19	28	3	50
Fin ...	41	35	5	81
Sei ...	7	5	1	13
Humpback	3	1	2	6
Sperm ...	—	1	—	1
		Total for all species	...	151

In the above list twins (which have occurred twice) are counted as two foetuses. Cases in which foetuses were known to have been present (e.g. by traces of foetal membranes), but were not found, are not included. Those recorded under "Sex not determined" were either too small or too much decomposed for their sex to be distinguished.

In Fig. 145 all the Blue whale foetuses which have been examined in the course of the work are plotted according to their lengths and the dates on which they were found. The average monthly lengths are also shown.

The curve is an attempt to show what is the probable rate of growth of the foetus. So far as its actual shape is concerned, it should represent the growth of any Blue whale foetus, while its position in respect to the time of year should enable one to find the *probable* mean size of all the foetuses at a given time. The curve in this case is drawn "freehand" to represent as well as possible the general trend of the mass of plotted points, regard being paid also to the monthly average lengths. It is not, of course, intended as a final representation of the rate of growth, but simply what seems most probable from the given material. A similar curve for Fin whales is shown in Fig. 146. Here the plotted points have turned out to be considerably more scattered than in the case of Blue whales, though the monthly average lengths arrange themselves in a fairly good line. One foetus, measuring 5 m. in November, lay far outside all the others and is not shown in the figure. This one, however, was an abortive foetus found in whale No. 262. It was a case of abdominal pregnancy and when found the foetus was in a degenerate condition and appeared to be in the process of reabsorption by the parent. It may therefore be left out of any calculations concerned with the growth of the foetus.

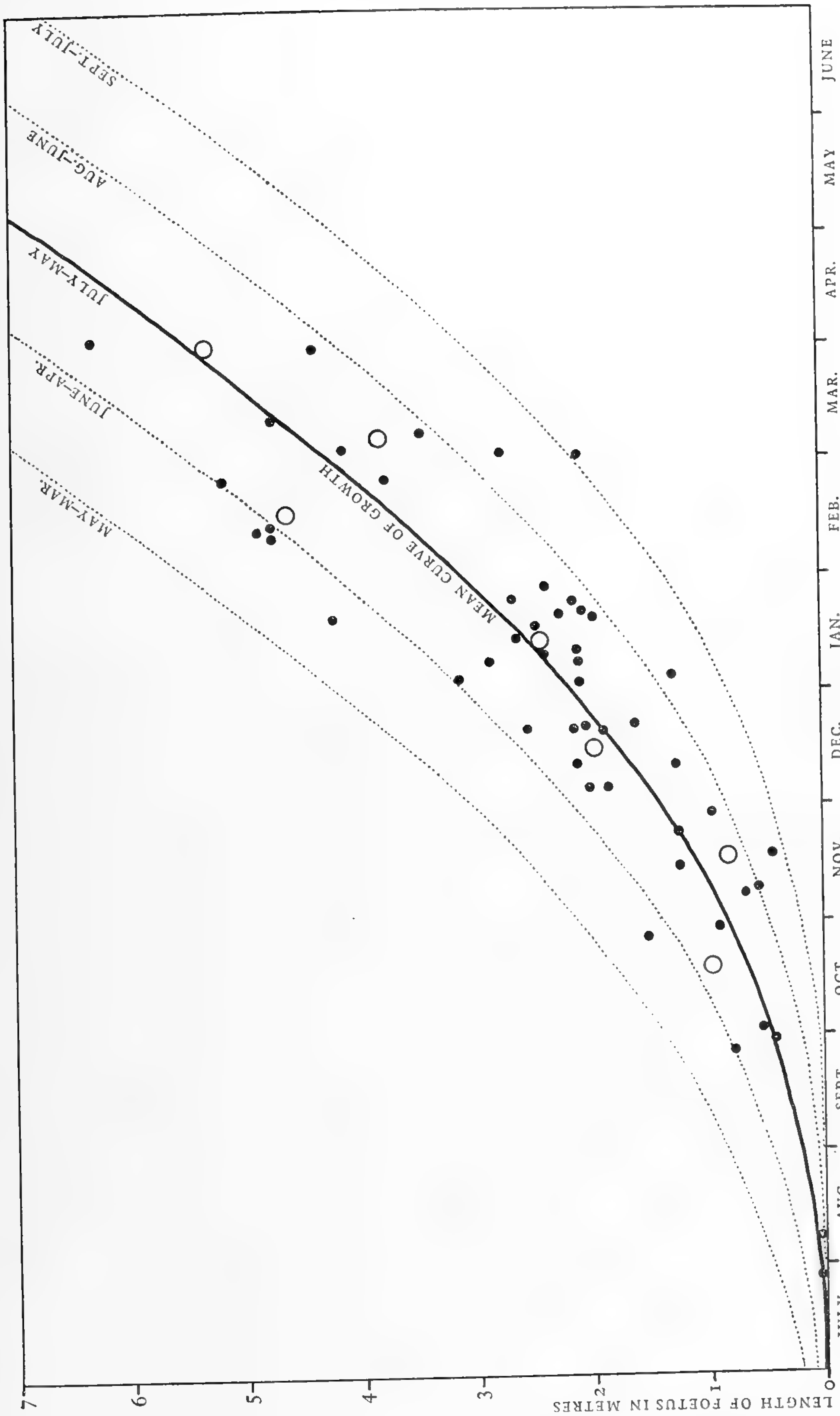

Fig. 145. Mean curve of growth of Blue whale foetuses.
● Individual foetuses. ○ Monthly average sizes.

It will be seen that the mean curve of growth rises only very gently during the earliest part of gestation and is drawn, in the case of Blue whales, to begin in June. Although the greater part of the curve is derived from the plotted foetal lengths, this earlier part depends on the time fixed as the height of the pairing season and in order to determine this time, the evidence provided by the reproductive organs may be used.

In order to get a clear idea as to what months are most likely to be occupied by the pairing season, it will be convenient to draw up a table as follows, in which the evidence from the testis, the ovaries, the minute foetuses, and the growth of the larger foetuses may be seen as a whole:

	Blue				Fin			
	1	2	3	4	1	2	3	4
	% of mature testes proliferating spermatozoa	% of mature females with functional corpus luteum but no foetus	Number of minute foetuses found	Height of mean curve of foetal growth	% of mature testes proliferating spermatozoa	% of mature females with functional corpus luteum but no foetus	Number of minute foetuses found	Height of mean curve of foetal growth
Jan.	—	—	—	2·5	5	—	2	2·0
Feb.	—	6	—	3·6	6	5	—	2·75
Mar.	—	4	—	4·8	—	—	—	3·5
April	66	—	—	6·1	75	—	—	4·4
May	100	33	—	Over 7	100	(100)	—	5·5
June	?	33	—	0	?	(100)	—	0
July	—	25	1	0·05	(100)	—	—	0·05
Aug.	—	—	1	0·12	—	—	1	0·13
Sept.	—	—	—	0·3	—	33	—	0·3
Oct.	—	12	—	0·6	—	—	—	0·57
Nov.	—	—	—	1·1	—	—	—	0·95
Dec.	—	—	—	1·8	—	—	—	1·45

NOTE. Owing to the relatively small number of mature whales for each month, the percentages are not as reliable as one could wish. Percentages in brackets mean that there was only one mature whale in that month. Column 1 refers to testes showing definite signs of increased activity, and column 2 refers to whales in which the corpus luteum showed that ovulation must have taken place recently. In column 4 the height of the curve is measured for the middle of each month, as will be seen by reference to Figs. 145 and 146.

No column has been kept to show the monthly sizes of the ovarian follicles as the data do not lend themselves so well to treatment of this kind, but reference may be made to Fig. 124 on p. 387.

It will be seen from the table that the testes in both species begin to show signs of activity in April and continue to proliferate spermatozoa during May and probably June, and that during most of the other months they are in a comparatively inactive condition. In regard to ovulations the results are inconclusive in the case of Fin whales owing to very limited material, but among Blue whales the majority fall in May, June and July, i.e. somewhat later than the activity of the testis. The two small Blue whale embryos occur, as might be expected, still later (in July and August). Of the small Fin whale embryos, one appears in August and the other two are aberrant. Finally, the

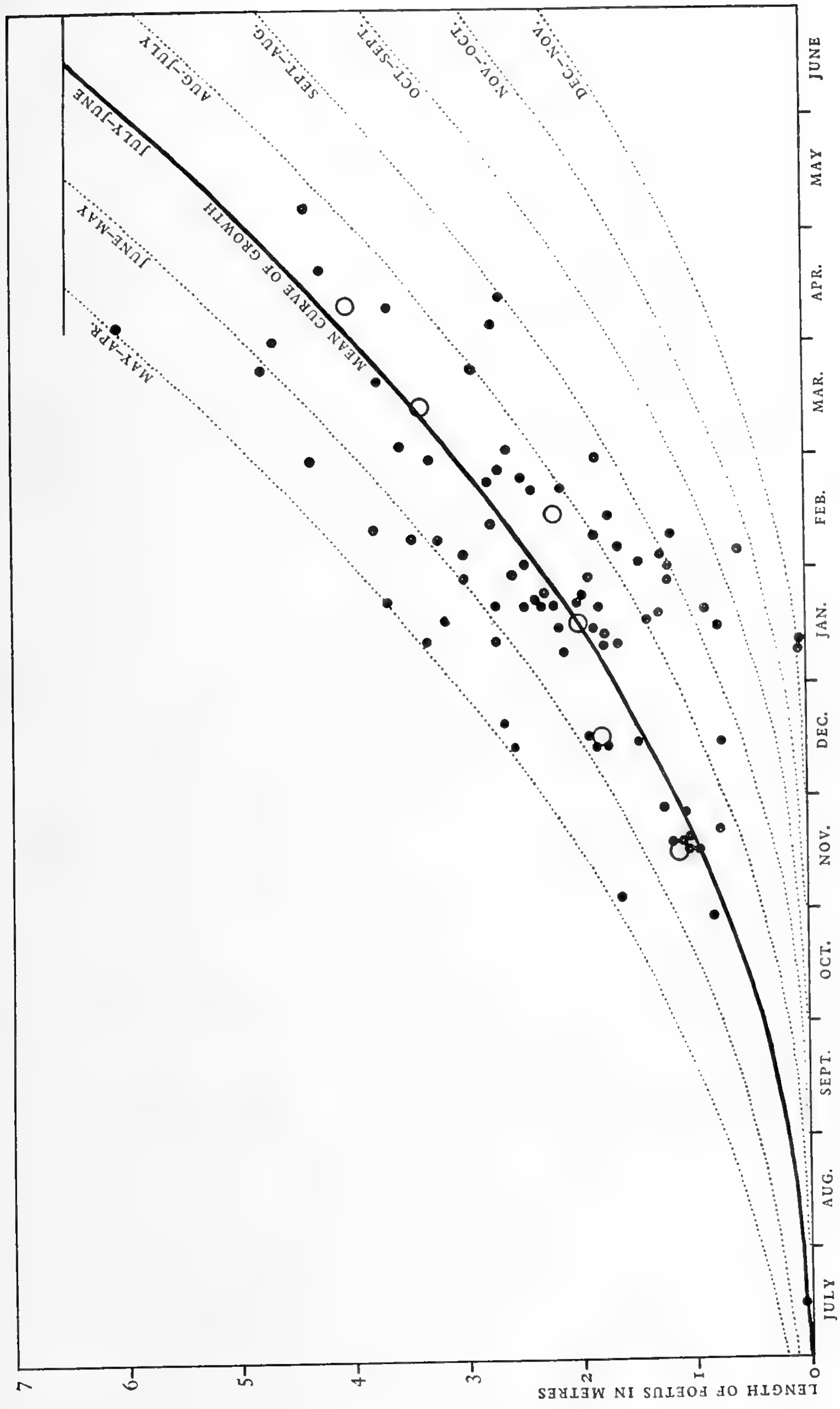

Fig. 146. Mean curve of growth of Fin whale foetuses.
● Individual foetuses. ○ Monthly average sizes.

height of the mean curve of foetal growth shows that the period of gestation is, on the average, well started by the end of August.

Taking the data as a whole, it may be inferred that the height of the pairing season falls in both species towards the end of June. As already mentioned, the early activity of the testes does not necessarily mean that pairing takes place equally early, and the instances of ovulation point to the end rather than the beginning of June, for it must be remembered that, as whales appear to be polyoestrous, several ovulations may occur before impregnation, but none will occur afterwards.

It will be seen that the curve for both species starts slowly but gradually increases throughout pregnancy. It cannot perhaps be regarded as certain that the rate of growth increases steadily during the latter part of gestation, but it is quite certain that growth

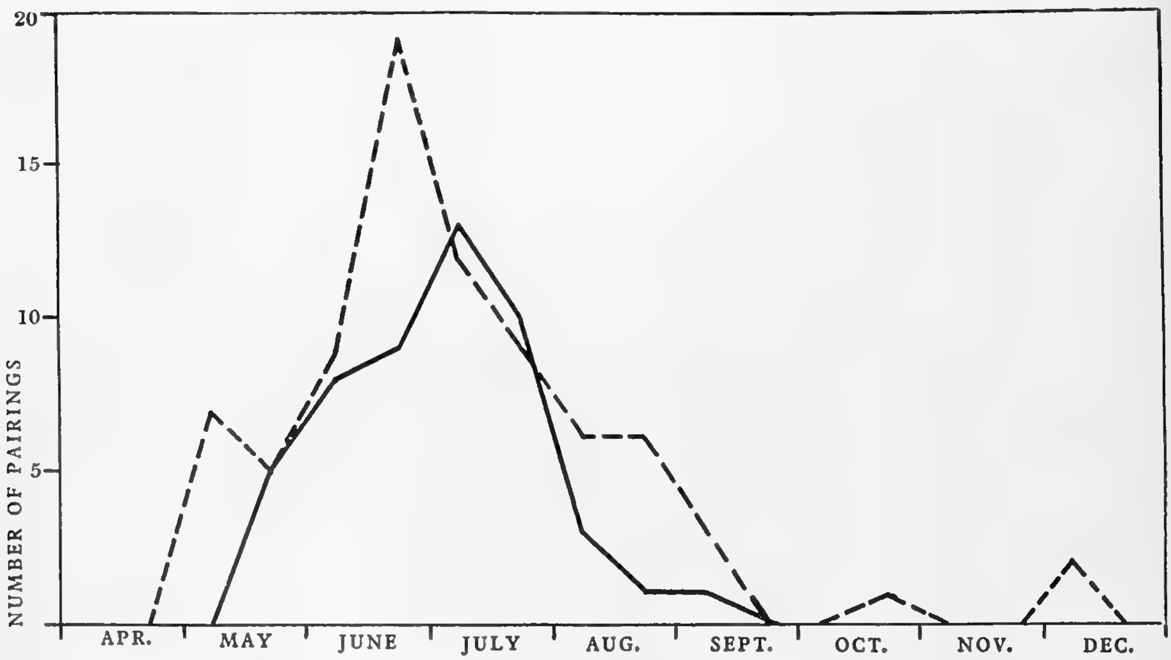

Fig. 147. Curve of frequency of pairing.
—— Blue whales. - - - - - Fin whales.

is relatively slow in the earlier stages. It is a characteristic feature of the development of these whales that the form of the body is practically perfected at a stage when the foetus is still very small. A 0·5 m. foetus, for instance, differs very little in appearance and bodily proportions from the adult and so far as the internal structures are concerned the organs are probably all laid down by the time the foetus has reached 0·1 m. It is therefore natural to suppose that the actual linear rate of growth is extremely slow while the foetus grows from zero to about 0·1 m. compared with its subsequent growth up to the end of gestation, for from between 0·1 m. and 0·5 m. up to birth at 6–7 m. development consists mainly in increase in size.

It appears that the rate of growth in Fin whales is somewhat less than in Blue whales and it is probable that in Sei whales it is slower than in Fin whales.

The dotted curves in Figs. 145 and 146 are reproductions of the mean curve of growth shifted to lateral intervals of one month so as to include all the plotted points. It will be seen from these that, given that all foetuses of one species grow at an equal speed, all the foetuses measured were conceived within a period of less than five months in the case of Blue whales and less than seven months in the case of Fin whales.

We are now in a position to draw curves showing the probable intensity of pairing during the season, indicated by the material in question. For this it is only necessary to count the numbers of plotted points between two parallel curves and one may plot the number obtained against the month in which they were conceived as indicated by the parallel curves, or better, one may divide the points between two curves into those lying nearer the one curve and those lying nearer the other, and count the number for each half-month. The results are shown for both species in the following table, and are plotted in Fig. 147.

Date of pairing	Blue	Fin	Date of pairing	Blue	Fin
May, 1st half	—	7	September, 1st half	1	3
May, 2nd half	5	5	September, 2nd half	—	—
June, 1st half	8	9	October, 1st half	—	—
June, 2nd half	9	19	October, 2nd half	—	1
July, 1st half	13	12	November, 1st half	—	—
July, 2nd half	10	9	November, 2nd half	—	—
August, 1st half	3	6	December, 1st half	—	2
August, 2nd half	1	6	December, 2nd half	—	—

Thus in both species it appears that May, June, July and August are the months in which the majority of pairings take place, the maximum falling at about the end of June or beginning of July. In the case of Fin whales, the results indicate that pairing may take place over seven or eight months and the fact that the Blue whale season appears more restricted is probably merely because we have not so many foetal records for this species. There would be no justification, however, for arguing from this that, if the records were sufficiently increased, instances of pairing in every month of the year would appear.

The results of this investigation of the breeding season differ slightly from those of Hinton and Harmer in that the period of maximum pairing is now set rather earlier in the winter. This difference is mainly the outcome of correlating the evidence of the reproductive organs with the curve of foetal growth.

The question of the female sexual season, although intimately connected with the breeding season in general, need not be considered here, as it has already been dealt with in the section on the ovaries. It has been shown that whales are almost certainly polyoestrous, and in view of the protracted nature of the breeding season one may suppose that in many cases several dioestrous cycles may occur before pregnancy supervenes. It is difficult, however, to express any opinion as to the length of the interval between the successive dioestrous cycles.

THE SEXUAL CYCLE AND GROWTH OF THE CALF

The length of the period of gestation can be found from the curve of growth of the foetus, provided the length of the calf at birth is known, a point which can be ascertained with a fair degree of accuracy. One way of finding the average length at which the calf is born is to compare the largest foetuses with the smallest calves which have been recorded. In the course of our work two very large foetuses were found. One was that of a Blue whale (No. 154) and measured 6·3 m. (20·6 ft.), the other was of a Fin whale (No. 173) and measured 6·05 m. (19·85 ft.). In both cases, but especially in the latter, the condition of the mother suggested that parturition would have shortly taken place. Before No. 173 was flensed, it was noticed that the genital region was greatly swollen and that the genital groove was stretched open to a remarkable extent. A sample of the mammary gland was preserved and sectioned and it was found that the condition of the gland suggested that secretion would shortly commence. The external genitalia of No. 154 were in a similar condition but sections were not made of the mammary glands.

These cases, so far as they go, suggest that in Blue whales the calf is born when rather more than 6·3 m. long and in Fin whales when a little over 6·0 m. Haldane (1905) records Blue whale calves of 6·7 m. (22 ft.) and 6·1 m. (20 ft.). Harmer mentions a Fin whale foetus of 6·4 m. (21 ft.) and a Blue whale foetus of 8·8 m. (29 ft.), but these are quoted from statistics supplied by the whalers and their precise accuracy cannot be regarded as very reliable. Records of the smallest calves are of course very hard to come by, for very small ones are rarely seen and hardly worth shooting. There is also a regulation in the Dependencies of the Falkland Islands prohibiting the whalers from attacking females accompanied by calves. However, Hinton (1925) mentions records of three Blue whale foetuses from 5·3 m. to 7·0 m., and the statistics supplied by Messrs Irvin and Johnson, whose whaling station is at Saldanha Bay, include a record of a Blue whale calf of 7·7 m. (25·3 ft.).

On the whole it seems probable that Blue whales are born on the average at about 7·0 m. (23·0 ft.) and Fin whales at about 6·5 m. (21·3 ft.). It is at least certain that the length at birth is not far from this. No doubt some variation occurs. It has been suggested, for instance, that the length of the calf at birth bears a definite ratio to the size of the mother, but this is a statement which it would be extremely difficult if not impossible to test. In any case if birth may take place at lengths other than 7·0 m. and 6·5 m. in the two species the difference would not materially affect the estimation of the length of the period of gestation especially as the rate of growth is fastest at the end of gestation.

By reference to Figs. 145 and 146 it is seen that the curve for Blue whales ends at 7·0 m., representing the close of the period of gestation. The point reached at the 7·0 m. level is opposite the beginning of May. In Fin whales the curve reaches 6·5 m. opposite the middle of June. This gives a period of gestation of slightly over ten months in the case of Blue whales, and of eleven and a half months in the case of Fin whales.

The time of the season of parturition may be worked out in the same way as the pairing season. If we continue on the assumption that all the foetuses of a species grow at the same rate the season of parturition will of course be identical in duration and intensity with the pairing season. All that needs to be done is to reproduce the pairing curves (Fig. 147) ten months later in the case of Blue whales and eleven and a half months later in the case of Fin whales. The result is shown in Fig. 148. The details of the shapes of these curves of course mean nothing, but they suggest in general that Blue whales are mostly born in April and May and Fin whales in June and July.

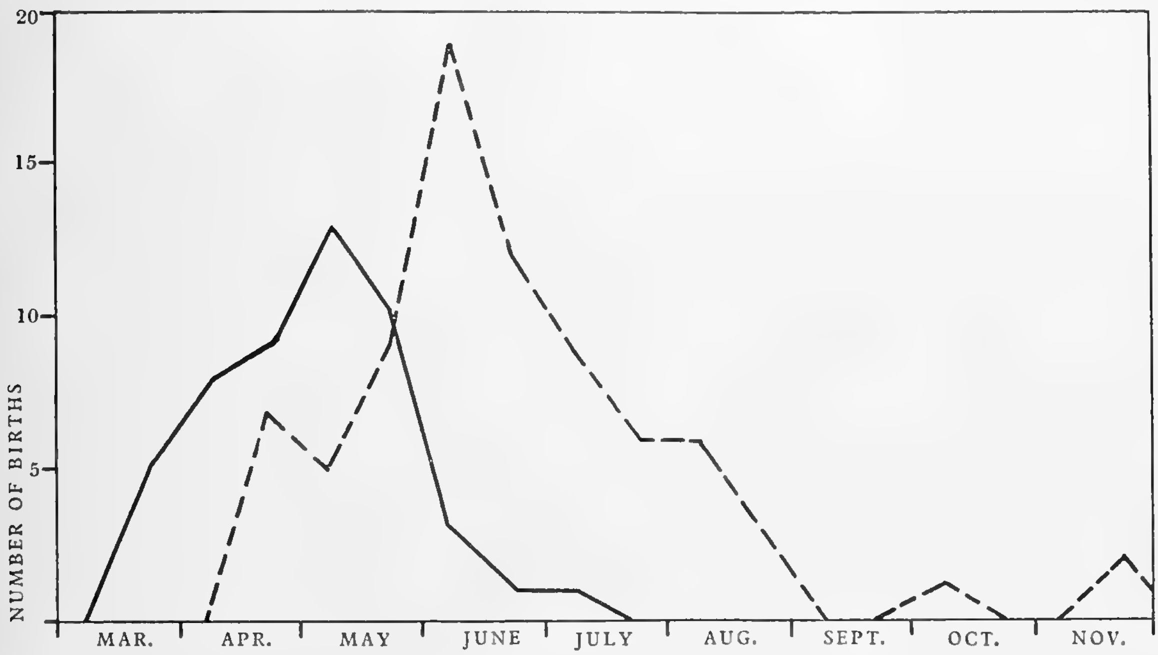

Fig. 148. Curve of frequency of births.
——— Blue whales. - - - - - Fin whales.

As explained above it is being assumed that the foetuses grow at the same speed during gestation. If, however, some foetuses grow faster than others the result would be that the season of parturition might be more protracted than the pairing season. On the other hand it is possible that a whale which was impregnated early might retain the foetus slightly longer than one which was impregnated later, since birth apparently takes place mostly when the parent migrates northwards to warmer waters, and the attainment of the proper environment might have the effect of stimulating slightly premature parturition in a whale in which the foetus was later than the average. There is still another assumption involved in the construction of the foetal growth curves, and that is that the earliness or lateness of a pregnant whale's visit to the neighbourhood of South Georgia is not affected by the age of the foetus, i.e. the time at which impregnation took place. But it seems quite possible that a female which had not been impregnated before the later part of the pairing season might delay her southern migration until impregnation took place, while those which had been impregnated earlier might also travel southwards earlier. Now as will be shown in a later section the whale population at South Georgia undergoes considerable changes during the season and it may be that the foetuses measured in the earlier part of the South Georgia season were conceived earlier than those measured in the later part of the season. The effect of this would be that the curve of mean foetal growth, constructed as it is from the progressive increase in the lengths of foetuses during the season, shows a slower rate of growth than that which actually takes place. In other words, if the time of the southern migration is influenced by the time of impregnation and if individual pregnant females stay in the vicinity of South Georgia only for a comparatively short time, then the length of the period of gestation is somewhat shorter than the period which has been estimated. However, there is no definite evidence to show that this actually happens and in any case the difference may not be very great.

An important point to be considered at this stage is the length of the interval which elapses between successive pregnancies in an individual. For this also the percentage of pregnant females must be examined. If, for instance, pregnancy normally took place every year we should expect to find nearly every adult female pregnant at almost any time of year since the period of gestation lasts only a little less than a year, and it would follow that a female would normally be impregnated long before she weaned her calf. On the other hand, if pregnancy recurs every two years one would expect to find slightly less than 50 per cent of the adult females to be pregnant at a given time or if every three years something less than 33 per cent and so on. Calculations of this kind, however, involve a dangerous assumption, namely, that the whales actually brought to the whaling station at South Georgia, or any other localities, constitute a representative sample of the general stock of whales. This is a subject to be dealt with in a later section, but it may be said at once that such an assumption is definitely not justified except so far as certain approximate estimations are concerned. It is quite certain that the whales caught off the south-west African coast are not representative of the whole stock, and at South Georgia the whale population is perpetually fluctuating both as regards constitution and numbers. However, as far as the latter locality is concerned some reasonably certain inferences may be drawn if they are based on observations covering several seasons. The percentages of adult females pregnant vary mostly between 20 per cent and 50 per cent in the case of Blue whales and 20 per cent and 70 per cent in the case of Fin whales. Of all the adult females examined at South Georgia and Saldanha Bay 31 per cent of the Blue whales and 46 per cent of the Fin whales were pregnant. From this alone it can be regarded as fairly certain that pregnancy does not normally recur every year and the fact that out of the large number of lactating whales examined not one was pregnant, clearly rules out the possibility of annual pregnancy so far as the great majority of whales are concerned. The uterus in lactating whales has not always been opened, but it has invariably been found in these whales that the ovaries have no functional corpus luteum, i.e. of the type referred to in the section on ovaries as corpus luteum *a*. There exist, however, one or two records of lactating females which were pregnant. It appears that Barrett-Hamilton found one or two pregnant Humpbacks with milk in the glands and Hinton mentions one or two cases recorded in the north among Blue whales. Risting also refers to such cases among Humpbacks. We have not examined a sufficient number of Humpbacks to express an opinion on that species, but so far as Blue and Fin whales are concerned it must be supposed that such cases are extremely rare, but might arise if a female were impregnated near the end of a long period of lactation.

The percentage of Fin whales pregnant (46 per cent) strongly suggests that pregnancy recurs every two years. The percentage of Blue whales pregnant is lower (31 per cent) but is still rather high for pregnancy every three years and one would not expect Blue and Fin whales to differ in this respect. Taking everything into consideration, including the uncertainty as to whether one is dealing with a representative sample of the general stock of whales, it may be said that although the possibility of pregnancy every three years is not finally ruled out, it may be regarded as almost certain that it recurs in the majority of cases every two years. It is probable that an interval of three years may occasionally elapse between pregnancies, but apart from considerations of the ratio of pregnant whales we have firstly the fact that gestation lasts for nearly a year, and secondly, as will be shown below, the nursing period lasts until after the next pairing is over. Thus it is naturally at the second pairing season after gestation that the next impregnation may be expected to take place.

We now come to the nursing period. This does not necessarily correspond to the whole period during which the mother is accompanied by the calf or to the whole period during which the mammary glands of the parent are in functional activity, but for our immediate purpose it is required to find the length of the period from birth until weaning. To find the length of the period of gestation it was necessary to ascertain the size of the calf at birth and the rate of growth from conception until parturition. In the same way it is now required to find the length of the young whale at weaning and the rate of growth of the calf during the nursing period.

The period of lactation is more difficult to determine than the period of gestation, but a few records are available which may be plotted out in much the same way as the foetuses. In the first place, the average length at which weaning takes place may be found (in the same way as the length at birth) from records of the largest sucking calves and the smallest young whales which are feeding independently.

Among Blue whales examined by us there appear to be only two which were being fed by the mother. These were both caught at Saldanha Bay in September. The first, No. 1064, measured 13·35 m., and had very poorly developed baleen plates, of which the longest were only 18 cm. A curve showing the rate of growth of the baleen is given in Fig. 49 on p. 314. This curve shows a sudden increase in the rate of growth after the calf has reached a length of 16·0 m., and it has already been suggested that this increase is connected with a change from a diet of milk to one of krill, and comes considerably after the longest plate has reached a length of 18 cm. Whale No. 1064 was taken two days after a lactating whale (No. 1057) by the same boat and at the same spot, and was considered by the whalers to be the calf of that whale. The stomach contained no krill but a turbid, watery fluid was present, and this seems compatible with the suggestion that this was a calf which was being fed by the mother but had been starved for two days. In any case it is fairly certain that this 13·35 m. whale can be safely put down as an unweaned calf.

Ten days after the capture of No. 1064 another Blue whale (No. 1085) was taken, which measured 13·95 m. Here the baleen was still short (22 cm.) and the stomach is noted as containing "a yellow fluid". The baleen seems hardly long enough for independent feeding and has not yet reached the length at which the increased rate of growth takes place. This may have been the calf of No. 1079, a lactating Blue whale caught the day before.

These two (Nos. 1064 and 1085) are the two largest unweaned calves of which we have been able to find records. Messrs Hamilton and Matthews, on a visit to Durban in 1926, measured a young Blue whale of 11·85 m. of which the baleen measured 15 cm., but there was unfortunately no opportunity to examine the contents of its stomach.

Unfortunately we met with only one whale measuring between 13·95 m. and 16·0 m. and in this whale (No. 823, 15·83 m.) the baleen and stomach were not examined. At 16·25 m. No. 248 had baleen 27 cm. long and a substance "like congealed blood" (which may well have been partially digested milk mixed with some blood) in the stomach. The probability is on the whole that this whale had not yet taken to independent feeding.

Two other whales (No. 767, 16·8 m. and No. 1584, 16·95 m.) both had krill in the stomach. The baleen was not measured in these whales but in No. 1104 which measured 16·82 m. (and had only blood in the stomach) the baleen was 40 cm. long, suggesting that this whale had also been weaned.

It is thus reasonably certain that weaning takes place when the calf has reached some length between about 14·0 m. and 16·5 m. In view of the fact that No. 248 measuring 16·25 m. was probably not weaned, and that the growth of the baleen plates appears to become speeded up between 16·0 m. and 17·0 m. it is probable that the required length is much nearer 16·5 m. than 14·0 m. Now, although No. 248 appeared not to be weaned it will probably be safest to put the mean length at which Blue whales are weaned at 16·0 m. for there is likely to be plenty of variation in the length of the calf at this stage and we have three whales from 16·8 m. to 16·95 m. which were all weaned.

Fin whales are evidently weaned at a much shorter length than Blue whales. The smallest specimen we examined measured 12·3 m. (No. 891) and had krill in the stomach and baleen 41 cm. long. Krill was also present in No. 999 (13·35 m.) but the baleen was not measured. In No. 910 (13·38 m.) the stomach was empty, but in No. 84 (13·55 m.) a milk-like substance was present in the stomach and the baleen measured 30 cm. In No. 1187 (also 13·55 m.), on the other hand, the baleen measured 50 cm. and though the stomach contents were not examined the faeces were typical of whales feeding on krill.

It is a pity that no Fin whales of less than 12·0 m. were seen, but it may be gathered that weaning in this species takes place when the calf is in fact about 12·0 m. long. There are not quite adequate data for the construction of the curve of baleen growth (see p. 355) and the first half of it rather depends on analogy with the curve for Blue whales, but it is evident from the plotted points that no spurt in growth takes place after the calf has reached much more than 13·0 m. and one may expect that it occurs between 12·0 m. and 13·0 m. All the whales over 12·0 m. were weaned except perhaps one. This one (No. 84 mentioned above) was probably unweaned, and it merely serves to show that if a Fin whale *can* reach 13·55 m. before being weaned, the normal length at which Fin whales are weaned is not likely to be far below 12·0 m. It might in fact be above 12·0 m., for No. 891 (12·3 m.) might have been weaned earlier than usual. Hinton refers to two records of Fin whale calves of 40 ft. and 45 ft. (i.e. 12·2 m. and 13·7 m.) from the North Atlantic which were suspected of being fed on milk owing to a yellowish substance found in the stomach.

In any case, until further material has been collected, it may be assumed that Blue whales are weaned on the average at 16·0 m. and Fin whales at 12·0 m. The difference between these two lengths is very striking, especially as it actually exceeds the difference between the lengths at which the two species become sexually mature, but it seems impossible to avoid the conclusion that if the growth of the baleen of Fin whales resembles that of Blue whales, the increase in the rate of growth takes place when the Fin whale is 4·0 m. shorter than the Blue whale.

In an estimation of the rate of growth of the calf during lactation and the length of the nursing period, an examination of the ratio of mature females which are nursing is not of much assistance, for their appearance is very irregular and there is a probability that a part of the nursing period is spent in some seclusion or segregation from the main herds, so that the proportion represented by those which do appear on the whaling grounds is uncertain. Furthermore, it must be remembered that the killing of females accompanied by a calf is prohibited in the Dependencies. From the accounts of the whalers it seems that young calves are very rarely seen in the Dependencies but are commoner off the South African coasts. This is to be expected since the calves appear to be born early in the southern winter when the mothers have travelled north into the warmer waters. Small calves are of course seldom killed by the South African whalers as they are scarcely worth pursuing, but, as is pointed out in the section on blubber, the lactating whales examined at Saldanha Bay were very fat compared with those at South Georgia, indicating a comparatively early stage in the nursing period. It happens occasionally at South African stations that sucking calves are killed and when this occurs valuable evidence is provided as to the rate of growth during the nursing period. At South Georgia Blue whales of less than 16·0 m. or Fin whales of less than 13·0 m. are practically never captured.

As scarcely any small calves have appeared in the course of our work it is necessary to turn elsewhere to find material on which to extend the curve of growth. Records of calves are extremely scarce, but among the statistics furnished to the British Museum by the whaling companies the number of whales recorded is so great that it is possible to glean a moderate number of measurements of whales sufficiently small to be regarded as unweaned calves. These have been plotted according to their size and date in Figs. 149 and 150, and are taken from the statistics of the whaling stations at South Georgia and of Messrs Irvin and Johnson's station at Saldanha Bay, Cape Colony. Records from the South Shetlands and South Orkneys have been excluded as unreliable owing to the difficulty of measuring whales from a floating factory.

For the estimation of the rate of growth during lactation Blue whales may be taken first, since for this species the material gives rather more definite results. It will be seen in Fig. 149 that the plotted points representing calves are much more scattered than those representing foetuses, but that the young calves are inclined to occur early in the southern winter while the large ones are massed in the late winter and early summer (i.e. about October, November and December). There is in fact an unmistakable path of points sloping upwards through the southern winter, and the mean curve of growth is drawn to represent as closely as possible the line of this path.

Two dotted curves are drawn parallel to the mean curve of growth and set on either side of it at intervals of two months. Over the gestation period these curves are accurate reproductions of the mean curve and represent the growth of foetuses conceived two months before or two months after the height of the breeding season. They are similar during the nursing period, but are drawn to diverge slightly to allow for differential rates of growth. It will be seen that these two curves enclose not only practically every foetus but also the vast majority of the calves. In other words, although they appear rather scattered and irregular, it may be supposed that the majority of recorded calves were born within four months of one another. Various factors might explain the points which fall outside the dotted curves, among which are exceptional pairings outside the breeding season, exceptionally rapid or slow growth after birth, and faulty measurement or recording by those supplying the statistics from which the plotted calves are derived.

To return to the mean growth curve it is seen that this reaches the 16 m. level opposite the earlier part of December. It may be estimated therefore that the nursing period lasts on the average from May to December, i.e. about seven months. Growth during this period thus appears to be very rapid and equal (in linear increase in size) to the rate at the end of gestation.

One might expect that the occurrence of lactating females, especially at South Georgia, might help to throw some light on the normal time at which the nursing period closes, but little help is to be found in this direction owing to the irregularity of the appearance of these whales. In the 1925–6 season at South Georgia there was a comparatively large number early in the season and few in the second half, a state of affairs which appears to tally well with the foregoing conclusions as to the nursing period. On the other hand, in the 1926–7 season, the lactating Blue whales predominated towards the end. It must of course be remembered that December would be only the average of a large number of times at which weaning might take place and that the process of weaning

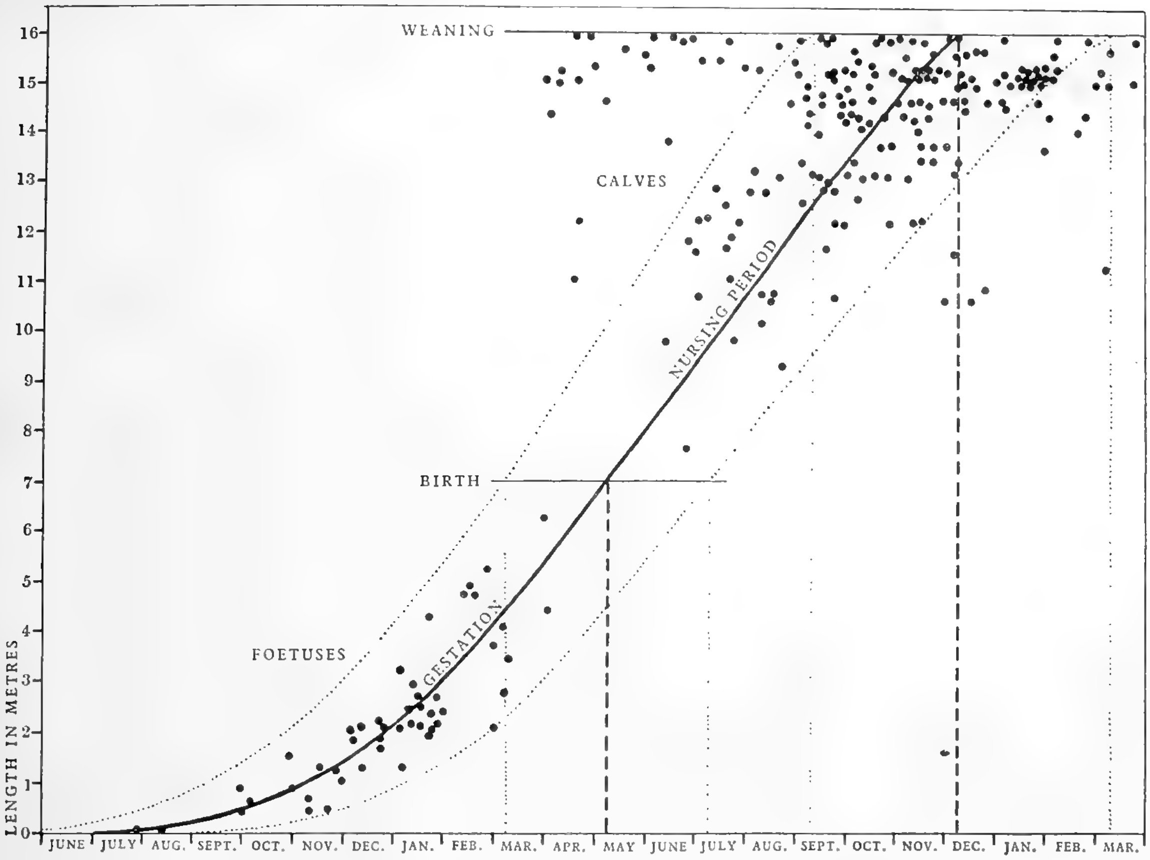

Fig. 149. Blue whales. Mean curve of growth during gestation and nursing.

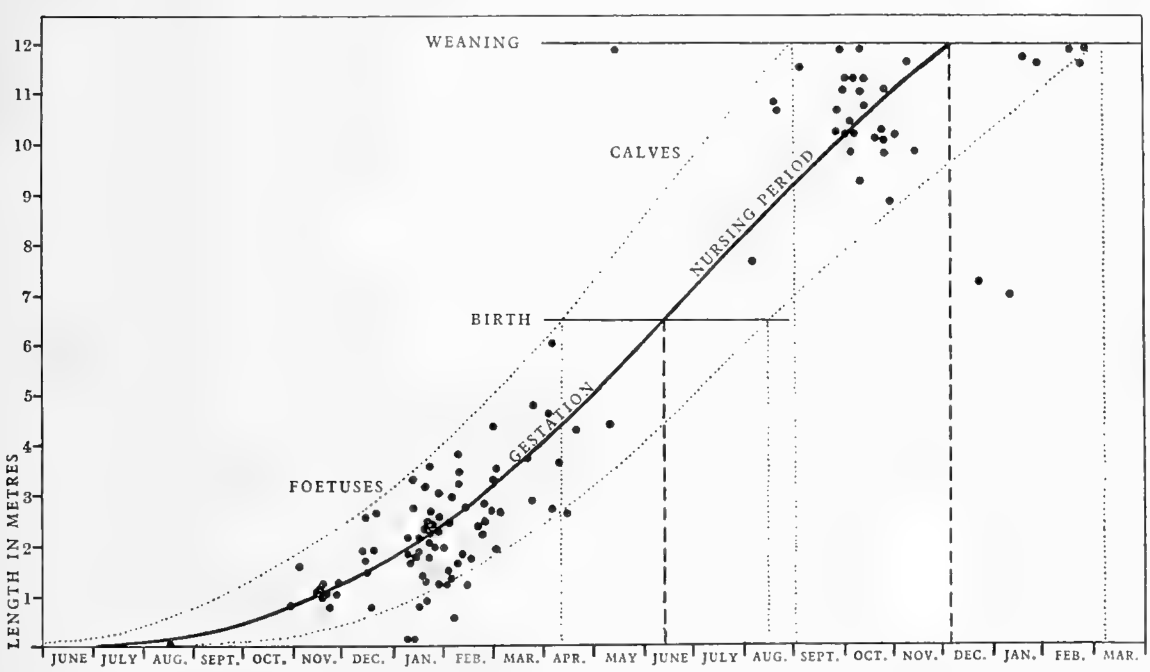

Fig. 150. Fin whales. Mean curve of growth during gestation and nursing.

may itself take some little time and an even longer period may elapse before the condition of the mammary glands has finally reverted to the normal. Thus in any case we may expect to find lactating whales long after December, but even so the most important cause of the irregularity in the appearance of lactating females is that their distribution and movements are probably different from other "classes" of Blue whales. It is not unlikely that they seek seclusion of some kind during a large part of the nursing period and it is probable that if the catches of the whaling stations constituted a representative sample of the whole stock, the lactating whales would regularly be found to be more numerous in the earlier part of the southern summer.

We have seen then that the nursing period in Blue whales appears to occupy about seven months, on the average from about May to December, and that during this period the length of the calf becomes more than doubled.

Fig. 150 has been constructed for Fin whales in just the same way as Fig. 149, but the records of calves are scarcer than in the case of Blue whales. This is no doubt due to the fact that the calves in this species, being weaned when much smaller than those of the Blue whale, are from the whaler's point of view not worth taking. All that can be said is that there is a group of large calves occurring mostly about October which were presumably born in the previous autumn (i.e. between about April and July). The mean growth curve is therefore continued upwards so as to pass through the middle of this group. It is then found to reach the 12 m. level opposite the month of December. Thus for Fin whales about six months is estimated for the nursing period which, on the average, should last from June to December. It will be noted that the rate of growth during this period is appreciably slower than that of Blue whale calves.

As to the occurrence of lactating whales much the same comments apply to Fin as to Blue whales, but lactating Fin whales appear to have been spread a little more evenly over the season than lactating Blue whales.

In considering now the subsequent growth of the young whale, Blue whales must again be taken first. Up till now the rate of growth of the calf has been extremely rapid, but there is some evidence that after weaning the rate of growth slows down considerably. This fact together with the almost certain intervention of different individual rates of growth would obscure any evidence from the plotting of larger whales according to length and date, and in order to find the rate of growth over the next period of development, that is from weaning to sexual maturity, different methods have to be employed.

By a kind of statistical analysis of the catches of whales it can be argued that in all probability the period which elapses between weaning and sexual maturity is rather less than two years, or rather more than two years from birth. The evidence from this cannot perhaps be regarded as conclusive, but receives support from evidence from certain other sources.

It is necessary first to consider some aspects of the migrations of Blue and Fin whales. It has been shown that the period of lactation mostly covers the winter and early part of the southern summer. During the winter the whales are to the north in warmer water, but in the spring the southward migration begins and from the fact that weaning appears to take place about December, it is to be supposed that the mother with her calf migrates southwards in the beginning of the summer in order to wean the calf on the feeding grounds of the Dependencies. Probably the migration of the mother is more leisurely than that of the main body of whales travelling to the south. This is in itself probable since the calf cannot be expected to swim as fast as the adult. The suggestion is also supported by other facts. For instance there is a phenomenon which appears to be quite regular from year to year at South Georgia. If reference is made to Plates XLIII and XLIV, it will be seen that in the second half of the South Georgia season there is a regular influx of smaller whales, and that many of these (unless growth has slowed down to an improbable extent) can hardly have been weaned more than a few months, and are thus the season's new batch of whales.

There is one point, however, which does not appear to agree very well with the theory that the mother and calf regularly migrate southwards towards the end of the nursing period and that is that there are numerous small whales off the South African coast in winter, many of which are obviously too small to have migrated south and back again to warmer waters since they were weaned. It is difficult to say what relation these small South African whales bear to the main stock. It is possible that in some cases the calf is weaned on the small and rather scarce krill in those waters and remains in the northerly regions for the first summer.

Up to the present the story of the whale's growth may be summarized as follows. Impregnation in both Blue and Fin whales may be expected to take place about June or July and the calf is born on the average about the beginning of the following May after the parent has made a southward migration to feed during gestation and returned to the warmer waters towards the north. The calf is born at 6·5 to 7 m. and during a nursing period of some six or seven months it grows to about 16 m. in the case of Blue whales and 12 m. in the case of Fin whales. At this stage the summer is reached and the calf is weaned when it has migrated with the parent to the southern feeding grounds.

It is now necessary to find the rate of growth from this point up to sexual maturity, and to throw light on this we must, as mentioned above, examine the catches from a statistical point of view.

The following table shows the length frequencies of all the whales examined in the course of our work. That is to say it shows, for various periods, the numbers of individuals which have occurred at different lengths, successive metres of length being taken as the most convenient length groups. Separate figures are given for separate seasons, but the second half of the 1924–5 season (when work was started) and the 1925–6 season are amalgamated in one column as the constitution of the whale population of South Georgia was somewhat similar in these two seasons, whereas it was quite different in the 1926–7 season.

The result of this analysis of the catches can be examined more satisfactorily in a graphic form. In Figs. 151, 152 and 153 the figures are plotted in charts which show the number of whales in each length group, the different seasons and sexes being kept separate as in the table.

Blue Whales

Length in m.	Number of females					Number of males				
	Feb. to May 1925	Oct. 1925 to Mar. 1926	Feb. 1925 to Mar. 1926	Nov. 1926 to Apr. 1927	Saldanha Bay 1926	Feb. to May 1925	Oct. 1925 to Mar. 1926	Feb. 1925 to Mar. 1926	Nov. 1926 to Apr. 1927	Saldanha Bay 1926
13	—	—	—	—	2	—	—	—	—	—
14	—	—	—	—	—	—	—	—	—	—
15	—	—	—	—	—	—	—	—	—	1
16	—	4	4	—	7	1	—	1	1	2
17	2	3	5	2	16	1	7	8	7	21
18	4	12	16	5	28	6	9	15	6	33
19	6	7	13	9	24	7	8	15	8	23
20	9	7	16	4	12	2	7	9	6	14
21	5	4	9	4	8	11	8	19	3	1
22	4	5	9	7	4	6	3	9	15	7
23	6	2	8	14	2	4	5	9	33	7
24	5	7	12	15	6	8	9	17	45	6
25	7	7	14	42	7	4	2	6	28	3
26	8	11	19	36	9	—	—	—	3	2
27	2	1	3	6	1	—	—	—	—	—
28	—	1	1	2	—	—	—	—	—	—

Fin Whales

Length in m.	Number of females					Number of males				
	Feb. to May 1925	Oct. 1925 to Mar. 1926	Feb. 1925 to Mar. 1926	Nov. 1926 to Apr. 1927	Saldanha Bay 1926	Feb. to May 1925	Oct. 1925 to Mar. 1926	Feb. 1925 to Mar. 1926	Nov. 1926 to Apr. 1927	Saldanha Bay 1926
12	—	—	—	—	1	—	—	—	—	1
13	—	—	—	—	1	1	—	1	—	5
14	—	1	1	1	14	—	2	2	1	23
15	2	2	4	3	25	—	2	2	4	30
16	2	6	8	1	14	2	3	5	2	18
17	5	3	8	3	9	4	4	8	5	8
18	8	9	17	5	2	8	9	17	7	3
19	9	8	17	4	1	17	42	59	13	9
20	12	18	30	11	4	18	88	106	18	13
21	17	40	57	18	4	6	56	62	10	4
22	15	40	55	13	—	—	4	4	1	—
23	4	9	13	3	—	—	—	—	—	—
24	1	3	4	—	—	—	—	—	—	—

If one were dealing only with fully grown whales one would expect a curve constructed in this way to resolve itself into something like a normal frequency curve, the medium-sized whales being commonest and the larger and smaller whales progressively fewer. But as young whales in several stages of growth are included in the catches, the beginning or left-hand side of the curve (representing the smaller whales) may be expected to rise more gradually, and over a greater range of size, than the right-hand

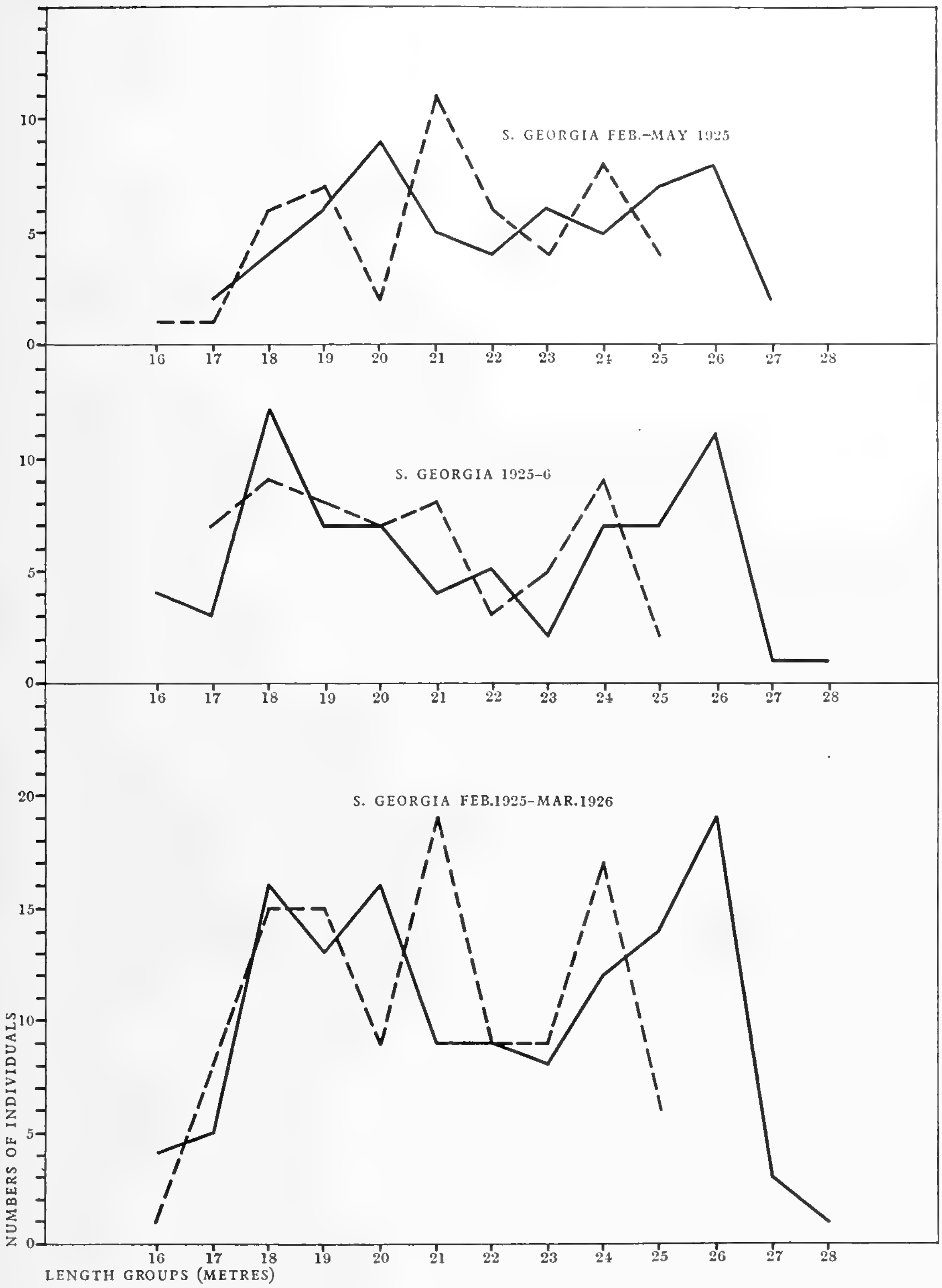

Fig. 151. Blue whales. Length frequencies for different periods.

——— Females. - - - - - Males.

part of the curve (representing the specially large whales). This, approximately, is the result obtained among Fin whales (Fig. 153). The difference between the two maxima represents roughly the normal difference in length between the sexes.

When we turn to the Blue whales we find that some of the curves are of quite an unexpected shape. In the 1926–7 season, when the majority were fully grown, the curves are of the normal type found in Fin whales with one marked apex for each sex, but in the preceding seasons the curves tend to resolve themselves into several apices

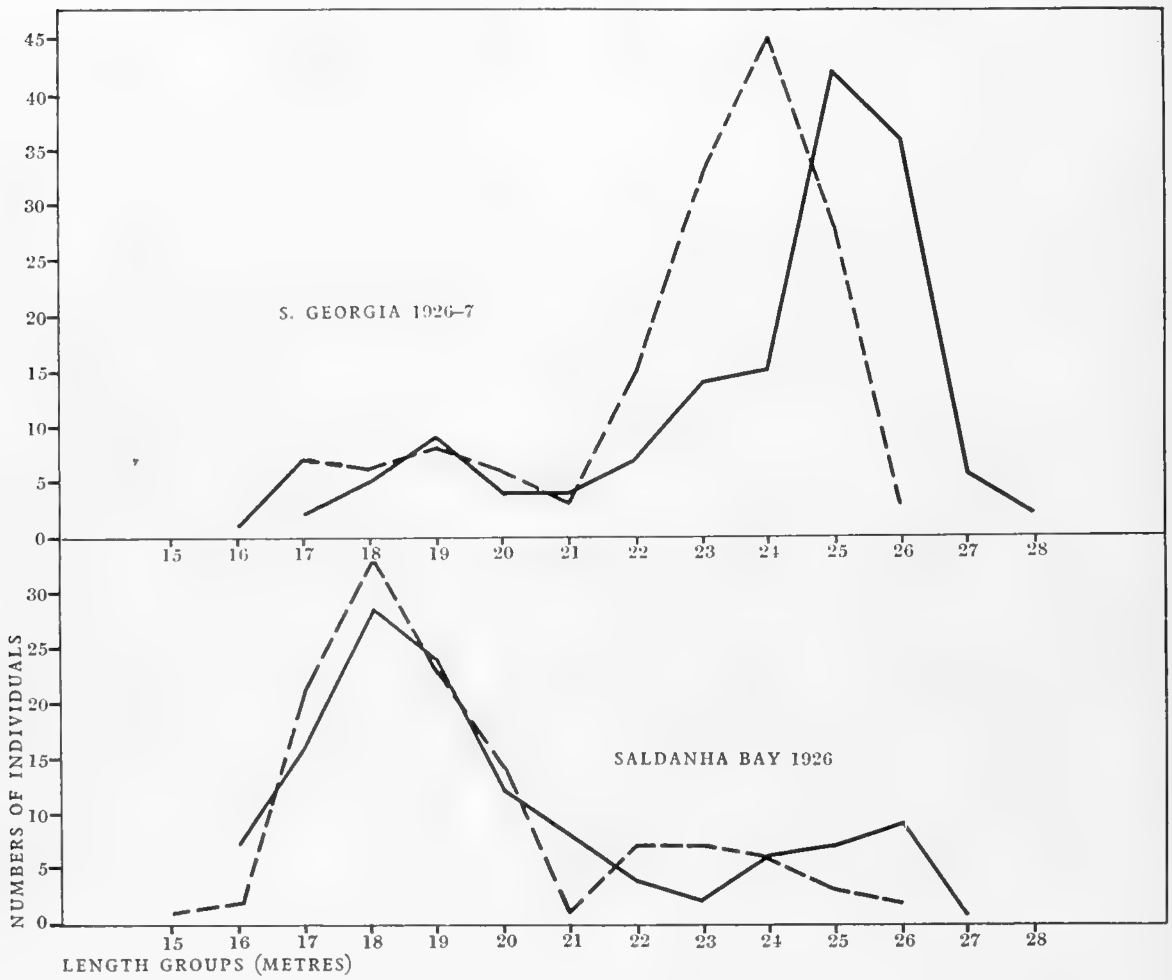

Fig. 152. Blue whales (*continued*). Length frequencies for different periods.

——— Females. - - - - - Males.

of comparatively uniform prominence. Perhaps the best example is furnished by the figures for males and females in the half-season February to May 1925. There are three maxima for each sex showing that males are commonest at 18–19 m., 21 m. and 24 m. and less numerous at 20 m. and 22–23 m., and that females are more numerous at 20 m., 23 m. and 26 m. and less numerous at 21–22 m. and 24 m. In other words these whales tend to approximate to one of three different sizes which may be regarded as (1) small immature (18–19 m. in males, 20 m. in females), (2) large immature (21 m.

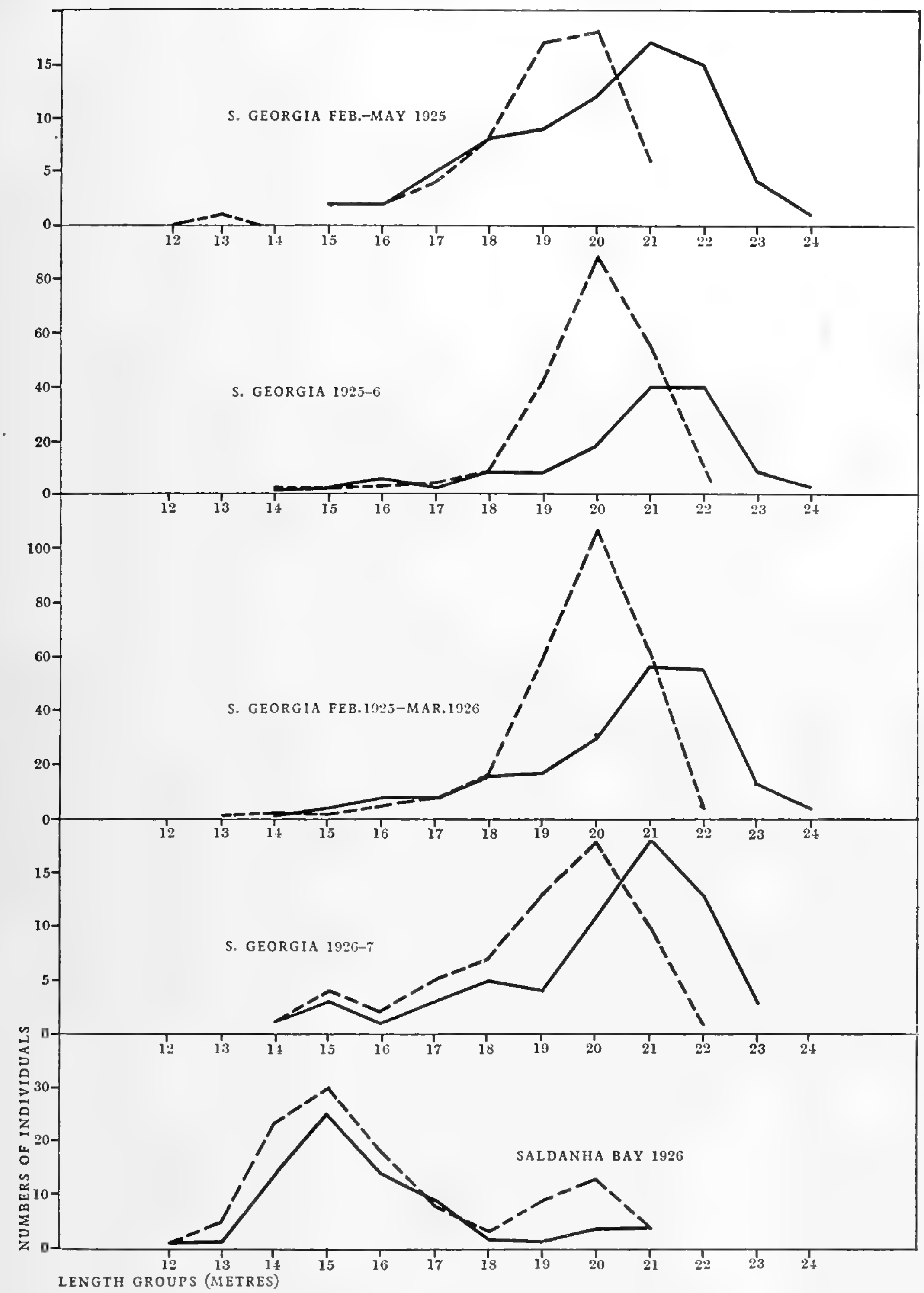

Fig. 153. Fin whales. Length frequencies for different periods.
——— Females. - - - - - Males.

in males, 23 m. in females), and (3) mature (24 m. in males, 26 m. in females). Again the differences between the maxima are about equal to the ordinary differences in length between the sexes.

The tendency towards three dominant length groups is also to be seen in the curves for the 1925–6 season, and in the graph showing the February–May 1925 figures combined with those of season 1925–6.

Although the numbers of whales on which these curves are based is small it is difficult to believe that the appearance of these length groups is due to chance, and the explanation seems to be as follows. If breeding took place regularly all the year round one would expect the young whales to appear equally at all sizes at any given time, but as breeding takes place mostly at a particular season there will be batches of

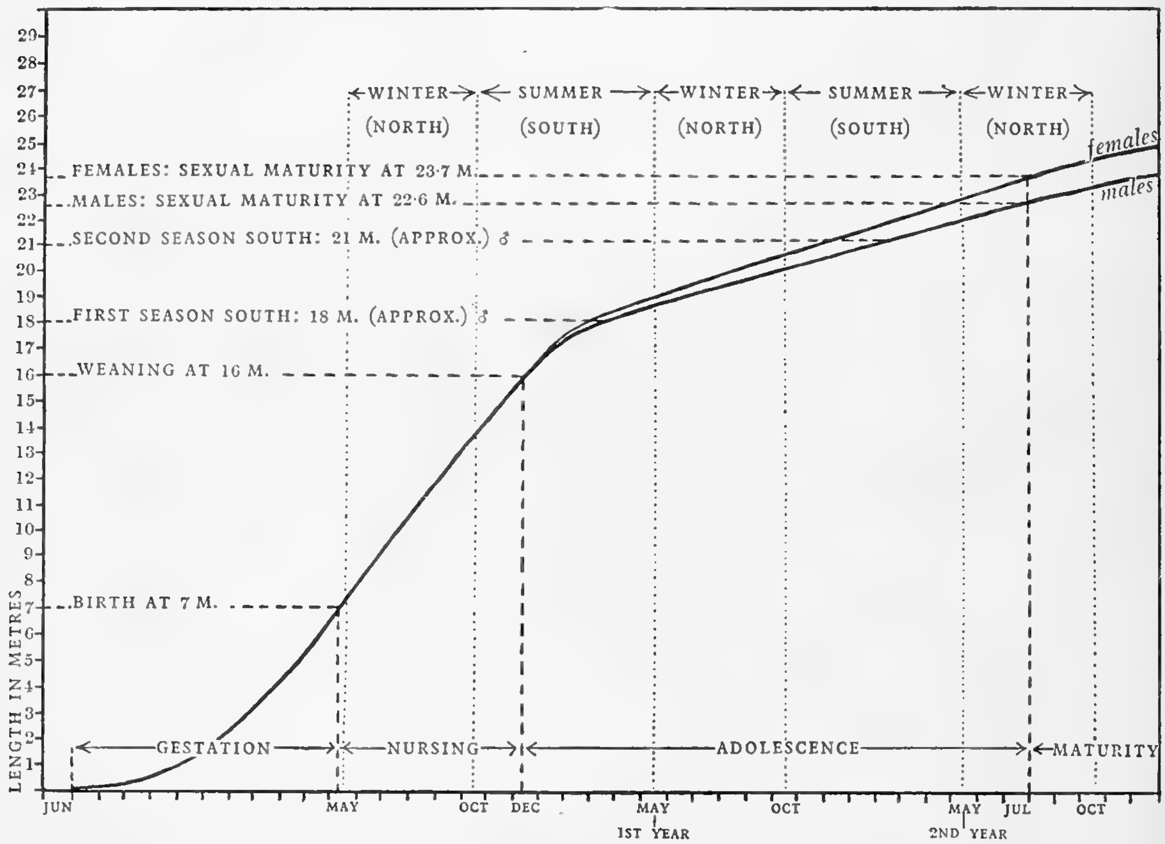

Fig. 154. Blue whales. Estimated mean curve of growth from conception to sexual maturity.

young whales differing in length from one another by an amount equal to a year's growth. It is therefore not unreasonable to suppose that the difference between our two immature groups represents a year's growth.

The most uniform results seem to be furnished by the male Blue whales. The facts may be stated as follows. In the summer season at South Georgia male Blue whales are most common at 18–19 m., 21 m. and 24 m. If the calf is weaned at 16 m. it might quite reasonably be expected, judging by its rapid growth during nursing, to grow to 18 m. before the end of its first summer (see Fig. 154). Then the inference from these length groups is that the young whale migrates northwards in the next winter, grows a little more and returns to the south in the second summer where it reaches a length of 21 m. At the end of this second summer it returns again to the north to grow up to 22 or 23 m. It is at this length (speaking still of male Blue whales) that sexual maturity is reached. Although there are very few whales among the winter catches at Saldanha Bay approximating to the length at which maturity is reached, it is still probable that this condition is attained before the commencement of the southward migration, for it appears that this locality is not the ordinary haunt of whales which leave the south in the winter.

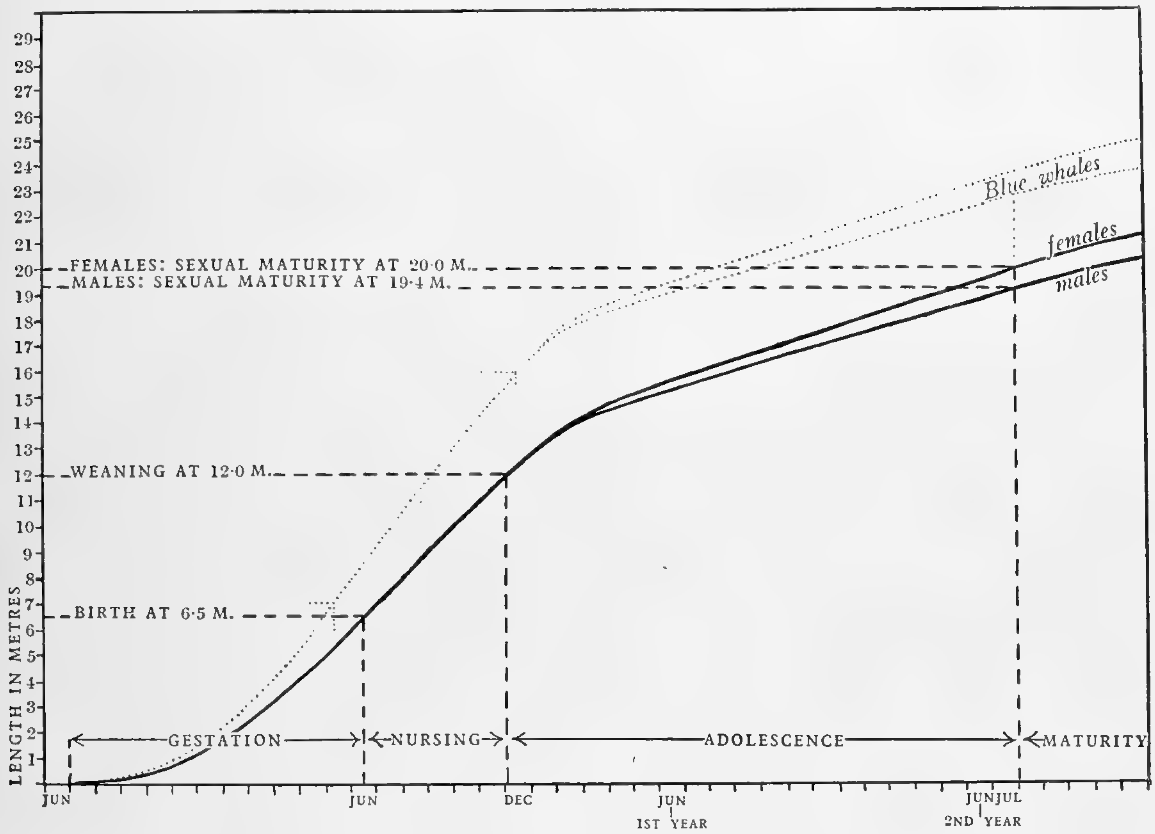

Fig. 155. Fin whales. Estimated mean curve of growth from conception to sexual maturity.

Thus if the whale is born at the beginning of May, then the indications are that sexual maturity is reached after a period of slightly more than two years. The general significance of this surprisingly rapid growth will be discussed later, and in the meantime we may complete the curve of growth for male Blue whales up to sexual maturity and slightly beyond that point, as it is to be supposed that the newly adult whale now grows up towards the third length group (24 m.) on its third visit to the south. This is shown in Fig. 154 in which the curve in Fig. 149 is continued and that of the female Blue whales added. It is suggested that the differences in length between males and females at sexual maturity and at maximum growth first appears some time after weaning. The smallest whales of both sexes caught at South Georgia are of about the same length.

In Fin whales it has already been seen that the rate of foetal growth is slower and that the foetus is born at a shorter length than that of Blue whales. The difference in length between the two species is thus marked from the start (by the slower growth rather than by the birth at a smaller size).

The breeding season among Fin whales appears to be less definite than that of Blue whales. As a consequence the length groups tend to coincide and this is presumably the explanation of the normal frequency curves shown in Fig. 153 instead of the trimodal curves of the Blue whales. As the growth rate of Fin whales is unlikely to be substantially different from that of Blue whales a provisional curve for the former can be constructed by analogy from weaning at 12 m. to sexual maturity at 20 m. for females and 19·4 m. for males (Fig. 155).

It may appear that a good deal has been taken for granted in the construction of this curve for Fin whales, but it must be remembered that the curves of growth subsequent to weaning are intended in both species only to represent the most probable rate of growth, as indicated by such evidence as is available. The important point is to find out whether two or three years or, say, five or six years are passed before maturity is reached, and the details of the curve are relatively insignificant.

At this point the steps by which the whole growth curve is built up from conception to the attainment of sexual maturity may be briefly recapitulated. The records of foetuses show that the greater part of foetal growth takes place during the southern summer, and this, coupled with the occurrence of very small embryos, evidence in the ovaries of ovulation and in the testis of a male sexual season, enables us to fix the middle of the breeding season about June or July. It is known that birth takes place in Blue whales at about 7 m. and in Fin whales at about 6·5 m., and by drawing a line to represent as nearly as possible the slope of the plotted foetuses we are able to complete the curve of growth during gestation, which gives us a period of about ten months. For the nursing period exactly the same method is used. The length of the calf at weaning is known to be in the neighbourhood of 16 m. in Blue whales and 12 m. in Fin whales. The gestation curve is extended over the nursing period, and, guided by points plotted to represent records of calves, reaches the length at which weaning takes place some six or seven months after birth. This brings us over the southern winter to the early part of the summer, the mother and calf having presumably migrated southwards during the spring. As to the rest of the curve of growth, the fact that adolescent Blue whales at South Georgia tend to approximate to one of two lengths is attributed to the production of annual batches of calves, and from this, the length at maturity being known, it is estimated that maturity is reached some two years after birth. Thus the whole curve is built up by ascertaining the lengths at which the important "landmarks", such as birth, weaning and sexual maturity, are reached, and by filling in the rate of growth between by whatever evidence is available.

The earlier part of the curve is based on the soundest evidence and it becomes more speculative towards the end. Perhaps the most important point which emerges is the very short period which elapses between birth and the attainment of sexual maturity.

The reliability of the statistical method of calculating this period might be questioned, but a glance at Figs. 154 and 155 will show that it is during the periods of gestation and nursing that the surprisingly rapid growth takes place and that the section of the curve based on the statistical evidence shows a marked reduction in the rate of growth.

Mention has already been made of a paper by Andrews (1914) on the Pacific Grey whale, *Rhachianectes glaucus*. Here there is more evidence of the rapid growth of whalebone whales, for, from some notes on the period of gestation and rate of growth, it appears that it more than doubles its length in its first year. An investigation of the rate of growth of this species is also made by Risting, who shows that by the end of this first year after birth this species is almost certainly adult.

Direct evidence of the rapid growth of a young whale, probably a Fin whale, is also mentioned in the *Report of the Interdepartmental Committee on Research and Development in the Dependencies of the Falkland Islands* (p. 77). Reference is here made to a case in which a recently born whale was observed early in May. It was presumably not more than about 8 m. long and had a wound by means of which it was recognizable. It was noticed by the whalers all through the summer, and by the autumn it had grown to some 14 or 15 m. This indicates a rate of growth which corresponds fairly well with that shown in Fig. 155.

The great size of Blue and Fin whales is apt to result, perhaps naturally, in the impression that they must require an exceptionally long time to grow to maturity and must live to a great age in comparison with other animals. It has been shown, however, that growth is surprisingly rapid during both gestation and adolescence, and that the whale becomes adult within an unexpectedly short time. It will therefore be interesting to make a comparison in this respect with some other mammals.

The period of adolescence in most mammals varies from about two to five times the length of the period of gestation, and up to a point it may be said that the larger the animal the longer the periods of gestation and adolescence. In the rat, for instance, the period of gestation is about three weeks, and it starts breeding about two months after birth, while in cats and dogs the corresponding periods are about two and ten months. The horse resembles the Blue and Fin whale in this respect, for gestation lasts for some eleven months and breeding may take place two years after birth. The longest period of gestation appears to be that of the elephant, in which twenty months elapse between conception and birth. The age at which puberty is reached is probably considerable, since full maturity is not reached before about twenty-five years.

Thus the periods of gestation and adolescence in whales are short in proportion to their size when compared with the land mammals. This is not only the case in Blue and Fin whales, but also, as we have seen, in *Rhachianectes*, in which both gestation and adolescence last only about one year. It is probable in fact that in marine mammals growth is in general relatively fast, for in the sea elephant also, which may be regarded as one of the definitely large mammals, the period of gestation is eleven months and breeding appears to begin about a year after birth.

A point of some interest arises when the development and growth of the whalebone whales is examined in connection with the enormous size attained by the adult. It has already been pointed out that during the early part of gestation growth is slow, but that the general form of the body is rapidly perfected, so that a foetus of 0·5 m. really differs very little from an adult whale.

Now although the difference in size between the sexes probably does not appear until about the time when the young whale is weaned, reference to Figs. 154 and 155 will show that the difference in size between Blue and Fin whales is apparent quite early in the development of the foetus. This specific difference in size is attained simply by more rapid growth on the part of the larger species and not by growth spread over a longer period. Blue whales are apparently ready for birth at a greater length in, if anything, an actually shorter time than Fin whales. It is probable that in the early stages of the development of the foetus, when the organs are being formed and the limbs completed, the actual increase in length would be approximately the same for both species, and it may be suggested that development up to this point does not differ in any special way from the development of other mammals, and that the foundations for the whale's great subsequent size have not yet been laid down. After this, however, instead of development being quietly finished off and birth taking place, the rest of gestation is devoted to a great burst of growth, the rapidity of which in the different species appears to be proportional to the size of the whale when fully adult. As it is practically certain that the great size of whales is, from the evolutionary point of view, a recently acquired character, it would naturally be expected to make its appearance in the later part of gestation. Thus the great size of a whale does not necessarily imply the need for a long period to attain that size. The capacity for rapid growth is to be regarded rather as one of a number of characters distinguishing certain whales from other mammals.

THE AGES OF WHALES

It is important that something should be known of the ages of whales, but the problem is a very difficult one to approach. At present no direct method of judging the age of any individual has been found, but it is often possible to say whether one whale is older or younger than another, and in the case of the younger whales there are sometimes grounds for making some kind of guess at the actual age. The main object, however, of this section will be to give an idea of the kind of results which may be hoped for in this direction in the future.

The size of a whale, the number of old scars, the condition of the vertebral epiphyses and the number of old corpora lutea may all throw some light on the age of a whale.

It is obvious that size is up to a point a rough criterion of age, and we already have grounds for supposing that when a whale reaches the size at which it should become adult it is about two years old. After a whale becomes adult it may reasonably be supposed that it will continue to grow at least a little and that in some cases it adds several metres to its length, so that one is justified in saying that, for instance, any female Fin whale measuring about 20 m. is unlikely to be more than two or three years old and that one measuring 23 or 24 m. is unlikely to be less than three or four years old. But one cannot go further than this.

The old scars left on the whale's skin by the wounds contracted in temperate or subtropical waters seem to be cumulative, for they are generally more numerous on large than on small whales, but they are of little value except that they may help to show whether a whale is comparatively old or comparatively young. It would be practically impossible to count the scars and such a figure would in any case convey very little information.

The condition of the vertebral epiphyses and the numbers of corpora lutea are worth considering in more detail. The former gives an indication of full maturity (and not merely of sexual maturity) and the latter, although it does not take us far, and applies only to females, is in some ways the most important clue to the age of a whale which has so far appeared.

The ankylosis of the epiphyses with the centra throughout the vertebral column can be taken as marking the attainment of full maturity in the animal and cessation of growth in length. Owen (1853), who found that the skeletons of such whales as were available for study possessed unfused epiphyses, suggested that no fusion ever took place and that the immature condition persisted to give greater flexibility to the body and tail, but Flower (1864) showed that when full maturity was reached fusion took place in whales as in other mammals. He further showed that the fusion first took place in the cervical and caudal regions and proceeded from each end to the middle of the column.

The examination of the vertebrae at whaling stations would be much more profitable than it is were it not for the practical difficulties involved. At South Georgia the cutting up of the carcasses is accomplished with considerable speed, and as the operation of exposing the epiphyses is a comparatively laborious process it is impossible to carry it out systematically. At Saldanha Bay some opportunities for this work occurred and a number of observations were made upon whales whose length suggested that they might be approaching or past full physical maturity. The method of examination consisted essentially in cutting away the periosteum between the vertebrae and exposing the edge of one of them. The state of fusion of the epiphysis with its centrum could then be noted. At the whaling station at Saldanha Bay the vertebral column was usually hauled on to the "bone platform" ventral side uppermost. This permitted the counting of the vertebrae from the first ventral chevron and facilitated the cutting away of the periosteum without assistance from station hands and machinery. As many vertebrae as time permitted were examined, but not more than three could be done at any time before the column was cut up.

The observations made were as follows:

Blue Males

Whale number	Length (m.)	Vertebrae examined	State of epiphyses	Notes
1045	23·3	3rd dorsal	Not ankylosed	Vertebra red, epiphysis white
		8th dorsal	Not ankylosed	Vertebra red, epiphysis white
		13th dorsal	Not ankylosed	Cartilaginous layer between epiphysis and centrum
1109	24·9	10th lumbar	Ankylosed	—
1100	25·9	10th dorsal	Ankylosed	Rounding off
		10th lumbar	Ankylosed	Rounding off
1029	26·3	10th dorsal	Ankylosed	No traces of join
		4th lumbar	Ankylosed	No traces of join
		9th lumbar	Ankylosed	No traces of join

Blue Females

Whale number	Length (m.)	Vertebrae examined	State of epiphyses	Notes
1095	19·85	5th dorsal	Not ankylosed	—
		10th dorsal	Not ankylosed	—
981	20·1	2nd or 3rd dorsal	Not ankylosed	—
1124	25·7	3rd dorsal	Not ankylosed	Vertebra red, epiphysis white. Greatest contrast in 3rd dorsal
		5th dorsal	Not ankylosed	
		10th dorsal	Not ankylosed	
1079	25·95	7th dorsal	Not ankylosed	Vertebra red, epiphysis white
900	26·3	10th dorsal	Not ankylosed	Vertebral column broken on platform. Epiphysis parted from centrum

Fin Males

Whale number	Length (m.)	Vertebrae examined	State of epiphyses	Notes
940	15·43	7th dorsal	Not ankylosed	—
1030	19·0	8th dorsal	Not ankylosed	Vertebra red, epiphysis white
		13th dorsal	Not ankylosed	—
1111	20·35	10th dorsal	Not ankylosed	Vertebra red, epiphysis white
		15th dorsal	Not ankylosed	Vertebra and epiphysis white
		10th lumbar	Not ankylosed	—
1094	21·2	10th dorsal	Ankylosed	Rounding off
		10th lumbar	Ankylosed	Rounding off
		15th lumbar	Ankylosed	Rounding off

Fin Females

Whale number	Length (m.)	Vertebrae examined	State of epiphyses	Notes
186	21·7	6th dorsal	Not ankylosed	—
963	16·78	1st dorsal	Not ankylosed	—

These observations, being made on the dorsal and lumbar vertebrae near the middle of the vertebral column, should, if Flower is correct, be sufficient in most cases to show whether or not fusion has spread through the whole column.

Complete maturity appears to have been attained in three of the Blue males but in none of the Blue females, although the largest measured over 26 m. Only one vertebra was examined in No. 1109, so that one cannot be certain about the whole column, but there is little doubt that Nos. 1100 and 1029 were fully mature. From this it appears that male Blue whales reach full physical maturity at somewhere about 25 m. and females at some length over 26 m., but the data are of course extremely meagre. The data for Fin whales suggest about 21 m. as the corresponding length in males and probably 22 or more metres in females.

As was to be expected these observations give further evidence that females are normally of greater size than males.

It has been pointed out in the section on the reproductive organs that a clue to the age of a female whale is to be found in the remains of the corpora lutea of the ovaries. At the end of its existence as a functional body (i.e. very soon after parturition; or, if the ovum is not fertilized, after presumably a much shorter period) the corpus luteum shrinks to a small fibrous body. Old corpora lutea formed in this way may accumulate, owing to their longevity, in considerable numbers in whales which have been adult sufficiently long. Thus a whale with a large number of corpora lutea is almost certainly older than one with a small number, and if one large group of females on the average has more corpora lutea than another group, there is hardly any doubt that they are on the average older whales. We may make use of this in a general comparison of the ages of the whales caught in successive seasons and examined by us. The figures are as follows:

Blue Whales

Season	Number of adult females*	Average length	Average number of corpora lutea
South Georgia, Feb.–May 1925	18	25·46	5·78
South Georgia, 1925–6 season	21	25·56	6·67
South Georgia, 1926–7 season	47	25·54	10·96
Saldanha Bay, 1926 season	25	25·54	7·10

* In which the total number of functional and old corpora lutea could be counted.

It is seen from this that female Blue whales averaged about the same age during the second part of the 1924–5 season at South Georgia and during the 1925–6 season at South Georgia and the 1926 season at Saldanha Bay. But it is evident that their ages were, in general, distinctly greater in the 1926–7 season at South Georgia.

In the case of Fin whales (see table overleaf) it appears that in all four seasons there was no marked difference in the average ages.

It has been shown that the difficulty of estimating a whale's actual age from the number of old corpora lutea lies in the uncertainty of the number which are formed each season. Several years at least, and possibly many years, must elapse before the last traces of a corpus luteum disappear, but as one cannot be sure that they do not last indefinitely, any estimations of actual age must be applied only to the younger whales.

Fin Whales

Season	Number of adult females*	Average length	Average number of corpora lutea
South Georgia, Feb.–May 1925	33	21·56	9·18
South Georgia, 1925–6 season	75	21·78	10·05
South Georgia, 1926–7 season	18	21·96	11·00
Saldanha Bay, 1926	6	21·12	9·50

* In which the total number of functional and old corpora lutea could be counted.

In a polyoestrous animal the possible number of ovulations in any one season is restricted by the supervention of pregnancy or by the season itself. It is probable that the number will not be very great. Further, in a social and migratory animal like the whale, one might hope to find, at least for a season or two after the attainment of sexual maturity, a similarity in the experiences of the majority in respect of the number of ovulations which do occur. For instance, all whales in their first year of sexual maturity ovulate. After their first sexual season the minimum number of corpora lutea will be one (the whale having become pregnant at the first ovulation) and the maximum number will represent the number of dioestrous cycles, probably not much more than half a dozen. A majority of whales would perhaps have ovulated the same number of times, perhaps four or five corpora lutea being formed, and become pregnant. At the next season these whales will begin lactation and no corpora lutea will be formed, but further ovulations and a fresh batch of corpora lutea will occur at the third season.

Assuming that the number of old corpora lutea is normally increased in this way in alternate years, it is interesting to examine the frequencies of the numbers in which they are found to occur in the ovaries.

In Figs. 156 and 157 the frequencies of the numbers of corpora lutea are plotted for Blue and Fin whales. These show that four to five and ten are the numbers of corpora lutea which have been found most commonly in Blue whales' ovaries, and about four to five, twelve, and possibly nineteen among Fin whales.

The following explanation may be suggested for the prevalence of these numbers. Taking Blue whales first we may call those with from one to eight corpora lutea Group 1. The whales in this group would be expected to consist mostly of those in their first year after sexual maturity which have not become pregnant, those pregnant for the first time, and those lactating or resting after lactation for the first time. Lactating whales will of course be in their second year from sexual maturity. First pregnancies may be recognized by the undeveloped state of the mammary glands. Any whales that are pregnant yet show signs of previous pregnancy appearing in this group are three seasons mature and really belong to Group 2. Group 2 may be taken as including whales with from nine to fifteen corpora lutea. Pregnant whales in this group will have been adult

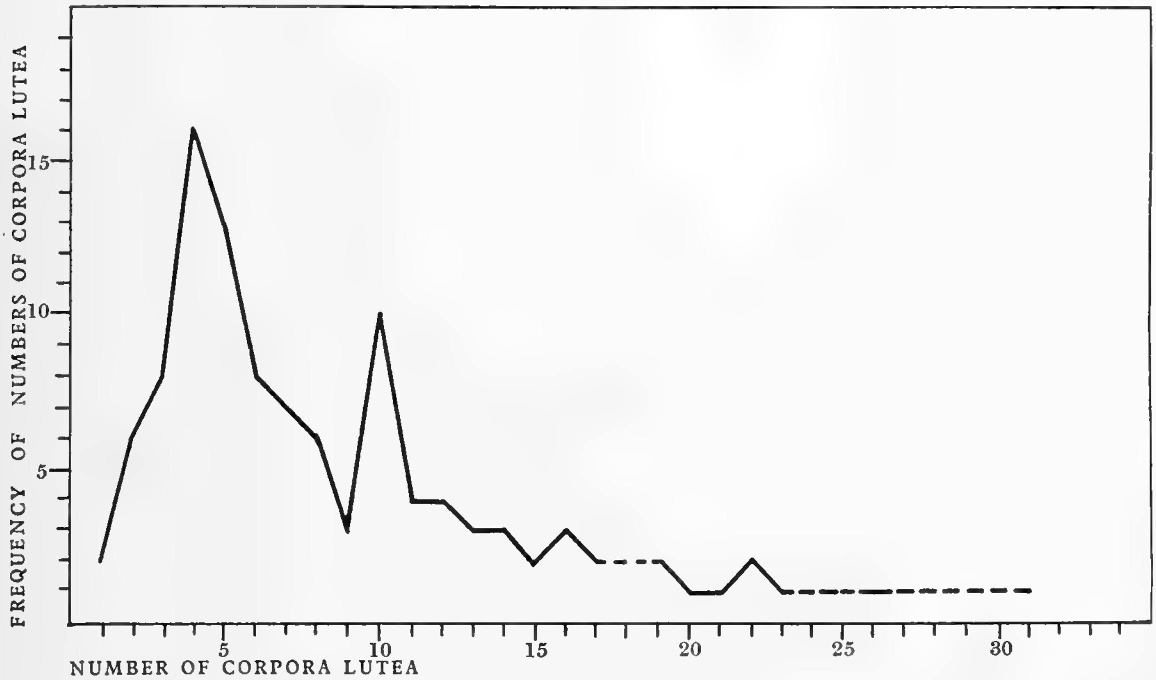

Fig. 156. Blue whales. Frequency of numbers of corpora lutea.

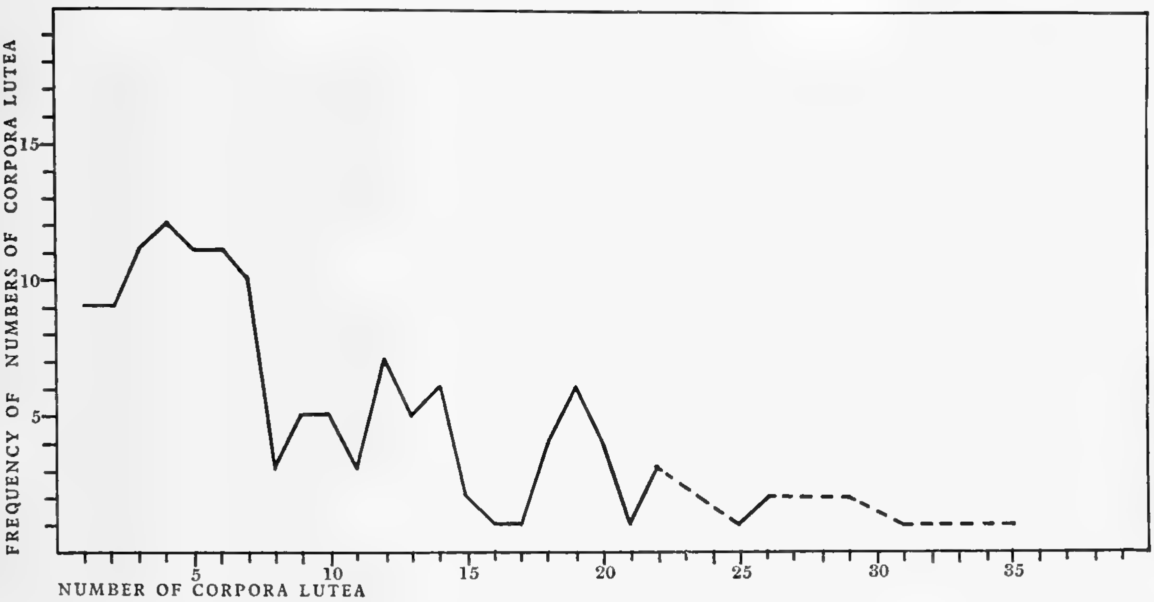

Fig. 157. Fin whales. Frequency of numbers of corpora lutea.

for three seasons, and lactating whales for four seasons. The remaining whales—those with sixteen or more corpora lutea—are presumed to be more than five years old.

Applying this grouping to the female Blue whales of South Georgia and South Africa we get the following analysis of the catches:

Seasons	Group 1		Group 2		Group 3
	3rd year from birth	4th year from birth	5th year from birth	6th year from birth	7th year and over
South Georgia, Feb.–May 1925	(1)*	14	1	1	1
South Georgia, 1925–6 season	1	9	5	4	1
South Georgia, 1926–7 season	6	8	10	12	11
Saldanha Bay, 1926 season	0	12	7	5	1
Total	8	43	23	22	14

* Maturity doubtful.

The columns here are headed by the supposed actual ages of the whales (on the assumption that two years elapse between birth and sexual maturity). Thus a whale in, say, its second year after maturity is in its fourth year after birth.

It will be realized that the exact distribution of the numbers of whales among the groups and sub-groups in the table is simply an expression of the probabilities so far as they can be understood at present, but the analysis at least strongly suggests that in the first two seasons at South Georgia a considerable proportion of the adult female Blue whales killed were not more than four or five years old, whereas in the 1926–7 season the majority had lived beyond this age.

In the case of Fin whales, the grouping shown in the frequency curve is not perhaps very well defined, but Group 1 may be taken as including whales with from one to seven corpora lutea in the ovaries, Group 2 those with from eight to fifteen, and Group 3 the remainder. The analysis is as follows:

Seasons	Group 1		Group 2		Group 3
	3rd year from birth	4th year from birth	5th year from birth	6th year from birth	7th year and over
South Georgia, Feb.–May 1925	4	14	2	6	7
South Georgia, 1925–6 season	4	19	27	11	15
South Georgia, 1926–7 season	2	3	7	1	5
Saldanha Bay, 1926 season	0	0	4	1	1
Total	10	36	40	19	28

Here the presumed age distribution shows greater similarity in the different seasons than in the case of Blue whales.

The tables suggest that in both species the majority of adult females killed are from about four to six years old. It must be emphasized that this is a very tentative conclusion, but it is interesting to note not only that Blue and Fin whales grow to sexual maturity in a remarkably short time, but also that there is some evidence to suggest that the whales killed are on the average unexpectedly young.

The small proportion of the total stock which appears to exceed six years is significant, for it suggests that the maximum age which a whale attains is a good deal lower than might have been anticipated.

THE STOCK OF WHALES

THE CONSTITUTION OF WHALE POPULATIONS

In the preceding sections the external characters, nourishment, reproduction and growth of the southern Blue and Fin whales have been separately dealt with and it remains now to consider the whole subject from a more general point of view. To begin with, in order to understand the effect which hunting is likely to have on the stock of whales, one needs to know, among other things, the composition of the communities or populations of whales which have become the object of the whalers' activities in different localities, and the fluctuations which take place in their occurrence and distribution. This involves an examination of the relative abundance of the species of whales; the proportions of males and females, of immature and adult whales, of pregnant, nursing and resting females; and a study of the fluctuations of these classes of whales and the degree to which they are mixed or segregated.

It need hardly be pointed out that whales are not scattered evenly throughout the southern ocean but are more or less concentrated in certain areas, although at the same time they are generally on the move. This implies that they tend to move in close aggregations through some comparatively limited regions and in a more dispersed form through other less limited areas, or that they travel perhaps in herds which spend part of their time in recurring visits to the same regions and part in travelling over various routes in the open ocean. For example, there must be great numbers of whales which regularly visit the coastal waters of South Georgia and other parts of the Dependencies where supplies of food are concentrated, and spend much of the rest of their time in migrations which take them far from land. It would appear in fact that the limitation of the areas in which *Euphausia superba* lives in such abundance is mainly responsible for the concentration of the whales in those areas, and therefore renders the catching of whales in large quantities comparatively easy. The vast majority of whales caught, for instance, off South Georgia are found within about forty miles of the coast, and if they happen at any time to become scarce within this range the whalers do not usually expect to find more by going much further from land.

The whaling industry does not, of course, need to rely on the great feeding grounds for its catches. Off the African coasts a moderate number of whales are caught, but here each station uses a comparatively large number of boats and the climatic conditions are much more favourable. The actual number of accessible whales is not to be compared with that at South Georgia or the South Shetlands.

The best known and most extensively exploited feeding grounds and areas of concentration are South Georgia and the South Shetlands. There are, of course, other such places as, for instance, in the Ross Sea where whales are known to exist in great numbers, but it is still uncertain to what extent the krill attracts large communities of whales round the less known fringes of the Antarctic Continent. The data upon which the present paper is based are, of course, restricted to the whales caught at South Georgia and Saldanha Bay, but it is convenient at this point to refer to the connection which exists between South Georgia and other parts of the Antarctic and sub-Antarctic.

Our knowledge of the whole stock of whales, so far as it is derived from the examination of whales at a whaling station, depends largely on the fact that there is very little discrimination in the killing of the whales in any particular area and that the nature and composition of the catches are therefore likely to be fairly representative of the nature and composition of the whale population of that area. Then, if that area is frequented by large numbers of whales of all ages and conditions, one can at least derive from it some idea of the probable nature of the whole stock. The danger of assuming too freely that the whales killed form a representative sample of the whole stock has already been pointed out (p. 430), and before a really thorough knowledge of the whole stock can be gained, it is desirable that observations should extend to a number of different localities so that comparisons can be made between the different whale populations, and the whole stock viewed from more than one angle.

In this connection a comparison between the catches at South Georgia and South Africa is of considerable interest, for it shows a striking contrast and serves to illustrate the segregation of different classes of whales and their distribution in different localities.

At Saldanha Bay Fin and Blue whales of two kinds are to be distinguished. There are (1) small immature whales which are relatively abundant, and (2) large and fully mature whales which are relatively scarce[1]. The former actually constitute 80 to 90 per cent of the whole catch. The length-frequency curves (Figs. 152, 153, pp. 440 and 441) show that intermediate-sized whales are very rarely taken. This being so, the large and small whales must be regarded as quite distinct. It is probable that the small whales are for the time being staying in this locality, feeding on what krill they can find, or are at least not actively migrating, while the large whales are taken while travelling past that part of the coast. This suggestion is supported by the greater regularity in the appearance of the smaller whales and the much better condition of the large whales, which, as has already been pointed out, have comparatively thick blubber although they have little or no food in their stomachs. There appears to be very little change in the composition of the local whale population during the season.

At South Georgia the constitution of the whale population is entirely different, and is much too complex to be classified into two simple groups. It is more representative than in the vicinity of Saldanha Bay, but there are considerable fluctuations in the numbers of whales, and indications of influxes and effluxes of different classes of whales during the season. The size and nature of the catches also varies, sometimes to a great extent, from season to season. The most obvious points, however, in which the whales of South Georgia differ from those of South Africa are their greater abundance and the fact that the majority are adult.

[1] This is commented on by Risting, 1928, p. 37.

In order to make a quantitative analysis of the constitution and variations of the catches it is necessary to separate the whales of both species into what we may call different "classes". These are as follows:

Females	*Males*
1. Immature	1. Immature
2. Mature	2. Mature
(*a*) Resting	
(*b*) Pregnant	
(*c*) Lactating	
(*d*) Pregnant or recently ovulated	

"Pregnant or recently ovulated" refers to whales in which a functional corpus luteum but no foetus was found. Such whales may be classed together since if a foetus was missed it would probably be so small that for our purpose the whale could practically be regarded as having "recently ovulated".

There is little object in separating males into more than the sexually mature and immature classes, but in the case of females some discrimination must be made between whales in the various stages in the sexual cycle.

The tables which follow show the ratios of the numbers of whales of each class which were caught in successive months, in successive seasons at South Georgia, in the season at South Africa, and in the whole period during which the observations were carried out.

In a number of whales it was of course impossible to examine the reproductive organs, generally on account of the decomposed condition of the carcass, and in some it was possible to examine, for instance, the mammary glands but not the internal genitalia. For this reason the exact number of whales in each class cannot be stated, but in order to give as accurate a comparison as possible between the numbers in each class, the number of whales, for example pregnant or lactating, are expressed as percentages of the number of whales in which the uterus or mammary glands respectively were examined. This applies only to the sub-classes of adult females.

Columns 8, 9 and 10 show the numbers of whales in which either some or all of the genitalia were examined. Thus in column 12, in January 1927 (1926–7 season), we see that 47 per cent of the thirty-two whales, quoted in column 8 as having had their uteri examined during that month, were pregnant.

Percentages are calculated to the nearest unit.

Reference should first be made to the total class ratios of all the Blue whales and all the Fin whales. In these figures we find a restatement of some of the results which have already been put forward. A relatively large number of immature whales, for instance, are caught, amounting in the case of Blue males and females to 55 per cent and 54 per cent respectively and Fin whales to 38 per cent and 41 per cent respectively. Even when the South African whales are left out of account, the figures for South Georgia show a high proportion of immature whales, at least in the case of Blue whales. About 31 per cent of the adult Blue whales and 46 per cent of the adult Fin whales are pregnant, and, as already explained, it may be argued from this that in all

Blue Whales

Locality	Periods	Males: Total no. of whales	Males: Percentage mature	Males: Percentage immature	Females: Total no. of whales	Females: Percentage mature	Females: Percentage immature	Adult females: Total no. mature	No. in which uterus, etc., were examined	No. in which mammary glands were examined	No. in which all genitalia were examined	Percentage (of col. 10) resting	Percentage (of col. 8) pregnant	Percentage (of col. 9) lactating	Percentage (of col. 8) recently ovulated or pregnant	Remaining percentage of doubtful cases
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
South Georgia, 1925	February	11	18	82	18	28	72	5	4	5	4	—	25	50	25	—
	March	24	21	79	24	54	46	13	13	13	13	62	—	38	—	—
	April	12	58	42	12	17	83	2	2	2	2	50	50	—	—	—
	May	3	67	33	4	100	—	4	3	3	3	33	—	33	33	1
		50	32	68	58	41	59	24	22	23	22	45	9	35	9	2
South Georgia, 1925–6	October...	4	50	50	8	88	12	7	7	7	7	—	29	57	14	—
	November	2	50	50	6	67	33	4	4	4	4	25	50	25	—	—
	December	1	—	(100)	—	—	—	—	—	—	—	—	—	—	—	—
	January...	10	80	20	5	80	20	4	3	4	3	67	33	—	—	—
	February	20	40	60	21	14	86	3	3	3	3	33	33	33	—	1
	March	21	5	95	30	37	63	11	9	9	8	75	—	11	11	3
		58	35	65	71	41	59	29	26	27	25	40	23	26	8	3
South Georgia, 1926–7	November	24	92	8	11	73	27	8	8	8	8	50	50	—	—	—
	December	50	94	6	40	82	18	33	22	25	22	59	41	—	—	—
	January...	40	70	30	51	75	25	38	32	33	30	50	47	—	—	3
	February	18	56	44	24	50	50	12	9	9	9	56	33	11	—	—
	March	18	44	56	14	86	14	12	12	12	12	25	42	25	8	—
	April	5	20	80	6	50	50	3	3	3	3	—	33	67	—	—
		155	75	25	146	73	27	106	86	90	84	48	43	7	1	1
Saldanha Bay, 1926	June	18	—	100	28	21	79	6	6	6	6	33	—	17	50	—
	July	31	26	74	26	19	81	5	5	5	5	40	20	20	20	—
	August	25	20	80	31	19	81	6	6	6	6	82	18	—	—	—
	September	37	22	78	28	25	75	7	7	7	7	29	28	43	—	—
	October...	9	—	100	14	15	85	1	1	1	1	—	(100)	—	—	—
		120	18	82	127	20	80	25	25	25	25	44	20	20	16	—
Totals and percentages for South Georgia		263	58	42	275	58	42	159	134	140	131	46	34	15	4	1
Grand totals and final percentages		383	45	55	402	46	54	184	159	165	156	46	31	16	6	1

Fin Whales

Locality	Periods	Males: Total no. of whales	Males: Percentage mature	Males: Percentage immature	Females: Total no. of whales	Females: Percentage mature	Females: Percentage immature	Adult females: Total no. mature	Adult females: No. in which uterus, etc., were examined	Adult females: No. in which mammary glands were examined	Adult females: No. in which all genitalia were examined	Adult females: Percentage (of col. 10) resting	Adult females: Percentage (of col. 8) pregnant	Adult females: Percentage (of col. 9) lactating	Adult females: Percentage (of col. 8) recently ovulated or pregnant	Adult females: Remaining percentage of doubtful cases
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
South Georgia, 1925	February	15	73	27	19	68	32	13	7	11	7	57	14	—	29	—
	March	19	53	47	20	50	50	10	7	9	7	57	29	11	—	3
	April	17	53	47	31	77	23	24	22	24	22	59	23	17	—	1
	May	5	60	40	5	40	60	2	2	2	2	50	50	—	—	—
		56	59	41	75	65	35	49	38	46	38	58	24	11	5	2
South Georgia, 1925–6	October...	4	100	—	2	(50)	(50)	1	1	1	1	—	(100)	—	—	—
	November	5	100	—	9	100	—	9	9	9	9	33	67	—	—	—
	December	3	100	—	9	100	—	9	8	8	8	12	63	25	—	—
	January...	103	92	8	52	88	12	46	36	42	36	25	61	12	—	1
	February	71	85	15	39	79	21	31	27	29	27	44	44	10	—	2
	March	24	58	42	28	46	54	13	12	11	11	73	17	9	—	1
		210	86	14	139	78	22	109	93	100	92	36	52	11	—	1
South Georgia ,1926–7	November	6	100	—	5	100	—	5	4	4	4	25	75	—	—	—
	December	2	100	—	2	100	—	2	2	2	2	—	(100)	—	—	—
	January...	10	60	40	18	89	11	16	11	11	10	20	64	9	—	7
	February	9	67	33	15	63	47	8	8	8	8	25	62	13	—	—
	March	18	39	61	13	46	54	6	4	4	4	—	75	25	—	—
	April	16	62	38	9	56	44	5	4	5	4	50	25	20	—	5
		61	61	39	62	68	32	42	33	34	32	22	64	12	—	2
Saldanha Bay, 1926	June	22	—	100	15	7	93	1	1	1	1	—	—	—	(100)	—
	July	17	12	88	15	7	93	1	1	1	1	—	—	—	(100)	—
	August	42	19	81	26	4	96	1	1	1	1	—	(100)	—	—	—
	September	26	38	62	15	20	80	3	3	3	3	67	—	—	33	—
	October...	7	57	43	4	—	100	—	—	—	—	—	—	—	—	—
		114	21	79	75	8	92	6	6	6	6	33	17	—	50	—
Totals and percentages for South Georgia		327	77	23	276	72	28	200	164	180	162	38	48	10	1	3
Grand totals and final percentages		441	62	38	351	59	41	206	170	186	168	38	46	10	3	3

probability the majority of these whales normally become pregnant in alternate years, practically never in successive years, but sometimes once in three years. The low percentage of lactating whales (16 per cent in Blue whales and 10 per cent in Fin whales) is not sufficiently accounted for by the fact that the nursing period (about eight months) is shorter than the period of gestation (ten to eleven months) and one must suppose that the mother spends much of her time with the calf away from the areas of concentration where the hunting is mostly carried on.

The totals for South Georgia and South Africa provide now a more precise basis for comparing the two localities. Taking first the ratio of immature whales we see that whereas at South Georgia well over 50 per cent of the whales are adult the percentage of immature whales at South Africa works out at about 80 per cent for Blue males and females and Fin males and over 90 per cent in the case of Fin females. In the subclasses of female whales the most striking difference between the two localities appears in the number of whales which had recently ovulated. Among the South Georgia whales 4 per cent of the adult female Blue whales showed indications of having recently ovulated and 1 per cent of the adult female Fin whales, while at South Africa 16 per cent of the Blue and 50 per cent of the Fin females were in this condition. There is a slightly higher percentage of pregnant whales at South Georgia than at Saldanha Bay. This is to be expected since the period of gestation is mostly spent in the southward migration. The figures for lactating whales are inconclusive.

It will of course be realized that some of the distinctions between the whales of the two localities are due to actual differences in distribution, such as appear in, for instance, the ratio of immature whales or the tendency towards fluctuation in the whale population, and some are due simply to the fact that different months are being compared (e.g. the different ratios of females ovulating or pregnant).

The proportion of pregnant females at Saldanha Bay naturally shows a tendency to increase as the season advances (i.e. as the pairing season advances) and the percentage of immature Fin whales decreases fairly steadily. Apart from this, however, there seems to be little fluctuation in the local whale population.

The observed changes in the composition of the catches at South Georgia, however, are of great importance. Reference should be made here both to the foregoing tables and to Plates XLIII and XLIV which give a "bird's-eye" view of the catches in respect of the numbers, sexes and sizes of all the Blue and Fin whales examined. In the second half of the 1924–5 season (February–May 1925) Blue and Fin whales were caught in roughly equal numbers and there was little fluctuation during these months in respect of sex or size or of the proportions of pregnant, resting, lactating whales, etc. The percentage of mature whales does not show any significant change except in the case of Blue males, where it increases from very low figures in February and March to relatively high ones in April and May. There was not much variation in the numbers of whales caught, except that during the greater part of March comparatively few were brought in. Small fluctuations like this, however, are not of great significance and are often caused by bad weather or difficulty in locating the whales. Attention should be drawn to the fact that during these months there was a high percentage of immature whales, especially among Blue whales where the adults were in a minority. In the case of Blue whales very few of the adults were pregnant but a comparatively large proportion were lactating. Rather more Fin whales were pregnant but relatively few lactating.

In the 1925–6 season far more Fin than Blue whales were taken, and fluctuations in the catches were very marked. Mention has already been made of the peculiarities of this season. Whales were very scarce in October, November and December. A few individuals, mostly large ones, were taken at the beginning of the season but they became more and more scarce and the Blue whales almost disappeared altogether. The weather during this period was on the whole fine and food appeared to be plentiful. Among the whales caught a rather high proportion were pregnant and several Blue and one or two Fin whales were lactating.

At the end of December a change occurred in the catches which is strikingly shown in Plate XLIV. Immense numbers of Fin whales appeared in the vicinity of the island. They were found at first about seventy miles from the coast and consisted of a great majority of males of a fairly uniform size. It is worth noting that a transport ship which had recently arrived at South Georgia, had previously reported seeing great numbers of whales some hundreds of miles to the north of the island. There was at first little or no food in the stomachs of the whales caught, but later they were to be found nearer to land and seemed to be finding food. The change in the type of krill has already been commented on. During January about twice as many males as females were caught, but the proportion of females rose in February and March. At the same time the average length of the whales of both sexes declined. This was evidently due to an influx of immature whales, for the latter rose from about 10 per cent in January to about 50 per cent in March. Pregnant females declined from 61 per cent in January to 17 per cent in March, while the ratio of resting females showed a corresponding increase. Some lactating females were caught among these Fin whales, but the ratio fell very slightly during January, February and March. Few Blue whales were caught during this period, but there was a slight influx of small ones which became quite marked at the beginning of March. Pregnant and lactating Blue whales were on the whole relatively fewer than at the beginning of the season. Taking the season as a whole the majority of Fin whales were adult and the majority of Blue whales immature.

This 1925–6 season may be described as a "Fin whale season". The third season at South Georgia, 1926–7, was undoubtedly a "Blue whale season". As may be seen from the chart Blue whales were in a great majority over Fin whales and were abundant during the greater part of the season. Fin whales were extremely scarce at the beginning of the season, but slightly more plentiful in January, at the end of February and beginning of March. It is true that since the whalers prefer Blue whales to Fin whales one may expect comparatively few of the latter to be caught when the former are plentiful, but this is not enough to explain the exceptionally small numbers of Fin whales taken in November and December.

An unusual feature of this season was that towards the end, when Blue and Fin whales seemed to become less plentiful a considerable number of Sei whales were taken.

As in 1925–6 the great majority of whales of both species caught in the earlier part of the season (November to January) were adult, but the average length diminished considerably in the second half, through the appearance of large numbers of immature whales; these came to form a majority in the catches of Blue whales and at least a fairly high proportion among the Fin whales from about February onwards.

In contrast to the previous season the ratio of immature Blue whales for the whole season was reduced to 27 per cent. The proportion of pregnant females, 43 per cent, is a great increase over previous seasons. A greater proportion, 48 per cent were resting, but very few (7 per cent) were lactating. The latter were all taken in the later part of the season.

There were relatively rather more immature Fin whales this season. A very high proportion of the adult females were pregnant but the percentage fell heavily in April. A moderate number were lactating in the later part of the season.

The causes of the fluctuations in the catches which have been described above must now be considered. In spite of the small number of seasons over which the observations have extended there are indications that certain features and fluctuations are more or less constant, while others are variable. Taking the constant features first we see from a glance at Plates XLIII and XLIV that nearly all the time the sexes are equally distributed throughout the season. The only exception to this appears in the sudden influx of Fin whales in January 1926 when for a few weeks males were in a great majority. At Saldanha Bay the sexes were equally distributed through the whole season. From this it may be inferred that, in general, the sexes are evenly distributed in the whale "communities" but that in some cases a certain amount of segregation may take place. Again, when the first and second halves of a season at South Georgia are compared it is found that in the first half the catch is composed of a majority of mature whales, while in the second half there is an influx of immature whales (and perhaps a withdrawal of adults) which causes a sharp reduction in the average lengths. It is quite probable that observations over further seasons will show that this is a regular phenomenon. It is evident in both Blue and Fin whales, though perhaps more marked in the former. Reference to the tables on pp. 456 and 457 suggests that there is a tendency in each season for pregnant whales to be more numerous in the first half of the season and lactating whales in the second half. It should be noted that the lactating whales in October and November 1926 form an exception to this.

Apart from the fact that immature whales have occurred in relatively greater numbers in the latter part of the season, there is an indication that of the adult whales themselves, those taken early in the season are mostly older than those taken later. In the section on the ages of whales it was shown that adult females could be divided into three age groups mainly according to the numbers of corpora lutea in their ovaries. There are not sufficient data to enable us to compare the separate months of each season in this respect, but if the three seasons are amalgamated, the majority of adult females of both species are found to belong to Group 2 in October, November and December, and to Group 1 in the succeeding months. This is shown in the following table in which the number of whales in each group is shown for each month of the South Georgia whaling season. The group containing the majority of whales for each month is marked in heavy type.

	Blue			Fin		
	Group 1	Group 2	Group 3	Group 1	Group 2	Group 3
October	2	2	0	0	**1**	0
November	2	**5**	0	4	**6**	2
December	4	**7**	4	2	**4**	3
January	**8**	1	4	**11**	6	8
February	**9**	2	1	**24**	7	6
March	**21**	5	3	**14**	4	2
April	2	2	0	**11**	6	6
May	1	1	1	**2**	0	0

The more important variable features of the catches seem to be the result of certain mass movements of the whales which differ from year to year. There is little doubt that these movements are largely affected by meteorological conditions and in particular by the position of the icebergs and pack-ice. The distribution of whales, the meteorological and hydrological conditions, and the abundance and distribution of food, must all, in fact, be closely connected with one another.

It is not within the scope of the present memoir to explore these causes very far, but in this connection it is interesting to compare the 1925–6 and the 1926–7 seasons at South Georgia.

In the 1925–6 season there was a small and diminishing quantity of large whales during the first two months or so. Then there appeared a mass of Fin whales with a male vanguard apparently in search of food which they succeeded in finding at South Georgia. This community of Fin whales settled down at South Georgia but dispersed gradually as the season wore on. During this season the ice appears to have remained far south and did not, at any rate, approach the vicinity of South Georgia in any great quantity.

The 1926–7 season opened with the capture of big Blue whales similar to those found at the beginning of the previous season, but instead of dispersing they remained around South Georgia in large numbers. Fin whales were scarce until reinforced by the arrival of immature ones in the latter part of the season. It has already been pointed out (p. 452) that the adult Blue whales of this season were, on the average, older than those of the previous seasons when they were less plentiful. In contrast to the preceding season the ice had drifted exceptionally far north. There were numerous icebergs in the vicinity of South Georgia and the pack-ice itself had here and there penetrated as far as and even farther north than the latitude of the island.

One cannot be certain, but the circumstances seem to show that the distribution of the Blue whales in these two seasons was correlated with the position of the ice. The suggestion is that a big herd of Blue whales had travelled further south than South Georgia early in the 1925–6 season, a few stragglers being caught in the first month or two, and that a herd of the same kind visited the island in the 1926–7 season. On this occasion they perhaps found the conditions they sought further north than before and thus remained in the vicinity instead of travelling further south.

It has already been shown that the average age of the adult Blue females in the 1926–7 season was distinctly greater than in the 1925–6 season.

A rather more definite view can now be taken of the nature of the whale population which is exploited at South Georgia. It may be suggested as a working hypothesis that it is composed partly of sections of the main stock of whales and partly of whales whose movements are influenced less by the movements of the main stock than by some other factor. One would imagine that the movements of the main "herds" (recognized by their large numbers, high average age, high proportion of pregnant whales, etc.) would be controlled mainly by the distribution of food, and the meteorological conditions, and as these conditions vary from season to season the appearance of these big herds at South Georgia is also liable to vary.

On the other hand, we have the whales which appear at South Georgia independently of the main stock. Among these the lactating whales are probably to be counted, for it seems probable, apart from a certain regularity in their appearance near the end of the season, that they lead a comparatively secluded life while nursing the calf, which presumably would not be strong enough to keep up with the majority of adults during the southern migration. The immature whales are perhaps the most prominent among those which appear independently of the main stock. An explanation of their appearance at South Georgia later than the majority of adults might be that being smaller they also take longer over the southern migration. Finally, there are what seem to be schools of stragglers which include many resting and rather few pregnant whales and which may yet form a considerable proportion of the whole stock of whales. These are mostly rather young whales.

This view of the make-up of the whale population round South Georgia is of course to be taken as a hypothesis which must depend for its substantiation on the results of some more seasons' work at South Georgia and the analysis of statistics from past seasons. However, it is probably not far from the truth and it at least gives an adequate explanation of the catches in the three seasons during which the work has been carried on. Risting's analysis of the catches cannot be used much for comparing previous seasons in this connection as he does not indicate the fluctuations in sizes, percentage pregnant etc. from month to month, though he shows the variations in the numbers of whales through several separate seasons.

It is interesting to note that, according to the above account of the fluctuations in the catches, one must suppose that during the greater part of the season the tendency is either for whales to leave South Georgia to go further south, or to arrive at South Georgia from the direction of the equator. Similarly among the catches at Saldanha

Bay the fat adult whales which are presumed to have recently arrived from the southerly feeding grounds, are not taken only at the beginning but well on into the middle of the season. It is true that those taken there in the latter part of the season are not so fat as those which appear earlier and it may be that some of them have started again on the southern migration, but the fact remains that the condition of the majority of these mature whales suggests that they had been recently feeding, and not on the scanty krill of the South African coast.

There are two possible explanations of this state of affairs. It may be that the "north-south" migration lags behind the season so that instead of a punctual southerly migration in spring and northerly migration in autumn there is a continuous movement to the south through most of the summer and towards the equator through most of the winter. Or it may be that a kind of "one-way" system operates, according to which some sort of procession passes through the South Georgia area. In this case the whales which appear early in the whaling season at South Georgia would be on their way back towards the equator by some other route during the second half of the season and so on. The point, however, cannot be regarded as settled at present. Possibly both factors operate to some extent. There is, however, some indication of a return of some of the whales at the end of the South Georgia season. There was, for instance, a slight increase in the number of adult male and pregnant female Fin whales in May 1925. The adults of both sexes also showed a relative increase again in April 1927 (see tables on pp. 456 and 457). Among Blue whales also there was an indication of a return of sexually mature whales at the end of the 1924–5 season.

CONCLUSIONS REGARDING THE WHOLE STOCK

The conclusions, which have a direct effect on our knowledge of the stock, may be summarized as follows:

1. Although it has not yet been possible to make a proper comparison between the whales of the northern and southern hemispheres, records of the external characters and bodily proportions have shown that a very complete resemblance exists between the Blue and Fin whales of South Georgia and South Africa and they have revealed no definite grounds for separating any of these whales as distinct sub-species or races. The general similarity of all the whales examined suggests that it is possible for interchange to take place between the whales of different localities and for a reduced number of whales in one locality to be replenished from the population of another. In a sense this is a negative result, but it is important.

2. Among Blue and Fin whales it is a general rule that the two sexes are everywhere mixed together in roughly equal numbers, though at times a certain amount of segregation may take place. Presumably less harm is done to the stock by the killing of a male than of a female and it is therefore of some importance to know that of a given number of whales killed approximately only half will be females.

3. It has been shown that the ratio of immature whales among the catches is very high, and this is a point of great importance. There are two reasons why the killing of immature whales is economically unsound, and more than one previous author has drawn attention to them. In the first place, since an immature whale has had no chance of reproducing itself, its death constitutes, so to speak, a permanent reduction of the stock. In a community of animals, members of which are killed for commercial purposes, it is above all essential that the breeding should be subjected to a minimum of interference, and the killing of immature individuals is perhaps the worst form of interference with the natural replenishment of the stock. In the second place the number of immature whales required to produce a given quantity of oil and other products, would enormously exceed the required number of adult whales.

At South African stations such as Saldanha Bay, where more than 80 per cent of the Blue and Fin whales caught are immature, the hunting is for these reasons far more damaging to the stock in proportion to the value of the products obtained than in South Georgia and the South Shetlands. Even at South Georgia the ratio of immature whales in the catches is undoubtedly high, amounting as it did among Blue whales of both sexes to 42 per cent of the whales examined in the course of the work. Among the Fin whales it came to the more moderate quantity of 23 per cent in the case of males and 28 per cent in the case of females.

4. The conclusions regarding the breeding season confirm and slightly adjust those reached by previous authors. Perhaps the most important point is that the whales actually engaged in pairing and parturition are not much molested by the whalers. The examination of whales at whaling stations does not throw much light on the whereabouts of the actively breeding whales. The catches at Saldanha Bay indicate that some pairing and parturition takes place off the S.W. African coast, but although there is here an immense stretch of coastal water, so few of these whales are caught that one can hardly suppose it to be the normal destination of the whales which migrate northwards from any large community of whales in the Antarctic. It seems more probable that the breeding processes normally take place further from land, or at any rate outside the ordinary range of the land stations. It may be that the whales are more scattered at this time, but if they are at all concentrated during the periods of pairing or parturition serious damage would be done to the stock if they were to be hunted at such a time. Without any definite evidence one would expect a certain tendency towards concentration at least during the pairing season.

The protracted period of breeding is a feature which favours the maintenance of the stock, for it implies a certain elasticity of habit and an ability to take the opportunity of pairing when it arises.

5. The frequency of the recurrence of pregnancy is of great importance in connection with the maintenance of the stock. An element of uncertainty remains here, but it is certain that except perhaps on very rare occasions an interval of not less than two years elapses between successive pregnancies and it is highly probable that the interval

sometimes extends to three years. The point to be emphasized here is that, since normally only one whale is born at a time, an adult female can *at the most* produce only one young every two years. The rate of reproduction is thus very slow.

7. The hypothesis that gestation in these whales occupies nearly a year is confirmed and it has been shown by evidence from more than one source that the young whale grows up to sexual maturity in about two years after birth, during rather less than half of which period it is nourished by the mother. Thus the slowness of the rate of propagation is to some extent counterbalanced by the rate at which the young grow to sexual maturity. The most important point is perhaps that the immature whales which can least be spared to the stock are exposed to danger for a comparatively short period. In view of this it is curious that so high a proportion of immature whales appears among the catches. The phenomenon may be largely due to differences in the distribution of the adult and immature whales.

8. Owing to segregation in a greater or lesser degree, different areas may harbour communities of whales which are differently constituted in respect of age, proportions of different classes, etc. Different whaling centres must thus be examined individually when any measures for the control of the industry are considered. Further, in an area such as that of South Georgia, where the whale population undergoes fundamental changes in the course of the season, the effect on the stock as a whole of hunting at different times of year needs to be taken into account. So far as the three seasons, over which the observations have extended, are concerned, it is not easy to say whether the killing of whales in the earlier or later part of the season has had the greater effect. On the one hand a higher percentage of pregnant females is killed in the earlier part of the season and the majority of whales are less "fat" than later on, while on the other hand many more immature whales are killed in the second half of the season. At South Africa the whale population shows little or no sign of changing during the season, and it may be supposed that whereas at South Georgia a large number of whales are exposed to danger for a short time, at South Africa a smaller number are exposed to danger for a longer time.

In connection with the effect of hunting on the stock of whales it is desirable that as much as possible should be known of the composition both of local communities and of the stock as a whole, in respect of the relative numbers of the two sexes and of whales in different stages of the reproductive cycle at any given time.

The analysis of the whales examined during the work, which is shown in the tables on pp. 456 and 457, may be taken as representative of the catches as a whole at South Georgia during the period over which the observations extended. But the catches at South Georgia, as already explained, are not necessarily representative of the whole stock of southern Blue and Fin whales, and a distinction must therefore be drawn between what might be called the apparent and the real constitution of the stock as a whole.

The apparent constitution of the stock, i.e. the ratios of the different classes of Blue and Fin whales examined at South Georgia, is as follows:

Classes	Blue		Fin	
Adult males...	28 %		42 %	
Immature males	21 %		13 %	
Pregnant females	10	29 %	16	32 %
Lactating females	4		3	
Resting or ovulating females	15		13	
Immature females	22 %		13 %	

In contrast to the population in the S.W. African region, that at South Georgia seems to have a generalized character which suggests that it may not be very far from representing the stock as a whole. One point, however, in which it might be found to differ substantially from the real constitution of the stock is in the ratio of immature whales. It is difficult to believe that any community of mammals normally includes 30 per cent or 40 per cent of immature individuals. In the case of whales, among which the immature appear not to exceed two years of age, it would mean that the "expectation of life" for a whale was extraordinarily short. It must not be forgotten, however, that the effect of hunting is to shorten the expectation of life, and that such evidence which exists as to the ages of whales does suggest that the majority are unexpectedly young.

There is not sufficient data on which to base an actual estimation of the real constitution of the stock of southern Blue and Fin whales, but it may be hoped that future investigations will provide sufficient information for this purpose. It will then be possible to estimate the birth rate and hence the fraction of the stock which might reasonably be killed annually for commercial purposes.

Future work may be profitably directed among other things to the question of the numerical equilibrium of the whole community of whales, and any enquiry into the effect of hunting must take into consideration the natural factors which limit the size of the stock. Under natural conditions it is to be supposed that in the long run the number of deaths equals the number of births. If these deaths are simply the result of the number of whales exceeding the maximum for which there is, so to speak, room (e.g. if the number is limited by, say, the amount of food available), then a number equal to the number to be born each year may be killed annually. On the other hand, if the deaths were due to causes operating independently of the size of the stock (e.g. attacks by killer whales, deaths from old age, etc.), then any deaths from hunting will add to, and not replace, the deaths from natural causes, and will therefore tend to cause depletion. The equilibrium of the stock is probably influenced by both types of factor.

It will obviously be of no practical value to calculate the percentage of the whole stock which may safely be killed annually unless some kind of estimate can be made of the total number of whales in the whole community. Anything approaching an accurate census is naturally impossible, but there are grounds for anticipating that at least some very rough approximation, sufficient for this purpose, will be achieved in due course.

Among the features of the habits and general biology of Blue and Fin whales discussed in this section, it would appear that some favour the survival of the stock, while others must be considered serious weaknesses. For instance, the protracted polyoestrous breeding season, the comparative immunity during the breeding processes and nursing of the young, and the rapid growth of the young to sexual maturity, are all to be regarded with satisfaction. On the other hand, since each female can at the most produce one young every two years the rate of propagation is extremely slow.

It is difficult to say whether or not the "elasticity" of the breeding season and the natural protection of the whales during the essential stages of the sexual cycle, are sufficient to counterbalance the weakness of the slow rate of propagation, but the killing of a disproportionately large number of immature whales is a separate and very serious matter.

It is not the object of this memoir to discuss or recommend any definite measures by which the whaling industry should be adjusted, but rather, as a beginning, to bring forward certain facts and inferences about the biology and habits of whales which have a bearing on the effect of hunting on the stock. One thing, however, is perfectly clear, and that is that in proportion to the value of the products obtained, far more damage is done to the stock in temperate and sub-tropical waters, such as at certain South African stations, than is done by the whaling stations and factory ships in the Dependencies of the Falkland Islands. That is to say, that at these stations where some 80 per cent or more of the catches consists of lean immature whales and much of the remaining 20 per cent (or so) includes actively breeding whales, the very maximum of damage is inflicted on the stock, with practically a minimum return in respect of produce.

It is not suggested that the sub-Antarctic industry has actually less effect on the stock, but here at least a relatively good return is obtained from each whale, and the catches are drawn from a much larger proportion of the classes of whales which can be spared from the stock.

SUMMARY

The preceding pages deal with the results of direct investigations on whales carried out at the Marine Biological Station at South Georgia and at Saldanha Bay, South Africa, from 1925 to 1927. During this period a total of 1683 whales was examined, of which 1577 consisted in almost equal numbers of Blue and Fin whales. The present memoir is concerned only with these two species. Similar work is being continued at South Georgia as there is much to be gained by the accumulation of further material.

The work has been guided by three main objects:

1. The determination of the characters of southern Blue and Fin whales and the

detection or elimination of any possible sub-specific or racial distinctions such as might be associated with distribution or migrations.

2. An investigation of the reproductive processes, breeding habits and growth.

3. The examination of the interrelations of breeding, nourishment, distribution and local fluctuations of the whales.

The results of this work may be summarized as follows:

By a series of measurements carried out on a large number of whales, the normal bodily proportions of southern Blue and Fin whales, and the extent to which they vary, have been defined; and the same has been done for various external features by means of detailed descriptions of the colour, baleen, ventral grooves and hair.

It has been shown in both species that no distinction can be drawn between the whales of South Georgia and South West Africa, and that there are no indications that more than one race exists together in either locality.

The series of measurements, as well as the notes on external characters, provides a standard from which it will be easy to ascertain if Blue and Fin whales examined in the northern hemisphere or from any other part of the world fall within the limits of variation observed in South Georgia and on the south-west coast of Africa.

Attention is drawn to certain marked changes which take place in the bodily proportions as the whale grows, and which, at one point, may be associated with the attainment of physical maturity.

Leading up to the problems of breeding and growth, an account is given of the reproductive organs, of which the most important are the ovaries. It is a peculiarity of the ovaries of these whales that the corpus luteum formed at each ovulation persists in a recognizable form for a very long time, probably for years, with the result that accumulations of old corpora lutea give some indication as to the number of ovulations which may have taken place. Other conclusions to be drawn from the reproductive organs relate to the determination of sexual maturity and the progress of the sexual cycle throughout the year. It may be regarded as reasonably certain that Blue and Fin whales are polyoestrous.

From an estimation of the ratios of immature whales in the catches the important fact emerges that a very high proportion of immature whales is killed. Sexual maturity is reached on the average at the following lengths:

Male Blue whales	...	22·6 m.	Male Fin whales	...	19·4 m.
Female Blue whales	...	23·7 m.	Female Fin whales	...	20·0 m.

By application of these figures to the whales examined during the work the percentages of immature whales are found to be as follows:

	Blue whales		Fin whales	
	♂	♀	♂	♀
South Georgia	42·2	42·2	22·3	27·5
South Africa	82·5	80·3	79·0	92·0

The condition of the reproductive organs together with the gradation in the sizes of foetuses, and the mean curve of growth which can be derived therefrom, confirm the hypothesis that pairing takes place for the most part during certain months in the southern winter, reaching a pronounced maximum in June and July, and that gestation lasts for a little less than a year. It is further shown that not less than two years elapse between successive pregnancies in a whale, but that two years is probably the normal interval.

An examination of the sizes of young whales at different times of year strongly suggests that the nursing period lasts for six or seven months, during which the growth of the calf is very rapid, and that sexual maturity is reached about two years after birth. This rapidity of growth is corroborated by evidence from other sources.

A discussion on the ages of whales follows the question of the rate of growth. For whales less than two years old, the age can be determined from the total length by means of the curves of growth for young whales. After the attainment of sexual maturity a clue to the ages of females is to be found in the accumulations of old corpora lutea in the ovaries, and though calculations on this basis are somewhat speculative, it appears that a remarkably small proportion of the females included in the catches are more than about six years old.

The study of the relations of breeding, nourishment, distribution, etc. consists partly in an investigation of the food and thickness of the whale's blubber and partly in a more general consideration of the stock of whales. At South Georgia the food, which consists entirely of *Euphausia superba*, is very plentiful, but off the African coast food is very scarce. The thickness of the blubber reflects fairly well the condition of nourishment of a whale except where it is affected by pregnancy and lactation.

An analysis of the different species and "classes" of whales included in the catches reveals (*a*) a marked distinction between the local whale populations of South Georgia and South West Africa, and (*b*) a tendency for the population at South Georgia to undergo important changes both in the course of the season and from year to year. Some of these changes appear to recur annually, while others are variable and are probably to be attributed to changes in the environment and ultimately perhaps to meteorological conditions.

In the last section of the memoir the practical aspects of the results are considered, and attention is drawn mainly to the following points:

1. The general similarity of all the whales examined suggests that it is possible for a reduced number of whales in one locality to be replenished from the population of another.

2. The ratio of immature whales killed is unduly high, especially at South African stations.

3. The protracted breeding season, the freedom from molestation by man during this period, and the rapid growth to maturity all favour the maintenance of the stock. On the other hand, the very slow rate of propagation is to be set off against these points.

The economic extravagance of whaling in South African waters is specially emphasized, and it is pointed out that although the industry here is on a small scale, a maximum of damage is inflicted on the stock relative to the profit obtained.

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APPENDIX I

A NOTE ON THE COMPOSITION OF WHALE MILK

By A. J. CLOWES, A.R.C.S., M.Sc.

During my stay at South Georgia it was found possible to take three samples of cetacean milk and analyse these for fat, total solids, solids not fat, specific gravity and ash. The difficulties of correct sampling of whale milk are great, and if the milk is obtained by dissection of the mammary glands, blubber oil and blood are apt to contaminate the sample of milk. When, however, lactating whales are hauled upon the flensing "plan" of the whaling station, the increased strain upon the milk reservoirs usually causes the milk to spout from the nipples and in this manner clean samples of milk can be secured. No blood or blubber-fat is included in the milk samples taken from the whale in this way, which was adopted in sampling the three milks examined by me, and I venture to suggest that these samples were taken under better conditions than those of the other known analyses of whale milk which will be referred to later. The whales from which the samples at South Georgia were taken were all freshly killed, and indeed in the case of one of the samples, Fin whale No. 563, the whole analytical weighings and the results, with the exception of the ash content, were completed within a period of four to five hours of the death of the whale.

In sampling the milk of any mammal the sample should represent the average contents of the milk reservoir, if it is to be regarded as representative of the milk of that mammal. It has to be borne in mind, however, that the milk is sometimes not of uniform composition, and that the cream rises in the milk reservoir in the same way as it does in milk after removal from the animal. In the case of milk drawn from the cow, for instance, the "fore-milk" first drawn from the lower part of the udder may contain only 1·7 per cent of fat, while the "strippings", last drawn from the udder, at the same milking may contain 4–10 per cent of fat. A representative sample of such a milking could only be obtained by thorough mixing of the "strippings" with the whole of the remainder of the milking. It is probable that the milk of whales, being thick and creamy, will not vary in composition in different parts of the mammary gland to the same extent as cows' milk. It is possible, however, that the milk extruded from the nipples during handling of the whale may be different from that remaining in the mammary glands, and that neither the extruded milk nor the milk dissected from the mammary gland, especially if this is only a small portion of its contents, can be regarded strictly as representative of whale milk. The variations in the results obtained by the analysis of whale milk are probably largely due to the difficulty of obtaining a representative average sample. Variations also probably occur due to seasonal effects or to the period of lactation.

It is to be noted that these samples taken at South Georgia were not analysed after preservation with formalin, as was the case with other known analyses. Formalin has a disadvantage in that it combines with the protein matter in milk and makes it much more difficult for the hydrochloric acid, which is added in the fat analysis, to break up the protein masses which occlude the fat globules, and in this way the result for the fat content is liable to be too low in a formalin-preserved sample.

The usual routine analyses for milk were employed, the Werner-Schmid process being used for the fat content analysis. A summarized account of the methods is given later.

The following results were obtained at South Georgia:

South Georgian whales (results expressed as percentages)

Whale No. ...	563	244	642
Species ...	Fin	Blue	Blue
Water... ...	54·19	50·52	41·62
Fat	30·20	34·62	36·59
Albuminoids...	—	—	—
Milk sugar ...	—	—	—
Ash	1·43	1·43	—
Total solids ...	45·81	49·48	58·38
Specific gravity	1·0254	1·0160	1·0090
Solids not fat	15·61	14·86	21·79

Comparison of the above three analyses may be made with the following results, which represent all the cetacean milk analyses I have been able to find in the literature:

Results taken from other observers' papers (results are percentages)

	1	2	3	4
	Delphinus phocaena	*Globicephalus melas*	Blue whale	Whalebone whale
Water... ...	41·11	48·67	60·47	69·80
Fat	45·80	43·76	20·00	19·40
Albuminoids...	11·19	} 7·57	12·42	9·43
Milk sugar ...	1·33 (?)		5·63	0·38
Ash	0·57	0·46	1·48	0·99
Total solids ...	58·89	51·33	39·53	30·20
Specific gravity	—	—	—	—
Solids not fat	13·09	7·57	19·53	10·80

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3. Blue whale, *Balaenoptera sibbaldi*, Backhaus, *Molkerei Zeit.*, Berlin, vol. 14, p. 481, 1904.
4. Bartenwal (Whalebone whale), Schreibe, *Münchener Mediz. Wochenschrift*, vol. 55, p. 795, 1908.

High percentages for the fat and the solids not fat are immediately noticed in both sets of figures. Cetaceans have a large amount of blubber tissue to keep up the blood heat and form a reserve of combustible material for times when intensive feeding has ceased and foodstuffs are absent; and presumably the richness of cetacean milk in fat and solids not fat is entirely due to the needs of the young calf for food with a high fat and sugar content. It will be observed that in the results from South Georgia the percentage of fat is much higher than in the Blue whale and Bartenwal results given by Backhaus and Schreibe respectively. This may point to a fundamental difference in the composition of the milk of northern rorquals from southern ones, or be due to physiological differences of the individual whales from which the samples were taken, or again to errors incidental to sampling or analysis. It has been previously pointed out in this note that the addition of formalin inhibits the breaking up of the protein masses which occlude the fat globules and so tends to produce a low milk-fat result for a formalin-preserved sample. Also Backhaus and Schreibe state that their samples were (i) of a reddish tinge, (ii) slightly red colour, which points to a dilution of the milk sample by blood. However, it is obviously impossible to comment at length on such a small number of analyses.

One very striking difference occurs in the milk-sugar figures of the Blue whale of Backhaus and the Bartenwal of Schreibe. In the former the percentage of milk-sugar is 5·63, whilst in the latter it is 0·38, which latter figure points to the supposition that the sample was not taken from a freshly killed whale, as stated by Schreibe, and decomposition of the milk-sugar has occurred, giving a low figure for this estimation and consequently too high a figure for the water content.

The milk-fat is described by Backhaus as non-solid at ordinary temperatures and water-clear in colour. Schreibe describes it as yellowish, whilst I should describe it as decidedly solid at ordinary temperatures and whitish in colour with a very faint yellow tinge. At South Georgia, some whale milk was shaken up and the resulting "butter" resembled soft lard in appearance and colour.

The following is a brief *résumé* of the methods used at South Georgia in the analysis of whale milk.

Specific gravity. By specific gravity bottle at 15·5° C.

Total solids. 5 c.c. of the well-mixed sample were weighed out into a porcelain dish and 1 c.c. of acetone added. The milk was evaporated to dryness on a steam bath and was then dried to constant weight in a steam oven.

Ash. The residue from the total solids estimation was gently ignited and the ash cooled and weighed.

Fat content. Werner-Schmid process. About 10 c.c. of well-mixed milk were weighed out into a flat-bottomed graduated tube fitted with a cork. 10 c.c. of concentrated hydrochloric acid were added and the tube and its contents were heated in a water bath at about 60° C. for ten minutes, with constant shaking. The tube was then rapidly cooled by immersion under running cold water. 30 c.c. of alcohol-free ether were then added. The cork was then inserted and the tube shaken vigorously for two minutes. When separation into two layers had occurred the ether layer was blown over into a weighed flask. The ether extraction was repeated three times, with 20 c.c. of ether each time. The ether was then distilled off on a hot-water bath and the flask containing the milk-fat was dried in a steam oven until constant in weight. The fat was then redissolved with ether and the flask again dried and weighed. The difference in weight gave the amount of fat present.

Water. Estimated by difference. The percentage of total solids is subtracted from 100 and the difference is the percentage of water.

Solids not fat. Obtained by subtracting the fat percentage from the total solids percentage.

APPENDIX II

A NOTE ON THE OIL CONTENT OF BLUBBER

By A. J. CLOWES, A.R.C.S., M.Sc.

This investigation was made in order to see if there was any variation in the fat content of whale blubber throughout the season, which variation, if present, might be taken as some indication of the condition of the whale. It is well known that the blubber on a whale varies in thickness in different parts of the whale, being thickest behind the dorsal fin and thinnest on the back behind the head, but whether the actual oil content (expressed as percentage by weight) varies in different positions is not known. In all the experiments made the blubber was always cut from the same position on the whale as described below.

A piece of blubber, roughly measuring a six-inch cube, was cut from the flank opposite the tip of the dorsal fin. This place was used in "thickness" measurements. Two parallel strips, about 5 cm. long and 1 square cm. in cross-section, were cut from this cube of blubber with the aid of a razor and then weighed and placed in a weighed soxhlet extraction thimble. The sections were always taken from the skin inwards, the skin being trimmed off before the strip of blubber was weighed. All handling of blubber was done with forceps and no attempt was made to wipe off free oil.

The method used was one of continuous extraction of the blubber by carbon tetrachloride in a soxhlet apparatus. Carbon tetrachloride was chosen because in addition to the primary object of dissolving fat, it was more easy to recover than petroleum-ether, or other solvents.

Carbon tetrachloride extract may be regarded as synonymous with fat content, although a small amount of substances other than true fats are extracted with the fat. It was considered that as the investigation was to be made on a number of whales, this would not matter for the comparative result which was desired. The strips of blubber, after being cut and weighed in the soxhlet thimble, were placed on a glass dish and cut into thin sections by means of a razor and forceps. This was done in order to accelerate the penetration of the cells of the blubber by the solvent. Any oil liberated during this process was washed into the soxhlet flask with carbon tetrachloride. The same procedure was adopted in all experiments made and by this means the experimental error was cut down to a constant minimum.

The following figures from a preliminary test give some indication of the amount of oil extracted each two hours over a period of ten hours' constant extraction.

Weight of sample of blubber = 5·7920 grm. Oil extracted:

In 1st two hours 3·9024 grm. In 3rd two hours 0·1718 grm.
In 2nd two hours 0·3955 grm. In 4th two hours 0·0572 grm.
In 5th two hours 0·0146 grm.

It can be seen that the bulk of the oil is extracted in the first two hours, but even so, at the end of ten hours there is still some oil left in the blubber. For this reason a standard time of six hours was adopted in all experiments. Extraction was allowed to proceed for six hours on a water bath, the soxhlet syphon operating about once every four minutes. At the end of the first three hours the flask of the soxhlet apparatus was changed for another weighed one containing a fresh quantity of carbon tetrachloride. After six hours' extraction the soxhlet flask was removed immediately after the syphon had operated. The carbon tetrachloride was then distilled off and the flasks were dried in an air oven at 90–100° C. for three hours and then weighed. Duplicate experiments on strips of blubber cut side by side were made in some cases, but in no case did the two results agree to within 2 per cent, results being expressed as the percentage of the weight of oil extracted in six hours to the total weight of the sample. With regard to the disparity in the results obtained in the duplicate experiments it must be assumed that either the error of sampling is great or else the blubber varies in composition from one place to another 1 cm. away. It is admitted that the error of sampling may be high, but as the same procedure was adopted in all cases it is unlikely that the discrepancy is due solely to this cause.

The following results were obtained:

Whale number	Species	Sex	Oil extracted in six hours ÷ weight of sample
249	Blue	Male	77·16 %
256	Blue	Male	73·69 %
257	Fin	Female	76·93 %
264*	Fin	Female	(1) 73·81, (2) 71·71 = 72·76 % average
263†	Fin	Female	88·09 %
269‡	Fin	Male	(1) 37·15, (2) 40·20 = 38·63 % average
259	Blue	Female	70·47 %
270	Blue	Female	(1) 63·45, (2) 61·05 = 62·25 % average

* Reported by Zoologists as "very lean whale".
† Reported by Zoologists as "very fat whale".
‡ Reported by Zoologists as "very fibrous whale".

Sections of the blubber of all the whales in these experiments were made by Mr Wheeler, and these were stained with resorcin fuchsin. Very little correlation could be established between the microscopical examination of these sections and the corresponding oil content figures.

Messrs Mackintosh and Wheeler report from an examination of a large number of whales at South Georgia the presence of numerous white flecks or marks on the skin of the whale. These white marks are discussed on p. 373, where it is shown that they are scars resulting from injuries received by the whale.

A hand-cut section of blubber was made through one of the scars and stained with Sudan III. The section was photographed and is shown in Plate XXXVII, fig. 3. This photograph demonstrates very clearly the presence of a large number of fibres which radiate downwards and sideways from the white mark on the skin. In some whales it would be impossible to sample the blubber without including some of these fibres, and consequently it can be seen that the whole method of sampling is liable to grave errors, as the presence or absence of these fibres undoubtedly has a very large influence on the oil content of blubber.

It seems, therefore, that the results obtained by chemical investigation depend largely on the presence of fibre in the blubber and cannot be taken as an index of blubber condition.

APPENDIX III

MEASUREMENTS OF BODILY PROPORTIONS

All measurements are in metres

Date	Whale Number	Sex	1 Total length, tip of snout to notch of flukes	2 Lower jaw, projection beyond tip of snout	3 Tip of snout to blow-hole	4 Tip of snout to angle of gape	5 Tip of snout to centre of eye	6 Tip of snout to tip of flipper	7 Eye to ear, centres	8 Notch of flukes to posterior emargination of dorsal fin	9 Flukes, width at insertion	10 Notch of flukes to anus
1925												
9 Feb.	5	Male	18·40	—	3·30	3·70	3·74	8·20	0·99	4·70	1·14	5·80
10 ,,	6	Male	16·85	—	2·42	2·68	2·84	6·55	—	—	0·88	5·40
10 ,,	8	Male	18·00	0·25	3·18	3·38	3·40	7·75	—	4·00	0·95	5·20
10 ,,	9	Female	18·85	0·30	3·20	3·60	3·60	7·90	0·95	4·90	1·00	6·00
11 ,,	10	Female	20·15		3·00	3·30	3·50	7·95	—	5·55	1·20	6·50
11 ,,	13	Female	20·00	—	3·35	3·80	3·93	8·65	—	—	1·15	5·90
13 ,,	21	Male	25·50	0·60	5·10	5·44	5·62	11·70	1·44	6·20	1·25	7·15
16 ,,	24	Female	25·80	0·64	4·75	5·15	5·00	11·30	1·40	6·20	1·33	7·40
17 ,,	26	Female	25·30	0·46	4·80	5·32	5·55	11·20	1·30	6·28	1·22	7·35
17 ,,	27	Female	24·20	0·38	4·35	—	4·90	10·35	—	5·70	1·35	7·03
20 ,,	30	Male	21·60	—	3·80	4·20	4·21	9·30	1·20	—	1·25	6·40
20 ,,	31	Female	18·30	0·27	2·94	2·25	3·35	11·30	0·90	4·97	1·00	5·75
21 ,,	34	Male	21·80	—	3·70	—	4·20	9·10	1·15	5·60	1·15	6·50
21 ,,	36	Male	21·65	0·27	4·00	4·70	4·50	9·75	1·20	3·34	1·15	6·50
21 ,,	37	Female	17·80	0·33	3·00	3·30	3·40	7·30	0·98	4·85	0·89	5·85
23 ,,	40	Male	23·05	—	4·25	—	4·60	10·10	1·60	5·80	1·30	6·80
23 ,,	41	Female	21·95	—	3·70	4·10	4·20	—	—	5·30	1·27	6·35
23 ,,	43	Female	19·45	—	3·30	3·50	3·65	8·30	1·10	5·00	1·11	6·10
24 ,,	46	Female	22·58	0·40	4·10	4·58	4·58	10·00	1·22	5·70	1·70	6·75
25 ,,	47	Male	19·10	0·26	2·95	3·58	3·52	7·85	1·00	—	1·01	5·75
25 ,,	48	Female	21·45	—	3·80	4·14	4·20	8·95	1·13	5·51	1·12	6·35
25 ,,	49	Female	20·27	—	3·50	3·90	4·05	9·00	1·10	5·00	1·18	5·95
25 ,,	50	Female	18·21	—	—	2·80	3·00	7·00	0·95	5·00	1·05	6·00
25 ,,	52	Female	26·20	—	5·10	5·45	5·62	11·50	1·40	6·50	1·25	7·70
26 ,,	53	Male	18·60	—	3·35	3·65	3·68	7·90	—	—	0·90	5·15
26 ,,	54	Female	26·20	—	4·90	—	5·30	11·25	1·32	6·15	1·30	7·45
26 ,,	55	Female	22·15	—	4·00	4·28	4·57	9·10	1·15	5·75	1·30	6·65
28 ,,	60	Female	20·50	0·30	3·35	4·10	4·20	8·90	1·11	5·10	1·10	5·90
2 March	72	Male	21·70	0·35	4·00	4·40	4·50	9·30	1·24	5·30	1·20	6·50
4 ,,	81	Female	19·85	—	3·30	3·70	3·75	8·50	1·00	5·55	1·25	6·30
4 ,,	82	Male	25·45	—	5·10	5·25	5·40	10·90	1·35	6·25	1·30	7·35
10 ,,	85	Male	20·10	—	3·50	—	3·90	8·45	1·08	5·20	1·10	6·20
12 ,,	87	Male	22·05	—	4·40	4·65	4·80	9·80	1·26	5·56	1·18	6·40
12 ,,	88	Female	23·85	—	5·00	—	5·20	10·74	1·38	6·10	1·18	6·78
13 ,,	89	Female	20·80	—	—	—	—	—	—	—	1·15	6·55
13 ,,	90	Female	21·40	—	3·60	4·05	4·20	8·80	1·15	5·40	1·20	6·56
13 ,,	91	Male	21·40	—	3·70	4·20	4·25	9·20	1·14	5·40	1·30	6·40
13 ,,	92	Male	23·20	—	4·15	—	4·60	10·30	1·25	6·10	1·35	6·50
13 ,,	93	Male	20·40	0·32	3·60	4·10	4·10	8·70	1·05	—	1·20	6·60
16 ,,	95	Male	18·80	—	3·15	3·45	3·60	7·75	1·00	4·68	1·00	5·50
20 ,,	98	Male	19·50	0·30	3·00	3·45	3·60	7·90	1·17	—	1·12	6·40
21 ,,	99	Female	19·90	—	4·50	4·80	4·80	8·45	—	—	1·10	6·00
21 ,,	102	Male	19·90	—	—	3·70	3·75	8·45	—	—	1·10	5·80
21 ,,	103	Female	23·70	—	4·40	4·97	5·00	10·80	1·34	5·70	1·35	7·45
23 ,,	104	Female	26·95	—	5·10	5·50	5·60	11·60	1·50	6·70	1·50	7·90
23 ,,	106	Female	26·70	—	5·10	—	5·65	11·80	1·53	—	1·50	8·10
23 ,,	107	Male	21·30	—	3·35	3·60	3·60	7·30	1·03	—	1·10	6·15
23 ,,	108	Female	24·13	—	4·60	—	4·80	10·20	1·30	6·20	1·20	7·10
23 ,,	109	Male	17·60	—	2·80	3·30	3·35	7·10	0·90	4·80	0·96	5·45
23 ,,	110	Male	19·40	—	3·00	—	3·40	7·55	—	—	1·00	6·40
23 ,,	112	Female	27·10	—	5·30	5·40	5·55	12·00	1·50	6·30	1·50	7·90
24 ,,	113	Male	23·80	—	4·60	4·90	4·95	11·00	1·37	5·90	1·35	6·95
25 ,,	115	Male	22·10	—	3·70	4·10	4·20	9·05	1·16	5·45	1·30	6·65
25 ,,	116	Male	19·30	—	3·20	3·72	3·77	8·10	1·15	4·68	0·94	5·48
25 ,,	117	Male	23·40	—	3·90	—	4·60	9·30	—	—	1·35	7·10
26 ,,	122	Female	24·70	—	4·55	—	5·15	11·00	1·38	6·15	1·30	7·30
26 ,,	123	Female	26·10	—	—	—	5·59	11·55	1·45	—	1·35	7·70
27 ,,	124	Female	24·40	—	4·50	—	5·45	10·80	1·31	—	1·30	7·45
27 ,,	125	Male	19·90	—	3·10	—	3·50	7·90	1·03	5·13	1·05	6·00
27 ,,	126	Male	22·35	—	—	—	4·58	—	—	—	1·25	7·90

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
8·80	8·30	1·20	0·27	1·00	2·10	2·60	3·72	0·68	4·75	2·40	—	—	—
8·20	—	0·80	—	—	2·15	2·50	—	0·60	3·50	—	—	—	—
8·40	8·00	1·35	0·25	0·85	1·75	2·25	2·50	0·67	4·55	2·00	—	—	—
9·20	8·45	0·50	0·20	0·65	1·95	2·55	2·65	0·65	—	—	—	—	—
9·50	9·50	0·45	0·30	0·85	1·80	2·57	2·75	0·70	4·40	2·15	—	—	—
—	—	—	—	—	2·00	1·70	1·75	0·45	4·90	2·47	—	—	—
11·30	10·40	1·55	0·33	1·00	2·80	3·48	3·62	0·95	7·10	3·04	—	—	—
11·70	10·85	0·60	0·17	0·80	2·70	2·87	3·10	0·90	6·50	3·50	—	—	—
11·50	10·13	0·63	0·23	0·82	2·60	3·40	3·60	0·92	6·70	—	—	—	—
10·85	10·50	0·67	0·30	1·25	3·55	—	—	—	6·34	—	—	—	—
9·90	—	1·10	0·13	—	2·15	2·43	2·60	0·76	—	—	—	—	—
8·55	8·10	0·25	0·25	0·80	1·85	2·53	2·80	0·75	4·15	2·25	—	—	—
9·75	9·50	0·81	0·20	0·90	2·20	2·80	2·88	0·75	5·23	2·40	—	—	—
10·20	9·65	1·70	0·27	1·10	2·15	2·80	2·90	0·80	3·45	3·54	—	—	—
8·75	—	0·60	0·28	0·65	1·70	2·30	2·45	0·60	4·30	2·30	—	—	—
10·50	9·65	1·80	—	0·88	2·40	3·00	3·10	0·90	5·70	2·70	—	—	—
10·15	9·90	0·55	—	1·00	—	—	—	—	—	—	—	—	—
9·25	8·76	0·60	—	0·70	2·10	2·40	2·55	0·76	—	—	—	—	—
10·35	9·55	0·55	0·25	0·90	2·35	3·30	3·40	0·90	5·80	2·70	—	—	—
9·20	—	0·70	0·25	0·70	1·81	2·40	2·50	0·68	5·90	2·20	—	—	—
9·88	9·35	0·55	0·40	1·30	1·91	2·55	2·60	0·75	5·25	2·70	—	—	—
9·22	8·65	0·48	0·20	0·55	1·90	2·80	2·90	0·80	—	—	—	—	—
8·95	8·75	0·45	0·20	0·65	1·75	2·55	2·65	0·65	—	—	—	—	—
11·98	11·40	0·58	0·27	1·00	2·58	3·55	3·80	0·92	6·84	3·40	—	—	—
—	—	0·65	—	—	1·84	2·53	2·65	0·74	4·60	2·00	—	—	—
11·50	10·70	0·70	0·25	0·80	2·10	3·20	3·44	1·00	7·00	2·90	—	—	—
10·40	9·50	0·55	0·22	0·75	1·50	—	—	—	5·50	—	—	—	—
9·50	8·85	0·50	0·30	0·90	2·15	2·55	2·75	0·70	5·10	2·35	—	—	—
10·20	9·40	1·20	0·25	0·90	2·10	—	—	—	5·40	2·34	—	—	—
9·70	9·10	0·45	0·32	1·06	2·05	2·80	3·00	0·79	4·60	2·25	—	—	1·90
11·60	10·70	1·95	—	1·15	2·30	—	—	—	—	—	—	—	2·30
9·35	8·80	1·50	0·32	1·00	2·05	2·80	2·95	0·78	5·00	2·20	—	—	1·98
10·00	9·15	1·40	0·25	0·90	—	2·90	3·08	0·85	5·90	—	—	—	2·20
10·55	10·05	0·59	0·29	0·98	2·55	3·32	3·48	0·94	6·30	2·80	—	—	2·20
9·55	—	0·60	—	—	—	2·70	2·75	0·75	4·80	2·20	—	—	—
9·80	9·30	0·50	0·24	0·80	2·00	2·85	2·97	0·65	5·10	2·36	—	—	—
9·80	9·10	1·20	0·27	0·90	2·20	2·90	2·95	0·85	5·30	2·25	—	—	2·15
10·25	10·00	1·50	0·35	0·80	2·30	—	—	—	6·10	2·60	—	—	2·45
9·50	—	1·05	—	—	1·90	2·80	2·90	0·72	4·70	2·20	—	—	—
9·00	8·45	1·30	0·27	0·55	1·75	2·35	2·45	0·68	4·50	2·05	—	—	1·70
9·65	—	0·90	—	0·70	1·90	2·60	2·65	0·72	4·30	2·10	—	—	—
9·60	—	0·65	—	—	1·90	2·37	2·48	0·68	4·70	2·16	—	—	—
9·10	—	0·85	—	—	—	—	—	0·72	4·70	2·20	—	—	—
10·70	—	0·45	0·49	1·15	2·50	3·05	3·23	0·87	6·35	2·95	—	—	—
11·90	11·05	0·75	0·23	0·95	2·20	—	—	—	7·00	3·10	—	—	—
12·30	—	0·45	—	—	2·50	3·65	3·80	1·00	6·80	3·10	—	—	—
9·30	—	0·80	—	—	1·30	2·40	2·40	0·68	4·50	2·20	—	—	—
11·30	10·30	0·65	0·39	0·87	—	3·10	3·30	0·84	5·05	2·80	—	—	2·45
8·60	7·90	1·20	0·24	0·58	1·70	—	—	—	—	—	—	—	1·80
9·70	—	—	—	—	1·75	2·60	2·65	0·60	4·10	2·10	—	—	—
12·05	9·10	0·52	0·26	0·66	3·00	4·25	4·30	1·05	—	—	—	—	2·34
10·40	9·70	1·57	0·40	1·00	2·40	3·30	3·50	0·88	6·15	3·00	—	—	2·50
10·45	9·80	1·25	0·32	0·80	2·15	—	—	0·77	5·30	2·55	—	—	2·25
8·90	8·50	1·52	0·25	0·85	1·80	2·55	2·67	0·67	—	—	—	—	1·60
10·65	—	1·00	—	—	2·20	—	—	—	5·70	3·00	—	—	—
11·00	10·40	0·50	—	1·20	2·70	—	—	—	—	—	—	—	—
11·35	—	0·65	—	0·95	—	3·50	3·65	—	6·90	2·98	—	—	—
11·40	—	0·75	0·26	0·80	—	3·60	3·95	0·98	6·30	2·79	—	—	—
9·55	9·05	1·40	0·29	0·85	1·85	—	—	—	—	—	—	—	1·95
—	—	0·95	—	—	—	3·02	3·25	0·80	5·65	2·23	—	—	—

Date	Whale Number	Sex	1 Total length, tip of snout to notch of flukes	2 Lower jaw, projection beyond tip of snout	3 Tip of snout to blow-hole	4 Tip of snout to angle of gape	5 Tip of snout to centre of eye	6 Tip of snout to tip of flipper	7 Eye to ear, centres	8 Notch of flukes to posterior emargination of dorsal fin	9 Flukes, width at insertion	10 Notch of flukes to anus
1925												
28 March	128	Female	21·10	—	—	3·80	3·92	8·80	—	—	1·15	6·10
28 ,,	129	Male	22·00	0·26	3·90	4·50	4·52	9·60	1·23	5·50	1·15	6·45
28 ,,	131	Female	20·70	—	—	—	3·95	—	—	—	—	—
28 ,,	132	Female	21·10	—	3·60	4·00	4·10	9·05	1·10	—	1·20	6·10
28 ,,	135	Female	17·90	—	—	—	3·50	7·65	—	—	1·05	5·55
30 ,,	136	Female	22·80	—	3·85	4·31	4·55	9·70	1·20	6·02	1·15	6·90
30 ,,	141	Female	25·80	—	4·73	—	5·35	11·40	1·37	6·95	1·45	7·60
30 ,,	142	Female	23·90	—	4·57	4·72	4·91	10·45	1·38	6·10	1·35	7·50
30 ,,	143	Male	21·97	—	3·80	—	4·36	9·44	1·14	5·55	1·10	6·40
30 ,,	145	Male	22·45	—	3·74	4·00	4·25	8·85	1·18	6·00	1·20	7·10
30 ,,	146	Male	21·25	—	3·80	4·08	4·17	8·70	1·16	6·14	1·20	6·65
31 ,,	147	Female	26·30	—	4·80	—	5·40	11·15	1·45	6·83	1·43	7·80
31 ,,	148	Male	24·50	—	4·48	—	5·02	10·60	1·42	6·48	1·41	7·52
31 ,,	149	Female	25·50	—	4·34	5·13	5·30	11·23	1·42	—	1·29	7·39
31 ,,	150	Female	23·90	—	4·74	—	5·22	10·79	—	5·65	1·28	6·87
31 ,,	151	Female	22·30	—	3·90	4·38	4·48	9·50	—	—	1·20	6·70
1 April	153	Female	20·40	—	3·15	3·60	3·55	8·20	1·18	5·30	1·05	6·00
1 ,,	154	Female	25·50	—	4·70	—	5·25	11·05	1·34	5·80	1·30	7·10
2 ,,	156	Male	24·10	—	4·60	—	5·27	11·00	1·30	—	1·30	6·87
2 ,,	157	Male	24·90	—	4·55	—	5·10	10·55	1·47	5·88	1·18	6·54
2 ,,	160	Male	21·20	—	3·60	4·05	4·15	9·00	1·16	5·35	1·05	6·30
3 ,,	167	Female	19·55	—	3·00	3·47	3·55	7·85	0·91	5·18	1·10	6·03
4 ,,	170	Male	18·45	—	3·00	3·27	3·27	7·55	—	—	0·90	5·25
6 ,,	171	Male	24·70	—	4·95	5·26	5·39	11·25	1·34	—	1·13	7·00
6 ,,	172	Female	19·55	0·27	3·08	3·45	3·55	7·90	1·05	4·85	1·10	6·17
13 ,,	182	Male	21·60	—	3·75	4·14	4·28	9·40	1·17	5·30	1·20	6·55
13 ,,	184	Female	26·30	—	5·10	—	5·60	12·00	—	—	1·45	7·35
14 ,,	191	Female	23·60	—	4·25	—	4·96	10·40	1·20	—	1·40	7·15
16 ,,	199	Male	25·10	—	—	5·15	5·33	11·30	—	—	1·22	6·90
18 ,,	202	Male	24·50	—	4·83	—	5·37	10·95	1·48	5·77	1·25	6·98
18 ,,	204	Female	18·39	—	3·24	3·76	3·80	7·55	1·00	4·60	0·95	5·47
20 ,,	205	Female	24·07	—	—	—	—	—	—	—	1·18	6·75
20 ,,	209	Female	23·00	—	4·10	—	4·75	10·16	1·30	5·80	1·08	6·92
21 ,,	211	Male	24·80	—	4·42	—	5·03	10·70	—	—	1·20	—
21 ,,	212	Male	22·25	—	4·00	—	4·58	9·70	1·30	5·56	1·25	6·25
21 ,,	215	Female	20·15	—	—	3·85	3·90	8·60	—	—	1·10	6·10
21 ,,	216	Female	20·30	—	3·60	4·08	4·18	8·30	1·07	—	—	6·03
29 ,,	220	Female	19·65	—	3·45	3·88	4·00	8·60	1·07	—	1·07	5·84
30 ,,	221	Male	25·83	—	—	—	—	—	—	—	1·30	—
30 ,,	224	Male	21·50	—	3·72	—	4·20	9·15	1·18	5·37	1·06	6·17
1 May	226	Female	25·75	—	4·74	—	5·32	11·37	1·42	6·36	1·30	7·50
4 ,,	232	Male	24·90	—	4·75	—	5·20	10·87	1·38	6·22	1·15	7·36
4 ,,	234	Female	25·00	—	5·40	—	5·66	11·50	1·37	6·00	1·20	7·02
4 ,,	235	Male	18·05	—	3·24	3·56	3·56	7·60	1·00	4·30	0·93	5·30
8 ,,	239	Female	27·15	—	4·90	—	5·70	11·37	—	—	—	8·28
11 ,,	240	Male	24·00	—	—	—	—	—	—	—	1·29	6·53
11 ,,	241	Female	26·60	—	5·00	—	5·40	12·00	1·48	6·28	1·45	7·65
15 Oct.	242	Female	25·90	—	4·85	5·47	5·55	11·90	1·53	6·08	1·37	7·80
20 ,,	243	Male	24·45	—	4·70	4·95	5·05	10·87	1·43	5·70	1·44	7·00
20 ,,	244	Female	26·37	0·43	4·95	—	5·55	11·47	—	6·55	1·60	7·60
20 ,,	245	Male	20·80	—	3·75	—	4·20	8·75	—	—	1·12	6·08
21 ,,	248	Female	16·25	—	2·03	2·28	2·47	6·14	0·75	—	0·90	5·50
24 ,,	249	Male	19·10	—	3·15	—	3·50	7·90	1·00	5·10	1·00	5·65
24 ,,	250	Female	27·20	—	5·20	—	5·60	11·45	1·38	6·60	1·35	7·50
27 ,,	253	Female	25·40	—	4·90	—	5·60	11·30	1·23	6·00	1·40	7·45
27 ,,	254	Female	25·70	—	4·50	4·90	5·17	10·75	—	—	1·33	7·00
28 ,,	256	Male	24·40	—	4·90	—	5·15	11·00	—	5·85	1·37	7·05
29 ,,	258	Female	24·84	—	3·96	—	4·93	10·90	1·54	5·88	1·28	7·10

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
9·20	—	0·40	0·28	0·90	2·10	2·90	3·05	0·80	5·00	2·60	—	—	—
9·80	—	0·95	0·35	0·90	2·20	3·10	3·24	0·86	5·50	2·70	—	—	—
—	—	—	—	—	—	-	—	—	4·70	2·30	—	- -	—
9·70	—	0·50	—	—	2·05	—	—	—	5·00	2·50	—	.	—
8·45	—	0·40	—	—	1·70	2·35	2·40	0·65	4·35	2·20	—	—	—
10·60	10·00	0·70	0·40	0·90	2·47	3·10	3·40	0·85	5·50	2·53	—	—	2·15
11·96	11·20	0·65	0·37	1·25	2·60	3·43	3·62	0·99	6·77	2·90	—	—	2·33
11·34	10·00	0·50	0·43	1·30	2·70	3·22	3·40	0·88	6·20	2·78	—	—	—
10·05	9·95	1·60	—	0·95	2·28	2·90	3·02	0·80	5·34	—	—	—	2·40
10·70	10·20	1·70	0·28	0·87	1·92	—	—	—	5·20	—	—	—	—
10·05	9·55	1·45	0·42	1·04	2·00	2·70	2·86	0·72	5·30	2·41	—	—	2·14
12·52	11·60	0·70	0·35	1·00	2·64	—	—	—	6·40	3·25	—	-	2·50
11·28	10·15	1·85	0·38	1·10	2·60	—	—	—	—	—	—	.	2·58
11·15	—	0·46	—	—	3·20	3·10	3·30	0·85	6·47	2·79	—	—	—
10·85	9·87	0·61	0·30	0·90	2·47	3·25	3·37	0·95	—	—	—	—	2·63
10·40	—	0·50	—	—	2·30	3·15	3·30	0·85	—	—	—	—	—
9·50	8·85	0·50	0·30	0·75	1·90	—	—	—	—	—	—	—	1·90
11·30	10·40	0·65	0·27	1·25	2·95	3·32	3·45	0·92	6·75	3·10	—	—	2·90
10·67	8·30	1·13	—	—	2·30	3·35	3·50	0·96	6·25	2·90	—	—	—
10·37	8·65	—	0·27	1·15	2·00	3·17	3·30	0·93	6·35	2·84	—	—	2·85
10·10	9·30	1·13	0·30	0·70	1·90	2·97	3·08	0·70	5·20	2·18	—	—	2·05
9·20	8·75	0·52	0·29	0·80	1·85	—	—	—	—	—	—	—	2·00
8·60	—	0·95	—	—	1·60	—	—	—	4·20	1·91	—	—	—
11·07	—	1·10	—	—	2·40	3·00	3·10	0·94	6·60	2·63	—	—	—
9·40	8·90	0·55	0·17	0·83	1·98	—	—	—	—	—	—	—	1·77
10·20	9·20	1·65	0·30	0·90	2·10	2·80	2·87	—	5·24	2·65	—	—	2·35
12·02	—	0·98	—	—	2·40	3·30	3·48	0·96	6·84	3·20	—	—	—
11·70	—	0·35	—	—	2·30	3·10	3·24	0·85	6·13	2·80	—	—	—
10·70	—	1·10	—	—	2·30	3·28	3·45	0·91	6·56	3·16	—	—	—
11·10	10·52	1·50	0·38	1·00	2·47	—	—	0·80	6·36	2·95	—	—	2·70
8·26	7·80	0·48	0·25	0·65	—	—	—	—	4·63	2·25	—	—	1·55
—	—	0·55	—	—	—	2·84	2·91	0·72	5·70	2·50	—	—	—
10·82	9·87	0·51	0·21	0·65	2·06	3·13	3·33	0·90	5·90	2·40	—	—	2·30
—	—	—	—	—	1·90	2·95	3·10	—	6·35	2·85	—	—	—
9·90	—	0·60	0·28	1·30	—	—	—	—	5·68	2·61	—	—	2·48
—	—	0·50	—	—	1·80	2·60	2·78	0·80	5·05	—	—	—	—
9·45	—	0·54	—	—	2·49	2·60	—	0·68	—	—	—	—	—
9·05	—	0·40	0·26	0·70	1·80	2·50	2·61	0·70	4·98	2·38	—	—	—
—	—	—	—	—	—	—	—	—	6·18	—	—	—	—
9·40	8·75	1·53	—	—	2·27	—	—	—	—	—	—	—	2·23
11·70	10·70	0·75	0·17	0·88	2·49	3·14	—	0·88	6·60	2·90	—	—	2·43
10·78	9·40	1·78	0·28	0·76	2·54	—	—	—	6·35	2·95	—	—	2·70
10·80	10·30	0·63	0·29	0·88	2·90	—	—	—	6·70	3·10	—	—	2·60
8·40	7·90	1·42	0·25	0·70	1·75	—	—	—	—	—	—	—	1·65
12·50	—	0·72	—	—	2·37	3·28	3·42	0·92	—	—	—	—	—
9·85	—	1·12	—	—	—	—	—	—	6·30	3·20	—	—	—
11·60	8·90	0·70	0·30	0·84	2·75	3·04	3·25	—	—	—	—	—	2·70
11·70	—	0·60	0·38	1·00	2·90	3·60	3·72	1·00	—	—	—	—	—
11·00	10·00	1·13	0·32	0·80	2·55	3·30	3·40	0·86	6·30	2·58	—	—	2·45
11·90	10·65	0·60	0·16	1·00	2·70	3·44	3·64	1·07	—	—	—	—	2·65
—	—	1·83	—	—	1·78	—	—	—	5·15	2·36	—	—	—
8·40	—	0·36	0·20	0·60	1·60	2·20	2·30	0·59	3·10	1·60	—	—	—
9·00	8·25	1·40	0·35	1·27	1·90	2·40	2·55	0·69	—	—	—	—	1·85
11·90	—	0·77	0·38	1·80	2·35	—	—	—	7·05	2·81	—	—	—
11·85	10·90	0·75	0·38	1·10	2·50	3·76	4·00	1·00	—	—	—	—	—
11·40	10·42	0·80	0·32	0·90	—	—	—	—	—	—	—	—	—
11·05	10·20	1·65	0·22	1·80	2·45	3·10	3·25	0·93	—	—	—	—	2·60
11·15	10·50	0·50	0·23	0·80	2·35	3·34	3·56	0·90	—	—	—	—	2·50

			1	2	3	4	5	6	7	8	9	10
DATE	WHALE NUMBER	SEX	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1925												
31 Oct.	259	Female	26·20	—	5·20	5·30	5·70	11·55	1·40	6·30	1·35	7·40
2 Nov.	261	Female	26·70	—	4·65	—	5·85	11·90	1·45	5·80	1·50	7·47
6 ,,	265	Female	21·85	—	3·95	4·55	4·70	9·65	1·20	5·40	1·10	6·60
6 ,,	267	Male	21·50	—	3·70	4·30	4·40	9·40	1·18	5·30	1·25	6·20
9 ,,	270	Female	26·30	—	4·35	5·00	5·13	11·00	1·30	6·40	1·34	7·45
9 ,,	271	Female	26·20	—	4·55	5·45	5·48	11·30	1·40	6·66	1·30	7·65
9 ,,	272	Female	26·42	—	4·73	—	5·52	11·80	1·43	6·65	1·45	8·00
16 ,,	274	Male	23·80	—	4·25	4·70	4·90	10·10	1·27	5·95	1·15	6·63
17 ,,	275	Female	22·30	—	3·90	4·30	4·50	9·65	1·23	5·80	1·25	6·75
9 Dec.	282	Female	18·90	—	3·20	3·60	3·76	7·90	1·02	4·53	0·98	5·43
15 ,,	291	Male	18·60	—	2·95	3·25	3·35	7·60	0·94	4·88	1·05	5·75
1926												
8 Jan.	302	Female	24·40	—	4·45	—	4·90	10·40	1·30	6·05	1·35	6·95
13 ,,	346	Male	24·10	—	4·80	—	5·30	10·70	1·25	—	1·35	6·85
16 ,,	360	Female	25·95	—	5·05	—	5·50	11·20	1·47	5·87	1·40	7·15
20 ,,	378	Female	23·90	—	4·20	—	4·83	10·00	1·34	—	1·18	7·10
20 ,,	379	Male	22·70	—	3·90	4·27	4·40	9·35	1·25	5·66	1·12	6·85
20 ,,	383	Male	24·40	—	5·13	—	5·60	11·00	1·19	5·40	1·20	6·57
21 ,,	399	Female	26·75	—	4·95	—	5·85	11·70	—	6·62	1·50	7·60
22 ,,	401	Male	25·25	—	4·53	—	5·10	10·90	1·44	6·20	1·35	7·30
22 ,,	402	Male	20·20	—	3·30	3·68	3·71	8·10	1·00	—	1·14	6·43
22 ,,	403	Female	20·60	—	3·53	3·90	4·10	8·75	1·14	5·12	1·19	6·23
23 ,,	418	Male	24·20	—	4·75	—	5·25	11·10	1·50	6·30	1·25	7·00
24 ,,	424	Male	24·80	—	4·45	—	5·17	10·80	1·34	5·98	1·32	7·10
25 ,,	440	Male	17·25	—	2·75	—	3·26	7·10	—	—	1·03	5·20
25 ,,	442	Male	24·10	—	4·36	—	4·85	10·74	1·33	6·05	1·24	6·85
27 ,,	444	Male	24·65	—	4·50	4·80	5·02	11·00	1·35	—	1·28	6·85
2 Feb.	494	Female	25·00	—	4·88	—	5·35	10·60	1·38	6·50	1·25	7·80
5 ,,	510	Male	18·30	—	2·78	3·23	3·30	7·67	0·95	—	1·04	5·90
6 ,,	517	Female	20·80	—	3·67	—	4·18	8·76	1·23	5·00	1·02	6·00
7 ,,	528	Female	18·80	—	3·05	3·38	3·60	7·90	0·95	4·35	0·99	5·45
8 ,,	532	Male	17·80	—	2·80	3·00	3·27	7·25	0·95	4·35	0·95	5·20
9 ,,	534	Male	20·50	—	3·62	—	4·13	8·80	0·88	5·08	0·98	6·00
12 ,,	554	Male	17·30	—	2·75	—	3·25	7·00	0·90	4·59	0·90	5·25
13 ,,	557	Female	26·85	—	4·86	—	5·45	11·40	1·50	—	1·38	7·50
14 ,,	567	Male	17·50	—	2·70	3·10	3·19	7·20	1·16	—	0·85	5·57
14 ,,	568	Male	18·80	—	2·95	3·30	3·45	7·25	0·97	4·48	0·86	5·85
14 ,,	569	Male	23·00	—	4·45	—	4·90	10·55	1·36	5·37	1·15	6·50
14 ,,	570	Female	20·80	—	3·90	4·27	4·25	9·00	1·12	—	1·09	6·15
14 ,,	571	Male	22·70	—	4·34	—	4·88	10·35	1·20	5·25	1·19	6·55
14 ,,	572	Male	23·10	—	4·35	4·75	4·95	10·40	1·30	5·75	1·21	6·75
15 ,,	578	Male	19·30	—	3·40	3·75	3·82	8·15	0·99	4·65	0·98	5·70
15 ,,	580	Male	22·60	—	3·75	4·15	4·32	9·50	1·25	5·80	1·13	6·55
15 ,,	581	Female	16·65	—	2·90	—	3·25	6·80	0·85	—	0·94	4·97
15 ,,	582	Female	18·35	—	3·20	3·35	3·40	—	0·95	4·65	1·00	5·55
15 ,,	583	Female	19·10	—	3·00	—	3·55	7·65	0·98	4·65	1·00	5·30
15 ,,	584	Female	18·23	—	3·00	3·30	3·35	7·40	1·13	4·50	1·05	5·55
16 ,,	591	Male	20·85	—	3·63	4·10	4·20	8·95	1·08	—	1·20	5·80
16 ,,	592	Male	19·35	—	3·20	3·50	3·65	7·88	1·00	5·30	1·00	5·85
16 ,,	593	Male	23·40	—	4·40	—	4·80	10·20	—	5·95	1·30	6·90
16 ,,	594	Male	18·80	—	3·10	3·44	3·57	8·06	1·00	4·81	1·09	5·45
16 ,,	595	Female	20·20	—	3·48	3·82	3·92	8·45	1·10	5·18	1·10	6·40
16 ,,	596	Male	21·70	—	3·90	4·13	4·23	9·20	—	5·50	1·22	6·65
16 ,,	597	Female	17·80	—	2·60	3·00	3·07	7·00	0·83	—	1·05	5·70
16 ,,	598	Male	21·90	—	4·00	—	4·40	9·45	1·10	5·15	1·10	6·40
16 ,,	599	Female	24·70	—	4·38	—	4·90	10·50	1·52	6·30	1·50	7·20
18 ,,	605	Female	18·80	—	3·10	3·42	3·53	7·45	0·95	—	0·95	5·90
18 ,,	608	Female	19·30	—	3·26	3·44	3·55	7·85	1·07	5·10	1·05	5·95
19 ,,	612	Female	19·10	—	3·08	3·30	3·50	8·06	0·95	4·80	1·10	5·70
19 ,,	613	Male	25·50	—	4·70	—	5·15	11·00	1·48	6·20	1·35	7·30
20 ,,	614	Female	21·10	—	4·00	4·40	4·50	9·10	1·12	—	1·20	6·40

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
11·45	11·00	0·75	0·32	1·65	2·65	—	—	—	—	—	—	—	—
11·55	10·60	0·63	0·35	1·15	2·80	—	—	—	—	—	—	—	2·60
10·25	9·50	0·50	0·37	1·00	2·14	3·07	3·20	0·85	5·60	2·66	—	—	2·20
9·85	9·00	1·60	0·21	0·65	2·10	—	—	—	—	—	—	—	1·95
11·80	11·38	0·75	0·27	1·00	2·60	3·50	3·75	0·98	—	—	—	—	2·50
11·70	10·80	0·67	0·34	1·00	2·60	3·24	3·36	0·98	6·60	3·09	—	—	2·20
11·95	10·95	0·90	0·41	1·10	2·70	—	—	—	—	—	—	—	2·35
10·50	10·30	1·82	0·08	1·44	2·20	3·00	3·14	0·74	—	—	—	—	2·25
10·20	—	0·50	0·15	1·65	2·20	2·90	3·13	0·88	5·50	2·63	—	—	—
8·85	8·55	0·47	0·26	1·00	1·90	2·50	2·59	—	—	—	—	—	1·62
9·00	8·10	1·15	0·25	1·00	1·98	2·55	2·75	0·73	—	—	—	—	1·65
10·80	10·60	0·65	0·28	0·70	2·30	3·17	3·28	0·85	—	—	—	—	2·70
10·88	10·19	1·65	—	—	2·35	3·35	3·45	0·75	6·40	2·80	—	—	2·60
11·25	10·90	0·63	—	1·25	1·90	3·34	3·53	0·90	6·90	3·21	—	—	2·55
10·90	—	0·56	—	—	2·15	2·85	3·04	0·83	—	2·77	—	—	—
10·75	10·90	—	0·27	0·90	2·05	2·58	2·64	0·80	5·52	2·60	—	—	1·90
10·60	10·00	1·65	—	0·80	2·20	3·23	3·38	0·88	6·95	3·14	—	—	2·35
12·12	—	0·75	0·33	1·20	2·84	3·75	4·00	1·00	—	—	—	—	2·85
11·15	10·35	1·63	—	1·15	2·15	—	—	—	6·30	—	—	—	2·35
9·44	—	0·80	—	—	1·85	2·60	2·67	0·70	4·60	—	—	—	—
10·00	9·50	0·62	0·27	0·90	1·90	2·57	2·63	0·70	4·95	2·34	—	—	1·80
10·75	9·60	1·60	0·38	0·95	2·50	3·30	3·45	0·93	6·34	2·72	—	—	2·20
10·78	10·10	1·55	0·39	1·50	2·30	3·16	3·28	0·90	6·23	2·98	—	—	2·45
8·34	—	0·70	—	—	1·68	2·30	—	—	—	—	—	—	—
10·85	10·30	1·75	0·32	0·80	2·60	3·23	3·46	0·88	6·02	—	—	—	2·45
10·85	—	1·20	—	—	2·57	3·38	3·47	0·84	—	—	—	—	—
11·65	10·75	0·53	0·38	1·40	2·63	3·25	3·45	0·90	6·60	2·75	—	—	2·60
9·05	—	0·85	—	—	2·10	2·75	2·82	0·65	4·05	1·95	—	—	—
9·30	9·14	0·49	0·34	1·10	1·88	2·58	2·75	0·75	5·20	2·48	—	—	—
9·07	—	0·55	0·16	0·40	1·82	2·60	2·82	0·71	4·42	2·21	—	—	—
—	8·00	1·40	0·21	0·60	1·70	—	—	—	—	—	—	—	1·45
9·35	8·65	1·40	0·21	0·90	2·00	2·78	2·92	0·71	5·08	2·48	—	—	2·10
8·05	7·00	1·10	0·20	1·08	1·64	2·17	2·30	0·60	4·00	1·90	—	—	1·50
12·00	—	0·70	—	—	2·44	3·29	3·45	0·98	6·75	3·18	—	—	—
8·50	—	0·79	0·23	0·58	1·50	2·41	2·45	0·65	3·94	2·10	—	—	—
9·10	8·50	1·25	0·24	0·52	1·55	2·32	2·43	0·65	4·24	2·15	—	—	1·77
10·50	10·10	1·60	—	0·76	2·30	—	—	0·92	—	—	—	—	2·18
9·60	—	0·47	0·23	0·70	2·10	2·82	2·95	0·78	5·05	2·54	—	—	—
10·05	9·50	1·50	0·30	0·85	2·26	3·07	3·32	0·90	6·07	2·81	—	—	2·10
10·30	10·10	1·75	0·30	0·85	2·40	3·15	3·30	0·73	5·95	2·63	—	—	2·15
9·10	8·10	1·35	0·22	0·90	1·95	2·43	2·51	0·65	4·60	2·16	—	—	1·75
10·65	9·80	1·95	—	0·80	2·05	—	—	—	—	—	—	—	2·00
8·02	—	0·47	—	—	1·60	—	—	—	4·00	1·85	—	—	—
8·50	7·85	0·62	0·19	0·65	—	2·40	2·55	0·66	4·15	2·00	—	—	1·55
8·80	9·00	0·67	0·13	0·57	1·60	2·40	2·55	0·70	—	—	—	—	—
8·60	8·10	0·60	0·24	0·60	1·70	—	—	—	—	—	—	—	1·50
9·25	—	1·02	—	—	1·96	2·80	2·95	0·70	5·15	2·15	—	—	—
9·17	8·70	1·30	0·27	0·90	1·85	—	—	—	—	—	—	—	—
10·85	9·90	1·65	0·25	1·10	2·40	3·15	3·31	0·87	6·04	2·81	—	—	2·50
8·77	8·15	1·40	0·16	0·96	2·02	2·67	2·80	0·76	4·40	2·10	—	—	1·70
9·60	8·90	0·40	0·25	0·80	2·00	2·65	2·80	0·74	4·80	2·42	—	—	1·80
10·30	9·40	1·40	0·32	1·47	2·10	—	—	—	5·30	2·40	—	—	2·15
8·70	—	0·40	—	—	1·65	2·30	2·45	0·61	3·75	1·87	—	—	—
10·15	9·40	1·60	0·31	0·95	2·35	2·93	3·00	0·79	5·35	2·35	—	—	2·20
11·20	10·60	0·60	—	1·28	2·27	3·23	3·38	0·85	6·07	2·90	—	—	—
9·05	—	0·45	0·22	0·72	1·50	2·40	2·59	0·62	4·15	2·08	—	—	—
9·20	8·70	0·55	0·23	0·90	1·90	2·52	2·65	0·67	4·30	2·31	—	—	—
8·95	—	0·58	—	0·89	1·95	2·65	2·80	0·74	4·45	—	4·33	3·00	1·83
11·25	10·19	1·85	0·32	1·10	2·26	—	—	—	—	—	—	—	2·55
9·65	—	0·50	—	—	1·80	2·78	2·94	0·83	5·35	2·55	—	—	—

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1926												
20 Feb.	615	Male	23·30	—	4·95	5·23	5·33	10·90	1·31	5·38	1·19	6·20
20 ,,	616	Female	22·75	—	4·30	4·70	4·82	—	1·32	5·72	1·20	6·76
20 ,,	617	Female	22·10	—	4·00	—	4·50	9·45	1·30	5·53	1·10	6·80
22 ,,	620	Female	21·55	—	3·70	4·00	4·28	9·45	1·26	5·58	1·09	6·85
22 ,,	623	Female	21·50	—	3·15	3·62	3·75	8·18	1·05	—	1·13	6·33
24 ,,	625	Female	19·00	—	3·18	3·47	3·60	8·10	1·00	4·90	1·02	5·70
25 ,,	628	Male	21·30	—	3·65	4·14	4·17	9·10	—	—	1·15	6·25
1 March	637	Female	26·70	—	4·87	—	5·63	11·47	1·40	6·67	1·55	7·95
1 ,,	638	Female	24·35	—	4·30	—	5·05	11·10	1·36	5·62	1·30	6·85
1 ,,	639	Female	20·00	—	3·40	—	3·82	8·35	1·03	—	1·10	5·15
1 ,,	640	Female	25·10	—	4·85	—	5·32	10·80	1·37	6·35	1·34	7·14
1 ,,	641	Female	20·30	—	3·60	—	4·05	8·70	—	4·82	1·06	6·00
1 ,,	642	Female	24·25	—	4·70	4·95	5·11	10·77	1·40	6·00	1·37	7·03
1 ,,	643	Male	24·40	—	4·80	—	5·25	10·75	1·34	5·75	1·30	6·85
1 ,,	644	Male	18·97	—	3·28	3·64	3·80	7·95	0·97	4·90	1·10	5·80
2 ,,	645	Female	26·40	—	—	—	5·25	—	—	—	1·39	6·85
2 ,,	646	Male	17·75	—	3·00	—	3·41	7·50	0·89	—	1·03	5·70
2 ,,	647	Male	21·75	—	—	4·03	4·15	—	—	5·60	1·11	6·55
2 ,,	648	Female	17·30	—	2·80	—	3·25	7·15	0·90	—	0·93	5·50
2 ,,	649	Male	18·05	—	3·00	3·30	3·55	7·80	0·96	4·85	0·96	5·35
2 ,,	650	Female	16·35	—	2·70	3·00	3·17	6·94	0·86	3·88	0·91	4·70
2 ,,	651	Female	18·25	—	2·50	3·30	3·45	7·65	0·94	4·15	1·00	5·60
2 ,,	652	Male	21·70	—	3·75	—	4·15	9·05	1·16	5·30	1·04	6·32
3 ,,	653	Male	19·20	—	3·35	3·81	3·93	8·35	0·98	—	1·07	5·75
3 ,	654	Female	19·20	—	3·00	3·63	3·70	7·80	1·02	5·05	1·05	5·86
3 ,,	655	Female	22·00	—	4·10	4·35	4·43	9·25	1·22	5·45	1·15	6·40
3 ,,	656	Male	18·10	—	3·00	—	3·26	—	1·00	—	—	5·50
3 ,,	657	Female	16·80	—	2·45	2·90	2·91	6·90	—	—	0·96	5·50
4 ,,	658	Male	21·50	—	4·00	4·45	4·50	9·55	1·24	—	1·17	6·30
4 ,,	659	Female	25·25	—	4·15	4·64	4·85	10·45	1·33	6·65	1·22	7·70
4 ,,	660	Female	22·10	—	3·70	4·27	4·37	9·50	1·14	—	1·22	6·40
4 ,,	661	Female	23·20	—	4·10	—	4·30	—	1·23	—	—	6·70
4 ,,	662	Male	18·30	—	2·60	—	3·10	7·10	0·83	4·60	0·90	5·70
4 ,,	663	Female	18·87	—	2·70	3·13	3·10	7·60	0·95	4·90	0·97	5·72
4 ,,	664	Female	24·70	—	4·60	—	5·20	—	1·42	5·50	1·20	6·80
4 ,,	665	Female	19·65	—	2·95	3·62	3·65	8·15	1·35	—	1·00	6·00
4 ,,	666	Female	24·90	—	4·00	—	4·78	10·65	—	6·25	—	7·45
5 ,,	667	Female	28·50	—	—	—	—	—	—	—	1·30	—
5 ,,	668	Male	21·65	—	3·80	4·36	4·47	9·25	—	—	1·23	6·50
5 ,,	669	Male	19·80	—	3·30	3·70	3·90	8·35	1·00	4·95	1·04	6·00
5 ,,	670	Male	20·30	—	3·40	3·76	3·88	8·00	1·07	5·30	1·04	6·10
6 ,,	671	Male	20·65	—	3·50	3·80	3·92	8·70	1·13	—	1·07	6·35
6 ,,	673	Male	19·20	—	3·25	3·65	3·77	8·30	—	4·90	0·95	5·70
8 ,,	676	Female	18·90	—	2·90	—	3·50	7·60	—	4·85	0·95	5·65
13 ,,	681	Female	18·60	—	3·14	3·20	3·29	7·30	—	—	1·03	5·80
14 ,,	684	Male	18·75	—	3·00	3·42	3·57	7·80	0·97	—	0·90	5·95
14 ,,	688	Male	17·70	—	2·80	3·30	3·50	7·10	—	—	0·86	5·50
19 ,,	695	Female	18·10	—	3·50	3·70	3·84	7·70	0·98	4·55	0·88	5·30
20 ,,	698	Male	19·00	—	3·00	3·55	3·60	8·10	1·00	4·75	1·03	5·75
22 ,,	702	Male	19·64	—	3·20	—	3·65	7·80	1·00	—	1·02	6·00
22 ,,	703	Male	17·75	—	2·98	3·14	3·35	7·10	0·98	4·40	0·97	5·40
22 ,,	704	Female	26·10	—	4·85	—	5·53	11·30	—	6·65	1·18	8·15
23 ,,	712	Female	17·95	—	2·80	—	3·10	6·90	0·97	4·30	0·80	5·35
24 ,,	716	Female	19·50	—	3·80	4·40	4·40	8·70	—	—	1·08	5·55
24 ,,	718	Female	18·80	—	3·25	3·60	3·78	8·00	0·93	4·65	0·98	5·55
25 ,,	720	Male	20·07	—	3·85	—	4·10	8·55	1·13	—	1·10	6·15
26 ,,	726	Female	20·02	—	3·60	3·90	3·97	8·80	—	5·10	1·07	6·15
29 ,,	737	Female	18·20	—	3·10	3·45	3·50	7·40	0·96	4·80	0·99	5·75

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
10·20	9·70	1·50	—	1·25	2·37	3·16	3·33	0·91	6·40	2·95	6·29	—	2·35
10·37	—	0·71	0·49	1·00	—	3·25	3·36	0·92	5·88	2·60	—	—	2·15
10·85	10·20	0·50	0·38	1·15	2·17	2·87	3·07	0·74	5·50	2·53	—	—	2·25
9·91	9·80	0·71	0·24	0·65	2·24	3·06	3·25	0·80	5·20	2·44	—	—	1·72
9·42	—	0·48	0·30	0·79	1·90	—	—	—	—	—	—	—	—
9·05	8·53	0·60	0·28	0·70	2·00	2·70	2·83	0·68	4·40	2·05	—	—	1·55
—	—	0·87	—	—	2·15	2·85	2·94	0·74	5·25	—	—	—	—
12·35	11·45	0·80	—	1·50	2·33	—	—	—	6·66	3·15	—	—	2·35
10·75	10·10	0·60	0·37	1·40	2·75	3·48	3·65	0·92	6·30	2·97	—	—	2·50
9·25	—	0·63	0·14	0·52	1·85	2·59	2·68	0·73	4·64	2·31	—	—	—
11·35	11·10	0·62	0·36	1·20	2·30	2·99	3·31	0·99	6·20	2·86	—	—	2·45
9·20	9·00	0·52	0·24	0·85	2·10	—	—	—	—	—	—	—	2·00
10·80	10·50	0·57	0·37	1·00	—	3·60	3·70	0·90	6·18	2·80	6·05	—	2·00
11·00	10·40	1·75	—	1·25	—	—	—	—	—	—	—	—	2·40
9·00	7·90	1·30	0·24	1·06	1·85	2·37	2·48	0·77	—	—	—	—	1·90
10·80	—	0·52	—	—	2·50	3·24	3·32	0·96	6·30	3·08	—	—	—
8·55	—	0·75	0·27	0·60	1·62	—	—	—	—	—	—	—	—
10·20	10·00	1·65	0·24	0·80	—	2·75	—	0·79	5·00	2·24	—	—	2·00
8·30	—	0·35	—	—	1·70	2·50	2·65	0·68	4·18	1·97	—	—	—
8·65	8·20	1·50	0·29	0·50	1·78	—	—	0·66	4·15	2·13	—	—	1·70
7·62	7·40	0·51	0·24	0·62	1·75	—	—	—	—	—	—	—	1·45
8·64	7·80	0·47	0·23	0·70	1·75	2·62	2·70	0·70	—	—	—	—	—
10·31	9·62	1·53	0·27	0·81	2·10	2·85	2·90	0·72	5·20	2·39	—	—	—
8·85	—	0·95	0·21	0·60	2·00	2·76	2·88	0·80	4·75	2·30	—	—	—
9·30	9·00	0·49	0·49	0·90	1·78	2·40	2·56	0·66	4·46	2·16	—	—	1·70
9·95	9·95	0·60	0·30	0·80	2·10	—	—	—	5·50	2·65	—	—	2·10
8·75	—	0·75	—	—	—	2·34	2·53	0·68	4·37	2·40	—	—	—
8·40	—	0·35	—	—	—	2·32	2·43	0·62	3·88	1·86	—	—	—
9·50	—	1·05	—	—	1·70	3·00	3·14	0·85	5·55	2·58	—	—	—
12·00	11·30	0·80	0·30	0·80	2·65	3·30	3·55	0·91	6·05	2·82	—	—	2·35
10·00	9·65	0·60	0·22	0·65	2·00	—	—	—	—	—	—	—	—
11·10	—	0·60	0·20	0·70	—	3·20	3·43	0·88	—	—	—	—	—
8·95	—	0·85	—	—	—	3·06	3·25	0·80	4·15	2·17	—	—	—
9·05	8·70	0·60	0·25	0·88	—	2·40	2·47	0·64	—	—	—	—	1·98
10·80	10·40	0·60	0·26	0·80	—	—	—	—	—	—	—	—	2·20
9·25	—	0·60	—	—	2·15	2·29	2·44	0·75	—	—	—	—	—
11·70	11·00	0·53	—	0·90	—	—	—	—	—	—	—	—	2·45
—	—	—	—	—	—	—	—	—	7·00	—	—	—	—
10·30	—	1·00	—	—	2·50	2·80	2·93	0·81	5·48	2·40	—	—	—
9·10	8·75	1·30	0·22	0·70	1·87	—	—	—	—	—	—	—	1·90
9·70	8·60	1·50	0·20	0·60	1·90	—	—	—	—	—	—	—	1·90
9·75	—	0·85	0·23	0·64	1·98	2·65	2·75	0·75	4·95	2·34	—	—	—
8·60	9·00	0·85	0·22	0·70	1·90	—	—	—	—	—	—	—	—
8·60	8·35	0·55	0·22	0·80	—	—	—	—	—	—	—	—	1·70
9·00	—	0·55	—	—	1·70	2·27	2·43	0·67	4·00	2·18	—	—	—
9·00	—	0·75	0·20	0·80	1·80	2·29	2·36	0·59	4·40	2·13	—	—	—
8·45	—	0·65	0·22	0·60	1·80	—	—	—	4·15	2·15	—	—	—
8·40	7·95	0·55	—	0·60	1·73	2·22	2·38	0·61	4·75	2·01	—	—	1·65
8·90	8·30	1·20	0·26	0·75	2·04	2·70	2·80	0·75	4·50	2·20	—	—	2·08
9·20	—	0·90	—	—	1·88	2·50	2·72	0·69	4·50	2·08	—	—	—
8·30	8·20	1·40	0·26	0·60	1·66	2·29	2·46	0·65	—	—	—	—	1·60
12·20	11·25	0·70	0·44	1·10	2·30	3·55	3·80	0·94	6·60	3·01	—	—	2·35
8·90	8·65	0·45	0·17	0·80	1·60	—	—	—	4·10	2·08	—	—	—
8·80	—	0·50	—	—	2·00	—	—	—	4·85	2·42	—	—	—
8·90	8·20	0·75	0·26	0·60	1·85	—	—	—	—	—	—	—	1·80
9·60	—	0·70	0·26	0·70	1·75	2·50	2·75	0·75	5·05	2·40	—	—	—
9·50	—	0·56	0·22	0·65	2·10	2·85	3·00	0·75	4·90	2·31	—	—	—
8·65	8·10	0·45	0·14	0·55	1·80	2·37	2·55	0·65	4·32	2·01	—	—	1·55

Date	Whale Number	Sex	1 Total length, tip of snout to notch of flukes	2 Lower jaw, projection beyond tip of snout	3 Tip of snout to blow-hole	4 Tip of snout to angle of gape	5 Tip of snout to centre of eye	6 Tip of snout to tip of flipper	7 Eye to ear, centres	8 Notch of flukes to posterior emargination of dorsal fin	9 Flukes, width at insertion	10 Notch of flukes to anus
Saldanha Bay 1926												
15 June	739	Female	18·25	—	2·82	3·48	3·35	7·40	0·94	5·00	1·10	5·75
15 ,,	740	Male	16·95	—	2·88	3·35	3·37	7·10	0·94	4·42	1·07	5·10
16 ,,	746	Female	17·90	—	2·92	3·20	3·37	—	0·91	4·50	0·92	5·45
16 ,,	747	Male	19·60	—	3·20	3·64	3·76	8·20	1·02	5·00	1·00	5·95
16 ,,	748	Female	21·00		3·65	—	4·25	9·05	1·10	5·13	1·10	6·20
17 ,,	753	Male	18·35	—	2·87	3·28	3·38	7·43	0·97	4·70	1·00	5·65
17 ,,	754	Female	24·30	—	4·90	—	5·40	11·10	1·35	—	1·27	6·70
17 ,,	756	Female	17·65	—	2·90	3·15	3·20	7·05	—	—	0·92	5·75
17 ,,	757	Female	19·65	—	3·10	3·50	3·65	8·05	1·00	5·15	1·02	6·50
19 ,,	759	Female	17·03	—	2·90	3·25	3·50	7·30	0·90	4·60	1·00	5·15
19 ,,	760	Male	18·40	—	3·00	3·16	3·40	—	1·01	4·80	1·00	5·65
20 ,,	761	Female	22·00	—	3·80	4·45	4·55	9·50	1·00	—	1·17	6·85
20 ,,	763	Female	16·90	–	2·45	2·85	2·86	6·75	0·70	4·40	0·92	5·50
20 ,,	764	Male	17·00	—	2·60	3·03	3·10	7·00	0·90	4·35	0·80	5·10
20 ,,	766	Male	19·00	—	2·85	3·25	3·40	7·55	0·90	4·80	0·93	5·80
20 ,,	767	Female	16·80		2·60	2·95	3·04	6·70	0·88	4·35	0·83	5·35
21 ,,	768	Female	21·70	—	3·60	4·00	4·17	8·80	1·20	5·20	1·08	6·70
21 ,,	769	Male	19·20	—	3·06	3·38	3·58	6·95	1·00	5·00	1·00	5·95
21 ,,	770	Female	23·64	—	4·15	—	4·78	10·15	1·29	6·03	1·20	6·90
22 ,,	773	Male	18·80	—	3·10	3·25	3·35	8·20	1·04	4·90	0·90	5·50
22 ,,	774	Male	18·00	—	2·95	3·40	3·54	7·60	0·94	4·57	1·01	5·50
22 ,,	776	Female	26·90	—	5·18	—	5·83	12·10	1·44	6·10	1·38	7·55
22 ,,	777	Male	19·80	—	3·30	3·70	3·85	—	1·02	4·90	0·91	5·75
23 ,,	779	Female	18·80	—	3·11	3·44	3·48	7·67	0·99	4·74	1·00	5·90
23 ,,	781	Female	16·75	—	2·80	—	3·22	6·95	0·95	4·30	0·85	5·20
24 ,,	785	Male	18·60	—	3·10	3·55	3·67	7·90	0·92	4·96	0·91	5·65
24 ,,	787	Female	16·90	—	2·85	3·25	3·32	7·20	0·95	4·37	0·89	5·35
25 ,,	794	Female	18·95	—	3·00	3·48	3·48	7·85	1·00	5·00	1·00	5·97
26 ,,	797	Male	18·40	—	3·15	3·54	3·67	8·00	1·00	4·60	0·96	5·60
26 ,,	799	Female	19·00	—	2·90	3·31	3·38	7·45	1·04	5·15	1·10	5·75
27 ,,	801	Female	26·10	—	5·15	—	6·00	11·90	1·55	6·12	1·37	7·14
27 ,,	802	Male	18·70	—	3·00	3·40	3·50	7·80	1·12	4·90	0·95	5·60
27 ,,	803	Female	17·90	—	2·85	—	3·23	7·10	0·98	4·65	1·00	5·60
27 ,,	805	Female	19·40	—	3·00	3·30	3·47	—	1·00	5·50	1·01	6·20
28 ,,	809	Male	18·90	—	2·95	—	3·53	7·90	0·94	—	1·04	5·45
28 ,,	810	Female	26·35	—	4·85	5·54	5·58	11·82	1·32	6·33	1·36	7·35
29 ,,	811	Male	17·85	—	—	—	—	—	—	—	0·95	—
29 ,,	812	Female	24·80	—	5·00	—	5·55	11·10	1·39	5·85	1·28	7·00
29 ,,	813	Male	16·90	—	2·72	3·10	3·18	7·04	1·20	4·30	0·80	5·15
29 ,,	814	Female	17·80	—	2·84	3·05	3·25	7·15	0·95	4·60	0·90	5·40
29 ,,	816	Female	22·40	—	4·00	4·40	4·60	—	1·22	5·40	1·18	6·45
29 ,,	818	Female	20·90	0·20	4·00	—	4·45	9·20	1·15	5·40	1·00	6·30
30 ,,	819	Male	17·50	—	2·80	3·14	3·20	7·30	0·91	—	0·89	5·40
30 ,,	820	Female	21·55	—	4·10	4·25	4·45	9·35	1·17	5·40	1·10	6·20
30 ,,	822	Female	20·60	—	3·75	4·04	4·28	—	1·14	5·00	1·09	5·85
30 ,,	823	Male	15·83	—	2·70	—	3·18	6·85	0·94	3·80	0·80	4·65
1 July	824	Male	18·30	—	3·35	3·66	3·70	8·00	0·96	—	0·88	5·30
1 ,,	825	Female	17·70	—	2·95	3·32	3·40	7·60	0·97	4·23	0·85	5·35
1 ,,	826	Female	19·30	—	3·25	3·63	3·73	8·20	—	—	1·00	5·95
1 ,,	827	Female	19·97	—	3·40	3·70	3·77	8·15	1·06	5·00	1·02	6·05
2 ,,	828	Male	17·80	—	2·82	3·20	3·32	7·45	0·95	—	1·00	—
2 ,,	829	Male	18·80	—	3·15	3·55	3·59	8·05	1·03	4·88	1·05	5·75
2 ,,	830	Male	22·90	—	3·85	4·41	4·58	10·20	1·31	5·95	1·17	6·70
2 ,,	833	Male	18·25	—	3·25	3·60	3·72	7·85	0·98	4·75	0·95	5·55
2 ,,	834	Male	18·17	—	3·10	3·40	3·56	7·75	1·04	4·45	0·95	5·60
3 ,,	835	Male	19·00	—	3·05	3·47	3·59	7·77	0·98	4·75	1·06	5·78
3 ,,	836	Female	19·10	—	3·10	3·54	3·67	7·90	0·98	5·16	1·13	5·95
3 ,,	838	Male	22·00	—	3·90	4·34	4·53	9·46	1·16	5·40	1·15	6·50

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
8·78	8·30	0·50	0·20	0·90	1·87	2·38	2·52	0·68	4·17	1·98	—	—	1·70
8·00	7·60	1·30	0·15	0·65	1·70	2·26	2·37	0·65	4·00	2·02	—	—	1·50
8·54	8·04	0·45	—	—	1·60	2·15	2·26	0·69	4·15	1·85	—	—	1·54
9·30	9·10	1·35	0·28	0·80	2·10	2·67	2·73	0·73	—	—	—	—	1·70
9·90	9·20	0·55	0·23	1·00	2·00	2·70	2·85	0·78	5·20	—	—	—	2·00
8·75	8·20	1·15	0·13	0·50	1·70	2·20	2·42	0·68	—	—	—	—	1·63
10·80	—	0·80	—	—	2·40	3·30	3·44	0·95	6·60	3·10	—	—	—
8·70	—	0·45	—	—	1·66	2·28	2·42	0·68	—	—	—	—	—
9·65	9·00	0·60	0·23	0·50	1·95	2·65	2·80	0·75	4·43	2·23	—	—	1·55
8·58	8·18	0·43	0·19	0·87	1·75	2·23	2·36	0·65	4·25	2·30	—	—	—
8·90	8·57	1·20	0·30	0·80	—	—	—	—	—	—	—	—	1·55
10·30	—	0·55	0·25	0·80	2·05	2·65	2·76	0·79	5·55	2·50	—	—	—
8·40	—	0·50	0·17	0·50	1·72	2·30	2·47	0·62	3·60	1·81	—	—	—
8·80	8·50	1·30	0·20	0·65	1·55	2·22	2·32	0·57	3·80	1·86	—	-	1·48
9·15	8·60	1·60	0·15	0·50	1·78	—	—	—	—	—	—	—	1·70
8·30	7·90	0·46	0·24	0·80	1·50	—	—	—	—	—	—	—	1·40
10·30	9·70	0·51	0·27	0·80	2·00	2·65	2·85	0·75	5·20	—	—	—	1·75
9·16	8·43	1·20	0·14	0·60	1·95	—	—	—	—	—	—	—	1·70
10·93	10·00	0·70	0·31	1·12	2·30	3·07	3·20	0·85	—	—	-	—	2·50
8·60	8·30	1·25	0·23	0·70	2·00	2·64	2·69	0·72	—	—	—	—	1·75
8·60	8·20	1·50	0·21	0·55	1·70	2·42	2·58	0·66	4·40	2·00	—	—	1·50
12·00	11·50	0·80	0·35	1·07	2·80	—	—	0·99	7·25	4·28	—	—	—
9·10	8·80	1·40	0·27	1·00	—	—	—	—	—	—	—	—	1·55
9·45	8·57	0·55	0·28	1·10	1·94	2·45	2·61	0·72	4·30	1·97	—	—	1·65
8·05	7·80	0·50	—	0·50	1·70	—	—	—	—	—	—	—	1·35
8·90	8·65	1·60	0·20	0·50	1·83	2·60	2·82	0·71	4·45	2·10	—	—	1·55
8·00	7·70	0·50	0·17	0·65	1·79	—	—	—	—	—	—	—	1·50
9·00	8·50	0·58	0·16	1·15	1·90	—	—	—	–	—	—	—	1·50
8·60	8·10	1·30	0·33	1·00	1·94	2·39	2·47	0·71	—	—	—	—	1·60
8·90	8·50	0·55	0·26	0·60	1·65	2·37	2·44	0·68	4·30	1·96	—	—	1·55
11·30	10·60	0·60	0·35	1·12	2·85	3·64	3·81	0·98	7·40	2·90	—	—	2·25
9·00	8·50	1·40	0·16	0·85	1·95	2·55	2·69	0·62	4·40	1·95	—	—	1·55
8·70	8·20	0·45	0·29	1·05	1·70	2·22	2·42	—	—	—	—	—	1·45
9·45	8·80	0·50	0·25	1·00	—	—	—	—	—	—	—	—	1·65
8·85	—	0·60	0·18	0·56	1·80	2·49	2·62	0·68	4·40	—	—	—	—
11·55	11·10	0·70	0·31	0·85	2·75	3·56	3·70	0·99	6·80	2·96	—	—	—
—	—	—	—	—	—	2·24	2·30	—	3·65	—	—	—	—
11·15	10·35	0·50	0·41	1·65	2·55	3·10	3·18	0·94	6·75	2·70	—	—	2·50
8·00	7·18	1·27	0·21	1·14	1·65	2·23	2·36	0·64	3·95	1·95	—	—	1·43
8·40	7·90	0·45	0·16	1·00	1·60	2·30	2·40	—	—	—	—	—	1·42
9·90	9·30	0·58	0·28	1·10	2·25	2·94	3·15	0·82	5·78	—	—	—	2·00
9·73	9·50	0·50	0·30	1·20	2·10	—	—	—	—	—	—	—	1·85
8·40	—	1·15	—	0·75	1·75	2·30	2·40	0·59	3·95	1·85	—	—	—
9·80	9·20	0·60	0·24	1·00	2·30	2·70	2·76	0·78	—	—	—	—	1·95
9·77	8·70	0·60	0·34	0·95	—	2·71	2·94	0·74	—	-	—	—	1·98
7·25	6·85	1·20	0·60	0·20	—	—	—	—	—	—	—	—	1·40
—	8·00	0·80	—	—	1·87	2·35	2·43	0·64	4·67	2·32	—	—	—
8·30	7·70	0·40	0·22	1·00	1·75	—	—	—	—	—	—	—	1·55
7·85	—	0·40	—	—	—	-	-	—	—	—	—	—	—
9·50	8·80	0·45	0·21	0·90	1·75	—	—	—	—	—	—	—	1·70
—	—	0·91	—	—	—	2·20	2·32	—	4·25	1·80	4·17	—	—
9·10	8·80	1·45	0·31	1·10	1·93	2·70	2·86	0·70	4·40	2·10	4·23	—	1·58
10·60	10·00	1·70	0·34	0·90	2·40	3·13	3·25	0·90	5·65	2·53	—	—	2·00
8·65	8·30	1·35	0·25	0·90	1·72	2·45	2·67	0·67	—	2·00	—	—	1·65
8·70	8·00	1·20	0·22	1·00	1·70	—	—	—	—	—	—	—	1·65
9·00	8·60	1·22	0·29	0·83	1·85	2·41	2·55	0·71	4·30	2·00	—	—	1·73
9·00	8·50	0·45	0·21	0·70	1·84	2·10	2·48	0·70	4·45	—	—	—	1·62
10·10	9·50	1·60	0·34	1·05	2·20	2·85	3·00	—	5·43	2·46	—	—	2·15

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1926												
3 July	840	Female	17·30	—	2·75	3·24	3·30	7·17	0·89	4·46	0·87	5·40
4 ,,	843	Male	19·30	—	3·37	3·78	3·81	8·20	—	—	1·10	6·27
4 ,,	844	Female	25·90	—	4·60	—	5·35	11·15	1·37	7·00	1·27	7·55
4 ,,	845	Male	26·00	—	4·35	4·98	5·10	10·80	1·33	6·20	1·20	7·60
4 ,,	846	Female	18·80	—	3·40	3·60	3·75	7·95	—	4·60	1·00	5·58
4 ,,	847	Female	19·75	—	3·50	4·00	4·04	8·50	1·03	4·84	0·93	5·90
4 ,,	848	Male	21·85	—	3·75	4·25	4·42	9·55	1·14	5·50	1·08	6·80
4 ,,	849	Female	16·00	—	2·68	3·13	3·15	—	0·84	4·27	0·87	5·43
5 ,,	850	Female	19·10	—	3·30	3·73	3·84	8·63	1·00	—	1·04	5·75
7 ,,	851	Female	20·07	—	3·05	—	3·60	8·15	1·06	5·20	1·05	6·20
8 ,,	853	Female	18·65	—	3·16	3·50	3·65	8·07	1·06	4·65	1·00	5·40
8 ,,	855	Male	19·45	—	3·55	3·70	3·79	8·50	0·98	—	1·00	6·13
9 ,,	857	Female	19·45	—	3·25	3·60	3·73	7·95	0·91	—	1·08	6·25
9 ,,	859	Female	17·85	—	3·10	3·30	3·50	—	0·90	4·40	0·95	5·43
9 ,,	860	Male	19·40	—	2·90	—	3·60	7·55	1·00	4·85	1·10	6·00
9 ,,	862	Female	25·60	—	4·87	—	5·40	—	1·33	5·95	1·35	7·45
9 ,,	863	Female	18·60	—	—	—	3·40	—	—	—	0·98	6·00
9 ,,	864	Male	24·55	—	4·75	5·05	5·28	10·30	1·28	5·46	1·23	7·10
11 ,,	866	Female	18·50	—	2·90	3·28	3·31	7·30	0·94	—	1·00	5·77
11 ,,	867	Male	23·80	—	4·27	4·76	4·95	10·40	1·25	6·10	1·25	6·90
12 ,,	868	Female	17·60	—	2·88	3·24	3·28	7·33	0·97	—	1·01	5·53
12 ,,	869	Male	17·25	—	2·83	3·40	3·30	7·40	0·86	4·85	0·93	5·55
12 ,,	871	Female	20·15	—	3·46	—	4·03	8·45	—	—	1·10	6·30
12 ,,	872	Male	22·55	—	3·97	4·48	4·69	9·80	1·17	5·58	1·05	6·60
12 ,,	874	Male	18·95	—	3·35	3·72	3·85	8·22	1·06	4·45	0·93	5·70
13 ,,	879	Female	19·20	—	3·08	3·62	3·68	8·25	0·97	4·80	0·98	5·60
14 ,,	885	Male	22·20	—	3·90	4·35	4·48	9·45	1·10	5·37	1·23	6·46
14 ,,	886	Male	20·37	—	3·46	3·70	3·85	8·40	1·06	5·03	1·00	6·00
23 ,,	888	Male	24·80	—	4·40	4·95	5·14	—	1·37	6·30	1·25	7·30
24 ,,	889	Male	23·50	—	—	—	5·08	10·70	1·28	5·90	1·20	6·25
25 ,,	890	Male	24·25	—	4·52	4·80	4·95	10·40	1·38	5·95	1·23	7·20
25 ,,	894	Male	24·15	—	4·40	4·90	5·07	10·70	1·35	5·80	1·20	7·15
26 ,.	895	Female	27·20	—	4·95	—	5·46	—	1·42	6·85	1·35	8·20
26 ,,	896	Male	17·90	—	2·80	—	3·45	7·60	0·92	4·48	0·89	5·07
27 ,,	900	Female	26·30	—	4·80	—	5·59	11·58	1·34	6·50	1·30	7·75
27 ,,	901	Female	20·20	—	3·50	4·04	4·14	8·75	1·09	5·05	1·08	5·93
28 ,,	904	Female	19·15	—	3·18	—	3·70	8·00	1·00	—	1·10	—
28 ,	906	Female	26·80	—	5·10	—	5·70	12·00	1·48	5·85	1·35	7·55
28 ,,	907	Male	17·40	—	2·90	3·10	3·32	7·25	0·98	4·40	0·98	5·25
28 ,,	908	Female	22·70	—	3·90	—	4·65	9·75	1·33	5·40	1·25	6·85
29 ,,	909	Male	20·00	—	3·20	3·68	3·80	8·25	1·01	5·15	1·10	6·35
3 Aug.	911	Female	20·42	—	3·70	—	4·30	9·03	1·20	4·75	1·02	5·85
3 ,	915	Female	16·20	—	2·55	—	2·97	6·74	0·90	—	0·95	5·10
6 ,,	919	Female	26·60	—	4·87	5·48	5·65	11·30	1·37	6·60	1·40	8·00
6 ,,	920	Female	26·65	—	5·00	5·50	5·69	11·75	1·42	6·88	1·40	7·75
7 ,,	921	Female	19·75	—	3·47	3·72	3·90	8·50	1·08	4·85	1·00	5·80
7 ,,	923	Male	20·55	—	3·60	3·85	4·13	9·00	0·98	4·90	1·00	6·15
8 ,,	925	Female	24·80	—	4·45	5·20	5·25	11·10	1·30	—	1·30	7·30
9 ,,	926	Female	26·85	—	5·30	—	5·70	12·10	1·45	6·47	1·36	7·50
9 ,,	927	Female	18·05	—	3·07	3·35	3·39	7·67	1·00	4·45	1·00	5·47
9 ,,	928	Female	18·40	—	3·00	3·44	3·52	7·75	0·94	—	0·93	5·85
9 ,,	929	Male	22·74	—	4·35	4·65	4·80	10·70	0·96	5·82	1·30	6·50
9 ,,	930	Female	23·85	—	4·60	4·95	5·10	10·60	—	5·72	1·35	7·20
12 ,,	936	Female	18·05	—	2·85	3·24	3·37	7·50	0·97	4·67	0·94	5·55
13 ,,	937	Female	18·60	—	3·00	3·40	3·47	7·77	1·02	4·63	0·96	5·70
13 ,,	938	Female	21·85	—	3·92	4·34	4·45	9·48	1·18	5·38	1·02	6·40
14 ,,	942	Male	18·55	—	3·05	3·40	3·45	7·70	0·96	—	0·97	5·75
14 ,,	943	Male	22·60	—	4·00	—	4·60	9·65	—	5·40	1·16	6·69
14 ,,	944	Female	18·20	—	2·85	3·20	3·35	7·45	0·87	4·67	1·02	5·60
14 ,,	945	Female	20·00	—	2·60	3·97	4·12	8·60	—	—	1·05	—

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
8·20	7·80	0·40	0·21	1·00	1·62	2·17	2·26	0·59	4·05	1·82	—	—	1·45
9·50	—	0·80	—	—	2·00	2·60	2·68	0·69	4·53	2·20	—	—	—
11·95	11·45	0·75	0·15	1·00	2·30	3·21	3·33	0·94	6·26	3·00	—	—	2·65
11·65	10·80	1·60	—	1·10	2·44	3·19	3·37	0·90	6·12	2·86	—	—	2·25
8·90	8·50	0·43	0·24	0·90	1·93	—	—	—	—	—	—	—	1·80
9·40	8·90	0·50	0·19	0·70	1·90	2·63	2·75	0·70	4·90	2·06	—	—	1·30
10·20	9·20	1·60	0·36	1·20	1·33	2·98	3·20	0·82	5·40	2·50	—	—	2·00
7·70	—	0·40	0·19	0·65	—	—	—	—	3·96	1·74	—	—	1·18
8·90	—	0·48	0·24	0·70	2·15	2·78	2·92	0·72	—	—	—	—	—
9·65	9·30	0·55	0·27	0·80	2·00	2·70	2·85	0·73	—	—	—	—	—
8·70	8·00	0·50	0·20	0·70	1·78	2·38	2·52	0·72	4·45	2·16	—	—	1·54
9·60	—	0·57	0·34	0·85	2·05	2·66	2·89	0·78	4·80	—	—	—	—
9·55	—	0·38	—	—	1·67	2·39	2·53	0·62	4·55	—	—	—	—
8·55	7·90	0·42	0·24	0·95	1·65	2·33	2·42	0·60	—	—	—	—	1·58
9·50	8·70	1·35	0·21	0·90	1·95	2·53	2·63	0·68	4·34	2·20	—	—	1·53
11·30	11·00	0·70	0·14	0·80	2·20	—	—	—	6·65	3·15	—	—	2·58
—	—	0·48	—	—	2·02	2·55	—	0·60	4·20	—	—	—	—
11·15	10·60	1·60	—	1·25	2·10	2·94	3·15	0·95	6·20	2·84	—	—	2·20
8·68	—	0·38	—	—	1·63	2·18	2·30	0·61	4·14	1·83	4·07	—	—
10·45	9·46	1·45	0·26	1·10	2·50	3·05	3·25	0·88	—	—	—	—	2·25
8·70	8·20	0·66	0·21	0·65	1·69	2·30	2·47	0·64	4·10	1·90	—	—	—
8·55	8·10	1·45	0·24	0·75	1·78	2·35	2·46	0·65	4·03	1·80	—	—	1·37
9·58	—	0·51	0·22	0·60	1·83	2·53	—	0·75	4·95	2·30	—	—	—
10·45	10·20	1·50	0·23	0·65	2·39	2·98	3·12	0·89	5·73	2·53	—	—	1·98
8·95	—	1·00	0·24	1·00	1·95	2·44	2·56	0·74	4·63	2·11	—	—	—
8·75	8·40	0·54	0·26	0·70	2·00	2·75	3·02	0·76	4·40	2·12	—	—	1·55
10·20	9·60	1·60	0·29	1·00	2·25	2·97	3·10	0·78	—	—	—	—	1·91
9·20	8·85	1·25	0·24	0·97	1·85	2·55	2·68	0·77	4·80	2·08	4·71	—	1·90
11·60	10·90	1·90	—	1·35	—	—	—	—	—	—	—	—	2·05
10·35	—	1·54	—	1·20	2·50	3·30	3·55	0·95	6·36	2·60	—	—	2·37
11·20	10·95	1·20	—	0·90	2·55	3·06	3·20	0·82	6·50	2·80	—	—	—
11·15	10·60	1·55	0·26	0·95	2·32	—	—	—	—	—	—	—	2·15
12·65	12·00	0·75	0·25	1·15	3·00	3·78	—	0·93	6·80	2·90	—	—	2·10
8·20	8·00	1·28	0·26	0·77	1·65	—	—	—	—	—	—	—	1·40
12·10	11·20	0·80	0·32	1·00	2·60	3·24	3·50	0·95	6·82	3·00	—	—	2·51
9·55	8·95	0·55	0·23	0·68	2·00	2·70	2·81	0·70	5·00	2·22	—	—	1·73
9·20	—	—	—	—	1·80	2·44	2·60	0·71	—	—	—	—	—
12·00	11·13	0·75	0·23	1·00	2·68	3·60	3·98	—	7·00	3·08	—	—	2·30
8·15	—	1·20	0·21	0·85	1·70	—	—	—	—	—	—	—	1·60
10·50	10·20	0·54	0·28	0·70	2·05	2·80	2·97	0·87	—	—	—	—	—
9·70	—	0·87	0·31	1·00	1·95	2·55	2·70	0·77	—	—	—	—	1·80
9·35	8·90	0·55	0·26	1·00	—	—	—	—	5·30	2·48	—	—	1·95
8·00	7·40	0·49	0·22	—	1·65	—	—	—	—	—	—	—	—
12·30	12·10	0·80	0·37	1·25	2·50	3·10	3·28	0·93	6·85	3·02	—	—	2·20
11·90	11·10	0·68	0·47	1·10	—	—	—	1·00	—	—	—	—	2·15
9·05	8·55	0·55	0·22	0·90	1·95	2·55	2·68	0·72	—	—	—	—	1·64
9·80	—	1·35	0·35	1·00	2·13	2·75	2·90	0·80	5·05	2·35	—	—	2·05
10·95	—	—	—	—	2·30	3·25	3·55	0·92	—	—	—	—	—
11·60	11·00	0·70	0·31	1·10	—	—	—	—	—	—	—	—	2·65
8·55	—	0·50	0·25	0·78	1·80	2·40	2·50	0·70	4·30	—	—	—	—
—	—	0·50	0·17	0·55	1·88	2·40	2·58	0·63	4·27	2·06	—	—	—
—	—	1·05	0·31	0·90	2·45	3·20	3·38	0·90	—	—	—	—	—
10·95	10·15	0·65	—	—	2·06	2·90	3·26	0·85	6·30	2·60	—	—	2·15
8·60	8·20	0·42	0·23	0·75	1·91	2·47	2·60	0·70	—	—	—	—	1·55
8·77	—	0·53	0·19	0·60	1·82	2·45	2·59	0·70	4·20	2·02	—	—	—
10·15	9·50	0·60	0·25	0·80	2·12	2·77	2·90	0·78	5·05	2·50	—	—	1·95
9·00	—	—	—	—	1·80	2·40	2·50	0·71	4·25	1·90	—	—	—
10·50	—	1·55	0·24	0·70	2·00	2·80	3·05	0·75	—	—	—	—	1·95
8·80	8·20	0·55	0·22	0·95	1·95	2·50	2·60	0·65	—	—	—	—	1·54
9·30	—	—	—	—	2·03	2·60	2·78	0·72	—	—	—	—	—

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1926												
16 Aug.	953	Female	17·80	—	2·90	3·25	3·40	7·40	0·92	4·40	1·00	5·60
17 ,,	956	Female	19·25	—	3·25	3·81	3·82	8·15	1·03	—	0·91	5·60
18 ,,	961	Male	25·20	—	—	5·45	5·70	11·80	1·55	5·56	1·28	6·90
19 ,,	964	Male	18·10	—	3·10	3·60	3·66	7·55	1·00	4·52	1·05	5·30
19 ,,	965	Male	17·53	—	2·85	3·20	3·28	7·20	0·95	—	0·91	5·25
19 ,,	967	Female	19·00	—	3·04	3·35	3·51	7·87	1·02	5·05	1·00	5·75
19 ,,	968	Female	25·05	—	4·45	—	5·12	10·65	1·28	6·48	1·31	7·80
20 ,,	971	Male	19·20	—	2·95	3·40	3·50	7·80	1·08	5·75	1·05	6·15
20 ,,	974	Male	20·00	—	3·45	3·87	3·95	8·45	1·07	4·90	0·93	5·90
20 ,,	976	Male	17·25	—	3·05	3·40	3·50	—	0·94	4·44	1·00	4·90
21 ,,	981	Female	20·10	—	3·13	3·69	3·76	8·05	1·05	5·32	1·02	6·07
22 ,,	984	Female	17·80	—	2·90	3·30	3·35	—	—	—	0·96	—
22 ,,	985	Male	18·10	—	2·90	3·25	3·35	—	0·97	4·62	1·00	5·75
23 ,,	991	Male	20·90	—	3·47	3·92	4·06	8·95	1·13	5·12	1·14	6·30
23 ,,	993	Female	19·60	—	3·50	3·85	4·05	8·35	0·99	5·20	1·17	6·20
24 ,,	994	Male	20·30	—	3·50	—	4·00	8·80	1·07	—	1·05	5·90
24 ,,	995	Female	18·17	0·19	3·20	—	3·55	7·60	0·97	4·20	0·97	5·60
24 ,,	996	Male	18·95	—	3·40	3·78	3·85	8·35	0·99	4·60	1·10	5·35
24 ,,	997	Male	19·85	—	3·38	4·69	4·82	—	—	—	1·05	5·55
24 ,,	998	Female	18·15	—	3·05	3·37	3·50	—	0·98	4·55	0·99	5·60
25 ,,	1006	Male	20·35	—	3·30	3·75	3·90	8·45	1·05	5·15	0·98	6·00
25 ,,	1007	Female	21·35	—	3·80	4·28	4·37	9·25	1·15	—	1·18	6·45
25 ,,	1008	Male	17·75	—	2·95	3·22	3·25	7·15	0·92	4·42	0·97	5·45
25 ,,	1010	Male	17·85	—	2·95	3·33	3·40	7·55	0·96	4·35	1·00	5·60
26 ,,	1012	Male	20·63	—	3·55	3·98	4·07	—	1·08	5·10	1·09	6·10
26 ,,	1013	Female	18·55	—	3·01	—	3·58	7·95	1·02	4·85	1·03	5·70
26 ,,	1016	Male	18·40	—	2·85	3·25	3·33	7·55	0·97	5·10	1·04	5·80
26 ,,	1017	Male	20·15	—	3·40	—	3·78	8·40	1·08	5·00	1·05	6·15
26 ,,	1018	Female	18·75	—	2·20	3·55	3·63	7·90	0·99	4·70	1·01	5·90
27 ,,	1022	Female	17·45	—	2·70	3·08	3·15	6·90	0·88	4·88	0·98	5·80
27 ,,	1023	Male	18·60	—	3·20	3·47	3·58	7·87	0·98	4·48	1·00	5·35
27 ,,	1026	Male	20·10	—	3·80	3·97	4·07	8·92	1·12	5·23	1·07	6·00
27 ,,	1027	Female	18·10	—	3·07	3·36	3·50	7·47	0·92	4·52	0·98	5·45
28 ,,	1029	Male	26·30	—	5·18	5·60	5·85	11·75	1·54	6·10	1·32	7·50
28 ,,	1031	Male	19·40	—	3·10	3·38	3·53	7·85	1·01	4·90	1·14	6·00
28 ,,	1034	Female	17·70	—	3·05	3·42	3·50	7·60	0·93	4·55	0·87	5·25
28 ,,	1036	Male	24·40	—	4·60	—	5·15	10·90	1·30	6·06	1·14	6·70
30 ,,	1041	Male	18·45	—	3·05	3·37	3·54	7·50	1·00	4·55	1·05	5·55
31 ,,	1045	Male	23·30	—	4·28	4·57	4·70	10·00	1·33	5·97	1·28	6·80
31 ,,	1046	Male	19·40	—	3·27	3·58	3·82	8·20	1·06	4·85	0·93	5·65
31 ,,	1047	Female	21·15	—	3·80	4·17	4·37	9·15	1·20	5·50	1·06	6·20
1 Sept.	1048	Female	18·20	—	2·95	3·18	3·37	—	0·87	—	0·94	5·70
1 ,,	1049	Male	19·05	—	3·10	3·44	3·58	7·95	0·98	4·96	1·00	6·00
1 ,,	1050	Male	19·55	—	3·45	3·77	3·94	8·30	1·07	4·70	1·10	5·75
2 ,,	1052	Female	20·00	—	3·35	3·73	3·87	8·20	1·05	5·35	1·11	6·30
2 ,,	1054	Male	18·40	—	2·94	3·23	3·44	7·75	0·97	4·65	1·00	5·65
3 ,,	1056	Male	23·90	—	4·70	5·26	5·30	10·70	—	—	1·20	6·75
3 ,,	1057	Female	25·10	—	4·45	5·05	5·16	10·95	1·46	6·25	1·30	7·30
4 ,,	1060	Female	18·00	—	2·75	3·18	3·27	—	0·94	4·73	0·94	5·70
4 ,,	1061	Male	24·45	—	4·80	5·10	5·25	10·88	1·31	5·85	1·22	7·00
4 ,,	1062	Male	17·50	—	2·90	3·22	3·33	—	0·93	4·00	0·87	5·30
5 ,,	1063	Male	19·85	—	3·40	3·85	3·90	8·35	1·04	4·85	1·00	5·85
5 ,,	1064	Female	13·35	—	1·75	1·95	2·00	5·05	0·67	3·67	0·84	4·53
5 ,,	1065	Female	21·30	—	4·05	4·40	4·53	9·27	1·13	—	1·12	6·15
6 ,,	1066	Male	18·20	—	3·05	3·45	3·51	7·65	0·97	4·40	0·98	5·50
6 ,,	1067	Male	20·80	—	3·58	4·00	4·15	8·80	1·07	4·90	1·02	5·73
6 ,,	1068	Male	19·50	—	3·30	3·57	3·72	8·30	1·05	5·05	1·05	5·75
7 ,,	1069	Female	17·90	—	3·15	3·40	3·45	7·50	1·00	—	—	5·35
7 ,,	1070	Male	22·90	—	4·10	—	4·73	10·25	1·38	5·20	1·20	6·35
7 ,,	1071	Female	25·47	—	4·78	—	5·35	11·35	1·36	6·05	1·18	7·50

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
8·55	—	—	0·22	1·05	1·85	2·40	2·50	0·66	—	—	—	—	1·55
9·00	—	0·55	0·20	0·80	1·79	2·45	2·56	0·68	4·70		—	—	—
11·15	10·20	1·75	—	1·65	2·65	3·16	3·30	0·98	—	—	—	—	2·07
8·45	7·85	1·30	0·23	0·75	1·84	—	—	0·67	—	—	—	—	1·65
8·20	—	0·70	—	—	1·68	2·35	2·45	0·62	4·10	1·98	—	—	—
9·00	7·70	0·52	0·18	0·50	1·92	2·50	2·69	0·75	4·28	2·12	—	—	1·59
11·80	11·10	0·70	0·28	0·70	2·40	3·16	3·23	0·90	—	—	—	—	1·95
9·55	8·70	1·10	0·26	1·15	1·90	2·45	2·57	0·69	4·25	2·05	—	—	1·60
9·35	8·95	1·55	0·35	1·25	1·86	2·55	2·74	0·73	4·48	2·17	—	—	1·80
7·87	7·45	1·20	0·25	1·20	—	—	—	—	—	—	—	—	1·60
9·35	8·75	0·60	0·16	0·45	1·90	—	—	0·66	—	—	—	—	1·47
8·30	—	—	—	—	—	2·40	2·60	0·71	4·20	1·97	—	—	—
8·80	8·30	1·25	0·22	1·00	—	—	—	—	—	—	—	—	1·45
10·10	9·80	1·70	0·30	1·00	2·15	2·76	2·93	0·75	4·90	2·41	—	—	1·73
9·45	8·70	0·60	0·22	0·70	1·94	—	—	—	—	—	—	—	1·80
9·40	—	—	—	—	2·15	2·74	2·88	0·73	4·80	2·20	—	—	—
8·65	8·15	0·57	0·21	0·85	1·70	2·30	2·38	0·66	4·45	1·85	—	—	1·55
8·57	8·00	1·35	0·27	0·90	2·00	2·80	3·00	0·74	—	—	—	—	1·75
9·00	—	—	0·24	0·90	—	—	—	0·76	4·70	2·10	—	—	—
8·60	8·08	0·38	—	0·90	1·82	2·35	2·45	0·70	4·25	2·00	—	—	1·58
9·45	8·90	1·60	0·24	0·80	1·97	2·60	2·74	0·77	4·62	2·30	—	—	1·73
9·90	—	0·40	—	—	2·18	2·80	2·95	0·75	5·20	2·50	—	—	—
8·70	8·30	1·40	0·22	0·85	1·65	2·31	2·44	0·64	4·00	1·82	—	—	1·45
8·70	7·85	1·40	0·24	0·60	1·83	—	—	—	—	—	—	—	1·15
9·70	9·20	1·50	0·28	1·00	2·12	2·68	—	0·70	5·00	2·25	—	—	1·75
9·00	8·30	0·55	0·26	1·10	1·95	2·55	2·68	0·68	—	—	—	—	1·63
9·00	8·75	1·35	0·21	0·90	1·85	—	—	—	4·20	1·80	—	—	1·45
9·50	—	1·40	0·16	1·20	2·20	2·80	2·96	0·77	—	—	—	—	1·73
9·05	8·90	0·50	0·24	—	1·75	2·45	2·50	0·68	—	—	—	—	1·65
8·75	8·10	0·53	0·17	0·60	1·55	2·15	2·21	0·59	—	—	—	—	1·48
8·75	8·10	1·40	0·23	0·88	1·77	—	—	0·72	—	—	—	—	1·59
9·15	8·60	1·60	0·37	1·00	2·03	2·67	—	0·79	5·15	2·50	—	—	1·90
8·35	7·98	0·55	0·20	0·50	1·75	2·20	2·40	—	—	—	—	—	1·42
11·80	10·60	1·80	0·45	1·30	2·70	3·35	3·47	1·00	7·10	3·00	—	—	2·37
9·15	8·60	1·30	0·18	0·70	2·05	2·55	2·64	0·68	4·30	2·10	—	—	1·60
8·20	7·80	0·48	0·27	0·80	1·67	2·28	2·41	0·68	4·20	1·98	—	—	1·57
10·85	10·10	1·90	0·35	0·80	2·70	3·08	3·17	0·90	—	—	—	—	1·85
8·70	8·35	1·30	0·26	1·10	1·68	2·34	2·46	0·62	4·38	2·02	—	2·67	1·65
10·60	10·20	1·75	0·28	0·80	2·33	3·00	3·13	0·87	—	—	—	—	2·03
9·05	8·60	1·45	—	0·60	1·90	2·58	2·69	0·73	4·67	2·30	—	—	1·74
9·85	9·40	0·60	0·21	0·60	2·10	2·85	2·95	0·80	—	—	—	—	1·74
8·75	—	0·45	0·21	0·60	—	2·41	2·56	0·64	4·15	1·86	—	—	—
9·10	8·75	1·30	0·32	0·70	1·88	2·53	2·67	0·70	4·32	2·18	—	—	1·70
9·10	8·60	1·35	0·26	0·80	1·90	—	—	—	—	—	—	—	1·77
9·70	9·10	0·55	0·38	0·85	1·87	2·43	2·55	0·73	4·65	2·25	—	—	1·80
8·85	8·00	1·20	0·28	1·00	2·04	—	—	—	—	—	—	—	1·54
9·55	—	1·72	—	1·50	2·36	3·05	3·24	0·87	6·45	2·70	—	—	—
11·05	10·80	0·60	0·37	1·00	2·43	3·24	3·45	0·85	—	—	—	—	2·05
8·80	8·35	0·50	0·29	1·00	1·95	2·46	2·60	0·67	4·10	2·00	—	—	1·68
10·90	9·80	1·78	—	0·90	2·40	3·13	3·30	0·87	6·30	2·86	—	—	1·80
8·25	7·70	1·35	0·18	0·50	—	—	—	—	—	—	—	—	1·40
9·00	8·65	0·40	0·21	1·00	1·85	2·60	2·69	0·64	—	—	—	—	1·65
6·98	6·70	0·27	0·31	0·85	1·36	1·85	2·00	0·60	—	—	—	—	1·43
9·70	—	0·65	—	—	1·88	2·79	2·94	0·70	—	—	—	—	—
8·60	8·20	1·10	0·32	0·80	1·70	2·32	2·44	0·64	4·33	2·03	—	—	1·75
9·30	8·30	1·60	0·28	0·85	1·87	2·54	2·62	0·74	5·00	2·30	—	—	1·67
9·15	8·75	1·55	0·25	0·65	2·14	—	—	—	—	—	—	—	1·65
8·55	—	0·50	—	—	1·84	2·30	2·47	0·69	—	—	—	—	—
10·30	9·65	1·70	—	0·95	2·30	3·20	3·40	0·88	—	—	—	—	1·90
11·60	10·85	0·65	0·29	1·20	2·47	3·27	3·48	0·90	6·60	2·70	—	—	2·00

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1926												
7 Sept.	1072	Male	23·40	—	4·30	—	4·85	—	1·23	5·95	1·22	6·80
7 ,,	1073	Male	23·20	—	4·40	—	4·90	—	1·35	5·30	1·23	6·50
7 ,,	1075	Male	18·07	—	3·06	3·35	3·45	—	0·96	4·45	0·85	5·60
8 ,,	1076	Male	18·50	—	3·00	3·35	3·40	7·50	0·98	4·45	0·93	5·40
8 ,,	1077	Male	19·10	—	3·40	3·80	3·95	8·60	1·02	4·55	1·00	5·60
8 ,,	1078	Female	19·90	—	3·45	—	3·98	8·40	1·05	4·90	1·06	4·80
14 ,,	1079	Female	25·95	—	5·06	5·50	5·61	12·00	1·45	6·30	1·35	7·40
14 ,,	1081	Male	20·50	—	3·47	4·00	4·09	8·85	1·08	4·83	1·02	5·90
15 ,,	1085	Female	13·95	—	1·93	2·07	2·18	5·25	0·73	3·83	0·86	4·55
17 ,,	1088	Male	18·70	—	3·33	3·55	3·76	7·55	1·04	4·76	0·98	5·65
18 ,,	1095	Female	19·85	—	3·60	4·00	4·10	8·50	—	—	1·05	6·00
20 ,,	1098	Male	18·50	—	3·15	3·50	3·57	7·75	1·00	4·47	0·95	5·55
20 ,,	1099	Female	20·30	—	3·10	3·68	3·82	8·07	1·04	5·25	1·03	5·95
20 ,,	1100	Male	25·90	—	4·59	—	5·32	11·60	1·44	6·20	1·14	7·58
21 ,,	1104	Female	16·82	—	2·73	3·05	3·14	7·00	0·94	4·09	0·80	5·20
21 ,,	1107	Male	18·00	—	2·75	3·05	3·19	7·10	0·91	5·04	1·00	5·78
22 ,,	1109	Male	24·90	—	4·55	5·00	5·20	10·90	1·27	6·41	1·25	7·46
22 ,,	1110	Female	24·15	—	3·92	4·46	4·56	9·65	1·27	6·15	1·29	7·28
22 ,,	1112	Female	20·57	—	3·72	4·10	4·42	8·70	1·16	5·00	1·15	5·55
22 ,,	1113	Male	18·90	—	3·05	3·46	3·53	7·60	0·97	4·90	0·97	5·75
22 ,,	1116	Male	19·25	—	3·10	3·44	3·52	7·80	1·05	4·95	0·83	6·00
23 ,,	1117	Female	21·90	—	3·70	4·16	4·33	9·30	1·16	5·73	1·11	6·80
24 ,,	1119	Male	20·95	—	—	4·00	4·10	9·00	1·14	5·30	1·15	6·50
24 ,,	1121	Male	17·65	—	3·00	3·20	3·35	7·50	0·90	4·30	0·99	5·40
24 ,,	1122	Female	19·25	—	3·15	3·35	3·52	7·60	0·99	5·00	0·90	5·90
25 ,,	1123	Male	18·05	—	2·88	3·18	3·30	7·40	0·95	—	1·10	5·65
25 ,,	1124	Female	25·70	—	5·10	5·57	5·73	11·50	1·39	6·12	1·35	7·30
25 ,,	1126	Male	17·30	—	2·67	3·08	3·16	7·10	0·91	4·47	0·89	5·40
25 ,,	1128	Female	18·00	—	2·90	3·20	3·34	7·30	0·97	4·76	0·98	5·75
26 ,,	1129	Male	19·75	—	3·00	3·39	3·50	7·90	1·00	—	1·13	6·25
26 ,,	1131	Male	18·05	—	2·80	3·10	3·20	7·10	0·98	—	1·00	5·55
27 ,,	1137	Female	19·80	—	3·30	3·75	3·82	8·30	1·02	4·90	1·05	6·10
27 ,,	1138	Female	18·60	—	3·30	3·52	3·61	—	1·00	4·80	1·00	5·75
27 ,,	1139	Female	19·25	—	3·20	3·45	3·53	7·92	1·02	5·25	0·98	6·10
27 ,,	1141	Male	17·50	—	2·75	3·10	3·16	7·10	0·95	4·45	0·93	5·40
27 ,,	1142	Female	22·00	—	3·90	—	4·45	9·30	1·24	5·27	1·07	6·50
28 ,,	1147	Female	24·10	—	4·20	—	4·90	10·34	1·35	5·95	1·20	6·80
28 ,,	1150	Male	23·86	—	4·07	—	4·65	9·90	1·26	6·05	1·22	7·10
29 ,,	1151	Female	26·10	—	5·00	—	5·55	—	1·40	6·25	1·15	7·40
29 ,,	1152	Male	18·05	—	3·10	—	3·55	7·70	0·97	4·50	1·04	5·55
29 ,,	1153	Male	17·65	—	2·80	3·16	3·27	—	0·97	4·35	0·90	5·20
30 ,,	1154	Female	17·80	—	2·85	3·30	3·38	7·30	1·01	4·34	1·02	5·55
30 ,,	1155	Male	20·65	—	3·30	3·80	3·90	7·70	1·09	5·60	1·12	6·40
30 ,,	1156	Male	17·10	—	2·80	3·05	3·12	—	0·89	—	0·91	5·30
30 ,,	1157	Female	17·60	—	3·10	—	3·42	7·45	0·99	4·50	0·95	5·60
30 ,,	1158	Male	18·35	—	3·23	3·53	3·65	6·79	1·09	4·60	0·90	5·55
2 Oct.	1159	Female	19·75	—	3·10	3·65	3·70	8·35	1·02	—	1·05	6·50
2 ,,	1160	Female	18·10	—	2·90	3·17	3·30	7·25	0·93	4·85	0·94	5·70
2 ,,	1161	Female	19·40	—	2·25	—	2·75	8·35	1·01	5·10	0·99	6·00
3 ,,	1162	Male	19·45	—	3·15	3·60	3·65	8·10	1·01	—	1·00	5·85
3 ,,	1166	Female	24·20	—	4·54	—	4·98	10·44	1·25	6·10	1·25	7·30
3 ,,	1167	Male	19·45	—	3·25	3·75	3·88	8·50	1·08	4·92	0·97	5·75
4 ,,	1168	Male	19·85	—	3·40	3·80	3·95	8·45	1·09	4·97	1·00	6·10
4 ,,	1169	Male	17·10	—	2·60	—	2·90	7·05	1·00	4·25	0·93	5·30
4 ,,	1170	Male	17·60	—	2·75	3·20	3·30	7·35	0·96	—	1·05	—
4 ,,	1171	Female	18·30	—	3·00	3·40	3·50	7·45	0·93	4·50	1·09	5·65
5 ,,	1172	Female	18·70	—	—	—	3·60	—	—	—	0·98	—
5 ,,	1173	Female	18·70	—	3·00	3·36	3·45	7·60	1·02	4·90	0·95	5·70
7 ,,	1174	Male	19·65	—	3·20	3·70	3·85	8·75	1·07	—	1·04	—
7 ,,	1176	Female	18·78	—	3·20	—	3·65	7·90	1·05	—	0·95	5·70

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
10·55	9·90	1·70	0·25	1·00	2·50	3·10	3·22	0·80	5·90	2·40	—	—	1·90
10·60	—	1·40	0·30	1·15	2·35	3·10	3·20	0·85	5·95	2·60	—	—	—
8·50	8·00	1·15	0·31	1·10	1·86	2·40	2·55	0·65	—	—	—	—	1·40
8·50	7·45	1·35	0·30	1·00	1·75	2·45	2·60	0·68	4·10	1·95	—	—	1·45
8·70	8·20	1·45	0·34	1·00	2·00	—	—	—	—	—	—	—	1·50
9·35	9·35	0·56	0·29	0·80	—	—	—	—	—	—	—	—	1·77
11·40	11·10	0·66	0·32	1·10	2·84	3·50	3·74	0·96	6·92	3·10	—	—	2·23
9·28	9·00	1·34	0·26	0·80	1·87	2·60	2·76	0·69	4·98	2·48	—	—	1·90
7·05	6·80	0·40	0·17	0·50	1·48	1·80	1·94	0·51	—	—	—	—	1·50
8·75	8·30	0·38	0·35	0·60	1·92	2·35	2·46	0·69	4·60	2·16	—	—	1·48
9·05	8·50	0·45	—	—	1·91	2·35	2·66	0·76	5·02	2·30	—	—	—
8·65	8·40	1·40	0·22	0·45	1·70	2·45	2·56	0·69	4·40	2·02	—	—	1·40
8·90	8·60	0·55	0·30	0·80	1·68	2·50	2·65	0·68	4·69	2·33	—	—	1·54
11·80	11·20	1·85	—	0·90	2·70	3·42	3·58	0·98	6·50	3·04	—	—	1·87
8·10	7·70	0·55	0·19	0·60	1·54	2·27	2·46	0·61	3·78	—	—	—	1·44
8·85	8·30	1·42	0·26	0·75	1·65	2·30	2·42	0·70	3·84	1·89	—	—	1·47
11·55	10·80	1·74	0·23	0·60	2·38	3·30	3·68	0·92	6·30	2·74	—	—	2·05
11·50	11·00	0·70	0·36	1·00	2·13	2·75	2·87	0·83	5·45	2·90	—	—	2·16
9·35	8·90	0·55	0·28	0·75	1·92	2·61	2·75	0·75	5·18	2·51	—	—	1·88
9·05	8·60	1·50	0·31	0·80	1·78	2·36	2·44	0·67	4·30	2·10	—	—	1·84
9·45	8·80	1·40	0·17	0·85	1·91	—	—	—	—	—	—	—	1·64
10·35	9·90	0·60	—	0·70	2·00	2·80	2·94	0·78	—	—	—	—	1·95
10·15	9·60	1·35	0·34	1·25	2·20	2·90	3·07	0·81	—	—	—	—	1·90
8·55	7·80	1·38	0·23	1·07	1·80	2·34	2·48	0·66	—	—	—	—	1·65
9·30	8·80	0·60	0·25	0·85	1·65	—	—	—	—	—	—	—	1·37
8·90	—	1·00	—	—	1·78	2·35	2·45	0·70	4·10	2·08	—	—	—
11·00	10·10	0·60	0·27	0·85	2·40	3·40	3·58	0·95	6·96	3·18	—	—	2·25
8·30	8·10	1·35	0·28	0·85	1·74	—	—	—	—	—	—	—	1·40
8·80	8·65	0·50	0·27	0·80	1·62	—	—	—	—	—	—	—	1·46
9·75	—	1·30	—	—	1·85	2·50	2·68	0·74	—	—	—	—	—
8·65	—	—	0·17	0·55	1·60	2·20	2·35	0·59	4·00	1·90	—	—	—
9·35	8·85	0·50	0·24	0·90	2·00	2·63	2·73	0·78	4·80	2·23	—	—	1·55
8·60	8·30	0·50	0·22	0·80	1·94	2·29	2·41	0·61	—	—	—	—	—
9·10	8·75	0·55	0·19	0·90	1·85	2·49	2·64	0·68	—	—	—	—	1·70
8·30	7·90	1·20	0·21	0·90	1·65	2·26	2·38	0·63	3·98	1·90	—	—	1·95
10·10	9·93	0·50	0·24	0·82	2·12	2·65	2·74	0·75	—	—	—	—	1·60
11·00	10·45	0·79	0·22	1·10	—	—	—	—	—	—	—	—	2·35
10·85	—	1·60	0·38	1·25	2·20	—	—	—	—	—	—	—	2·05
12·00	11·40	0·60	0·31	0·90	2·40	3·20	3·45	0·83	—	—	—	—	2·45
8·65	8·10	1·00	0·28	1·20	1·89	2·40	2·45	0·68	4·28	2·12	—	—	1·55
8·40	7·90	1·40	0·28	1·00	—	—	—	—	—	—	—	—	1·55
8·90	8·10	0·35	0·23	1·05	1·70	2·27	2·38	0·59	4·25	1·93	—	—	1·68
9·55	8·95	1·45	0·29	0·90	2·10	2·67	2·87	0·68	—	—	—	—	1·75
8·10	—	—	—	—	1·70	2·20	2·35	0·59	3·94	1·71	—	—	—
8·50	8·00	0·50	0·25	0·95	1·65	2·26	2·37	0·70	4·34	1·93	—	—	1·60
8·40	7·55	1·35	0·23	0·90	1·67	—	—	—	—	—	—	—	1·50
9·75	—	—	—	—	1·97	2·65	2·73	0·70	4·60	2·15	—	—	—
8·85	8·15	0·50	0·24	0·95	1·87	2·40	2·49	0·64	4·10	—	4·00	—	1·45
9·05	8·80	0·50	0·36	1·30	2·08	2·65	2·82	0·69	—	—	—	2·93	1·60
9·00	—	—	—	—	2·02	2·65	2·82	—	4·45	2·10	—	—	—
11·30	10·65	0·70	—	1·35	2·30	3·00	3·10	0·86	—	—	—	—	2·10
9·00	8·50	1·35	0·23	1·00	2·00	—	—	—	—	—	—	—	1·65
9·50	9·00	1·30	0·19	1·20	2·00	2·70	2·82	0·74	—	—	—	2·92	1·67
8·25	7·60	1·20	0·21	0·90	1·90	—	—	—	—	—	—	—	1·50
—	—	—	0·22	0·70	1·70	2·35	2·52	0·66	—	—	—	—	—
8·65	8·30	0·55	—	1·00	1·78	—	—	—	—	—	—	—	1·50
8·80	—	—	—	—	—	2·42	2·57	—	4·40	2·08	—	—	—
8·95	8·25	0·50	0·39	1·40	1·75	—	—	—	—	—	—	—	1·53
9·10	—	—	—	—	1·87	2·45	2·54	0·70	—	—	—	—	—
8·90	—	—	—	—	1·80	2·60	2·66	0·68	—	—	—	—	—

Date	Whale Number	Sex	1 Total length, tip of snout to notch of flukes	2 Lower jaw, projection beyond tip of snout	3 Tip of snout to blow-hole	4 Tip of snout to angle of gape	5 Tip of snout to centre of eye	6 Tip of snout to tip of flipper	7 Eye to ear, centres	8 Notch of flukes to posterior emargination of dorsal fin	9 Flukes, width at insertion	10 Notch of flukes to anus
1926												
8 Oct.	1177	Female	20·00	—	3·60	3·92	3·96	8·65	1·06	—	1·02	6·39
8 ,,	1178	Female	19·03	—	3·10	3·40	3·51	7·80	1·03	4·85	1·00	5·80
8 ,,	1179	Male	17·20	—	2·85	3·20	3·32	7·15	0·93	3·95	0·92	4·85
8 ,,	1181	Female	18·80	—	3·20	3·55	3·65	7·90	1·00	4·80	1·00	5·80
8 ,,	1182	Female	19·25	—	3·10	3·55	3·60	8·00	1·06	5·00	1·00	5·95
8 ,,	1183	Male	18·20	—	2·70	3·10	3·20	7·25	0·90	4·75	0·90	5·70
9 ,,	1185	Female	22·35	—	4·37	—	4·87	—	—	5·40	1·12	6·30
9 ,,	1186	Female	18·20	—	3·09	3·20	3·30	7·45	0·94	4·60	0·92	5·75
11 ,,	1191	Male	17·80	—	3·05	—	3·42	7·40	0·95	4·35	0·90	5·25
South Georgia												
15 Nov.	1195	Female	24·90	—	4·50	—	5·20	—		—	1·30	6·80
15 ,,	1196	Female	25·10	—	5·00	—	5·48	11·38	1·52	6·03	1·28	7·00
16 ,,	1200	Male	22·70	—	4·09	—	4·67	9·49	1·21	5·35	1·15	6·57
16 ,,	1201	Male	24·70	—	4·60	—	5·10	11·00	1·35	5·95	1·20	6·75
16 ,,	1202	Male	20·60	—	3·87	—	4·22	8·90	1·03	—	1·06	6·25
17 ,,	1204	Male	24·30	—	4·61	—	5·06	10·77	—	—	1·29	7·08
17 ,,	1205	Male	25·30	—	4·71	—	5·21	11·38	1·38	5·82	1·30	7·38
17 ,,	1206	Female	24·20	—	4·50	—	5·08	9·40	1·37	—	1·41	6·85
17 ,,	1207	Male	23·75	—	4·30	4·60	4·82	—	1·33	—	1·20	6·50
18 ,,	1208	Female	26·40	—	5·00	—	5·40	11·55	1·43	—	1·20	7·60
18 ,,	1209	Male	25·50	—	5·10	—	5·70	11·70	1·50	—	1·35	7·00
18 ,,	1212	Male	23·40	—	4·50	4·75	4·92	11·50	1·33	5·70	1·20	6·80
19 ,,	1213	Male	24·45	—	4·71	5·12	5·20	11·10	1·32	—	1·38	7·21
19 ,,	1214	Male	24·00	—	4·58	—	5·17	10·48	1·43	5·48	1·18	6·85
19 ,,	1215	Male	24·30	—	4·65	5·05	5·15	10·75	1·43	5·92	1·38	6·84
19 ,,	1216	Male	24·50	—	4·85	—	—	11·40	1·30	—	1·10	6·50
19 ,,	1217	Female	18·75	—	2·70	3·20	3·30	7·30	0·95	5·10	1·05	6·00
20 ,,	1218	Male	23·60	—	4·38	—	5·06	10·45	1·32	5·49	1·25	6·68
20 ,,	1219	Male	23·25		4·47	—	5·06	10·40	1·25	5·66	1·15	6·50
20 ,,	1220	Female	24·95		4·83	—	5·28	11·40	—	6·20	1·34	6·98
22 ,,	1222	Male	22·40	—	4·20	—	4·60	9·60	—	5·35	1·12	6·30
22 ,,	1223	Female	25·00	—	4·80	—	—	10·90	—	6·10	1·30	7·30
22 ,,	1225	Female	18·35	—	2·90	3·17	3·30	7·60	1·00	4·85	1·18	5·75
24 ,,	1226	Male	24·75	—	4·58	4·97	5·15	11·07	1·00	—	1·25	7·13
24 ,,	1227	Female	24·90	—	4·46	5·11	5·19	11·30	1·47	—	1·27	7·24
24 ,,	1228	Male	25·00	—	4·73	—	5·37	10·83	1·42	6·15	1·35	7·15
25 ,,	1229	Male	23·70		3·90	4·40	4·67	10·20	1·25	6·20	1·20	7·00
26 ,,	1230	Male	24·80		4·55	4·88	5·05	10·68	1·33	—	1·16	7·18
26 ,,	1232	Male	24·85	—	4·60	—	5·25	10·80	1·45	5·76	1·21	6·95
27 ,,	1233	Male	23·10	—	4·03	4·54	4·59	9·48	—	—	1·27	6·85
27 ,,	1234	Male	20·85	—	3·50	3·79	3·92	8·46	1·13	5·28	1·05	6·28
29 ,,	1236*	Female	25·40	—	5·04	—	5·58	11·14	1·32	4·92	—	5·77
30 ,,	1237	Female	21·10	—	3·56	4·19	4·28	9·10	—	—	1·04	6·23
30 ,,	1238	Male	24·20	—	4·68	—	5·30	11·00	1·41	5·65	1·27	6·74
30 ,,	1239	Male	24·20	—	4·71	—	5·12	10·90	1·41	5·20	1·23	6·79
1 Dec.	1240	Female	26·30	—	5·25	—	5·70	12·35	1·43	—	1·50	7·72
1 ,,	1241	Female	26·90	—	5·10	—	5·78	12·40	1·49	6·15	1·62	7·48
2 ,,	1242	Male	25·35	—	4·70	—	5·35	10·90	1·40	—	1·18	7·15
2 ,,	1243	Male	25·00	—	4·75	—	5·27	10·75	1·30	—	1·32	7·00
2 ,,	1244	Female	21·00	—	4·07	—	4·80	9·30	1·15	5·10	1·00	6·00
2 ,,	1245	Male	24·70	—	4·65	5·05	5·30	11·00	1·30	5·60	—	6·70
2 ,,	1246	Female	25·10	—	4·70	—	5·40	11·45	1·30	5·60	1·25	7·10
3 ,,	1247	Female	23·15	—	4·52	—	4·90	10·15	—	—	1·35	6·85
3 ,,	1248	Female	26·00	—	5·18	—	5·81	12·01	1·50	6·08	1·41	7·18
3 ,,	1249	Male	25·65	—	4·98	—	5·56	11·57	1·39	5·75	1·05	7·32
3 ,,	1250	Male	24·40	—	4·82	—	5·30	10·82	1·31	6·22	1·15	6·76
4 ,,	1251	Male	22·00	—	3·78	—	4·25	9·05	1·15	—	1·11	6·65
4 ,,	1252	Female	26·20		5·05	—	5·57	11·50	1·27	6·45	1·30	7·20
5 ,,	1253	Female	25·45	—	4·90	—	5·41	11·05	1·37	6·22	1·34	7·03
5 ,,	1254	Male	24·20	—	4·93	—	5·45	9·20	1·43	5·64	1·27	6·97

* Tail missing, measurement to stump.

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
—	—	—	—	—	1·72	2·48	2·56	—	4·65	2·25	—	2·53	—
8·90	8·40	0·55	0·34	1·10	1·85	2·50	2·58	0·73	—	—	—	2·63	1·58
7·95	7·60	1·30	0·20	1·20	1·60	—	—	—	—	—	—	—	1·50
8·95	8·40	0·45	0·23	1·10	1·85	2·40	2·53	0·70	4·50	—	—	—	1·40
9·20	8·80	0·50	0·21	1·17	1·90	2·52	2·65	0·73	—	—	—	—	1·60
8·95	—	—	0·21	0·85	1·80	2·30	2·47	—	—	—	—	—	—
9·95	8·70	0·50	0·34	1·50	1·23	—	—	—	—	—	—	—	2·15
8·85	8·30	0·45	—	0·70	1·77	2·32	2·47	0·66	4·09	2·00	—	—	1·40
8·40	8·00	1·40	0·32	0·90	1·71	2·33	2·44	—	4·20	1·75	—	—	1·40
11·15	10·15	0·70	0·26	—	—	3·20	3·37	0·90	—	—	—	—	2·35
10·85	9·80	0·50	0·25	1·00	2·27	—	—	—	6·75	3·03	—	—	2·25
9·41	10·10	1·51	0·30	1·10	2·22	3·00	3·18	0·82	5·70	2·70	—	—	—
10·90	9·80	1·95	0·26	1·05	2·50	3·27	3·56	0·95	—	—	—	—	2·10
9·69	—	0·90	—	—	—	2·65	2·78	—	5·25	2·20	—	—	—
11·03	—	1·03	—	—	2·10	—	—	0·98	6·25	2·80	—	—	—
11·17	10·90	1·81	—	1·89	2·59	3·38	3·62	—	—	—	—	—	2·30
10·65	—	0·58	—	—	2·20	—	—	—	6·13	2·70	—	—	—
10·40	—	1·15	—	—	—	3·22	3·49	0·93	—	—	—	—	—
11·85	—	0·70	0·32	—	2·50	3·55	—	0·90	6·65	2·85	—	—	—
10·70	—	1·10	—	—	—	3·50	3·65	0·98	6·75	2·96	—	—	—
11·20	11·20	1·55	—	1·30	2·55	—	—	—	—	—	—	—	1·90
11·10	—	0·94	—	—	2·45	3·24	3·40	0·90	6·40	2·80	—	—	—
10·75	9·80	1·65	0·40	1·59	2·10	2·94	3·09	0·93	—	—	—	—	2·30
10·80	10·25	1·59	0·37	1·30	2·45	—	—	—	6·30	2·75	—	—	2·15
10·75	—	—	—	—	—	3·30	3·40	0·96	6·70	—	—	—	—
9·05	8·45	0·50	0·27	0·80	1·80	2·40	2·49	0·68	—	—	—	—	1·60
10·70	—	1·07	—	0·90	2·30	3·31	3·40	0·90	6·10	2·70	—	—	—
9·98	9·30	1·95	—	1·40	2·40	—	—	—	6·28	2·63	—	—	2·28
11·10	10·45	0·65	0·22	0·73	2·70	3·45	3·58	0·95	—	—	—	—	2·25
9·95	9·20	1·60	0·39	1·60	2·10	—	—	—	5·67	—	—	—	2·20
11·00	10·40	0·63	—	1·25	—	—	—	—	—	—	—	—	2·15
9·00	8·40	0·70	0·33	1·20	1·93	—	—	—	—	—	—	—	1·80
11·05	—	1·12	—	—	2·55	—	—	—	—	—	—	—	—
11·00	—	0·60	—	—	2·78	3·48	3·52	0·92	6·12	2·73	—	—	—
11·25	10·60	1·65	0·40	1·20	2·25	3·01	3·18	0·93	—	—	—	—	2·55
11·00	10·45	1·67	0·27	1·15	2·20	—	—	—	—	—	—	—	2·10
11·90	—	1·17	—	1·05	2·38	3·20	3·39	0·90	6·25	2·69	—	—	—
10·73	10·37	1·83	0·24	1·20	2·25	3·14	3·26	0·95	—	—	—	—	2·35
10·48	—	1·00	—	—	2·02	2·89	3·00	0·80	5·48	2·71	—	—	—
9·75	9·25	1·49	0·32	1·20	1·73	2·61	2·75	0·72	—	—	—	—	2·15
9·98	9·40	0·78	0·27	1·05	—	—	—	—	—	—	—	—	—
—	—	0·55	—	—	2·33	2·67	2·85	0·69	5·25	2·42	—	—	—
10·53	9·81	1·61	—	1·20	2·48	—	—	—	6·45	3·01	—	—	2·08
10·75	9·50	1·76	0·22	1·45	2·54	—	—	—	—	—	—	—	2·20
11·50	—	0·54	—	—	3·10	3·88	3·99	1·07	—	—	—	—	—
12·05	11·60	0·60	0·29	1·30	3·00	3·74	3·95	1·07	7·05	3·00	—	—	2·45
11·55	—	—	—	—	2·54	3·17	3·25	0·89	6·45	2·85	—	—	—
11·00	10·20	1·65	—	—	2·60	3·28	3·44	0·92	6·35	2·90	—	—	2·30
9·30	8·55	0·60	0·22	0·90	2·07	—	—	—	5·55	2·48	—	—	1·85
10·80	10·20	1·75	—	1·06	2·60	—	—	1·00	—	—	—	—	2·00
11·00	10·50	0·65	—	1·10	2·95	—	—	—	—	—	—	—	—
—	—	0·62	—	—	—	—	—	—	5·82	2·68	—	—	—
11·07	10·38	0·57	0·18	1·25	2·40	3·45	3·52	1·04	6·95	—	—	—	—
11·35	10·75	1·82	0·28	1·30	2·42	3·54	3·65	0·86	—	—	—	—	2·38
10·85	9·90	1·39	—	0·90	2·29	3·14	3·21	0·88	—	—	—	—	2·24
10·35	—	0·95	—	—	1·92	—	—	—	5·14	2·40	—	—	—
11·40	10·50	0·65	0·32	1·10	—	—	—	—	—	—	—	—	2·55
11·25	10·48	0·62	0·21	1·40	2·45	—	—	—	6·48	—	—	—	2·07
10·65	10·00	1·67	—	1·00	2·78	—	—	—	—	—	—	—	2·40

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1926												
6 Dec.	1255	Female	24·90	—	4·88	—	5·60	10·97	—	5·74	—	7·05
6 ,,	1256	Male	23·95	—	4·57	4·95	5·11	10·83	1·24	6·11	1·32	7·09
6 ,,	1257	Female	26·40	—	4·84	—	5·61	11·65	1·47	—	1·30	7·32
7 ,,	1258	Male	25·17	—	5·19	—	5·75	11·66	1·48	—	1·34	7·22
7 ,,	1259	Female	23·95	—	4·49	—	4·94	10·10	1·29	5·78	1·32	6·70
8 ,,	1260	Female	26·60	—	5·20	—	5·65	—	1·40	—	1·40	8·00
8 ,,	1261	Female	25·70	—	5·00	—	5·65	11·55	1·42	6·10	1·30	7·20
9 ,,	1262	Male	25·35	—	4·71	—	5·29	11·60	—	—	1·39	6·85
9 ,,	1263	Male	24·65	—	4·69	5·15	5·23	10·95	1·27	5·91	1·32	6·90
9 ,,	1264	Male	22·72	—	4·54	4·87	5·03	10·52	1·33	—	1·25	6·38
9 ,,	1265	Male	24·30	—	4·75	—	5·12	11·10	1·43	5·71	1·14	6·86
9 ,,	1266	Male	24·93	—	5·00	5·22	5·26	10·75	1·39	6·24	1·35	7·00
9 ,,	1267	Female	23·00	—	4·30	4·59	4·68	9·96	—	—	1·28	6·92
10 ,,	1268	Male	25·42	—	4·53	4·93	5·00	11·10	—	—	1·34	6·98
10 ,,	1269	Male	25·28	—	4·87	—	5·44	11·21	1·50	6·03	1·34	7·27
11 ,,	1271	Male	26·15	—	4·74	5·14	5·40	11·66	1·43	—	1·33	7·32
11 ,,	1272	Male	24·00	—	4·70	4·95	5·20	10·59	1·39	5·80	1·27	6·62
11 ,,	1273	Male	24·36	—	4·21	—	4·70	10·57	1·32	—	1·21	6·84
11 ,,	1274	Female	26·10	—	4·61	—	5·07	10·80	1·28	6·68	1·29	7·62
11 ,,	1275	Male	24·68	—	4·82	—	5·31	11·45	1·42	5·24	1·29	6·53
11 ,,	1276	Female	23·30	—	4·17	4·44	4·75	9·95	1·13	—	1·25	7·21
11 ,,	1277	Female	23·18	—	3·82	—	4·55	9·84	1·22	5·98	1·13	6·68
11 ,,	1278	Male	24·40	—	—	5·15	5·40	—	—	—	1·20	6·10
12 ,,	1279	Female	25·70	—	5·10	—	5·50	—	1·50	5·70	1·30	7·00
12 ,,	1280	Female	25·68	—	5·06	5·44	5·56	11·35	1·32	—	1·24	7·28
12 ,,	1281	Female	28·20	—	5·55	6·15	6·23	12·64	1·54	6·50	1·35	7·69
12 ,,	1282	Male	24·44	—	5·03	—	5·65	11·47	1·45	5·99	1·30	6·52
12 ,,	1283	Male	24·70	—	4·63	5·07	5·18	11·82	1·34	6·05	1·19	6·93
12 ,,	1284	Female	25·30	—	5·19	—	5·53	11·50	—	5·95	1·30	6·82
13 ,,	1285	Male	24·50	—	4·54	—	5·21	11·05	1·27	—	1·18	6·94
14 ,,	1287	Male	25·15	—	4·55	—	5·37	10·75	1·27	—	1·36	7·10
14 ,,	1288	Male	24·20	—	4·72	—	5·25	11·06	1·22	5·71	1·29	6·75
14 ,,	1289	Male	24·47	—	4·78	—	5·26	11·25	1·40	6·07	1·44	6·93
14 ,,	1290	Female	27·00	—	5·04	—	5·46	—	1·34	6·40	—	7·68
15 ,,	1291	Male	24·50	—	4·80	—	5·35	10·95	1·41	—	1·33	6·46
16 ,,	1293	Male	23·63	—	4·35	4·79	4·91	10·40	1·40	5·71	1·29	6·74
18 ,,	1294	Female	24·50	—	4·40	—	5·00	10·70	—	—	1·30	7·20
18 ,,	1295	Male	23·75	—	4·30	—	4·90	10·30	—	—	1·20	7·10
18 ,,	1296	Male	21·55	—	3·55	—	4·00	8·80	—	—	1·00	6·45
21 ,,	1298	Female	25·95	—	—	—	5·35	11·60	—	—	1·25	7·20
21 ,,	1299	Female	25·60	—	4·95	—	5·48	11·40	1·44	5·25	1·30	7·15
21 ,,	1300	Male	25·35	—	4·90	—	5·30	11·30	—	—	1·25	7·00
21 ,,	1301	Female	26·00	—	4·75	—	5·60	11·80	1·43	—	1·35	7·25
21 ,,	1302	Male	24·50	—	4·60	—	5·00	11·00	1·35	6·00	1·30	7·40
21 ,,	1303	Female	25·30	—	4·90	—	5·36	10·55	1·30	—	1·27	7·20
21 ,,	1304	Male	26·45	—	4·90	5·15	5·43	11·60	1·38	6·70	1·24	7·70
22 ,,	1305	Male	23·75	—	4·65	—	5·10	10·65	1·35	5·40	1·30	6·30
22 ,,	1306	Female	25·40	—	4·90	—	5·45	11·00	1·40	6·80	1·30	7·10
22 ,,	1307	Female	25·65	—	4·85	—	5·45	11·70	1·30	6·25	1·27	7·25
22 ,,	1308	Female	25·60	—	5·10	—	5·70	11·65	1·49	5·90	1·35	7·00
22 ,,	1309	Male	23·00	—	3·80	—	4·70	9·40	0·62	—	1·23	6·60
22 ,,	1310	Female	25·80	—	5·40	—	5·90	11·90	—	5·60	1·30	6·85
23 ,,	1311	Female	25·20	—	4·30	—	5·02	11·00	1·40	—	1·35	7·35
23 ,,	1312	Male	24·30	—	4·80	4·97	5·10	11·00	—	—	1·05	6·30
23 ,,	1313	Female	19·45	—	3·25	3·55	3·70	8·10	1·00	5·22	1·00	5·95
23 ,,	1314	Male	22·35	—	4·40	4·47	4·64	10·00	1·35	5·05	1·14	6·26
23 ,,	1315	Male	23·00	—	4·15	4·50	4·73	10·20	1·22	5·55	1·14	6·35
23 ,,	1316	Female	26·65	—	5·32	5·40	5·60	12·13	1·45	—	1·35	7·00
23 ,,	1317	Female	26·00	—	5·30	—	5·90	11·89	1·32	5·95	1·45	7·10
24 ,,	1318	Male	25·10	—	—	—	5·20	—	1·30	5·75	1·20	7·10

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
11·00	10·25	0·58	0·20	1·50	2·32	—	—	—	6·78	3·00	—	—	—
10·97	10·56	1·80	0·33	1·15	2·57	—	—	—	—	—	—	—	2·34
11·65	10·98	0·63	—	—	3·11	3·48	3·74	—	—	—	—	—	—
11·27	—	1·15	—	—	2·55	3·59	3·67	0·99	7·05	3·00	—	—	—
10·65	9·89	0·65	0·15	1·35	2·34	—	—	—	—	—	—	—	2·42
11·70	—	0·60	—	—	—	—	—	1·08	7·15	2·85	—	—	—
11·00	11·00	0·55	0·33	1·00	2·34	—	—	—	6·80	—	—	—	2·00
10·98	—	1·15	—	—	2·53	3·43	3·53	0·94	6·35	2·90	—	—	—
10·97	10·29	1·81	0·30	1·53	2·13	3·07	3·22	0·80	—	—	—	—	2·20
9·83	—	1·00	—	—	2·41	3·27	3·30	0·97	6·18	—	—	—	—
11·00	10·80	1·74	0·27	1·15	2·38	3·21	3·36	0·89	6·29	2·70	—	—	2·20
11·70	11·10	1·75	0·42	—	—	—	—	—	—	—	—	—	2·52
10·40	—	0·41	—	—	2·65	3·05	3·21	0·73	5·70	2·69	—	—	—
10·80	—	1·03	—	—	2·31	3·42	3·75	0·90	6·25	2·76	—	—	—
11·41	10·83	1·68	0·34	1·10	2·47	3·27	3·58	0·78	6·57	—	—	—	2·23
11·09	10·70	1·35	—	—	2·56	3·39	3·58	0·87	6·51	2·84	—	—	—
10·20	9·53	1·62	—	0·94	2·43	3·25	3·32	0·94	6·25	2·80	—	—	2·26
11·05	—	1·10	—	—	2·15	3·08	3·16	0·83	—	2·98	—	—	—
11·88	11·17	0·70	—	1·40	2·43	3·11	3·20	0·88	6·05	2·78	—	—	2·44
10·91	—	1·23	0·29	1·27	2·90	3·24	3·45	0·90	6·55	2·84	—	—	—
10·98	—	0·54	—	0·80	2·16	2·92	3·05	0·85	—	—	—	—	—
10·79	10·08	0·55	0·30	0·80	2·20	—	—	—	—	—	—	—	1·83
—	—	—	—	—	—	—	—	—	—	—	—	—	—
11·20	10·20	0·50	0·26	1·00	—	—	—	—	—	—	—	—	2·05
11·20	—	0·59	—	—	2·24	3·24	3·37	0·89	6·74	2·61	—	—	—
12·30	11·50	0·60	0·33	1·18	2·85	3·68	3·85	—	7·45	3·31	—	—	3·02
10·64	9·95	1·43	—	1·85	2·55	—	—	—	—	—	—	—	2·15
10·75	10·00	1·92	0·38	1·30	2·42	3·49	3·65	1·00	—	—	—	—	2·29
10·75	10·75	0·63	0·37	1·60	—	—	—	—	7·08	2·97	—	—	2·75
10·82	—	1·10	—	—	2·65	—	—	—	—	—	—	—	—
11·40	—	—	0·32	1·00	—	—	—	—	—	—	—	—	—
10·35	10·35	1·45	0·36	1·30	2·47	3·37	3·50	0·93	6·08	2·73	—	—	2·10
10·82	9·72	1·50	0·34	1·14	2·61	—	—	—	6·50	—	—	—	2·44
11·80	11·15	0·98	—	1·15	—	—	—	—	—	—	—	—	2·45
11·52	—	1·20	—	—	—	3·33	3·47	0·88	—	—	—	—	—
—	—	0·97	0·18	0·90	2·25	—	—	—	—	—	—	—	2·09
11·00	—	0·50	0·27	0·80	2·55	3·30	3·47	0·80	6·05	2·60	—	—	—
11·20	—	—	—	—	2·30	3·25	3·43	0·90	6·00	2·60	—	—	—
10·30	—	—	—	—	2·00	—	—	—	—	—	—	—	—
—	—	0·75	—	—	2·50	—	—	—	—	—	—	—	—
11·40	—	0·55	0·27	1·45	—	—	—	—	—	—	—	—	2·75
11·00	—	—	—	1·00	2·45	—	—	—	—	—	—	—	—
11·80	—	0·75	—	—	2·60	3·45	3·58	0·98	6·43	2·80	—	—	—
11·35	10·50	1·60	0·43	1·37	2·40	—	—	—	—	—	—	—	2·35
11·15	—	0·69	—	—	2·22	3·00	3·18	0·84	6·20	2·96	—	—	—
11·85	11·30	1·65	0·42	1·23	2·45	3·45	3·60	1·03	—	—	—	—	2·20
10·55	10·40	1·50	0·70	0·90	2·83	3·55	3·75	0·95	6·30	2·80	—	—	2·30
11·20	10·90	0·70	0·33	1·20	2·35	3·58	3·75	0·90	6·40	2·91	—	—	2·45
11·85	10·80	0·70	0·38	1·25	2·65	3·45	3·63	0·89	—	—	—	—	2·35
11·35	10·40	0·60	0·32	1·25	2·71	3·60	3·93	—	6·90	3·30	—	—	2·60
10·20	—	1·00	—	—	2·20	3·20	3·35	0·81	5·65	2·75	—	—	—
10·85	9·80	0·65	0·34	1·15	2·58	3·70	3·89	1·08	—	—	—	—	—
11·47	—	0·65	0·34	1·00	2·55	3·23	3·45	0·89	6·00	3·00	—	—	—
10·20	—	1·05	—	—	2·45	3·10	3·28	0·90	6·05	3·00	—	—	—
9·20	8·85	0·50	0·23	0·60	1·75	2·47	2·59	0·67	4·45	2·35	—	—	1·85
10·00	9·30	1·64	—	0·80	2·70	—	—	—	—	—	—	—	2·20
10·35	9·65	1·85	0·40	0·90	2·30	—	—	0·87	5·27	2·65	—	—	2·20
11·10	—	0·75	—	—	2·82	3·25	3·38	0·96	6·70	2·90	—	—	—
11·00	10·50	0·70	0·33	1·10	2·54	—	—	—	—	—	—	—	—
11·30	10·55	1·90	0·25	1·20	2·50	3·30	3·49	0·94	—	—	—	—	2·15

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1926												
24 Dec.	1319	Male	24·14	—	4·40	—	4·95	10·50	1·32	—	1·15	7·00
24 ,,	1320	Female	26·90	—	5·25	—	5·60	—	—	—	1·45	7·50
24 ,,	1321	Male	24·20	—	4·65	—	5·00	10·00	1·32	—	1·20	—
24 ,,	1322	Male	24·75	—	4·60	—	5·20	—	1·40	5·90	1·20	6·90
28 ,,	1323	Female	26·05	—	5·20	—	5·40	10·80	—	—	1·32	7·60
28 ,,	1324	Male	24·55	—	4·30	—	4·75	10·00	1·30	6·20	1·36	7·60
28 ,,	1325	Male	24·80	—	4·75	—	5·30	10·60	1·35	5·98	1·20	6·80
28 ,,	1326	Male	23·60	—	4·45	4·80	4·90	10·40	1·45	—	1·30	6·90
28 ,,	1327	Female	26·70	—	4·80	—	5·40	11·80	1·45	6·30	1·37	7·45
29 ,,	1328	Male	23·90	—	4·10	4·70	4·83	10·40	1·29	—	1·25	7·00
29 ,,	1329	Male	24·75	—	4·70	5·10	5·45	11·22	1·37	5·95	1·22	7·30
30 ,,	1330	Male	25·00	—	—	—	5·25	—	—	—	1·47	6·47
30 ,,	1331	Female	22·75	—	4·05	4·30	4·45	9·60	1·17	5·55	1·08	6·65
30 ,,	1332	Male	23·55	—	4·60	—	5·10	11·30	1·35	—	1·25	6·50
30 ,,	1333	Male	26·00	—	5·30	—	5·70	—	1·50	5·90	1·25	7·15
1927												
3 Jan.	1334	Female	24·90	—	4·45	—	5·25	11·10	1·30	—	1·25	7·20
3 ,,	1335	Female	25·75	—	4·80	—	5·55	11·20	1·00	5·95	1·40	7·00
3 ,,	1336	Female	25·90	—	5·15	—	5·70	10·90	—	5·90	1·40	7·30
4 ,,	1337	Female	25·60	—	4·50	—	5·05	11·00	1·32	—	1·32	7·30
4 ,,	1339	Male	22·65	—	4·15	4·43	4·54	9·45	—	5·70	1·08	6·70
4 ,,	1340	Male	25·80	—	5·25	5·46	5·58	11·35	—	6·35	1·40	7·40
5 ,,	1341	Male	25·40	—	—	—	5·35	—	1·37	—	1·25	—
5 ,,	1342	Female	23·90	—	4·20	4·60	4·80	10·35	1·28	—	—	—
5 ,,	1343	Female	26·40	—	4·75	—	5·40	—	1·40	6·40	1·30	7·60
5 ,,	1344	Male	24·85	—	4·50	—	5·15	10·75	—	—	1·20	7·20
5 ,,	1345	Male	22·75	—	—	—	—	—	1·38	5·45	1·15	6·30
6 ,,	1346	Female	26·15	—	4·75	—	5·40	10·70	1·40	5·75	1·30	7·35
6 ,,	1347	Female	21·70	—	3·60	—	4·10	8·90	1·20	5·60	1·05	6·25
6 ,,	1348	Female	26·10	—	5·00	—	5·60	11·20	—	6·00	1·35	7·40
7 ,,	1349	Female	22·90	—	4·50	—	5·00	—	1·24	—	1·20	6·60
7 ,,	1350	Male	23·05	—	4·50	—	4·80	—	1·30	5·40	1·20	6·40
7 ,,	1351	Male	24·90	—	5·00	—	5·35	—	1·44	6·05	1·50	7·10
7 ,,	1352	Female	22·40	—	4·20	—	4·65	9·70	1·23	5·35	1·10	6·60
8 ,,	1353	Female	25·20	—	4·50	—	5·00	11·25	1·25	—	1·30	7·40
9 ,,	1355	Female	23·40	—	4·10	—	4·75	10·35	—	5·90	1·15	7·00
9 ,,	1356	Male	24·90	—	4·30	—	5·00	11·10	1·35	—	1·13	6·80
9 ,,	1359	Female	25·35	—	4·75	—	5·20	10·90	1·40	6·00	1·20	7·15
9 ,,	1360	Female	24·50	—	4·70	—	5·24	10·70	1·30	5·63	1·20	6·80
9 ,,	1361	Female	26·05	—	5·00	—	5·60	11·75	1·45	6·05	1·25	7·10
10 ,,	1362	Male	19·10	—	4·00	4·37	4·40	7·95	1·07	—	0·90	5·70
10 ,,	1363	Female	25·85	—	4·60	—	5·30	11·20	1·35	6·50	1·10	7·30
10 ,,	1364	Male	23·50	—	4·25	—	4·70	10·30	1·35	—	1·30	6·90
10 ,,	1366	Female	24·40	—	4·25	4·80	4·95	10·30	1·30	6·15	1·33	7·00
10 ,,	1367	Female	26·20	—	5·10	—	5·75	11·20	1·35	6·35	1·30	7·25
10 ,,	1368	Female	26·20	—	4·65	—	5·25	10·90	1·25	6·15	1·30	7·35
12 ,,	1373	Female	26·15	—	5·40	—	5·90	11·10	1·45	—	1·22	7·40
12 ,,	1374	Male	25·50	—	4·20	—	4·95	10·60	1·35	6·00	1·00	7·00
12 ,,	1375	Female	20·90	—	3·50	4·00	4·20	9·10	1·07	—	1·10	6·30
12 ,,	1376	Male	18·90	—	2·80	—	3·37	7·60	1·02	4·85	1·00	5·75
15 ,,	1378	Female	26·00	—	4·75	—	5·40	11·20	1·33	5·85	1·30	7·05
15 ,,	1379	Male	17·55	—	2·85	3·10	3·35	7·30	0·96	4·50	0·88	5·40
15 ,,	1380	Female	26·60	—	5·20	5·35	5·50	12·00	1·40	—	1·37	7·30
15 ,,	1382	Male	20·30	—	3·10	3·50	3·65	7·95	1·05	5·40	0·95	6·05
15 ,,	1383	Female	25·65	—	—	—	5·50	—	1·35	—	1·27	7·35
15 ,,	1384	Male	20·80	—	3·70	4·05	4·14	9·10	1·12	—	1·00	6·20
15 ,,	1385	Female	26·30	—	5·10	—	5·50	—	—	6·10	1·23	7·44
17 ,,	1386	Male	24·70	—	4·20	—	5·05	10·80	1·35	—	1·20	6·89
17 ,,	1387	Male	22·30	—	3·85	—	4·50	9·25	1·25	5·40	1·10	6·45
17 ,,	1388	Male	25·20	—	4·50	—	5·15	10·20	1·32	5·80	1·33	7·10

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
10·95	—	—	—	—	—	3·20	3·30	0·82	6·10	2·70	—	—	—
12·55	—	0·80	—	—	—	—	—	—	—	—	—	—	—
10·60	—	—	—	—	2·30	3·18	3·33	0·85	6·20	2·90	—	—	—
10·90	10·40	1·60	0·33	1·25	—	—	—	—	—	—	—	—	2·40
12·10	—	0·50	—	—	2·60	3·15	3·30	0·90	6·60	3·10	—	—	—
11·65	11·25	0·65	0·31	1·36	2·43	3·08	3·18	0·81	5·80	2·70	—	—	2·15
10·80	9·75	1·65	0·20	1·30	—	—	—	—	6·40	3·10	—	—	2·20
10·60	—	1·05	—	—	2·74	3·30	3·35	0·98	6·05	2·90	—	—	—
11·85	11·40	0·70	0·30	1·45	—	—	—	—	—	—	—	—	2·45
10·90	—	1·15	0·13	0·60	2·20	3·20	3·35	0·90	5·88	2·95	—	—	—
11·15	10·90	1·65	0·22	0·80	2·65	3·05	3·24	1·03	—	—	—	—	2·10
11·80	—	—	—	—	2·60	3·25	3·45	—	—	—	—	—	—
10·50	9·80	0·65	0·21	1·10	2·10	—	—	—	—	—	—	—	1·95
9·90	9·30	1·60	—	—	—	—	—	—	—	—	—	—	—
11·50	11·00	1·95	0·27	1·10	2·55	—	—	—	—	—	—	—	—
11·45	—	0·70	—	—	2·55	3·34	3·45	0·90	6·35	3·20	—	—	—
11·50	10·80	0·70	0·30	1·50	—	—	—	—	—	—	—	—	2·40
11·10	10·30	0·60	0·23	1·35	2·30	3·10	3·20	1·00	6·80	3·30	—	—	2·20
11·55	—	0·60	—	—	2·43	3·33	3·47	1·01	6·20	2·86	—	—	—
10·50	10·00	1·80	0·34	1·10	1·90	—	—	—	5·40	2·66	—	—	1·98
11·60	—	1·35	—	0·75	2·35	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	0·50	0·36	0·90	—	3·40	3·55	0·87	5·80	2·70	—	—	—
11·70	10·80	0·70	—	1·30	—	—	—	—	6·60	2·50	—	—	2·30
11·10	—	—	—	1·10	2·43	—	—	—	—	—	—	—	—
10·30	9·40	1·70	0·28	1·60	—	—	—	—	—	—	—	—	2·30
11·60	11·30	0·65	0·20	1·10	—	—	—	—	6·65	3·10	—	—	2·05
10·10	9·05	0·60	0·30	0·80	2·05	2·75	2·80	0·80	5·15	2·50	—	—	2·10
12·00	11·40	0·75	0·29	1·40	—	—	—	—	—	—	—	—	2·40
10·50	—	0·60	—	—	—	3·18	3·30	0·90	6·00	2·80	—	—	—
10·45	—	—	—	1·18	—	—	—	—	5·60	2·65	—	—	—
11·10	10·10	1·80	—	1·30	—	3·30	3·42	0·95	6·65	2·75	—	—	2·25
10·10	10·00	0·70	0·30	1·15	2·30	—	—	—	—	—	—	—	2·00
11·40	—	0·60	0·31	1·20	2·75	3·32	3·45	0·90	6·15	2·86	—	—	—
10·90	—	0·50	0·33	1·30	2·50	—	—	—	5·80	2·45	—	—	—
11·15	—	—	0·22	—	2·60	3·40	3·65	0·86	—	—	—	—	—
11·30	10·60	0·75	0·36	0·30	—	3·15	3·35	0·90	—	—	—	—	2·65
10·85	9·90	0·60	0·19	1·00	2·37	—	—	0·95	6·70	2·90	—	—	2·30
11·40	10·40	0·75	0·40	1·40	—	3·60	3·80	1·08	—	—	—	—	2·30
9·00	—	1·10	—	—	2·07	2·75	2·85	0·78	4·65	2·30	—	—	—
11·50	11·00	0·60	0·35	1·20	2·68	3·50	3·85	0·90	6·55	3·20	—	—	2·65
10·80	—	1·10	0·26	1·25	2·45	3·39	3·63	0·91	5·90	2·40	—	—	2·25
11·25	10·50	0·70	0·34	1·10	2·50	3·26	3·50	0·87	6·10	2·60	—	—	2·20
11·60	10·95	0·70	0·43	1·10	2·75	3·60	3·80	0·94	6·90	—	—	—	2·50
11·30	10·90	0·80	0·35	1·30	2·54	3·40	3·70	0·87	6·35	3·00	—	—	2·15
11·65	—	0·65	—	—	3·00	3·45	3·75	1·02	7·00	3·20	—	—	—
10·75	10·30	1·70	—	1·55	2·45	3·25	3·40	0·92	6·50	3·10	—	—	2·34
9·55	—	0·45	0·21	0·80	2·17	2·75	2·90	0·70	5·20	2·45	—	—	—
9·70	9·10	1·52	0·22	0·90	—	—	—	—	4·23	2·12	—	—	1·80
11·15	10·45	0·70	0·30	1·55	—	—	—	—	—	—	—	—	—
8·40	8·10	1·30	—	1·00	1·70	—	—	—	—	—	—	—	1·60
—	—	0·62	—	—	2·50	3·65	3·87	1·04	—	—	—	—	—
9·50	9·10	1·35	0·19	1·10	1·65	—	—	—	—	—	—	—	2·00
—	—	0·45	—	—	—	—	—	—	—	—	—	—	—
9·65	9·15	0·65	0·18	1·05	2·10	—	—	—	—	—	—	—	—
11·50	11·00	0·66	0·32	1·30	—	—	—	—	—	—	—	—	—
11·00	—	1·20	—	—	2·50	3·28	3·34	0·89	6·15	3·05	—	—	—
10·30	9·90	1·55	0·26	0·95	—	—	—	—	5·50	2·75	—	—	1·95
11·45	10·35	1·65	0·37	0·95	—	—	—	—	—	—	—	—	2·55

Date	Whale Number	Sex	1 Total length, tip of snout to notch of flukes	2 Lower jaw, projection beyond tip of snout	3 Tip of snout to blow-hole	4 Tip of snout to angle of gape	5 Tip of snout to centre of eye	6 Tip of snout to tip of flipper	7 Eye to ear, centres	8 Notch of flukes to posterior emargination of dorsal fin	9 Flukes, width at insertion	10 Notch of flukes to anus
1927												
17 Jan.	1389	Female	27·45	—	4·45	—	5·50	11·70	1·38	—	1·27	7·90
17 ,,	1390	Male	22·80	—	3·90	—	4·25	9·10	1·14	—	1·25	6·70
18 ,,	1395	Male	25·00	—	4·60	—	5·20	—	1·23	5·90	1·15	7·00
19 ,,	1396	Male	19·25	—	2·90	—	3·47	8·05	0·97	—	0·95	6·00
19 ,,	1397	Female	27·75	—	5·20	—	5·85	11·90	1·64	6·80	1·35	7·90
21 ,,	1402	Male	24·00	—	—	—	—	—	—	—	—	—
21 ,,	1403	Male	25·20	—	4·65	—	5·30	10·40	1·30	5·70	1·25	6·85
21 ,,	1405	Female	19·20	—	2·90	3·30	3·45	8·30	1·00	5·03	0·90	6·05
21 ,,	1406	Female	25·30	—	4·90	—	5·45	10·90	1·30	—	1·25	7·50
21 ,,	1407	Male	24·00	—	4·30	—	5·95	10·40	1·50	5·55	1·20	6·55
21 ,,	1408	Female	23·10	—	3·90	—	4·65	9·95	1·27	5·62	1·25	6·70
22 ,,	1409	Female	24·50	—	—	—	5·35	11·40	1·34	—	1·17	6·25
22 ,,	1410	Male	22·60	—	4·00	—	4·50	9·45	1·29	5·50	1·07	6·20
22 ,,	1411	Female	25·70	—	4·55	—	5·15	11·00	1·50	5·80	1·25	7·35
22 ,,	1412	Male	18·[illegible]	—	2·95	—	3·55	7·65	—	4·40	1·07	5·65
23 ,,	1417	Female	28·00	—	5·25	—	5·75	11·40	1·46	—	1·35	7·80
23 ,,	1418	Female	26·50	—	4·90	—	5·75	11·40	1·35	6·15	1·25	6·42
23 ,,	1419	Female	25·25	—	4·75	—	5·40	11·05	1·35	—	1·30	7·00
23 ,,	1420	Male	23·90	—	4·45	—	5·30	10·50	1·20	5·30	1·40	6·50
23 ,,	1421	Male	22·95	—	4·30	—	4·90	10·50	1·28	5·30	1·20	6·30
24 ,,	1422	Female	25·10	—	4·65	—	5·10	—	1·40	6·15	1·25	7·25
24 ,,	1423	Female	26·10	—	5·30	—	5·75	12·05	1·47	5·95	1·35	7·15
24 ,,	1424	Male	23·90	—	4·60	—	4·95	—	1·30	—	1·23	6·45
25 ,,	1425	Female	25·70	—	4·90	—	5·25	11·60	1·45	—	1·40	7·70
25 ,,	1426	Male	25·40	—	4·90	—	5·40	11·00	1·55	5·60	1·23	7·00
25 ,,	1427	Female	25·60	—	4·60	—	5·40	11·35	1·40	—	1·35	6·90
25 ,,	1428	Male	23·70	—	4·00	—	4·70	10·00	1·37	5·40	1·20	6·35
25 ,,	1429	Female	22·55	—	3·75	—	4·45	9·50	1·17	5·50	1·20	6·55
25 ,,	1430	Male	23·80	—	4·10	—	4·70	10·20	1·24	5·35	1·18	6·90
25 ,,	1431	Male	25·35	—	4·70	—	5·45	11·00	1·25	5·56	1·30	7·00
26 ,,	1432	Female	25·65	—	5·00	—	5·45	10·80	1·42	5·45	1·35	6·85
27 ,,	1434	Male	19·55	—	3·55	—	3·85	8·15	0·98	—	1·00	5·75
27 ,,	1436	Female	23·00	—	4·20	—	4·72	9·90	—	5·75	1·13	6·65
27 ,,	1437	Male	18·80	—	2·95	—	3·45	7·75	1·17	—	0·95	—
28 ,,	1438	Male	25·00	—	4·90	—	5·30	11·25	1·35	6·50	1·25	6·85
28 ,,	1439	Female	26·50	—	—	—	—	—	—	5·90	1·25	7·40
28 ,,	1440	Female	26·15	—	4·75	—	5·40	11·50	—	6·20	1·40	7·45
28 ,,	1441	Female	25·00	—	4·50	—	5·00	10·70	1·25	6·20	1·35	7·30
28 ,,	1442	Male	19·60	—	3·15	3·60	3·75	7·90	1·00	—	1·05	—
28 ,,	1443	Male	23·25	—	4·05	—	4·65	10·00	1·28	5·70	1·20	6·90
28 ,,	1444	Male	23·10	—	4·00	—	4·60	9·80	—	5·80	1·10	6·40
29 ,,	1445	Female	19·30	—	3·00	—	3·62	7·50	1·00	—	1·07	6·00
29 ,,	1446	Male	23·90	—	4·70	—	5·50	10·90	1·35	5·85	1·30	6·50
29 ,,	1447	Female	26·90	—	5·00	—	5·70	—	1·45	6·00	1·55	7·55
30 ,,	1448	Female	26·35	—	5·05	5·65	5·77	—	—	—	1·30	7·30
30 ,,	1449	Male	23·95	—	4·70	—	5·25	10·90	—	—	1·20	—
30 ,,	1450	Female	20·10	—	3·75	3·85	4·20	8·80	1·05	5·20	1·10	5·75
7 Feb.	1453	Female	25·60	—	5·20	—	5·75	11·00	1·41	—	1·30	6·60
7 ,,	1454	Female	19·60	—	3·30	3·00	3·66	8·15	1·02	5·18	1·02	6·30
7 ,,	1455	Male	23·50	—	4·30	4·55	4·70	10·10	1·32	5·40	1·18	6·80
7 ,,	1457	Female	18·55	—	3·23	3·50	3·66	7·85	0·95	4·30	0·96	5·30
8 ,,	1458	Male	23·90	—	4·35	—	5·05	10·60	1·30	—	—	6·60
8 ,,	1459	Female	25·00	—	5·00	—	5·50	11·15	1·40	5·90	1·20	6·65
8 ,,	1460	Male	23·50	—	4·40	—	5·00	9·95	1·30	5·24	1.25	6·40
8 ,,	1461	Male	17·60	—	2·80	—	3·20	7·25	0·95	4·65	0·95	5·30
8 ,,	1462	Male	25·40	—	4·55	—	5·10	11·35	1·26	6·30	1·30	7·00
8 ,,	1463	Female	23·70	—	4·30	—	5·00	10·20	1·43	5·70	1·33	7·05
9 ,,	1464	Female	23·40	—	4·85	5·00	5·06	10·70	1·30	—	1·32	7·00
9 ,,	1465	Female	24·60	—	4·78	4·84	5·04	10·30	1·34	5·80	1·23	6·90
9 ,,	1466	Male	24·80	—	4·60	—	5·35	11·10	—	—	1·18	7·15

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
12·25	—	0·70	—	—	2·71	3·36	3·74	0·98	6·75	3·20	—	—	—
10·60	—	1·00	—	—	2·17	3·35	3·75	0·75	5·30	2·60	—	—	—
10·90	10·90	1·90	—	1·55	3·05	—	—	—	—	—	—	—	2·30
9·55	—	0·95	—	—	1·90	2·65	—	0·70	4·30	2·25	—	—	—
12·45	12·00	0·80	0·15	1·10	3·00	3·55	3·60	1·00	7·00	3·20	—	4·10	2·25
—	—	—	—	—	—	—	—	—	—	—	—	—	—
10·90	8·55	0·85	0·30	1·20	2·65	3·45	3·55	0·99	6·55	2·95	—	—	2·30
9·15	—	0·33	0·29	0·90	—	—	—	—	4·34	2·20	—	—	—
11·65	—	0·60	—	—	2·50	3·55	3·30	1·00	6·60	3·15	—	—	—
10·50	9·45	1·70	0·40	1·25	—	—	—	—	6·10	2·85	—	—	2·25
10·40	10·75	0·55	0·33	1·10	2·50	3·00	3·10	0·80	5·70	2·70	—	—	2·30
10·30	—	0·65	—	—	—	—	—	—	6·45	2·85	—	—	—
9·90	9·45	1·60	0·24	1·15	—	—	—	—	—	—	—	—	2·10
11·60	10·80	0·75	—	1·35	2·55	3·20	3·40	0·90	6·30	2·95	—	—	2·65
8·75	8·35	1·05	0·22	1·30	1·92	—	—	—	—	—	—	—	1·80
12·60	—	0·75	—	1·30	2·70	3·60	3·97	1·04	7·10	3·30	—	—	—
11·45	10·60	0·75	0·23	1·20	2·55	3·36	3·79	—	—	2·80	—	—	2·15
11·20	—	0·55	—	—	2·85	3·45	3·70	0·95	6·45	2·90	—	—	—
10·40	9·30	1·65	0·15	1·30	2·50	3·10	—	—	6·40	2·80	—	—	2·55
9·85	9·40	1·70	0·34	1·20	2·60	3·50	3·80	0·73	5·90	—	—	—	2·25
11·65	11·00	0·65	—	—	—	—	—	—	—	—	—	—	2·40
11·20	10·70	0·65	0·38	1·35	2·50	—	—	—	—	—	—	—	2·55
10·15	10·00	1·55	—	—	—	—	—	—	—	—	—	—	2·20
12·00	—	0·70	—	—	3·00	3·75	3·97	1·03	6·60	3·15	—	—	—
11·55	10·50	1·85	0·36	—	—	—	—	—	6·60	3·20	—	—	2·35
11·30	—	0·40	—	—	2·50	3·45	3·60	0·92	6·45	2·90	—	—	—
10·50	9·80	1·70	0·22	1·10	—	—	—	—	5·85	2·55	—	—	2·25
10·00	9·75	0·55	0·19	1·00	2·26	3·01	3·17	0·82	5·55	2·65	—	—	2·20
10·90	—	1·15	0·29	1·10	2·30	3·00	3·20	0·88	5·80	2·75	—	—	—
11·10	10·60	1·65	0·30	1·15	2·67	3·46	3·54	0·98	—	—	—	—	2·35
11·20	10·65	0·75	0·29	1·30	—	—	—	—	—	—	—	—	2·35
8·95	—	0·82	—	—	1·97	2·65	2·80	0·71	—	—	—	—	—
10·40	10·50	0·70	0·25	1·10	2·35	3·20	3·44	0·75	—	2·75	—	—	2·50
8·50	7·55	1·30	—	1·00	1·88	2·55	2·65	0·69	4·30	2·30	—	—	—
10·95	10·40	1·70	0·37	1·35	2·44	3·40	3·60	0·95	6·60	2·75	—	—	2·40
11·50	10·80	0·60	0·33	1·40	2·60	3·40	—	0·95	6·90	3·10	—	—	2·15
11·75	11·20	0·65	0·36	1·75	2·60	—	—	—	6·70	3·10	—	—	2·60
11·50	10·80	0·75	0·24	1·20	2·50	—	—	—	6·00	2·80	—	—	2·40
9·10	—	—	—	—	1·65	—	—	—	—	—	—	—	—
10·75	10·25	1·70	—	1·30	2·25	3·10	3·25	0·88	—	—	—	—	2·05
10·40	9·75	1·70	0·31	1·20	—	—	—	—	—	—	—	—	2·30
9·10	—	0·50	—	—	1·77	2·48	2·60	0·74	—	—	—	—	—
10·70	10·20	1·75	0·32	1·25	2·55	3·25	3·49	0·95	6·30	2·80	—	—	2·15
11·80	11·70	0·65	0·20	1·30	—	—	—	—	—	—	—	—	2·60
11·44	—	0·60	—	—	2·65	3·40	3·50	0·95	6·90	3·00	—	—	—
—	—	—	0·44	1·30	2·50	—	—	—	6·50	2·75	—	—	—
8·90	8·40	0·35	0·37	1·25	1·85	2·62	2·77	0·74	—	—	—	—	—
10·70	—	0·60	—	—	2·30	3·18	3·36	0·95	7·00	3·00	—	—	—
9·60	9·00	0·45	0·36	0·76	2·02	2·59	2·85	0·57	4·53	2·10	—	—	1·77
10·30	9·80	1·60	0·38	0·80	2·45	—	—	—	—	—	—	—	2·55
8·50	8·00	0·50	0·22	0·46	1·92	—	—	—	—	—	—	—	1·55
10·70	—	1·10	—	—	2·50	3·25	3·48	0·85	6·30	2·90	—	—	—
10·70	10·35	0·65	0·35	1·10	2·55	3·50	3·78	0·95	6·80	3·00	—	—	2·50
10·65	—	1·15	0·22	0·80	—	—	—	—	6·30	2·95	—	—	—
8·30	7·70	0·75	0·28	0·94	1·50	2·42	2·50	0·71	4·05	2·25	—	—	1·70
11·35	9·85	1·70	0·15	1·50	2·25	3·10	3·20	0·87	6·35	2·80	—	—	—
10·40	10·30	0·45	0·25	1·10	—	—	—	—	—	—	—	—	—
10·60	—	0·60	—	—	2·35	3·27	3·48	0·85	6·20	2·70	—	—	—
11·05	10·70	0·55	0·37	0·70	2·02	—	—	—	—	—	—	—	2·05
11·45	—	1·20	0·31	0·80	2·66	3·54	3·68	0·94	—	—	—	—	—

			1	2	3	4	5	6	7	8	9	10
DATE	WHALE NUMBER	SEX	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1927												
9 Feb.	1467	Male	20·50	—	3·38	3·86	4·02	8·20	—	—	1·12	5·90
14 ,,	1468	Female	25·55	—	—	—	—	—	—	—	—	—
14 ,,	1470	Male	22·50	—	3·15	—	3·65	—	1·05	5·10	1·05	6·20
14 ,,	1471	Female	25·50	—	4·85	—	5·60	11·30	1·35	5·50	1·20	7·17
15 ,,	1472*	Male	22·00	—	3·85	—	4·42	9·60	—	5·40	—	6·40
15 ,,	1473	Male	17·50	—	2·90	3·27	3·40	7·15	0·86	4·43	1·00	5·30
17 ,,	1477	Male	19·10	—	2·85	—	3·42	7·60	—	4·65	1·02	5·73
17 ,,	1478	Female	17·90	—	3·08	4·35	4·50	7·40	0·91	4·40	0·90	5·60
21 ,,	1479	Female	27·60	—	5·22	—	5·80	11·70	1·44	—	1·24	7·70
21 ,,	1480	Male	23·10	—	4·45	—	5·03	10·30	1·23	5·10	—	6·43
21 ,,	1481	Female	26·50	—	5·25	—	5·80	12·10	1·50	6·45	1·32	7·60
21 ,,	1482	Female	23·40	—	4·10	—	4·75	9·95	1·15	5·75	1·11	7·10
21 ,,	1483	Male	23·30	—	4·40	—	4·94	10·30	1·26	5·50	1·20	6·20
21 ,,	1484	Male	21·50	—	3·63	—	4·25	8·80	1·13	5·30	1·15	6·15
21 ,,	1486	Female	22·70	—	4·00	—	4·62	9·40	1·24	5·50	1·13	6·35
22 ,,	1491	Female	20·30	—	3·30	—	3·85	8·20	0·95	5·10	1·10	6·10
23 ,,	1493	Female	26·10	—	5·08	—	5·75	—	—	—	1·28	7·10
23 ,,	1494	Female	27·70	—	5·00	—	5·60	9·25	1·45	6·87	1·38	8·20
23 ,,	1495	Female	19·00	—	2·65	3·08	3·14	5·40	0·89	5·20	1·03	6·15
24 ,,	1496	Female	22·50	—	3·80	—	4·45	9·30	1·12	5·10	1·05	6·70
24 ,,	1497	Female	24·30	—	4·65	—	5·10	10·50	1·30	5·75	1·20	6·85
25 ,,	1503	Female	17·10	—	2·65	3·13	3·27	†	0·91	4·30	0·90	5·50
25 ,,	1504	Male	20·40	—	3·60	—	4·17	8·95	1·10	5·50	1·08	6·05
26 ,,	1508	Male	25·15	—	4·60	—	5·10	10·70	1·29	—	1·28	7·30
26 ,,	1509	Female	21·25	—	3·70	—	4·30	9·15	1·12	—	1·15	6·25
27 ,,	1512	Female	25·00	—	—	—	5·20	10·80	—	—	1·28	6·88
27 ,,	1514	Male	17·85	—	2·73	3·12	3·22	7·30	0·97	5·06	1·00	5·70
27 ,,	1517	Female	19·40	—	3·15	—	3·64	7·93	0·97	5·20	1·03	5·90
28 ,,	1520	Male	25·30	—	4·60	—	5·25	10·50	1·33	5·90	1·25	6·65
1 March	1525	Female	25·50	—	4·80	—	5·70	11·30	1·38	6·35	1·25	7·00
3 ,,	1532	Male	20·05	—	3·05	3·40	3·56	8·00	1·07	5·30	1·07	6·17
3 ,,	1533	Female	24·45	—	4·33	—	4·90	10·31	1·25	—	1·22	7·20
3 ,,	1534	Male	22·35	—	3·86	4·10	4·42	9·89	1·24	5·60	1·20	6·77
4 ,,	1538	Female	24·45	—	4·20	—	4·90	10·40	1·20	6·20	1·25	7·00
4 ,,	1547	Female	26·45	—	5·35	—	5·83	11·95	1·37	5·95	1·22	6·95
5 ,,	1549	Male	22·50	—	4·20	—	4·58	7·60‡	1·20	—	1·10	6·30
5 ,,	1550	Female	25·55	—	4·78	—	5·45	11·40	1·37	6·05	1·25	7·15
5 ,,	1551	Male	19·82	—	3·20	3·65	3·75	—	1·05	5·15	1·04	5·95
7 ,,	1557	Male	21·70	—	3·90	—	4·45	9·10	1·04	—	1·09	6·03
7 ,,	1558	Male	24·45	—	5·10	—	5·50	11·20	1·40	5·70	1·20	6·60
9 ,,	1561	Female	24·70	—	5·05	—	5·60	11·50	1·44	5·75	1·28	6·86
9 ,,	1562	Male	19·00	—	2·98	—	3·58	7·80	—	—	0·92	5·80
11 ,,	1563	Male	23·70	—	4·15	—	4·60	10·50	1·17	5·70	1·25	6·85
11 ,,	1564	Male	17·65	—	2·45	—	2·91	5·00§	0·95	4·60	0·92	5·05
11 ,,	1565	Male	24·45	—	—	—	5·30	8·60	1·39	5·70	1·26	7·10
11 ,,	1566	Female	18·10	—	—	—	3·67	5·60	0·94	4·68	—	5·60
12 ,,	1568	Male	23·70	—	—	—	4·95	8·00	—	5·50	—	6·90
12 ,,	1569	Male	23·80	—	—	—	5·18	8·35	1·34	5·40	—	6·60
12 ,,	1570	Male	25·15	—	—	—	5·55	8·90	1·25	—	—	6·50
12 ,,	1571	Male	24·10	—	—	—	4·85	8·10	—	5·40	—	6·90
13 ,,	1573	Female	25·23	—	—	—	—	—	—	—	—	6·62
13 ,,	1574	Female	23·70	—	—	—	5·15	8·20	—	—	—	7·15
13 ,,	1576	Male	19·86	—	—	—	4·02	6·45	1·04	4·70	—	5·87
18 ,,	1583	Female	26·40	—	—	—	6·25	9·75	1·45	5·80	—	6·95
18 ,,	1584	Male	16·95	—	—	—	2·97	5·10	0·92	—	—	5·15
20 ,,	1586	Female	18·30	—	—	—	3·30	5·65	0·95	4·95	—	5·85
20 ,,	1588	Female	25·50	—	—	—	5·40	8·50	—	5·95	—	7·15
21 ,,	1593	Female	23·50	—	—	—	5·10	8·10	1·23	5·30	—	6·65
29 ,,	1600	Male	17·10	—	—	—	2·77	4·65	0·98	4·50	—	5·18
29 ,,	1605	Female	24·95	—	—	—	5·35	10·20	1·42	5·96	—	6·98

* Flukes broken off, 1 m. added to all. † R. 7·10. L. 7·42. ‡ Measurement taken to the axilla.
§ Subsequent to this (No. 1564) this measurement was always taken to the axilla.

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
9·35	—	0·95	—	—	1·80	2·63	2·80	0·74	—	—	—	—	—
—	—	—	—	—	—	—	—	—	6·75	—	—	—	—
9·30	9·10	1·40	0·22	1·20	1·85	2·30	2·40	0·85	4·50	2·25	—	—	1·60
11·50	11·25	0·48	0·28	1·00	2·70	3·47	3·67	1·05	6·80	2·80	—	—	2·65
9·95	9·30	1·55	0·34	0·90	2·25	3·10	3·24	0·80	5·50	2·70	—	—	—
8·40	8·30	1·35	0·23	0·65	1·70	—	—	—	—	—	—	—	1·74
9·15	8·75	1·47	—	—	1·96	2·42	2·50	0·70	4·20	—	—	—	—
8·33	7·65	0·40	0·21	0·60	1·77	—	—	—	—	—	—	—	1·68
11·95	—	0·60	0·26	0·80	2·40	3·25	3·46	0·95	7·10	2·96	—	—	—
10·28	9·60	1·52	—	0·90	2·10	2·92	3·00	0·93	6·05	2·86	—	—	2·20
11·50	10·90	0·55	0·34	1·20	2·52	3·24	3·50	1·00	7·00	3·40	—	—	2·55
10·70	10·20	0·58	—	0·45	2·07	—	—	—	5·60	2·70	—	—	2·18
9·70	9·50	1·35	0·23	0·60	2·40	—	—	—	6·05	—	—	—	2·20
9·60	8·60	1·62	0·27	0·80	1·88	2·47	2·63	0·74	5·30	2·60	—	—	2·10
10·20	9·50	0·65	0·31	0·80	2·00	—	—	—	5·60	2·54	—	—	2·00
9·65	9·00	0·60	0·30	0·90	1·97	2·64	2·90	0·70	4·60	2·20	—	—	—
11·00	—	0·45	—	—	2·51	3·26	3·34	1·09	7·00	3·20	—	—	—
12·30	11·70	0·60	0·35	0·90	2·30	3·00	3·17	0·90	6·70	3·05	—	—	2·07
9·65	9·07	0·55	0·31	0·60	1·53	—	—	—	—	—	—	—	1·72
10·20	—	0·50	0·20	0·85	2·10	2·70	2·93	0·76	5·45	2·60	—	—	—
10·70	10·40	0·65	0·15	1·35	2·35	3·20	3·30	0·90	6·30	2·80	—	—	2·20
8·20	7·80	0·35	0·20	0·60	—	2·33	2·46	0·65	—	—	—	—	1·70
9·40	9·10	1·50	0·27	0·70	2·00	2·65	2·81	0·76	—	—	—	—	2·20
11·25	—	1·15	—	—	2·50	3·25	3·37	0·94	6·10	2·90	—	—	—
9·90	—	0·65	0·36	0·90	2·17	2·90	3·00	0·83	5·20	2·70	—	—	—
10·70	—	0·57	—	—	2·70	—	—	—	6·20	2·88	—	—	—
8·45	8·20	1·15	0·22	0·70	1·75	2·45	2·57	0·65	—	2·07	—	—	1·80
9·10	8·50	0·45	0·32	1·10	1·86	2·41	2·58	0·68	4·40	2·38	—	—	2·00
10·55	9·75	1·55	0·40	1·10	2·40	3·10	3·35	0·88	6·45	3·00	—	—	2·40
11·00	10·50	0·60	0·28	0·80	2·77	3·10	3·20	0·87	6·95	3·15	—	—	2·60
9·35	8·90	1·43	0·27	0·83	1·82	2·48	2·63	0·74	—	—	—	—	1·95
11·00	—	0·60	—	—	2·43	3·25	3·36	0·88	5·96	2·86	—	—	—
10·55	9·90	1·80	0·40	0·90	2·34	2·83	3·00	0·84	5·37	2·56	—	—	—
10·90	10·10	0·65	—	0·95	2·35	3·10	3·40	0·92	5·90	—	—	—	—
11·00	10·80	0·70	0·28	0·95	2·35	3·45	3·80	1·02	6·90	3·30	—	—	2·35
10·25	—	1·35	—	—	—	—	—	—	5·70	2·65	—	—	—
10·80	10·30	0·67	0·33	0·80	2·65	3·40	3·58	—	6·68	2·90	—	—	2·60
9·25	8·75	1·55	0·22	0·70	2·00	2·30	2·42	0·63	4·70	2·10	—	—	2·00
9·78	—	1·07	—	—	1·79	2·52	2·61	0·77	5·48	2·50	—	—	—
10·65	10·10	1·70	0·16	0·60	2·40	3·30	3·43	0·90	6·60	3·00	—	—	—
10·35	9·55	0·60	0·37	1·00	2·68	3·52	3·77	1·02	—	—	—	—	2·65
9·10	—	0·88	0·24	0·53	1·80	—	—	—	—	—	—	—	—
10·65	10·10	1·45	0·35	—	2·45	3·04	3·26	0·83	—	—	—	—	1·45
8·10	7·90	1·35	0·22	0·75	1·45	1·97	—	—	3·70	2·00	—	—	2·15
11·00	10·80	1·50	0·21	0·75	2·20	3·11	—	0·92	6·15	2·98	—	—	2·40
8·60	—	0·45	—	—	1·70	—	—	—	—	—	—	—	—
10·70	—	1·70	0·29	—	2·64	—	—	0·93	6·00	2·90	—	—	2·45
10·50	—	1·65	0·29	—	2·55	—	—	0·93	6·30	3·00	—	—	2·45
10·65	—	1·55	—	—	2·80	—	—	0·97	6·80	3·00	—	—	—
10·75	—	1·70	—	—	2·93	—	—	—	6·00	2·80	—	—	—
—	—	—	—	—	2·55	—	—	0·90	6·53	3·16	—	—	—
11·35	—	0·58	—	—	2·35	—	—	0·85	6·15	2·96	—	—	—
9·03	—	0·43	0·23	—	2·19	—	—	0·69	4·94	2·24	—	—	1·85
11·55	—	0·65	—	—	2·30	—	—	0·93	7·40	3·20	—	—	—
8·00	—	0·75	—	—	1·70	—	—	0·68	3·80	1·95	—	—	—
8·60	—	0·35	—	—	1·88	—	—	0·65	4·10	2·00	—	—	1·80
11·25	—	0·60	0·39	—	2·65	—	—	0·90	6·70	3·05	—	—	—
10·50	—	0·68	0·28	—	2·60	—	—	0·86	6·40	2·95	—	—	2·25
8·33	—	1·37	0·23	—	1·63	—	—	0·49	3·90	1·52	—	—	2·00
10·76	—	0·58	0·28	—	2·30	—	—	0·83	6·37	3·10	—	—	—

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1927												
30 Mar.	1609	Male	25·60	—	—	—	5·12	8·25	1·25	6·30	—	7·50
1 April	1623	Female	26·00	—	—	—	5·10	8·30	1·50	6·15	—	7·50
8 ,,	1631	Female	25·10	—	—	—	5·34	8·40	1·30	6·30	—	7·25
8 ,,	1632	Male	18·45	—	—	—	2·90	5·25	0·94	4·95	—	5·70
9 ,,	1638	Female	19·10	—	—	—	3·45	6·20	0·94	5·00	—	6·10
12 ,,	1642	Male	18·80	—	—	—	3·37	6·05	0·98	4·80	—	5·70
12 ,,	1644	Female	27·50	—	—	—	5·65	9·70	1·56	6·65	—	7·80
12 ,,	1648	Male	17·75	—	—	—	3·15	5·50	0·90	4·50	—	5·40
19 ,,	1659	Male	18·50	—	—	—	3·60	5·95	—	5·00	—	5·65
19 ,,	1661	Male	23·45	—	—	—	5·00	7·85	1·30	5·20	—	6·45
23 ,,	1672	Female	19·40	—	—	—	3·75	6·00	1·06	—	—	6·00
25 ,,	1680	Female	19·10	—	—	—	3·60	5·80	1·00	5·00	—	5·80

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
11·60	—	1·60	0·30	—	2·55	—	—	0·90	6·80	3·10	—	—	2·60
12·00	—	0·70	—	—	2·45	—	—	0·99	6·14	3·20	—	—	2·60
11·40	—	0·75	0·34	—	2·18	—	—	0·98	6·26	2·90	—	—	—
8·70	—	1·30	0·26	—	—	—	—	0·54	3·65	1·80	—	—	—
9·60	—	0·40	0·20	—	—	—	—	—	4·20	2·20	—	—	1·90
9·05	—	1·50	0·24	—	1·80	—	—	0·70	4·22	1·96	—	—	—
11·75	—	0·60	0·31	—	3·10	—	—	1·10	6·94	3·05	—	—	—
8·15	—	1·36	0·24	—	1·73	—	—	0·59	3·95	2·00	—	—	—
8·80	—	1·45	0·20	—	1·70	—	—	0·67	4·45	2·20	—	—	—
10·05	—	1·55	0·24	—	2·35	—	—	0·80	6·15	2·70	—	—	—
9·20	—	0·40	—	—	2·15	—	—	0·75	4·60	2·35	—	—	—
9·20	—	0·45	0·25	—	2·00	—	—	0·72	4·45	2·20	—	—	—

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1925												
5 Feb.	2	Female	20·80	0·20	4·03	—	4·53	8·85	1·00	4·90	1·05	6·20
5 ,,	3	Female	17·60	—	3·50	—	3·80	7·50	—	4·80	0·90	5·10
5 ,,	4	Male	—	—	—	—	—	—	—	5·25	1·00	6·00
10 ,,	7	Female	19·55	0·30	4·00	4·20	4·35	8·35	1·00	5·00	1·00	5·50
11 ,,	11	Male	19·50	—	4·00	4·19	4·25	8·20	1·10	4·70	0·95	5·20
11 ,,	12	Female	17·30	—	3·23	3·50	3·65	7·20	0·87	4·30	0·85	4·75
11 ,,	14	Male	17·90	—	3·15	3·42	3·55	7·15	0·88	4·35	0·85	5·35
12 ,,	15	Male	19·00	—	—	3·85	3·87	7·70	—	—	0·95	—
12 ,,	16	Male	20·50	0·15	4·07	4·40	4·36	9·00	1·05	4·80	0·85	5·40
12 ,,	17	Male	19·60	—	3·85	4·00	4·30	8·20	0·95	4·18	1·00	5·20
12 ,,	18	Male	18·70	—	3·70	—	4·10	7·73	0·90	4·80	0·95	5·25
12 ,,	19	Male	19·45	—	3·85	4·15	4·25	7·80	1·00	4·65	0·95	5·30
13 ,,	20	Female	20·80	0·24	3·75	4·15	4·23	8·50	0·93	—	1·00	6·10
13 ,,	22	Male	20·30	—	3·60	3·80	4·00	8·25	0·94	5·60	1·05	6·20
16 ,,	23	Female	21·50	—	4·05	4·20	4·35	8·90	1·06	—	1·23	6·10
16 ,,	25	Male	19·90	—	3·70	3·95	4·00	8·30	1·00	5·13	1·20	6·60
17 ,,	28	Female	17·65	—	3·30	3·50	3·76	7·40	0·90	4·60	0·93	4·88
18 ,,	29	Female	21·70	0·27	4·25	4·50	4·60	9·20	1·00	5·00	1·05	5·70
20 ,,	32	Female	18·05	0·15	3·25	3·70	3·60	7·25	0·82	4·50	0·92	5·25
21 ,,	33	Female	15·50	0·10	2·33	—	2·50	5·45	0·68	—	0·95	4·70
21 ,,	35	Male	17·55	—	—	—	—	—	—	—	—	—
21 ,,	38	Male	21·20	—	4·40	—	4·93	9·30	1·00	5·30	0·92	5·80
23 ,,	39	Female	22·80	—	4·53	4·79	4·88	9·70	—	—	1·25	6·50
23 ,,	42	Female	23·60	—	4·80	5·10	5·00	10·00	—	—	1·12	6·70
23 ,,	44	Male	20·20	—	3·75	3·98	4·10	8·30	1·05	5·30	0·97	5·78
23 ,,	45	Female	22·55	—	4·25	4·63	4·93	9·85	1·10	5·70	1·20	6·40
25 ,,	51	Male	20·60	—	4·00	4·30	4·50	—	1·00	—	1·05	4·70
27 ,,	56	Male	20·87	0·25	4·20	4·65	4·75	8·17	1·05	—	1·15	4·95
27 ,,	57	Female	19·35	0·22	3·65	3·98	3·85	7·95	0·92	4·75	1·05	5·55
27 ,,	58	Female	20·90	—	3·78	4·18	4·28	8·40	1·00	5·20	1·00	5·88
27 ,,	59	Female	21·25	—	4·15	4·40	4·55	8·75	—	5·52	1·07	5·80
28 ,,	61	Female	21·12	—	4·25	4·58	4·80	9·10	1·00	5·20	1·10	6·02
28 ,,	62	Female	21·40	—	4·20	4·50	4·65	8·70	1·05	5·50	1·15	6·00
28 ,,	63	Female	20·50	—	3·80	4·20	4·30	8·60	0·90	—	1·15	5·90
1 Mar.	64	Male	19·10	—	3·65	—	3·80	7·70	—	—	1·00	5·60
1 ,,	65	Male	20·10	—	3·70	3·90	4·10	8·20	1·00	5·10	0·95	5·60
1 ,,	66	Female	19·25	—	3·50	4·00	3·95	7·80	—	4·90	0·85	5·50
1 ,,	67	Female	22·50	—	4·70	5·1[illegible]	5·10	9·60	—	4·85	1·15	6·00
1 ,,	68	Female	23·30	—	—	—	—	—	—	—	1·00	—
1 ,,	69	Male	20·50	—	4·00	—	4·30	8·60	1·00	—	1·10	6·05
1 ,,	70	Male	19·70	—	4·00	4·00	4·10	8·10	0·93	4·65	1·00	—
2 ,,	71	Female	19·30	—	3·30	3·75	3·78	7·60	0·91	—	0·90	5·80
3 ,,	73	Female	22·35	—	4·55	—	5·00	9·90	1·05	—	1·15	6·20
3 ,,	74	Female	21·50	—	4·50	4·75	4·85	9·20	1·00	4·95	1·10	6·10
3 ,,	75	Female	21·20	—	4·00	4·20	4·30	8·60	1·05	5·40	1·15	6·00
3 ,,	76	Female	20·20	—	4·10	—	4·40	8·40	1·00	—	1·05	5·90
3 ,,	77	Female	19·70	—	3·85	4·10	4·20	8·10	1·00	5·00	1·05	5·70
3 ,,	78	Male	18·70	—	3·50	4·00	4·15	8·00	0·95	4·50	0·90	5·20
3 ,,	79	Male	20·80	—	4·20	4·35	4·65	8·70	0·95	5·25	1·15	5·90
3 ,,	80	Female	21·50	—	4·00	4·05	4·25	8·60	—	5·40	1·10	6·10
9 ,,	83	Female	20·00	—	3·95	4·35	4·50	8·45	0·95	5·20	1·00	5·90
10 ,,	84	Male	13·55	—	1·85	—	3·35	—	0·95	—	0·90	4·30
12 ,,	86	Male	19·90	—	3·75	4·00	4·10	7·75	0·98	5·00	0·96	5·80
19 ,,	97	Male	19·35	—	3·85	—	4·25	8·05	0·99	—	0·93	5·43
21 ,,	100	Male	19·55	0·25	3·70	3·92	4·15	8·10	0·95	5·00	1·05	5·60
21 ,,	101	Female	21·00	—	4·55	—	5·15	9·80	1·15	5·03	1·10	5·50
23 ,,	105	Female	18·50	—	3·15	3·60	3·55	7·20	0·85	4·90	0·90	5·60
23 ,,	111	Female	22·60	—	4·35	4·78	4·90	9·40	1·16	5·70	1·00	6·30
25 ,,	114	Male	20·20	—	3·70	4·35	4·30	8·30	1·03	—	1·10	5·85
25 ,,	118	Male	18·60	—	3·30	3·74	3·85	7·70	0·92	—	0·93	6·47

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
9·30	9·30	0·60	0·50	—	—	—	—	0·58	5·50	—	—	—	—
8·20	8·20	0·70	0·50	—	1·45	1·85	1·90	0·48	4·58	—	—	—	—
9·50	—	1·50	0·50	1·40	—	—	—	—	—	—	—	—	—
8·80	—	0·50	0·50	1·10	1·65	2·25	—	0·56	5·35	3·15	—	—	—
8·35	8·00	1·55	0·50	1·20	—	—	—	—	5·30	2·20	—	—	—
7·70	7·40	0·50	0·40	0·95	—	1·60	—	0·50	—	—	—	—	—
8·30	—	0·90	0·38	0·90	1·50	2·10	2·11	0·53	—	—	—	—	—
—	—	—	—	—	1·45	—	—	—	—	—	—	—	—
8·70	8·45	1·55	0·50	1·00	1·65	2·10	2·20	0·55	—	—	—	—	—
8·75	8·50	1·50	0·55	1·25	—	—	—	—	—	—	—	—	—
8·65	8·00	1·50	0·52	1·40	1·50	1·80	—	0·45	4·95	2·05	—	—	—
8·55	8·20	1·20	0·60	1·00	1·40	2·00	2·20	0·52	—	—	—	—	—
9·65	—	0·65	0·47	1·00	2·25	2·16	2·18	0·55	5·21	2·43	—	—	—
9·50	9·40	1·30	—	1·20	1·75	—	—	—	—	—	—	—	—
9·50	—	0·65	—	—	1·90	—	—	—	5·45	2·27	—	—	—
9·35	9·30	0·77	0·48	1·30	1·65	—	—	—	—	—	—	—	—
—	7·25	0·59	0·45	1·40	1·50	—	—	—	—	—	—	—	—
9·50	9·60	0·85	0·50	1·50	1·85	2·58	2·67	0·64	5·65	2·47	—	—	—
8·45	8·45	0·50	0·35	0·80	1·55	1·90	2·00	0·43	4·55	1·85	—	—	—
7·20	—	—	—	0·90	1·25	1·60	1·77	0·43	3·45	1·80	—	—	—
—	—	—	—	—	—	—	—	—	4·65	2·10	—	—	—
9·40	9·00	1·70	0·35	3·80	1·70	—	—	—	—	—	—	—	—
10·00	—	0·50	0·50	1·60	2·00	3·00	3·50	0·65	5·90	2·40	—	—	—
—	—	0·60	—	—	2·00	—	—	—	6·40	—	—	—	—
9·10	9·10	1·52	0·52	1·20	1·70	—	—	—	5·00	2·20	—	—	—
10·25	9·90	0·70	0·48	1·20	2·18	—	—	—	—	—	—	—	—
—	—	0·80	0·42	0·95	—	—	—	—	5·50	2·45	—	—	—
9·50	—	1·10	0·42	1·30	1·92	2·40	2·42	0·60	5·75	2·25	—	—	—
9·00	8·52	0·55	0·53	1·08	1·75	2·20	2·28	0·56	4·92	2·16	—	—	—
9·14	8·72	0·47	0·55	0·97	1·20	2·35	2·40	0·53	5·20	2·20	—	—	—
—	8·70	0·55	0·48	1·00	—	—	—	—	—	—	—	—	—
9·65	9·30	0·60	0·60	1·15	1·80	—	—	—	5·70	2·30	—	—	2·40
9·30	8·90	0·60	0·50	1·25	1·75	—	—	—	—	—	—	—	2·35
9·30	—	0·55	—	—	1·65	2·20	2·35	0·55	5·23	2·16	—	—	—
8·85	—	0·95	—	—	1·40	2·27	2·33	0·55	—	—	—	—	—
8·95	8·60	1·50	0·62	1·30	1·40	2·20	2·25	0·53	5·30	2·16	—	—	—
8·90	8·40	0·35	0·53	0·95	1·40	2·15	2·17	0·52	4·90	2·00	—	—	1·87
9·95	9·20	0·60	—	1·20	1·50	—	—	0·60	—	—	—	—	3·00
—	—	—	—	—	—	—	—	—	5·80	2·40	—	—	—
9·60	—	1·05	—	—	1·70	—	—	—	5·50	2·65	—	—	—
—	—	—	0·50	1·05	1·50	2·30	3·60	0·61	—	—	—	—	2·25
9·00	—	0·50	—	—	1·50	—	—	—	4·60	1·85	—	—	—
9·60	—	0·50	—	—	1·80	2·60	2·70	0·68	6·00	2·30	—	—	—
10·00	9·50	0·60	0·49	0·92	1·90	2·28	3·05	0·62	5·85	2·30	—	—	1·75
9·65	9·20	0·65	0·55	1·20	1·80	—	—	—	—	—	—	—	1·75
8·90	—	0·35	—	—	1·40	2·00	—	0·60	5·40	2·16	—	—	—
8·85	8·70	0·40	0·68	1·10	1·50	2·00	2·05	0·53	5·20	2·15	—	—	1·80
8·55	8·00	0·67	0·50	1·00	1·70	—	—	—	5·00	2·30	—	—	1·90
9·35	9·00	1·40	0·50	1·15	1·80	2·15	2·20	0·57	5·50	2·30	—	—	2·30
9·80	—	0·50	0·50	1·10	1·60	2·40	2·42	0·50	5·20	2·20	—	—	2·15
9·20	8·75	0·50	0·55	1·10	1·85	2·25	2·30	0·55	5·50	2·05	—	—	2·05
6·95	—	0·85	—	—	—	1·40	1·50	0·45	3·00	1·22	—	—	—
9·10	9·00	1·30	0·55	1·10	2·15	2·10	2·18	0·51	5·60	2·00	—	—	2·00
8·65	—	1·20	—	1·00	1·60	2·25	2·29	0·51	5·25	2·05	—	—	—
9·00	—	1·00	0·55	1·08	1·45	2·10	2·15	—	4·92	2·30	—	—	—
9·10	8·90	0·70	0·46	1·00	2·10	2·60	2·70	0·67	6·15	2·60	—	—	1·80
8·85	8·40	0·60	0·46	0·80	1·70	—	—	—	—	—	—	—	1·70
9·90	9·30	0·50	0·53	1·20	1·70	2·50	2·56	0·68	5·90	2·60	—	—	2·20
9·10	—	0·95	—	1·50	—	—	—	—	5·45	2·05	—	—	—
8·50	—	0·90	—	—	1·50	2·05	2·07	0·51	4·68	2·10	—	—	—

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1925												
25 Mar.	119	Male	20·40	—	3·85	—	4·20	8·90	—	—	1·10	5·90
26 ,,	120	Female	22·40	—	3·98	—	4·38	8·75	—	—	1·07	6·40
26 ,,	121	Male	19·95	—	3·65	3·95	4·05	8·22	1·00	5·08	1·10	5·85
27 ,,	127	Female	17·90	—	3·15	3·60	3·70	7·40	0·90	—	0·95	5·40
28 ,,	130	Male	20·40	—	4·00	—	4·54	8·70	—	4·95	1·24	5·70
28 ,,	133	Male	16·75	—	3·10	3·35	3·43	7·00	0·85	4·40	0·85	5·00
28 ,,	134	Female	18·65	—	3·70	4·03	4·05	7·90	0·91	4·80	1·00	5·70
30 ,,	137	Female	18·15	—	3·55	3·85	3·90	7·50	—	4·50	0·95	5·05
30 ,,	138	Female	16·00	—	2·75	3·08	3·20	6·25	0·82	4·20	0·90	4·60
30 ,,	139	Female	18·50	—	—	3·65	3·75	7·80	—	—	0·92	5·40
30 ,,	140	Male	19·15	0·29	3·46	—	3·90	7·80	0·85	—	1·00	5·40
30 ,,	144	Male	18·96	—	3·60	3·78	3·96	7·95	—	4·65	0·98	5·40
31 ,,	152	Male	20·30	—	3·90	4·38	4·42	8·50	1·00	5·10	1·08	5·88
1 April	155	Female	19·65	—	3·68	3·98	4·05	8·00	0·95	4·80	1·00	5·50
2 ,,	158	Female	20·65	—	3·80	4·09	4·30	8·30	1·02	5·00	0·96	5·70
2 ,,	159	Female	19·90	—	3·90	4·22	4·25	8·05	1·00	—	1·10	5·32
2 ,,	161	Female	21·70	—	4·20	—	4·55	8·90	—	5·17	1·13	5·93
2 ,,	162	Male	21·70	—	4·65	4·72	4·95	9·38	1·07	5·20	1·01	5·75
2 ,,	163	Female	17·40	—	2·70	3·37	3·37	6·50	0·87	4·48	0·90	5·10
3 ,,	164	Female	22·35	—	4·50	4·90	5·00	9·55	1·11	—	1·10	6·20
3 ,,	165	Male	17·10	—	3·00	3·13	3·20	6·50	0·82	4·55	0·90	5·25
3 ,,	166	Female	23·00	—	4·60	—	5·00	9·90	1·18	—	1·18	6·20
3 ,,	168	Female	21·82	—	4·20	4·40	4·57	8·90	1·08	5·45	1·05	6·18
3 ,,	169	Male	20·10	—	3·90	3·95	4·20	8·40	1·20	4·78	1·00	5·65
6 ,,	173	Female	22·33	—	—	4·70	4·80	—	—	—	—	—
6 ,,	174	Female	20·15	—	3·94	4·35	4·42	8·73	0·95	—	1·04	6·75
6 ,,	175	Female	23·25	—	4·90	5·00	5·17	9·90	1·12	5·70	1·13	6·50
6 ,,	176	Male	18·60	—	3·40	3·79	3·88	7·75	0·96	—	0·95	5·40
11 ,,	177	Male	19·10	—	3·30	3·65	3·75	7·64	—	—	1·00	5·60
11 ,,	178	Female	22·85	—	4·45	4·90	5·05	9·45	1·00	5·20	1·05	6·10
11 ,,	179	Female	22·45	—	4·20	4·43	4·64	9·28	1·10	5·65	1·07	6·45
11 ,,	180	Male	17·10	—	2·90	—	3·30	6·95	—	—	0·90	4·85
11 ,,	181	Female	22·60	—	4·44	—	4·93	9·85	1·15	5·35	1·03	6·38
13 ,,	183	Female	22·50	—	5·00	—	5·35	—	1·20	5·30	1·15	5·80
13 ,,	185	Female	21·00	—	4·30	4·45	4·70	9·40	1·02	5·10	1·06	5·76
13 ,,	186	Female	21·70	—	4·00	4·23	4·50	9·10	—	—	1·07	6·10
13 ,,	187	Female	18·00	—	3·15	—	3·53	7·05	—	—	0·94	5·30
14 ,,	188	Male	19·75	—	3·40	3·80	3·87	8·00	0·89	—	0·98	5·70
14 ,,	189	Male	21·20	—	4·10	—	4·69	8·73	1·00	4·80	1·07	5·55
14 ,,	190	Female	22·00	—	3·90	4·17	4·30	8·65	1·05	5·65	1·17	6·50
14 ,,	192	Female	18·60	—	3·50	3·73	3·85	7·75	—	—	0·90	5·55
14 ,,	193	Female	21·70	—	4·44	4·55	4·65	9·23	—	5·35	1·02	6·05
15 ,,	194	Male	19·17	—	—	—	4·20	—	—	—	1·00	—
15 ,,	195	Female	16·70	—	2·90	3·18	3·26	6·65	0·81	—	0·80	5·00
15 ,,	196	Male	18·90	—	3·64	3·80	3·94	8·00	—	4·50	0·98	5·30
15 ,,	197	Male	16·75	—	—	3·10	3·05	6·55	—	—	0·95	4·75
15 ,,	198	Female	22·60	—	4·70	4·90	5·10	9·60	1·07	5·25	1·16	6·35
17 ,,	200	Female	24·15	—	4·50	5·02	5·02	10·25	—	—	1·10	6·75
18 ,,	201	Female	22·70	—	4·44	4·80	4·85	9·60	—	—	1·15	6·30
18 ,,	203	Female	19·25	0·21	3·70	—	4·20	8·23	—	—	0·90	5·25
20 ,,	206	Male	20·30	—	3·80	4·20	4·27	8·35	0·90	—	1·02	5·80
20 ,,	207	Male	20·30	—	4·10	4·47	4·46	9·00	1·03	4·68	0·98	5·46
20 ,,	208	Female	20·02	—	—	—	—	7·97	—	—	1·01	5·70
20 ,,	210	Male	21·70	—	4·15	4·15	4·45	9·05	1·06	5·16	1·10	6·14
21 ,,	213	Male	20·55	—	4·20	—	4·66	8·83	1·03	4·65	1·00	5·80
21 ,,	214	Female	20·70	—	3·65	3·95	4·15	8·15	—	—	1·04	5·67
25 ,,	217	Female	21·40	—	4·50	—	5·00	9·45	1·10	—	1·06	5·90
27 ,,	218	Male	21·10	—	4·07	4·05	4·36	9·10	1·08	—	1·10	6·13
27 ,,	219	Female	21·50	—	4·30	—	4·84	9·25	0·98	5·25	1·00	5·95
30 ,,	222	Female	18·20	—	3·30	3·59	3·73	7·49	0·89	4·57	0·91	5·40

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
9·30	—	1·05	0·50	1·20	1·80	2·45	2·47	0·62	5·25	2·36	—	—	—
10·25	—	0·65	0·55	0·95	1·70	2·16	2·18	0·60	5·33	2·12	—	—	—
9·55	9·05	1·60	0·54	1·40	—	2·40	2·45	0·61	5·05	2·07	—	—	2·10
8·55	—	0·45	—	1·00	1·75	—	—	—	4·48	1·90	—	—	—
9·30	8·80	1·10	0·50	1·00	1·90	—	—	—	5·40	2·45	—	—	—
8·00	7·60	1·20	0·42	1·02	1·50	—	—	—	4·25	1·70	—	—	1·70
8·90	8·45	0·50	0·45	1·00	1·80	—	—	—	—	—	—	—	1·90
8·30	8·15	0·65	0·45	1·15	1·27	—	—	—	4·79	1·86	—	—	1·90
7·63	7·45	0·53	0·40	1·10	—	—	—	—	—	—	—	—	1·65
—	—	0·40	—	—	1·53	—	—	—	4·72	1·98	—	—	—
8·30	—	0·80	—	—	1·65	—	—	—	4·71	1·98	—	—	—
8·64	8·56	1·45	—	1·00	1·67	—	—	—	4·76	—	—	—	1·96
9·00	8·70	1·42	0·45	1·18	1·40	—	—	—	—	—	—	—	1·85
8·15	8·10	0·50	0·49	1·10	1·50	2·05	2·10	0·47	—	—	—	—	1·75
9·70	9·00	0·62	0·58	0·92	1·55	—	—	—	5·15	2·20	—	—	1·85
8·77	—	0·48	0·44	0·85	1·85	—	—	—	5·25	2·20	—	—	—
9·75	9·25	0·70	0·44	0·85	1·70	—	—	—	—	—	—	—	2·35
9·60	9·10	1·55	0·60	1·30	2·18	—	—	—	6·00	2·55	—	—	—
8·10	7·90	0·40	0·46	0·90	1·30	—	—	—	—	—	—	—	1·75
9·70	—	0·50	—	—	1·85	2·50	2·55	0·59	6·10	2·35	—	—	—
8·32	8·12	1·15	0·42	0·80	1·30	—	—	—	4·00	1·90	—	—	1·75
9·90	—	0·60	—	—	1·90	—	—	—	6·22	2·50	—	—	—
10·05	9·50	0·52	0·54	1·10	1·70	2·30	2·40	0·60	5·50	2·20	—	—	—
9·15	8·75	1·45	0·44	1·00	1·70	—	—	—	5·05	2·35	—	—	2·10
—	—	—	—	—	—	—	—	—	5·50	2·30	—	—	—
9·00	—	0·45	—	—	1·70	2·40	2·45	0·58	5·35	2·14	—	—	—
10·64	10·30	0·70	0·46	1·09	2·10	—	—	—	6·20	—	—	—	2·40
8·30	—	0·75	—	1·20	1·55	—	—	0·54	—	—	—	—	—
—	—	0·90	—	—	1·54	—	—	—	4·50	—	—	—	—
9·85	9·50	0·55	0·49	1·20	1·75	—	—	—	6·00	2·60	—	—	2·11
10·50	10·00	0·55	0·56	1·00	1·85	—	—	—	—	—	—	—	2·10
7·80	—	0·85	—	—	1·45	2·00	2·05	0·40	4·10	1·90	—	2·19	—
10·05	9·55	0·62	0·55	0·90	2·20	2·58	2·63	0·58	6·10	2·34	—	—	2·10
9·43	9·30	0·50	0·60	1·40	—	—	—	—	—	—	—	—	2·35
—	8·45	0·66	0·46	0·90	1·95	2·20	2·23	0·55	5·74	3·10	—	2·45	2·05
9·70	—	0·40	—	—	1·70	—	—	—	—	—	—	—	—
8·27	—	0·42	—	—	1·35	—	—	—	—	—	—	—	—
8·90	—	0·90	0·54	1·00	1·67	2·00	2·05	0·50	4·80	1·80	—	—	—
9·30	9·15	1·20	0·44	1·20	1·40	—	—	—	5·53	2·47	—	—	2·08
10·10	10·10	0·65	0·50	1·20	1·85	—	—	—	—	—	—	—	2·15
8·60	—	0·50	—	—	1·60	2·05	2·15	0·47	4·78	1·90	—	—	—
9·60	9·30	0·60	0·50	1·40	1·70	2·35	2·46	0·56	—	—	—	—	1·99
—	—	—	—	—	—	—	—	—	5·07	2·20	—	—	—
7·60	—	0·35	—	—	1·35	—	—	—	4·06	1·70	—	—	—
8·45	8·20	1·40	0·48	1·00	1·50	—	—	—	—	—	—	—	1·92
—	—	0·72	—	—	1·25	1·70	1·73	0·45	3·60	1·67	—	—	—
10·30	9·50	0·65	0·47	1·24	1·95	—	—	—	6·10	2·47	—	—	2·20
10·40	—	0·41	—	—	1·95	2·58	2·63	0·63	6·09	2·49	—	—	—
10·10	—	0·55	—	—	1·83	2·40	2·47	—	6·93	3·30	—	—	—
8·43	—	0·50	—	—	—	—	—	—	5·60	2·16	—	—	—
9·40	—	1·07	—	—	1·55	—	—	—	5·14	2·07	—	—	—
8·90	8·60	1·60	0·45	1·33	1·87	2·45	2·50	—	—	—	—	—	2·00
9·10	—	0·50	—	—	—	—	—	—	5·02	2·17	—	—	—
10·10	9·50	1·56	0·35	0·85	1·95	—	—	—	—	—	—	—	2·22
9·30	8·99	1·55	0·63	1·40	1·65	—	—	—	5·60	2·29	—	—	2·00
9·40	—	0·55	—	—	1·40	—	—	—	5·16	2·02	—	—	—
9·20	—	0·55	—	1·15	1·94	2·45	2·50	0·65	6·00	2·52	—	—	—
9·58	—	1·00	—	—	1·70	—	—	—	5·32	2·36	—	—	—
9·30	8·68	0·57	0·56	1·15	1·65	—	—	—	—	—	—	—	2·10
8·50	8·21	0·70	0·47	1·15	1·68	—	—	—	—	—	—	—	1·89

Date	Whale Number	Sex	1 Total length, top of snout to notch of flukes	2 Lower jaw, projection beyond tip of snout	3 Tip of snout to blow-hole	4 Tip of snout to angle of gape	5 Tip of snout to centre of eye	6 Tip of snout to tip of flipper	7 Eye to ear, centres	8 Notch of flukes to posterior emargination of dorsal fin	9 Flukes, width at insertion	10 Notch of flukes to anus
1925												
30 April	223	Male	19·80	—	3·63	3·90	4·07	7·95	0·93	5·00	0·98	5·85
1 May	225	Male	18·15	—	3·68	—	4·03	8·04	0·90	—	0·86	5·15
1 ,,	227	Female	19·73	—	3·53	4·15	4·15	8·25	—	5·04	0·98	5·65
1 ,,	228	Male	19·20	—	3·90	—	4·22	8·20	0·98	4·50	0·95	5·40
1 ,,	229	Female	15·40	—	2·65	2·95	2·95	6·10	—	—	0·82	5·00
4 ,,	230	Female	20·20	—	3·65	4·06	4·08	7·80	0·96	—	1·03	6·00
4 ,,	231	Male	21·25	—	4·36	—	4·37	8·79	1·03	5·25	1·00	6·00
4 ,,	233	Male	18·55	—	3·30	3·50	3·40	7·47	0·85	—	0·96	5·76
8 ,,	236	Female	21·70	—	—	4·74	4·80	—	1·02	—	1·20	6·10
8 ,,	237	Male	20·00	—	3·95	—	4·40	8·20	1·10	4·90	1·00	5·67
8 ,,	238	Female	21·70	—	4·10	—	4·63	8·90	—	5·70	1·15	6·50
21 Oct.	246	Male	19·25	—	3·95	4·00	4·35	8·15	0·94	4·70	0·90	5·10
21 ,,	247	Female	19·30	—	—	—	4·20	—	—	—	1·00	5·60
26 ,,	251	Male	20·90	—	4·00	4·27	4·50	8·60	1·03	5·30	1·05	5·65
27 ,,	252	Male	19·60	—	3·50	—	4·08	8·00	1·05	4·87	0·95	5·44
27 ,,	255	Male	21·77	—	3·80	4·13	4·30	8·90	1·00	5·57	1·10	6·17
29 ,,	257	Female	22·57	—	4·67	4·96	5·12	9·60	1·08	5·37	1·10	6·25
2 Nov.	260	Female	21·30	—	4·15	—	4·60	8·75	1·00	5·33	1·10	6·00
3 ,,	262	Female	22·40	—	4·80	4·97	5·20	9·90	1·08	5·40	1·10	6·20
4 ,,	263	Female	24·00	—	4·80	5·28	5·40	10·37	1·17	5·48	1·08	6·90
5 ,,	264	Female	21·05	—	3·90	—	4·50	8·70	1·10	5·10	1·05	5·85
6 ,,	266	Male	20·55	—	4·00	4·30	4·40	8·80	1·05	4·65	1·07	5·85
7 ,,	268	Male	20·00	—	3·70	3·95	4·20	8·60	0·95	5·05	1·10	5·60
7 ,,	269	Male	20·30	—	4·00	4·10	4·40	—	1·02	4·55	1·00	5·45
11 ,,	273	Female	22·10	—	4·30	4·65	4·90	8·65	—	5·20	1·15	6·00
17 ,,	276	Female	22·45	—	4·30	4·70	4·80	9·25	1·05	5·55	1·05	6·30
18 ,,	277	Male	20·20	—	4·08	4·36	4·50	8·70	0·98	4·72	0·86	5·35
18 ,,	278	Female	21·85	—	3·85	—	4·50	8·80	1·00	—	1·13	6·15
24 ,,	279	Male	20·60	—	4·00	4·30	4·48	8·90	1·02	4·80	1·00	5·70
26 ,,	280	Female	22·15	—	—	—	4·65	—	—	—	1·10	6·30
27 ,,	281	Female	21·75	—	4·05	4·30	4·40	8·80	1·06	4·15	1·05	6·20
10 Dec.	283	Male	20·90	—	3·90	4·33	4·45	8·90	0·98	—	1·10	6·00
14 ,,	285	Female	22·90	—	4·60	4·85	5·15	10·17	1·18	5·40	1·08	6·10
14 ,,	286	Female	22·20	—	4·45	—	4·85	9·40	1·14	5·10	1·17	6·20
14 ,,	287	Female	20·30	—	4·25	—	4·60	8·70	0·95	4·95	1·00	5·60
14 ,,	288	Female	21·40	—	4·00	—	4·68	9·05	1·12	—	1·14	6·10
15 ,,	289	Female	22·15	—	4·25	4·45	4·70	9·25	1·03	—	1·10	6·20
15 ,,	290	Female	23·95	—	4·80	5·00	5·27	10·25	1·15	5·45	—	6·50
16 ,,	292	Female	20·90	—	4·10	4·50	4·65	8·25	0·90	5·15	1·06	5·80
17 ,,	293	Female	22·65	—	4·62	4·90	4·95	9·65	1·13	5·80	1·10	6·35
17 ,,	294	Male	20·65	—	4·00	4·40	4·52	9·00	1·03	4·88	1·08	5·65
17 ,,	295	Male	20·60	—	4·25	4·30	4·48	8·80	1·00	4·70	1·04	5·60
17 ,,	296	Female	21·50	—	4·30	4·60	4·70	9·20	1·03	5·40	1·12	6·00
1926												
8 Jan.	297	Male	21·10	—	4·20	—	4·55	9·20	—	—	1·00	6·15
8 ,,	298	Male	18·75	—	3·26	3·55	3·70	7·50	0·93	4·50	1·00	5·50
8 ,,	299	Male	21·30	—	3·80	—	4·37	8·70	1·10	5·10	1·07	6·00
8 ,,	300	Female	21·60	—	4·20	—	4·78	9·56	1·00	4·86	1·20	5·95
8 ,,	301	Male	19·20	—	3·65	3·66	3·95	7·65	0·94	4·65	1·00	5·50
8 ,,	303	Male	20·85	—	4·00	—	4·40	8·80	—	5·04	1·05	6·00
8 ,,	304	Female	22·80	—	4·75	4·72	5·00	9·70	1·12	5·48	1·10	6·40
8 ,,	305	Male	20·00	—	3·88	—	4·18	8·35	—	4·60	0·93	5·25
8 ,,	306	Male	20·70	—	4·10	4·20	4·48	9·25	1·00	5·15	1·12	5·90
8 ,,	307	Male	19·20	—	3·40	3·65	3·90	7·67	0·92	4·70	0·95	5·50
8 ,,	308	Male	21·70	—	4·30	4·35	4·60	9·00	1·14	5·62	1·07	6·10
9 ,,	309	Female	21·70	—	4·34	—	4·80	8·94	1·08	—	1·15	6·10
9 ,,	310	Male	20·50	—	4·10	—	4·50	8·90	1·07	5·35	1·00	5·60
9 ,,	311	Male	20·40	—	4·20	4·20	4·60	8·85	1·08	5·90	1·02	5·66
9 ,,	312	Male	19·00	—	3·70	4·13	4·20	8·10	—	—	0·95	5·55

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
9·47	9·10	1·58	—	1·00	1·50	—	—	—	4·88	—	—	—	1·70
7·95	—	0·85	—	—	1·74	—	—	—	4·86	2·20	—	—	—
9·05	8·68	0·48	0·50	1·13	1·55	—	—	—	5·16	2·18	—	—	—
8·60	8·20	1·30	0·53	1·25	1·90	—	—	—	—	—	—	—	2·12
7·40	—	0·23	—	—	1·33	1·62	1·70	0·50	—	—	—	—	—
9·33	—	0·53	—	—	1·32	—	—	—	4·93	2·20	—	—	—
9·16	8·80	1·50	0·60	1·25	1·74	2·00	2·07	0·62	5·47	2·32	—	—	2·38
9·00	—	0·82	—	—	1·56	1·95	1·98	0·46	4·45	—	—	—	—
9·45	—	0·53	—	—	—	—	—	—	—	—	—	—	—
9·07	9·10	1·43	0·59	1·45	1·85	—	—	—	—	—	—	—	2·27
10·15	9·70	0·60	0·60	1·30	1·90	—	—	—	—	—	—	—	2·30
8·50	7·90	1·40	—	1·80	1·55	2·30	2·36	0·58	—	—	—	—	1·75
8·60	—	0·40	—	—	1·80	—	—	—	5·00	2·20	—	—	—
9·25	8·70	1·43	0·62	1·10	1·70	—	—	—	—	—	—	—	1·77
8·87	8·60	1·34	0·48	1·45	1·50	2·06	2·08	0·55	4·90	2·06	—	—	2·00
10·00	9·10	1·57	0·47	1·00	1·80	2·60	2·63	0·64	—	—	—	—	—
9·70	—	0·59	0·42	1·05	1·73	2·67	2·78	0·66	6·10	2·42	—	—	—
9·60	9·30	0·70	0·48	1·20	1·50	2·30	2·30	0·58	5·50	2·30	—	—	2·20
—	9·40	0·65	0·60	1·70	1·90	2·60	2·70	0·72	6·26	2·58	—	—	1·90
10·90	10·30	0·70	0·47	1·20	1·93	2·82	2·87	0·63	6·50	2·57	—	—	2·15
9·60	9·20	0·60	0·52	1·40	1·90	2·20	2·27	—	5·40	2·29	—	—	1·95
9·15	8·80	1·61	0·52	1·20	1·80	2·30	2·35	0·58	5·45	2·21	—	—	1·70
9·20	8·70	1·40	0·65	1·40	1·95	2·50	2·60	—	5·10	2·29	—	—	1·70
8·80	—	1·35	0·55	1·50	—	—	—	—	—	—	—	—	1·70
9·65	—	0·50	0·45	1·10	—	2·48	2·58	0·60	5·90	2·32	—	—	—
10·35	9·90	0·75	0·38	1·20	1·80	—	—	—	5·90	2·43	—	2·75	1·90
—	8·55	1·65	0·50	1·08	1·73	2·30	2·38	—	—	—	—	—	1·75
9·60	—	0·60	—	—	1·65	2·37	2·39	0·60	—	—	—	—	—
9·20	9·05	1·60	0·50	1·40	1·75	2·30	2·32	0·52	5·43	2·20	—	—	1·83
—	—	0·55	—	1·10	—	—	—	—	5·70	2·50	—	—	—
9·80	—	0·60	0·45	1·10	1·50	2·26	2·33	0·58	5·40	2·22	—	—	—
9·50	—	1·15	—	—	1·82	2·45	2·57	0·60	5·45	2·31	—	—	—
10·00	9·60	0·65	0·50	1·10	2·10	2·75	2·80	0·67	6·10	2·50	—	—	1·50
10·30	9·90	0·60	0·55	1·68	1·80	2·75	2·80	0·67	5·90	2·35	—	—	2·10
9·00	8·70	0·60	0·52	1·35	1·65	—	—	—	5·55	—	—	—	2·15
9·80	—	0·65	0·40	1·10	1·85	—	—	0·65	5·55	2·56	—	—	—
10·00	—	0·55	—	—	1·85	2·60	2·70	0·61	5·75	2·34	—	—	—
10·15	10·10	0·75	0·65	1·80	2·10	2·65	2·68	0·65	6·30	2·75	—	—	2·05
9·50	9·00	0·65	0·58	1·30	1·77	2·38	—	0·55	—	—	—	—	2·00
10·08	9·40	0·70	0·53	1·60	1·90	2·55	2·65	0·64	—	—	—	—	1·70
9·40	9·05	1·60	0·56	1·22	2·00	2·52	2·58	0·60	—	—	—	—	1·67
9·50	9·20	1·47	0·59	1·33	1·70	2·43	2·44	0·57	5·40	2·26	—	—	1·76
9·40	9·30	0·60	0·65	1·35	1·80	2·33	2·45	0·61	—	—	—	—	1·70
9·65	—	0·85	—	—	1·90	2·27	2·32	0·60	5·45	2·08	—	—	—
8·50	8·30	1·30	0·52	1·20	1·35	2·10	2·17	0·54	4·55	2·10	—	—	1·75
9·90	9·55	1·45	0·53	1·10	1·75	—	—	—	5·35	2·20	—	—	2·15
—	—	0·60	0·38	1·20	2·05	2·58	2·70	0·58	5·60	2·42	—	—	—
8·80	8·55	1·50	0·38	1·10	1·40	2·10	2·13	0·55	4·70	2·09	—	—	1·70
9·60	9·40	1·40	0·47	1·20	1·85	2·40	2·41	0·60	5·22	2·30	—	—	1·80
10·40	10·25	0·70	0·44	1·15	2·00	2·55	2·75	0·65	6·00	2·56	—	—	1·95
8·95	8·80	1·50	0·54	1·00	1·86	2·17	2·20	0·60	5·15	2·15	—	—	1·90
9·15	9·15	1·35	0·53	0·90	—	2·40	2·43	0·59	5·35	2·32	—	—	2·00
8·75	8·50	1·50	0·44	1·00	1·56	2·20	2·25	0·55	4·65	2·20	—	—	1·80
9·95	9·65	1·70	0·52	0·85	1·75	2·45	—	0·62	—	—	—	—	1·80
9·70	—	0·70	—	—	1·70	2·32	—	0·60	5·85	—	—	—	—
8·90	8·55	1·55	0·54	1·30	1·80	—	—	—	5·54	—	—	—	1·95
9·32	8·80	1·42	0·53	1·13	1·70	—	—	—	—	—	—	—	—
8·90	—	1·05	—	—	1·80	2·17	2·23	0·57	4·80	2·24	—	—	—

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1926												
9 Jan.	313	Male	21·70	—	4·50	—	4·80	9·40	1·14	5·15	1·10	5·90
9 ,,	314	Male	21·15	—	3·85	4·02	4·35	8·70	1·06	5·50	1·00	6·10
9 ,,	315	Female	17·40	—	3·22	3·45	3·55	7·20	0·88	—	0·90	5·45
9 ,,	316	Female	22·35	—	4·30	4·40	4·70	9·50	1·05	—	1·05	6·45
9 ,,	318	Female	21·95	—	4·30	4·47	4·80	9·60	1·05	5·55	1·15	6·30
10 ,,	319	Male	20·70	—	4·50	—	4·60	8·60	1·00	—	1·05	5·90
10 ,,	320	Male	21·75	—	4·40	—	4·67	9·28	1·14	5·40	1·06	6·10
10 ,,	322	Male	21·60	—	4·20	—	4·70	9·10	1·18	5·27	1·04	6·20
10 ,,	323	Male	21·45	—	4·10	4·34	4·53	8·95	1·05	—	1·17	6·15
10 ,,	324	Male	19·50	—	3·80	—	4·40	8·50	1·02	4·75	0·90	5·20
10 ,,	325	Male	21·10	—	4·40	—	4·71	9·20	1·07	5·10	1·12	5·80
10 ,,	326	Male	20·40	—	3·88	—	4·30	8·30	1·10	—	1·00	5·62
10 ,,	327	Male	20·90	—	4·25	—	4·51	9·00	1·14	4·95	1·02	5·46
10 ,,	328	Male	21·10	—	4·10	4·17	4·40	—	1·10	5·00	1·10	5·90
10 ,,	329	Male	21·00	—	3·95	4·12	4·38	8·45	1·03	5·34	0·95	5·95
10 ,,	330	Male	21·80	—	4·17	4·32	4·65	9·25	1·12	5·27	1·05	6·15
11 ,,	331	Female	21·80	—	4·45	—	4·87	9·40	1·12	—	1·05	6·10
11 ,,	332	Female	22·35	—	4·59	4·83	4·98	9·42	1·00	5·55	1·05	5·15
11 ,,	333	Male	20·50	—	4·04	4·20	4·40	8·58	1·00	5·00	1·02	5·85
11 ,,	334	Male	21·70	—	4·15	—	4·57	9·30	—	—	1·12	6·15
11 ,,	335	Female	22·70	—	4·50	—	4·70	—	1·13	5·55	1·14	6·35
11 ,,	336	Male	20·83	—	4·15	4·28	4·45	—	1·05	5·25	1·18	5·50
11 ,,	337	Male	21·20	—	4·30	4·50	4·65	8·80	0·98	5·30	1·06	6·25
11 ,,	338	Male	19·50	—	3·70	3·98	4·10	8·45	1·00	4·95	1·00	5·55
12 ,,	339	Male	20·47	—	4·10	4·28	4·45	8·75	1·17	5·00	1·08	5·65
12 ,,	341	Male	21·20	—	3·90	4·15	4·30	8·30	1·04	5·15	1·03	5·40
12 ,,	342	Female	23·00	—	4·37	4·55	4·80	—	—	5·47	1·10	6·30
12 ,,	343	Female	23·00	—	4·60	4·95	5·00	9·80	1·04	5·45	1·05	6·30
12 ,,	344	Male	20·65	—	4·00	4·12	4·45	8·68	0·98	4·65	1·00	5·75
13 ,,	347	Male	21·75	—	3·98	4·20	4·48	8·65	1·09	5·30	0·97	5·85
13 ,,	348	Male	20·90	—	3·90	4·00	4·18	8·20	1·05	—	1·15	6·30
13 ,,	349	Male	19·25	—	3·75	3·88	4·18	8·30	0·95	4·80	1·00	5·40
13 ,,	350	Female	23·80	—	4·74	4·93	5·20	10·20	1·15	5·85	1·14	6·90
13 ,,	351	Male	21·50	—	4·50	4·50	4·70	9·40	1·18	5·28	1·12	6·25
13 ,,	352	Female	20·50	—	4·06	4·35	4·56	8·77	1·00	5·14	1·09	6·03
13 ,,	353	Male	20·75	—	4·46	4·50	4·77	—	1·07	5·02	0·95	5·65
13 ,,	354	Male	20·34	—	3·85	4·06	4·39	8·60	0·97	4·97	1·10	5·75
13 ,,	356	Male	22·65	—	4·42	—	4·80	9·67	1·16	5·35	1·07	6·40
15 ,,	357	Female	21·43	—	4·35	4·53	4·70	9·00	1·11	5·00	1·12	6·00
15 ,,	358	Female	23·60	—	4·87	5·28	5·32	10·17	1·20	5·70	1·15	6·30
15 ,,	359	Female	21·20	—	4·10	4·50	4·60	8·80	1·05	5·00	1·05	6·00
18 ,,	362	Male	20·85	—	4·25	4·63	4·75	8·90	1·02	—	1·02	5·75
18 ,,	363	Female	21·90	—	4·40	4·45	4·70	9·20	1·15	5·38	1·08	6·30
18 ,,	364	Female	20·00	—	3·92	4·20	4·25	9·00	1·05	5·04	0·98	5·75
18 ,,	365	Male	19·60	—	3·95	4·10	4·45	8·10	0·95	5·00	1·00	5·55
18 ,,	366	Male	20·30	—	3·90	4·40	4·58	9·00	0·98	4·85	1·15	5·85
18 ,,	367	Male	21·35	—	4·20	—	4·74	8·90	1·05	5·15	1·06	5·90
18 ,,	368	Male	20·70	—	3·90	4·25	4·43	8·50	1·03	5·08	1·03	5·82
18 ,,	369	Female	23·10	—	4·65	—	5·26	9·80	1·15	5·68	1·04	6·60
18 ,,	370	Male	21·15	—	4·15	4·48	4·60	9·07	0·95	4·80	1·07	5·90
18 ,,	371	Male	20·20	—	3·75	3·85	4·14	8·48	1·01	4·95	1·00	5·72
18 ,,	372	Male	21·10	—	4·05	4·37	4·63	7·90	1·00	5·20	0·95	5·75
19 ,,	374	Male	20·32	—	4·20	4·40	4·52	8·54	1·04	—	1·10	5·80
19 ,,	375	Male	20·30	—	4·00	4·24	4·40	8·55	0·96	5·00	1·00	5·65
19 ,,	376	Female	22·55	—	4·36	4·52	4·73	9·45	1·05	5·54	1·08	6·20
19 ,,	377	Female	19·60	—	3·80	4·00	4·15	8·15	0·99	4·60	1·03	5·80
20 ,,	380	Male	18·70	—	3·70	3·92	4·10	7·75	0·88	4·60	0·96	5·36
20 ,,	381	Female	22·70	—	—	—	4·92	—	—	5·67	1·10	6·30
20 ,,	382	Male	20·60	—	4·05	—	4·42	8·70	1·02	—	1·08	5·70
20 ,,	384	Male	21·30	—	4·20	4·38	4·70	9·10	0·98	5·10	0·99	6·05

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
9·80	9·30	1·50	0·50	1·30	1·90	2·45	2·47	0·60	5·90	2·35	—	—	2·00
9·80	9·55	1·60	0·56	1·10	1·80	—	—	—	—	—	—	—	1·80
8·25	—	0·45	—	—	1·40	1·95	2·00	0·50	4·30	1·85	—	—	—
10·35	9·75	0·50	—	—	1·85	—	—	—	5·70	—	—	—	—
—	—	0·60	0·50	1·30	1·95	—	—	—	—	—	—	—	—
9·20	—	1·15	—	—	1·55	2·30	2·36	0·58	5·36	2·31	—	—	—
9·70	9·35	1·60	0·45	1·50	2·00	2·40	2·42	0·64	—	—	—	—	2·00
9·90	9·65	1·70	0·75	1·55	1·85	2·60	2·67	0·62	5·75	2·38	—	—	2·10
9·85	—	1·05	—	—	1·60	—	—	—	5·10	2·26	—	—	—
8·65	8·40	1·40	0·47	1·20	1·70	2·30	2·33	0·56	5·60	—	—	—	2·05
9·40	9·00	1·50	0·54	1·50	1·80	2·40	2·41	0·58	5·70	—	—	—	1·85
—	—	1·13	0·42	1·00	1·60	2·30	2·32	0·60	5·20	2·18	—	—	—
9·20	8·70	1·64	0·62	1·15	1·75	2·30	2·37	0·60	5·27	2·26	—	—	1·95
9·50	9·15	1·40	0·50	1·20	1·70	2·42	2·49	0·61	5·35	2·36	—	—	1·90
9·60	9·30	1·55	—	0·70	1·65	2·27	2·37	0·59	5·40	2·21	—	—	1·85
9·75	9·45	1·60	0·58	1·15	1·90	—	—	—	—	—	—	—	1·70
9·80	—	0·65	—	—	—	—	—	—	5·80	—	—	—	—
10·27	9·78	0·68	0·53	1·25	1·82	—	—	—	—	—	—	—	2·10
9·50	9·30	1·47	0·58	1·50	1·80	—	—	—	—	—	—	—	1·95
9·70	—	1·15	—	—	2·12	—	—	—	5·50	2·49	—	—	—
10·05	9·60	0·45	0·56	1·00	1·82	2·68	2·70	0·60	—	—	—	—	—
9·30	8·80	1·50	0·70	1·45	—	2·45	2·56	0·60	5·45	—	—	—	—
9·70	9·70	1·35	0·51	1·20	1·65	2·44	2·52	0·60	5·50	2·36	—	—	1·75
8·80	8·50	1·35	0·26	0·90	1·67	2·30	—	0·52	—	—	—	—	1·60
9·20	8·90	1·45	0·38	1·30	1·73	2·28	2·30	0·56	5·60	2·22	—	—	1·90
9·25	8·90	1·40	0·42	1·25	1·70	—	—	—	—	—	—	—	1·86
9·80	9·55	0·50	0·50	1·50	—	—	—	—	5·55	2·48	—	—	2·00
10·70	10·20	0·70	0·47	1·60	1·80	2·18	2·28	0·59	—	—	—	—	—
9·10	8·90	1·55	0·60	1·30	1·48	—	—	—	—	—	—	—	1·70
9·35	8·98	1·45	0·55	1·50	1·70	—	—	—	5·40	2·32	—	—	1·80
9·75	—	1·10	—	—	1·80	2·50	2·56	0·60	4·88	2·30	—	—	—
8·80	8·70	1·45	0·51	1·10	1·80	2·40	2·45	0·58	5·00	2·26	—	—	1·80
10·75	10·60	0·73	0·59	1·30	2·17	2·70	2·76	0·62	5·17	2·46	—	—	2·00
9·85	9·60	1·45	0·62	1·30	2·00	2·50	2·57	0·63	—	—	—	—	2·05
9·36	—	0·36	0·60	1·46	1·60	2·18	2·27	0·57	5·43	2·24	—	—	—
9·10	8·88	1·45	0·54	1·25	—	2·40	2·46	0·58	—	—	—	—	—
9·13	8·95	1·55	0·48	1·25	1·79	2·56	2·60	0·56	5·10	2·36	—	—	1·68
10·45	10·15	1·80	0·52	1·50	1·95	—	—	—	—	—	—	—	1·90
9·70	9·40	0·70	0·48	1·10	1·76	2·46	2·52	0·59	5·60	2·41	—	2·74	2·05
9·95	9·90	0·60	0·51	1·50	1·87	2·70	2·75	0·63	6·40	2·76	—	—	1·90
9·75	9·40	0·60	0·42	1·10	1·70	2·45	2·50	0·65	5·60	2·36	—	—	—
—	—	1·25	—	—	1·70	2·52	2·55	0·60	—	—	—	—	—
10·20	10·00	0·65	—	1·30	1·90	2·60	2·65	0·61	5·60	2·26	—	—	2·00
9·10	8·90	0·55	0·54	1·15	1·80	2·36	2·42	0·59	5·00	2·36	—	—	1·75
9·10	8·75	1·45	0·49	1·26	1·67	2·10	2·15	0·55	5·10	2·16	—	—	1·90
9·30	9·10	1·00	0·50	1·30	1·95	—	—	—	5·50	—	—	—	1·90
9·10	9·00	1·35	0·59	1·60	1·90	2·58	2·62	0·06	5·70	—	—	—	1·80
9·35	9·35	1·43	0·55	1·50	1·64	2·38	2·43	0·62	—	—	—	—	1·90
10·45	10·10	0·65	0·51	1·23	1·96	2·78	2·84	0·70	6·30	2·62	—	—	2·00
9·40	9·25	1·55	0·51	1·40	1·77	2·52	2·58	0·58	5·45	2·26	—	2·82	1·80
9·25	9·10	1·35	0·47	1·04	1·80	—	—	—	5·00	2·18	—	—	1·90
9·75	9·50	1·55	0·50	1·40	1·75	2·33	2·40	0·52	5·40	2·40	—	—	1·65
8·95	—	1·10	—	1·40	1·58	2·35	2·37	0·55	—	—	—	2·70	—
9·00	9·00	1·45	0·46	1·55	1·70	2·28	2·40	0·60	5·45	—	—	—	1·79
10·00	9·75	0·65	0·52	1·43	1·90	2·45	2·55	0·62	—	—	—	—	2·04
9·00	8·65	0·45	0·53	1·26	1·63	—	—	—	—	—	—	—	1·85
8·80	8·60	1·49	0·50	1·20	1·40	—	—	—	—	—	—	—	1·60
10·00	9·70	0·66	0·58	1·60	—	2·35	2·43	0·67	5·80	2·46	—	—	2·00
9·80	—	1·14	—	—	1·64	1·98	2·01	—	5·45	2·37	—	—	—
9·60	9·30	1·45	0·53	1·00	1·87	2·47	2·58	0·68	5·60	2·10	—	—	1·60

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1926												
20 Jan.	385	Male	20·25	—	3·90	4·18	4·20	8·45	1·00	4·90	1·00	5·50
21 ,,	389	Female	23·90	—	4·85	—	5·30	10·30	1·10	—	1·20	6·85
21 ,,	390	Female	21·85	—	4·42	4·64	4·80	9·45	1·05	5·45	1·12	5·88
21 ,,	391	Male	20·00	—	3·75	4·00	4·15	8·30	1·01	5·00	0·98	5·65
21 ,,	392	Male	19·20	—	3·73	3·88	4·04	8·00	0·90	4·80	0·95	5·60
21 ,,	393	Male	20·30	—	4·10	4·37	4·54	8·85	1·06	4·82	1·04	5·65
21 ,,	394	Female	22·55	—	4·55	4·65	4·87	9·40	1·08	5·50	1·06	6·18
21 ,,	395	Female	21·80	—	4·24	4·30	4·58	8·90	1·08	5·55	1·06	6·50
21 ,,	396	Male	20·90	—	3·80	4·00	4·27	8·40	0·98	5·18	0·96	5·90
21 ,,	397	Female	22·05	—	4·49	—	4·98	9·80	1·12	5·35	1·15	6·08
21 ,,	398	Female	21·20	—	—	—	4·50	8·70	0·98	5·20	1·05	6·00
21 ,,	400	Male	20·55	—	3·85	4·18	4·40	8·35	1·03	5·00	0·95	5·80
22 ,,	404	Male	19·70	—	3·75	—	4·10	7·90	0·93	5·00	0·97	5·77
22 ,,	405	Female	22·30	—	4·50	—	5·00	9·50	1·05	5·30	1·20	6·15
22 ,,	406	Female	17·00	—	3·15	3·50	3·63	6·95	0·84	4·30	0·88	5·10
22 ,,	409	Female	22·30	—	4·30	—	4·75	9·60	1·05	5·26	1·10	6·15
22 ,,	410	Female	22·30	—	4·40	4·55	5·00	9·35	0·90	5·55	1·00	6·45
23 ,,	411	Female	21·85	—	4·30	4·53	5·70	9·20	1·00	—	1·05	6·20
23 ,,	412	Male	20·30	—	3·95	4·28	4·46	8·25	0·92	4·85	1·05	5·80
23 ,,	413	Female	22·80	—	4·40	4·70	4·85	9·35	1·05	6·85	1·20	6·90
23 ,,	414	Female	21·90	—	4·40	4·76	4·76	9·35	1·05	5·73	1·12	6·10
23 ,,	415	Male	21·00	—	4·20	4·58	4·70	9·20	1·04	4·87	0·99	5·80
23 ,,	416	Male	17·15	—	2·90	3·26	3·38	6·87	1·04	4·48	0·90	5·15
23 ,,	417	Male	20·90	—	3·90	4·07	4·28	8·45	1·12	5·06	1·08	5·62
23 ,,	419	Male	19·90	—	3·75	3·95	4·15	8·25	0·95	4·80	1·00	5·95
23 ,,	420	Female	20·65	—	3·85	4·10	4·33	8·43	0·99	5·40	1·13	6·10
23 ,,	421	Female	20·65	—	4·00	4·16	4·25	8·75	1·02	5·25	1·08	6·00
23 ,,	422	Female	22·83	—	4·50	4·76	5·05	9·63	1·15	5·60	1·02	6·03
24 ,,	423	Female	21·75	—	4·75	4·97	5·05	9·55	1·15	—	1·00	5·90
24 ,,	425	Female	21·60	—	4·65	4·85	5·06	9·35	0·97	5·20	1·00	6·00
24 ,,	426	Female	22·45	—	4·25	4·63	4·81	9·70	1·13	4·55	1·27	6·40
24 ,,	427	Male	21·28	—	4·00	4·22	4·37	8·83	1·03	4·90	1·10	6·00
24 ,,	428	Male	21·35	—	4·10	—	4·54	8·90	1·10	5·30	1·15	5·95
24 ,,	429	Male	21·70	—	4·35	4·62	4·78	9·10	1·08	5·27	1·19	6·00
24 ,,	430	Male	20·20	—	4·10	4·25	4·50	8·80	1·09	4·82	0·83	5·40
24 ,,	431	Female	21·80	—	4·15	4·20	4·48	8·75	1·10	4·80	1·12	6·20
24 ,,	432	Female	19·55	—	3·70	3·80	4·08	8·10	—	5·15	0·98	5·75
25 ,,	433	Female	20·70	—	3·76	4·05	4·17	8·30	0·91	—	1·05	6·10
25 ,,	434	Female	18·75	—	3·25	3·50	3·65	7·30	0·85	—	0·92	5·45
25 ,,	435	Male	20·15	—	3·90	4·20	4·33	8·55	1·01	4·77	1·00	5·65
25 ,,	436	Male	21·40	—	4·10	—	4·45	9·10	1·04	—	1·07	6·10
25 ,,	437	Male	19·55	—	3·90	4·20	4·37	8·25	1·00	4·72	1·00	5·50
25 ,,	438	Male	20·00	—	3·50	3·80	3·96	8·05	0·99	5·03	0·95	5·75
25 ,,	439	Male	19·70	—	4·00	4·03	4·17	8·30	0·93	4·86	0·96	5·55
25 ,,	441	Female	18·75	—	3·40	3·50	3·75	—	0·95	4·77	1·00	5·47
25 ,,	443	Male	19·10	—	3·73	3·87	3·95	8·15	0·89	4·43	0·97	5·10
27 ,,	445	Male	19·75	—	3·80	4·00	4·20	8·30	0·95	4·83	1·00	5·40
27 ,,	446	Male	19·50	—	3·70	4·00	4·22	8·30	1·02	—	0·92	5·45
27 ,,	447	Female	21·00	—	4·14	4·15	4·38	8·65	1·00	5·06	1·02	6·02
27 ,,	448	Male	20·75	—	3·95	4·17	4·32	8·06	1·08	5·05	0·96	5·83
27 ,,	450	Male	21·35	—	4·15	—	4·60	9·35	1·07	5·00	1·05	5·80
27 ,,	451	Male	20·85	—	3·70	—	4·17	8·75	1·03	4·96	1·08	5·90
27 ,,	452	Female	19·80	—	3·68	3·90	4·19	8·29	—	4·89	0·95	5·65
28 ,,	454	Male	20·15	—	3·60	4·15	4·19	7·50	0·89	—	1·02	5·93
28 ,,	455	Male	19·70	—	3·72	4·05	4·15	8·20	0·96	4·74	0·95	—
29 ,,	456	Female	22·57	—	4·30	—	4·85	9·55	1·08	—	1·15	—
29 ,,	457	Male	22·30	—	4·55	—	4·90	9·80	1·08	5·25	1·10	6·10
29 ,,	458	Male	19·54	—	4·05	4·10	4·38	8·30	1·00	5·75	1·03	5·45
29 ,,	459	Male	20·90	—	3·90	—	4·40	9·00	—	4·80	—	5·90
29 ,,	460	Male	20·45	—	4·20	—	4·66	8·85	0·97	5·20	1·02	6·00

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
9·30	9·20	1·30	0·48	1·30	1·70	2·24	2·31	0·54	5·53	—	—	—	1·95
11·10	—	0·55	—	1·00	2·05	2·76	—	0·65	—	—	—	—	—
9·55	9·21	0·58	0·51	1·48	1·90	2·53	2·58	0·62	5·80	2·39	—	—	2·20
9·15	8·70	1·40	0·55	1·20	1·70	2·35	2·43	0·58	5·10	2·22	—	—	1·85
8·90	8·65	1·40	0·45	1·15	1·50	2·20	2·22	0·60	4·80	2·17	—	—	1·70
9·00	8·70	1·15	0·56	1·30	1·77	2·55	2·61	0·60	5·45	2·34	—	—	1·85
9·97	9·90	0·69	0·46	1·20	1·83	2·50	2·57	0·59	5·76	2·42	—	—	1·95
10·36	10·08	0·80	0·47	1·25	1·74	2·38	2·42	0·62	—	—	—	—	1·90
9·90	9·50	1·60	0·57	1·55	1·52	2·30	2·37	0·57	5·10	2·06	—	—	1·88
9·50	9·30	0·47	0·59	1·50	1·92	2·64	2·73	0·65	6·10	2·43	—	—	2·33
9·65	9·42	0·77	0·45	1·40	1·50	—	—	—	5·50	—	—	—	1·83
9·43	9·10	1·35	0·47	1·35	1·65	2·14	2·18	0·55	5·30	2·16	—	—	1·92
8·85	8·95	1·48	0·52	1·30	1·62	—	—	—	5·02	2·05	—	—	1·70
9·95	9·84	0·70	0·54	1·40	1·90	2·37	2·44	0·59	5·40	—	—	—	—
7·80	7·80	0·50	0·38	0·95	1·40	1·85	1·85	0·50	4·36	1·85	—	—	1·60
9·70	9·70	0·75	0·48	1·30	1·80	2·72	2·78	0·63	5·65	2·42	—	—	2·05
10·00	9·80	0·75	0·63	1·70	1·80	—	—	0·61	5·86	2·24	—	—	2·00
9·65	—	0·65	—	—	1·50	2·20	2·27	0·59	5·70	2·18	—	—	—
9·26	9·00	1·45	0·42	1·39	1·80	2·30	2·40	0·55	5·40	—	—	—	1·80
10·35	10·40	—	0·49	1·48	1·80	—	—	—	5·75	2·30	—	—	—
9·65	9·40	0·60	0·51	1·50	1·87	2·60	2·65	0·59	5·77	2·41	—	—	2·20
9·60	9·20	1·50	0·52	1·50	1·86	2·35	2·41	0·56	5·55	2·42	—	—	1·90
8·20	7·75	1·10	0·42	1·30	1·28	1·90	1·97	0·43	4·08	1·78	—	—	1·60
9·45	9·20	1·48	0·50	1·25	1·61	—	—	—	5·23	2·15	—	—	1·75
—	9·10	1·45	0·40	1·40	1·70	2·35	2·45	0·55	5·10	1·95	—	—	1·85
9·40	9·54	0·65	0·35	1·10	1·70	2·25	2·30	0·50	5·22	2·28	—	—	1·93
9·35	9·05	0·60	0·50	1·40	1·85	2·35	2·44	0·58	5·30	2·23	—	—	1·85
9·50	9·60	0·50	0·53	1·30	1·65	2·55	2·58	0·67	6·00	2·50	—	—	2·15
9·70	—	0·70	0·56	1·02	1·92	2·37	2·47	0·60	—	—	—	—	—
9·85	10·00	0·75	0·42	1·25	1·90	—	—	0·55	5·90	—	—	—	1·82
9·45	9·80	0·74	0·52	1·08	2·10	2·77	2·84	—	5·88	2·40	—	—	2·20
9·70	9·26	1·15	0·59	1·15	2·18	2·50	2·60	0·62	5·30	2·17	—	—	1·89
9·46	9·25	1·50	0·51	1·40	1·90	2·36	2·44	0·64	5·60	2·40	—	—	2·18
9·35	9·58	1·60	0·62	1·20	1·66	2·38	2·42	0·60	5·65	2·36	—	—	2·00
8·85	8·50	1·40	0·55	1·40	1·83	2·23	2·31	0·56	5·40	2·37	—	—	2·00
10·10	9·70	0·60	0·55	1·30	1·60	—	—	—	—	—	—	—	1·80
9·25	9·00	0·50	0·48	1·20	1·70	—	—	—	—	—	—	—	1·90
9·70	—	0·60	—	—	1·88	2·35	2·48	0·53	5·00	2·14	—	—	—
8·47	—	0·45	0·44	0·90	1·40	—	—	—	4·45	1·96	—	—	—
9·10	9·00	1·60	0·53	1·15	1·80	—	—	—	—	—	—	—	1·85
9·70	—	1·05	—	—	1·86	2·47	2·57	0·57	5·45	—	—	—	—
8·70	8·70	1·20	0·42	1·10	1·60	2·00	2·00	0·46	5·07	2·23	—	—	1·90
9·25	9·30	1·51	0·51	1·40	1·70	2·17	2·21	0·58	4·84	2·06	—	—	1·75
9·70	9·20	1·70	0·57	1·40	1·65	—	—	—	—	—	—	—	1·85
—	8·52	0·60	0·45	1·00	—	—	—	—	—	—	—	—	1·80
8·30	8·10	1·50	0·43	0·90	1·75	—	—	—	—	—	—	—	1·85
8·70	8·50	1·40	0·48	1·43	1·60	2·32	2·40	0·56	—	—	—	—	1·90
—	—	0·95	—	—	1·60	2·27	2·31	0·59	5·87	2·50	—	—	—
9·85	9·50	0·83	0·55	1·10	1·65	2·38	2·44	0·60	5·27	2·30	—	—	1·90
9·50	9·15	1·48	0·49	1·50	1·42	2·10	2·15	0·55	5·15	2·09	—	—	1·80
—	9·10	1·60	0·58	1·60	1·75	2·45	2·54	0·62	—	—	—	2·85	2·06
9·55	9·25	1·50	0·48	1·48	1·70	2·35	2·40	0·58	—	—	—	—	1·90
—	8·74	0·65	0·47	0·90	1·63	2·20	2·22	0·57	—	—	—	—	2·00
9·25	—	0·97	0·54	1·20	1·67	2·13	2·17	—	5·07	2·13	—	—	—
8·90	8·50	1·85	0·46	1·30	—	2·40	2·47	—	—	—	—	—	1·90
10·30	—	—	—	—	1·80	2·30	2·38	0·57	5·80	2·30	5·71	—	—
9·75	9·65	1·50	0·58	1·06	1·90	2·55	2·62	0·63	6·10	2·50	—	—	2·20
—	8·58	1·40	0·41	1·15	1·50	—	—	—	—	—	—	—	1·80
—	8·95	1·50	0·45	1·10	2·02	2·48	2·60	0·63	5·40	2·25	—	—	1·70
9·25	9·00	1·00	0·55	1·50	1·82	2·34	2·42	0·60	5·60	2·18	—	—	1·90

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1926												
29 Jan.	461	Male	21·00	—	4·05	4·28	4·52	9·25	1·04	5·30	1·07	6·00
29 ,,	462	Male	20·60	—	4·00	4·02	4·26	8·70	0·92	—	0·96	5·77
29 ,,	463	Female	24·00	—	4·86	—	5·37	9·80	1·16	5·65	1·04	6·90
29 ,,	464	Male	20·10	—	3·75	—	4·33	8·55	1·00	4·65	1·04	5·37
29 ,,	465	Female	20·37	—	4·35	4·55	4·85	9·90	1·10	5·87	1·20	6·75
29 ,,	466	Male	21·15	—	4·25	—	4·60	—	—	4·98	1·14	—
29 ,,	467	Male	21·25	—	3·98	4·17	4·41	9·00	1·00	—	1·10	6·00
29 ,,	468	Male	20·40	—	3·84	4·05	4·27	—	1·30	4·80	1·04	5·55
30 ,,	469	Male	21·00	—	4·10	4·30	4·44	8·80	1·06	5·25	1·00	5·80
30 ,,	470	Male	21·60	—	3·95	4·18	4·38	8·70	1·05	5·67	1·04	6·10
30 ,,	471	Male	20·35	—	3·85	4·10	4·27	8·50	1·00	4·85	1·09	5·70
30 ,,	472	Male	21·80	—	4·15	—	4·56	9·20	1·03	5·40	1·08	6·15
30 ,,	473	Male	21·75	—	3·90	—	4·45	9·00	1·03	5·50	1·09	6·30
30 ,,	474	Male	21·70	—	3·85	3·95	4·15	8·45	0·95	5·05	1·04	6·12
30 ,,	475	Male	20·00	—	3·70	—	4·15	8·30	1·00	—	1·00	—
30 ,,	476	Male	20·90	—	3·85	—	4·37	—	1·00	4·85	1·10	6·00
30 ,,	477	Male	20·90	—	4·07	4·10	4·38	8·70	—	—	1·05	5·85
31 ,,	478	Female	24·53	—	—	—	—	—	—	—	—	—
31 ,,	479	Male	19·57	—	—	—	4·30	8·15	1·02	—	1·05	5·30
31 ,,	480	Male	20·53	—	3·65	3·72	4·10	—	0·98	5·25	1·02	5·90
1 Feb.	481	Male	21·17	—	4·02	—	4·35	—	1·07	5·10	1·08	5·78
1 ,,	482	Male	20·20	—	3·90	4·10	4·25	8·60	1·10	4·70	1·05	5·65
1 ,,	483	Female	22·20	—	4·45	—	4·90	9·60	—	5·70	1·24	6·35
2 ,,	484	Female	22·35	—	4·25	4·50	4·67	9·50	1·00	—	1·10	6·35
2 ,,	485	Male	20·95	—	4·13	4·23	4·50	8·78	1·03	5·23	1·08	5·84
2 ,,	486	Male	21·85	—	4·25	4·50	4·59	9·10	0·98	4·74	1·05	5·75
2 ,,	489	Male	21·40	—	4·13	—	4·32	—	1·01	—	1·20	—
2 ,,	490	Male	21·70	—	4·34	4·40	4·72	9·32	1·15	5·00	1·15	5·96
2 ,,	491	Female	23·10	—	4·70	—	5·13	—	—	5·44	1·03	6·25
2 ,,	492	Male	19·80	—	3·68	—	4·16	8·00	0·98	—	0·94	5·50
2 ,,	493	Male	19·30	—	3·80	3·95	4·05	7·95	1·00	4·75	0·94	5·60
2 ,,	495	Male	18·70	—	3·66	4·00	4·00	8·05	1·00	4·50	0·97	5·35
2 ,,	496	Female	18·45	—	3·40	3·65	3·84	7·55	0·88	4·60	0·90	5·15
2 ,,	497	Female	22·65	—	4·57	4·60	4·82	9·55	1·18	5·58	1·10	6·27
3 ,,	498	Male	20·30	—	3·90	4·18	4·38	8·40	0·99	—	1·05	5·87
3 ,,	499	Male	20·80	—	3·70	—	4·10	8·20	0·98	4·85	1·05	5·78
3 ,,	500	Male	20·70	—	4·10	4·25	4·40	8·95	1·13	5·40	1·15	6·00
3 ,,	501	Female	19·30	—	3·80	4·00	4·20	7·95	—	—	0·98	5·40
3 ,,	502	Female	22·74	—	4·25	—	4·85	9·60	1·10	5·47	1·15	6·45
4 ,,	504	Female	21·75	—	4·24	4·70	4·80	9·15	1·00	—	1·11	5·88
4 ,,	505	Male	19·40	—	3·75	—	4·10	8·20	0·96	4·90	0·90	5·20
4 ,,	506	Male	20·05	—	3·75	4·00	4·18	8·30	1·00	4·55	0·95	5·38
4 ,,	507	Male	18·60	—	3·50	3·70	3·88	7·85	—	4·37	0·89	5·10
4 ,,	508	Female	20·10	—	3·80	—	4·15	8·25	0·96	5·00	0·90	5·90
4 ,,	509	Male	20·25	—	4·00	4·10	4·25	—	1·03	4·92	1·05	5·70
5 ,,	511	Male	20·00	—	3·65	—	4·00	8·20	1·03	5·13	0·96	5·60
5 ,,	512	Male	17·70	—	3·10	3·19	3·45	7·00	0·81	4·33	0·85	5·15
6 ,,	513	Male	19·20	—	3·60	3·85	3·99	8·17	1·03	4·80	1·08	5·35
6 ,,	514	Female	20·95	—	4·00	4·28	4·45	8·85	1·00	5·30	1·00	6·00
6 ,,	515	Male	18·75	—	3·35	3·72	3·86	7·60	0·89	4·50	1·00	5·15
6 ,,	518	Male	22·40	—	4·75	4·84	5·00	10·00	1·16	5·30	1·14	6·07
6 ,,	519	Male	21·90	—	4·37	—	4·77	9·40	1·12	5·10	1·03	5·95
6 ,,	520	Male	20·00	—	3·75	4·07	4·24	8·30	0·87	4·97	1·02	5·75
6 ,,	521	Female	21·25	—	4·80	—	5·10	9·20	1·02	5·03	1·02	5·70
7 ,,	522	Female	20·80	—	4·00	—	4·50	—	1·00	—	1·00	5·90
7 ,,	523	Female	21·70	—	4·15	—	4·55	8·60	1·02	5·60	1·00	6·35
7 ,,	524	Male	21·30	—	4·20	—	4·70	—	—	4·80	1·08	5·70
7 ,,	525	Male	18·00	—	3·42	3·70	3·80	7·25	—	—	0·92	5·35
7 ,,	526	Male	21·05	—	4·15	4·41	4·65	8·90	1·08	4·90	1·04	5·65
7 ,,	527	Male	20·40	—	3·95	3·96	4·24	—	1·02	5·15	1·07	6·00

11 Notch of flukes to umbilicus	12 Notch of flukes to end of system of ventral grooves	13 Anus to reproductive aperture, centres	14 Dorsal fin, vertical height	15 Dorsal fin, length of base	16 Flipper, tip to axilla	17 Flipper, tip to anterior end of lower border	18 Flipper, length along curve of lower border	19 Flipper, greatest width	20 Severed head, condyle to tip	21 Skull, greatest width	22 Skull length, condyle to tip of premaxilla	23 Flipper, tip to head of humerus	24 Tail, depth at dorsal fin
9·65	9·20	1·55	—	1·60	1·85	2·63	2·70	0·69	5·50	2·19	—	—	2·05
9·45	9·30	1·48	—	1·00	1·70	2·40	2·44	0·61	5·10	2·23	—	—	1·75
10·55	10·20	0·64	0·47	1·25	2·25	2·50	2·60	0·67	6·40	2·50	—	—	2·00
9·00	8·72	1·42	0·40	1·08	1·85	2·17	2·25	0·55	5·20	2·30	5·11	—	1·95
10·80	10·25	0·68	0·51	1·35	1·73	2·68	2·77	0·64	—	—	—	—	—
9·47	9·00	—	—	1·14	1·65	2·30	2·36	0·58	5·55	2·10	—	—	2·03
9·60	—	1·10	0·47	1·40	—	2·58	2·62	0·60	5·45	2·30	—	—	—
—	8·80	1·40	0·49	1·20	—	2·26	2·35	0·61	5·25	2·46	—	—	1·65
9·65	9·40	1·80	0·46	1·27	1·70	2·30	2·45	0·62	5·20	2·37	—	—	1·70
10·10	9·85	1·60	0·56	1·10	1·80	2·41	2·51	0·62	5·38	2·28	—	—	1·85
9·20	8·70	1·50	0·44	1·38	1·82	2·26	2·33	0·58	5·20	2·28	—	—	2·05
9·55	9·25	1·55	0·51	1·30	1·86	2·50	2·65	0·66	5·50	2·46	—	—	2·05
10·20	10·10	1·70	0·48	2·20	1·70	—	—	—	5·50	2·34	—	—	2·05
9·65	9·40	1·33	0·52	1·20	1·44	2·29	2·34	0·61	—	—	—	—	1·90
9·00	—	1·00	0·55	1·20	1·60	2·35	2·42	0·60	4·90	2·24	—	—	—
9·50	9·10	1·35	0·43	1·15	1·48	2·20	2·25	0·55	5·27	2·20	—	—	—
—	9·00	1·40	—	1·60	1·70	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	5·60	—	—	—	—
—	—	1·00	—	—	1·30	2·05	2·13	0·55	5·17	—	—	—	—
—	9·40	1·00	—	1·40	—	2·30	2·39	0·58	5·00	2·22	—	—	1·92
9·30	9·07	1·37	0·53	1·30	1·78	2·52	2·62	0·65	5·37	—	—	—	1·90
9·00	8·65	1·55	0·62	1·38	1·75	2·35	2·40	0·59	—	—	—	—	1·97
—	9·75	0·60	0·52	1·70	1·80	—	—	—	—	—	—	—	2·35
10·13	—	0·81	—	—	1·88	2·60	2·67	0·61	5·55	2·44	—	—	—
—	8·95	1·61	0·55	1·15	1·74	2·34	2·39	0·66	5·50	2·28	—	—	1·90
9·50	9·00	1·65	0·50	1·60	1·78	2·35	2·44	0·63	5·50	2·32	—	—	1·85
9·53	—	—	0·54	1·35	1·72	—	—	—	5·39	2·30	—	—	—
9·50	9·04	1·44	0·53	1·10	1·90	2·36	2·43	0·62	5·73	2·40	—	—	—
—	9·84	0·55	0·47	1·10	—	—	—	—	—	—	—	—	2·20
8·80	—	0·99	—	—	1·40	2·10	2·14	0·56	4·92	2·31	—	—	—
8·80	8·60	1·40	0·44	1·20	1·50	2·28	2·33	0·58	4·95	2·16	—	—	1·60
8·23	8·17	0·95	0·52	1·25	1·57	2·30	2·37	0·57	4·75	2·11	—	—	—
9·45	8·00	0·57	0·40	1·00	1·52	—	—	—	—	—	—	—	1·75
10·38	10·38	0·69	0·56	1·20	1·84	—	—	—	—	—	—	—	2·10
9·23	—	1·13	—	—	1·55	2·30	2·36	0·58	5·35	2·13	—	—	—
9·13	8·74	1·32	0·48	1·30	1·73	2·30	2·35	0·64	4·85	2·08	—	—	2·00
9·78	9·40	1·20	0·55	1·30	2·04	—	—	—	5·52	2·15	5·42	—	2·10
8·85	8·70	0·60	0·55	—	1·48	2·25	2·32	0·56	5·07	2·08	—	—	—
10·50	10·06	0·65	0·60	1·40	1·80	—	—	—	—	—	—	—	2·45
9·53	—	0·55	—	1·45	1·74	2·36	2·41	0·64	—	—	—	—	—
8·30	8·70	1·50	0·50	1·10	1·62	2·26	2·34	0·55	4·90	2·10	—	—	1·85
8·90	8·50	1·39	0·48	1·50	1·80	2·50	2·55	0·58	5·05	2·23	—	—	1·90
8·15	8·25	1·40	0·50	1·15	1·40	2·08	2·22	0·50	4·75	2·01	—	—	1·78
9·10	8·90	0·70	0·45	1·30	1·50	2·33	2·39	0·56	5·50	2·10	—	—	1·75
9·20	9·00	1·53	0·56	1·20	—	—	—	—	—	—	—	—	1·85
9·20	8·85	1·40	0·46	1·10	1·63	2·25	2·30	0·55	4·95	2·10	—	—	1·92
8·45	8·40	1·20	0·37	0·95	1·30	—	—	—	—	—	—	—	1·55
8·70	8·60	1·45	0·47	1·40	1·80	2·40	2·44	0·58	4·85	2·18	—	—	1·90
9·40	9·25	0·63	0·51	1·20	1·83	2·42	2·47	0·57	5·45	2·32	—	—	1·90
8·25	8·10	1·45	0·52	1·20	1·49	—	—	—	—	—	—	—	1·80
9·45	9·30	1·78	—	1·40	1·96	2·80	2·85	0·65	6·15	2·38	—	—	1·90
9·70	9·30	1·15	0·61	1·40	1·83	2·58	2·62	0·65	5·85	2·31	—	—	2·10
9·25	8·90	1·60	0·47	1·40	1·60	2·19	2·28	0·62	5·20	2·11	—	—	1·85
9·35	8·40	0·60	0·46	1·20	—	—	—	—	6·10	2·40	—	—	2·00
9·45	—	0·45	—	—	—	2·35	2·40	0·55	5·40	2·15	—	—	—
9·85	9·65	0·70	0·48	1·20	1·60	2·20	2·25	0·55	5·40	2·35	—	—	1·95
—	8·65	1·40	0·47	1·39	—	—	—	—	—	—	—	—	2·10
8·20	—	0·85	—	—	1·50	2·10	2·15	0·53	4·60	1·94	—	—	—
9·30	9·10	1·55	0·50	1·40	1·68	2·37	2·42	0·63	5·55	2·33	—	—	1·90
9·75	9·50	1·60	0·51	1·10	1·65	2·35	2·45	0·59	5·00	2·24	—	—	1·85

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1926												
7 Feb.	529	Female	22·40	—	4·55	4·62	4·83	—	1·11	5·55	1·06	6·27
8 ,,	530	Female	22·75	—	4·65	4·95	5·10	9·90	1·11	—	1·07	6·20
8 ,,	531	Female	21·25	—	4·50	—	4·70	9·10	1·02	5·05	1·00	5·65
9 ,,	533	Male	21·55	—	4·00	—	4·55	8·85	1·02	5·10	1·03	5·90
9 ,,	535	Female	22·90	—	4·46	4·65	4·88	9·26	1·08	—	—	—
9 ,,	536	Male	21·00	—	4·37	4·63	4·74	9·25	1·00	—	1·16	5·90
9 ,,	537	Male	19·70	—	3·96	4·20	4·37	9·00	1·07	4·45	0·95	5·20
9 ,,	538	Male	20·45	—	4·15	4·45	4·56	8·80	1·07	4·93	0·99	5·70
9 ,,	539	Female	22·50	—	4·10	4·30	4·50	8·80	1·05	5·73	1·06	6·70
9 ,,	540	Male	19·50	—	3·60	4·06	4·17	8·00	0·89	4·90	1·00	5·55
9 ,,	541	Female	22·50	—	4·45	4·70	4·84	9·50	1·08	5·58	1·09	6·65
9 ,,	542	Male	19·65	—	3·75	4·10	4·18	8·15	0·99	4·70	1·00	5·50
10 ,,	543	Male	19·70	—	3·85	—	4·25	8·40	0·96	—	0·95	5·65
10 ,,	544	Female	16·20	—	3·15	3·36	3·50	6·80	0·80	4·00	0·80	4·70
10 ,,	545	Male	19·50	—	3·80	4·05	4·19	8·10	0·97	4·80	0·90	5·60
10 ,,	546	Male	20·35	—	4·10	—	4·55	9·35	1·13	4·45	1·00	5·30
10 ,,	547	Female	21·85	—	4·15	—	4·45	9·10	1·15	5·60	1·10	6·55
11 ,,	548	Female	21·00	—	4·00	—	4·45	8·80	0·98	—	1·10	6·30
11 ,,	549	Female	21·45	—	4·30	4·60	4·67	9·00	1·07	5·20	0·98	5·90
11 ,,	550	Male	19·10	—	3·90	4·20	4·39	8·24	0·99	4·55	0·90	5·30
11 ,,	551	Male	20·70	—	3·89	4·20	4·37	8·60	1·00	5·13	0·96	5·90
12 ,,	552	Male	19·75	—	3·95	—	4·28	8·34	0·94	—	1·15	5·30
12 ,,	553	Male	21·60	—	4·28	4·37	4·63	8·98	1·00	5·00	1·13	6·00
12 ,,	555	Male	19·60	—	4·30	4·54	4·71	9·20	1·06	4·70	1·00	5·40
12 ,,	556	Male	20·60	—	3·80	4·10	4·28	8·80	1·00	—	1·05	5·80
13 ,,	558	Male	21·10	—	4·25	4·45	4·60	9·10	0·97	5·02	0·98	5·70
13 ,,	559	Male	22·08	—	4·70	4·74	4·90	9·57	1·12	5·15	0·98	6·07
13 ,,	560	Female	21·15	-	4·50	4·80	5·00	9·05	1·04	5·10	1·02	5·80
13 ,,	561	Male	20·50	—	3·20	3·65	3·90	8·13	1·00	5·03	0·96	6·00
13 ,,	562	Male	20·40	—	3·70	4·00	4·30	8·60	1·10	4·85	1·04	5·90
13 ,,	563	Female	22·30	—	4·53	4·95	5·08	9·50	0·98	5·78	1·06	6·70
13 ,,	564	Male	20·80	—	4·36	—	4·75	8·95	1·10	—	1·02	5·80
13 ,,	565	Female	22·60	—	4·30	—	4·75	9·20	1·16	5·70	1·15	6·33
13 ,,	566	Female	21·65	—	4·00	—	4·55	8·90	—	5·38	1·00	6·25
14 ,,	573	Male	19·80	—	3·90	—	4·05	8·75	0·97	—	0·98	5·30
14 ,,	574	Male	21·00	—	4·10	4·30	4·40	8·82	1·00	5·30	1·03	5·20
14 ,,	575	Female	21·00	—	4·40	—	4·76	9·83	1·11	5·23	0·97	5·75
14 ,,	576	Male	20·30	—	3·70	3·88	4·00	8·00	0·98	—	0·97	5·85
14 ,,	577	Male	20·60	—	4·10	4·25	4·45	9·00	1·05	4·83	0·94	5·80
15 ,,	579	Male	20·00	—	3·80	4·14	4·35	8·30	1·00	4·80	0·98	5·55
15 ,,	585	Female	22·55	—	4·25	4·65	4·70	9·60	—	5·10	1·20	6·40
15 ,,	586	Male	19·30	—	3·65	—	4·05	8·10	—	4·46	0·90	5·25
15 ,,	587	Female	20·70	—	3·90	4·10	4·28	8·44	1·07	5·18	0·97	5·80
15 ,,	588	Female	22·90	—	4·54	4·74	4·87	9·60	1·06	—	1·25	6·40
15 ,,	589	Male	21·60	—	4·27	—	4·70	9·30	1·09	5·22	1·07	6·20
15 ,,	590	Male	20·20	—	3·60	—	4·15	8·10	—	5·15	1·04	5·60
16 ,,	600	Male	18·53	—	3·55	3·64	3·92	7·73	0·93	4·30	0·95	5·10
16 ,,	601	Male	21·30	—	4·30	—	4·67	9·40	1·03	5·33	1·02	5·85
18 ,,	602	Male	21·75	—	4·20	—	4·75	9·00	0·98	—	1·00	5·60
18 ,,	603	Female	20·30	—	3·87	4·10	4·24	8·36	1·06	4·85	0·98	5·70
18 ,,	604	Female	15·20	—	2·70	2·88	3·05	6·10	0·73	3·90	0·70	4·60
18 ,,	606	Male	20·40	—	4·07	4·26	4·40	8·60	1·00	4·90	1·03	5·80
18 ,,	607	Male	19·73	—	3·47	3·80	3·94	8·10	0·95	4·70	1·00	5·74
18 ,,	609	Male	20·10	—	3·70	4·02	4·25	8·13	0·95	5·10	1·02	5·70
18 ,,	610	Female	22·20	—	4·60	5·00	5·14	9·60	1·08	5·29	1·07	6·35
19 ,,	611	Male	20·50	—	—	—	4·30	8·45	—	—	1·00	5·80
20 ,,	618	Female	18·50	—	3·50	3·65	3·84	7·88	—	4·90	0·90	5·70
22 ,,	619	Male	18·70	—	3·60	3·95	4·03	8·07	0·92	4·70	0·92	5·55
22 ,,	621	Female	21·70	—	3·90	4·16	4·27	8·45	1·00	5·25	1·03	6·35
22 ,,	622	Male	20·20	—	3·57	3·90	4·05	8·25	0·98	5·00	1·03	5·70

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
10·20	10·00	0·88	0·53	1·00	—	—	—	—	—	—	—	—	—
10·10	—	0·65	—	—	1·90	2·60	2·70	0·67	—	—	—	—	—
—	9·00	0·62	0·37	1·00	1·50	2·00	—	—	—	—	—	—	1·95
9·73	9·10	1·20	0·30	1·40	—	2·25	2·32	0·61	5·47	2·34	—	—	—
—	—	0·75	0·50	1·40	1·66	2·40	2·42	0·65	5·90	2·39	—	—	—
9·65	—	1·05	—	1·30	1·86	2·35	—	0·69	5·75	2·26	—	—	—
8·55	8·20	1·75	0·56	1·10	1·84	2·37	2·44	0·67	—	2·15	—	—	—
9·15	—	1·50	0·48	1·10	1·71	2·33	2·36	0·59	5·57	—	—	—	2·05
10·40	10·45	0·65	0·61	1·40	1·90	—	—	—	5·40	2·50	—	—	2·30
9·10	8·80	1·50	0·51	1·20	1·75	—	—	—	—	—	—	—	1·90
10·50	10·20	0·80	0·41	1·20	2·00	2·70	2·78	0·65	5·75	2·56	—	—	2·00
8·90	8·70	1·55	0·58	1·00	1·50	—	—	—	—	—	—	—	1·70
8·70	—	1·00	—	—	—	2·20	2·28	0·58	5·00	2·20	—	—	—
7·45	7·30	0·52	0·38	1·10	1·40	—	—	—	—	—	—	—	1·60
—	8·77	1·30	0·46	1·22	1·55	—	—	—	—	—	—	—	1·80
8·85	8·45	1·50	0·47	1·40	1·85	2·60	2·68	0·60	5·35	—	—	—	2·02
10·00	10·05	0·70	0·70	1·70	1·88	—	—	—	—	—	—	—	2·40
9·58	—	0·65	—	—	1·65	2·24	2·35	0·57	5·25	2·32	—	—	—
9·45	9·20	0·60	0·56	1·20	1·67	2·26	2·34	0·62	5·68	2·31	—	—	1·77
8·50	8·40	1·30	0·48	1·30	1·58	—	—	—	—	2·33	—	—	1·80
—	9·85	1·65	0·51	1·20	1·87	—	—	—	—	—	—	—	1·99
8·80	—	1·20	—	—	1·68	2·20	2·24	0·53	5·10	2·14	—	—	—
9·45	9·35	1·45	0·52	1·20	1·70	—	—	—	5·50	2·25	—	—	1·90
—	8·40	1·40	0·53	1·40	1·80	2·40	2·48	0·59	5·70	—	—	—	1·90
9·30	8·60	1·55	—	1·30	2·00	2·50	2·54	0·62	5·20	2·26	—	—	1·90
9·25	9·10	1·20	0·41	1·00	1·87	2·45	2·56	0·50	5·47	2·24	—	—	2·05
9·90	9·50	1·53	0·57	1·30	1·88	2·55	2·64	0·68	5·88	2·60	—	—	1·95
9·20	8·75	0·60	0·53	1·10	1·68	2·20	2·30	0·64	6·00	2·35	—	—	2·00
9·65	—	1·17	0·45	1·20	1·75	2·40	2·48	0·59	4·75	2·20	—	—	—
9·46	9·00	1·40	0·52	1·20	1·79	2·34	2·39	0·63	5·20	2·29	—	—	1·70
10·55	10·15	0·70	0·53	1·35	1·75	—	—	—	6·05	2·46	—	—	1·90
9·50	—	1·10	0·50	1·20	1·50	2·20	2·28	0·60	5·65	2·28	—	—	—
10·20	9·70	0·71	0·52	1·10	1·70	2·46	2·53	0·62	5·85	2·39	—	—	2·20
9·90	10·00	0·65	0·54	1·17	1·80	2·52	2·59	0·53	5·30	2·33	—	—	1·90
8·75	—	1·10	0·51	0·87	1·52	2·32	2·36	0·63	5·30	2·38	—	—	—
9·85	9·60	1·50	0·67	1·50	1·64	2·45	2·55	0·61	5·40	2·30	—	—	1·85
9·24	9·50	0·55	0·53	1·40	1·88	—	—	—	5·75	2·38	—	—	2·00
9·20	—	1·25	—	—	1·60	—	—	—	—	—	—	—	—
9·45	9·20	1·40	0·48	1·20	1·73	2·40	2·50	0·60	5·35	2·28	—	—	1·65
8·99	8·90	1·40	0·51	1·10	1·68	—	—	—	5·12	2·29	—	—	1·95
10·15	9·95	0·55	0·52	1·50	2·20	—	—	—	—	—	—	—	2·35
8·75	8·00	1·45	—	1·50	1·65	—	—	—	4·94	2·03	—	—	1·75
9·20	9·00	0·60	0·45	1·00	1·92	2·26	2·31	0·54	—	—	—	—	1·87
10·10	—	0·67	—	—	1·70	2·52	2·60	0·68	—	—	—	—	—
9·90	—	1·30	0·46	1·10	1·60	—	—	—	—	—	—	—	—
9·40	9·20	1·35	0·60	1·20	1·75	—	—	—	—	—	—	—	2·05
8·15	8·05	1·45	0·47	1·10	1·50	2·00	2·10	0·50	4·65	2·20	—	—	1·95
9·50	9·45	1·55	0·54	1·22	1·98	—	—	—	—	—	—	—	2·20
8·90	—	1·15	0·51	1·10	1·55	2·27	2·31	0·58	5·45	—	—	—	—
9·20	8·90	0·70	0·49	0·90	1·65	2·16	2·21	0·53	5·20	2·24	—	—	1·80
7·05	7·00	0·40	0·42	0·75	1·28	1·68	1·72	0·39	—	—	—	—	1·40
9·25	9·10	1·50	0·51	1·35	1·64	2·19	2·25	0·60	5·40	2·16	—	—	1·97
9·30	8·90	1·56	0·49	0·90	1·64	2·20	2·28	0·53	4·85	2·16	—	—	1·80
9·40	9·20	1·23	0·58	1·20	1·42	2·20	2·26	0·54	5·13	2·24	—	—	1·90
9·80	9·70	0·45	0·49	1·27	1·75	2·37	2·44	—	—	—	—	—	2·00
9·00	—	1·00	—	—	—	2·25	2·37	0·58	5·25	2·10	—	—	—
9·17	8·75	0·50	0·40	1·00	1·65	—	—	—	—	—	—	—	1·70
8·70	—	0·85	0·50	1·05	1·78	2·30	2·36	0·54	4·85	2·10	—	—	1·80
9·80	9·85	0·40	0·45	1·55	1·80	2·15	2·28	0·60	5·15	2·26	—	—	1·95
9·50	9·47	1·50	0·52	1·37	1·70	2·24	2·30	0·57	4·90	2·21	—	—	2·03

Date	Whale Number	Sex	1 Total length, tip of snout to notch of flukes	2 Lower jaw, projection beyond tip of snout	3 Tip of snout to blow-hole	4 Tip of snout to angle of gape	5 Tip of snout to centre of eye	6 Tip of snout to tip of flipper	7 Eye to ear, centres	8 Notch of flukes to posterior emargination of dorsal fin	9 Flukes, width at insertion	10 Notch of flukes to anus
1926												
24 Feb.	624	Male	19·45	—	3·50	3·90	4·00	8·25	0·90	—	0·96	5·30
24 ,,	626	Female	22·47	—	4·60	—	5·05	9·55	1·14	5·10	1·00	6·20
24 ,,	627	Male	21·60	—	4·25	4·45	4·70	9·20	1·04	5·16	1·08	6·00
25 ,,	629	Male	19·75	—	3·70	4·04	4·10	8·24	1·02	5·18	0·98	5·80
25 ,,	630	Male	20·55	—	3·90	4·18	4·57	8·55	0·96	5·07	1·03	6·00
25 ,,	631	Male	19·30	—	3·78	4·06	4·24	8·40	0·94	4·70	0·94	5·30
25 ,,	632	Female	19·20	—	3·56	3·80	4·10	8·10	1·06	4·70	0·94	5·45
25 ,,	633	Male	16·90	—	3·00	3·30	3·47	7·00	0·82	4·07	0·85	4·97
27 ,,	634	Female	22·24	—	4·42	—	4·80	9·60	—	—	1·16	6·76
27 ,,	635	Male	21·25	—	4·10	4·50	4·65	9·65	1·02	—	1·10	5·90
1 March	636	Female	21·30	—	—	—	—	—	—	—	1·15	—
6 ,,	672	Female	20·00	—	4·05	—	4·40	8·50	1·00	4·95	0·90	5·55
8 ,,	674	Male	20·00	—	3·70	4·17	4·16	7·90	—	—	1·05	5·15
8 ,,	675	Female	22·20	—	4·15	—	4·62	8·95	1·05	5·30	1·10	6·10
11 ,,	677	Female	16·00	—	2·60	2·82	2·90	6·30	0·72	3·80	0·88	4·80
12 ,,	678	Female	16·30	—	2·85	—	3·30	6·65	—	—	0·85	4·95
12 ,,	679	Male	15·90	—	2·65	2·90	3·03	6·00	0·72	4·00	0·75	4·65
12 ,,	680	Male	20·40	—	4·05	—	4·57	8·65	1·03	4·55	1·08	5·40
13 ,,	682	Male	19·00	—	3·45	3·90	3·94	7·90	0·92	4·70	0·94	5·40
13 ,,	683	Male	17·80	—	3·30	3·55	3·68	7·20	0·85	4·45	0·89	5·15
14 ,,	685	Male	19·70	—	3·55	3·96	4·10	8·10	0·92	4·70	0·92	5·40
14 ,,	686	Female	20·00	—	3·70	4·00	4·10	8·10	—	5·20	1·02	5·85
14 ,,	687	Female	14·80	—	2·40	—	2·80	5·87	—	4·25	—	4·70
14 ,,	689	Male	16·25	—	2·15	—	3·00	6·40	0·73	4·30	0·85	4·90
14 ,,	690	Female	16·55	—	2·15	3·00	3·05	6·55	0·80	4·10	1·10	5·00
14 ,,	691	Female	17·15	—	2·90	3·15	3·30	6·90	0·84	4·40	0·90	4·90
14 ,,	692	Female	15·20	—	2·40	—	2·55	—	0·70	4·30	0·79	5·00
15 ,,	693	Female	21·45	—	—	—	—	—	—	—	1·03	6·15
15 ,,	694	Male	20·10	—	4·20	—	4·68	8·90	0·85	4·60	0·93	5·40
19 ,,	696	Male	18·35	—	3·30	3·55	3·67	7·20	0·85	4·77	0·90	5·60
20 ,,	697	Female	19·90	—	3·80	—	4·30	8·30	1·00	4·90	0·87	5·40
20 ,,	699	Female	21·40	—	4·10	—	4·65	8·80	1·03	5·30	1·10	6·00
20 ,,	700	Female	18·60	—	3·20	—	3·70	7·30	0·83	—	0·86	5·30
20 ,,	701	Male	19·90	—	3·70	4·00	4·10	8·15	1·06	4·65	1·05	5·50
22 ,,	705	Male	14·70	—	2·45	2·77	2·82	6·00	0·76	3·70	0·79	4·40
22 ,,	706	Male	20·20	—	3·60	4·05	4·15	8·10	0·93	5·20	0·97	6·00
22 ,,	707	Male	20·35	—	4·18	4·35	4·45	8·65	1·07	5·25	0·98	6·10
23 ,,	708	Female	20·05	—	3·80	—	4·13	8·30	0·97	—	0·98	5·65
23 ,,	709	Male	21·00	—	4·00	4·30	4·30	8·50	1·03	4·85	1·06	5·85
23 ,,	710	Female	16·35	—	2·70	2·85	2·95	6·25	0·83	4·00	0·85	4·80
23 ,,	711	Female	16·20	—	2·60	—	3·00	6·20	—	—	0·82	4·75
23 ,,	713	Female	18·85	—	3·55	3·80	3·90	7·75	0·94	4·55	0·91	4·90
23 ,,	714	Female	21·50	—	4·20	—	4·67	9·00	0·97	5·00	1·04	5·90
23 ,,	715	Male	14·20	—	2·15	2·35	2·40	5·25	0·65	—	0·80	4·45
24 ,,	717	Female	19·45	—	3·70	3·95	4·04	8·00	0·93	4·85	0·90	5·65
24 ,,	719	Male	17·35	—	3·35	3·55	3·72	7·20	0·86	4·35	0·84	5·35
25 ,,	721	Female	21·00	—	3·90	—	4·45	8·65	1·00	4·80	1·10	5·65
25 ,,	722	Male	15·75	—	3·00	—	3·35	7·00	0·95	4·39	1·08	4·50
25 ,,	723	Male	21·50	—	4·10	—	4·35	8·60	1·02	5·55	—	6·30
25 ,,	724	Female	23·10	—	4·00	—	4·80	9·35	1·08	5·65	1·10	6·20
25 ,,	725	Male	20·10	—	3·90	4·25	4·30	8·00	1·01	5·00	1·20	5·65
26 ,,	727	Female	20·95	—	4·20	—	4·47	8·90	1·05	5·25	1·05	5·80
27 ,,	728	Male	20·25	—	3·70	—	4·05	8·20	0·99	4·90	1·00	6·05
29 ,,	729	Male	20·60	—	3·90	—	4·40	8·70	1·05	4·80	1·10	5·60
29 ,,	730	Male	19·80	—	3·80	—	4·40	8·00	0·90	4·95	1·00	5·55
29 ,,	731	Female	18·70	—	3·75	3·90	3·95	7·90	0·94	4·55	0·95	5·15
29 ,,	732	Female	21·90	—	4·70	—	5·20	9·70	1·20	5·25	1·08	6·00
29 ,,	733	Female	18·00	—	3·40	—	3·90	7·50	0·95	4·30	0·92	5·00
29 ,,	734	Male	16·80	—	3·00	3·30	3·35	6·55	0·83	4·00	0·90	4·85
29 ,,	735	Female	18·25	—	3·35	—	3·80	7·25	0·90	4·30	0·83	4·95

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
8·55	—	1·00	0·48	1·00	1·82	2·20	2·27	—	4·85	2·10	—	—	—
9·70	9·70	0·80	0·53	1·25	1·80	2·34	2·40	0·60	6·15	2·34	—	—	1·95
9·70	10·10	1·55	0·56	1·40	1·90	—	—	—	—	—	—	—	1·90
9·18	8·90	1·45	0·54	1·10	1·77	2·23	2·32	0·54	5·44	2·13	—	—	1·74
9·65	9·40	1·35	0·48	1·08	1·70	—	—	—	5·17	2·26	—	—	1·80
9·00	8·80	1·60	0·46	1·10	1·82	2·20	2·27	0·61	5·10	2·13	—	—	1·85
8·70	8·50	0·55	0·56	1·20	1·66	2·13	2·20	0·56	5·07	—	4·95	—	1·65
7·85	7·70	1·12	0·35	1·00	1·42	—	—	—	—	—	—	—	1·50
9·47	—	0·67	0·56	1·15	1·98	—	—	0·60	—	—	—	—	—
9·40	—	1·20	0·56	1·05	1·90	2·52	2·61	0·61	5·60	2·38	—	—	—
—	—	—	—	—	—	—	—	—	5·50	—	—	—	—
9·10	8·90	0·65	0·50	0·90	1·60	2·18	2·24	—	5·20	2·15	—	—	1·90
—	—	1·00	—	—	—	—	—	—	—	—	—	—	—
9·55	9·60	0·63	0·44	1·50	—	—	—	—	—	—	—	—	2·05
7·70	7·30	0·50	0·40	1·00	—	1·70	—	0·50	3·85	1·90	—	—	—
7·64	—	0·32	—	—	1·34	1·80	1·83	0·45	4·00	1·76	—	—	—
7·70	7·40	1·20	0·33	1·10	1·20	1·67	1·68	0·44	3·65	1·80	—	—	1·30
9·15	8·80	1·50	—	1·40	1·55	—	—	—	—	—	—	—	—
8·70	8·50	1·45	0·53	1·00	1·73	—	—	—	4·70	1·92	—	—	1·90
8·35	8·20	1·35	0·44	1·13	1·53	—	—	—	—	—	—	—	1·60
8·85	8·60	1·55	0·43	1·10	1·57	—	—	—	4·85	2·26	—	—	—
9·40	9·00	0·70	0·55	1·20	—	2·22	2·27	0·55	5·00	2·11	—	—	—
7·10	6·90	0·40	0·42	0·90	—	—	—	—	—	—	—	—	—
7·70	7·47	1·15	0·37	1·00	1·40	1·67	2·00	0·42	3·80	1·70	—	—	1·48
7·75	8·00	0·45	0·36	1·10	—	1·70	1·76	0·40	4·07	1·90	—	—	1·45
8·00	7·60	0·70	0·40	0·75	1·35	1·88	1·96	0·48	4·25	2·10	—	—	1·70
7·60	7·32	0·45	0·35	0·80	1·17	1·70	1·76	0·40	—	—	—	—	1·40
8·80	—	0·50	—	—	—	—	—	—	5·35	2·35	—	—	—
9·00	—	1·10	0·39	1·50	1·80	2·45	2·49	—	5·75	2·35	—	—	2·00
9·00	8·70	1·40	0·36	1·00	1·45	—	—	—	—	—	—	—	1·60
8·90	8·50	0·45	0·52	1·05	1·85	2·37	2·42	0·55	5·20	2·24	—	—	2·20
9·90	9·10	0·55	—	1·27	1·50	—	—	—	5·70	2·55	—	—	2·15
8·50	—	0·45	—	—	1·45	1·95	2·00	0·51	4·55	2·30	—	—	—
8·80	8·65	1·30	0·45	1·10	1·65	2·35	2·10	0·58	5·05	2·40	—	—	1·85
7·20	6·85	1·25	0·38	0·75	1·20	1·68	1·70	0·44	3·58	1·54	—	—	1·30
9·45	9·20	1·40	0·48	1·20	1·65	2·24	2·30	0·57	5·25	2·16	—	—	2·00
9·45	9·30	1·40	0·57	1·05	1·52	—	—	—	—	—	—	—	1·90
8·95	—	0·55	—	—	1·65	2·25	2·29	0·60	5·20	2·35	—	—	—
9·60	9·30	—	0·55	1·10	1·75	2·34	2·42	0·58	5·45	2·35	—	—	1·90
7·60	7·50	0·50	0·60	0·80	1·20	1·62	1·73	0·45	—	—	—	—	1·40
7·30	—	0·35	—	—	1·10	1·66	1·71	0·41	3·90	1·83	—	—	—
8·20	8·00	0·50	0·50	1·00	1·40	—	—	—	4·90	2·13	—	—	1·90
9·30	8·80	0·50	0·60	1·10	1·75	—	—	—	—	—	—	—	1·90
7·00	—	0·65	0·45	0·80	1·10	1·58	1·59	0·44	—	—	—	—	—
9·00	8·80	0·60	—	1·00	1·74	2·20	2·25	0·54	4·90	2·00	—	—	1·75
8·55	8·40	1·35	0·41	0·90	1·53	—	—	—	—	—	—	—	1·40
9·40	9·00	0·55	0·46	1·05	1·70	2·30	2·34	0·58	5·35	2·23	—	—	—
7·25	7·35	1·30	0·44	1·02	1·47	1·85	1·90	0·47	4·10	1·71	—	—	1·40
10·10	9·90	1·50	0·51	1·36	1·80	1·80	1·83	0·50	5·35	2·31	—	—	2·10
10·10	10·35	0·60	0·55	1·05	1·75	2·35	2·44	0·62	5·90	2·31	—	—	1·82
9·40	9·00	1·45	0·52	1·11	1·57	2·20	2·29	0·56	5·30	2·10	—	—	1·90
9·50	9·20	0·65	0·42	1·12	1·60	2·25	2·30	0·61	5·65	2·46	—	—	2·00
9·80	—	1·00	0·50	1·10	1·70	2·20	2·25	0·56	5·05	2·21	—	—	—
9·10	9·00	1·60	—	1·10	1·85	2·45	—	0·62	—	—	—	—	2·10
9·08	9·00	1·40	0·60	1·30	1·65	2·15	2·22	0·55	5·25	2·00	—	—	1·90
8·30	8·30	0·55	0·50	1·20	1·85	—	—	—	—	—	—	—	1·80
9·60	9·30	0·70	—	1·08	2·00	2·65	2·70	0·63	6·30	2·61	—	—	2·40
7·90	—	0·50	0·40	1·00	1·55	2·08	2·15	0·56	4·70	2·04	—	—	—
—	7·80	1·15	0·45	1·05	1·37	1·86	1·90	0·46	—	—	—	—	1·50
8·10	8·05	0·60	0·45	0·85	1·40	1·85	1·92	0·48	4·65	2·01	—	—	1·60

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1926												
29 March	736	Female	20·20	—	3·70	—	4·20	8·15	1·00	5·00	1·10	5·70
29 ,,	738	Male	21·00	—	4·00	—	4·40	8·55	1·03	5·05	1·10	6·00
Saldanha Bay												
15 June	741	Female	16·77	—	3·10	3·45	3·47	7·10	0·83	4·20	0·91	4·80
15 ,,	742	Female	16·85	—	2·97	3·30	3·36	6·57	0·77	4·20	0·79	4·48
15 ,,	743	Male	13·92	—	2·29	—	2·60	5·72	0·70	3·45	0·75	4·25
15 ,,	744	Male	15·50	—	2·90	—	3·33	6·50	0·78	3·87	0·81	4·60
15 ,,	745	Male	13·90	—	2·32	2·60	2·65	5·45	0·72	3·58	0·77	4·28
16 ,,	749	Male	15·50	—	2·50	2·85	3·00	6·00	—	3·75	0·80	4·80
16 ,,	750	Male	17·15	—	3·30	3·70	3·77	7·35	0·83	4·35	0·85	4·90
16 ,,	751	Male	15·75	—	2·70	3·04	3·10	—	0·75	4·05	0·85	4·85
17 ,,	752	Male	16·60	—	—	3·40	3·46	6·50	0·86	—	0·90	5·05
17 ,,	755	Female	16·50	—	3·00	3·48	3·52	6·90	0·80	3·78	0·88	4·95
20 ,,	762	Female	17·10	—	3·05	3·45	3·55	7·10	0·83	4·05	0·78	4·90
20 ,,	765	Female	20·85	—	3·67	4·15	4·25	8·60	0·97	5·15	1·00	6·05
22 ,,	771	Male	16·50	—	3·05	3·25	3·37	6·70	0·76	—	0·79	5·00
22 ,,	772	Male	15·45	—	2·70	3·05	3·16	6·45	0·70	3·80	0·81	4·65
22 ,,	775	Female	21·70	—	4·20	4·40	4·53	8·94	1·05	5·50	1·01	6·50
23 ,,	778	Female	17·75	—	3·40	3·65	3·80	7·45	0·82	—	0·90	4·95
23 ,,	780	Male	17·10	—	2·90	3·35	3·42	6·90	0·84	4·33	0·84	5·30
24 ,,	782	Male	15·60	—	3·00	3·17	3·21	6·55	0·78	—	0·80	4·65
24 ,,	783	Male	16·50	—	3·10	3·20	3·35	6·70	0·84	4·07	0·80	4·70
24 ,,	784	Female	17·65	—	3·25	3·57	3·68	7·35	0·85	4·47	0·90	5·45
24 ,,	786	Male	14·48	—	2·70	2·96	3·09	6·00	0·74	3·53	0·70	4·20
24 ,,	788	Female	15·95	—	3·00	3·35	3·40	6·80	0·76	—	0·92	4·85
25 ,,	789	Male	16·45	—	3·10	3·20	3·30	6·87	0·87	—	0·82	5·18
25 ,,	790	Male	16·50	—	2·94	3·16	3·29	6·70	0·85	4·15	0·85	4·89
25 ,,	791	Male	15·10	—	2·54	2·79	2·90	7·96	0·74	3·95	0·88	4·70
25 ,,	792	Female	18·50	—	3·85	4·20	4·23	8·10	0·98	—	0·93	5·35
26 ,,	795	Male	15·60	—	2·80	2·95	3·04	6·28	—	—	0·82	4·80
26 ,,	796	Male	15·25	—	2·70	2·94	3·08	6·20	0·74	3·85	0·73	4·30
26 ,,	798	Female	15·85	—	2·65	2·90	3·05	6·15	0·73	4·17	0·76	4·78
26 ,,	800	Female	16·25	—	2·90	3·05	3·16	6·42	0·72	4·42	0·86	4·80
27 ,,	804	Male	16·00	—	2·80	3·00	3·16	6·50	0·83	4·23	0·90	4·70
27 ,,	806	Male	14·67	—	2·60	—	2·98	5·94	0·73	3·76	0·74	4·35
28 ,,	807	Female	20·15	—	4·12	4·45	4·46	8·35	0·93	—	0·94	5·73
28 ,,	808	Female	15·14	—	2·70	3·10	3·17	6·00	0·75	3·80	0·80	4·40
29 ,,	815	Male	16·50	—	2·80	3·00	3·15	6·50	0·81	4·33	0·90	4·95
29 ,,	817	Female	14·60	—	2·60	2·78	2·93	5·90	0·74	3·85	0·80	4·60
30 ,,	821	Male	16·10	—	2·74	2·84	3·03	6·15	0·72	4·10	0·80	4·70
2 July	831	Male	18·85	—	3·65	4·40	4·68	7·55	0·96	4·77	1·02	5·55
2 ,,	832	Female	15·32	—	2·68	3·03	3·09	6·26	0·73	3·80	0·70	4·48
3 ,,	837	Male	15·55	—	2·77	2·95	3·05	6·30	0·77	3·78	0·75	4·30
3 ,,	839	Female	14·80	—	2·40	2·60	2·75	5·62	0·70	3·97	0·74	4·50
3 ,,	841	Female	14·23	—	2·40	2·65	2·78	5·65	0·66	3·82	0·77	4·60
3 ,,	842	Female	14·90	—	2·50	2·70	2·83	5·65	0·70	3·70	0·72	4·45
8 ,,	852	Female	14·60	—	2·73	2·04	2·08	6·05	—	—	0·70	4·35
8 ,,	854	Female	15·75	—	3·00	3·15	3·26	6·55	0·76	3·95	0·82	4·63
8 ,,	856	Male	17·20	—	3·17	3·33	3·48	7·03	0·84	4·27	0·90	5·00
9 ,,	858	Male	15·00	—	2·77	2·98	3·06	6·05	0·80	3·87	0·80	4·50
9 ,,	861	Male	19·20	—	3·78	4·12	4·18	8·25	0·98	4·70	0·90	5·30
10 ,,	865	Male	15·43	—	2·75	—	3·05	6·20	0·79	4·00	0·79	4·60
12 ,,	870	Male	19·00	—	3·80	4·12	4·28	8·37	0·95	4·66	0·96	5·45
12 ,,	873	Male	16·60	—	3·17	3·35	3·45	6·85	0·87	4·62	0·88	5·00
12 ,,	875	Female	19·20	—	3·75	4·12	4·20	8·10	1·00	4·73	0·96	5·45
13 ,,	876	Male	16·47	—	2·76	3·10	3·13	6·25	0·84	—	0·78	5·15
13 ,,	877	Female	21·60	—	4·10	4·35	4·50	8·80	0·98	5·58	1·05	6·25
13 ,,	878	Female	15·30	—	2·75	3·00	3·15	6·20	0·72	3·90	0·75	4·40
13 ,,	880	Female	15·55	—	2·85	3·10	3·24	6·55	0·83	3·90	0·75	4·40

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
9·20	9·00	0·70	0·37	0·85	1·65	2·20	2·25	0·59	5·10	2·36	—	—	1·80
9·45	9·35	1·40	0·67	1·35	1·65	2·25	2·33	0·60	5·40	2·06	—	—	2·15
7·45	7·10	0·50	0·41	1·00	1·42	1·91	1·95	—	4·30	1·66	—	—	1·38
7·25	7·00	0·47	0·39	1·00	1·30	1·70	1·75	0·45	4·18	1·73	—	—	1·35
6·70	6·55	1·02	0·33	0·85	1·28	1·72	1·76	0·41	3·18	1·41	—	—	1·30
7·25	7·00	1·30	0·45	0·78	1·30	1·88	—	0·43	—	1·63	—	—	1·15
6·70	6·60	1·09	0·26	0·87	1·15	—	—	—	—	—	—	—	1·20
7·50	7·10	1·00	0·28	—	1·15	1·80	1·87	0·47	—	—	—	—	1·40
7·90	7·65	1·30	0·36	0·90	1·45	—	—	—	4·60	1·76	—	—	1·50
7·65	7·20	1·20	0·39	1·00	—	—	—	—	—	—	—	—	1·35
—	—	0·65	—	—	1·24	—	—	—	4·25	1·74	—	—	—
8·10	7·70	0·45	0·49	1·13	1·35	1·90	1·92	0·48	—	—	—	—	1·30
7·50	7·40	0·45	0·38	0·90	1·40	1·90	1·99	0·47	4·35	1·86	—	—	1·50
10·00	9·60	0·60	0·39	0·90	1·70	2·30	2·42	0·54	5·00	2·20	—	—	1·80
7·60	—	0·75	—	—	1·32	1·84	1·90	0·44	3·95	1·60	—	—	—
7·45	7·30	1·25	0·32	0·90	1·40	1·82	1·90	0·43	3·90	1·60	—	—	1·23
9·75	9·75	0·70	0·50	1·00	1·75	2·46	2·49	—	5·50	—	—	—	1·85
8·05	—	0·40	—	—	1·57	2·10	2·14	—	4·45	2·00	—	—	—
8·10	7·90	1·01	0·41	1·20	1·37	2·00	2·05	0·50	4·23	1·65	—	—	1·50
7·27	—	0·64	—	—	1·30	1·78	1·84	0·45	3·90	—	—	—	—
7·55	7·15	1·20	0·39	0·80	1·43	—	—	—	4·13	—	—	—	1·35
—	8·40	0·35	0·41	1·10	1·48	—	—	—	—	—	—	—	1·52
6·70	6·50	1·10	0·28	0·55	1·14	1·58	1·67	0·40	3·72	1·48	—	—	1·04
7·80	—	0·33	—	—	1·42	1·83	1·89	0·46	—	—	—	—	—
8·00	—	0·68	—	—	1·35	1·87	1·93	0·47	4·10	1·80	—	—	—
7·86	7·58	0·99	0·46	1·20	1·40	1·95	1·98	0·50	4·05	—	—	—	1·47
7·35	7·28	1·08	—	0·80	1·32	—	—	—	—	—	—	—	1·30
8·40	—	0·35	—	—	1·67	—	—	—	5·12	2·15	—	—	—
8·17	—	0·85	—	—	1·25	1·79	1·83	0·46	3·62	1·66	—	—	—
7·27	7·00	1·18	0·37	0·80	1·25	1·81	1·86	0·44	3·74	1·52	—	—	1·25
7·60	7·45	0·39	0·42	0·86	1·27	1·62	1·65	0·38	3·72	1·60	—	—	1·32
7·50	7·20	0·40	0·36	0·93	1·34	1·68	1·71	0·41	—	—	—	—	1·30
7·43	7·30	1·23	0·43	1·00	1·35	1·89	1·94	0·46	3·95	1·70	—	—	1·46
6·90	6·75	1·12	0·40	1·03	1·32	—	—	—	—	—	—	—	1·40
9·10	—	0·49	0·50	0·80	1·50	2·10	2·16	—	5·42	—	—	—	—
6·90	6·85	0·48	0·40	0·70	1·18	1·53	1·60	0·37	3·75	1·60	—	—	1·27
7·85	7·60	1·20	0·37	1·20	1·40	—	—	—	3·84	1·53	—	—	1·35
6·95	6·80	0·30	0·39	1·00	1·20	—	—	—	3·60	1·40	—	—	1·18
7·55	7·35	1·20	0·41	0·80	1·30	1·72	1·75	0·34	3·85	1·60	—	—	1·24
9·00	8·80	1·45	0·62	0·90	1·66	2·17	2·22	0·57	4·88	2·06	—	—	1·68
6·90	6·75	0·46	0·34	0·70	1·35	1·77	1·81	0·43	3·72	1·50	—	—	1·25
7·10	6·85	1·30	0·35	0·80	1·35	1·95	2·08	0·47	3·70	1·50	—	—	1·13
7·20	6·90	0·45	0·31	0·80	1·15	1·59	1·63	0·41	3·40	1·48	—	—	1·19
7·00	6·80	0·30	0·37	0·95	1·13	1·55	1·58	0·39	3·30	1·50	—	—	1·24
7·00	7·40	0·45	0·36	0·80	1·20	1·70	1·72	0·42	—	—	—	—	1·11
—	—	0·35	—	—	1·13	1·51	1·56	0·40	3·70	1·50	—	—	—
7·15	7·00	0·49	0·46	1·00	1·20	1·75	1·78	0·41	—	—	—	—	1·35
7·80	7·95	1·25	0·48	0·90	1·38	2·02	2·10	0·48	—	—	—	—	1·40
7·25	7·00	1·30	0·32	0·90	1·22	1·70	1·70	0·43	—	—	—	—	1·20
8·80	8·45	1·40	0·46	1·25	1·75	2·35	2·50	—	5·04	1·94	—	—	1·80
—	6·90	1·10	0·43	1·20	1·20	—	—	—	—	—	—	—	1·35
8·80	8·20	1·35	0·51	1·10	1·70	—	—	—	5·12	2·30	—	—	1·80
8·10	7·60	1·20	0·51	0·95	1·32	1·90	1·94	0·49	4·27	1·72	—	—	1·40
8·50	8·40	0·65	0·57	1·25	1·56	2·05	2·10	0·53	—	2·05	—	—	1·88
8·15	—	0·45	—	—	1·25	1·84	1·89	0·46	3·90	1·62	—	—	—
10·20	10·00	0·70	0·56	1·30	1·75	2·34	2·40	0·58	5·35	2·25	—	—	2·15
7·20	7·00	0·58	0·36	1·00	1·30	1·72	1·76	0·43	3·90	1·60	—	—	1·13
7·05	6·95	0·40	0·43	1·20	1·23	1·86	1·89	0·45	3·85	1·63	—	—	1·35

Date	Whale Number	Sex	1 Total length, tip of snout to notch of flukes	2 Lower jaw, projection beyond tip of snout	3 Tip of snout to blow-hole	4 Tip of snout to angle of gape	5 Tip of snout to centre of eye	6 Tip of snout to tip of flipper	7 Eye to ear, centres	8 Notch of flukes to posterior emargination of dorsal fin	9 Flukes, width at insertion	10 Notch of flukes to anus
1926												
13 July	881	Male	14·85	—	2·55	2·79	2·89	5·92	0·71	3·82	0·76	4·35
13 ,,	882	Female	14·80	—	2·65	2·85	2·98	—	0·69	4·10	0·80	4·70
14 ,,	883	Female	16·45	—	2·85	—	3·23	5·35	—	—	0·75	5·00
14 ,,	884	Female	15·20	—	2·52	2·79	2·86	5·90	0·70	4·00	0·80	4·75
14 ,,	887	Male	15·60	—	2·75	—	3·10	6·30	0·79	3·90	0·76	4·90
25 ,,	891	Male	12·30	—	2·22	—	2·42	5·00	—	—	0·60	3·83
25 ,,	892	Male	17·40	—	3·15	3·50	3·60	7·20	0·88	4·40	0·90	5·20
25 ,,	893	Male	16·88	—	3·06	3·42	3·47	6·97	0·80	4·48	0·92	4·92
26 ,,	897	Male	15·40	—	2·38	2·65	2·73	5·85	0·70	—	0·84	—
26 ,,	898	Male	20·70	—	4·10	—	4·45	8·70	1·05	4·90	0·98	6·15
27 ,,	899	Female	15·85	—	2·82	—	3·20	6·45	0·79	4·04	0·85	4·80
27 ,,	902	Male	14·85	—	2·34	2·68	2·71	5·90	0·71	3·80	0·75	4·45
27 ,,	903	Female	15·25	—	2·78	3·03	3·12	6·35	0·75	4·00	0·80	4·65
3 Aug.	910	Male	13·38	—	—	—	2·48	—	—	—	0·72	4·07
3 ,,	912	Female	17·10	—	3·35	3·60	3·78	7·17	0·77	4·05	0·85	4·65
3 ,,	913	Female	16·10	—	2·85	3·09	3·15	6·39	0·81	3·90	0·80	4·63
3 ,,	914	Male	15·78	—	2·65	2·88	2·97	6·35	0·79	—	0·80	4·80
6 ,,	916	Female	17·75	—	3·18	3·55	3·68	7·30	0·83	—	0·82	5·75
6 ,,	917	Female	14·52	—	2·80	2·90	3·03	6·06	0·73	3·75	0·78	4·35
7 ,,	922	Female	14·65	—	2·45	2·80	2·85	5·85	0·70	—	0·79	4·10
7 ,,	924	Male	16·20	—	2·80	3·15	3·22	6·45	0·79	4·00	0·86	4·80
11 ,,	933	Female	15·80	—	2·97	—	3·33	6·85	0·81	3·85	0·76	4·85
12 ,,	934	Male	15·80	—	—	—	3·50	7·00	0·79	—	0·81	4·60
12 ,,	935	Male	14·40	—	2·78	2·85	2·98	5·55	0·70	3·69	0·71	4·10
13 ,,	940	Male	15·43	—	2·58	2·85	2·97	6·07	0·76	3·94	0·79	4·77
13 ,,	941	Female	14·70	—	2·55	2·73	2·80	5·72	0·68	3·80	0·79	4·50
15 ,,	946	Female	14·25	—	2·57	—	2·94	—	0·70	—	0·73	4·28
15 ,,	948	Female	16·80	—	2·04	3·20	3·33	6·75	0·81	4·30	0·91	5·00
15 ,,	949	Female	20·70	—	4·00	4·45	4·53	8·74	0·99	4·88	1·00	5·84
15 ,,	950	Male	20·80	—	3·85	4·22	4·32	8·53	1·05	4·90	1·07	6·00
16 ,,	954	Female	15·35	—	—	—	3·05	—	—	—	0·77	4·45
16 ,,	955	Male	20·22	—	3·88	4·03	4·34	8·40	0·95	4·80	1·07	5·74
17 ,,	957	Male	14·20	—	2·50	2·70	2·76	5·77	0·71	3·65	0·75	4·20
17 ,,	959	Male	14·90	—	2·40	2·60	2·75	5·75	0·73	3·90	0·81	4·55
18 ,,	960	Female	15·60	—	2·90	3·22	3·25	6·35	—	—	0·80	4·75
19 ,,	962	Male	14·55	—	2·48	2·82	2·82	5·97	0·75	—	0·78	4·40
19 ,,	963	Female	16·78	—	3·10	3·40	3·45	6·77	0·76	4·45	0·86	5·05
19 ,,	966	Male	17·90	—	3·35	3·68	3·80	7·48	0·89	4·40	0·83	5·10
20 ,,	969	Male	15·65	—	—	—	2·90	—	—	—	0·84	—
20 ,,	970	Male	15·20	—	2·75	—	3·19	6·20	—	4·15	0·83	5·00
20 ,,	972	Male	20·90	—	3·80	4·20	4·36	—	1·03	5·20	1·05	5·85
20 ,,	973	Male	14·10	—	2·45	2·72	2·81	5·65	0·66	3·45	0·78	4·15
20 ,,	975	Male	18·00	—	3·40	3·65	3·80	7·50	0·96	4·50	0·90	5·15
20 ,,	977	Male	14·00	—	2·45	2·60	2·70	5·40	0·69	3·70	0·76	4·30
21 ,,	978	Male	14·45	—	2·58	—	2·83	5·85	—	—	0·77	4·50
21 ,,	979	Female	15·47	—	2·60	2·80	2·94	5·95	0·73	4·00	0·81	4·75
21 ,,	980	Female	15·75	—	2·75	—	3·14	6·27	0·75	3·91	0·79	4·65
21 ,,	982	Male	14·45	—	2·42	2·59	2·72	5·60	0·74	3·88	0·80	4·44
21 ,,	983	Female	15·67	—	2·79	3·04	3·17	6·30	0·75	3·87	0·88	4·60
22 ,,	986	Male	19·95	—	4·08	4·30	4·42	—	0·98	4·45	1·00	5·40
23 ,,	987	Male	15·55	—	2·65	2·95	2·95	6·05	—	—	0·87	4·80
23 ,,	988	Male	16·05	—	2·87	3·10	3·22	6·26	0·69	3·90	0·77	4·45
23 ,,	989	Female	14·60	—	2·53	2·73	2·85	5·86	0·76	3·90	0·79	4·62
23 ,,	990	Female	16·20	—	2·86	3·21	3·32	6·62	0·78	4·18	0·81	4·75
23 ,,	992	Male	16·70	—	2·98	3·23	3·33	6·77	0·80	4·34	0·89	4·90
24 ,,	999	Male	13·35	—	2·43	2·50	2·58	5·40	0·66	3·35	0·71	4·03
24 ,,	1000	Male	15·50	—	2·65	2·90	3·00	6·20	0·77	4·20	0·85	4·35
24 ,,	1001	Male	15·10	—	2·88	3·10	3·25	6·55	0·71	4·15	0·80	4·80
24 ,,	1002	Male	14·65	—	2·30	2·65	2·75	5·70	0·72	3·65	0·83	—
24 ,,	1003	Male	18·15	—	4·25	4·50	4·64	7·40	0·84	4·40	0·90	5·35

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
7·10	7·20	1·10	0·34	0·80	—	1·56	1·62	0·41	3·40	1·60	—	—	1·13
7·20	7·00	0·40	0·30	0·65	—	—	—	—	—	—	—	—	1·30
7·80	—	0·42	—	—	1·31	1·85	1·87	0·42	—	—	—	—	—
7·50	7·30	0·50	0·41	0·90	1·09	1·85	1·88	0·39	—	—	—	—	1·20
7·60	—	—	0·38	1·10	1·25	1·70	1·72	0·40	—	—	—	—	—
6·40	—	0·50	—	—	1·05	1·42	1·45	0·35	3·00	1·26	—	—	—
8·30	8·00	1·32	0·42	1·07	1·40	1·87	1·92	0·47	4·32	1·81	—	—	1·44
7·75	7·65	1·28	0·46	1·00	1·40	1·75	1·78	0·44	4·12	—	—	—	1·50
7·35	—	—	—	—	1·17	1·65	1·74	0·41	3·50	1·40	—	—	—
10·00	9·50	1·45	0·55	1·30	1·70	2·20	2·35	—	—	—	—	—	—
7·60	7·40	0·47	0·38	0·78	1·26	1·67	1·71	0·42	3·92	1·70	—	—	1·42
7·40	6·95	1·22	0·34	0·60	1·32	1·65	1·68	0·41	3·35	1·48	—	—	1·10
7·85	7·25	0·47	0·57	1·15	1·25	—	—	—	—	—	—	—	1·38
6·37	—	0·74	—	—	1·05	1·56	1·62	0·41	3·15	1·40	3·08	—	—
7·80	7·55	0·50	0·42	1·10	1·48	—	—	—	4·50	1·75	—	—	1·45
—	7·43	0·45	0·39	1·10	1·31	1·68	1·77	0·42	4·00	1·55	—	—	1·30
7·50	—	0·70	0·35	—	1·30	1·70	1·78	0·44	3·70	1·55	—	—	—
8·05	—	0·30	0·37	0·78	1·32	1·88	1·90	0·45	4·48	1·68	—	—	—
7·10	6·70	0·45	0·37	0·80	1·24	1·72	1·75	0·39	3·70	1·55	—	—	1·25
7·10	—	0·40	0·33	—	1·16	1·55	1·62	0·38	3·45	1·45	—	—	—
8·00	7·57	1·20	0·44	1·00	1·23	—	—	—	—	—	—	—	1·25
7·40	—	0·30	0·30	1·00	1·45	1·82	1·87	0·45	—	—	—	—	—
7·15	—	—	—	—	1·40	1·94	2·00	0·50	4·25	—	—	—	—
—	6·70	0·85	0·31	0·90	1·25	1·65	1·73	0·43	—	—	—	—	1·25
7·30	7·10	1·20	0·35	0·95	1·20	1·57	1·62	0·42	3·60	1·60	—	—	1·18
7·30	7·00	0·40	0·39	0·80	1·20	1·58	1·60	0·39	—	—	—	—	1·32
6·85	—	0·29	—	—	—	—	—	—	—	—	—	—	—
8·00	7·65	0·43	0·40	0·80	1·30	2·10	2·19	0·45	4·03	1·76	—	—	1·38
9·15	8·85	0·79	0·43	1·20	1·70	2·30	2·37	0·56	5·50	2·18	—	—	1·85
9·75	9·45	1·64	0·50	1·40	1·65	—	—	—	—	—	—	—	1·78
7·10	—	—	—	—	1·52	1·74	1·76	—	3·75	1·52	—	—	—
9·00	8·70	1·23	0·45	1·35	1·67	2·20	2·26	0·58	—	—	—	—	1·72
6·75	6·25	1·10	0·41	0·70	1·18	1·53	1·57	0·38	3·40	1·57	—	—	1·35
7·07	7·00	1·10	0·35	0·75	1·24	1·64	1·67	0·41	—	—	—	—	1·20
7·30	—	—	0·30	0·75	1·15	1·66	1·73	0·42	—	—	—	—	—
6·90	—	0·58	—	—	1·22	1·62	1·65	0·42	2·52	1·55	—	—	—
8·00	7·80	0·50	0·44	0·85	1·30	1·80	1·85	0·44	4·07	1·74	—	—	1·32
8·75	8·25	1·40	0·39	0·95	1·55	2·03	3·11	0·52	4·62	1·84	—	—	1·50
7·60	—	—	—	—	1·20	1·60	1·64	0·42	3·85	1·50	—	—	—
7·90	7·49	1·10	0·39	1·05	—	1·65	1·70	0·41	—	—	—	—	1·40
9·00	9·22	1·50	0·59	1·75	—	—	—	—	—	—	—	—	1·65
6·75	6·60	1·10	0·35	1·00	1·07	1·60	1·64	0·41	3·40	1·45	—	—	1·35
8·15	8·05	1·20	0·51	1·35	1·39	1·95	2·03	—	4·65	1·80	—	—	1·50
—	6·50	0·90	0·40	0·98	1·05	1·42	1·45	0·39	—	—	—	—	1·20
7·05	—	—	—	—	1·13	1·64	1·66	0·43	3·50	1·53	—	—	—
7·65	7·15	0·45	0·36	0·80	1·30	1·64	1·67	0·42	—	—	—	—	1·31
7·55	7·00	0·49	0·39	0·80	1·18	1·62	1·66	0·44	3·75	1·70	—	—	1·23
7·25	6·80	1·00	0·49	0·90	1·25	1·49	1·54	0·43	2·38	1·57	—	—	1·46
7·30	7·10	0·47	0·38	0·80	1·20	1·64	1·68	0·42	—	—	—	—	1·23
9·00	8·55	1·45	0·55	1·40	—	—	—	—	—	—	—	—	1·60
7·45	—	0·80	—	—	1·20	1·74	1·76	0·43	3·67	1·65	—	—	—
6·90	6·70	0·90	0·45	0·90	1·17	1·68	1·74	0·42	3·90	1·55	—	—	1·40
7·05	6·90	0·43	0·32	0·98	1·16	1·61	1·64	0·44	3·58	1·62	—	—	1·38
7·35	7·00	0·40	0·39	1·00	1·40	1·74	1·79	0·46	4·03	1·70	—	—	1·40
7·85	7·55	1·35	0·36	0·75	1·26	—	—	—	—	—	—	—	1·28
6·40	6·27	0·97	0·33	0·90	1·02	1·50	1·60	0·37	3·20	1·32	—	—	1·00
7·65	7·40	1·00	0·40	1·15	1·30	1·85	1·90	0·42	—	—	—	—	1·20
—	7·45	1·16	0·38	1·05	1·35	1·90	1·95	0·42	3·85	1·55	—	—	1·30
7·30	—	—	0·42	1·00	1·22	1·70	1·76	0·41	—	—	—	—	—
8·50	8·10	1·27	0·54	1·10	1·45	2·00	2·04	0·47	—	—	—	—	1·35

Date	Whale Number	Sex	1. Total length, tip of snout to notch of flukes	2. Lower jaw, projection beyond tip of snout	3. Tip of snout to blow-hole	4. Tip of snout to angle of gape	5. Tip of snout to centre of eye	6. Tip of snout to tip of flipper	7. Eye to ear, centres	8. Notch of flukes to posterior emargination of dorsal fin	9. Flukes, width at insertion	10. Notch of flukes to anus
1926												
24 Aug.	1004	Male	20·45	—	4·27	—	4·65	9·06	1·05	4·95	1·07	5·80
25 ,,	1005	Male	17·70	—	3·20	3·50	3·68	7·35	0·84	—	0·82	5·30
25 ,,	1009	Female	16·28	—	3·00	3·20	3·43	6·85	0·77	4·25	0·86	4·90
26 ,,	1011	Male	14·30	—	—	—	2·80	—	—	—	0·76	—
26 ,,	1014	Female	17·05	—	3·32	3·50	3·55	7·15	0·82	—	0·91	4·80
26 ,,	1015	Male	15·85	—	2·87	3·10	3·33	6·40	0·77	3·85	0·82	4·34
27 ,,	1021	Male	14·95	—	2·60	—	2·83	6·00	—	—	0·75	4·90
27 ,,	1024	Male	19·60	—	4·00	4·07	4·20	8·45	0·96	4·70	1·04	5·60
27 ,,	1025	Female	15·90	—	2·80	2·95	3·12	6·35	0·73	4·40	0·76	5·05
28 ,,	1028	Male	15·50	—	2·60	2·86	2·98	6·23	—	—	0·79	4·88
28 ,,	1030	Male	19·00	—	3·65	3·90	4·00	7·90	0·98	4·80	0·88	5·35
28 ,,	1032	Male	16·10	—	2·80	3·05	3·20	6·55	0·80	4·15	0·91	4·90
28 ,,	1033	Male	20·90	—	4·15	4·35	4·62	8·95	0·96	5·20	1·03	5·80
28 ,,	1035	Male	15·75	—	2·90	3·13	3·26	6·47	0·76	3·85	0·85	4·55
29 ,,	1037	Female	15·80	—	2·80	3·08	3·10	6·20	0·75	—	0·85	4·95
29 ,,	1038	Female	17·20	—	3·30	3·55	3·70	7·30	0·86	4·27	0·81	4·93
29 ,,	1039	Female	14·60	—	2·42	2·64	2·73	5·70	0·74	3·85	0·76	4·35
29 ,,	1040	Male	16·80	—	3·13	3·38	3·47	6·93	0·90	4·10	0·88	4·80
30 ,,	1042	Male	20·15	—	3·75	4·06	4·23	8·30	1·01	4·90	0·95	5·70
31 ,,	1043	Female	16·70	—	2·95	3·20	3·24	6·45	0·83	—	0·85	5·05
31 ,,	1044	Female	15·85	—	2·88	3·04	3·16	6·83	0·74	4·05	0·88	4·80
2 Sept.	1051	Male	14·85	—	—	—	—	5·70	—	—	0·80	4·90
2 ,,	1053	Female	14·40	—	2·36	2·53	2·67	5·55	0·67	3·75	0·80	4·33
3 ,,	1055	Female	21·20	—	4·30	4·54	4·73	9·00	1·01	5·10	0·98	5·75
4 ,,	1058	Male	20·20	—	4·00	4·23	4·28	8·45	0·99	—	0·98	5·50
4 ,,	1059	Male	20·17	—	4·00	4·28	4·43	—	0·93	4·98	0·99	5·50
14 ,,	1080	Male	16·00	—	2·78	2·98	3·04	6·16	0·74	4·10	0·80	4·80
14 ,,	1082	Male	15·25	—	2·65	2·80	2·98	5·95	0·70	3·73	0·76	4·47
15 ,,	1083	Male	17·70	—	3·35	3·70	3·73	7·48	0·86	—	0·88	5·40
15 ,,	1084	Male	20·45	—	2·85	4·10	4·24	8·55	1·03	4·75	1·03	5·60
15 ,,	1086	Female	20·25	—	4·05	4·40	4·48	8·40	0·92	4·77	0·98	5·50
17 ,,	1087	Male	14·71	—	—	—	2·55	—	—	—	0·82	4·65
17 ,,	1089	Male	17·00	—	3·10	3·28	3·44	6·80	0·80	4·17	0·83	5·05
17 ,,	1090	Male	14·45	—	2·60	2·92	2·96	5·55	—	—	0·76	4·50
17 ,,	1091	Female	15·95	—	2·82	3·03	3·20	6·35	0·71	3·88	0·87	4·78
17 ,,	1092	Female	16·35	—	3·18	3·35	3·48	6·80	0·81	3·95	0·93	4·79
17 ,,	1093	Female	15·30	—	2·68	2·89	2·98	5·96	0·72	4·00	0·73	4·72
17 ,,	1094	Male	21·20	—	4·04	4·20	4·42	8·70	1·03	5·10	1·01	5·68
18 ,,	1096	Male	13·90	—	2·25	2·49	2·60	5·28	0·66	3·46	0·78	4·12
18 ,,	1097	Female	12·75	—	2·01	2·33	2·36	4·80	0·61	3·49	0·67	3·90
20 ,,	1102	Male	16·50	—	2·96	3·20	3·38	6·70	0·72	—	0·75	4·75
21 ,,	1103	Female	15·20	—	2·60	—	2·95	6·10	—	—	0·82	4·45
21 ,,	1105	Male	15·25	—	2·45	2·77	2·90	6·05	0·72	3·90	0·77	4·50
21 ,,	1106	Female	15·05	—	2·71	2·89	2·98	6·06	0·78	3·90	0·77	4·68
21 ,,	1108	Male	14·80	—	2·76	3·00	3·10	6·15	0·72	3·58	0·74	4·18
22 ,,	1111	Male	20·35	—	3·87	4·00	4·17	8·20	1·01	5·00	0·95	5·75
22 ,,	1114	Female	15·25	—	2·88	3·07	3·17	6·20	0·80	3·73	0·77	4·62
22 ,,	1115	Female	17·90	—	3·40	3·70	3·85	7·60	0·89	4·47	0·84	5·10
24 ,,	1118	Male	14·05	—	2·35	2·50	2·60	5·45	0·66	—	0·81	4·30
24 ,,	1120	Female	14·80	—	2·35	2·60	2·69	5·70	0·75	3·80	0·83	4·60
25 ,,	1127	Female	21·25	—	4·07	4·32	4·56	8·70	1·08	5·40	1·00	5·90
26 ,,	1130	Male	19·20	—	3·40	3·70	3·84	7·70	0·92	4·78	0·95	5·45
26 ,,	1132	Male	21·75	—	4·20	—	4·77	9·20	0·98	5·30	1·13	6·10
26 ,,	1133	Male	21·20	—	4·23	—	4·64	8·95	1·04	5·10	0·96	5·60
26 ,,	1134	Male	14·25	—	2·55	2·70	2·77	5·68	0·75	—	0·77	4·15
26 ,,	1135	Female	17·45	—	3·35	3·55	3·67	7·20	0·85	4·40	0·85	5·30
26 ,,	1136	Male	20·15	—	3·90	—	4·30	—	1·00	4·90	0·90	5·55
27 ,,	1140	Male	14·65	—	2·25	2·70	2·70	5·60	0·69	—	0·76	4·40
27 ,,	1144	Female	16·65	—	3·10	3·45	3·50	—	0·80	4·00	0·83	4·80
28 ,,	1146	Male	19·60	—	3·98	4·15	4·34	8·00	0·98	—	0·93	5·45

11 Notch of flukes to umbilicus	12 Notch of flukes to end of system of ventral grooves	13 Anus to reproductive aperture, centres	14 Dorsal fin, vertical height	15 Dorsal fin, length of base	16 Flipper, tip to axilla	17 Flipper, tip to anterior end of lower border	18 Flipper, length along curve of lower border	19 Flipper, greatest width	20 Severed head, condyle to tip	21 Skull, greatest width	22 Skull length, condyle to tip of premaxilla	23 Flipper, tip to head of humerus	24 Tail, depth at dorsal fin
9·50	9·10	1·50	0·52	1·30	1·58	—	—	—	—	—	—	—	2·00
8·30	—	—	—	—	1·37	1·95	1·98	0·48	4·45	1·84	—	—	—
7·85	7·70	0·50	0·43	1·00	1·40	1·90	1·95	0·49	4·18	2·80	—	—	1·45
6·95	—	—	—	—	1·08	1·54	1·62	—	3·40	1·30	—	—	—
7·50	—	0·45	—	—	1·45	—	—	—	4·37	1·65	—	—	—
7·30	6·90	1·00	0·39	1·10	1·12	1·67	1·71	0·40	3·92	1·50	—	—	1·35
6·90	—	0·50	0·38	1·00	1·20	1·65	1·67	—	3·50	1·45	—	—	—
8·90	8·60	1·42	0·51	1·05	1·80	—	—	—	5·00	2·27	—	—	1·59
7·90	7·70	0·55	0·32	0·80	1·27	1·78	1·81	0·43	3·74	1·64	—	—	1·25
7·30	—	—	0·39	0·80	—	1·77	1·85	0·44	3·70	1·63	—	—	—
8·90	8·60	1·30	0·46	1·40	1·60	2·10	2·18	0·54	4·85	1·98	—	—	1·77
7·80	7·50	1·25	0·44	0·80	1·37	1·87	1·92	0·48	3·88	1·83	—	—	1·25
9·60	9·20	1·70	0·63	1·30	1·70	—	—	—	5·50	2·14	—	—	1·67
7·30	7·05	1·23	0·48	0·90	1·35	1·70	1·75	0·44	3·98	1·65	—	—	1·34
7·50	—	0·35	—	—	1·34	1·70	1·75	0·41	3·80	1·61	—	—	—
8·00	7·70	0·57	0·43	0·90	1·43	1·99	2·02	0·49	4·48	1·86	—	—	1·52
7·00	6·65	0·45	0·37	0·70	1·28	—	—	—	—	—	—	—	1·33
7·85	7·70	1·33	0·39	1·00	1·30	—	—	—	—	—	—	—	1·53
9·10	8·75	1·50	0·42	1·20	1·70	—	—	—	—	—	—	—	1·77
7·80	—	0·43	0·37	0·73	1·30	1·80	1·87	0·43	4·00	1·71	—	—	—
7·60	7·35	0·50	0·38	1·00	1·20	1·84	1·91	0·42	3·86	1·54	—	—	1·28
7·65	—	0·75	—	—	—	—	—	—	3·36	1·65	—	—	—
6·90	6·65	0·47	0·42	0·85	1·14	1·65	1·73	0·38	—	—	—	—	1·25
9·30	9·00	0·65	0·45	1·00	1·75	2·32	2·40	0·60	5·63	2·40	—	—	1·78
9·00	—	1·18	0·62	1·00	1·60	2·20	2·28	0·57	5·10	2·35	—	—	—
8·65	8·25	1·55	—	1·24	1·65	2·30	2·36	—	5·25	2·14	—	—	1·75
7·60	7·45	0·75	0·36	0·75	1·22	1·57	1·63	0·41	—	—	—	—	1·24
7·10	7·00	1·22	0·42	0·95	1·13	1·61	1·67	0·39	—	—	—	—	1·35
8·20	—	0·80	0·45	0·80	1·45	—	—	0·50	4·45	1·90	—	—	—
9·30	9·10	1·70	0·56	1·20	1·70	2·25	2·30	0·60	5·15	—	—	—	1·83
8·90	8·60	0·65	0·55	1·30	1·56	2·09	2·13	0·56	—	—	—	—	1·75
7·00	—	—	—	—	1·31	1·77	1·81	0·43	3·21	1·56	—	—	—
8·10	7·90	1·30	0·37	0·85	1·25	—	—	—	—	—	—	—	1·35
6·85	—	—	—	—	1·12	1·47	1·51	0·37	—	—	—	—	—
7·55	7·30	0·37	0·36	1·00	1·37	1·76	1·79	0·45	3·87	1·62	—	—	1·32
7·45	7·25	0·41	0·44	0·90	1·37	1·79	1·82	—	—	—	—	—	1·47
7·30	7·10	0·38	0·30	0·80	1·18	1·63	1·69	0·38	—	—	—	—	1·28
9·60	9·45	1·72	0·51	0·90	1·48	—	—	—	5·36	2·20	—	—	1·54
6·57	6·40	1·08	0·33	0·65	1·10	1·65	1·70	0·38	3·19	1·40	—	—	1·20
6·25	6·40	0·42	0·32	0·70	1·00	1·59	1·62	0·35	—	—	—	—	1·05
7·60	7·70	1·20	0·38	0·80	1·34	1·90	1·96	—	—	—	—	—	—
7·00	—	0·35	—	—	1·17	1·61	1·65	0·43	3·68	1·53	—	—	—
7·18	7·00	1·00	0·41	0·80	1·21	1·62	1·66	0·40	3·57	1·51	—	—	1·36
7·20	6·90	0·42	0·45	1·00	1·36	1·94	2·00	0·40	3·72	1·49	—	—	1·35
6·60	6·45	1·18	0·41	0·90	1·18	1·80	1·86	0·42	—	—	—	—	1·31
9·26	8·90	1·55	0·57	1·10	1·44	1·95	1·96	0·55	5·04	2·04	—	—	1·63
7·25	7·00	0·46	0·52	1·00	1·15	1·47	1·56	0·38	3·90	1·60	—	—	1·38
8·10	7·80	0·50	0·38	1·00	1·38	1·98	2·10	0·46	4·65	1·94	—	—	1·57
6·75	—	—	0·38	0·80	1·08	1·55	1·61	0·37	3·19	1·50	—	—	—
7·25	7·25	0·40	0·39	0·95	1·18	1·61	1·70	0·41	—	—	—	—	1·15
9·60	9·20	0·65	0·55	1·10	1·60	2·17	2·21	0·62	5·46	2·36	—	—	1·87
9·00	8·65	1·50	0·42	1·15	1·46	1·72	1·76	0·49	—	—	—	—	1·60
9·90	9·55	1·58	0·50	1·15	1·80	2·50	2·34	0·66	—	—	—	—	1·60
9·45	9·10	1·15	0·47	1·10	1·75	2·29	2·34	0·64	5·65	2·20	—	—	1·80
6·80	—	1·16	0·36	0·60	1·15	1·40	1·49	0·38	—	—	—	—	—
8·45	8·10	0·40	0·47	1·20	1·45	1·92	1·97	0·51	—	—	—	—	1·50
8·95	8·60	1·55	0·38	1·37	—	2·20	2·26	0·58	—	—	—	—	1·70
7·00	—	—	0·43	1·05	1·22	1·55	1·58	0·40	—	—	—	—	—
7·55	7·45	0·45	0·37	0·90	1·37	1·79	1·86	0·46	—	—	—	—	1·45
8·95	—	—	—	—	—	—	—	—	—	—	—	—	—

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1926												
28 Sept.	1148	Male	16·80	—	3·14	3·35	3·43	6·80	0·83	4·25	0·85	4·90
28 ,,	1149	Male	15·95	—	2·80	3·15	3·28	—	0·76	4·00	0·77	4·70
3 Oct.	1163	Female	15·40	—	2·75	2·83	2·92	6·05	0·74	4·10	0·81	4·75
3 ,,	1165	Female	18·80	—	3·45	3·85	3·90	7·80	0·93	4·66	0·94	5·40
7 ,,	1175	Male	19·60	—	4·19	—	4·40	—	0·97	4·65	0·90	5·50
8 ,,	1180	Male	14·90	—	2·40	2·60	2·68	5·55	0·70	—	0·81	4·40
9 ,,	1184	Female	16·70	—	2·90	3·20	3·26	6·60	0·82	—	0·90	5·00
9 ,,	1187	Female	13·55	—	2·20	2·48	2·57	5·39	0·66	3·48	0·68	4·05
9 ,,	1188	Male	15·00	—	2·75	3·00	3·10	6·15	0·74	3·75	0·75	—
11 ,,	1189	Male	19·35	—	3·60	—	4·13	—	1·02	4·45	1·00	5·45
11 ,,	1190	Male	21·70	—	4·00	—	4·30	—	0·98	5·00	0·90	6·05
11 ,,	1192	Male	20·70	—	4·10	—	4·48	8·90	1·05	4·70	1·00	5·70
11 ,,	1193	Male	15·25	—	2·47	2·65	2·75	5·95	0·77	3·95	0·85	4·75
South Georgia												
15 Nov.	1194	Male	20·25	—	3·90	—	4·20	—	1·03	—	1·04	6·10
15 ,,	1197	Male	21·30	—	3·89	4·34	4·52	9·24	1·04	4·75	1·03	5·89
15 ,,	1198	Male	21·33	—	4·65	5·45	4·85	9·67	—	—	1·08	5·73
16 ,,	1199	Male	19·60	—	3·75	4·05	4·21	8·33	0·94	—	0·90	5·02
17 ,,	1203	Female	20·70	—	4·26	—	4·50	9·31	—	—	1·03	5·95
18 ,,	1210	Female	21·80	—	4·44	4·82	4·88	—	—	—	0·98	6·00
18 ,,	1211	Male	20·30	—	3·90	—	4·37	8·30	1·03	5·00	1·00	5·60
22 ,,	1221	Female	22·40	—	4·25	—	4·65	—	1·05	—	0·95	6·40
22 ,,	1224	Female	22·35	—	4·40	—	4·85	9·65	—	—	1·00	6·00
26 ,,	1231	Male	20·96	—	4·12	4·28	4·37	8·76	1·05	4·86	1·10	6·20
29 ,,	1235	Female	22·48	—	4·05	—	5·13	9·50	1·10	—	1·12	6·47
10 Dec.	1270	Male	22·50	—	3·85	4·11	4·25	8·30	0·91	5·11	0·96	5·81
13 ,,	1286	Male	20·24	—	3·88	—	4·27	—	1·02	4·87	1·00	5·69
16 ,,	1292	Female	22·03	—	4·21	4·71	4·71	9·25	1·10	—	0·95	5·91
20 ,,	1297	Female	22·75	—	4·00	4·60	4·70	8·80	1·03	—	1·02	5·60
1927												
4 Jan.	1338	Female	21·80	—	4·55	4·62	4·77	9·25	1·05	5·07	1·09	6·00
9 ,,	1354	Female	21·85	—	4·30	4·60	4·65	—	1·05	—	1·10	6·40
9 ,,	1357	Female	21·70	—	4·40	—	4·90	9·20	1·08	—	1·00	5·65
9 ,,	1358	Male	20·20	—	4·05	—	4·57	8·61	—	—	1·05	5·62
10 ,,	1365	Female	21·40	—	4·20	—	4·80	9·25	1·02	5·30	1·00	6·00
10 ,,	1369	Female	21·00	—	4·10	—	4·55	8·45	1·00	—	1·05	5·80
11 ,,	1370	Female	22·45	—	4·70	—	5·20	10·00	1·08	—	1·15	6·10
11 ,,	1371	Male	23·60	—	4·60	—	5·05	10·10	1·06	—	1·05	6·15
11 ,,	1372	Male	18·90	—	3·55	3·88	4·00	7·95	0·89	—	0·85	5·15
15 ,,	1377	Male	20·20	—	—	—	—	—	—	—	—	—
15 ,,	1381	Female	23·35	—	—	—	—	—	—	—	—	—
17 ,,	1391	Male	21·05	—	—	—	—	—	—	—	—	—
18 ,,	1392	Male	19·60	—	—	—	—	—	—	—	—	—
18 ,,	1393	Male	20·05	—	—	—	—	—	—	—	—	—
18 ,,	1394	Female	20·60	—	—	—	—	—	—	—	—	—
19 ,,	1398	Male	19·30	—	—	—	—	—	—	—	—	—
19 ,,	1399	Female	21·10	—	—	—	—	—	—	—	—	—
19 ,,	1400	Female	21·80	—	—	—	—	—	—	—	—	—
19 ,,	1401	Female	22·00	—	—	—	—	—	—	—	—	—
21 ,,	1404	Female	21·40	—	—	—	—	—	—	—	—	—
22 ,,	1413	Female	20·40	—	—	—	—	—	—	—	—	—
22 ,,	1414	Female	21·10	—	—	—	—	—	—	—	—	—
22 ,,	1415	Male	17·40	—	—	—	—	—	—	—	—	—
22 ,,	1416	Female	22·05	—	—	—	—	—	—	—	—	—
26 ,,	1433	Female	17·30	—	—	—	—	—	—	—	—	—
27 ,,	1435	Male	19·60	—	—	—	—	—	—	—	—	—
30 ,,	1451	Male	18·30	—	—	—	—	—	—	—	—	—
30 ,,	1452	Female	21·80	—	—	—	—	—	—	—	—	—
7 Feb.	1456	Female	19·50	—	—	—	—	—	—	—	—	—
14 ,,	1469	Male	16·00	—	—	—	—	—	—	—	—	—

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
7·90	7·65	1·30	0·44	1·10	1·40	—	—	—	4·23	1·70	—	—	1·35
7·27	—	0·95	0·44	1·00	—	—	—	—	—	—	—	—	1·32
7·60	6·15	0·55	0·32	1·15	1·32	1·80	1·82	0·44	3·60	—	3·52	2·00	1·40
8·40	—	0·45	0·54	1·30	1·60	2·21	2·30	0·52	4·70	2·00	4·61	2·42	1·62
8·90	—	1·40	0·29	1·10	1·70	2·18	2·20	0·58	—	—	—	—	1·65
7·03	—	1·15	—	—	1·10	—	—	—	3·40	1·45	—	1·62	—
7·80	—	—	0·49	1·00	1·36	1·85	1·90	0·44	4·00	1·62	3·92	2·03	—
—	6·15	0·50	0·31	0·90	1·10	1·44	1·49	0·35	—	—	—	1·62	1·22
7·00	—	—	0·38	0·85	1·15	1·60	1·62	—	—	—	—	—	—
8·60	8·60	1·45	—	1·45	—	2·10	2·19	0·50	4·90	2·00	—	—	1·70
9·95	9·75	1·65	—	1·20	—	—	—	—	—	—	—	—	1·60
—	8·85	1·50	—	1·30	1·85	2·46	2·52	—	—	—	—	—	1·70
—	7·63	1·29	0·36	1·00	1·25	1·67	1·68	—	—	—	—	—	1·30
9·55	—	1·05	—	—	—	—	—	—	—	—	—	—	—
9·43	—	1·01	—	1·30	1·75	2·39	2·50	0·60	—	—	—	—	—
9·20	8·70	1·53	—	1·38	1·88	2·49	2·52	0·61	—	—	—	—	—
8·91	—	1·27	—	—	1·75	2·20	2·25	0·54	5·15	2·14	—	—	—
8·86	—	0·51	—	—	1·77	2·35	2·41	0·62	5·60	2·30	—	—	—
9·90	—	0·65	—	—	—	—	—	—	5·85	2·40	—	—	—
9·10	8·80	1·40	0·57	1·40	1·55	—	—	—	—	—	—	—	1·85
10·30	—	0·70	—	—	—	—	—	—	—	—	—	—	—
9·70	—	0·70	—	—	1·75	—	—	—	—	—	—	—	—
9·95	9·58	1·45	0·57	1·70	1·83	2·29	2·32	0·60	—	—	—	—	1·85
9·50	—	0·58	0·42	1·05	2·05	2·31	2·42	0·64	6·28	2·58	—	—	—
9·83	9·27	1·40	0·54	1·40	1·67	—	—	—	—	—	—	—	1·90
9·25	9·25	1·43	0·53	0·97	—	—	—	—	—	—	—	—	1·87
9·79	—	0·65	—	—	1·82	2·41	2·47	0·62	5·58	2·48	—	—	—
9·30	—	0·55	0·56	—	2·03	—	—	0·65	5·65	2·40	—	—	—
9·70	9·50	0·60	0·53	1·36	1·87	2·44	2·57	0·65	5·60	2·36	—	—	1·94
10·10	—	0·60	—	—	—	—	—	—	—	—	—	—	—
9·20	—	0·55	—	—	1·60	—	—	—	6·00	2·20	—	—	—
9·10	—	—	—	—	—	—	—	0·51	5·50	2·20	—	—	—
9·65	—	0·50	0·40	1·30	2·29	2·42	2·50	0·54	5·85	2·40	—	—	—
9·20	9·00	0·60	0·50	1·30	—	—	—	—	5·50	—	—	—	1·95
—	—	—	—	—	1·80	—	—	—	6·20	2·50	—	—	—
10·40	10·40	1·15	—	—	2·10	—	—	—	6·05	2·37	—	—	—
8·45	—	—	0·46	—	1·50	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
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—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1927												
15 Feb.	1474	Male	21·30	—	—	—	4·30	—	—	—	—	6·00
15 ,,	1475	Female	22·80	—	—	—	4·87	—	—	—	—	6·40
17 ,,	1476	Male	17·00	—	—	—	3·42	—	—	—	—	4·97
21 ,,	1485	Female	23·40	—	—	—	5·27	—	—	—	—	6·58
22 ,,	1487	Male	19·40	—	—	—	3·15	6·40	0·95	4·80	—	5·40
22 ,,	1488	Male	21·70	—	—	—	4·55	7·25*	1·08	5·00	—	5·95
22 ,,	1489	Male	19·80	—	—	—	3·50	6·55	0·90	4·75	—	5·55
22 ,,	1490	Female	22·40	—	—	—	4·65	7·45	1·05	5·50	—	6·25
24 ,,	1498	Female	20·50	—	—	—	4·40	6·80	0·95	4·95	—	5·90
24 ,,	1500	Male	20·00	—	—	—	4·45	7·00	1·03	4·70	—	5·70
24 ,,	1501	Female	17·60	—	—	—	3·35	5·45	0·81	4·90	—	5·10
25 ,,	1502	Female	21·20	—	—	—	4·58	7·20	1·08	—	—	5·95
25 ,,	1505	Female	22·10	—	—	—	4·94	7·60	1·10	—	—	6·40
25 ,,	1506	Female	18·30	—	—	—	3·70	5·90	0·94	4·60	—	5·25
26 ,,	1510	Male	20·30	—	—	—	4·25	6·75	0·90	4·83	—	5·30
26 ,,	1511	Male	17·10	—	—	—	3·67	5·85	0·85	4·20	—	4·70
27 ,,	1513	Female	20·40	—	—	—	4·20	6·50	—	5·13	—	5·72
27 ,,	1515	Female	17·55	—	—	—	3·72	5·90	0·88	4·53	—	5·20
27 ,,	1516	Female	22·85	—	—	—	4·95	7·40	1·20	5·15	—	6·30
27 ,,	1519	Female	14·10	—	—	—	2·36	4·07	0·67	3·95	0·73	4·52
28 ,,	1521	Female	20·80	—	—	—	4·30	5·80	—	5·05	—	6·10
28 ,,	1522	Female	15·85	—	—	—	2·85	4·50	0·80	4·15	—	4·80
1 March	1527	Female	20·10	—	—	—	4·33	6·65	1·05	4·90	—	5·55
1 ,,	1528	Male	18·50	—	—	—	3·80	6·00	0·88	4·55	—	5·20
3 ,,	1529	Male	21·00	—	4·00	—	4·50	7·15	0·98	—	—	5·95
3 ,,	1531	Female	19·40	—	—	—	3·95	6·20	0·88	4·80	—	5·25
3 ,,	1536	Male	17·65	—	—	—	3·62	5·75	0·83	4·45	—	5·00
3 ,,	1537	Female	21·50	—	—	—	4·58	7·35	1·05	5·20	—	5·65
4 ,,	1539	Male	17·30	—	—	—	3·63	5·75	0·91	4·20	—	5·10
4 ,,	1540	Female	18·80	—	—	—	3·80	6·05	0·90	4·90	—	5·60
4 ,,	1541	Female	18·40	—	3·50	—	4·10	6·65	—	—	—	5·40
4 ,,	1542	Male	19·10	—	—	—	4·05	6·40	0·90	4·45	—	5·20
4 ,,	1543	Male	20·10	—	—	—	4·59	7·30	1·03	—	—	5·55
4 ,,	1544	Male	20·10	—	—	—	4·23	6·85	—	—	—	5·50
4 ,,	1545	Male	18·85	—	—	—	3·90	6·30	—	4·20	—	5·15
4 ,,	1546	Male	18·20	—	—	—	3·90	6·00	—	4·35	—	5·10
4 ,,	1548	Male	19·70	—	—	—	3·80	6·25	0·87	4·60	—	5·50
5 ,,	1552	Female	21·50	—	—	—	4·30	7·10	1·00	5·55	—	6·50
5 ,,	1553	Male	18·30	—	—	—	3·75	5·90	0·86	4·65	—	5·10
5 ,,	1554	Male	20·78	—	—	—	4·30	7·00	0·98	4·85	—	5·80
16 ,,	1580	Male	20·09	—	—	—	4·47	6·95	1·48	—	—	5·10
20 ,,	1585	Male	20·80	—	—	—	4·45	7·00	—	—	—	5·45
20 ,,	1587	Female	20·80	—	—	—	4·65	7·70	1·03	4·35	—	6·10
20 ,,	1589	Male	15·30	—	—	—	3·50	4·56	0·74	4·80	—	4·60
20 ,,	1590	Female	15·10	—	—	—	2·55	4·45	0·75	3·90	—	4·60
21 ,,	1591	Male	15·90	—	—	—	—	—	—	—	—	4·61
21 ,,	1592	Male	15·00	—	—	—	2·75	4·70	0·71	3·90	—	4·40
21 ,,	1594	Female	21·05	—	—	—	4·38	6·55	1·33	5·28	—	6·05
23 ,,	1595	Female	18·90	—	—	—	3·98	6·20	0·88	—	—	5·58
23 ,,	1596	Male	21·20	—	—	—	4·20	7·45	0·97	5·15	—	5·95
24 ,,	1597	Female	20·90	—	—	—	4·23	6·90	0·95	—	—	6·20
24 ,,	1598	Female	21·05	—	—	—	4·50	7·05	1·03	5·10	—	5·70
29 ,,	1603	Female	15·80	—	—	—	2·93	4·86	—	—	—	4·80
5 April	1626	Female	20·90	—	—	—	4·35	6·45	1·00	4·25	—	5·90
6 ,,	1627	Male	19·50	—	—	—	4·03	6·35	—	—	—	5·60
6 ,,	1628	Female	20·95	—	—	—	4·35	7·00	1·00	6·10	—	5·85
6 ,,	1629	Male	19·70	—	—		4·38	6·70	0·96	4·65	—	5·50
9 ,,	1641	Male	19·90	—	—	—	4·20	6·75	1·00	—	—	5·25
12 ,,	1643	Male	20·80	—	—	—	4·36	6·95	0·97	5·10	—	5·80
12 ,,	1645	Female	22·90	—	—	—	5·08	7·60	1·10	5·55	—	6·20

* Measurements to the axilla.

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—
8·70	—	1·45	0·50	—	1·60	—	—	0·55	4·80	2·15	—	—	1·95
9·50	—	1·55	0·45	—	—	—	—	—	5·50	2·45	—	—	—
8·90	—	1·45	0·45	—	1·51	—	—	0·58	5·00	2·10	—	—	—
10·00	—	0·70	0·50	—	1·65	—	—	0·55	5·70	2·40	—	—	—
9·50	—	0·65	0·57	—	—	—	—	—	5·35	2·35	—	—	2·00
9·25	—	1·30	0·53	—	1·60	2·10	—	0·47	—	—	—	—	—
8·15	—	0·50	—	—	1·36	2·08	—	0·50	4·15	1·90	—	—	—
9·75	—	—	—	—	—	—	—	—	5·50	2·29	—	—	—
9·60	—	—	—	—	—	—	—	—	—	—	—	—	—
8·35	—	0·42	—	—	—	—	—	—	—	—	—	—	—
8·69	—	1·00	0·46	—	1·75	2·30	—	0·60	5·15	2·27	—	—	2·00
7·70	—	—	0·52	—	1·50	1·97	—	0·45	4·57	1·98	—	—	—
9·25	—	—	0·46	—	1·67	2·33	—	0·60	5·00	2·36	—	—	—
8·05	—	—	0·53	—	1·60	1·92	—	0·46	4·50	1·98	—	—	1·65
10·20	—	—	0·51	—	2·08	2·48	—	0·64	5·95	2·55	—	—	—
6·90	—	0·44	0·33	—	1·17	1·67	—	0·37	—	—	—	—	1·47
9·30	—	0·60	0·50	—	1·75	2·30	—	0·55	5·15	2·30	—	—	—
7·70	—	0·60	0·43	—	1·25	1·67	—	0·42	3·60	1·70	—	—	—
8·95	—	—	0·42	—	1·80	2·35	—	0·58	5·18	2·30	—	—	—
8·40	—	—	0·48	—	1·53	—	—	—	—	—	—	—	1·77
9·45	—	—	—	—	1·78	2·53	—	0·63	—	—	—	—	—
8·40	—	—	0·40	—	1·54	2·24	—	0·53	—	—	—	—	1·93
8·10	—	—	0·46	—	1·28	1·80	—	0·46	4·39	1·89	—	—	—
9·30	—	—	0·51	—	—	—	—	—	—	—	—	—	—
7·90	—	1·25	0·40	—	1·30	1·93	—	0·47	4·45	2·00	—	—	—
8·80	—	0·40	0·40	—	—	—	—	—	—	—	—	—	—
8·75	—	0·50	—	—	—	—	—	—	—	—	—	—	—
8·40	—	1·45	0·45	—	1·70	—	—	0·50	4·95	2·20	—	—	—
9·85	—	1·35	—	—	—	—	—	—	5·50	2·55	—	—	—
9·00	—	1·05	0·48	—	1·78	2·25	—	0·58	5·50	2·35	—	—	—
8·30	—	1·35	0·42	—	1·56	2·05	—	0·52	4·70	2·20	—	—	—
8·40	—	1·55	0·45	—	1·55	1·97	—	0·55	4·50	2·10	—	—	—
8·80	—	1·30	0·43	—	1·45	2·02	—	0·52	4·67	2·10	—	—	—
9·95	—	0·60	0·55	—	1·75	2·20	—	0·58	—	—	—	—	—
8·38	—	—	0·43	—	1·49	—	—	—	—	—	—	—	—
9·40	—	—	0·53	—	1·58	—	—	—	—	—	—	—	—
8·55	—	1·00	—	—	1·95	—	—	0·59	5·45	2·60	—	—	—
8·50	—	1·15	—	—	1·80	—	—	0·55	5·20	2·05	—	—	—
9·80	—	0·50	—	—	1·90	—	—	0·62	5·60	2·60	—	—	—
7·20	—	1·10	0·37	—	1·25	—	—	0·45	3·50	1·70	—	—	1·45
7·40	—	0·45	0·32	—	1·24	—	—	0·41	3·30	1·70	—	—	—
—	—	0·74	—	—	—	—	—	—	3·50	1·60	—	—	—
7·30	—	1·30	0·28	—	1·02	—	—	0·37	3·65	1·80	—	—	1·65
9·55	—	0·75	0·55	—	1·63	—	—	0·55	—	—	—	—	—
8·95	—	0·52	—	—	1·63	—	—	0·51	4·78	1·90	—	—	—
9·30	—	1·45	0·56	—	—	—	—	—	—	—	—	—	—
9·80	—	0·60	0·49	—	1·74	—	—	0·53	5·10	2·25	—	—	—
9·40	—	0·75	0·50	—	1·96	—	—	0·62	5·65	2·25	—	—	2·05
7·55	—	0·38	—	—	1·13	—	—	0·41	3·65	1·71	—	—	—
9·60	—	0·70	0·40	—	1·59	—	—	0·54	5·32	2·32	—	—	—
9·10	—	1·15	—	—	1·46	—	—	0·62	4·90	2·14	—	—	—
9·50	—	0·62	0·38	—	1·73	—	—	0·60	5·52	2·24	—	—	—
8·50	—	1·30	0·46	—	1·55	—	—	—	—	—	—	—	—
9·00	—	1·25	—	—	1·75	—	—	0·53	5·25	2·20	—	—	—
9·36	—	1·45	0·53	—	1·78	—	—	0·58	5·32	2·11	—	—	—
10·60	—	0·60	—	—	1·91	—	—	—	6·03	2·50	—	—	—

			1	2	3	4	5	6	7	8	9	10
Date	Whale Number	Sex	Total length, tip of snout to notch of flukes	Lower jaw, projection beyond tip of snout	Tip of snout to blow-hole	Tip of snout to angle of gape	Tip of snout to centre of eye	Tip of snout to tip of flipper	Eye to ear, centres	Notch of flukes to posterior emargination of dorsal fin	Flukes, width at insertion	Notch of flukes to anus
1927												
12 April	1646	Male	21·20	—	—	—	4·65	—	—	4·95	—	5·65
12 ,,	1647	Female	18·90	—	—	—	3·78	5·80*	0·79	—	—	5·90
13 ,,	1650	Female	19·25	—	—	—	4·20	6·40	0·85	4·55	—	5·35
13 ,,	1651	Male	21·19	—	—	—	4·40	6·95	1·05	—	—	5·80
13 ,,	1652	Male	20·90	—	—	—	4·50	7·35	1·20	—	—	5·50
13 ,,	1653	Female	21·15	—	—	—	4·25	7·00	1·00	5·60	—	6·20
13 ,,	1654	Male	21·10	—	—	—	4·45	7·15	1·06	5·05	—	5·70
13 ,,	1655	Male	19·80	—	—	—	4·05	6·50	0·93	4·70	—	5·40
19 ,,	1660	Male	20·30	—	—	—	4·20	6·80	1·10	4·50	—	5·75
19 ,,	1662	Male	15·55	—	—	—	2·80	4·70	0·75	4·10	—	4·80
20 ,,	1663	Male	20·30	—	—	—	4·53	6·90	0·95	4·85	—	5·70
20 ,,	1664	Female	22·70	—	—	—	5·00	7·85	—	5·20	—	5·95
20 ,,	1665	Female	19·10	—	—	—	4·10	6·20	0·97	—	—	5·45
20 ,,	1666	Male	19·20	—	—	—	4·10	6·25	0·92	4·90	—	5·45
22 ,,	1668	Male	14·70	—	—	—	2·80	4·70	0·77	3·63	—	4·40
22 ,,	1669	Male	16·50	—	—	—	3·50	5·40	0·79	3·86	—	4·50
22 ,,	1670	Female	16·50	—	—	—	3·22	5·25	—	—	—	5·00
23 ,,	1674	Male	18·60	—	—	—	3·80	4·95	0·85	4·20	—	5·30

* Measurements to the axilla.

11	12	13	14	15	16	17	18	19	20	21	22	23	24
Notch of flukes to umbilicus	Notch of flukes to end of system of ventral grooves	Anus to reproductive aperture, centres	Dorsal fin, vertical height	Dorsal fin, length of base	Flipper, tip to axilla	Flipper, tip to anterior end of lower border	Flipper, length along curve of lower border	Flipper, greatest width	Severed head, condyle to tip	Skull, greatest width	Skull length, condyle to tip of premaxilla	Flipper, tip to head of humerus	Tail, depth at dorsal fin
9·40	—	1·50	—	—	—	—	—	—	5·67	2·15	—	—	—
8·80	—	0·35	—	—	1·58	—	—	0·52	4·50	1·85	—	—	—
8·55	—	0·45	0·47	—	—	—	—	0·55	5·10	2·15	—	—	—
9·60	—	1·45	0·50	—	—	—	—	—	—	—	—	—	—
9·00	—	1·00	—	—	1·84	—	—	0·59	5·50	2·30	—	—	—
9·90	—	0·65	0·55	—	1·90	—	—	0·59	—	—	—	—	—
9·35	—	1·35	—	—	1·84	—	—	0·58	5·40	2·35	—	—	—
8·75	—	1·40	0·40	—	1·64	—	—	0·54	4·85	2·15	—	—	—
9·20	—	1·45	0·50	—	1·70	—	—	0·59	5·00	2·55	—	—	—
7·60	—	1·20	0·35	—	1·20	—	—	0·47	3·40	1·70	—	—	—
9·15	—	1·40	0·56	—	1·90	—	—	—	5·47	2·04	—	—	—
9·70	—	0·58	0·51	—	—	–	—	—	—	—	—	—	—
8·70	—	0·55	0·37	—	—	—	—	—	—	—	—	—	—
8·60	—	1·45	0·39	—	1·57	—	—	—	—	—	—	—	—
7·05	—	0·80	0·40	—	1·22	—	—	0·42	3·45	1·20	—	—	—
7·40	—	1·40	0·52	—	1·50	—	—	0·45	4·28	1·84	—	—	—
7·95	—	0·30	—	—	1·33	—	—	0·46	3·95	1·75	—	—	—
8·60	—	1·50	0·45	—	1·65	—	—	0·54	4·65	2·10	—	—	2·00

INDEX

PLATES XXV—XLIV

PLATE XXV

Fig. 1. Blue whale, ♀, 25 m. From a coloured drawing by J. F. G. Wheeler based on measurements, notes and sketches made at South Georgia.

Fig. 2. Fin whale, ♀, 21 m. From a coloured drawing by J. F. G. Wheeler based on measurements, notes and sketches made at South Georgia.

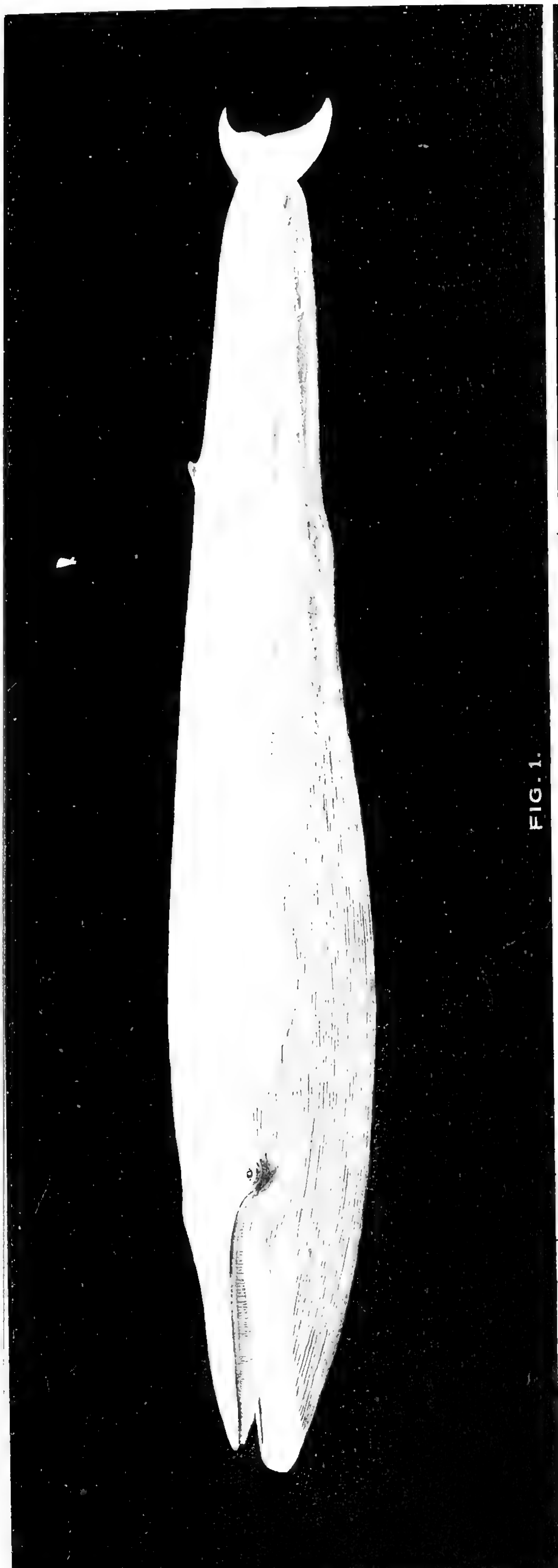


FIG. 1.

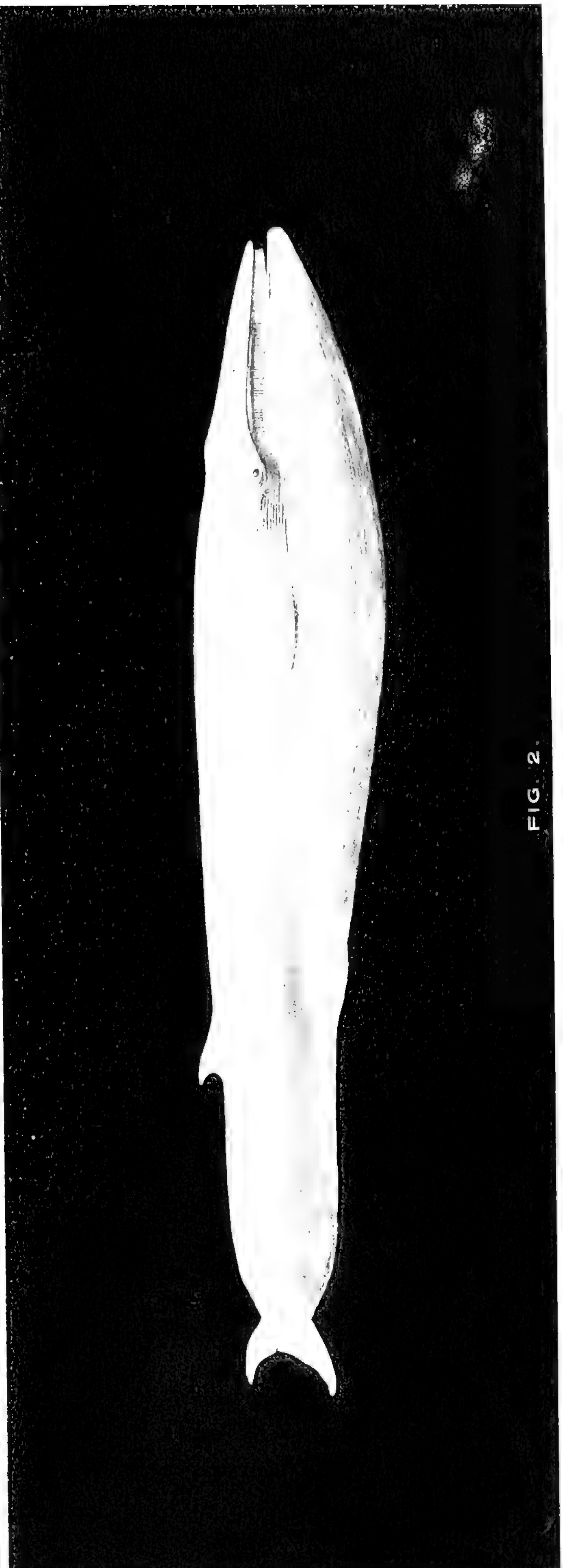


FIG. 2.

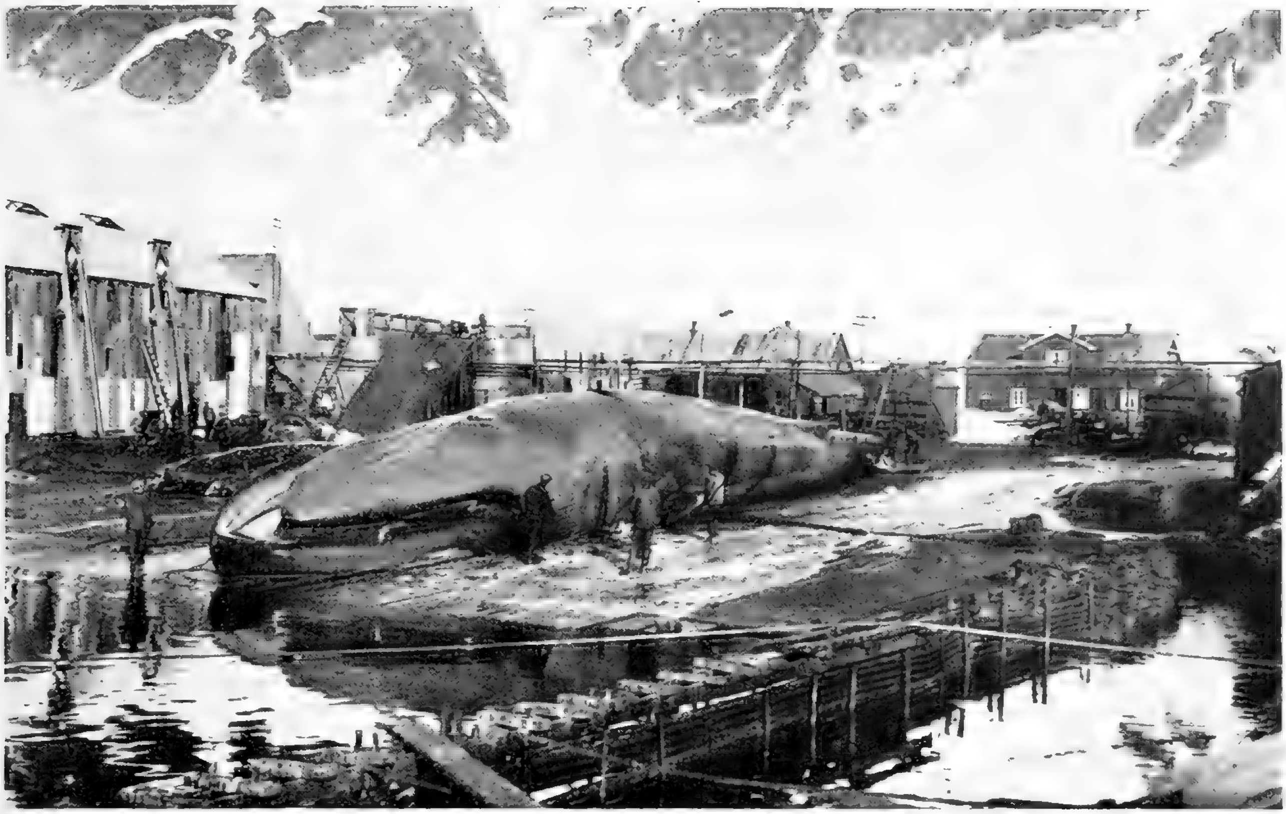
Fig. 1. Blue Whale, *Balaenoptera musculus*.

Fig. 2. Fin Whale, *Balaenoptera physalus*.

PLATE XXVI

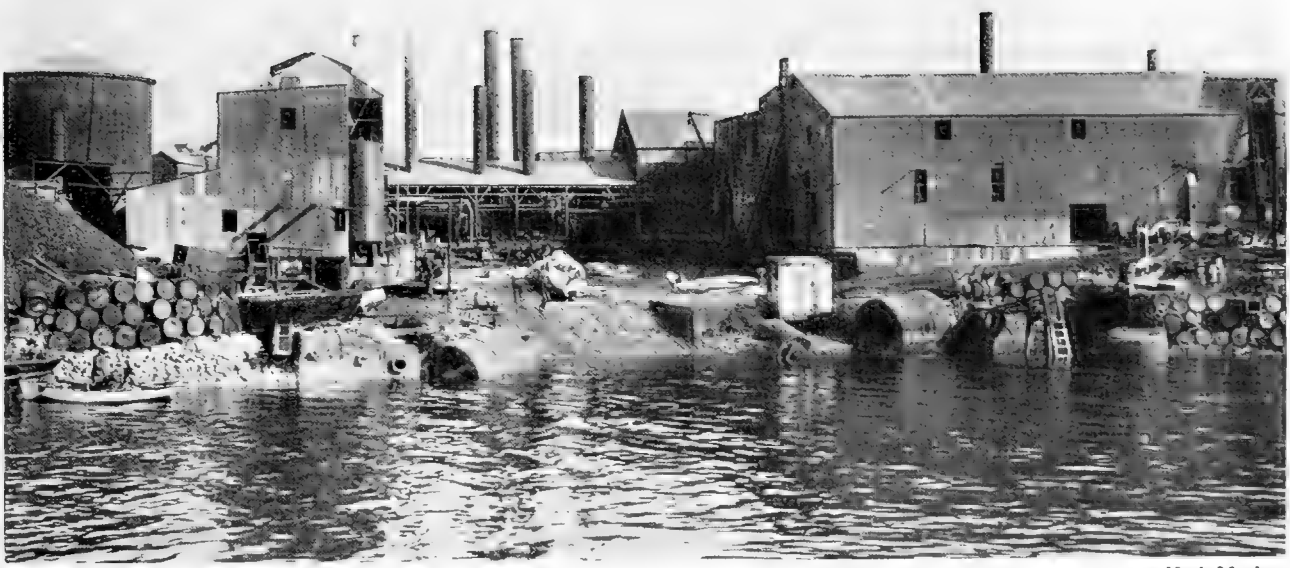
Fig. 1. Flensing platform of whaling station at Grytviken, South Georgia, showing large Blue whale (No. 250).

Fig. 2. Flensing platform at Saldanha Bay, Cape Colony, with partially dismembered carcass of a whale.



N. A. M. phot.

Fig. 1



N. A. M. phot.

Fig. 2

SOUTHERN BLUE AND FIN WHALES

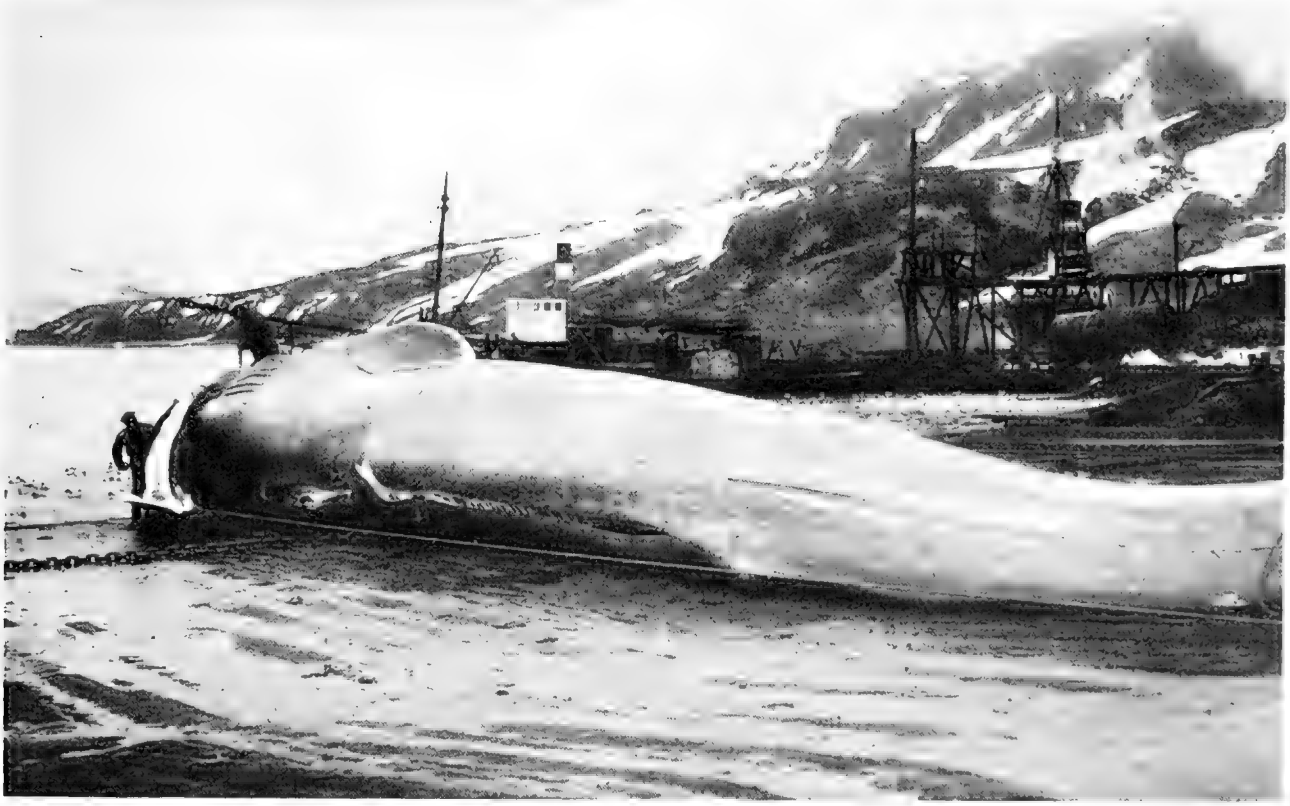
PLATE XXVII

Fig. 1. Blue whale, ♀, No. 862. Dorsal view. Showing pale spots on back and flanks.

Fig. 2. Blue whale, ♀, No. 275. Dorsal view. Showing pale spots on back and flanks.

N. A. M. phot.

Fig. 1



N. A. M. phot.

Fig. 2

SOUTHERN BLUE AND FIN WHALES

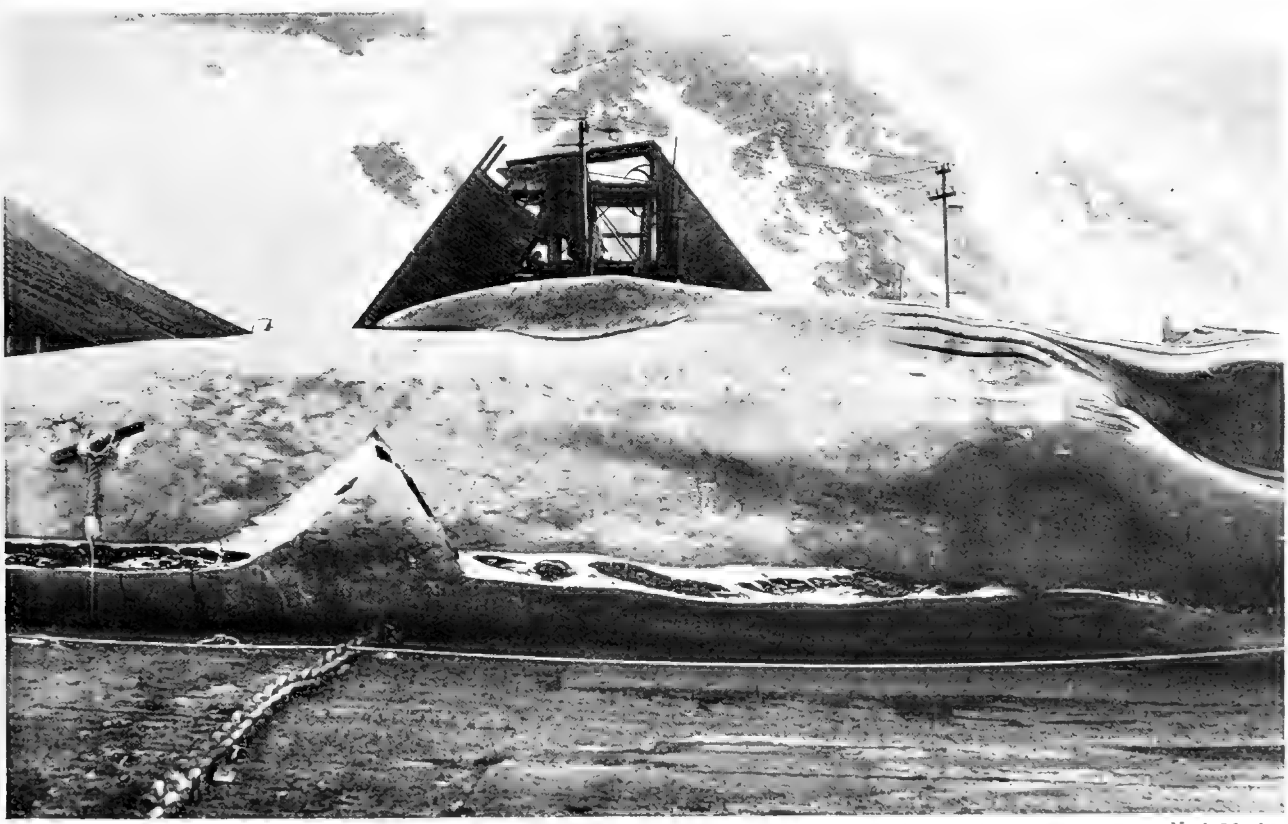
PLATE XXVIII

Fig. 1. Blue whale, ♀, No. 250. Showing pigmentation of head and shoulder.

Fig. 2. Blue whale, ♀, No. 265. Showing pigmentation of shoulder and flank.

N. A. M. phot.

Fig. 1



N. A. M. phot.

Fig. 2

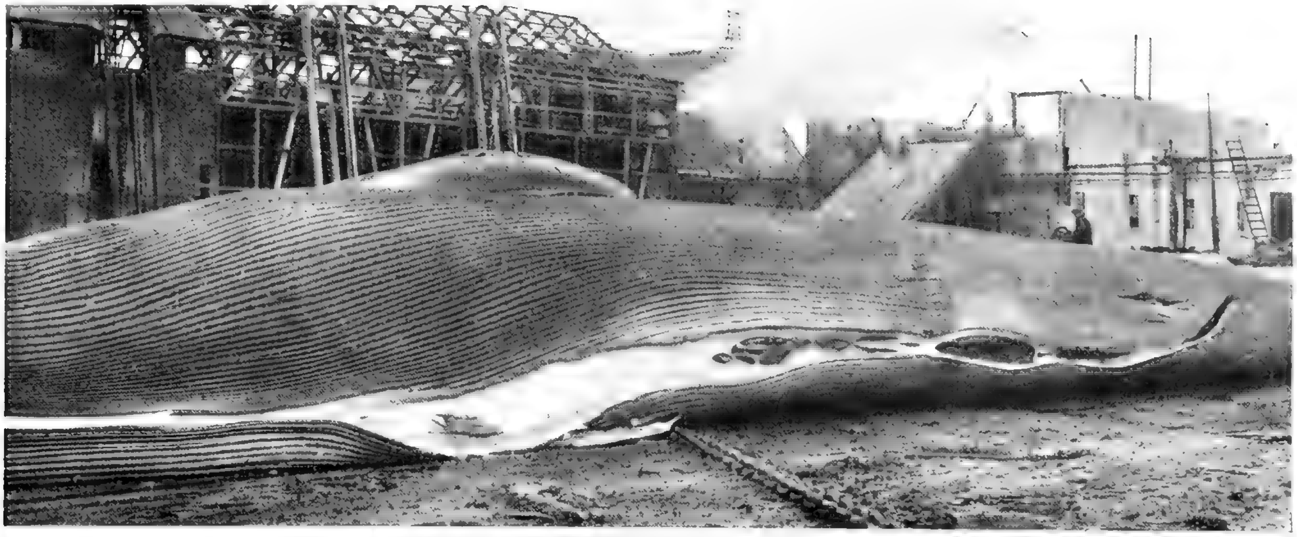
SOUTHERN BLUE AND FIN WHALES

PLATE XXIX

Fig. 1. Blue whale, ♀, No. 248. Ventral view. Note absence of white flecks on the ventral grooves.

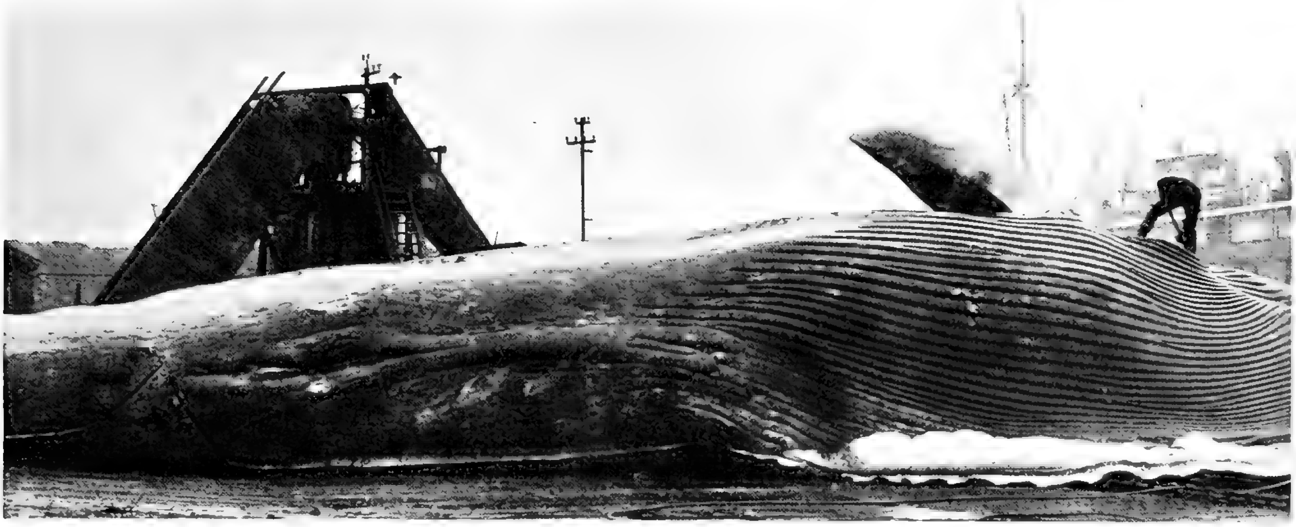
Fig. 2. Blue whale, ♀, No. 261. Ventral view. Note small number of white flecks.

Fig. 3. Blue whale, ♂, No. 256. Ventral view. Note white flecks grouped well forward.



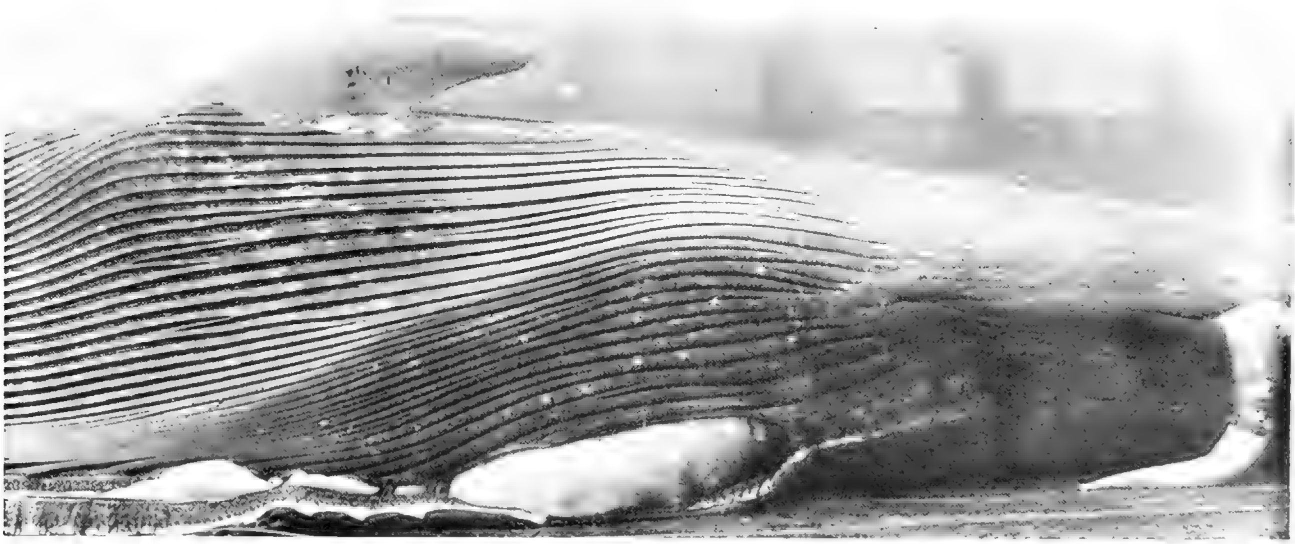
N. A. M. phot.

Fig. 1



N. A. M. phot.

Fig. 2



N. A. M. phot.

Fig. 3

SOUTHERN BLUE AND FIN WHALES

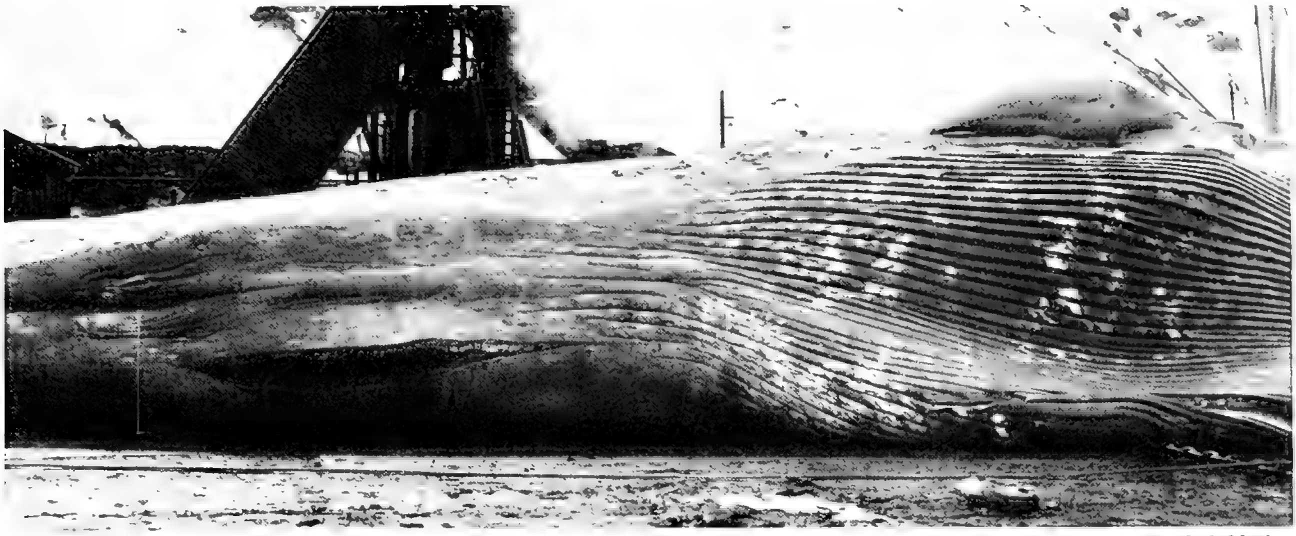
[illegible]
[illegible]

PLATE XXX

Fig. 1. Blue whale, ♀, No. 244. Ventral view. Typical arrangement of white flecks on the ventral grooves. Note the swollen condition of the mammary glands. Cf. Plate XXXV, fig. 3.

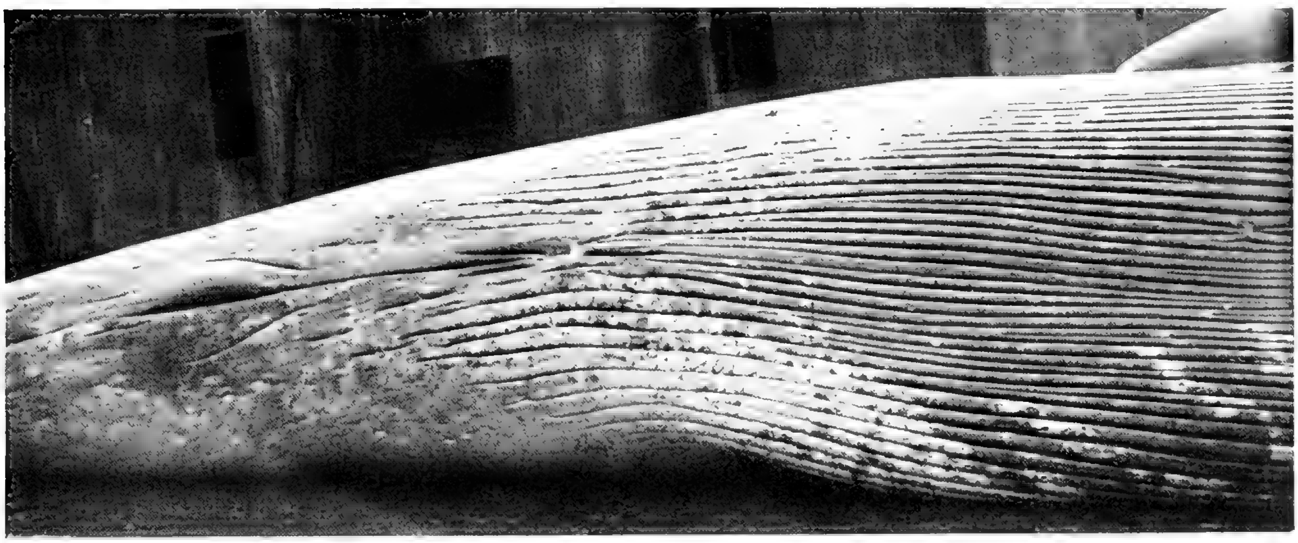
Fig. 2. Blue whale, ♂, No. 907. Ventral view. Note numerous white flecks.

Fig. 3. Blue whale, ♀, No. 253. Ventral view. Note very numerous white flecks and white splash over the umbilicus.



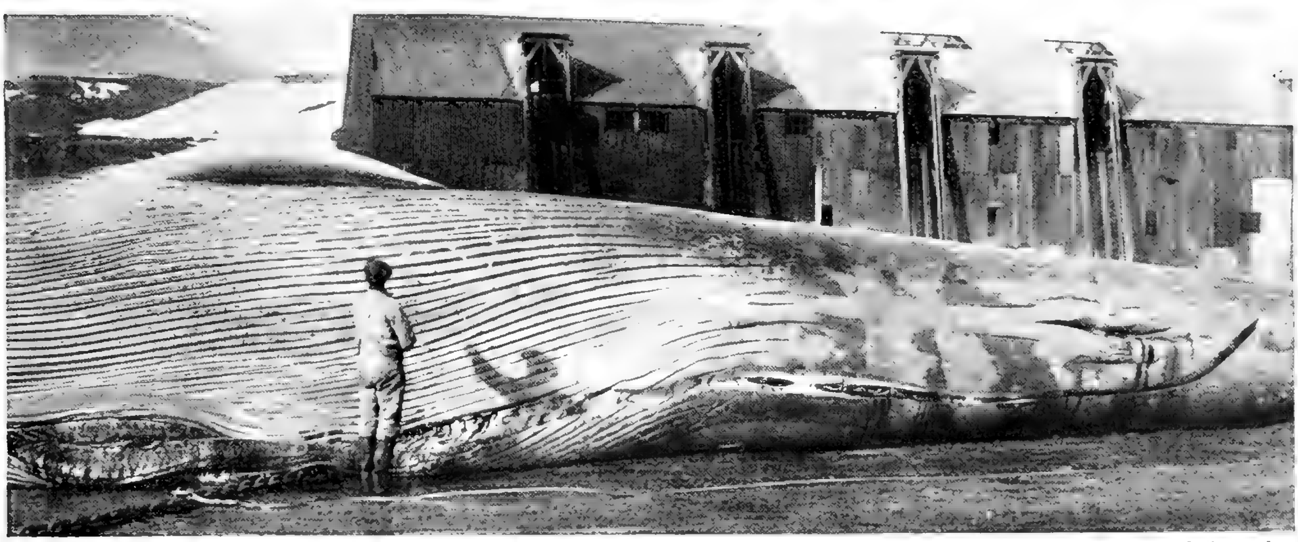
N. A. M. phot.

Fig. 1



N. A. M. phot.

Fig. 2



N. A. M. phot.

Fig. 3

SOUTHERN BLUE AND FIN WHALES

PLATE XXXI

Fig. 1. Blue whale, ♀, No. 1299. Ventral view. Showing transverse white patches just behind the umbilicus in the centre of the photograph.

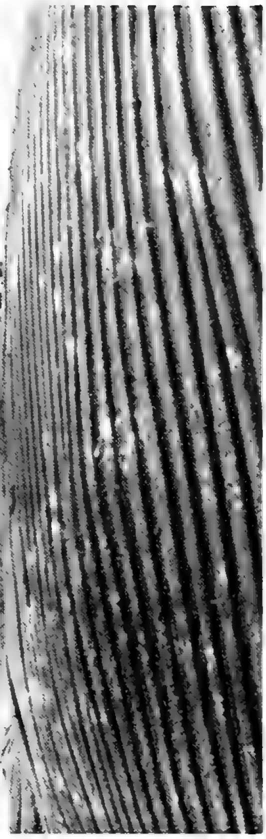
Fig. 2. Blue whale, ♂, No. 1345. Under surface of flipper, showing heavy pigment.

Fig. 3. Blue whale, ♂, 1350. Ventral view of tail showing striations on the under surface of the flukes.

Fig. 4. Blue whale, ♂, No. 157. Ventral view showing genital aperture and ventral grooves.

N. A. M. phot.

Fig. 1



N. A. M. phot.

Fig. 2

N. A. M. phot.

Fig. 3

N. A. M. phot.

Fig. 4

SOUTHERN BLUE AND FIN WHALES

PLATE XXXII

Fig. 1. Fin whale, ♀, No. 865. Right side of head. Note the sharp distinction between the dark and light baleen plates, the unpigmented lower jaw and the unpigmented part of the upper jaw opposite the white baleen plates.

Fig. 2. The same whale. Left side of head. Here the baleen plates are all dark and the upper and lower jaws are both pigmented. Note the thin pale streak running back from the very small aperture of the ear.

N. A. M. phot.

Fig. 1

N. A. M. phot.

Fig. 2

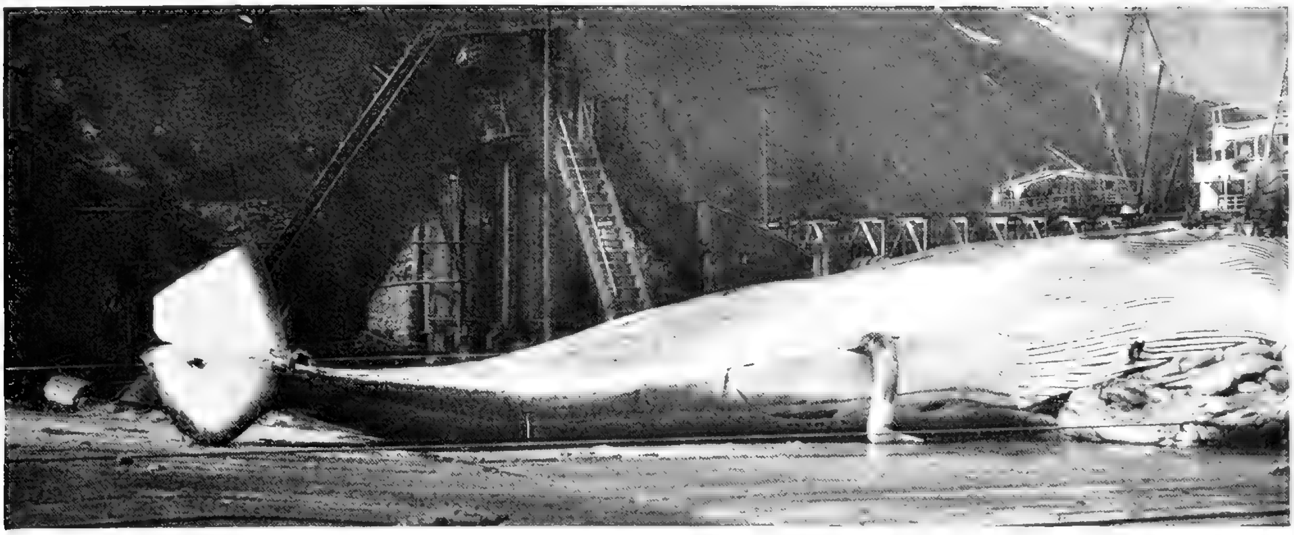
SOUTHERN BLUE AND FIN WHALES

PLATE XXXIII

Fig. 1. Fin whale, ♂, No. 320 (?). Ventral view. Showing heavy pigmentation in the tail region.

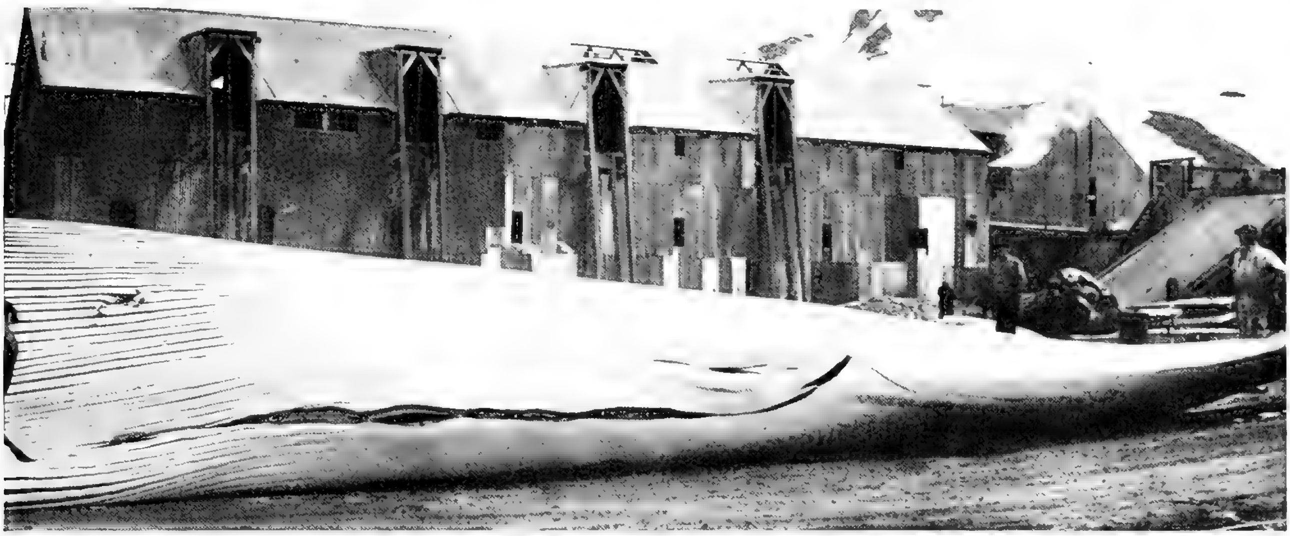
Fig. 2. Fin whale, ♀, No. 263. Ventral view. Showing tongues of pigment behind anus.

Fig. 3. Fin whale, ♀, No. 260. Ventral view. Also showing tongues of pigment behind anus.



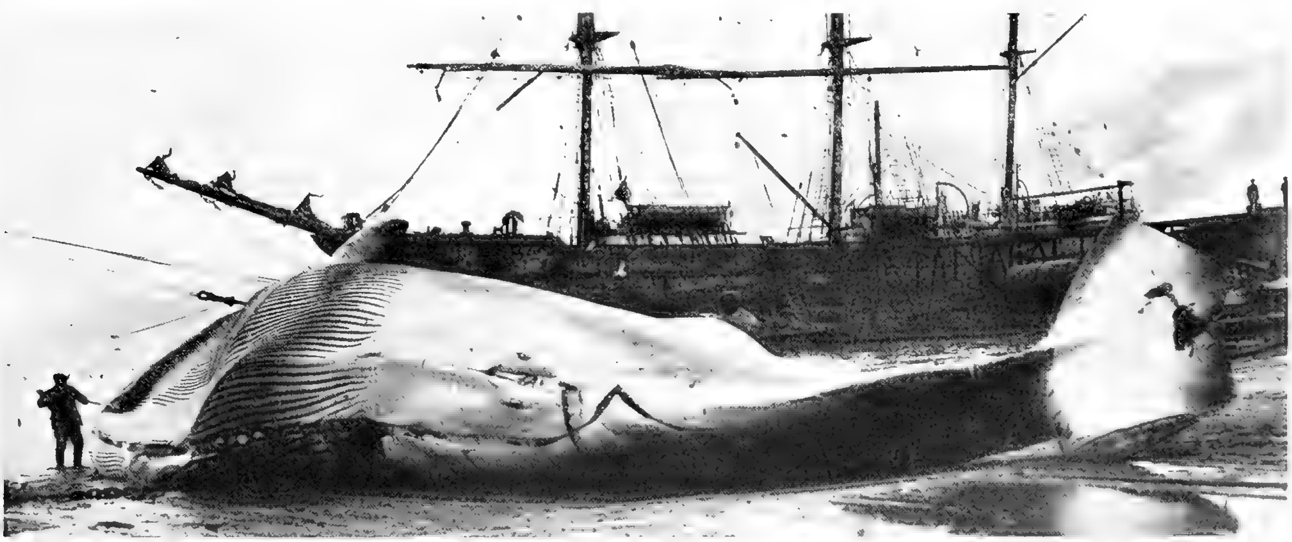
N. A. M. phot.

Fig. 1



N. A. M. phot.

Fig. 2



N. A. M. phot.

Fig. 3

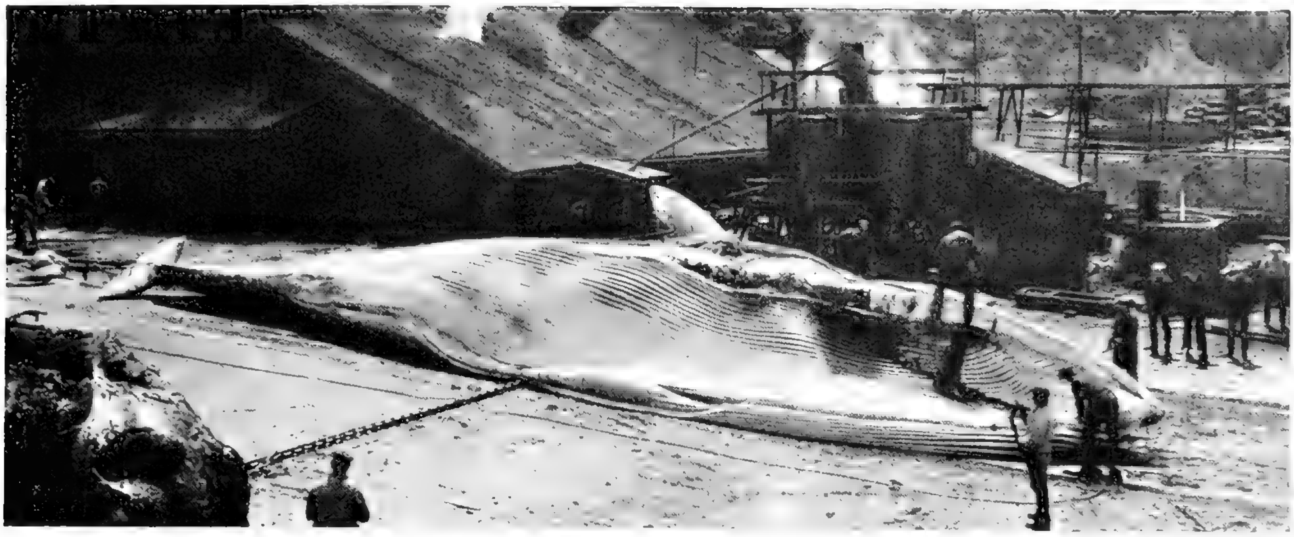
SOUTHERN BLUE AND FIN WHALES

PLATE XXXIV

Fig. 1. Fin whale, ♀, No. 1357. Ventral view. Showing pigmentation of the ventral grooves.

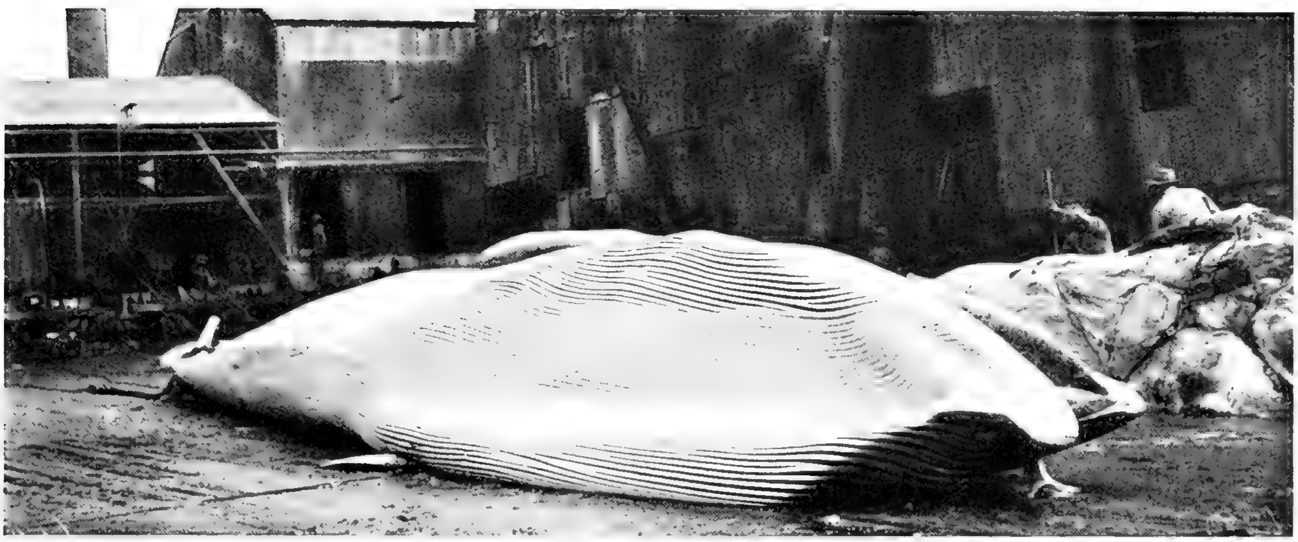
Fig. 2. Fin whale, ♀, No. ?. Ventral view. Showing asymmetry of anterior pigmentation.

Fig. 3. Fin whale, ♂, 607. View of right side of head and shoulder. Note dark streak running back from the eye. The whale is lying almost on its back.



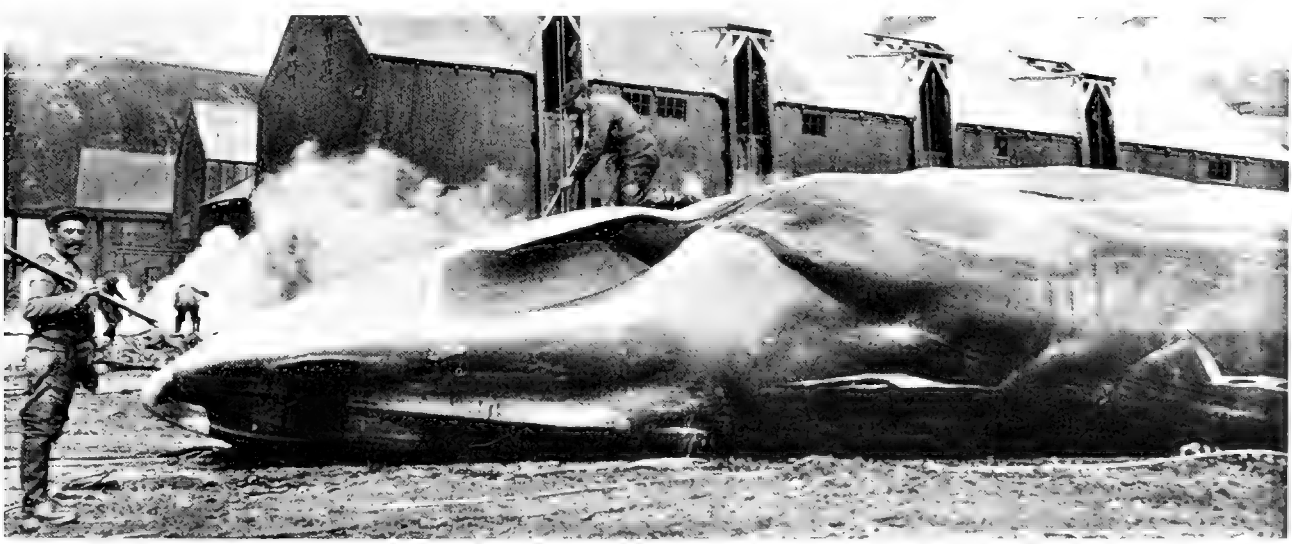
J. E. Hamilton phot.

Fig. 1



J. T. G. W. phot.

Fig. 2



N. A. M. phot.

Fig. 3

SOUTHERN BLUE AND FIN WHALES

PLATE XXXV

Fig. 1. Fin whale, ♂, No. 255. Stomach, containing a large quantity of *Euphausia superba*. Only a part of the stomach is visible.

Fig. 2. Blue whale, ♀, No. 254. Ventral view. Showing projecting nipples on either side of the genital aperture. The nipples are in an unnaturally swollen condition owing to decomposition of the carcass.

Fig. 3. Blue whale, ♀, No. 244. Ventral view. Mammary glands after removal of the blubber.

N. A. M. phot.

Fig. 1

N. A. M. phot.

Fig. 2

N. A. M. phot.

Fig. 3

SOUTHERN BLUE AND FIN WHALES

PLATE XXXVI

Figs. 1–10. Successive stages in the formation and healing of pits in the skin and blubber.

Fig. 1

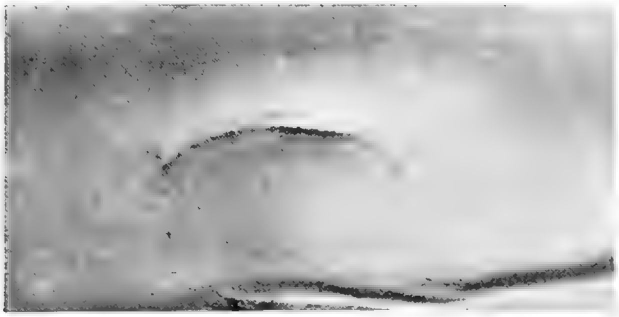


Fig. 2

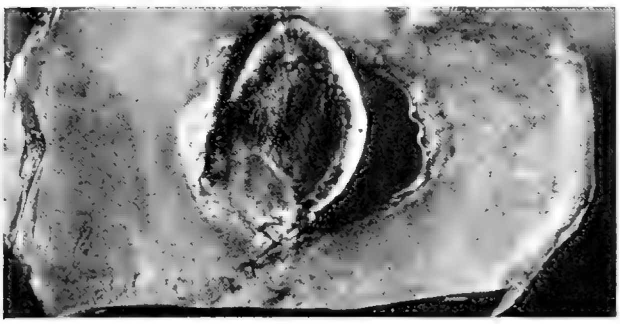


Fig. 3

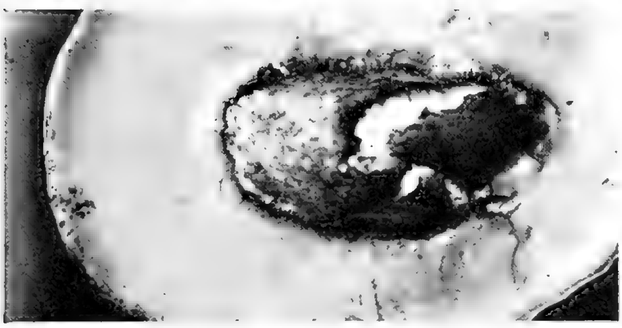


Fig. 4

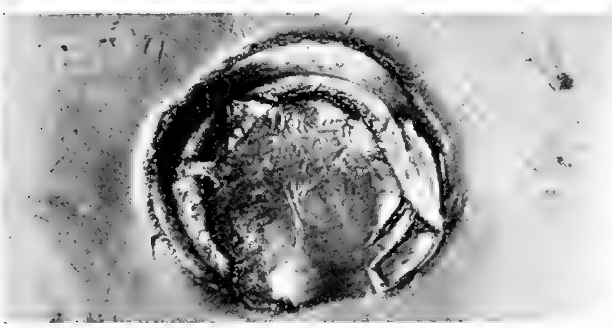


Fig. 5

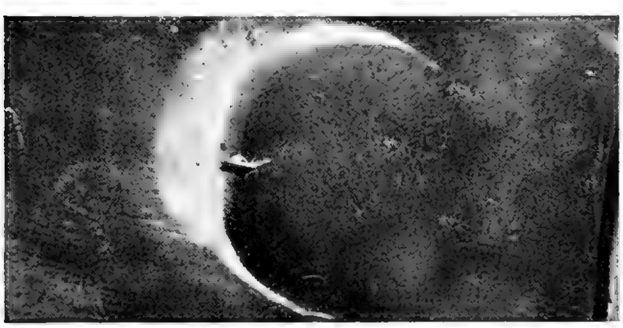


Fig. 6

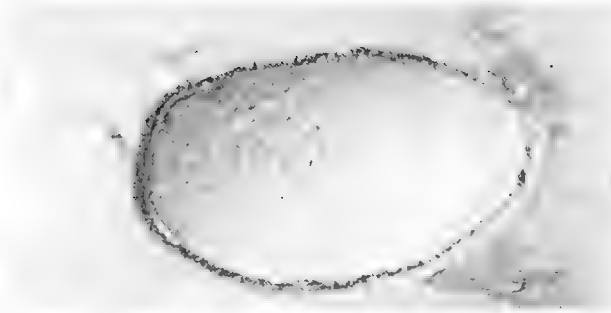


Fig. 7

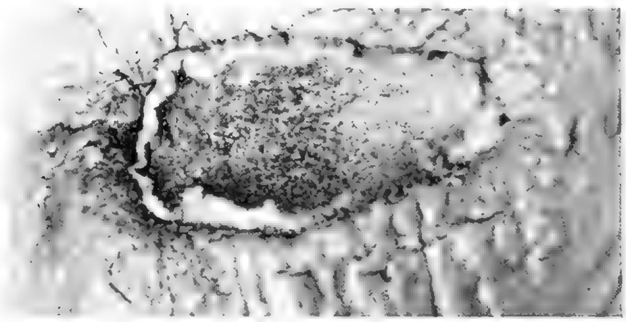


Fig. 8

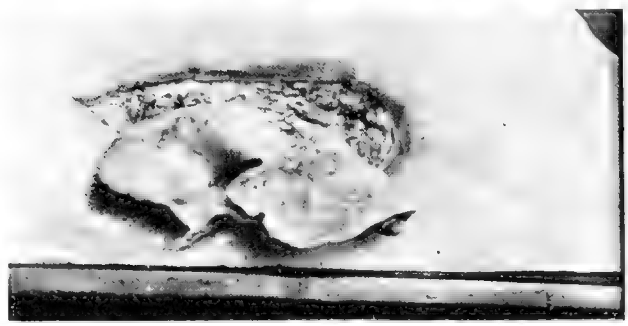


Fig. 9

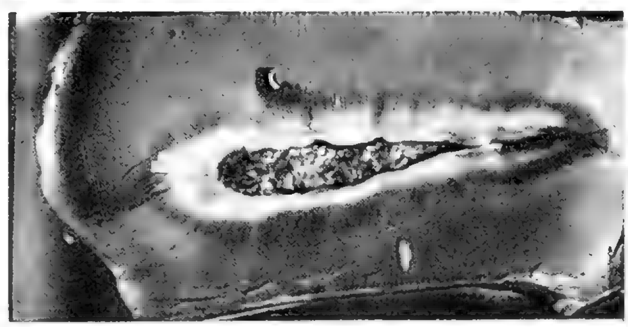
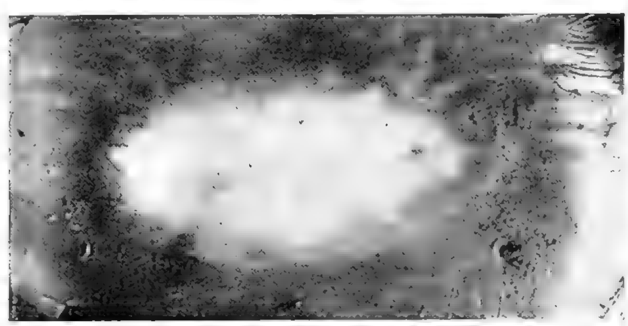


Fig. 10



J. F. G. W. phot.

SOUTHERN BLUE AND FIN WHALES

PLATE XXXVII

Fig. 1. Fresh scar left on the skin by *Coronula* sp.

Fig. 2. Old impression left on the skin by *Coronula* sp.

Fig. 3. Section of blubber through scar, stained with Sudan III, and showing radiating fibres.

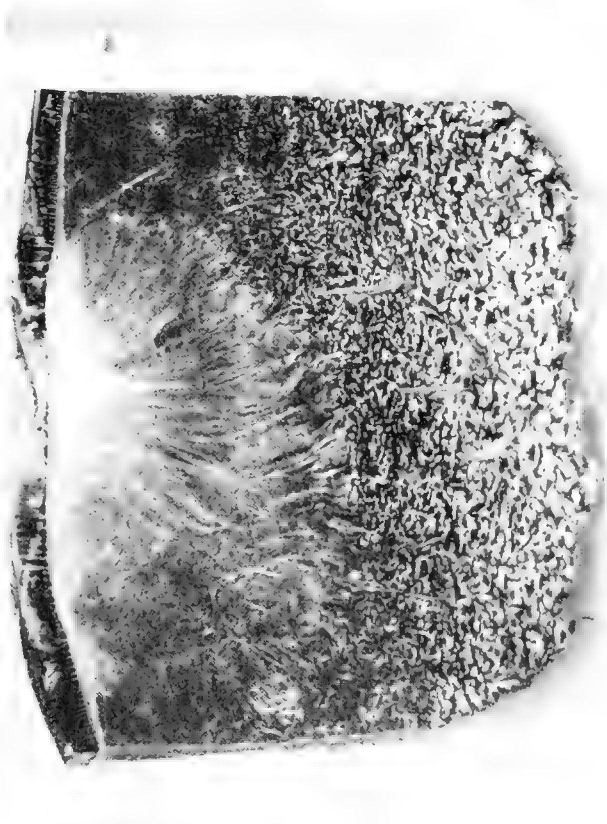
Fig. 4. Close view of pale marks on skin of Blue whale. About $\frac{1}{8}$ natural size.

J. F. G. W. phot.

Fig. 1

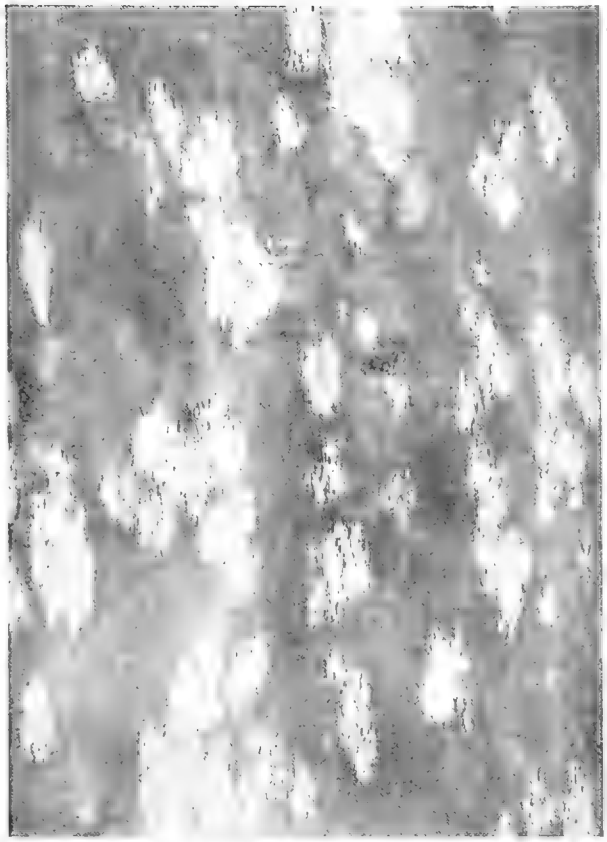
J. F. G. W. phot.

Fig. 2



J. F. G. W. phot.

Fig. 3



N. A. M. phot.

Fig. 4

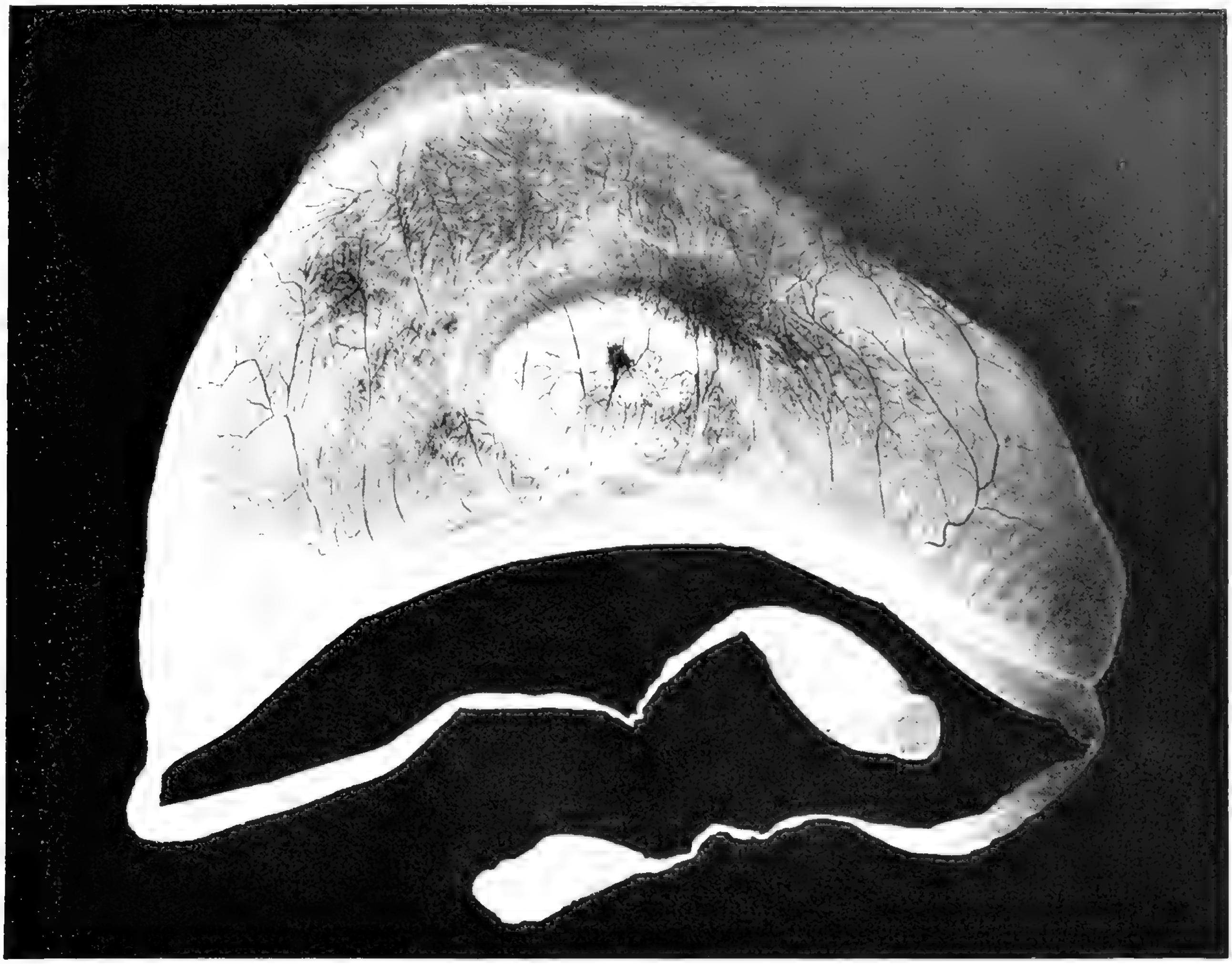
SOUTHERN BLUE AND FIN WHALES

PLATE XXXVIII

Fig. 1. Embryo and foetal membranes of Fin whale, No. 949. Natural size.

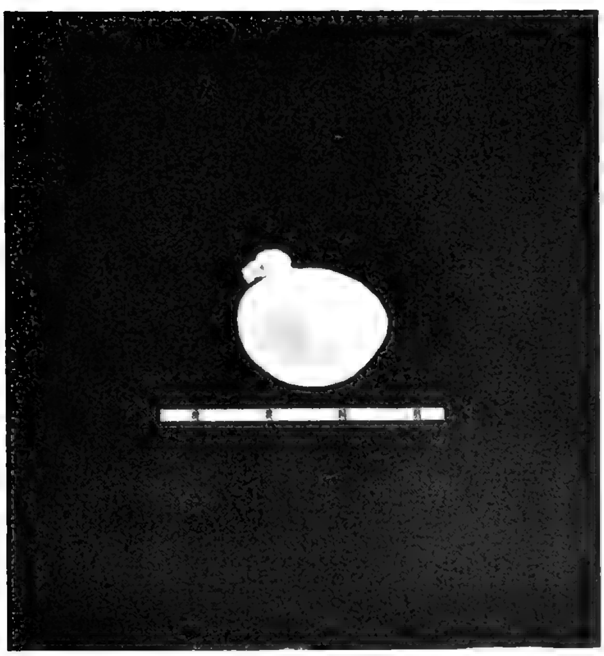
Fig. 2. Embryo and foetal membranes of Sei whale, No. 1074. Natural size.

Fig. 3. Embryo and foetal membranes of Blue whale, No. 900. Natural size.



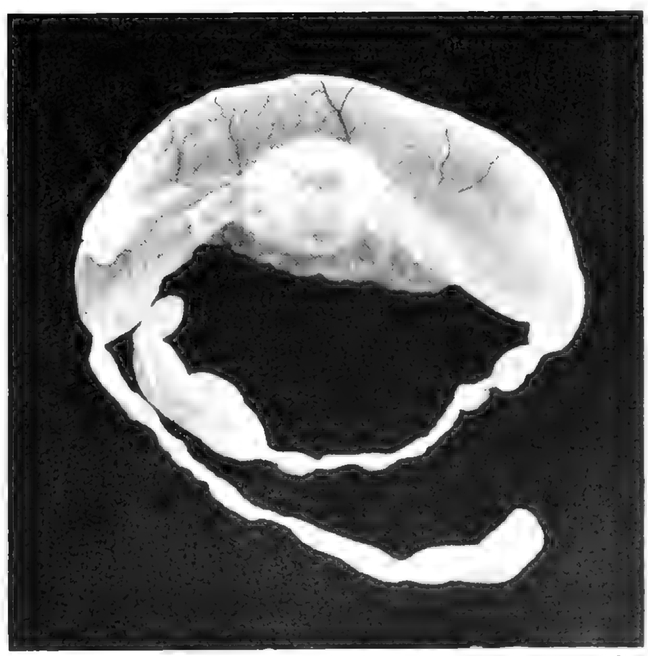
N. A. M. phot.

Fig. 1



J. F. G. W. phot.

Fig. 2



J. F. G. W. phot.

Fig. 3

SOUTHERN BLUE AND FIN WHALES

PLATE XXXIX

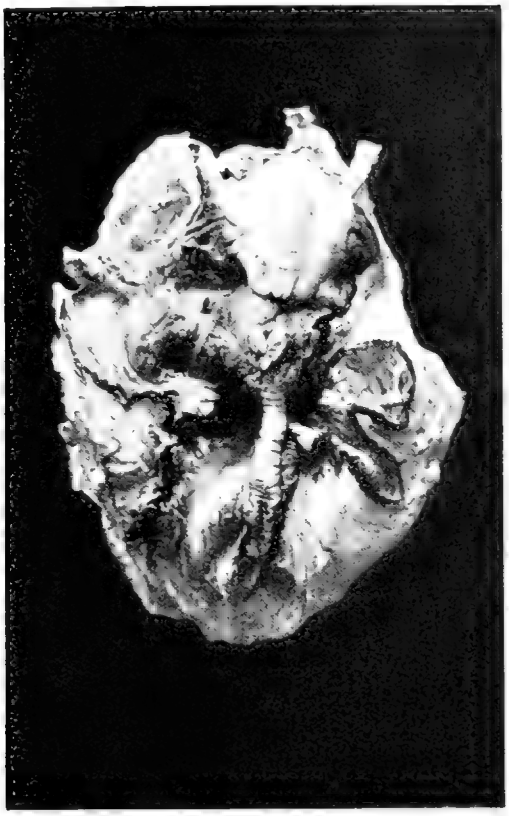
Fig. 1. Genital aperture of young female Fin whale showing the vaginal band. (After flensing.)

Fig. 2. Similar photograph taken before flensing.

In both these photographs the clitoris is the lobed structure with the vaginal band lying in line with and below it.

Fig. 3. Genital aperture, uterus, and one ovary of 2·76 m. foetus of Fin whale No. 173. Vaginal band present.

Fig. 4. Ovaries of 6·3 m. foetus of Blue whale, No. 154.



J. F. G. W. phot.

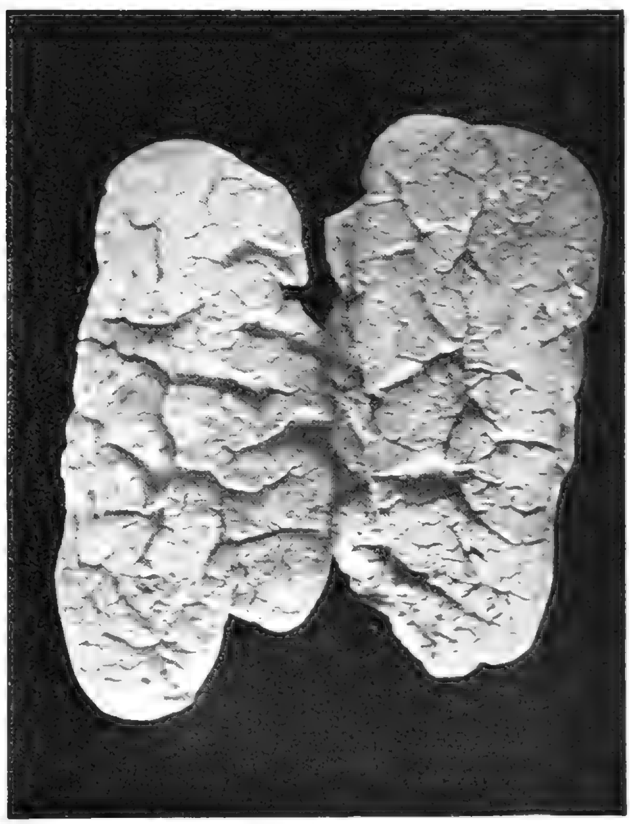
Fig. 1

J. F. G. W. phot.

Fig. 2

J. F. G. W. phot.

Fig. 3



J. F. G. W. phot.

Fig. 4

SOUTHERN BLUE AND FIN WHALES

PLATE XL

(Photographs about $\frac{1}{3}$ natural size.)

Fig. 1. Ovaries of immature Blue whale, No. 48.

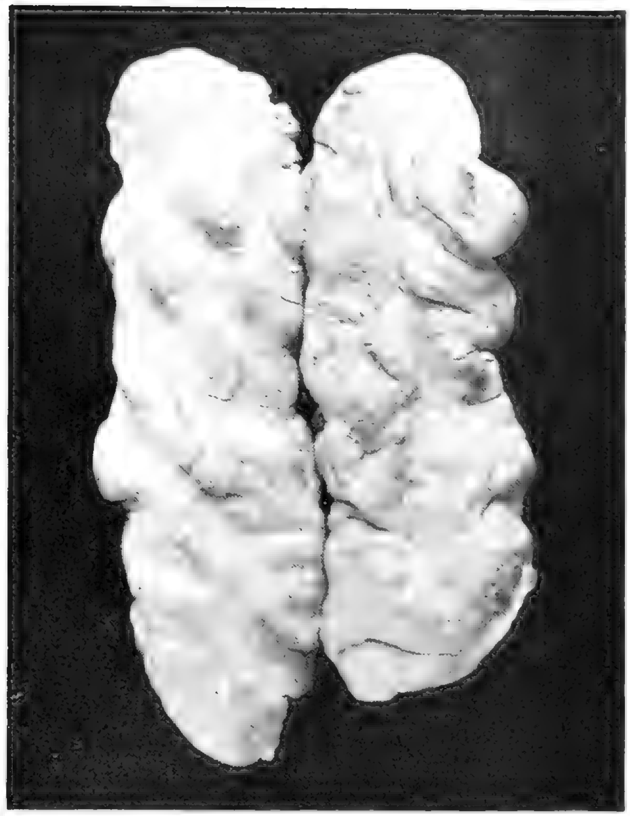
Fig. 2. Ovaries of adult Fin whale, No. 111. Many old corpora lutea are present and a large follicle is seen bulging from the lower left-hand side of the left ovary.

Fig. 3. Ovaries of pregnant Fin whale, No. 173. The huge swelling on the left-hand ovary is the corpus luteum of pregnancy. Both ovaries have many old corpora lutea.

Fig. 4. Ovaries of pregnant Fin whale, No. 175. The functional corpus luteum here has a very pronounced neck.

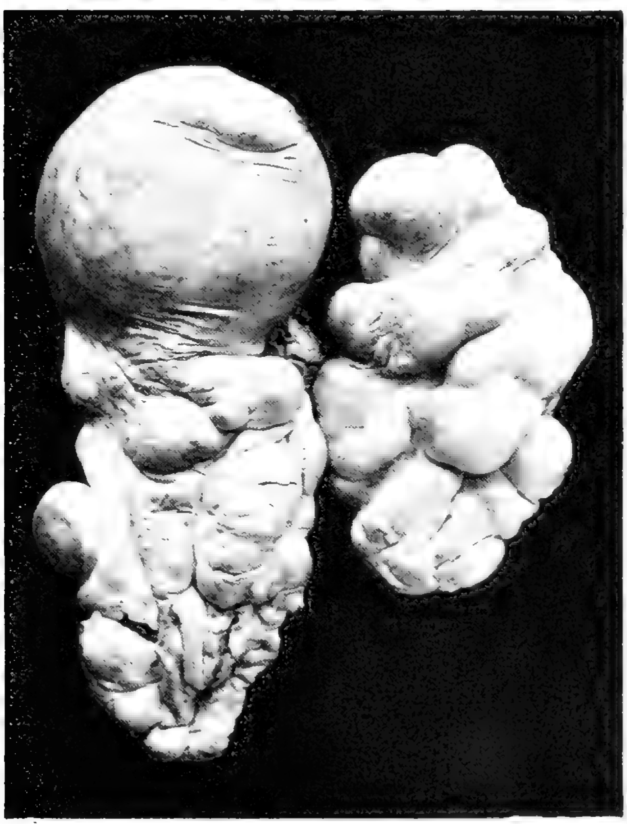
J. F. G. W. phot.

Fig. 1



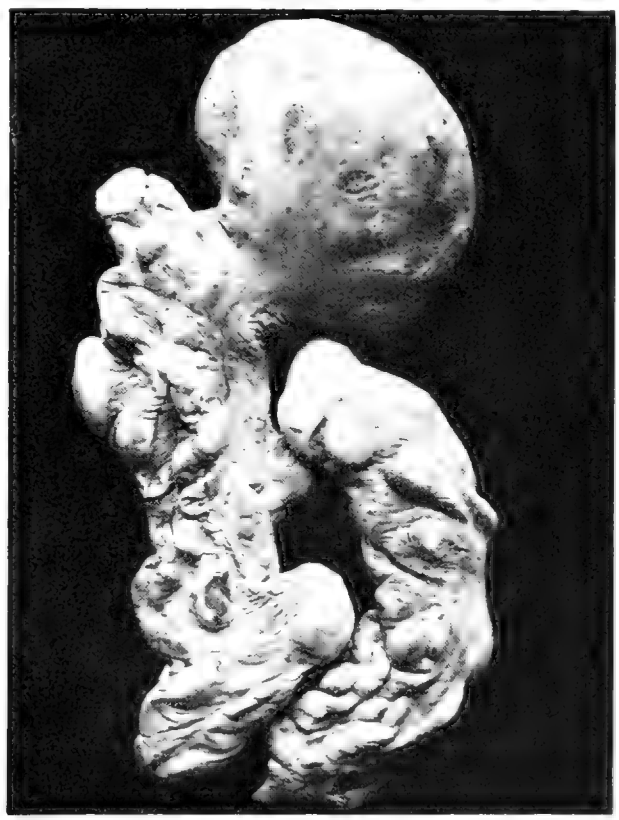
J. F. G. W. phot.

Fig. 2



J. F. G. W. phot.

Fig. 3



J. F. G. W. phot.

Fig. 4

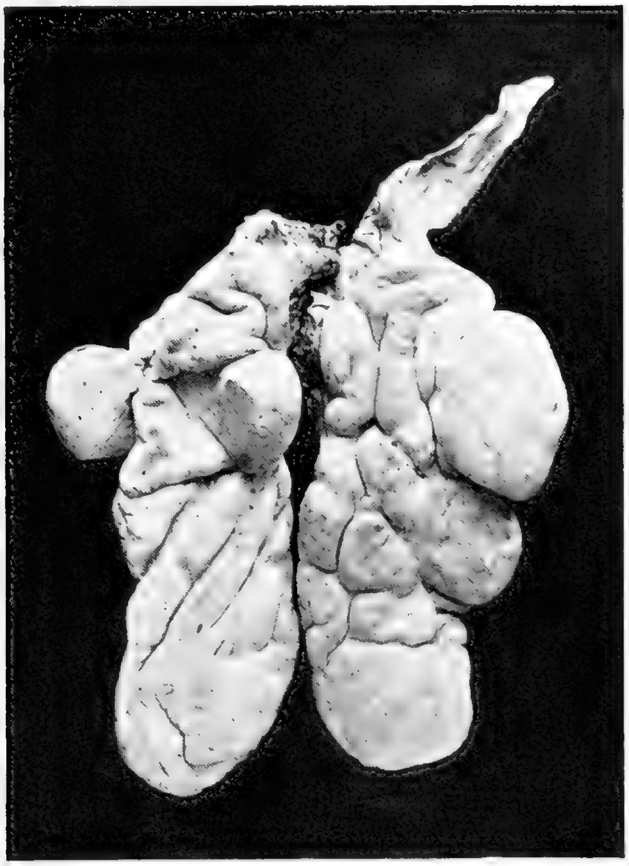
SOUTHERN BLUE AND FIN WHALES

PLATE XLI

Fig. 1. Ovaries of a lactating Fin whale, No. 168. The body on the side of the right-hand ovary is the recent corpus luteum of pregnancy.

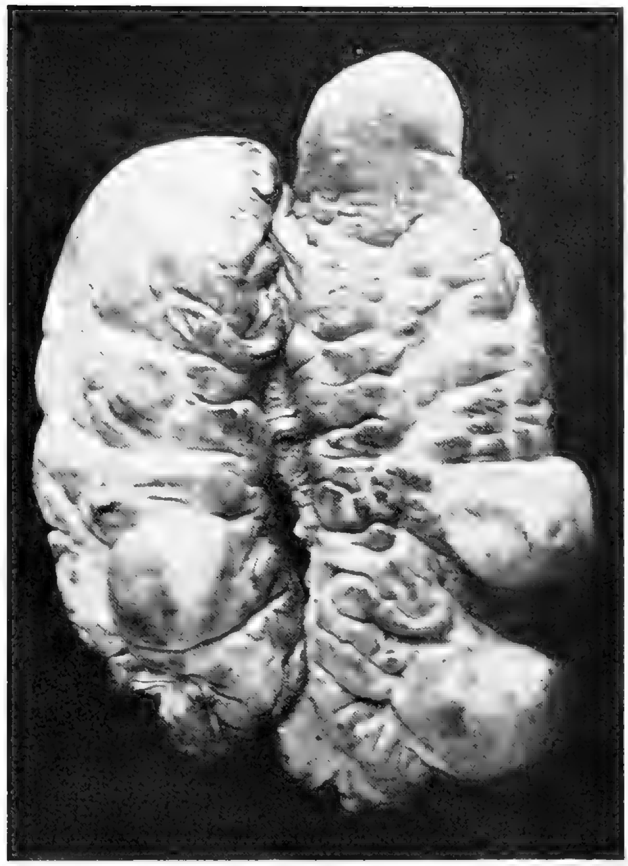
Fig. 2. Ovaries of Blue whale, No. 106, with only four old corpora lutea which have not undergone much retrogression.

Fig. 3. Series of old corpora lutea from one pair of Fin whale ovaries, seen in section.



J. F. G. W. phot.

Fig. 1



J. F. G. W. phot.

Fig. 2

J. F. G. W. phot.

Fig. 3

SOUTHERN BLUE AND FIN WHALES

PLATE XLII

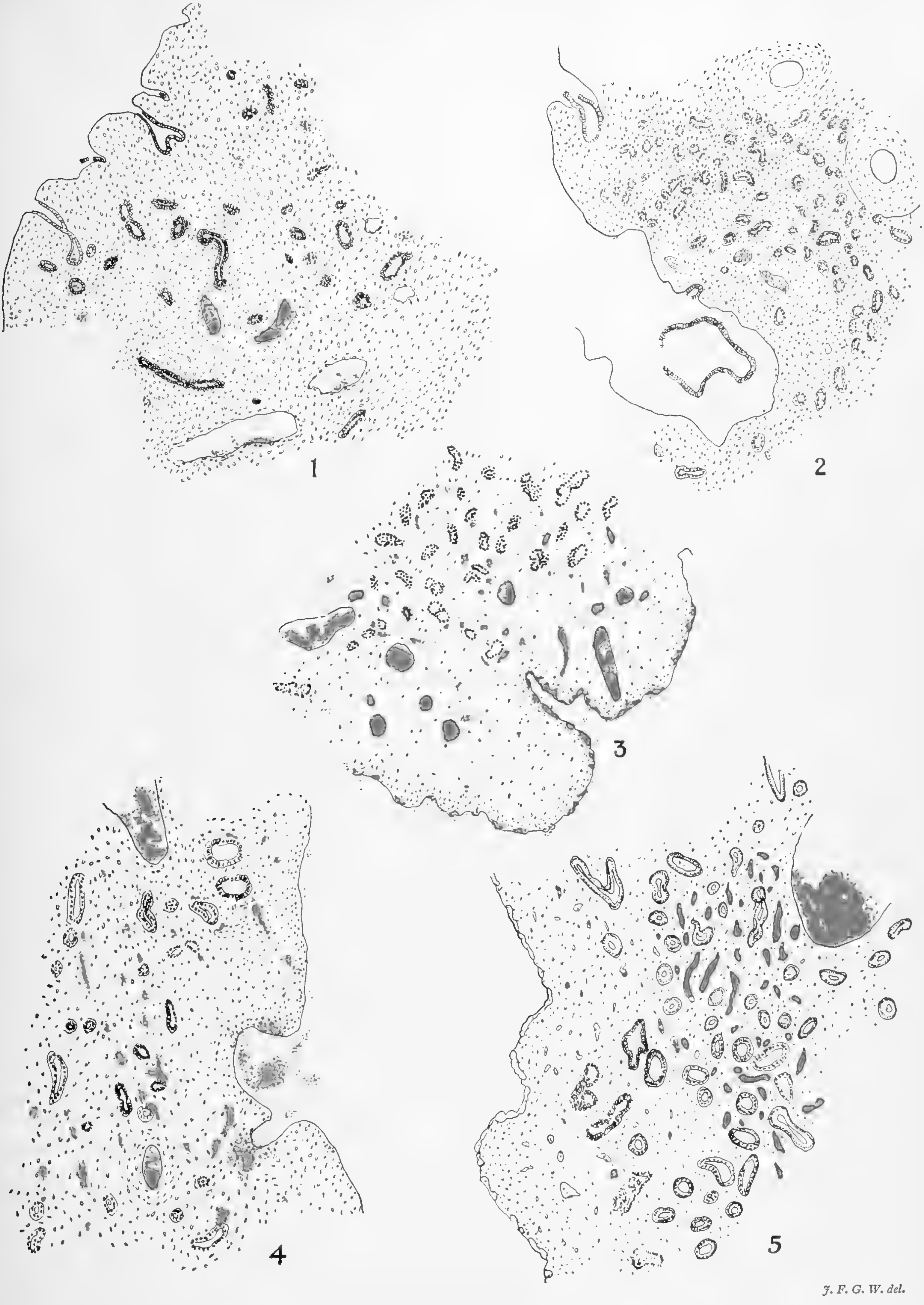
Fig. 1. Uterine mucosa of immature whale.

Fig. 2. Uterine mucosa of adult whale neither pregnant nor lactating.

Fig. 3. Uterine mucosa during early pregnancy.

Fig. 4. Uterine mucosa during early lactation.

Fig. 5. Uterine mucosa of whale in which ovulation had recently taken place.



J. F. G. W. del.

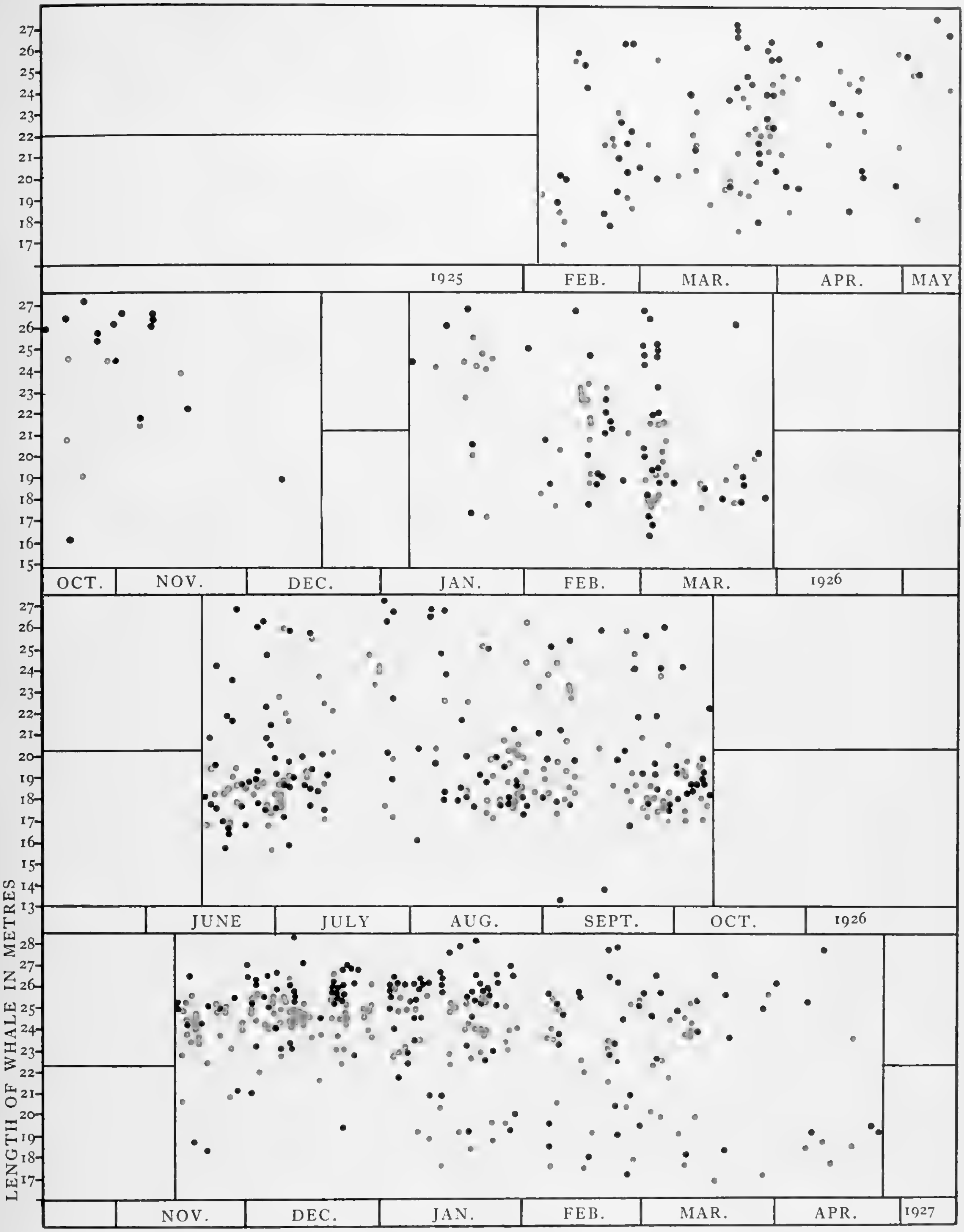
SOUTHERN BLUE AND FIN WHALES

PLATE XLIII

Blue Whales

Chart showing the lengths and date of capture of all Blue whales examined.

Males in red, females in black.



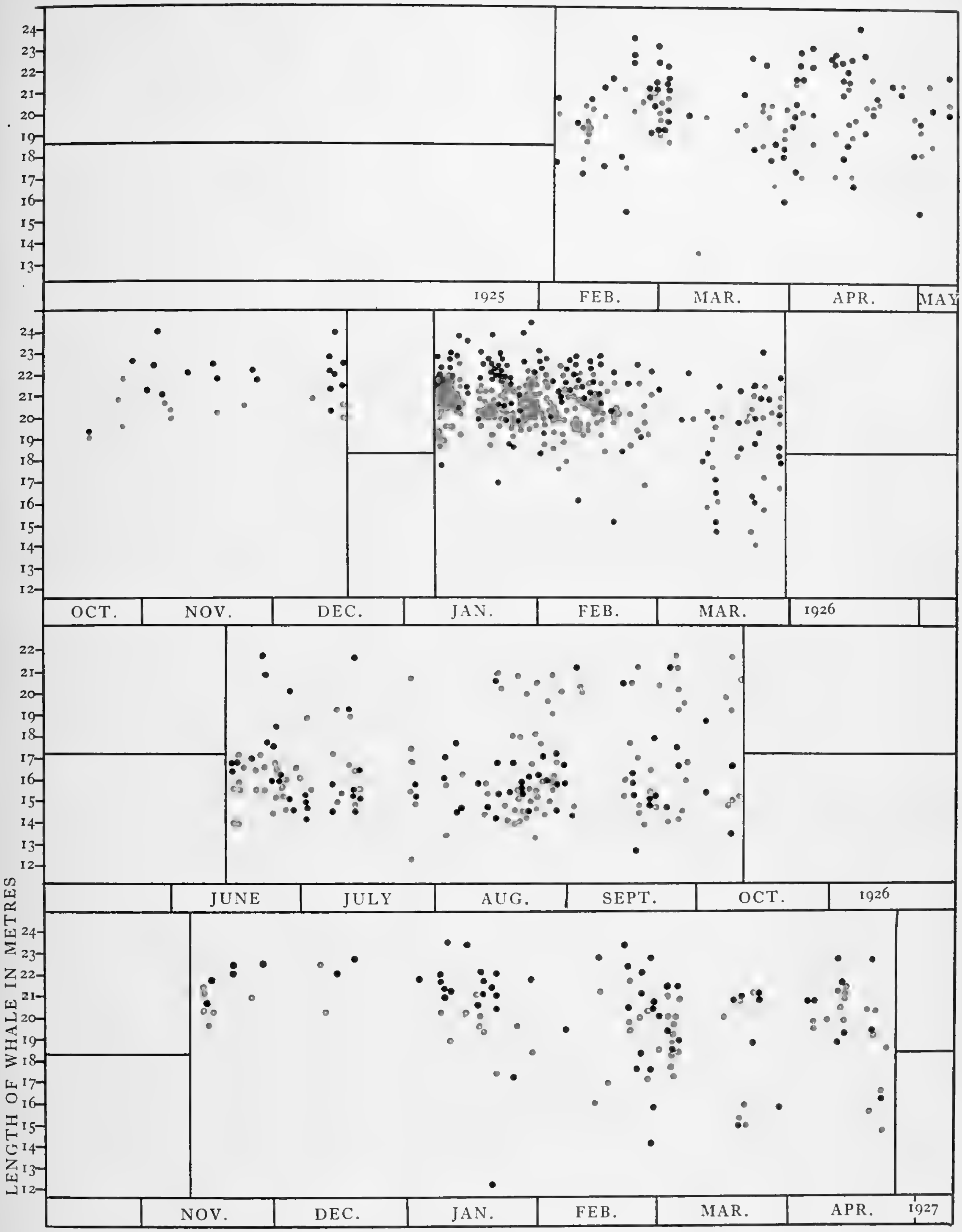
SOUTHERN BLUE AND FIN WHALES

PLATE XLIV

Fin Whales

Chart showing the lengths and date of capture of all Fin whales examined.

Males in red, females in black.



SOUTHERN BLUE AND FIN WHALES

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PARASITIC NEMATODA & ACANTHOCEPHALA COLLECTED IN 1925–1927

by

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Department of Zoology, British Museum (Natural History)[1]

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The present report deals with the earliest consignments of material belonging to these two groups obtained during the Discovery investigations, which were kindly submitted to the writer by Dr S. W. Kemp for determination. It is hoped that it may be followed by other reports from time to time, as further material is accumulated. The period now covered is approximately the same as that covered by the Station List for 1925–1927 (*Discovery Reports*, I, pp. 1–140), in which the localities indicated only by letters and numbers will be found.

The collection is of considerable interest, including as it does at least five species of Nematoda and three of Acanthocephala which appear to be new to science, and throwing new light also on the distribution of many other forms in Antarctic and Sub-antarctic regions. Almost all the material was admirably preserved, and the members of the expedition are to be congratulated upon their success in dealing, often under very trying conditions, with these difficult groups.

NEMATODA

Order ASCAROIDEA

Family ASCARIDAE Sub-family ANISAKINAE

Anisakis similis (Baird, 1853)

This species occurred in large numbers in the stomach of a sea-elephant (*Mirounga leonina*) at North Bay, Ice Fjord, South Georgia, March 1926.

Anisakis typica (Diesing, 1860)

Two females and several larvae from the stomach of a dolphin (*Lagenorhynchus obscurus*), taken off South-west Africa, north of Saldanha Bay, are referred to this species.

Anisakis physeteris (Baylis, 1823)

This species was collected on three occasions from the stomachs of sperm whales (*Physeter catodon*). Localities: Durban, July 30, 1926; Saldanha Bay, South Africa, August 10, 1926; South Georgia.

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Anisakis catodontis, sp. n.

(Fig. 1)

Among specimens of *A. physeteris* in the stomach of a sperm whale (No. 932) at Saldanha Bay, South Africa (August 10, 1926), there were a single mature male and several immature forms of a different species.

The male is about 80 mm. in length and 1·3 mm. in thickness. The cuticular striations are coarse in the oesophageal region, where the interval between them is about 0·05 mm. In the middle region of the body, however, they are much finer, the interval being about 0·0075 mm. Each lip has a broad base and a narrow anterior lobe, deeply indented in the middle and provided with a prominent dentigerous ridge composed of coarse and irregular teeth. The oesophagus (measured from the extremity of the lips and excluding the ventriculus) is 4·5 mm. long. Its greatest thickness (near the posterior end) is 0·39 mm. The ventriculus is straight, and measures about 1·7 mm. in length and 0·4 mm. in greatest width (at its posterior end). The nerve-ring is situated at 0·6 mm., and the cervical papillae at 0·75 mm., from the anterior end.

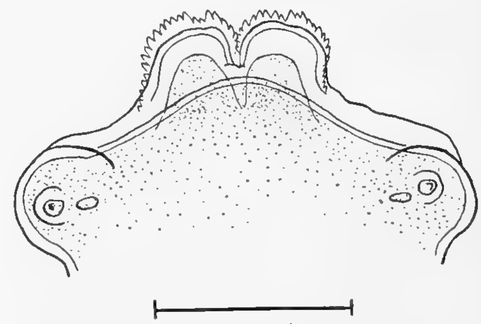

Fig. 1. *Anisakis catodontis*. Dorsal lip of male, external aspect.

The tail is bluntly conical and measures 0·25 mm. in length. It has only been possible to examine it in lateral view, and only a single pair of postanal papillae was observed. This was situated near the posterior end. There are numerous preanal papillae, arranged irregularly and extending forward for a considerable distance. The spicules are tubular and without alae. The left spicule measures 2·25 mm., the right 1·45 mm. in length. Their dorso-ventral diameter is about 0·03 mm.

The immature specimens measure up to about 47 mm. in length and 0·9 mm. in maximum thickness, and show the same oesophageal structure as the adult male.

Anisakis sp.

Several immature specimens of a species of *Anisakis* occurred in [the stomach of ?] a humpback (*Megaptera nodosa*) at Durban, July 29, 1926.

Porrocaecum falklandicum, sp. n.

(Fig. 2)

A pair of specimens, male and female, collected from a dotterel (*Eudromias* (*Zonibyx*) *modestus*) at Port Stanley, Falklands, March 28, 1927. This species is very closely related to *P. ensicaudatum* (Zeder, 1800) and *P. semiteres* (Zeder, 1800) from European birds. The male is 13·7 mm. long and 0·7 mm. thick, the female 23·5 mm. and 1·2 mm. respectively. The cuticular striations (in the female) are at intervals of about 0·017 mm.

The pulp of each lip has a pair of outwardly and posteriorly directed processes at its anterior corners, as in the other species mentioned. There are well-developed interlabia. The length of the oesophagus (including the ventriculus) is about 1·9 mm. in the male and 2·75 mm. in the female. The sub-globular ventriculus is about 0·2 mm. long in the male and 0·3 mm. in the female, while the intestinal caecum measures about 0·6 and 1 mm. respectively. The nerve-ring is situated at 0·42 mm. from the anterior end in the male, and at about 0·65 mm. in the female. Well-developed cervical alae are present, the species resembling in this respect *P. semiteres* rather than *P. ensicaudatum*.

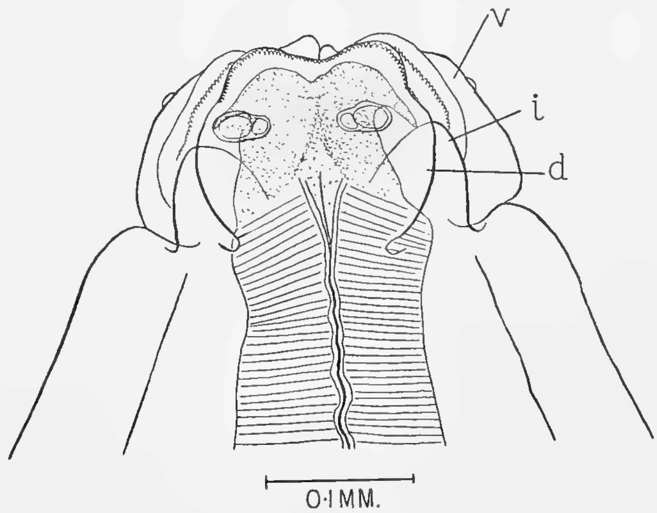

Fig. 2. *Porrocaecum falklandicum*. Anterior end of female, dorsal view. *d.*, dorsal lip; *i.*, interlabium; *v.*, ventro-lateral lip.

The tail is conical in both sexes. In the male it is about 0·3 mm. long. There are apparently five pairs of very small postanal papillae (of which the most posterior but one is laterally situated) and some thirteen pairs of preanal papillae. The spicules are about 0·45 mm. long, and are apparently broadly alate, but they are retracted, and therefore difficult to see clearly. Their tips are blunt.

The tail of the female is 0·55 mm. long. The vulva is situated at 10·5 mm. from the anterior extremity. The eggs are ovoid and measure 0·1–0·11 mm. × 0·0675–0·07 mm.

Porrocaecum decipiens (Krabbe, 1878) (?)

A large number of larval forms of some species of *Porrocaecum*, probably *P. decipiens* ("*Ascaris capsularia*"), were collected on different occasions off South Georgia, the Falklands and the South Shetlands, from the peritoneum and mesenteries of various species of fish. The list of hosts is as follows:

Chaenocephalus aceratus	10 collections; Stations 39, 45, 123, 149, 154, MS 68, etc
Champsocephalus esox	Station WS 71
Merluccius sp.	3 collections; Stations WS 73, 77
Notothenia rossii (?)	Station 174
Notothenia wiltoni	Station WS 86
Notothenia ramsayi	Station WS 94
Parachaenichthys georgianus	Grytviken, S. Georgia
"Large fish"	Station 142

These larvae were frequently accompanied by those of *Contracaecum* sp. in the same host. This occurred in *Champsocephalus esox*, *Merluccius* sp., *Notothenia wiltoni* and *N. ramsayi*. In such cases it is noticeable that the *Porrocaecum* larvae are much longer and whiter than the *Contracaecum* larvae, and are usually coiled up like watch-springs in disc-shaped or lenticular capsules (see Fig. 3 A), whereas the *Contracaecum* larvae,

A

B

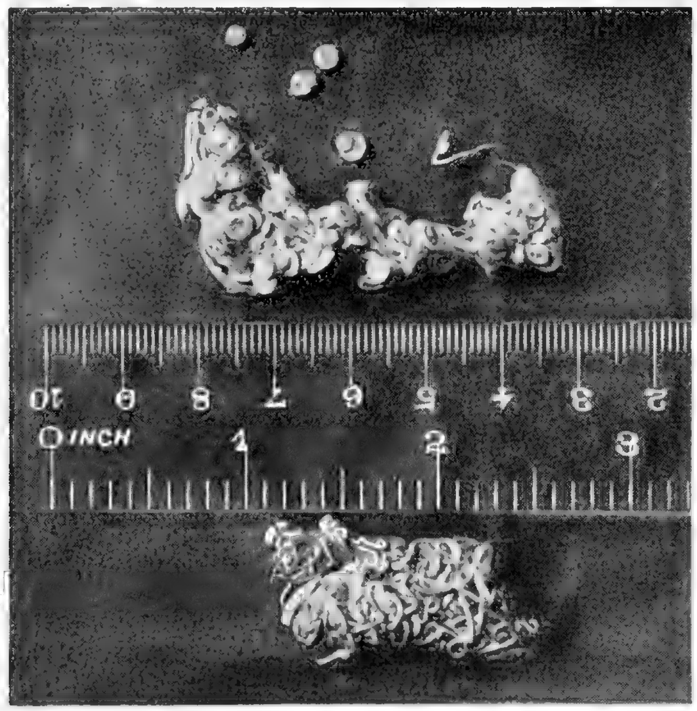

Fig. 3. A, part of a mass of *Porrocaecum* or *Anisakis* larvae from *Macruronus magellanicus*; B, part of a mass of *Contracaecum* larvae from *Notothenia wiltoni*.

though enclosed in sheaths consisting partly of old cuticles and partly of pigmented peritoneal tissue from the host, are not usually coiled.

Porrocaecum or Anisakis sp.

Larval forms having a ventriculus like that of the adults of these two genera, but without an intestinal caecum, occurred in similar situations in the following fishes:

Gadus sp.	Station WS 99, off the Falklands, together with *Contracaecum* larvae
Cottoperca gobio	Station WS 95, off the Falklands, together with *Contracaecum* larvae
Coryphaena sp.	Atlantic Ocean, 24° 05′ N., 15° 46′ W.
Macruronus magellanicus	A large mass of specimens, with which a few *Contracaecum* larvae were mixed. Station WS 92, off the Falklands
Thyrsites atun	Station 4, off Tristan da Cunha

Two similar larvae, possibly of two species, were found in the stomach of a slender-beaked dolphin (*Steno rostratus*), taken in the Atlantic Ocean, off the West African coast not far from Cape Verde, October 27, 1925.

Contracaecum spiculigerum (Rud., 1809)

A large number of specimens of this extremely common and cosmopolitan species were collected from the stomach of a cormorant (*Phalacrocorax magellanicus*) at St Martin's Cove, Hermite Island, Cape Horn (Station 222).

Contracaecum clavatum (Rud., 1809)

Adult or immature specimens which are referred to this species were collected on about six occasions from the stomach or intestine of *Merluccius* sp. at various places off the Falkland Islands (Stations WS 73, 90, 96, 99).

These worms are rather small, as compared with specimens of *C. clavatum* from hake and cod in northern latitudes, and the males have shorter spicules, but a specific distinction does not seem justifiable.

A single small male, apparently of the same species, occurred in the intestine of *Stromateus* sp. at Station WS 78, and an immature specimen in the stomach of *Gadus* sp. at Station WS 99 (both off the Falklands).

Contracaecum rectangulum (v. Linstow, 1907)

A number of specimens of this species, of various ages, occurred among the stomach contents (chiefly Cephalopod remains) of a sea-leopard (*Hydrurga leptonyx*) in the South Sandwich region, January 22, 1928.

Immature forms, probably also of this species, were collected from the intestine of another sea-leopard at Station 184, March 15, 1927, and from the stomach of a crab-eater seal (*Lobodon carcinophagus*) at Station 187, March 18, 1927. Both these stations were in the Palmer Archipelago.

Contracaecum zenis, sp. n.

(Fig. 4)

Four adult females from *Zeus capensis* off South-west Africa, July 8, 1927. The worms are stated to have been found in the body-cavity, but had probably escaped from the alimentary canal. The length of the specimens varies between 55 and 70 mm., and the maximum thickness reaches 1·5 mm. The cuticular striations are fine (about 0·005 mm. apart). The dorsal lip has wide cuticular expansions laterally, and the anterior lobes of the pulp have inwardly-directed processes. There are deep incisions at the bases of the lips. The cervical alae are well developed. The oesophagus is 7 mm. long. The ventriculus measures, in the largest specimen, about 0·25 mm. in length and 0·3 mm. in width. In this specimen, the intestinal caecum extends forward to a point about 2·5 mm. from the anterior extremity, and the oesophageal appendix is about 2·3 mm. long. The cervical papillae are situated at 1·1 mm., and the nerve-ring at 0·9 mm., from the anterior

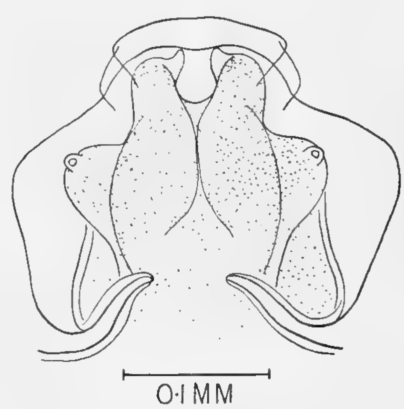

Fig. 4. *Contracaecum zenis.* Dorsal lip of female, external aspect.

end. The tail is 0·55 mm. long, conical and sharply pointed, and terminates in a small spike. The body is considerably thickened in the posterior half, to which the genital organs are confined. The vulva is situated at about the middle of the body, and the coils of the uterine branches and ovaries extend from this level to within about 2 mm. of the anus.

This species differs markedly from *C. fabri* (Rud., 1819), which occurs in *Zeus faber*, in the length of the intestinal caecum (see Baylis (1923 *a*), p. 5).

Contracaecum sp.

Some immature specimens of a species of *Contracaecum* occurred in the stomach of a fin whale (*Balaenoptera physalus*), at South Georgia, March 24, 1927.

Contracaecum spp.

Larval forms of undetermined species of *Contracaecum* were found very abundantly in various fishes, in the peritoneal lining and mesenteries, and more particularly on the surface of the liver. The list of hosts in which such larvae occurred is as follows:

Merluccius sp.	Several collections, off the Falkland Islands; Stations WS 73, 76, 77, 80, 94
Champsocephalus esox	Off the Falklands; Station WS 71
Chaenocephalus aceratus	Grytviken, S. Georgia
Gadus sp.	Off the Falklands; Station WS 99
Notothenia ramsayi	Off the Falklands; Station WS 94
Notothenia wiltoni	Several collections, off the Falklands; Stations WS 76, 77, 86
Cottoperca gobio	2 collections, off the Falklands; Stations WS 94 and 95
Parachaenichthys georgianus	Stromness, S. Georgia
"Crocodile fish"—probably *Parachaenichthys georgianus*	2 collections, off South Georgia
Macruronus magellanicus	Off the Falklands; Station WS 92

The general differences in appearance between these *Contracaecum* larvae and the *Porrocaecum* larvae with which they are often associated have already been noticed. The larvae of *Contracaecum* frequently occur in large, tangled masses (see Fig. 3 B), in which many of the individual worms, though enclosed in sheaths, do not appear to have been definitely confined in capsules to one spot, but may have had a certain power of movement.

The specimens from *Merluccius*, *Champsocephalus* and *Chaenocephalus* appear probably to belong to one and the same species. Those from *Notothenia wiltoni* and *N. ramsayi* probably include more than one species.

Acanthocheilus quadridentatus (Molin, 1858)

(Figs. 5 and 6)

A single specimen (an immature female) taken from the stomach of *Mustelus vulgaris* at Simonstown, South Africa, October 18, 1926, is referred somewhat doubtfully to this species. Molin's (1858, 1861) description of *A. quadridentatus* is very brief, and his figures are evidently very diagrammatic. He records the species from the small intestine of *Mustelus plebejus* (= *M. vulgaris*). Örley (1885 *a*) gives a somewhat fuller description of material from *M. vulgaris* and *M. laevis*, but this is unfortunately in Hungarian, and his German summary (1885 *b*) contains only the statements that the spicules of the male are short and slender, and that there are 16 pairs of caudal papillae.

The length of the present specimen is 24·5 mm., and its maximum thickness about 0·65 mm. The cuticular striations are too fine and faint to measure. The oesophagus is just over 2 mm. long, including a spherical, posterior, non-muscular ventriculus measuring 0·23 mm. in diameter. The muscular oesophagus proper is club-shaped. It

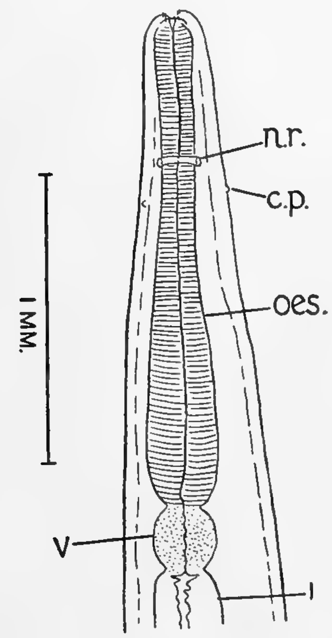

Fig. 5. *Acanthocheilus quadridentatus.* Anterior end of female, dorsal view. *c.p.*, cervical papilla; *i.*, intestine; *n.r.*, nerve-ring; *oes.*, oesophagus; *v.*, ventriculus.

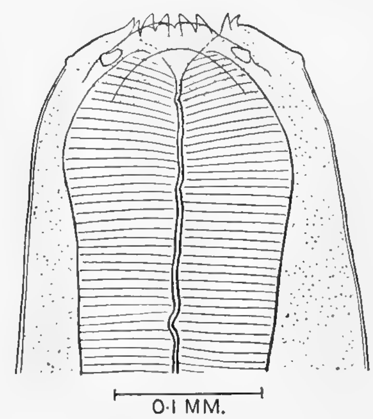

Fig. 6. *Acanthocheilus quadridentatus.* Anterior end of female, dorsal view.

is surrounded by the nerve-ring at 0·55 mm. from the anterior extremity. There is no intestinal caecum running forward by the side of the oesophagus, nor is such a structure mentioned by Molin or by Örley, though in another species, *A. nidifex* Linton, 1900, such a caecum is said to be present. At a point 0·67 mm. from the anterior end there is a pair of small, button-like cervical papillae. The excretory pore is probably close to the base of the ventro-lateral lips.

Molin describes each of the three lips as having a single median papilla, while Örley also appears to refer only to three cephalic papillae. In the present specimen the dorsal lip bears a pair of lozenge-shaped papillae, while on each ventro-lateral lip one such large papilla is present towards the ventral border. It is uncertain whether or not there is a smaller papilla near the lateral border. Each lip bears on its inner surface the four sharp, forwardly-directed teeth mentioned in the earlier descriptions. These are not, however, arranged in two widely separated pairs, as in Molin's figures, nor is there a blunt, median projection between the two pairs of teeth, as indicated by Örley.

The tail is rapidly tapering and conical, with a minute terminal button. It is about 0·3 mm. long, and has a pair of small, sessile papillae at about its middle. The anus is conspicuous, but its lips are not very prominent. The vulva is situated at about 10 mm. from the anterior end. The vagina is stout and muscular, and runs posteriorly from the vulva. There are two uterine branches, which run parallel in a posterior direction. One of the ovarian tubes ends posteriorly, the other turning forward to end in the anterior region. No eggs are present in this specimen.

Family HETERAKIDAE Sub-family HETERAKINAE

Heterakis dispar (Schrank, 1790)

A few specimens of this species were collected from the rectum of an upland goose (*Chloëphaga magellanica*) at Teal Inlet, Falklands, March 5, 1927.

Order STRONGYLOIDEA

Family TRICHOSTRONGYLIDAE Sub-family TRICHOSTRONGYLINAE

Nematodirus spathiger (Railliet, 1896)

Numerous specimens of this species occurred in the small intestine of a sheep at Port Stanley, Falklands, March 9, 1927.

Order FILARIOIDEA

Family PHILOMETRIDAE

Philometra globiceps (Rud., 1819)

A single female worm, about 170 mm. long, found in the gonad of a Percoid fish at Station 274, off St Paul de Loanda, Angola, W. Africa, August 4, 1927, is doubtfully referred to this species. The characteristic swelling of the anterior end of the oesophagus is present, though not very pronounced. The oesophagus is almost exactly 1 mm. long. The colour of the worm, when fresh, was "red, with black centre".

Family SPIRURIDAE Sub-family ACUARIINAE (?)

Crassicauda crassicauda (Creplin, 1829)

A number of specimens of this species were collected from the penis of fin whale No. 796 (*Balaenoptera physalus*) at Saldanha Bay, South Africa, June 26, 1926.

Sub-family THELAZIINAE

Spinitectus guntheri, sp. n.

(Figs. 7–9)

One male, three mature and two immature females of this form were found among a haul of fishes from a depth of 1000 metres at Station 86, off South-west Africa, June 24,

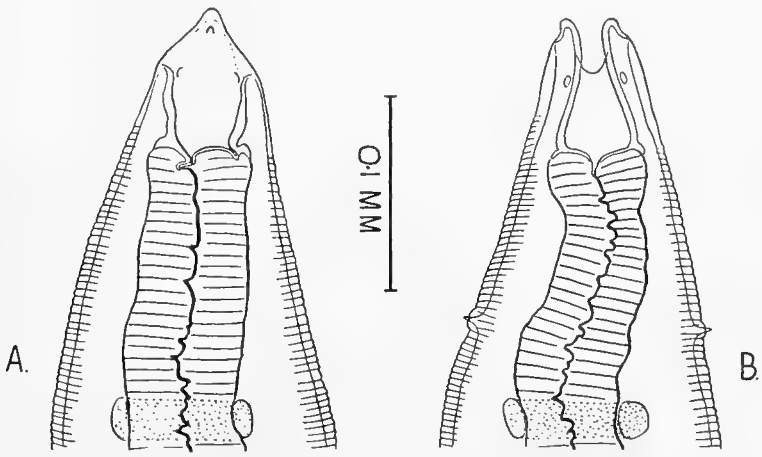

Fig. 7. *Spinitectus guntheri.* Anterior end of female: *A*, lateral view; *B*, dorsal view.

1926. It is probable that, as often happens with fishes brought to the surface from considerable depths, some of them had been so badly damaged as to allow the parasites to escape. It is unfortunately impossible to state from what species of fish they came.

The length of the male is 17·75 mm., that of the mature females varying between 19·8 and 23·3 mm. The body is slender in the oesophageal region, and much stouter in the posterior region, which contains the genital organs. The maximum thickness in the male (near the posterior end of the body) is 0·29 mm., in the female 0·45–0·5 mm. The oesophagus has an anterior, muscular portion which is usually much contracted and sinuous, and measures about 1–1·5 mm. in length, and a long, granular, posterior portion. The total length of the oesophagus is 6–8·1 mm. The cuticular striations are

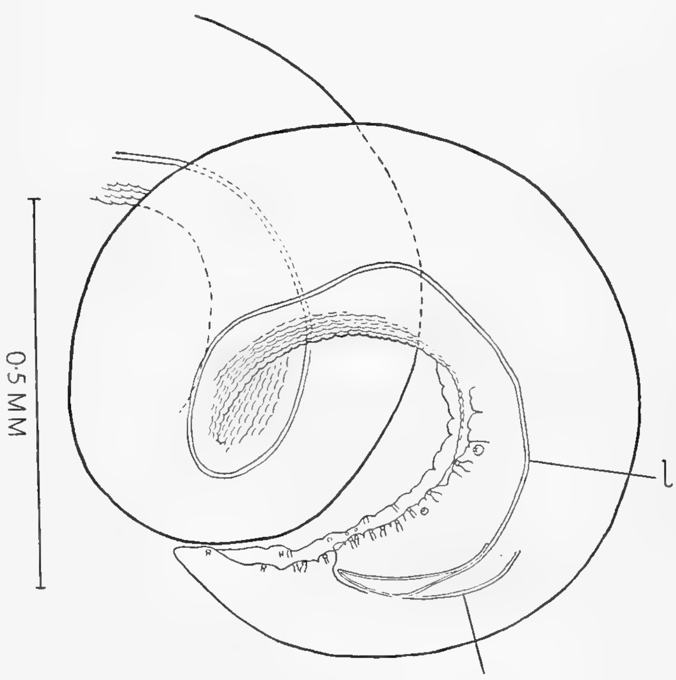

Fig. 8. *Spinitectus guntheri.* Posterior end of male, lateral view. *l.*, left spicule; *r.*, right spicule.

relatively coarse in the oesophageal region, where they have prominent posterior edges, giving the outlines of the body a saw-like appearance in optical section. The interval between the striations in this region is about 0·01 mm. in the male and 0·015 mm. in the female. More posteriorly the striations are much finer and less prominent. The cuticular spines which are so conspicuous a feature in other species of the genus, forming complete circles on the posterior edges of the cuticular rings, are here represented by very small spines confined to the ventral surface of part of the oesophageal

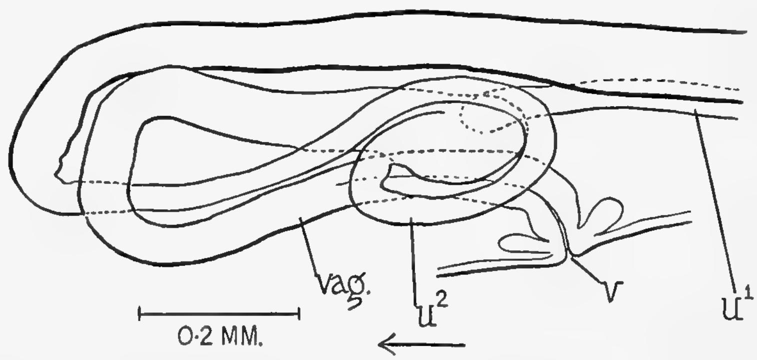

Fig. 9. *Spinitectus guntheri*. Part of the female genital organs, in lateral view. (The arrow points towards the anterior end.) u^1, u^2, the two uterine branches; *v*., vulva; *vag*., vagina.

region. They do not extend forward much beyond the level of the junction of the two portions of the oesophagus, or backward as far as its posterior end.

The paired lateral lips are conical, and each appears to be provided with three papillae, one near the apex and two at the base. The lateral walls of the buccal capsule are formed by a continuation of the thickened cuticle of the lips, while its dorsal and ventral walls begin at the level of their bases. There is a pair of prominent cervical papillae, situated, in the female, at about 0·17 mm. from the anterior extremity. The nerve-ring is situated at about 0·2–0·21 mm., and the excretory pore at about 0·25–0·29 mm., from the anterior end.

The posterior end of the male is spirally coiled. The tail is about 0·23 mm. long, and is conical. There are slight lateral alae, into which project ten pairs of preanal and five pairs of postanal papillae. The cuticle of the ventral surface, for some distance from the posterior end, is raised into numerous longitudinal series of rectangular plates or tubercles. These doubtless correspond to the more restricted number of rows of "plates", "tubercles" or "ridges" described in other species (four rows in *S. cristatus* Railliet and Henry, 1915 (= *Filaria serrata* Linton, 1901) and *S. ranae* Morishita, 1926; four to eight rows in *S. gracilis* Ward and Magath, 1916). The left spicule is long and filiform, measuring about 2·5 mm. in length. The right spicule is very stout and measures only about 0·25 mm. in length. There is no accessory piece.

In the female, the tail, which is rapidly tapering and pointed, is 0·23–0·27 mm. long. The vulva is situated at 6·2–6·7 mm. from the posterior end. The vagina runs forward at first from the vulva, but soon doubles back again, and at about the level of the vulva expands into a small oval swelling, which gives off at right angles to itself the two uterine branches. One of these has a tendency to turn forward at first, but ultimately turns posteriorly parallel to the other. Both turn forward again at a short distance from the anus, and the ovaries lie in the prevulvar region. The eggs are small (0·04–0·045 mm. × 0·025–0·03 mm.) and oblong-oval. They have thick shells, apparently without the polar filaments described for the genotype.

Owing to the absence of a full description of the genotype of *Spinitectus*, the systematic position of this genus is somewhat doubtful. If the present species is correctly assigned to *Spinitectus*, the detailed examination of it which it has been possible to make leaves little doubt that the genus belongs to the sub-family Thelaziinae, in an appendix to which it was placed by Baylis and Daubney (1926).

Family CUCULLANIDAE

Cucullanus fraseri, sp. n.

(Figs. 10 and 11)

This species occurred in the rectum of *Chaenocephalus aceratus* (four collections, including types) off South Georgia (Stations 45, 154, MS 68 and Grytviken), and of *Trematomus hansoni* (one collection, off South Georgia, Station 154).

The male (of which there is only a single specimen) is 5 mm. in length and 0·29 mm. in maximum thickness. Mature females are 6–7 mm. long and about 0·4 mm. thick. The cuticular striations are at intervals of about 0·0025 mm. The opening of the mouth is slightly tilted dorsally. The cuticle of the cervical region is relatively very thick. There is a pair of prominent cervical papillae at 0·33 mm. in the male, and about 0·4 mm. in the female, from the anterior end. The expanded anterior portion of the oesophagus contains paired, latero-ventral thickenings within its muscular walls. At about the level of the cervical papillae the oesophagus becomes very narrow, and at a point a little behind them (0·4–0·45 mm. from the anterior extremity) is surrounded by the nerve-ring. Behind this point the oesophagus increases again in

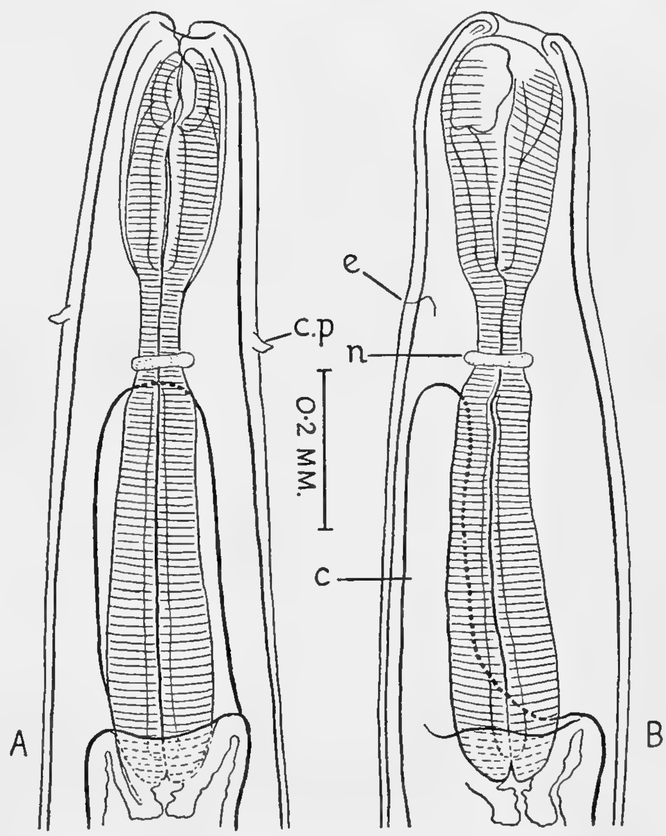

Fig. 10. *Cucullanus fraseri*. Anterior end of female: *A*, dorsal view; *B*, lateral view. *c.*, intestinal caecum; *c.p.*, cervical papilla; *e.*, excretory pore; *n.*, nerve-ring.

diameter, its posterior portion being club-shaped. Its length is 0·9–1 mm. There is a large intestinal caecum, which runs forward ventrally to the oesophagus almost as far as the nerve-ring. The excretory pore is situated at 0·35–0·37 mm. from the anterior extremity of the worm.

The caudal end of the male is curved ventrally. The tail is conical and sharply pointed, and measures 0·21 mm. in length. The usual preanal sucker-like organ is present. There are ten pairs of caudal papillae, of which five are preanal. Their arrangement is indicated in Fig. 11. The spicules are about 0·85 mm. long, and the accessory piece about 0·1 mm.

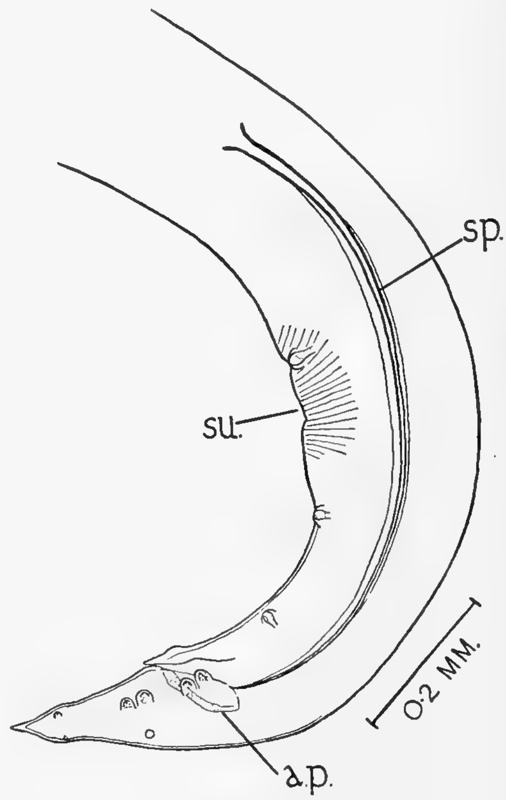

Fig. 11. *Cucullanus fraseri*. Posterior end of male, lateral view. *a.p.*, accessory piece; *sp.*, left spicule; *su.*, sucker-like organ.

The tail of the female is straight and conical, measures 0·2–0·22 mm. in length and is usually tilted dorsally at an obtuse angle. The vulva, which has very prominent lips, is situated at 2·3 mm. from the posterior end in a specimen 6·3 mm. long. The vagina and the common trunk of the uterus run anteriorly from it. At a point slightly in front of the middle of the body the common trunk divides into two branches. One of these runs straight forward, and the coils of its ovary extend as far as the junction of the oesophagus and intestine. The other branch almost immediately turns posteriorly, and the coils of its ovary extend nearly as far as the anus. The eggs measure about 0·09 mm. × 0·05 mm.

This species would fall into the genus *Dichelyne* Jägerskiöld, 1902, as recently re-defined by Gendre (1927, p. 261). This genus was suppressed by the writer (1923 *b*, p. 233) as a synonym of *Cucullanus*. The only real character which can be adduced to separate it from the latter being the presence of an intestinal caecum, the revival of the genus *Dichelyne* does not appear necessary unless a further study of the contained species should reveal other important distinguishing characters.

Cucullanus fraseri, var. nototheniae, nov.

Examples of a form scarcely specifically distinct from that just described, but larger, occurred in the intestine of *Notothenia gibberifrons* off South Georgia (Station 123), December 15, 1926. The male measures nearly 7 mm., the females up to 9·6 mm., in length. The cervical papillae, instead of being in front of the nerve-ring, are some distance behind it (0·6 mm. from the anterior end in the male, 0·65–0·7 mm. in the female).

ACANTHOCEPHALA

Family ECHINORHYNCHIDAE Sub-family CENTRORHYNCHINAE

Corynosoma bullosum (v. Linstow, 1902)

One small, immature specimen of this species occurred in the intestine of a crab-eater seal (*Lobodon carcinophagus*) at Station 187 (Palmer Archipelago, between Anvers Island and Graham Land), March 18, 1927.

Larval forms, found encysted in the peritoneum of *Chaenocephalus ? aceratus* off South Georgia (Station MS 68), March 2, 1926, and in the mesentery of a "crocodile fish" (probably *Parachaenichthys georgianus*), also off South Georgia, April 30, 1925, are referred to this species. They differ from the larvae assigned to *C. hamanni* in the same characters as the adults of the two species—viz. in having a much longer and more slender posterior portion, and in the fact that the body-spines do not extend along the whole of the ventral surface.

Corynosoma hamanni (v. Linstow, 1892)

Numerous larval forms which are referred to this species occurred encysted on the outside of the intestine of *Notothenia rossii* off Deception Island, South Shetlands (Station 174), February and March 1927. Similar larvae also occurred, mixed with those of *C. bullosum*, in a "crocodile fish" (probably *Parachaenichthys georgianus*) off South Georgia, April 30, 1925.

Bolbosoma brevicolle (Malm, 1867)

This species was collected on at least six occasions from the intestines of blue whales (*Balaenoptera musculus*) at Durban and Saldanha Bay, South Africa, and at South Georgia. On one occasion (at Saldanha Bay, July 9, 1926) it was found in a fin whale (*B. physalus*), and the collector's label states that when fresh the worms in the small intestine were red, while those in the large intestine were white. The presence of an orange-red colour in Acanthocephala is not uncommon. The present observation suggests that it may be not an inherent property of the worms themselves, but an accident in some way connected with the food of the host.

Bolbosoma turbinella (Dies., 1851)

This species occurred on six occasions, at Durban, Saldanha Bay and South Georgia, in sei whales (*Balaenoptera borealis*), and it is noteworthy that it was not found in any other host. The fact that it did not occur in *Balaenoptera musculus* or *B. physalus*, whereas *Bolbosoma brevicolle* occurred in these two species and not in *B. borealis*, would seem to indicate the existence of some important difference between the habits of the sei whale and those of the other species.

Bolbosoma capitatum (v. Linstow, 1880)

A single immature specimen, probably referable to this species, occurred in the stomach of a slender-beaked dolphin (*Steno rostratus*) taken off the West African coast, not far from Cape Verde.

Bolbosoma hamiltoni, sp. n.

(Figs. 12–14)

A single male and several females of this form occurred in a fin whale (*Balaenoptera physalus*) at South Georgia, February 18, 1926. A single specimen was also found, together with *B. brevicolle*, in a blue whale (*Balaenoptera musculus*) at South Georgia. The species is very closely related to *B. capitatum* (v. Linstow, 1880), but the spines on the "bulb" are smaller and much more numerous than in that species. The proboscis-hooks are also more numerous, and their roots are less broad and flat than in *B. capitatum*.

The length of the male is about 60 mm., the females attaining about 64 mm. The maximum thickness of the male is 2·05 mm., that of the female 2·7 mm. The diameter of the "bulb" is 3·78 mm. in the male and 3·51 mm. in the female. The length of the proboscis (in the female) is about 0·9 mm., and its maximum diameter (near the base) about 0·6 mm. It bears apparently 26 longitudinal rows of hooks, each containing seven or eight. (In *B. capitatum* there are only 18(–20?) rows of hooks.) The more anterior hooks are slender and sharply pointed, and their tips show a slight tendency to curve outwards, while the blade is as long as the root. The length of the largest hooks (i.e. the second and third in each row from the anterior end), measured in a straight line from the tip to the point of insertion, is about 0·09 mm. in a female specimen. The roots of these anterior hooks have a very slight "heel", or suggestion of an anterior root. More posteriorly the hooks become gradually shorter, stouter and blunter, and the blades become shorter than the roots. The most posterior hooks are very small and thorn-like, with scarcely any root.

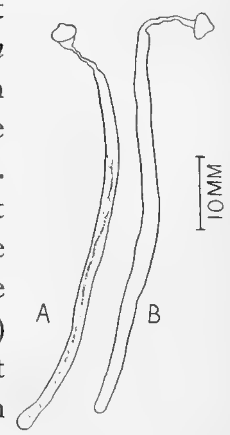

Fig. 12. *Bolbosoma hamiltoni*. Male (*A*) and female (*B*); natural size.

The spines on the bulb are very numerous, and the largest of them (those in the posterior rows) are less than 0·1 mm. in length, whereas in *B. capitatum* the posterior spines are about 0·24 mm. long.

The posterior testis of the male is just in front of the middle of the body. The eggs are spindle-shaped, and measure 0·112–0·137 mm. × 0·027–0·03 mm.

Sub-family ECHINORHYNCHINAE (?)

Echinorhynchus s.l.

An immature specimen of "*Echinorhynchus*" occurred in the intestine of *Parachaenichthys georgianus* at Stromness, South Georgia, January 7, 1927.

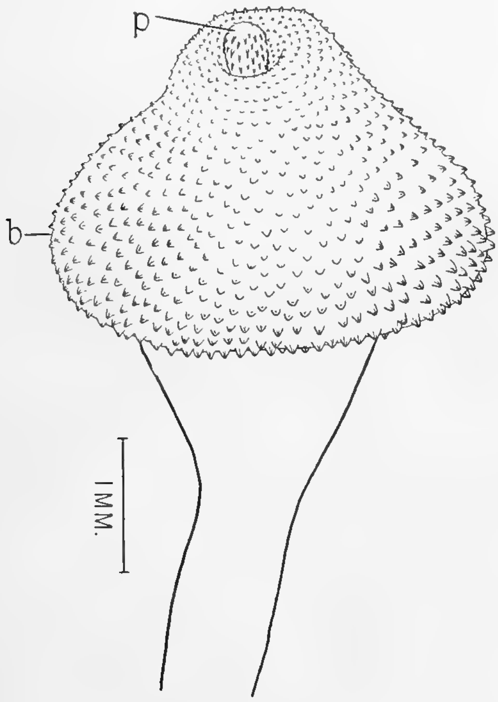

Fig. 13. *Bolbosoma hamiltoni*. Anterior end of female. *b*., "bulb"; *p*., proboscis.

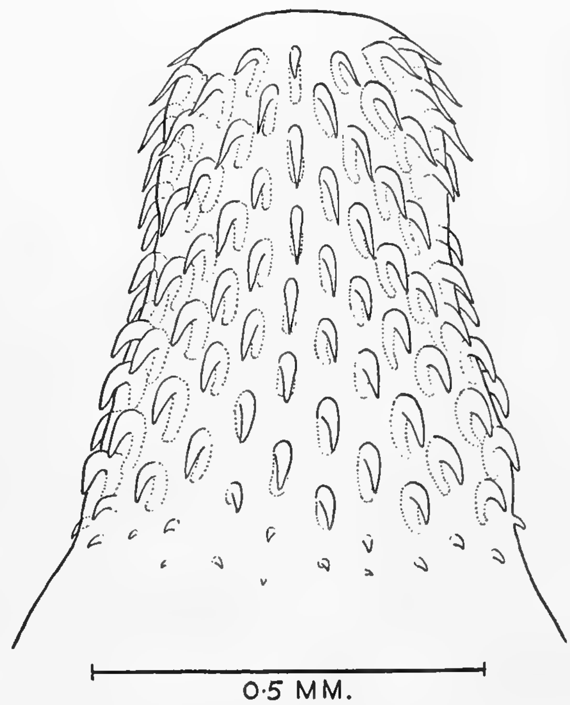

Fig. 14. *Bolbosoma hamiltoni*. Proboscis of female.

Family RHADINORHYNCHIDAE

Rhadinorhynchus wheeleri, sp. n.

(Fig. 15)

This species[1] occurred in the intestine (especially the rectum) of the following fishes:

Notothenia rossii	Stromness and Grytviken, S. Georgia, December 1926 and January 1927
Parachaenichthys georgianus	Stromness, January 1927
Trematomus ? hansoni	Cumberland Bay, South Georgia

The collector's label in one tube (from *Notothenia rossii*, Stromness) says "Approximately 300 in one fish—many in rectum and extending right up the intestine. When fresh a yellow colour".

The worms measure 3–8 mm. in length and 1·4–2 mm. in maximum thickness. The

[1] Since this report was sent to press, an account has been published by Van Cleave (*Ann. Mag. Nat. Hist.* (10) IV, p. 229, August, 1929) of a form from "*Trematomus* or *Notothenia*" from the South Shetlands, which he names *Aspersentis austrinus*, gen. et sp. n. This form seems to approach very closely to *Rhadinorhynchus wheeleri*, though in certain details the two descriptions are not in complete agreement.

proboscis is about 0·7–0·9 mm. long and 0·3 mm. in diameter. It bears 14 longitudinal rows of 8–10 hooks each. As is characteristic of the genus, the hooks in the ventral rows

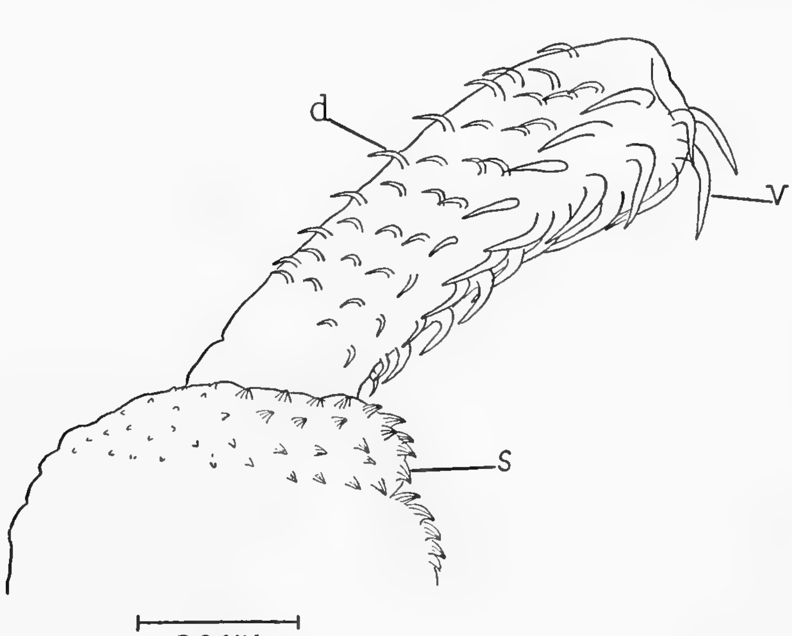

Fig. 15. *Rhadinorhynchus wheeleri*. Anterior end of female, lateral view. *d.*, dorsal proboscis-hook; *s.*, body-spine; *v.*, ventral proboscis-hook.

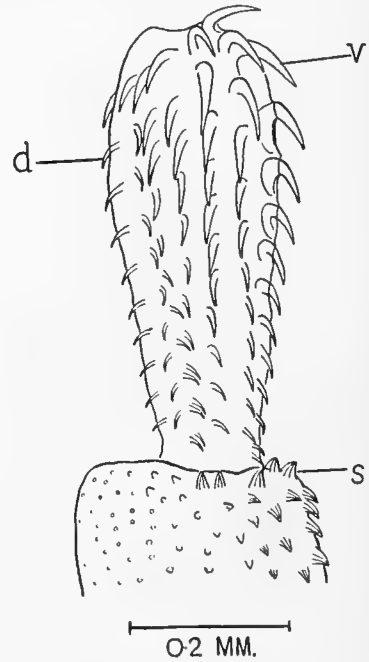

Fig. 16. *Rhadinorhynchus johni*. Anterior end of female, lateral view. *d.*, dorsal proboscis-hook; *s.*, body-spine; *v.*, ventral proboscis-hook.

are much larger than those in the dorsal rows. The former (measured in a straight line from tip to insertion) reach a length of about 0·15 mm., while the latter are only about 0·06 mm. long. The spines on the anterior portion of the body are small (0·025–0·03 mm. long), and are arranged in fairly regular transverse ventral rows, extending well round on to the lateral surfaces. The proboscis-sac is about 1–1·3 mm. long. The lemnisci are apparently short, oval sacs. The eggs measure about 0·09 mm. × 0·025 mm.

Of the species of *Rhadinorhynchus* already known, *R. pristis* (Rud., 1802), *R. horridus* (Lühe, 1912) and *R. tenuicornis* Van Cleave, 1918, are said to possess 14 longitudinal rows of hooks on the proboscis. The two first-mentioned species are much larger than the present form, while in all three the number of hooks per row is much larger (26 in *pristis*, about 26 in *tenuicornis*, 31 in *horridus*). Indeed, in no species of *Rhadinorhynchus* hitherto described, so far as the writer is aware, is the number of hooks in each row less than about 20.

Rhadinorhynchus johni, sp. n.

(Fig. 16)

This second species of *Rhadinorhynchus* occurred in the rectum of a hake (*Merluccius* sp.) off the Falklands (Station WS 73), March 7, 1927.

The worms are about 2·5–3·5 mm. in length and 0·4–0·7 mm. in maximum thickness. The proboscis is 0·6 mm. long in the male, and 0·7 mm. in the female. Its maximum diameter, in the male, is 0·18 mm., in the female 0·22 mm. It bears 14 longitudinal rows of hooks, each containing 12–14. The largest of the hooks on the ventral side are 0·0875 mm. in length (in a straight line from tip to insertion), while those on the dorsal side measure not more than 0·065 mm. The spines on the anterior region of the body are arranged in irregular transverse rows, which extend right round on to the dorsal surface, though here the spines become very minute. The largest of the body-spines, on the ventral surface, are about 0·03 mm. in length. In fully-extended specimens the spines extend back ventrally beyond the level of the middle of the proboscis-sac. This organ is about 0·7 mm. long in the male and 0·9 mm. in the female. The lemnisci are as long as, or a little longer than, the proboscis-sac. The eggs measure about 0·05 mm. × 0·015 mm.

This species is clearly very closely related to the last described, and differs in the same respects from previously-known forms.

Rhadinorhynchus sp.

Two immature specimens of a species of *Rhadinorhynchus* occurred in the intestine of *Naucrates ductor* off the Canary Islands, October 16, 1925. In both the proboscis is retracted.

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by
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THE BIRDS OF SOUTH GEORGIA

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L. HARRISON MATTHEWS, M.A.

CONTENTS

THE BIRDS OF SOUTH GEORGIA

By L. Harrison Matthews, M.A.

(Plates XLV–LVI)

THE following notes comprise a complete list of the birds of South Georgia, including the observations made in 1925–7 while the 'Discovery' investigations were in progress, and the records of previous expeditions. As all the species are known ones, with few exceptions no descriptions of the plumages are given, but notes of the soft parts, which shrivel up and change colour in the preparation of specimens, are included. Most of the species are oceanic, one or two are land birds, and a few are peculiar to the island. The presence of several whaling stations on the island attracts great numbers of birds, which come to feed on the refuse from the working-up of the whales. This easy supply of food leads to overpopulation of the island during the summer, so that there are more birds of some species than the island could naturally support. In winter, when whaling ceases, large numbers die of starvation. The appropriately named Bird Island, and the Willis Islands off the north-west coast afford breeding grounds to immense numbers of birds.

Diomedea exulans, Linn.

Wandering Albatross

(Plate XLVIII; Plate XLIX; Plate L, fig. 1.)

The Wandering Albatross is common at sea all round the island during the whole year. Ashore it is found nesting at suitable places on the northern parts of the island from the Bay of Isles, on the north-east coast, to Ice Fjord, on the south-west coast. Shackleton also found young albatross, presumably of this species, when he landed in King Haakon Bay after his boat journey from the South Orkney Islands in 1916. On their breeding grounds the albatross are very numerous, for instance the writer was out with one of the whale-boats in January, 1926, when in three days over 2000 eggs of this species were collected for eating. At sea the birds are not gregarious, but many are often seen near each other resting on the water or soaring over it. On land they are very ungainly and walk with a waddling gait, the head being held low down, stretched out in front, and moved from side to side with each step. As soon as they stop walking the head is held up again. If they are hurried the wings are spread, but their balance is precarious and they easily trip up and fall forward on to the breast over the smallest obstructions. The wing spread is so wide that they cannot rise from level ground unless a strong wind is blowing. On the nests they are quite tame and fearless, merely snapping the bill when approached and they can be stroked if they are handled gently, but a sudden movement makes them bite severely.

There has been a great deal of confusion as to the different species of the larger albatrosses. Three species are separated by Godman,[1] the Wandering, Snowy and Royal Albatrosses. The observations of the writer in South Georgia show that the Wandering and Snowy Albatrosses are the different ages and sexes of the same species. The Royal Albatross is recorded from the sub-antarctic waters of New Zealand and the writer has had no opportunity of examining specimens of it, but he is strongly of the opinion that when a thorough examination of the species comes to be made it will prove to be the same as the other two.

When they are old, the birds are pure white all over, with black tips to the primaries and the outer secondaries, and have a little dark pencilling on the upper wing coverts. Those seen ashore nesting usually have a patch of salmon-pink colour over the ears, sometimes on one side only. This appears to be a stain of some sort and is not a true pigmentation of the feathers; it is not constant, sometimes being absent, or on one side only, as stated above. The writer is able to offer no explanation as to its cause. In these old birds during the winter the bill is bright salmon-pink, with the tip of the mandible white, and the feet and legs are pink; but in the nesting season the pink colour is very much less pronounced, the bill being yellowish buff and the feet light grey. These are the examples that fall into the category of species *Diomedea chionoptera* (Plate XLVIII, fig. 1).

The younger breeding birds have more black markings on them, being white with dark pencilling all over them, not confined to the upper wing coverts, as in the older birds. The only parts of the plumage which are white are the sides of the head and the neck. The bill changes from pink at the base to buffish white at the tip, the mandible being yellowish with a slight pink flush at the base. The feet are very light bluish grey: darker examples occur with darker feet and yellower bills. In all the iris is very dark brown and the eyelid is white with a greenish tinge. These are the examples that fall into the category of species *Diomedea exulans* (Plate XLVIII, fig. 2).

That the two species, *Diomedea chionoptera* and *exulans*, are identical is proved by the fact that the writer has frequently seen birds of each type pairing together. In Plate XLIX, figs. 1, 2, 3, 4, an *exulans* female with dark head, back, tail and wings is shown going through the courtship ceremonies with a *chionoptera* male with white head, back and tail. The all-white *chionoptera* type is the fully adult form, and the darker type covered in greater or lesser degree with black pencillings is the younger bird (Fig. 1). The females reach the light phase of plumage at a later age than do the males, and this is shown by the fact that, though two light birds and two dark birds have been seen mated together, the usual rule is to see a light and a dark bird mated, the light one being the male (Plate L, fig. 1).

The albatross come to land for nesting in November. Though they all nest in proximity on certain areas of ground the nests are not placed close enough together to call the breeding colonies rookeries. The spots selected for nest building are the tussac covered islands, hills and headlands near the sea. They do not nest on the precipitous

[1] Godman, *A Monograph of the Petrels*, 1908.

cliffs, but on the sloping and level ground above them. Always, however, they nest near a steep slope or cliff so that they can have a good "take-off" for getting on the wing, as they are unable to rise into the air off the level. The nest is a bulky structure built of mud, tussac, and peaty moss up to a height of half a metre, and is about a metre across. The sides are sloping and there is a shallow depression on the top in which the egg is laid. The nest is built by the materials being laid down in a heap and trodden down by the large webbed feet of the birds, no interweaving of the materials taking place. As the young one grows the nest gets trodden down more and more so that it gets much flattened out, and new materials are added to it from time to time during the occupation of the young. For instance, in Coal Harbour in September, 1925, nests were found with blades of tussac newly laid on top of them, though the snow was level with the top of the nests and in many cases was above them. The young had occupied these nests for about eight months.

Fig. 1. *Diomedea exulans.* Diagram showing plumages intermediate between the *chionoptera* and *exulans* stages. Sketched from living birds on the nests.

In the breeding season, before and after pairing takes place, the albatross go through an elaborate courtship. In all cases the courtship ceremonies are the same, but before pairing takes place several males and one female take part, whereas after pairing it is confined to the one male and female. After the egg is laid and incubation has started the courting is discontinued, though the birds of each pair still show a great affection for one another. In courting before pairing several males gather around one female and bow to her, bringing the head close down to the ground. As they do this they utter a harsh groaning sound, and the female bows and groans back at them. After several bows the males open the wings to about half their extent and side-step around her. They then edge into a position so that they are directly facing her and open the wings to their widest extent so that the tips of the primaries are raised above the level of the head and are curved forwards towards the female. At the same time the males raise the head so that the bill points straight up into the sky, and give vent to a loud braying cry. They then close the wings and start all over again. Several males do this at the same time around the one female, but they do not all act in unison so that unless they are watched carefully one gets the impression of half a dozen male birds dancing round the female and going through a series of haphazard actions, but one finds that they all adhere to the same course of action if attention is directed to each in turn.

After pairing has taken place and before incubation has started the courtship ceremonies are even more elaborate than before (Plate XLIX). The nests are built on the bases of those of the last season, which are now trodden down to about half their full size. The female sits on the half-built nest and the male walks around among the surrounding tussac picking up bits of peaty moss and mud. He brings these to the female and deposits them on the edge of the nest and bows to her, at the same time making a groaning sound. She returns the bow and groan to him and then takes up the load of material which he has brought and arranges it on the nest, shuffling around on half-bended legs to stamp it down with her large webbed feet. The male then sits down on the ground close alongside the nest and makes a vibrating bubbling noise in the throat several times, at the end of each call stretching the head up and braying with the bill open. The female answers him, and then they start nibbling the feathers of each other's throats, heads and necks. This is followed by a further round of bubbling and braying and then the male gets up and goes to fetch another load of nest-building materials.

After every four or five loads that the male brings to the nest both sexes go through a more passionate demonstration of affection. The male brings his load and deposits it, and after bubbling and braying, and nibbling each other's heads and throats they both stand up, and the female steps down off the nest. Facing each other they both stretch up their heads and give a harsh bray with the bill widely open. Immediately after the bray the bill is brought so that it points vertically downwards and is thrust among the plumage of the breast (Plate XLIX, fig. 3). The bray is expiratory, and a lower, inspiratory note is made while the bill is touching the breast. They then lean forward together and touch the tips of each other's bills. After this they both keep the neck bent forwards, and bend the head upwards slightly and vibrate the mandibles very rapidly causing a peculiar rattling sound. The syrinx is not used in producing this sound, which has a slight musical ring, rising from a low note to a high one during its performance. This is owing to the increasing quickness of the vibrations and to the filling of the lungs with air during the process so that the thorax acts as a sound-box.

After these antics are repeated several times the male starts to walk sideways round the female, working his head from side to side at each step, and the female steps around without moving from her position so that she is facing him all the time. The male spreads his wings widely, and pointing his head upwards repeats the vibration of the mandibles (Plate XLIX, fig. 4). He next bends forward, doing it again, and the female answers him (Plate XLIX, fig. 2), at the same time spreading her wings too. They continue in this attitude stretching out and touching bills, then vibrating (Plate XLIX, fig. 1) and touching their own breasts with the tip of the bill twenty times or more, after which pairing takes place and they return to the nest, the female sitting down on it, and the male carrying on his work of collecting materials for it.

The eggs are laid between the twentieth of December and the last day of the year, Boxing Day being the regular day on which they are collected by the whalers for eating. Each egg holds three-quarters of a pint of liquid; they are very good eating, the yolks being yellow and the albumen setting white when cooked. Each hen albatross lays one egg only, though if the eggs are taken a second laying takes place, preceded by a second courtship. The eggs are white, with red spots and frecklings, always more at the large end and sometimes forming there a definite ring or zone. In January, 1926, one was seen on Albatross Island, in the Bay of Isles, that was entirely covered with the red markings so that the ground colour was completely obscured. Data regarding the period of incubation were not collected. Some newly hatched young and others judged to be at least a fortnight old were seen at Undine Harbour late in March, 1926, but as practically all the eggs were collected from this place in the preceding December and January these young probably represented a second laying, so that no inference as to the period of incubation can be drawn from them. Both sexes incubate. On a sunny day in December, 1925, a number of large black lice (Mallophaga) were observed crawling about on the surface of the feathers of several incubating birds.

The newly hatched young are covered with white down and have the bill and feet yellowish white and the eye dark brown. The tip of the bill, both of mandible and maxilla, is bent downwards and it is not until the young are three to four months old that it assumes its typical shape. During the first six weeks of their existence the young are sheltered by one of the parents sitting on the nest, but by the time they are two months old they are too big to be brooded and the nest is left unprotected by both parents, who go fishing at sea. When newly hatched the young has a soft chirping sound which it makes when hungry. In feeding the young the old birds regurgitate partly digested food into the bill, from which it is taken by the nestling.

The young remain in the nest for ten full months and by the end of August they are as big as their parents. They are then covered with a thick coat of buffish white woolly down, attached to the ends of the feathers which grow underneath it. On the head and neck the down is lighter, being nearly white. The feet are grey-white and the bill is buffish and as the birds get older it develops a pinkish tinge at the base. The eye is dark brown (Plate XLVIII, fig. 3). When they are approached at this age they sit back in the nest and stretch up the neck, all the while facing the visitor. They then snap the bill several times in rapid succession and make a gobbling noise very much like that made by a turkey. If they are further worried they vomit up the contents of their stomachs. The parents stay away at sea most of the time, returning only about once a day to their young. When they arrive with food they sit down on the snow beside the young one, which nibbles the throat of the parent and makes its gobbling cry in asking for food. The parent then regurgitates the food into the throat from which the young one takes it. The parent leaves again as soon as the young one has been fed, remaining with it only a few minutes.

In November and December the down covering falls off the ends of the feathers, exposing the first adult plumage. This is a dark brown black all over, with the exception of the facial area which is white. The feet are dark grey with a pink tinge and the bill is buffish (Plate XLVIII, fig. 4). When the down is shed the parents desert the young, which do not at once leave the land, but haunt the old neighbourhood for some days during the beginning of the nesting season, and a few of them do not leave it until January, soon after the new season's eggs are laid.

The adult albatross do not breed every year, as they do not finish feeding their young until after the new season's eggs are laid (by other birds) and incubation has started. Consequently there must be an interval of at least one season between the consecutive matings of any one bird.

In the moult of the first year after leaving the nest the brown-black plumage of the young adult gives place to white feathers with black cross pencillings, except on the face, which is white. The wings and tip of the tail remain black. This is the typical *exulans* plumage, and in succeeding moults white feathers replace the barred ones more and more until the *chionoptera* plumage is attained. This is white, including the tail, with black ends to the primaries and outer secondaries, and with a trace of pencilling on the scapulars (Fig. 1).

The food of the albatross consists of fish and cephalopods. The stomachs of a number of young ones examined at Coal Harbour in September, 1925, contained remains of Nototheniid fish up to eighteen inches in length and numerous cephalopod beaks and spermatophores. They also contained roots of tussac and burnet, and the birds were seen to reach out of the nests and pick these up from the sides and bases of them. At sea the adult birds, with other species, quickly gather round the whalers when they have killed a whale, and eat the blood clots and "krill" vomited up by the dying whale. When each whale is killed a circular hole is cut in the tail so that a rope can be passed through it. The albatross are the only birds big enough to eat the circular piece of blubber which comes out of this and great is the competition amongst them to secure it.

Diomedea melanophrys, Temm.
Black-Browed Albatross

(Plate XLV, figs. 1, 2; Plate L, figs. 2–4)

Black-Browed Albatross or Mollymauks—called "White Mollyhawks" by the whalers—abound at sea off South Georgia all the year round and sometimes are seen in extensive flocks. They rarely come into the bays, but are occasionally to be seen near the whaling stations. During the season 1926–7 a flock of about a dozen took up their quarters at Husvik Whaling Station, paddling around the bay picking up scraps, becoming so tame that if a little food was thrown to them they swam up to be fed, like domestic ducks.

In the nesting season they come ashore early in October in enormous numbers, breeding in rookeries on the cliffs, especially at the north-west end of the island. There are also rookeries at the south-east end near Cape Disappointment. The rookeries are on the steep slopes at the summits of the cliffs, and each contains several thousand nests. The nests are built of mud and peaty moss on ledges amongst the tussac. They are cylindrical, from one to one and a half feet in height, with vertical sides and a depression on the top (Plate L, figs. 2, 3, 4). The materials for the nests are collected from the ledges in the immediate vicinity. When the nest is being built the female stands on it and the male collects the mud and brings it to his mate (Plate L, fig. 2).

He places this on the nest and then bows the head down to the ground and spreads the tail and makes a loud braying cry. The female bows and brays too, and then arranges the mud on the nest and treads it down. The birds then nibble each other's beaks and bow and bray again, after which the male fetches another load of mud. In between spells of nest-building, and after it is complete, they go through a further ceremony. Standing on or near the nest, facing each other, they touch the tips and sides of the bill, as though fencing with them. They then bow to each other, and each turns the head round so that it faces backwards, and touches the back between the shoulders with the tip of the bill. They stop in this attitude for a moment and make a low grunt and then face forward again and start braying with the beaks wide open, moving the head from side to side while the tail is spread. They then nibble the feathers of each other's heads before going through the same process again. The displays are not usually followed by pairing. When they bray the feathers of the side of the face are parted so that a furrow is formed running back from the gape: this exposes a ridge of pink skin. The ridge is kept exposed for a few moments after the call and then the feathers are allowed to fall into place. When they arrive in the rookery after being away fishing at sea they bray loudly as soon as they have got on to their feet: they land very awkwardly and usually capsize on to the breast.

The single egg is laid by the beginning of the third week in October. It is white with a varying amount of red spots and freckles, often concentrated into a zone at the larger end. The period of incubation is said to be about five to six weeks; newly hatched young were seen in January, 1926, but they were probably from a second laying of eggs, as the rookery had been disturbed and the eggs gathered earlier in the season. Both sexes incubate.

The young nestlings are clothed in short grey-white down and have the feet light grey, bill black, with white egg tooth, and iris dark brown (Plate XLV, fig. 1). They make a soft piping cry in the nest and are fed by the parents regurgitating the food into the throat, from which they take it. When half grown (Plate XLV, fig. 2) they are clothed in grey-white woolly down, which is short on the face. The feet and legs are light grey with a pink tinge, the bill is black and the iris dark brown, the inside of the mouth is bright pink. The cry is loud and shrill, and after they are half grown they attempt to imitate the braying call of the adults. They start right but the voice then breaks and they finish on a falsetto note. When approached they sit back in the nest and stretch up the neck, all the while shuffling round so as to face the visitor (Plate L, figs. 3, 4). They snap the bill at him, at each snap making a gulping sound. If closely approached the snapping becomes rapid and a quantity of dark orange-red oil is brought up into the throat and ejected. The oil is quite clear with a strong odour and sets solid on cooling.

The soft parts of the adult are as follows: bill yellow with orange tip and a black line at the base. The feet and toes greyish white, claws white and webs greyish. When the webs are seen by transmitted light, as the bird spreads them to alight, they appear bright pink. The iris is dark brown.

Cephalopods are the food of this species, the stomachs of those examined being packed with beaks and spermatophores, some of which, judging by their size, must have come from animals over a metre in length.

Thalassogeron culminatus, Gould

Grey-Headed Albatross

(Plate XLV, fig. 3; Plate LI, figs. 1, 2)

This species is so similar to *Diomedea melanophrys* in habits that no separate description will be given, all the remarks on the nesting and courtship of that species applying equally to both. This species is known to the South Georgia whalers as the "Blue Mollyhawk". It occurs in large numbers at sea in the neighbourhood of the island all the year round and comes ashore for nesting in October. Its rookeries are at the north-east end of the island; they are extensive and in similar places to those of *D. melanophrys*, and often close to them (Plate LI, fig. 1). The two species are not mixed in the rookeries but keep apart, though occasional pairs of each nest in the rookeries of the other.

The single egg (Plate LI, fig. 2), laid about half way through October, is indistinguishable from that of *D. melanophrys*. Both sexes incubate. The eggs of both species are taken by the whalers in large numbers for eating. So tame are the birds that the eggs can be taken from under them without pushing them off the nest; they merely rattle and snap the bill in protest at the disturbance. If the egg is taken a second one is laid. Though large quantities are taken annually there are so many inaccessible rookeries that there is no danger of diminishing either of the species.

The writer has not seen the young of *Th. culminatus*, but is informed that it is similar to that of the *D. melanophrys*.

The soft parts of the adult are: bill black with a yellow dorsal stripe, tip orange; the lower border of the mandible yellow. Iris dark brown (Plate XLV, fig. 3). Feet and legs greyish white, claws white. The ridge of skin at the gape, exposed by parting the feathers when the bird brays, is orange-yellow.

Cephalopod beaks and spermatophores only were found in the stomachs examined.

Phoebetria palpebrata antarctica, Mathews

Sooty Albatross

(Plate LI, figs. 3, 4)

The Sooty Albatross is common at sea off South Georgia all the year. It may sometimes be seen in small flocks of about a dozen sitting on the water at the entrances of the fjords. Ashore it occurs all round the coasts at the breeding season. It is not gregarious, each pair as a rule nesting away from its neighbours. However, three pairs were found nesting within a few feet of each other on the same ledge of a cliff at North Bay in Ice Fjord in October, 1925. Usually the nests are on ledges of inaccessible cliffs, but several that could be reached were found. They are built of mud and are cylindrical, about a foot high and eighteen inches across (Plate LI, fig. 4). One egg only is laid, in the last week of October or first of November, and it is indistinguishable from those of *D. melanophrys* and *Th. culminatus*.

No elaborate courtship like that of the other albatrosses was seen in this species. At the nesting season a loud shrill cry is produced. One pair was found at the nest before the egg was laid. The female sat on the nest while the male stood on the ledge near by, frequently uttering this cry. It consists of two notes, first a loud shrill one made with the beak open and the head thrown back, so that the bird is looking straight up into the sky (Plate LI, fig. 3). This is an expiratory note and is immediately followed by a much lower and quieter inspiratory note, made with the bill closed and held pointing down to the ground so that the under surface of the mandible rests against the breast. Every two or three times that the male did this the female stood up on the nest and answered in the same way and then sat down again.

The young in January is covered with grey down, lighter round the face. The beak is black, as are the feet and legs, the webs being lighter.

The feet and legs of the adult are grey, the bill black with a blue mandibular sulcus. The iris is dark brown. The birds seen in South Georgia all belong to the light plumaged race with blue sulcus on the mandible.

The food consists of cephalopods.

Macronectes giganteus, Gmel.

Giant Petrel, or Stinker

(Plate XLV, fig. 4; Plate LII, figs. 1–3)

This bird is always very numerous at sea and inshore all round the island. It rarely comes on land outside the breeding season, and when it does so it is only to gather carrion off the beach.

The Giant Petrels come ashore to nest early in October (Plate LII, fig. 1). They nest in small colonies on the grassy bluffs and headlands, though the nests are not built close to each other. They always choose high ground for their colonies so that they will have a "take-off" to get on to the wing, as they cannot rise from level ground. The nests are conical piles of tussac, lichen, moss and mud, about two feet in diameter at the base, and about eighteen inches at the top (Plate LII, fig. 2). They are from eighteen inches to two feet in height and have a depression on the top in which the egg is laid. In the South Orkney Islands, where there is no tussac and little moss, all the nests seen by the writer were built of small stones and were not so high. The first eggs are laid half-way through October, and some are not laid until three weeks later; they are white, without markings, and the shell is of coarse texture. There is only one egg in each nest. The period of incubation is said to last six weeks. Young not more than a week old were found in January, 1926 and 1927 (Plate LII, fig. 3). They are covered with white or grey-white down, which is very short round the eye and base of the bill. This is soon replaced by light grey down. The eye is dark brown, the feet and legs grey and the claws darker grey. The bill is light buff yellow with a few darker spots at the base (Plate XLV, fig. 4). When being brooded by the parent they make a feeble chirping cry. When disturbed they shuffle round in the nest so as to keep facing the visitor, and, uttering a shrill straining cry, spit at him the contents of the stomach, an oily mass of half-digested food. They are able to throw this a distance of four or five feet. When hungry the young one puts its beak up to that of its parent and makes a scraping sound with the bill closed: this sounds as though it is made right inside the bird's body and not in the syrinx. The old one then brings up some of the stomach contents into the throat. If the young one is small it puts its head into the parent's mouth, but when it is bigger the parent brings the food into the bill, which it holds open while the young one takes the food from the mandible. The young leave the nest in March.

There are three main phases of plumage in the Giant Petrel—dark, light and intermediate. The intermediate one is the most common in South Georgia, the next in numbers being the dark one, while the light one is represented by a very small percentage. The colour phases mingle indiscriminately in nesting. The few white examples found nesting in South Georgia were all paired with dark or intermediate ones. In the South Orkney Islands, where the white phase is much more numerous, some white ones were seen paired together, but this was evidently haphazard and only due to the higher proportion of them, as others were seen paired with intermediate birds.

The dark phase is a very dark chocolate brown and this is connected through all shades of grey brown and grey to the light one, which is pure white with a few interspersed dark feathers. The intermediate forms most commonly have the head and neck very light grey, the back and wings grey brown and the belly grey. The beak of all forms is greenish yellow; the feet of the dark and intermediate forms dark grey, those of the light form being very light grey. In all the iris is light greenish buff.

On land this species walks with difficulty, the tarsus being kept inclined at an angle with the perpendicular, unless the bird is hurried, when the tarsus approaches the vertical. When sitting the tarsus is horizontal on the ground. When the bird is walking the wings are kept half opened to assist in keeping the balance, while the tail is bent up at right angles to the back. Giant Petrels cannot rise on to the wing off the level; if they are on the sea they run along the surface, flapping their wings and paddling with the feet for a hundred yards, until they gain sufficient momentum to rise. If they are feeding on the beach they have to return to the water to take a run before they can fly. They sit on the water to preen the feathers and wash themselves. They bathe by half spreading the wings and then tipping forward and ducking the head under. They then bob up and a quantity of water is thrown on to the back along which it runs to the tail between the half open wings.

These petrels are very greedy and will gorge themselves with carrion until they are so heavy that they cannot fly. They then sit on the water until they have digested sufficient of their meal to lighten themselves, but if they are approached before this has happened they paddle away with half open wings, and if closely pursued vomit up the stomach contents and then fly away. If they are approached on the land and cornered when they are feeding or on their nests, they defend themselves by shooting the contents of the stomach at the intruder. This is accompanied by a high-pitched straining sound, and the head is shaken from side to side at each shot. The young birds in the nest are more skilful at hitting the cause of their annoyance than are the old ones. If seized these birds bite severely. The species has a strong musky odour which scents the eggs and nests. In addition the vomited stomach contents have a most disgusting smell, so that it well deserves its common name of "Stinker". The ordinary voice is a low hoarse croak, but as stated above the note goes up to a falsetto when the bird is annoyed. If a bird passes close to an observer when it is flying it can often be heard to be making a low creaking noise at each stroke of the wings. This is uttered without opening the bill.

The natural food of this species at South Georgia is largely augmented by the scraps from the whaling stations round which it congregates in immense numbers. The birds also attack the dead whales that are waiting to be cut up, climbing out on to their backs as they lie in the water and digging into the blubber with their powerful bills. During the winter, when whaling is suspended, large numbers die of starvation. A large number were seen at Undine Harbour in November, 1925, feeding on a carcass of a seal. In the hide there was only a small hole through which one bird at a time could just force its head. They were doing this in turn, pushing in as far as possible until stopped by the shoulders, and all had the head and neck stained bright red by the blood. At the nesting season they also feed on young penguins. Nestlings have been examined whose stomachs were crammed with the "krill" on which the penguins had been feeding. With this were mixed pieces of the intestines of the penguins. The stomach of an adult examined during the winter contained a little brown fluid and a few blades of tussac.

Majaqueus aequinoctialis, Linn.

Cape Hen

(Plate XLV, figs. 5, 6)

The Cape Hen, called "Shoemaker" by the whalers, is common at sea off South Georgia all the year round, and may sometimes be seen in large flocks. Ashore it breeds in large numbers, but is rarely seen on land as it nests in burrows and is nocturnal.

In early October this species commences nesting, the burrows of previous seasons being used, as well as fresh ones which are dug as soon as the ground thaws. Many burrows are dug close to each other, forming a rookery like a rabbit warren. They are always on raised ground, usually at the top of a cliff or steep bank. Before the eggs are laid the birds sit about in pairs among the tussac at the entrances of the burrows, uttering a shrill chattering cry. This cry is also made in the day-time when they are below ground, especially if one walks about over the burrows. The burrows are made among the tussac, the entrance usually being under a clump of the grass, which partly overhangs the mouth. They are four to six feet deep, and are wider at the entrance than a foot or so in, where they are about six inches in diameter. At the end there is a circular chamber about a foot in diameter containing the nest. This is made of mud and tussac roots, with a few blades of the grass. It is circular and only raised an inch or so above the general level, but is higher at the circumference, between which and the sides of the chamber there is a narrow gutter. When first occupied in the season the ground is frozen and the floor of the burrow consists of ice. As the season advances the ground thaws and the floor of the burrow and the nest become extremely wet and muddy, making the birds and the egg very dirty.

At the beginning of November, 1925, a Cape Hen was observed digging its burrow in the ground above the cliffs at North Bay in Ice Fjord. It was using the beak as a pick for digging out the soil and it then scratched the loose earth out of the burrow by scraping it back between the legs with the feet. The digging was done in short spells; in the intervals the bird sat down on the tussac outside the burrow and preened the feathers, frequently uttering its chattering note. It also made a lower harsher note, holding the beak pointing upwards and vibrating it rapidly. This note was not heard on any other occasion.

The single white egg is laid about half way through November; the writer has not seen the young in down: a burrow dug out in February, 1926, held two old birds only.

If the birds are dug out of their burrows they are quite tame and make no effort to get away, but if handled they make good use of the beak and claws, inflicting severe scratches. Unless they are chased, when they take to the wing, they waddle about among the tussac and soon go back to the burrow. In the writer's opinion these birds have a courting ceremony somewhat similar to that of their relatives, the albatrosses. If a burrow is dug out so far that the sitting bird can be reached by thrusting the arm down, the bird does not at first bite. The outstretched hand is felt to be gently touched by the bird's bill, in a way similar to the "fencing" of the Black-Browed and Grey-Headed Albatrosses. This is followed by a gentle nibbling, and it is not until one seizes the bird and it realizes that it is not its mate that is entering the burrow, that it starts biting and scratching.

The colouring of the soft parts is as follows: bill yellowish grey; a small area in front of the openings of the nostrils, and the tip, dark grey. Feet and legs black, with yellowish centres to the webs. Iris very dark brown (Plate XLV, figs. 5 and 6).

The stomachs of those examined contained cephalopod beaks only.

Priocella glacialoides, Smith

Silver Grey Petrel

(Plate XLV, figs. 7, 8)

This bird is not common in South Georgian waters, though single specimens are seen fairly often. It does not breed on the island, but the writer thinks it likely that it does so in the South Orkney Islands, judging by the number seen in that neighbourhood in January, 1926. The Swedish South Polar Expedition found it nesting in Louis Phillipe Land. Occasionally examples are seen in the fjords of South Georgia among the flocks of Cape Pigeons round the whaling stations. They have also been noticed, with Cape Pigeons, pecking at sea elephant blubber as it was lying in the water alongside a sealing vessel in King Haakon Bay.

The bill is pink, with the base blue and tip brown-black. The feet are pinkish grey with some black scales on the toes and the claws brown-black, the outer side of the middle one being white. The iris is dark brown (Plate XLV, figs. 7 and 8).

Pagadroma nivea, Gmel.

Snow Petrel

(Plate XLV, figs. 9, 10)

The Snow Petrel is frequently seen off South Georgia, especially in the winter, when it occasionally comes into the fjords. The German Expedition of 1882–3 (Pagenstecher, 1885, p. 21) records it as breeding on the island in inaccessible rock crevices in the mountains near the sea. The writer has found no sign of it breeding in South Georgia, though a sharp look-out has been maintained. Places similar to those it uses for nesting in at the South Orkneys are to be found at the south-east end, and on the south coast of the island, but they are difficult of access.

The bill is black; feet grey with darker toes and claws. The iris is very dark brown (Plate XLV, figs. 9, 10). The stomach of one shot at Grytviken in July, 1925, contained a reddish yellow oil that solidified to a waxy consistency when cool.

Daption capensis, Linn.

Cape Pigeon

(Plate LII, fig. 4; Plate LIII, fig. 1)

The Cape Pigeon is always common at South Georgia, flocking in hundreds of thousands to the whaling stations to feed on the refuse (Plate LII, fig. 4, and Plate LIII, fig. 1). It has never been found breeding on the island, though it may do so in some suitable spots on the south coast that resemble its breeding places in the South Orkneys.

At sea it feeds on small planktonic animals and carrion, and soon collects in numbers to feed on the blood when a whale is killed. At the whaling stations it pecks at the whales and pieces of meat that fall into the water, and can dive to a depth of three or four feet to regain a morsel that is sinking. The wings are used in diving. At the whaling stations it also eats the small globules of oil and particles of fat floating on the water, and when doing so the method which it uses in feeding on planktonic animals can be observed. If the bill of a fresh specimen is examined it will be found to have a series of fine serrations on the inner side of each margin of the maxilla, which overlaps the mandible of each side when the bill is closed. The skin between the rami of the mandibles is naked and thrown into folds and can be depressed to form a small pouch. The whole apparatus is very similar to the beak of the Whale Birds (*Prion*),[1] though not so highly developed (Figs. 2, 3). In feeding, the minute particles are hooked up by the tip of the maxilla, with a few drops of water, in rapid succession into the mouth, and the pouch is quickly expanded and contracted so that the water is strained off at the sides of the bill and the food particles are retained on the serrations. When feeding in this manner the bird keeps vigorously paddling to each side with the feet, so that it only moves forward slowly and a current of water is drawn in towards it from the front.

Fig. 2. *Daption capensis.* Head showing throat pouch expanded and contracted.

The Cape Pigeons are very noisy and quarrelsome birds when feeding, keeping up an incessant chattering with their harsh shrill cries night and day at the whaling stations. When swimming they float high on the water and paddle about with the tail cocked up. They are very rarely seen on the land, though they may often be seen sitting in numbers on ice floes or steep snow banks over the sea. When sitting the tarsus is kept on the ground and in walking it is only raised a little from the horizontal, while a few awkward steps are taken with the wings partly spread. The birds are unable to rise from calm water without running some way on the surface first, but at sea with a breeze they can spring into the air from the crest of a wave. In the harbours they are often seen in flocks, all washing themselves at the same time. The head is dipped under while the wings are partly spread, so that the water runs up on to the front part of the back and is thrown back over the tail when the head bobs up again.

Fig. 3. *Daption capensis.* Upper and under sides of head, the latter showing the pouch between the rami of the mandibles.

The bill, feet and legs are black, and there are light patches on the inner sides of the inner and middle toes. The iris is dark brown.

[1] See Wilson, E. A., *Report of the National Antarctic Expedition*, 1901–4, Vol. II. Zoology, Pt II. Aves, p. 105.

Thalassoeca antarctica, Gmel.

Antarctic Petrel

This species was not observed at South Georgia, neither was it seen by the German Expedition of 1882–3, nor by the Swedish South Polar Expedition in 1902. Several were seen and one was shot, six miles off the north-east coast, by Mr Erik Sörling, a collector from the Natural History Museum of Stockholm, on August 1st, 1905 (Lönnberg, 1906, p. 82).

Oceanites oceanicus, Kuhl

Wilson's Petrel

This little petrel is a summer visitor and breeds in very large numbers on South Georgia. It is to be seen in flocks at sea off the island from November to May, and in small numbers near the whaling stations from November to February. In February and March it comes into the whaling stations in incredible numbers, so that the water is sometimes black with them, and stays till May. At sea it feeds on plankton and at the whaling stations on floating oil globules and fat particles, hovering over the water and continually dipping the feet in as it picks up its food. It is almost always on the wing, and is but rarely seen to settle for a few moments on the water.

It lays its egg in crevices of the cliffs and amongst the stones of screes. No nest is made but the same burrow is returned to year after year, so that a quantity of debris—feathers, dead young and so on—is accumulated on which the egg is laid. The eggs are difficult to obtain, as those in the cliffs are usually inaccessible, and among the screes they are so far in that it is often impossible to remove enough stones without causing a land slide. The sitting bird makes a low whistling cry which is very difficult to locate. At dusk the birds flit about near the entrance to the nesting hole and produce a harsh grating noise. The eggs are laid in early December and both sexes take part in incubation. When captured the birds squirt from the mouth and nostrils a dark red oil with an evil odour. They are unable to stand with the tarsi erect and shuffle in and out of the burrows with the whole length of them on the ground.

The bill, feet and legs are black, and there is a bright yellow patch in the webs. The iris is dark brown.

Fregatta melanogaster, Gould

Black-Bellied Storm Petrel

This species was not seen at South Georgia, though a sharp look-out was kept for it, as it is easily confused with Wilson's Petrel when on the wing. The German Expedition of 1882–3 (Von der Steinen, 1890, p. 208) found it breeding at Royal Bay, and collected an egg and a skin. Since then it has not been recorded from the island.

Garrodia nereis, Gould

Grey-Backed Storm Petrel

This petrel was found on South Georgia by the German Expedition of 1882–3 (Pagenstecher, 1885, p. 18) and by Mr Erik Sörling (Lönnberg, 1906, p. 84) in 1904, but it was not seen during the course of the Discovery investigations. The German Expedition found that it nested at Royal Bay in burrows on bare screes, and recorded that it left the island with the young at the end of April. Mr Sörling shot an example as it flew from a tussac hill in Moraine Fjord, Cumberland Bay, on November 27th, 1904. He was unable to find the nest, which was evidently there, as the bird, a male, had bare brood spots on the belly. He also found the dried up remains of a half fledged young one of the previous season at Grytviken in the same month.

Genus **Prion**

Whale Birds

Whale Birds are extremely common at sea off the island, flying over the waves in large flocks. They breed abundantly ashore but are never seen on land during daylight, as they are there nocturnal. Three species are recorded from the island, and the following notes apply equally to all.

They feed on small planktonic animals, swimming on the surface with outstretched wings, occasionally diving below it, and scooping up their food into the pouch-like mouth and straining off the water through the lamellae of the bill as described by Wilson.[1] The flocks at sea fly and turn together like those of some of the northern sandpipers; as they wheel round all the white breasts flash at once and then simultaneously disappear as the darker back is shown.

Ashore they are found nesting in burrows dug amongst the tussac, all round the island, on low ground as well as on hills and headlands. The burrow is not more than three feet deep in the peaty earth and is about three inches in diameter, ending in a small chamber. No nest is made, the single white egg being laid in a hollow of the earth in the terminal chamber. Most of the eggs are laid at the end of November, but some not until well into the following month. Before the egg is laid both birds are usually in the burrow in the daytime, but afterwards the writer has found only one bird, though other observers have found as many as three. When in the burrow the birds make a low grunting noise. If they are pulled out of it they bite and scratch vigorously.

Whale Birds are killed in large numbers by the Antarctic Skuas, and for this reason they are nocturnal when ashore.

Prion vittatus, Gmel.

Broad-Billed Whale Bird

This species is recorded as breeding on the island by Mr A. G. Bennett, the Government Naturalist of the Falkland Islands.

[1] Wilson, E. A., *Report of the National Antarctic Expedition*, 1901–4, Vol. II. Zoology, Pt II. Aves, p. 105, fig. 45.

Prion banksi, Gould

Banks' Whale Bird

(Plate LIII, fig. 2)

All the specimens of the genus *Prion* from South Georgia examined by the writer belong to this species (Plate LIII, fig. 2).

The bill is blue, the dorsal part black and the tip buff; the mandible is black. The iris is dark brown. The feet are blue, the webs buff with grey outer markings.

Prion desolatus, Gmel.

The German Expedition of 1882–3 (Pagenstecher, 1885, p. 23) found this species breeding at Royal Bay "in burrows like a rabbit warren". Eggs and many advanced embryos were collected in January and it was found that the young did not leave the burrow until the beginning of May.

The Swedish South Polar Expedition also collected a specimen of this species in Cumberland Bay in April, 1902.

Halobaena caerulea, Gmel.

Blue Petrel

This species has not been recorded as breeding at South Georgia. Several were seen on the wing two miles off the entrance to Cumberland Bay on November 30th, 1926. They may have been *H. murphyi*, a species described from a specimen taken at Stromness Bay, South Georgia, in 1913; but it is impossible to distinguish it from *H. caerulea* on the wing (Brooks, 1917, p. 146). When flying they can easily be distinguished from Prions by the square-shaped tail with terminal white band.

Pelecanoides georgicus, Murphy & Harper

Diving Petrel

(Plate XLVII, figs. 1, 2; Plate LIII, fig. 3)

The Diving Petrel is common in South Georgian waters all the year round and breeds plentifully on the island. This species, like the Whale Birds, is eaten in large quantities by the Antarctic Skuas, so that when nesting it has to adopt nocturnal habits, and the nest burrows are dug at night. At sea it is usually only seen on the wing when disturbed by the passage of the ship. In diving they use the wings to swim under water and can fly into and out of it as though the two mediums were one. The food consists of small planktonic animals.

This species comes ashore to nest in the second half of November. It nests in burrows dug in places where there is little or no vegetation, but where there is a fair amount of earth and gravel with larger stones, such as in accumulations of moraine material high up on the hillsides and as much as a mile from the sea (Plate LIII, fig. 3). The burrow is up to four feet in length and usually twists and bends. No nest is made in the chamber at the end, but the single, white, nearly spherical egg is laid on the bare earth so that it gets discoloured by contact with the ground. Before the egg is laid both birds are to be found in the burrows, but afterwards only one. The eggs are laid at the beginning of December and one, still unhatched, containing a chick on the point of breaking through, was found on February 12th, 1926. On the same date nestlings in down were found in other burrows. Both sexes take part in incubation.

The nestlings are clothed in long ashy grey down and have a bare patch on the throat and sides of the head and neck, but the head is kept drawn down so that in life these patches are invisible. The eyes are not open when the young are hatched. The bill is black and the feet are grey with buff webs (Plate XLVII, fig. 1). They make a very feeble chirping cry when the burrow is opened, but the adults were not heard to utter any sound.

The adult has the bill black and iris dark brown, the legs and toes blue, webs dark grey, and claws black (Plate XLVII, fig. 2).

Catharacta lönnbergi clarkei, Mathews

Antarctic Skua

(Plate XLVII, figs. 3, 4; Plate LIII, fig. 4; Plate LIV, fig. 1)

This bird is very common in South Georgia from September to May. It is absent in the winter. Like all gulls it does not go far to sea but haunts the coasts and shores, feeding on carrion and the eggs and young of other birds.

Nesting commences in November, the nests being placed on the ground amongst tussac at the top of a small hill or slope. The nest is built of tussac and moss, with a few feathers and bits of dried kelp. After the middle of November the eggs are laid, usually two, sometimes three, olive brown with blotches and spots of brown and grey. A set was found on December 30th, 1925, with embryos nearly ready for hatching. The day previous new hatched chicks were found in another nest and also several chicks which had already left the nest.

The Skuas are very rapacious, and are always on the look-out for some unprotected nest from which they can steal eggs or young. They haunt the penguin rookeries and any exposed egg is quickly pounced upon, and they kill and devour large numbers of the young when they are hatched. They are a scourge to the Whale Birds and Diving Petrels, any unwary example of which that leaves its burrow or returns to it, when it is not quite dark, is relentlessly pursued and devoured in the air. In pursuing a bird the Skua shows great skill in following every twist and turn as the victim tries to escape. Round one Skua's nest on Bird Island fifty pairs of Whale Birds' wings were counted and there were many more, besides those of some Diving Petrels. Skuas were also seen to chase, but not to kill, the Cape Hens.

If anyone approaches the neighbourhood of the nest the old birds attack and attempt to drive away the intruder. Before he has approached closely the birds stand on some rock or mound near the nest and, raising the wings, scream with the head pointed downwards. At a closer approach they rise into the air and circle round, making a shrill croaking noise and then suddenly swoop down at their enemy. They look extremely fierce as they swoop head-on straight for one's face, but always rise above the head when about a yard away, to repeat the attack from behind, when they will frequently deal a heavy blow with one of the wings. If the intruder refuses to leave the neighbourhood they get tired of attacking and settle on the ground and start screaming again.

The newly hatched nestling is clothed in light brown down. The bill is very dark grey and the egg-tooth white (Plate XLVII, fig. 3). The iris is dark brown; the feet blue-grey with lighter webs and dark grey claws. They have a feeble, piping cry. Although the Skuas usually hatch two young (Plate LIII, fig. 4), one of them always disappears after a day or two, and is probably eaten by the parents. They leave the nest and run about amongst the tussac when they are a few days old. The older nestling is covered with brown down and when the feathers are sprouting the blue skin round the eye and beak shows through the down. The ear coverts are black and the sprouting quills blue (Plate XLVII, fig. 4, and Plate LIV, fig. 1). If alarmed it utters a succession of shrill screams.

The plumage of the adult varies in colour, some being dark brown with a few lighter feathers, while others have a great many light feathers, especially on the back, giving them the appearance of dark ones with bleached plumage. The bill, feet and legs are black, and the iris is brown.

Larus dominicanus, Licht.

Dominican Gull

(Plate XLVI, figs. 1–9)

This gull is very common at South Georgia all the year round, frequenting the coast and bays and not venturing far to sea. The birds gather in large numbers round the whaling stations to feed on the refuse, and become very tame in winter. They can dive well, rising first a little way into the air and plunging in with half-open wings so that they are completely submerged. When a number are feeding together they quarrel continuously, trying to drive each other away, and making a loud laughing cry, like that of the European Black-Backed Gull. The natural food consists largely of limpets which they pick off the rocks at low tide. The vicinity of the nest is often strewn with hundreds of the empty shells. They nest in colonies of several dozen pairs close together.

The nest is built in October, of tussac, moss, dried kelp, bits of whale bone and a few feathers. It is placed on the ground among tussac or in quite bare places, usually on rising ground, or on top of a boulder. The eggs, two or more often three, in number, brown with darker brown and olive spots and splashes, are mostly laid early in

November, some not until the beginning of December. The Scotia Expedition found the period of incubation to be about twenty-five days. The young are covered with black-speckled buff down, and have the bill and feet black and the egg-tooth white. They leave the nest a few days after hatching and run about actively. They have a piping cry. When they are about half grown and the quills are sprouting the tip of the bill becomes white (Plate XLVI, fig. 9). At this age they can run fast and swim well, readily taking to the water if pursued. When the colony is disturbed all the old birds rise in the air and hover over the intruder, making harsh cries all the while.

The Dominican Gull is three seasons in reaching maturity. In the first winter the plumage is grey-brown with buff specklings; the bill is black with white tip; legs brown; feet grey, darker towards the edge of the web; claws black. The iris is dark brown and the eyelids grey (Plate XLVI, figs. 1 and 2). The second winter the grey-brown plumage is heavily spotted with buff and white and the mantle is brown. The base and tip of the bill are yellow and the centre is black. The iris is light brown and the eyelids are dull red. The feet and legs are green-grey, the webs grey at their margins and the claws are black (Plate XLVI, figs. 3 and 4). The third winter the mantle and wings are black, and the rest of the plumage is white, except for some scattered dark feathers in the head, neck, breast and tail. The bill is yellow, the mandible with an orange-red spot and a few small black streaks above the angle of the gonys. The eyelid is red and the iris light yellow. The feet and legs are yellowish green, claws black (Plate XLVI, figs. 5, 6). In the fourth year, when the bird breeds, the wings and mantle are black, the rest of the plumage being white. The bill is yellow, and the mandible red from the angle of the gonys to the tip. The eyelid is bright red and the iris yellow, The feet are yellow with a tinge of green, and the claws are black (Plate XLVI, figs. 7, 8).

Sterna vittata georgiae, Reichenof

Wreathed Tern

(Plate LIV, fig. 2)

The Wreathed Tern is a common resident round the shores of South Georgia. The food chiefly consists of small fish and the birds have also been observed catching euphausians swimming near the surface. Large flocks are often to be seen settled on the beach or moraines near the sea.

This species nests in colonies of from half a dozen to twenty or thirty pairs, often some way from the sea. Inland the colonies are on moraines or screes, but one was found on the beach at Albatross Island in the Bay of Isles in December, 1925. No nest is built, but a hollow is scraped in the ground and a few small stones are placed round it. The single egg is usually laid in the second half of November, but some fresh eggs were found at the end of December, 1925 (Plate LIV, fig. 2). They were probably a second laying after the first ones had been stolen by the Skuas. The egg is grey-brown with darker brown and olive spots. It is very difficult to see as it lies in the nest. When nesting the birds behave in the usual tern manner if disturbed, rising on the wing with harsh screams, hovering above, and even swooping at and pecking the head of the visitor. They always thus betray the whereabouts of the colony, but if only they sat still it would probably be passed unnoticed, for the birds are very hard to see as they sit on the nest among the grey stones. If a Skua comes near the colony the birds fly up and attack it fiercely.

The eggs are hatched in December and early January, the nestling being clothed in grey down with dark specklings, lighter below. The young soon leave the nest and crouch among the stones near by. When the down is shed the head is speckled with black and buff, and the upper parts are barred with the same colours. The throat and breast are mottled with light brown and the belly is grey-white. The bill is black and the iris brown. The feet and claws are black and the legs brown-black with a tinge of red.

The adults have the bill red with black tip, iris very dark brown, the feet dull red, the toes darker and the legs lighter.

Nettion georgicum, Gmel.

South Georgia Teal

This species, peculiar to South Georgia, is common on the island but not abundant. The German Expedition of 1882–3 (Pagenstecher, 1885, p. 13) found it in large flocks as did Mr Erik Sörling in 1904–5 (Lönnberg, 1906, p. 66), but at the present time it does not occur in such numbers. This is probably due to the fact that it is very good for the table and has been continually shot for the pot since the island has been resorted to by the whalers. In summer it frequents the tussac-covered plains, streams and fresh water pools in the valleys, but in winter it is confined to the beach where it is to be found in small flocks of about half-a-dozen birds. It feeds on small mollusca and crustacea. It is very hard to see the bird on the beach or amongst tussac, as the dull brown plumage harmonizes very well with the background, but a slight movement of the head and light yellow bill often draws one's attention to it. The flight is quick and strong; on the wing they look much like European Teal. They produce a shrill whistling cry.

The nest is built among the tussac and lined with greyish down. It is placed so that the hanging blades of the tussac at the edge of the clump conceal it. The yellowish grey eggs are four or five in number, and are laid in the second half of November. They are hatched in December and the young are covered with light brown down, lighter below. They leave the nest at once and run about among the tussac, being very agile in eluding capture.

The bill of the adult has a central black stripe; the front third is blue and the rest yellow. The iris is light brown. The legs and toes are dark olive-green, the webs and joints being darker, almost black.

Chloephaga leucoptera, Gmel.

Upland Goose

This bird is not a native of the island but has been introduced from the Falkland Islands. A few pairs live in the valleys of West and East Cumberland Bays, chiefly in the former. They must necessarily be confined to the beach during the winter. A goose and seven goslings were seen swimming on a fresh water pool at West Cumberland Bay in January and February, 1926.

Phalacrocorax georgianus, Lönnberg

South Georgia Shag

(Plate XLVII, figs. 5–7)

This Shag, subspecifically different from *Ph. atriceps*, is a common resident at South Georgia. It feeds on fish, which it catches by diving, round the coast and in the fjords. It breeds in small colonies of ten to twenty pairs, building the nests on tussac-covered ledges of the cliffs over the sea. The birds are often to be seen sitting about on the rocks and boulders near the sea, drying the wings in typical cormorant fashion. They have a peculiar habit when approached by the whale ships at sea: they fly up towards the vessel and, keeping the same speed as it, fly alongside the crow's-nest at the foremast head. This is often the cause of their destruction, as they can then easily be knocked down so that they fall on deck, and they are much sought after as a table delicacy in South Georgia.

The nests are built of mud, tussac and dried kelp. The eggs, usually three in number, are pale blue-green with a coating of chalky substance. They are laid early in December and hatch in the first half of January. The young when hatched are quite naked, but soon get a covering of dark grey down with a few tufts of white interspersed among it. The down is shed in February, and in the next month they leave the nest. The colouring of the first plumage is similar to that of the adults, but there is a dull brown tinge in the dorsal and wing feathers, which have a metallic blue and green sheen respectively in the adult. The bill is light greyish brown, darker dorsally and lighter at the tip. The caruncles are not developed but are represented by a dark purplish brown area covered with small papillae. The same colour extends round the eye but is lighter below it. The iris is light brown (Plate XLVII, fig. 5). The feet and legs (Plate XLVII, fig. 6) are pink, with the edges of the webs and the ends and joints of the toes grey, the claws black. The adult (Plate XLVII, fig. 7) has the bill dark brown, the nasal caruncles orange yellow, the bare area of the face purplish brown, the eyelids ultramarine and the feet pink.

Chionis alba, Gmel.

Sheathbill

(Plate XLVII, figs. 8, 9)

The Sheathbill, known to the whalers as "Rype", is a fairly common resident species in South Georgia, being found in flocks of six to thirty or more, except in the nesting season. It is a shore bird, frequenting the beaches and penguin rookeries. It is extremely tame and has so little fear of man that, with a little care, the birds can be caught in the hand.

The Sheathbill is omnivorous; a green alga that grows on the rocks that are uncovered each tide forms a large item in its diet, especially in winter. Small mollusca and crustacea are also taken, as is carrion of any sort. The birds frequent the elephant seal rookeries when the pups are born and feed on the placentas. They also sit about in the penguin rookeries and eat any eggs that are left uncovered so that they can steal them. They have also been seen to steal the eggs of the Giant Petrel.

The nest is built in November in holes in the rocks and under boulders, two or three feet in, and is made of tussac, moss and feathers. The eggs are laid in the following month; they are buff with black pencillings all over them and are two or three in number. The young are hatched in January. They are clothed in a brown and black mottled down; the bill is dark brown and the legs are greyish brown. The iris is dark brown and there is a bare area on the face below the eye, but the wattles are not developed. The nestlings live in the nest hole until they are nearly fully fledged and can run about actively.

When not feeding, the Sheathbills are often to be seen sitting motionless on the rocks. They stand on one foot and hold the body very erect, keeping quite still for many minutes on end. They then run forward for a short distance with quick steps and sit motionless again. When feeding on the beach they walk about with a bobbing motion of the head, and look much like pigeons. The flight is like that of a pigeon and the shape of the wings, when flying, is reminiscent of a gallinaceous bird. If they are winged Sheathbills will take to the water and swim well. They have a harsh call note.

The adult has the bill black at the tip, shading through ochre and green to blue-grey at the base. The wattles, which are larger in the male, are pinkish or yellowish white, and the iris is brown (Plate XLVII, figs. 8 and 9). The legs are grey and the toes and claws are black.

Anthus antarcticus, Cab.

Antarctic Pipit

The Antarctic Pipit, confined to South Georgia, is common on the low ground near the coast all round the island and does not migrate. It lives much on the seashore, and round the streams and freshwater pools further inland: in winter it is confined to the beach. It feeds on small insects, crustacea and mollusca.

The nest is built of dry tussac stems in November, among the tussac or in crevices of the rocks. The egg is described as dull grey-green thickly speckled with dirty red-brown streaks and flecks. Neither the eggs nor nestlings were seen by the writer, the only nesting places found being in inaccessible crevices of the cliffs. The young leave the nest at the end of December when they are fledged, but still have some few tufts of down adhering to the head, and have short stumpy tails. They can then fend for themselves and hop about on the beach feeding with their parents.

This Pipit has a twittering song which is uttered while sitting on the top of some boulder or tussac clump. In late October and early November, when they are mating, the male sits singing on some such elevated post and keeps rising into the air a little way with fluttering flight, making a short trill, and then returns to the ground. The general appearance in flight and the habits are very similar to those of the European Rock Pipit. The German Expedition of 1882–3 (Pagenstecher, 1885, p. 9) found examples of this bird sitting on floating kelp as far as thirty kilometres from the coast.

The bill is dark brown, the feet and legs yellowish brown, and the iris is dark brown.

Pygoscelis papua, Forst.

Gentoo Penguin

(Plate XLVII, figs. 10–12; Plate LIV, figs. 3, 4; Plate LV, fig. 1)

The Gentoo Penguin is very common all the year round and nests in thousands on the island. It feeds on the euphausians and cephalopods which swarm in the surrounding waters, and is often seen at sea fifty or sixty miles from the land. In September and October, before they start nesting, every evening the penguins come out on to the beaches in thousands to sleep on the snow banks behind, returning to the sea in the morning.

In November they gather in rookeries, often of large size, to nest. The rookeries are on low tussac-covered ground by the sea, or on the hills behind, up to a height of several hundred feet. The nests are placed close together, those of the last season being rebuilt for present use. When they have paired the two birds sit on or near the nest and bow to each other, at the same time making a low hiss. This is repeated several times and then the head is thrown up and they both trumpet loudly. In doing this the bill is wide open and two notes are produced, a loud expiratory one and a quieter inspiratory one in a lower pitch. In making the expiratory note the skin over the base of the front of the neck is bulged out.

The nest is made of tussac, moss, kelp, mud and stones, sometimes of the latter alone. In building it the female of the pair stands on it while the male collects the materials and brings them to her. They are deposited on the nest and the birds bow to each other; the female then arranges them on the nest, while the male stands by and trumpets before going for more. The birds are continually stealing materials from the nests of their neighbours and this leads to a lot of fighting and noise. The rightful owner pecks and strikes out with the flippers at the other, who at once does the same, both trumpeting loudly the while.

The rookery soon gets very foul with mud produced by the constant passing to and fro of the birds, and with the red remains of the euphausians eaten by them. If the rookery is not close to the beach a well-worn path is soon made to it. The two nearly spherical eggs are laid at the beginning of November, and hatched early in December. The yolk of the egg is deep red in colour, differing from those of the King and Macaroni penguins which are yellow. Incubation starts as soon as the first one is laid, so that there is a difference of several days in the ages of the young: this causes a marked difference in size, as they grow very rapidly. If the eggs are taken, a second set is laid, and in some of the rookeries that are much visited by the whalers to collect eggs for eating, as many as four or five layings are produced. The later layings consist of only one egg instead of two, and it is smaller in size than the first ones. Egg collecting may delay the hatching until February. While incubating the birds sit on the breast with the flippers held along the sides of the body. Both sexes incubate (Plate LIV, fig. 3).

When the young (Plate LIV, fig. 4) are hatched they are covered in short grey down, darker on the back of the head and lighter on the under parts. They are very weak and helpless. The front half of the bill is blue-grey, the rest pink, and the egg-tooth is buff (Plate XLVII, fig. 10). The feet are pinkish grey and the iris dark brown. The cry of the new-hatched young is a very feeble and shrill piping. When the young are a few days old the second down coat starts to grow and the first down adheres to the ends of the down feathers until worn off. The second coat (Plate LV, fig. 1) is grey dorsally and white ventrally, and by the time the bird is half grown the bill is pink with the upper part black, the tip of the mandible being buff with a black mark just behind it. The iris is brown (Plate XLVII, fig. 11). The egg-tooth is not shed until the young is nearly full grown. At first the parents brood the young, which like to nestle underneath, until they are so big that they can only get their heads under. The young ask for food by putting up the head and piping, and nibbling the parent's throat and neck. The parent regurgitates the food into the throat and opens the bill and the young puts its head in as far as it can. When the young are about three-quarters grown they leave the nests, which get trodden down nearly level with the ground, and herd together under the charge of a few adult nurses. As soon as an old one returns from the sea they all start pestering it for the food, which it is at first usually reluctant to part with. Finally it feeds one or two and then leaves again. On sunny days the young appear to feel the heat considerably and stand about panting, almost gasping, for breath. This is probably due as well to the strong ammoniacal vapours which rise from the ground of the rookery when it is heated. The fumes are very concentrated near the ground, as one finds if one sits down in the rookery. Early in February the young start shedding the down, which comes off in patches, leaving exposed the adult plumage which has grown underneath. They are still fed by the parents for a short time after all the down has been shed, and take to the water in March. Their feet and bills after the moult are similar to those of the old ones, but considerably paler.

When swimming about the penguins only bring the head and tail out of the water when they come up to breathe, but when making a passage they leap out of the water at intervals, jumping out like porpoises. During the leap the flippers are held out from the sides. In landing on the beach they shoot out of the water, landing on their feet, and shake themselves, look round, and waddle away. If there is much surf running they cannot jump out in this way and sometimes have considerable difficulty in scrambling out of the breakers. In entering the sea they walk down the beach with the flippers held out behind and the neck bent forward until they are in the water, when they duck the head under and flash away. They then usually come up, and lying first on one side and then on the other they wash themselves with the uppermost flipper and foot.

On land they walk with the flippers held out behind and the head pushed forward. If hurried they fall forward on to the breast and push themselves along with the feet, aided by the flippers which give quick strokes on the ground at each side. When preening themselves they stand upright, using the stiff tail feathers to help them keep their balance. When resting they usually recline on their fronts with the feet tucked up underneath and the head drawn in on to the shoulders. They usually sleep in this position, but also do so standing up, with the head put round behind one of the flippers, in the position of a bird sleeping with its head under its wing. This species has more fear of man than others: if the rookery is visited most of the birds leave their nests when the intruder comes near to them, but some of the birds will refuse to go and peck and strike with the flippers.

The adults moult after nesting, shedding the feathers in March. At the same time the feet become a light orange colour which changes to pink later on. The bill of the adult is red, black dorsally. There is a buff tip on the mandible, and behind it lies a black patch (Plate XLVII, fig. 12). The iris is brown and the pupil polygonal, and the feet are pink.

Pygoscelis antarctica, Forst.

Ringed Penguin

This penguin occurs in small numbers at South Georgia, odd ones being seen from time to time. Several were observed at Grytviken during the course of the Discovery investigations; one was seen in 1926 among the Macaroni Penguins in their rookery near Fortuna Bay, and several were seen elsewhere. The German Expedition of 1882–3 (Pagenstecher, 1885, p. 14) found a few pairs nesting in Royal Bay. The headquarters of this species is in the South Orkney and South Shetland Islands.

Pygoscelis adeliae, Homb.

Adélie Penguin

This penguin, abundant in the South Orkney Islands, has only occurred as an occasional straggler at South Georgia.

Eudyptes chrysolophus, Brandt

Macaroni Penguin

(Plate LV, figs. 2, 3)

The Macaroni Penguin, called locally "Rocky Penguin", is extremely abundant at South Georgia and in the waters round the island, though it rarely comes on land except at its rookeries. The rookeries as a rule are large, containing thousands of birds: they are situated on the tussac-covered slopes above the cliffs in exposed parts of the coast outside the bays. There are large rookeries on Willis and Bird Islands to the north, and on Cooper Island to the south, and at many places between on the mainland (Plate LV, fig. 2). Seen from the sea the rookeries present a characteristic appearance; the crowd of white breasts of the birds surrounded by a dark green ring where the tussac grows luxuriantly, and beyond the pale yellow-green of the ordinary tussac. The birds come ashore to the rookeries in November and leave them by the beginning of May. The following notes were made during a visit to a rookery between Cape Saunders and Fortuna Bay on November 30th, 1925, to gather eggs which were then new laid.

The rookery was situated on some steep sloping land at the top of the cliffs, with cliffs rising again behind to a height of about a thousand feet. The penguins jump out of the sea on to the rocks and hop up the cliff to the rookery. There are many thousands of birds in the rookery and they are packed tight wherever there is standing room. The noise they make is deafening, especially when they are disturbed by anyone walking through the rookery, and the smell of it is beyond description. Individually the birds have a strong goaty smell. Their nests are made of small stones, or of mud and tussac, but many of the eggs are laid on the loose stones of the rookery without any nest. The main part of the rookery where the birds are most thickly congregated is quite bare, but I saw odd birds among the tussac on the mountain cliff as high up as about eight hundred feet above the sea. As we walked through the rookery most of the birds moved aside to let us pass, making all the while a tremendous braying, but a few of them would not leave their eggs, which they defended stoutly with their bills and flippers. Though they were thickly packed it was apparent that they were all in pairs.

Their voice is very loud, something like the trumpeting of the Gentoo Penguin, but much harsher and deeper. The two birds of each pair were frequently to be seen braying to each other. When they did this they held their flippers widely open, pointing upwards and backwards at an angle of about 45 degrees from the shoulder. They then stretched the head up and threw it back so that the beak was pointing up into the sky behind them, and started calling. All the time that they were braying the head was moved from side to side with a wriggling motion, so that the tip of the bill nearly touched the tip of each upraised flipper alternately. This bout of braying was usually preceded by both birds of the pair bowing to each other so that the bill touched the ground, and when their heads were close together like this they gave a low grunt. Frequently they repeated this after braying.

There is only one egg to each pair and it varies greatly in size and shape, from short and round to long and pointed. When the birds are walking about the rookery or hopping up and down the cliffs they hold their flippers in front of them, but as soon as they stop moving they hold them elevated behind them (Plate LV, fig. 3). In climbing up the cliff they hop from point to point, making quite long jumps, and when scrambling up a difficult bit they use the bill to help them. Even when hurried they were not seen to toboggan as the other penguins do. They are very quarrelsome, pecking each other and walloping each other with the flippers unmercifully; any bird walking through the rookery comes in for a shower of pecks and blows from all his neighbours as he passes. Many of the birds get very dirty with the mud in the rookery, which is very wet, as several small streams descend the cliff behind. There were many Skuas flying round the rookery and settling on the neighbouring rocks, but as soon as one tried to alight in the rookery, no doubt to steal eggs, it was attacked by the penguins and driven away. There were also some Sheathbills in the rookery but these were left unmolested although they too are egg stealers.

This rookery was again visited on February 14th, 1926, when the following notes were made:

We found most of the young hatched and half grown: they were covered with down, black on the back and white in front, and had black bills, pink feet and dark brown iris (Plate LV, fig. 3). A few of the old ones were still sitting on eggs, probably addled ones. We did not see any small young ones in their first down coat. About half of the old ones were moulting. Their yellow head plumes were nearly all shed and the old feathers were coming off in patches, leaving the new ones showing underneath. They also shed the casing of the beak; in most of them it had not yet peeled off, but was scaly, and dull in colour. The scales on the feet too were being shed and the irides of the moulting birds were light brown. When they enter the water they, like the Gentoos, wash themselves and then swim away.

The adults have the bill rich red brown and the bare skin at the gape pink. The iris is red. The feet are pink, the webs varying from grey at the base to black at the margin. The bases of the claws are white and have black edges and tips. The soles of the feet are black. In the stomachs of the birds examined cephalopod beaks and euphausians were found.

Aptenodytes patagonica, Mill

King Penguin

(Plate LV, fig. 4; Plate LVI, figs. 1–4)

The King Penguin is common but not very numerous in South Georgia. It breeds in rookeries, some of which number several hundred birds, but away from them only odd examples are sometimes seen on the beaches. The largest rookeries seen were in the Bay of Isles, Right Whale Bay, Gold Harbour, St Andrew's and Fortuna Bays. In other bays there are small rookeries consisting of some dozen birds or so. Though the rookeries are often near those of the Gentoo Penguins the Kings never mix with their neighbours. The rookeries are usually on flat ground or moraines (Plate LV, fig. 4) up to nearly a mile from the sea, and the one at Right Whale Bay is on the hill about a hundred and fifty feet above sea level.

The eggs are laid from the beginning of December onwards, but there is great individual variation in the time of laying, as there also is in the time of the moult. No nest is built, but the single egg is carried on top of the feet and is protected by a transverse fold of skin which hangs down in front and covers it (Plate LVI, fig. 1). The period of incubation and appearance of the new hatched young were not observed. The eggshell, like that of other penguins, is thick.

Before the egg is laid the birds wander about in pairs and caress each other by crossing the necks, after which the male presses the back of the female's neck until her head touches the ground. They frequently trumpet to each other. They do this by stretching up to their full height and, pointing the bill straight up, make a loud, almost musical trumpeting sound. Immediately after they have done this they hold the head stiffly at right angles to the neck, whilst the latter is still stretched up, and look straight forward for a moment. They then resume the normal attitude with the head drawn down on to the shoulders.

When incubating the King Penguins sit close together and are very quarrelsome, stabbing at each other with their sharp bills and dealing each other resounding blows with the flippers (Plate LVI, fig. 2). They can only shuffle about slowly when they are carrying the egg on their feet and often help themselves along with the bill and flippers. There is always a number of non-breeding and moulting birds, as well as large young ones, standing about the rookeries.

In walking these birds do not use their flippers as balancers, as do the other species of penguins, but carry them hanging at the sides. When a group is walking together they go in single file. If they are hurried they fall forward on the chest and toboggan along, pushing off with the feet and using the flippers to help them. They are not disturbed by the presence of man, merely walking disdainfully away if approached, and do not run and toboggan unless chased.

The time of the moult is very irregular. Some birds were observed moulting in November and others as late as March. The old feathers come off in patches, leaving the new ones exposed, and the covering of the bill and feet is also shed. The young ones are as big as their parents by November. They are covered in long woolly down, which adheres to the ends of the adult plumage feathers underneath, so that they look much bigger than the adults (Plate LVI, fig. 3). This coat is very necessary as they spend the winter in the rookery, but in the spring and summer, before it is shed, the birds appear to suffer from the heat if the sun happens to shine, and sit panting with open bills. The bill is black, the feet greenish brown and the iris brown. Some of them commence to shed the down as early as November, but most of them lose it in December and January. It goes first on the flippers, then on the belly and back, and last on the head and neck. The first adult plumage is similar to that of the old ones, but the orange on the neck and breast is represented by yellow, and the black of the head has a brownish tinge.

The young have a shrill whistling cry, and they wander about the rookery begging for food from the old ones (Plate LVI, fig. 4). They walk up to an old one and start whistling and chirping, all the time nibbling its beak. The old one looks extremely bored, but if the young one worries it long enough it brings up into the throat some food which the young one takes by putting its bill into that of the other. The food consists of cephalopods.

The bill of the adult is black with a strip of yellowish red on the side of the basal half of the mandible. The iris is light brown and the pupil is polygonal. The feet are black.

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PLATES XLV—LVI

From colour sketches and photographs by the author

PLATE XLV

Fig. 1. *Diomedea melanophrys.* Newly hatched young.

Fig. 2. *D. melanophrys.* Half grown young.

Fig. 3. *Thalassogeron culminatus.* Adult male.

Fig. 4. *Macronectes giganteus.* Young about 21 days old.

Figs. 5, 6. *Majaqueus aequinoctialis.* Adult female.

Figs. 7, 8. *Priocella glacialoides.* Adult female.

Figs. 9, 10. *Pagadroma nivea.* Adult male.

PLATE XLV

BIRDS OF SOUTH GEORGIA

PLATE XLVI

Larus dominicanus.

Figs. 1, 2. Female. First winter.

Figs. 3, 4. Female. Second winter.

Figs. 5, 6. Male. Third winter.

Figs. 7, 8. Female. Fourth winter.

Fig. 9. Young about half grown.

BIRDS OF SOUTH GEORGIA

PLATE XLVII

Fig. 1. *Pelecanoides georgicus*. Newly hatched young, with unopened eyes.

Fig. 2. *P. georgicus*. Adult male.

Fig. 3. *Catharacta lönnbergi clarkei*. Newly hatched young.

Fig. 4. *C. lönnbergi clarkei*. Young, about 21 days old.

Figs. 5, 6. *Phalacrocorax georgianus*. Female. First winter.

Fig. 7. *P. georgianus*. Adult male.

Fig. 8. *Chionis alba*. Adult female.

Fig. 9. *C. alba*. Adult male.

Fig. 10. *Pygoscelis papua*. Newly hatched young in first down.

Fig. 11. *P. papua*. Young in second down.

Fig. 12. *P. papua*. Adult female.

BIRDS OF SOUTH GEORGIA

PLATE XLVIII

Fig. 1. *Diomedea exulans*. *Chionoptera* form, on nest.

Fig. 2. *D. exulans*. *Exulans* form, on nest.

Fig. 3. *D. exulans*. Year old young in the nest in December. The down shed in patches, showing dark feathers beneath.

Fig. 4. *D. exulans*. Young after leaving the nest, the down nearly all shed: a few tufts remain below the wing.

Fig. 1.

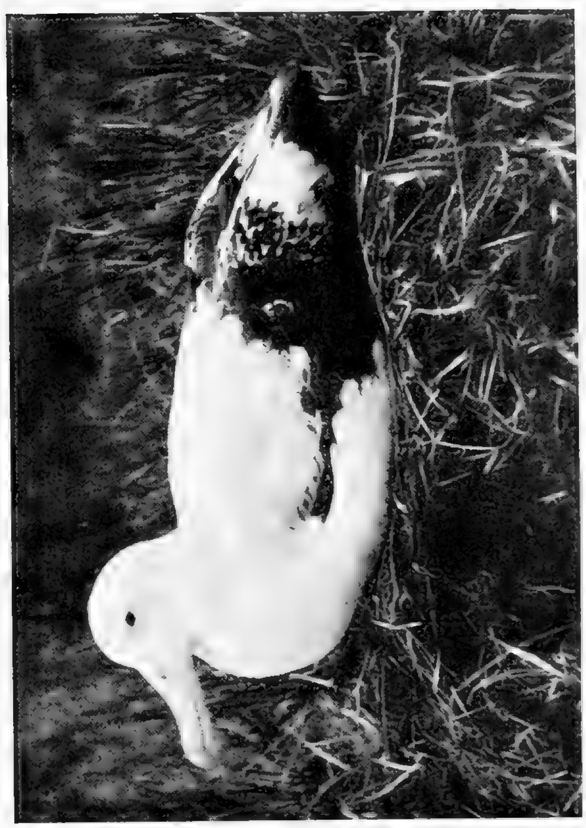

Fig. 2.

Fig. 3.

Fig. 4.

BIRDS OF SOUTH GEORGIA

PLATE XLIX

Diomedea exulans. Courtship.

Fig. 1. Both birds with upstretched heads vibrating the bill while the wings are held open.

Fig. 2. The female vibrating the bill in answer to the male just before spreading her wings.

Fig. 3. The female, with head turned away, has thrust the bill amongst the plumage of her breast.

Fig. 4. The male vibrating the bill.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

BIRDS OF SOUTH GEORGIA

PLATE L

Fig. 1. *Diomedea exulans.* A pair at the nest. The sitting bird is of the light *chionoptera* stage, the one standing is intermediate, with dark back and a small amount of dark pencilling on the head.

Fig. 2. *Diomedea melanophrys.* Male and female at the nest, the female standing.

Fig. 3. *D. melanophrys.* The parent standing beside the nest. The young one in the normal resting attitude.

Fig. 4. *D. melanophrys.* Young one sitting up in the nest when disturbed.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

BIRDS OF SOUTH GEORGIA

PLATE LI

Fig. 1. *Thalassogeron culminatus.* Rookery near Cape Pariadin.

Fig. 2. *Th. culminatus.* Nest and egg.

Fig. 3. *Phoebetria palpebrata antarctica.* Male crying to the female, making the shrill expiratory note.

Fig. 4. *P. palpebrata antarctica.* Nest and egg on a tussac-covered cliff ledge.

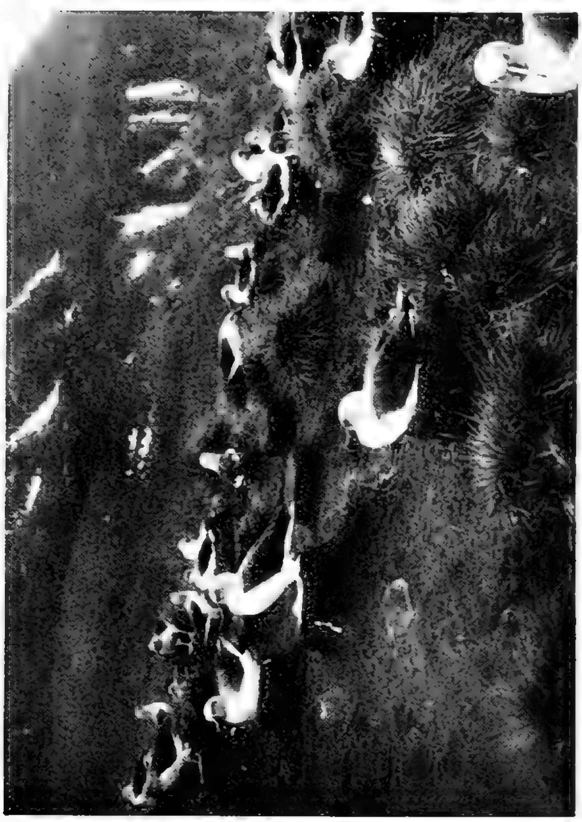

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

BIRDS OF SOUTH GEORGIA

PLATE LII

Fig. 1. *Macronectes giganteus.* Intermediate plumage phase on nest.

Fig. 2. *M. giganteus.* Nest, built of tussac, and egg.

Fig. 3. *M. giganteus.* Young about a week old, in the nest.

Fig. 4. *Daption capensis.* Part of a flock near the whaling station at Grytviken.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

BIRDS OF SOUTH GEORGIA

PLATE LIII

Fig. 1. *Daption capensis.*

Fig. 2. *Prion banksi.* Adult and egg dug out of nesting burrow.

Fig. 3. Nesting place of *Pelecanoides georgicus.* Glacial moraine under the stones of which are the entrances of the burrows.

Fig. 4. *Catharacta lönnbergi clarkei.* Two newly hatched young in the nest.


Fig. 1.


Fig. 2.


Fig. 3.


Fig. 4.

BIRDS OF SOUTH GEORGIA

PLATE LIV

Fig. 1. *Catharacta lönnbergi clarkei.* Young about 21 days old.

Fig. 2. *Sterna vittata georgiae.* Nest and egg.

Fig. 3. *Pygoscelis papua.* An incubating bird on the nest.

Fig. 4. *P. papua.* Newly hatched young in first down.

Fig. 1.

Fig. 2.

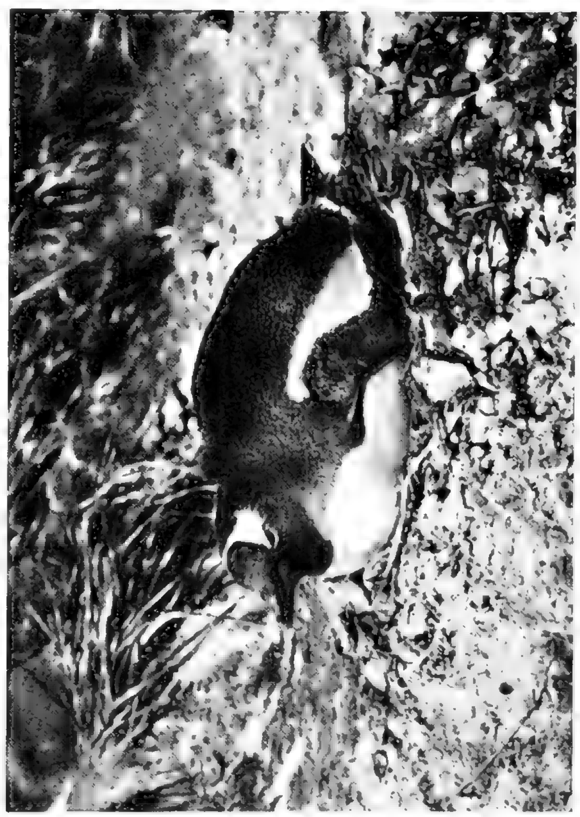

Fig. 3.

Fig. 4.

BIRDS OF SOUTH GEORGIA

PLATE LV

Fig. 1. *Pygoscelis papua.* Young in second down.

Fig. 2. *Eudyptes chrysolophus.* Part of rookery.

Fig. 3. *E. chrysolophus.* The bird on the right is standing with the flippers elevated behind it: the one on the left is hopping and has the flippers held in front. In the centre a young one in the second down coat.

Fig. 4. *Aptenodytes patagonica.* Young birds in a rookery on a moraine at the Bay of Isles, about half a mile from the sea.


Fig. 1.

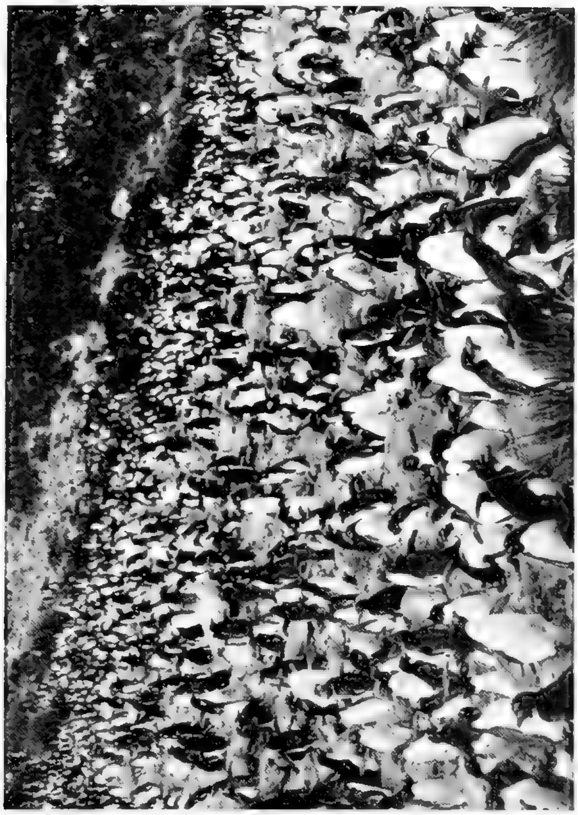
Fig. 2.


Fig. 3.


Fig. 4

BIRDS OF SOUTH GEORGIA

PLATE LVI

Aptenodytes patagonica.

Fig. 1. A sitting bird holding the egg on the feet and covering it with a flap of the skin of the belly.

Fig. 2. Brooding birds fighting.

Fig. 3. Before the moult the thickness of the down makes the young appear bigger than the adults.

Fig. 4. Young asking the adult for food.

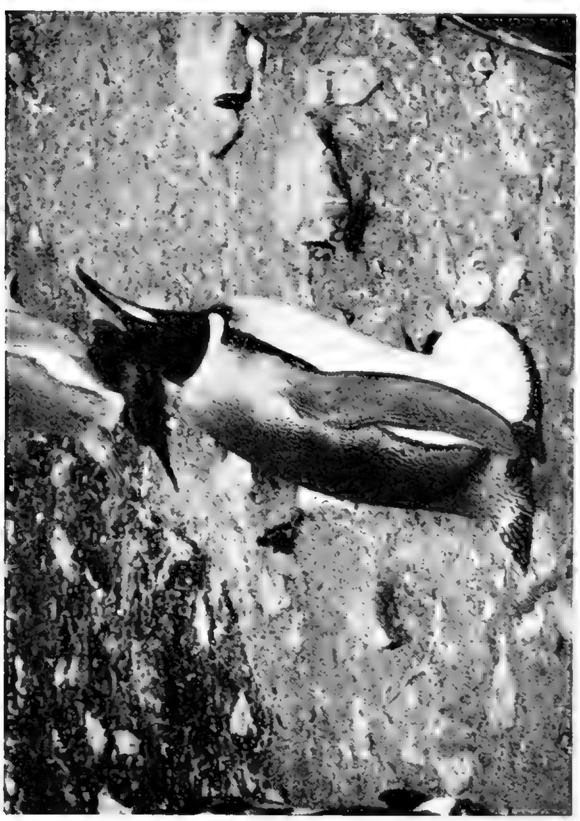

Fig. 1.

Fig. 2.

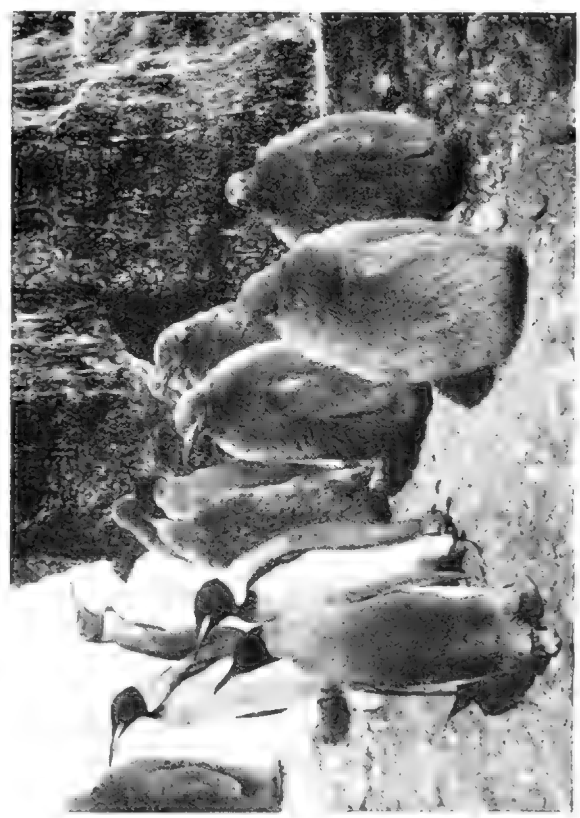

Fig. 3.

Fig. 4

BIRDS OF SOUTH GEORGIA

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